



Institutions and Heterogeneity in the Labour Market

Andrea Garnero

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DOCTORAL THESIS

ANDREA GARNERO

Institutions and Heterogeneity in the Labour Market

Publicly Defended on 16 January 2015

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EXECUTIVE SUMMARY

This thesis aims to give a contribution to the academic debate on three specific issues related to institutions and heterogeneity in the labour market. In the first part it analyses the effect of employment protection legislation on worker flows, i.e. the rate of worker reallocation, in OECD countries. The second part revisits the debate on minimum wages in Europe bringing new evidence on systems without a statutory minimum wage and comparing them with countries with a statutory one. The third part delves in a relatively newer debate, about the pros and cons of workforce diversity for firms, bringing some evidence on the effect of diversity on firm productivity and wages in Belgium and France.

The first part exploits a unique dataset including cross-country comparable hiring and separation rates by type of transition for 24 OECD countries, 23 business-sector industries and 13 years to study the effect of dismissal regulations on different types of gross worker flows, defined as one-year transitions. Chapter 1 uses both a difference-in-difference approach - in which the impact of regulations is identified by exploiting likely cross-industry differences in their impact - and standard time-series analysis - in which the effect of regulations is identified through regulatory changes over time. Findings suggest that the more restrictive the regulation, the smaller is the rate of within-industry job-to-job transitions, in particular towards permanent jobs. By contrast, it finds no significant effect as regards separations involving an industry

change or leading to non-employment. The extent of reinstatement in the case of unfair dismissal appears to be the most important regulatory determinant of gross worker flows.

The second part brings new evidence to the debate on minimum wages in Europe by collecting data on systems without a statutory minimum wage and comparing them with countries with a statutory one. Chapter 2 provides a description of minimum wage systems in Europe. Chapter 3 explores the link between different institutional features of minimum wage systems and the minimum wage bite. It notably addresses the striking absence of studies on sectoral-level minima and exploit unique data covering 17 European countries and more than 1,100 collective bargaining agreements. Results provide evidence for a neglected trade-off: systems with bargained sectoral-level minima are associated with higher Kaitz indices than systems with statutory floors, but also with more individuals actually paid below prevailing minima. Higher collective bargaining coverage can to some extent reduce this trade-off between high wage floors and non-compliance or non-coverage. Chapter 4 explores how the diversity of minimum wage systems affects earnings inequalities within European countries. Empirical results confirm the intuition of many practitioners that the combination of sectoral minima and high collective bargaining coverage can be regarded as a functional equivalent of a binding statutory minimum wage, at least for earnings inequalities. Regression results suggest indeed that both a national statutory minimum and, in countries with sectoral minima, higher collective bargaining coverage is significantly associated with lower levels of (overall and inter-industry) wage inequalities and a smaller fraction of workers paid below prevailing minima.

The third part of the thesis does not study a labour market institution as such but the effect of workers diversity, a feature that might prompt some kind of regulations in the future but it is already strongly affecting firms which need to balance their public image and corporate social responsibility practices with internal organisation and profit maximisation. Chapter 5 estimates the impact of workforce diversity on productivity, wages, and productivity-wage gaps (i.e., profits) using detailed Belgian linked employer-employee panel data and different econometric tools to solve for endogeneity and heterogeneity issues. Findings show that educational diversity is

beneficial for firm productivity and wages while age diversity is harmful. While gender diversity is found to generate significant gains in high-tech/knowledge-intensive sectors, the opposite result is obtained in more traditional industries. Estimates do not vary substantially with firm size nor point to sizeable productivity-wage gaps except for age diversity. Chapter 6 extends the analysis of workforce diversity to the French case using data from a comprehensive establishment-level survey (RE-PONSE) for 2011 matched with companies' balance sheet data. Controlling for a wide set of workers' and firms' characteristics, findings suggest that, very much in line with previous studies, demographic diversity (age and gender) has a negative effect on productivity and wages while educational diversity has a positive effect. Contrary to some widespread beliefs, the chapter finds no differential effect according to manager characteristics (gender, age, tenure) but some heterogeneity according to the type of proprietary structures of the firms (family firms vs. firms quoted in the stock exchange vs. foreign owner vs. workers among shareholders): in family firms gender diversity seems to play a slightly more positive effect than in other firms while in firms listed on the stock exchange education diversity has a more beneficial role.

RÉSUMÉ

Cette thèse vise à apporter une contribution originale au débat académique sur trois questions spécifiques liées aux institutions et à l'hétérogénéité dans le marché du travail. Dans la première partie, la thèse analyse l'effet de la législation relative à la protection de l'emploi sur les flux de travailleurs (embauches, licenciements, démissions, changements d'emploi) dans les pays de l'OCDE. La deuxième partie contribue au débat sur le salaire minimum en Europe en apportant de nouvelles données sur les pays où les salaires sont fixés au niveau sectoriel en les comparant avec les pays où le salaire minimum est fixé au niveau national. La troisième partie aborde la question relativement récente du rôle de la diversité de la main-d'œuvre pour les entreprises, et estime l'effet de la diversité sur la productivité et les salaires en Belgique et en France.

La première partie (chapitre 1) analyse une base de données qui comprend les flux d'entrées (embauches) et de sorties (démissions et licenciements) du marché du travail pour 24 pays de l'OCDE et 23 industries sur une période de 13 ans pour étudier l'effet de la réglementation relative au licenciement sur les différents types de flux de travailleurs (mesurés en termes de transitions annuelles). Le chapitre utilise à la fois une approche en double différence - dans laquelle l'impact de la régulation est identifié par l'analyse des différents besoins de réallocation selon les industries (l'hôtellerie a un taux de réallocation beaucoup plus élevé que la chimie par exemple) à travers

les pays - et d'analyse de séries temporelles - dans laquelle l'effet de la régulation est identifié par des changements réglementaires au cours du temps. Les résultats suggèrent qu'une régulation plus contraignante diminue le taux de réallocation au sein du même secteur et les transitions d'un emploi à un autre, en particulier vers des emplois permanents. En revanche, une régulation plus restrictive n'a pas d'effet significatif sur les séparations impliquant un changement de secteur ou une perte d'emploi. La possibilité de réintégration en cas de licenciement abusif semble être le déterminant le plus important des flux de travailleurs.

La deuxième partie de la thèse (chapitres 2, 3 et 4) apporte un regard nouveau sur le débat sur les salaires minima en Europe, en particulier par la collecte de données sur les pays avec des minima sectoriels et la comparaison avec les pays avec un salaire fixé au niveau national. Le second chapitre fournit une description détaillée des différents systèmes de salaire minimum en vigueur en Europe. Le troisième chapitre étudie le lien entre les différentes caractéristiques institutionnelles des systèmes de salaire minimum et leur niveau par rapport au salaire médian. L'analyse pallie notamment l'absence frappante d'études sur les minima au niveau sectoriel en examinant des données couvrant 17 pays européens et plus de 1100 conventions collectives. Les résultats montrent un arbitrage jusqu'ici négligé: les systèmes avec des minima négociés au niveau sectoriel sont associés à un salaire minimum relativement plus élevé que les systèmes dotés de salaire minimum national, mais cela va de pair avec davantage de travailleurs rémunérés en dessous des minima en vigueur. Une meilleure couverture de la négociation collective peut, dans une certaine mesure, réduire cet arbitrage entre salaires minima relativement plus élevés et leur non-respect ou non-couverture. Le quatrième chapitre explore l'impact de la diversité des systèmes de salaire minimum sur l'inégalité salariale au sein des pays européens. Les résultats empiriques confirment l'intuition que la combinaison de minima sectoriels et de couverture élevée de la négociation collective peut être considérée comme l'équivalent fonctionnel d'un salaire minimum légal national. Les résultats suggèrent en effet que, dans les pays avec des minima sectoriels, une plus grande couverture de la négociation collective est associée à des niveaux inférieurs d'inégalités, globales et intersectorielles, et à une plus petite fraction des travailleurs rémunérés en dessous des minima en vigueur.

La troisième partie de la thèse (chapitres 5 et 6) n'étudie pas une institution du marché du travail en tant que telle, mais la diversité des travailleurs. Il s'agit d'un phénomène qui pourrait inspirer un certain type de régulation à l'avenir, mais qui affecte déjà fortement les entreprises qui ont besoin de trouver un équilibre entre leur image publique et la responsabilité sociale avec l'organisation des ressources humaines et la maximisation du profit. Le cinquième chapitre estime l'impact de la diversité de la main-d'œuvre sur la productivité, les salaires, et l'écart productivité-salaire. Pour ce faire, nous utilisons des données belges de panel appariées employeur-employé entre 1999 et 2006 et différents outils économétriques pour résoudre les questions d'endogénéité et d'hétérogénéité. Les résultats montrent que la diversité en termes d'années d'éducation est bénéfique pour la productivité et les salaires alors que la diversité d'âge est nuisible. Bien que la diversité de genre génère des gains importants dans les secteurs à forte intensité technologique ou de connaissance, le résultat inverse est obtenu dans les industries plus traditionnelles. Les résultats ne varient pas avec la taille des entreprises et ne mettent aucun écart important entre productivité et salaires en évidence à l'exception de la diversité d'âge. Le sixième chapitre étend l'analyse de la diversité de la main-d'œuvre au cas français. Nous utilisons les données de l'enquête REPONSE qui permettent, entre autres, une analyse approfondie, autour du thème des liens entre politiques de gestion du personnel, stratégies économiques et performances des entreprises. Tout en prenant en considération un large éventail de caractéristiques des travailleurs et des entreprises, les résultats suggèrent que la diversité démographique (âge et genre) a un effet négatif sur la productivité et les salaires tandis que la diversité d'éducation a un effet positif. Contrairement à une idée assez répandue, les caractéristiques des dirigeants (genre, âge, ancienneté) n'ont aucun effet sur la diversité. En revanche le type de structure de propriété des entreprises (entreprises familiales, entreprises cotées en bourse, propriétaire étranger ou participation des travailleurs dans l'actionnariat) implique une certaine hétérogénéité de l'effet de la diversité (firmes familiales plus favorable à la diversité de genre, firmes cotées en bourse plus favorable à la diversité d'éducation).

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Writing a doctoral thesis is quite a lonely work. But alone I would not have gone very far (probably I would not have even started).

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could have. Andrea, Alessandro, Carlo, Giacomo and the team of Lo Spazio della Politica were a great source of discussion, good spirit, and learning out of the university walls. Nicole was my first human contact at the ENS in 2008 and it is fantastic to still count on your friendship. The crew from the Collegio superiore Annalisa, Dimitrii, Gianandrea, Umberto, Michele also provided great moral and practical support and repeated mathematical guidance. Fabrizio and Marco in Rome were fantastic housemates and *bros*. It was important to count on you all at different moments of these years!

This thesis starts and ends at the OECD. I am particularly indebted to Andrea Bassanini for having supervised me with patience and attention during my internship at OECD in 2009 where Part I of this thesis began to take form. I am proud to be back now to work with very talented people and I hope to be able to really contribute to OECD's mission of formulating better policies for better lives. In the end this is the only reason why I did a PhD.

In the last five years I also had the opportunity to have amazing work experiences at the European Commission and in the Prime Minister's Office in Rome. I have learned immensely on policies and even more on the personal level. It has been a rare honour (and I trust it will be again) to serve my homelands, Italy and Europe and to work with knowledgeable supervisors and colleagues. I will never be able to express all my gratitude for these great opportunities. "*There's so much beauty and promise, and so much waste. Italy (and Europe, I add) breaks your heart*" as the New York Times once rightly put it.

I could not thank enough my parents, Maura e Secondo for their constant support and for the infinite stimuli and discussions that generated my interest for the *res pubblica*. And also thank to Liliana, Giovanni, Paola, Alberto, Francesca and Lorenzo: you don't know how your continuous support was important for me.

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The best has yet to come.

Institutions and Heterogeneity in the Labour Market

INTRODUCTION

“Give your evidence and don’t be nervous, or I’ll have you executed on the spot.”

Alice’s Adventures in Wonderland, Chapter XI

Why in times of austerity should public money be spent to subsidize economic research on institutions and heterogeneity in the labour markets? Institutions and regulations are a matter for lawyers, or political scientists. Moreover there is already an endless list of papers on these topics. What’s the value added? Does this lead at least to find a job to everybody? These are legitimate questions the (French and Belgian in this case) taxpayers might ask at the end of my three year research as a PhD student.

I must immediately clarify that I have not found the solution for full employment. Nor I am going to give ready-made straight policy choices, but mainly present a series of relatively neglected or new trade-offs to be considered when designing policies. I know from personal experience how much policy-makers value straightforward solutions. US President Harry Truman, being tired of economic advisors saying “on the one hand... on the other hand...”, famously asked to be sent a “one-armed” economist. Indeed for some years the debate on institutions in the labour market has been dominated by “one hand” solutions. And policy-makers followed happily. However, reality

is rarely black or white, but more a series of shades of grey. An economist should offer the policy-maker these shades of grey and it is up to the policy-maker, possibly following a public debate, to choose between the different trade-offs. This is what I will try to do in this thesis.

Institutions and economics

Institutions are a matter for lawyers, or political scientists. But they also affect economic outcomes of nations and individuals. People react to the incentives they receive by different institutional designs and this affects the way they behave. Therefore institutions are also a matter for economists.

In fact, economics has an entire field devoted to studying institutions, the so-called institutional economics and recently the new institutional economics. Researchers in this field are interested in understanding the role of institutions in shaping economic behaviour. It is not a mainstream field in economics. When in 2009 the Nobel Prize in economics was awarded to Elinor Ostrom the amazement was great among mainstream economists. Not really because she was the first woman to be awarded, but because she was unknown to many scholars. Institutional economics has been possibly more popular in France where the theory of regulation enjoyed some popularity in the 1970s, but this approach never really crossed the French borders.

However the interest of economics towards institutions goes well beyond a specific research stream and contaminates all fields. Institutions affect individual incentives and therefore cannot be neglected in microeconomics. Institutions might be a driver of growth and therefore macroeconomics cannot ignore them.

In particular here I focus on institutions in the labour market. What are labour market institutions in the neo-classical setting that is usually taught in universities? According to Boeri and van Ours (2013) they are “*a system of laws, norms or conventions resulting from a collective choice and providing constraints or incentives that alter individual choices over labour and pay*”. In this thesis I will not focus on the genealogy of labour market institutions nor I will take them just as a deviation from the perfect equilibrium framework. Institutions are too often viewed as an external

constraints. In fact, institutions are more than a simple constraint and are the result of the complex interaction between individuals, firms and the State and their cultural and social norms. Institutions are at the core of modern labour markets. In concrete terms they are labour laws, unions, minimum wages, unemployment benefits, collective bargaining, working time regulations, pension rules, anti-discrimination policies. These are usually discussed and set-up by a public body and enforced by Law. Firms might decide to further regulate work by adopting specific human resource practices to specific needs of workers and firms. The decreasing role of the State in favour of a subsidiarity principle (in the UK they would call it “big society”) is forcing firms to take some of the burden of the welfare state. Human resource policies provide further constraints or incentives for workers but are usually designed to improve performances from an employer’s point of view.

Why do we need labour market institutions? The straight answer is because governments set up a pile of different tools to govern and regulate the great heterogeneity of workers and firms.

The neo-classical model of labour supply and demand is based on the hypothesis of perfect competition, and hence homogeneity between workers and firms. In fact, many different markets for labour co-exist. All jobs and all workers do not look the same. This does not only fragment the labour markets but also generates several sources of imperfection arising from informational asymmetries (employers cannot fully monitor employees and workers do not know their exact contribution to the firm and then ask for a “just” return) or market power (if employers are too strong they can push wages down too much). This heterogeneity might generate rents from some, but also entail costs for others.

Since 1800 a wide set of labour market institutions has been put in place to limit the negative effects of labour market heterogeneity by achieving some redistributive goals, and improve efficiency.

The debate on labour market institutions

Labour market institutions in the last two decades have sparked an enormous academic debate. If we look at the number of papers available on Google Scholar on “labour market institutions” (or the US spelling “labor”) and we compare it to the number of paper published more generally on “labour market”, we clearly see a diverging trend since the Nineties (see Figure 1).

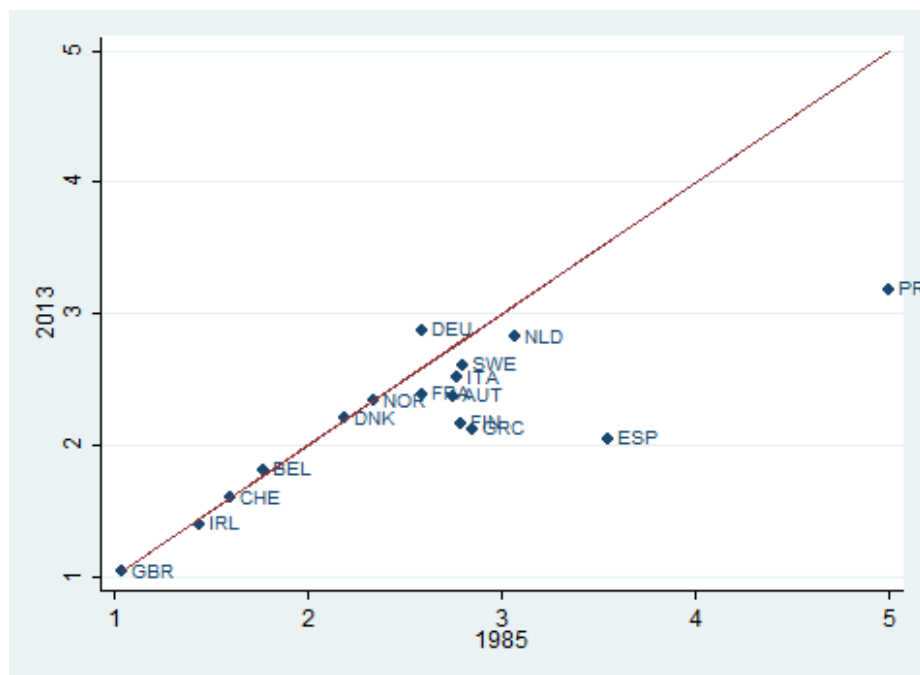
Figure 1: *Papers published on Labour (or labor) market institutions vs. Labour (or labor) market, (60–70=100).*



Source: Google Scholar, own calculations.

In the 1970s until early 1980s most economists favoured macroeconomic explanations and cures for economics problems, according to Richard Freeman. Labour institutions were then completely peripheral in academic research. The US looked at Europe with a mix of curiosity and envy for its mix of strong economic performance (“the Glorious Thirty”), low unemployment and strong welfare state. Conferences were dedicated to study the European experience. A US policy-maker in 1964 even went to say that he was “looking enviously at our European friends to see how they do it” (Myers, 1964).

Then, after the oil shocks of the 1970s, increasing unemployment rate and weak

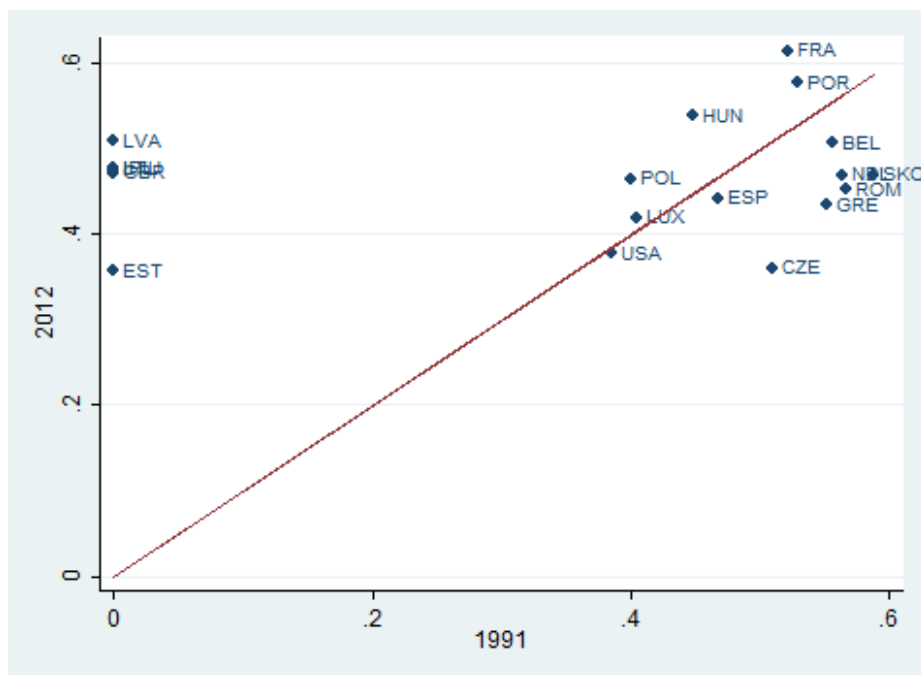
Figure 2: *EPL deregulation for permanent workers and collective dismissals*

Source: OECD Employment Protection Legislation Index, own calculations.

productivity growth in the 1980s pushed European economists to start diving into the possible role of labour market institutions in explaining the divide with the US. The hypothesis was fairly easy: the USA enjoyed a much bigger economic success thanks to their deregulated economy compared to the European one. The debate was totally reversed: the European economists were looking enviously at their American colleagues. A key turning point for this debate is 1994 when the OECD published its Jobs Strategy with 10 recommendations to member countries to deregulate all across the board. Institutions were seen as the clear culprit of the European sclerosis as opposed to the American dynamic society.

Figure 2 shows the variation of the OECD Employment Protection Legislation Index, an indicator to measure the stringency of dismissal regulation, between 1985 and 2013 (the OECD EPL index only starts in 1985, see page 9 for more details). It clearly shows the downward trend in employment protection (EPL index is lower in 2013 than in 1985, below the 45 degree-line) in most European countries.

Figure 3 shows a more nuanced picture for statutory minimum wages between 1991 and 2012 (before 1991, Eastern European countries did not have a statutory

Figure 3: *Minimum wage variation 1991-2012*

Source: OECD MW data, own calculations.

minimum wage). The United Kingdom, Ireland, Estonia and Lithuania introduced a minimum wage from scratch relatively late (UK in 1999, Ireland in 2000, Estonia in 1999 and Lithuania in 19997). France, Portugal, Poland, Hungary and Luxembourg saw an increase of the minimum wage compared to the median wage. On the opposite, Belgium, Spain, the Netherlands, the Slovak Republic, Romania, Greece and the Czech Republic saw a decrease of the minimum wage with respect to the median wage.

At the turn of the 21st century, says Richard Freeman (2007), questions regarding labour market institutions replaced macroeconomic policy at the centre of much policy debate in advanced economies. In 2005, before the financial crisis, Olivier Blanchard wrote: “*There is fairly wide agreement among economists on what constitutes optimal or, at least, good product market and financial market institutions. There is much less agreement on what constitutes optimal or, at least, good labor market institutions*”. In 2004, ten years after its very influential Jobs Strategy, the OECD started revisiting it (Employment Outlook 2004) and in 2006 it published a reassessment of the Jobs study. The tones were much smoother: the evidence in

favour of a total deregulation in fact proved to be not so robust and very specific on national contexts. Moreover, many reforms between 1994 and 2006 were partial and “sometimes counter-productive”. The OECD reassessment still pushed for cautious deregulation but also praised the importance of effective safety nets to strike a fine balance between efficiency and equity, social and employment goals. The magic word became “activation”. Labour market institutions should protect workers but not deter them to look for a new job, but on the opposite accompany them out of unemployment.

To summarize, the debate and the policy-making has been characterised by three main waves in the last fifty years: the first was a regulation wave in the 1960s and 1970s. Then came the deregulation wave between the end of the 1980s and the 1990s. We are now in “softer deregulation” wave. Still, the debate is not over.

In 2014 I am not sure the agreement on financial market institutions identified by Blanchard ten years ago still holds, but surely the steps towards an agreement on labour market institutions have been very limited. Undoubtedly, we understand better the functioning of the labour market today than twenty years ago, but still we are far from a general consensus. The crisis has shaken the foundations of economic research and put many more results into questions. The asymmetric response to the shock of the Great Recession has once again put institutions under the lights.

The lack of a clear academic consensus is reflected also in a quite poor public debate “*dominated by clichés and slogans (...) [with] the focus of policy makers on politically feasible, incremental reforms, with little sense of the ultimate goal*” (Blanchard, 2005). More than 800 reforms of labour market institutions were passed between 1980 and 2007 according to Boeri and van Ours (2013). The euro crisis put European competitiveness under pressure and several labour market reforms were asked to countries in difficulty, most notably perhaps in Portugal, Greece and Italy. Others are coming.

After 25 years of fierce debate and several reforms, the need for evidence has not been exhausted. In the end all that matters is evidence, as Alice’s Mad Hatter was gently reminded by the King (see initial quote). Still too many labour market reforms in Europe are undertaken without a serious ex-ante and ex-post evaluation process.

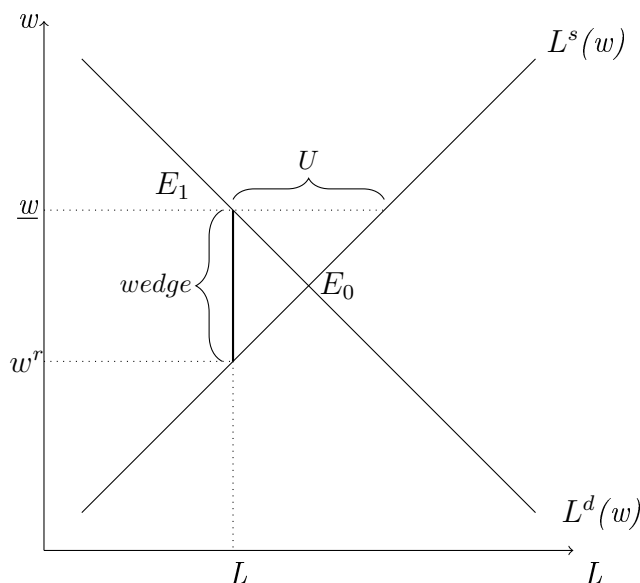
However, if we project the number of papers published between 2011 and today to 2020 we see a diminishing interest in labour markets but still an increasing interest in labour market institutions. This thesis aims to give at least a modest contribution to this debate from three different angles: the first will focus on employment protection legislation, the second on minimum wages in Europe, and the third on workforce diversity. Diversity is not an institution as such (although it can be considered as a by-product of antidiscrimination legislation) but a matter of concerns for employers, unions, business associations, NGOs and policy-makers and the subject of increasing calls for regulations or at least a more attentive management.

Institutions in “standard” labour economics

How are labour market institutions formalised in “standard” or “mainstream” economics? Boeri and van Ours (2013) divide labour market institutions in two groups: those acting on prices (minimum wages, taxes, unemployment benefit, ...) and those on quantities (EPL, working time, affirmative action/quotas, ...). In this thesis, Part I and III are dedicated to issues related to institutions or labour policies acting on quantities, Part II is dedicated to an institution acting on prices (minimum wages).

From a theoretical point of view, institutions can be expressed as a wedge moving the equilibrium of perfect competition (a formal derivation has been developed by Bertola and Boeri, 2002). A minimum wage for instance fixes a lower floor below which workers cannot be paid (see Figure 4).

This creates a *wedge* between \underline{w} and w^* by increasing wages (\underline{w}) but reducing employment and even generating unemployment (U) for those workers who would have worked for a lower wage (i.e. a “lower reservation wage”). Institutions acting on quantities indirectly introduce a wedge either by restricting labour supply or labour demand. Figure 5 shows the case of a downward shift of the labour demand. Employment protection legislation (EPL) makes it more costly for employers to adjust the number of workers and hence firms may decide to avoid paying firing costs by choosing a stable employment level which might be lower (but it could also be higher) than the one obtained without dismissal regulation.

Figure 4: *Price-based institutions*

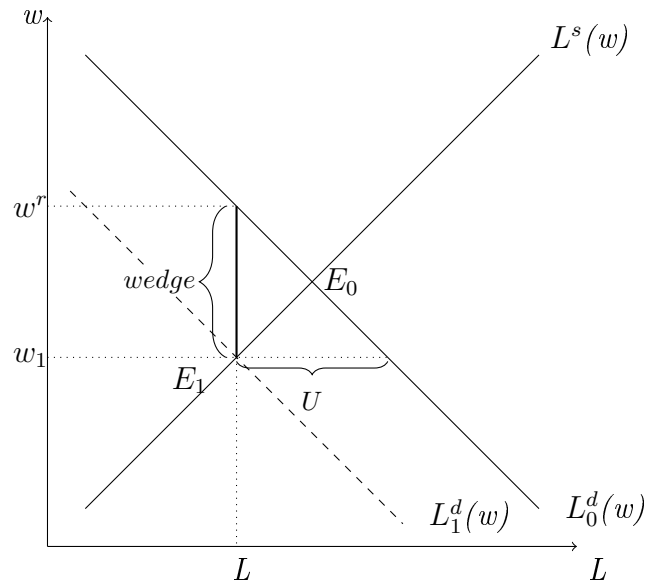
Source: Adapted from Boeri and van Ours 2013.

How can we measure labour market institutions?

Empirical analysis of labour market institutions faces a first serious issue: how can one quantify institutions? Those acting on prices can usually be easily measured in money terms. Minimum wages, taxes, unemployment benefit can all be quantified. It is more difficult to measure those institutions acting on quantities, in particular those encompassing many dimensions, like employment protection legislation. One solution has been to develop indices to rank countries along a common scale by looking at rules and procedures in place that limit firms to hire and fire workers at will. The OECD has developed an index ranging from 0 to 6 covering all relevant dimensions of EPL (regulations for permanent and fixed-term contracts and for collective dismissals included in statutory laws, collective bargaining agreements and case law).

Indices are useful but also entail many problems: first they might summarize too many things in one figure. In the past, the OECD used to provide an aggregate score. In the most recent release of 2013, the OECD provides separate scores for permanent and temporary employment arguing that it makes little sense to treat restrictions on permanent employment (all on the firing side) to those for temporary employment (many also on the hiring side). Moreover, indices like the one of the OECD describe

Figure 5: *Quantity-based institutions (acting on labour demand)*



Source: Adapted from Boeri and van Ours 2013.

institutions “de jure”, i.e. as they are written by lawyers. But what about the effective enforcement? Bertola, Boeri and Cazes (2000) considered the EPL index too poor to be effectively used because of the lack of information on effective enforcement. Secondly, as argued since the beginning, firms react to the incentives provided by institutional settings and might change hiring practices. If permanent employment is too costly, they might focus on temporary workers even if restrictions are also high. Boeri and van Ours in their first version of their book on labour market institutions proposed a revised EPL index for permanent employment taking into account the number of people effectively covered. The difference was not negligible especially in view of the large disparities in temporary work across OECD countries. However this added only marginal information and denatured a bit the initial index (the authors have not replicated the table in the second version of their book).

A way to (partially) circumvent this measurement problem is studying just a sub-component of employment protection (e.g. the length or the trial period) or to directly study the effect of a specific reform without having to measure it quantitatively (see below).

Evaluating the effect of labour market institutions

Methods used in labour economics to evaluate the impact of institutions have varied a lot over time. Since the focus was on the comparison between institutions in different countries the first wave of empirical studies used simple cross-country regressions. This kind of approach however overlooked endogeneity and heterogeneity issues. Differences which seem to arise from different institutional settings in reality might be driven by different cultural attitudes or other economic fundamentals (e.g. the structure of the national economy, natural resources, etc). Economic outcomes might also determine changes in labour market institutions. If a country is experiencing a fall in union power, voters (or rulers) might decide to strengthen the collective bargaining coverage or even introduce a minimum wage floor. This is for instance what happened in the last few years in Germany leading to the introduction of a national minimum wage of 8.50 euros. This kind of studies offer just tentative conclusions since they cannot identify a clear counterfactual, i.e. what would be the situation without a specific institution in place.

Finding an appropriate counterfactual is not straightforward, because one cannot easily construct it in a laboratory. Some researchers have recently started running experiments on some labour market institutions just as if they were drugs tested on mice or patients. Randomized control trials are nowadays quite common in economic research but are not easily applied to evaluations of labour market institutions. The most notable exceptions are possibly on activation policies where the design of a treatment and a control group are relatively easier. However this kind of studies is often limited to a very specific tool in a specific place. The only big experiment on labour market institutions done so far to my knowledge is the one run in France by a team of J-PAL researchers (Crépon et al. 2013) in coordination with *Pôle Emploi*, the national employment agency: their random treatment consisted in an activation program for around 30,000 young people in the areas covered by 235 public employment agencies, across 10 administrative regions during 3 years (1 year of treatment and 2 years of follow-up surveys). Another experiment, still in France, tried to gauge the effect of a reform of a minimum income scheme (the *Revenu de Solidarité Active*). However the evaluation did not manage to be a real randomized control trial:

randomizing treatment and control cities turned to be politically very difficult.

Randomized control trials, though very appealing, are not easy to transpose to other institutions because they are very costly and might run against moral and legal principles of equality (it is not straightforward to justify to policy-makers and public opinion why taxes, minimum wages, dismissal protection regulations should differ randomly between groups of citizens).

The second-best evaluation tool is a natural experiment, usually a reform taking place in a country and either compare the outcomes with another country or better between individuals/firms/sectors inside a country if the reform does not apply to all. In this case not only the researcher can compare the outcomes before and after the reform but also between treated groups and controls, almost as the reform had been designed in the laboratory. These studies offer robust results but their external validity, i.e. the extent to which the results can be generalised to other situations and to other people, may not be very high. Moreover, again labour market reforms are often preceded by long and wide public debate which reduces their random effect and might affect workers' or firms' behaviour even before their implementation.

Lacking an experiment or an endogenous reform researchers have started to use other identification tools. For example, they have started to look, for variables which might explain the current institutional settings without having a direct impact on the outcome researched (they are called instrumental variables). Some, for instance, tried to "instrument" the current institutional setting referring to the historical legal tradition of the country. However, as Max Weber (1905) famously discussed, the cultural, and hence legal, tradition of a country might have direct effects on current economic outcomes, thus invalidating the instrument.

Other researchers used thresholds that define the entitlement to some policies to compare outcomes of the people at the border (the so called Regression Discontinuity Design): for instance a famous paper by DiNardo and Lee (2004) studies the effect of union presence on wages comparing outcomes for employers where unions barely won the election (e.g., by one vote) with those where the unions barely lost. Leonardi and Pica (2013) apply a discontinuity design to study the effect of employment protection legislation (EPL) on workers' individual wages exploiting a reform

that introduced unjust-dismissal costs in Italy for firms below 15 employees and left firing costs unchanged for bigger firms. Yannelis (2014) analyzes the employment effects and dynamics of the minimum wage using an age-based reform in Greece where the minimum wage was reduced differentially for workers above and below the age of 25.

Another possibility is to specify complete models of economic behaviour in the presence of institutions and estimates or calibrates such models. This method is called structural analysis and is often put in opposition to reduced-form estimations of the kind discussed above. As Chetty (2009) explains, “*advocates of the structural estimations criticize the reduced-form approaches for estimating statistics that are not policy-invariant parameters of economic models and therefore have limited relevance for policy and welfare analysis*”. Reduced-form advocates respond that “*it is difficult to identify all primitive parameters in an empirically compelling manner because of selection effects, simultaneity bias, and omitted variables*”. To my knowledge most papers using structural estimations studied taxation and social benefits (e.g. Blundell et al. 2000 or Autor and Duggan, 2003).

The quest for a strong identification strategy might undermine a bit the scope and relevance of the academic research. There is indeed a trade-off between the internal validity and the external validity of the study (see the fierce debate between Deaton, 2009, Heckman and Urzua, 2009 and Imben, 2009). The most rigorous researchers might say that in fact without internal validity there is no external validity. To some extent this is obviously true but as Thomas Piketty recently said “*academic economics is so focused on getting the econometrics and the statistical interpolation technique correct that [researchers] don’t really think, don’t dare to ask the big questions*”. Limiting academic evaluation to subjects and settings where bullet-proof research tools can be used will not stop policy-makers from acting or public opinion from debating. Therefore a fine balance between the econometrics and the relevance of questions researched has to be found.

This is what I have tried to do in my thesis using a mix of econometric techniques specific to the type of research questions and data used. Each chapter will discuss in details pros and cons of the choices made.

Outline of the thesis

This thesis aims to give a contribution to the academic debate on three specific issues related to institutions and heterogeneity in the labour market. In the first part I analyse the effect of employment protection legislation on worker flows, i.e. the rate of worker reallocation, in OECD countries. The second part revisits the debate on minimum wages in Europe bringing new evidence on systems without a statutory minimum wage and comparing them with countries with a statutory one. The third part delves in a relatively newer debate, about the pros and cons of workforce diversity for firms, bringing some evidence on the effect of diversity on firm productivity and wages in Belgium and France.

Part I: Employment protection and workers flows

The first part of the thesis studies the effect of employment protection legislation on worker flows, i.e. the share of people quitting a job, finding one or changing it. Finding, changing or losing a job are major and remarkable events in people's life and have an important impact on people's welfare and well-being. Every year, more than 20% of jobs are created and/or destroyed on average in the OECD area, and more than 30% of all workers are hired and/or separated from their employers. Labour markets are not a static framework as some textbook models might lead us to think.

The literature has found that reallocation of resources significantly contributes to productivity and output growth but also comes at some (sometimes large) costs both for firms and workers: vacancies are costly for firms and searching and switching to new jobs is costly for workers too. For those who are dismissed or have been asked to leave, it takes time to find another job and, even when this is accomplished, the new job might not offer comparable pay (e.g. OECD, 2004). On the other hand, leaving a job for unemployment is often a big source of trouble both at the individual level and the social level.

Employment protection is a way to induce firms to internalise the social costs of dismissals by moving the social burden of re-allocating a worker to another job closer to the firm's profitability criteria. However, if these regulations are particularly strict,

as in many European countries, firms may become more cautious about adjusting their workforce, not by firing less but also by hiring less (Bentolila and Bertola, 1990).

A large body of theoretical and empirical literature suggests that employment protection legislation is a key determinant of labour reallocation. In the first part of the thesis we ask whether dismissal regulations affect also where labour resources are reallocated. Put it another way, in economies with less stringent regulations, do separations result more often in job-to-job transitions within the same industry as opposed to job-to-job transitions across industries and transitions from employment to non-employment?

To identify the effect of employment protection on worker flows Chapter 1 uses the fact that not all industries are affected in the same way by employment protection: if firms need to lay off workers to restructure their operations in response to changes in technologies or product demand, high firing costs are likely to slow the pace of reallocation of resources. By contrast, in industries where firms restructure through internal adjustments, changes in employment protection can be expected to have little impact on adjustment costs and, therefore, on labour reallocation. Therefore, employment protection will have a greater impact on job and worker flows in industries that have a greater natural propensity to make staff adjustments on the external labour market. Therefore, as done in a few recent cross-country studies on the effects of EPL (e.g. Bassanini et al., 2009, and Cingano et al., 2010), Chapter 1 identifies the effect of dismissal regulations by exploiting this theoretical property and using a difference-in-difference approach à la Rajan and Zingales (1998), where low-reallocation industries are used as a sort of control group for high-reallocation industries.

To anticipate the results, Chapter 1 finds that the more restrictive the regulation, the smaller is the rate of within-industry job-to-job transitions, in particular towards permanent jobs. By contrast, no significant effect are found as regards separations involving an industry change or leading to non-employment. The extent of reinstatement in the case of unfair dismissal appears to be the most important regulatory determinant of gross worker flows.

Party II: Minimum wages in Europe

The second part of the thesis, composed by three chapters, provides an empirical contribution to the current debate on minimum wages in Europe. Minimum wages, as other institutions, have suffered from bad press in the last decades. However, the crisis has brought them back on stage. In January 2014 Barack Obama pledged to increase minimum wages to 9 dollars per hour starting from federal workers and contractors. In March 2014 the German Government passed a law to establish a minimum wage of 8.5 euros since 2015. In UK minimum wage is a source of fierce debate and political campaign. During the electoral campaign for the European election in May 2014, the conservative (and eventually successful) candidate to the European Commission Jean-Claude Juncker repeated his old idea of a European minimum wage.

In the 1990s the academic debate on minimum wages was basically concerned only by the employment effects. But since the mid-2000s, academics, trade unionists and policymakers in Europe have been involved in a new debate about the need for a harmonised European minimum wage policy. The third part of the thesis leaves the beaten track of minimum wage analysis by focussing on the institutional diversity of minimum wage systems within the EU.

The European debate should be better framed in terms of a choice between alternative systems rather than a choice of any particular rate for Europe as a whole. In Europe minimum wages are set in different ways. In the rest of the world minimum wages are set by Governments sometimes in accordance with social partners, sometimes unilaterally. In Europe they are also set by Governments but only in some countries like for instance in France, the UK, Spain, Portugal or the Eastern European countries. But in other countries they are set autonomously by social partners, like in the Nordic countries, Italy, Austria and Germany (until the end of 2014). These different institutional settings have been studied only on the surface and most often by political scientists and not by economists. The reason is mainly linked to the lack of data for those countries where thousands of collective agreements prevail. Hence, in the second part of the thesis we collect data for more than 1000 collective agreements in countries without a statutory minimum wage and we compare them to countries with statutory minimum.

In particular, Chapter 2 provides a description of minimum wage systems in Europe and some preliminary descriptive statistics. Chapter 3 explores the link between different institutional features of minimum wage systems and the minimum wage bite at sectoral-level minima. Chapter 4 explores how the diversity of minimum wage systems affects earnings inequalities within European countries.

To anticipate the results, Part II shows that the combination of sectoral minimum rates and high levels of collective bargaining coverage can, at least in terms of inequality reduction, be regarded as a functional equivalent to a binding statutory minimum wage at the national level. But there are also trade-offs. In particular, minimum wage systems with statutory rates at national level are related to relatively low wage floors but in systems without statutory minima, there are higher rates for insiders at a cost for outsiders.

Part III: Managing diversity inside firms

The third part of the thesis will not study a labour market institution as such but the effect of workers diversity, which is a matter of increasing concerns for employers and policy-makers and the subject of calls for regulations or at least a more attentive management. In many countries companies are under legislative pressure to diversify their workforce either through “hard law” like gender quotas or forms of affirmative action or through “soft law” like “corporate social responsibility” policies and “diversity charters”.

Workforce diversity has thus become an essential business concern not only as a by-product of antidiscrimination legislation but as a societal value as such. Until 30-40 years ago labour force was composed mainly by prime-age low educated white men. Today’s labour force is getting more and more heterogeneous: ageing, migration, women empowerment and technological change are key drivers of this phenomenon. Parallel to that, in many countries companies are under legislative pressure to diversify their workforce either through quotas or affirmative action. New labour market institutions are being created to fight discrimination and promote diversity.

Workforce diversity has thus become an essential policy and business concern and a matter of public discussion. Firms have to manage diversity both internally

(i.e. among management and staff) and externally (i.e. by addressing the needs of diverse customers, suppliers or contractors). As a result, an increasing number of firms employs a “diversity manager” whose task is to ensure that diversity does not hamper productivity but may contribute to the attainment of the firm’s objectives. Moreover, diversity has become a central component of corporate social responsibility, marketing, creativity and communication strategies. From the workers’ point of view, labour diversity may also generate benefits or losses. The latter may be the result of a more (or less) enjoyable working environment, but they may also derive from a higher (or lower) wage. According to competitive labour market theory, workers are paid at their marginal revenue products. Hence, if labour diversity affects productivity, it may also influence workers’ earnings. If, on the opposite, wages do not adjust to productivity, then firms or workers are able to extract a rent.

The empirical evidence regarding the impact of labour diversity on productivity is very inconclusive. Moreover, findings must often be interpreted with caution because of methodological and/or data limitations. In addition, studies on the wages effects of diversity are almost non-existent (as far as I know, Ilmakunnas and Ilmakunnas (2011) is the only exception). Finally, only few papers examine whether the diversity-productivity nexus is influenced by specific working environments, by managers’ characteristics or by the proprietary structure of the firms. The optimal degree of diversity is likely to depend on the nature of the production unit and its technology (Lazear, 1999). For instance, it has been argued that traditional industries, which are essentially characterized by routine tasks, might be better off with a more homogeneous workforce. In contrast, high-technology/knowledge-intensive sectors may benefit more from diversity as it stimulates creative thinking and innovation. Also managers’ characteristics could influence how diversity affects productivity and wages since executives exercise the day-to-day control of running the business and may have idiosyncratic sympathies or incompatibilities with some employees. Managers might favour similar workers (women executives with women employees or older managers with older workers for instance) or, on the opposite, disregard them (the “Queen bee syndrome”). When workers and supervisors are similar, mentoring may be more effective or are better equipped at interpreting signals of productivity

from similar workers. Finally, shareholders may also affect the impact of diversity on productivity and wages by defining the overall company culture and values or by giving formal incentives to managers to create a diverse workforce.

Chapter 5 will put the relationship between labour diversity (measured through education, age and gender) and firm productivity to an updated test, taking advantage of access to detailed Belgian linked employer-employee panel data for the years 1999-2006, using various diversity indicators and addressing important methodological issues such as firm-level invariant heterogeneity and endogeneity (using both the generalised method of moments (GMM) and Levinsohn and Petrin (2003) estimators). We will also examine how the benefits or losses of labour diversity are shared between workers and firms and whether the diversity-productivity-wage nexus varies with the degree of technological and knowledge intensity of sectors or with firm size.

Chapter 6 extends the analysis of workforce diversity to the French case using data from a comprehensive establishment-level survey (REPONSE) for 2011 matched with companies' balance sheet data. Controlling for a wide set of workers and firms characteristics, findings suggest that demographic diversity (age and gender) has a negative effect on productivity and wages while educational diversity is found to have a positive impact. Contrary to some widespread beliefs, the chapter finds no differential effect according to manager characteristics (gender, age, tenure) but some heterogeneity according to the type of shareholders of the firms (family firms, companies listed on the stock exchange, etc.): in family firms gender diversity seems to play a slightly more positive effect than in other firms while in firms listed on the stock exchange education diversity has a more beneficial role.

Part I

Employment Protection Legislation

CHAPTER 1

DISMISSAL PROTECTION AND WORKER FLOWS IN OECD COUNTRIES

This chapter is based on the paper “*Dismissal Protection and Worker Flows in OECD Countries: Evidence from Cross-Country/Cross-Industry Data*” joint with Andrea Bassanini and published in *Labour Economics*, vol. 21 (pp. 25-41) in 2013.

1.1 Introduction

Market-based economies are characterised by a continuous reallocation of labour resources. New firms are created; existing firms expand, contract or shut down. A number of firms do not survive their first few years in the market, while other successful young businesses develop rapidly. In the process, large numbers of jobs are created and destroyed. At the same time many individuals enter the market and fill new job vacancies, while others change jobs or leave employment. Each year, more than 20% of jobs, on average, are created and/or destroyed, and around one third of all workers are hired and/or separate from their employer (see e.g. OECD, 2009).

A large body of theoretical and empirical literature suggests that employment protection legislation (EPL hereafter), and especially dismissal regulation, is a key

determinant of labour reallocation. From a theoretical viewpoint, standard equilibrium models of the labour market (e.g. Bentolila and Bertola, 1990, and Bertola, 1990) describe firms' optimal behaviour in the presence of positive firing costs - as well as wage rigidities, financial market imperfections and/or uncertainty about the future of the firm - and show that the best strategy for firms is to reduce both job creation and destruction, with an ambiguous effect on average employment levels.¹ These predictions are by and large confirmed by the empirical literature: both microeconomic evaluations of policy reforms and cross-country macroeconomic studies tend to find, with few exceptions, that restrictive dismissal regulations hinder job creation and hiring while simultaneously compressing job destruction and separations.² In other words, stringent dismissal regulations dampen the reallocation of labour resources across firms.

In this chapter we ask whether dismissal regulations affect also where labour resources are reallocated. Put it another way, in economies with less stringent regulations, do separations result more often in job-to-job transitions within the same industry as opposed to job-to-job transitions across industries or transitions from employment to non-employment? Job-to-job transitions are defined here as situations in which an individual is with one employer at one year and with another one at the subsequent year.³ In order to investigate this issue, we build and exploit a unique dataset including cross-country comparable hiring and separation rates by type of transition for 24 OECD countries and 23 business-sector industries. To anticipate our results, we find that the more restrictive the regulations, the smaller is the rate of job-to-job transitions within the same industry - and in particular of transitions towards permanent jobs - while no significant effect is detected as regards other types of separations. Moreover, as we have very detailed data in terms of regulatory

¹Search and matching models, such as those of Garibaldi (1998) or Mortensen and Pissarides (1999), also come to the conclusion that job mobility is negatively affected by the stringency of dismissal regulations.

²See among others Autor *et al.* (2007), Boeri and Jimeno (2005), Marinescu (2009), Gomez-Salvador *et al.* (2004), Messina and Vallanti (2007), Haltiwanger *et al.* (2014), Cingano *et al.* (2010), and, for less conclusive findings, Bauer *et al.* (2007), Martins (2009) and von Below and Thoursie (2010).

³Obviously, workers might experience short spells of unemployment between the two dates. By contrast, employment to non-employment transitions imply that individuals are not in employment the subsequent year.

provisions, we can assess the different importance of each of them as regards these transitions. In particular, we find that the possibility of reinstatement in the case of unfair dismissal is key in shaping gross worker flows.

We think that tracing where labour resources are reallocated and assessing the impact of employment protection on different types of transitions is interesting because structural reforms that relax the stringency of regulations might decrease the efficiency of the reallocation process while increasing overall reallocation. For example, the Spanish experience of the past thirty years suggests that reforms that increase the use of temporary contracts have opposite effects on reallocation and productivity (see e.g. Dolado and Stucchi, 2010). A key concern about reforms of dismissal regulations is that if they induce excessive turnover they might enhance inefficient destruction of industry-specific human capital, thereby impairing productivity growth in the long-run. In fact, the literature on job displacement has shown that dismissals leading to protracted unemployment spells and/or industry changes induce long-lasting wage penalties that are interpreted as due to destruction of (usually industry-specific) human capital.⁴ Therefore, by increasing displacement, reforms relaxing firing restrictions might reduce the efficiency of the reallocation process. However, to the extent that laxer firing restrictions prompt firms to do more experimentation with new recruits and more hirings, more productive matches might also be realised, resulting in greater efficiency. Although in our dataset we cannot distinguish dismissals from voluntary quits, by distinguishing separations leading to either unemployment spells or a job in the same industry or a job in another industry, our analysis sheds some light on the likelihood that the increase in reallocation associated with the relaxation of firing restrictions could induce excessive destruction of (industry-specific) human capital.

One key problem in the cross-country analysis of the impact of regulations is that it is difficult to control for an exhaustive list of confounding factors. In addition, regulatory changes might be endogenous to worker flows, in particular insofar as they might be prompted by a sudden rise in dismissals and job destruction. Theory however predicts that, under standard assumptions on adjustment costs, dismissal

⁴See e.g. Neal (1995), Gregory and Jukes (2001), Kletzer and Fairlie (2003), von Wachter and Bender (2006), Schmieder et al. (2012).

regulations have a greater impact on job and worker flows in industries with greater natural propensity to make staff adjustments on the external labour market, in the absence of adjustment costs (see e.g. Micco and Pages, 2006). For example, if firms need to lay off workers to restructure their operations in response to changes in technologies or product demand, high firing costs are likely to slow the pace of reallocation of resources. By contrast, in industries where firms restructure through internal adjustments, changes in employment protection can be expected to have little impact on adjustment costs and, therefore, on labour reallocation. As done in a few recent cross-country studies on EPL and labour reallocation (e.g. Haltiwanger et al., 2014, and Cingano et al., 2010), we identify the effect of dismissal regulations by exploiting this theoretical property and using a difference-in-difference approach à la Rajan and Zingales (1998), where low-reallocation industries are used as a sort of control group for high-reallocation industries. The advantage of this approach is that it allows to control for all factors that are unlikely to affect labour flows in a different way in high- and low-reallocation industries. In addition, through this approach we can better address endogeneity issues. In contrast with cross-country studies on labour reallocation, however, we explicitly acknowledge possible cross-industry general-equilibrium effects, which would not be identified through industry comparisons, and check that our results also hold when we estimate a standard cross-country/time-series model in which the effect of EPL is identified through regulatory changes over time.

This chapter complements existing micro and macro studies on EPL and labour reallocation. Autor et al. (2007) study the impact of the adoption of wrongful-discharge protection norms by state courts in the United States on several performance variables constructed using establishment-level data. By using cross-state differences in the timing of adopting stricter job security provisions, they find a negative effect of these provisions on job flows and firm entry. Using Italian firm-level data, Boeri and Jimeno (2005) exploit exemption clauses exonerating small firms from job security provisions within a difference-in-differences approach. Their estimates confirm a significant effect of employment protection on job turnover and job destruction in particular. Similar findings are obtained by Schivardi and Torrini (2008) and Kugler

and Pica (2008). Marinescu (2009) exploits a 1999 British reform that reduced the trial period for new hires from 24 to 12 months of tenure, thereby directly affecting only employees within this window, and finds that the firing hazard for these employees significantly decreased with respect to that of workers with longer job tenure. Kugler et al. (2003) study the effects of a 1997 Spanish reform, which lowered dismissal costs for older and younger workers, and find that it was associated with a relative increase in worker flows for these groups. By contrast, insignificant effects are found by Bauer et al. (2007), Martins (2009) and von Below and Thoursie (2010) - who look at the impact of small-firm exemptions on worker turnover in Germany, Portugal and Sweden, respectively - possibly because of the small economic significance of the exemptions, typically concerning only procedural requirements. The fact that significant changes to labour legislation are rare makes it difficult to evaluate the impact of large differences in regulations through microeconomic studies concerning specific reforms in single countries. This is why a relative large cross-country empirical literature has emerged on this issue. Gomez-Salvador et al. (2004) estimate the effect of different degrees of stringency of employment protection legislation using a classical cross-country/time-series regression analysis based on European firm-level data and find a negative effect on job reallocation controlling for the effect of other labour market institutions. On the same data, Messina and Vallanti (2007) find that strict employment protection significantly dampens job destruction over the cycle with mild effects on job creation. In order to avoid omitted variable and endogeneity problems, Micco and Pages (2006), Haltiwanger et al. (2014) and Cingano et al. (2010) use a difference-in-differences estimator similar to that used in this chapter on a cross-section of industry-level data for more than a dozen countries. They find that the negative relationship between layoff costs and job flows is more negative in industries where reallocation rates are larger, that is where it can be expected that EPL effects are, if any, stronger. This chapter complements these papers, by looking at the impact of dismissal regulations on different types of transitions. In addition, as far as we know, this chapter is the first cross-country study using harmonised data covering all firms and workers for a large number of OECD countries.⁵ We believe that we are

⁵The samples of Micco and Pages (2006) and Haltiwanger et al. (2014) include few OECD countries and their data come from different national sources. Gomez-Salvador et al. (2004),

also the first who, on the basis of cross-country evidence, simultaneously compare the effect on gross flows of different types of regulations concerning dismissals of regular workers.

This chapter is also related to the literature on EPL and productivity. Recent studies have pointed out that dismissal regulations tend to reduce multi-factor productivity growth (see e.g. Autor et al., 2007, Bassanini et al., 2009, van Schaik and van de Klundert, 2013). These findings have been linked to a growing body of evidence suggesting that the reallocation of resources from declining and less efficient businesses to expanding and more efficient companies contributes significantly to productivity and output growth (e.g. Griliches and Regev, 1995; Foster et al., 2001; Bassanini, 2010; and OECD, 2009, for a survey). Although given these two bodies of evidence it seems natural to argue that EPL slows down productivity growth by impairing efficient labour reallocation,⁶ this conclusion would not be warranted if laxer EPL reduced the efficiency of the reallocation process. We are not aware of any paper providing evidence on this. We contribute to this debate by showing that the effect of dismissal regulations on separations is essentially confined to those leading to rapid job finding within the same industry, suggesting that it is unlikely that laxer regulations lead to inefficient destruction of industry-specific human capital.

Finally, this chapter can be of interest to scholars and policy-makers who worry about distributional consequences of structural reforms and, more generally, the political economy of reforms. There is no doubt that a liberalisation reform negatively affects those workers that are displaced after the policy change and would not have been displaced in the absence of the reform. While the trajectories of displaced workers have been intensively researched, often comparing different countries (see e.g. Bender et al., 2002, for one of these cross-country comparisons), there are only few studies that follow these trajectories in the aftermath of structural reforms (see Eslava et al., 2011, and Menezes-Filho and Muendler, 2011, for two examples concerning trade reforms in developing countries) and we are aware of no such cross-country study. By showing that dismissal regulations affect mainly within-industry job-to-job

Messina and Vallanti (2007) and Cingano et al. (2010) use firm-level data from the Bureau van Dijk's Amadeus, which are in principle comparable but exclude firm entry and exit.

⁶For theories suggesting alternative channels through which stricter dismissal regulations negatively affect productivity growth, see Saint-Paul (2002) and Bartelsman et al. (2010).

transitions, our results provide suggestive evidence that those displaced workers that would not have been displaced in the absence of deregulation tend to find relatively quickly another job that is likely to fit their previously accumulated competences.

The layout of the rest of the chapter is as follows. Section 1.2 presents the theoretical framework and the empirical strategy. Section 5.4 describes the dataset and presents summary statistics. Section 5.5 reports our empirical results. Section 5.6 concludes.

1.2 Theoretical and empirical framework

The identification of the impact of EPL on worker reallocation requires more than a standard cross-country/time-series techniques: gross worker flows vary a lot across industries and therefore changes in the industry composition of each country might bias the estimation. Moreover, it would be necessary to include a control for all aggregate policies and institutions that are likely to affect gross worker flows which is not possible and, therefore, we would be likely to suffer severely from omitted-variable bias. Furthermore, it is easy to imagine that employment protection legislation is endogenous to the business cycle and therefore to worker reallocation, i.e. in case of a negative shocks firms might lobby to relax dismissal regulations. In this case, a reverse causality would further bias the estimations. Last but not least of the problems, available time-series for worker reallocation are short (2000-2007) and variation in employment protection legislation are rare and of low intensity.

To help finding a proper identification strategy, we formalise the decisions of the firms and the impact of EP provisions through a simple model.

1.2.1 A simple theoretical framework

Classical economic textbooks tend to represent the labour market equilibrium as a static result of demand and supply. However, labour markets are better described as a “perpetual motion machine” (Bassanini, 2010) where jobs are continuously created and destroyed or where workers simply switch job. However, the motion machine does not work in the same way in all industries: some need more reallocation than

others because of higher volatility of product demand or because of higher variability of job supply. Moreover, employment protection legislation imposes a cost on firms to dismiss workers. Intuitively, EP is more binding, and hence costlier, for those industries that need more reallocation and less binding for those industries that in any case do not reallocate many workers. For instance, in the US, where employment protection is very limited, the sector of hotels and restaurants reallocate almost 90% of its workforce every year. On the contrary, the electricity, gas and water supply sector only reallocate 20% of its workforce. The two sectors would be impacted very differently by a more stringent dismissal regulation, with the former largely affected and the latter much less.

To describe the effect of employment protection institutions on worker reallocation we use the model developed by Micco and Pages (2006) and adapt it to our framework.

The firm faces a linear demand $p = a - cQ$ and a production function $Q = bL$. There is no capital and firms are price-takers. Profits are:

$$\pi = (a - cQ)Q - wL = (a - cbL)bL - wL = (ab - w)L - cb^2L^2 \quad (1.1)$$

$$\Leftrightarrow \frac{\pi}{2cb^2} = \frac{(ab - w)}{2cb^2}L - \frac{1}{2}L^2$$

The optimal level of employment without adjustment costs can be derived by the FOC of (1.1) and we obtain: $L^* = \frac{(ab-w)}{2cb^2}$ or, to keep notation simple, $L^* = A$, where $A = \frac{(ab-w)}{2cb^2}$.

The optimal level of employment is therefore subject to industry-specific technological factors (b in our framework), product demand factors (a and c) and wages w . For example, demand characteristics in some industries imply that firms face higher volatility in their product demand than other industries. The textile industry, for instance, is subject to the swing of fashion whereas the hotel sector is subject to seasonal variations. Likewise, technological characteristics may require more frequent re-tooling of the production process with the associated need to adjust the workforce. Alternatively, certain technological characteristics may require firms to use highly specialized workers and thus make them less likely to frequently adjust their workforce to respond to idiosyncratic shocks, as in the financial industry or the

electricity, gas and water supply industry. Demand and technological characteristics also affect the composition of firms within each industry and their response to shocks. For example, some industries are characterized by the presence of small firms which tend to be more volatile than large businesses in all countries.

Using the definition of job reallocation rate in industry j and country c in all firms i at time t by Davis and Haltiwanger (1999) we obtain the optimal job reallocation rate:

$$JF_{jc}^* = \frac{E(|A_{ijct} - A_{ijct-1}|_{jc})}{E(A_{ijct}|_{jc})} \quad (1.2)$$

The optimal job reallocation rate without adjustment costs depends only on technological and demand shocks. The more shock variability the firm faces, the more it will create and destroy jobs.

1.2.2 Adjustment costs

However, firms are never free to adjust workforce at will and often incur some costs to adjust employment. Employment protection deliberately imposes some further costs on firms which dismiss workers in order to make them internalize social cost.

Because adjusting is costly, firms change manpower slowly and we know from neo-keynesian macroeconomics that, in the presence of quadratic adjustment costs (however, Rotemberg (1987) proves that there is an equivalence between constant hazard models and models with quadratic adjustment costs), the optimal dynamic level of employment L_{ijct} is a weighted average between the current and expected optimal levels of employment that would be realised in the absence of adjustments costs:

$$L_{ijct} = A_{ijct}(\lambda) + E(A_{ijct}|_{jc})(1 - \lambda) \quad (1.3)$$

where λ is a decreasing function of adjustment costs.

Inserting (1.3) in (1.2) and taking into account that when the firm does not adjust $E(|L_{ijct} - L_{ijct-1}|_{jc}) = 0$ and that $E(A_{ijct}|_{jc})$ is time invariant we obtain the optimal level of adjustment in the presence of adjustment costs:

$$JF_{jc} = \lambda^2 \frac{E(|A_{ijct} - A_{ijct-1}|_{jc})}{E(A_{ijct}|_{jc})} = \lambda^2 JF_{jc}^* \quad (1.4)$$

The industry - country job reallocation rate falls with adjustment costs induced by institutions and this decline is higher for industries with higher “natural” volatility of employment, JF_{jc}^* .

The natural volatility JF_{jc}^* is likely to be a function of industry specific characteristics (such as demand volatility, technological peculiarities, etc.) and country specificities other than the simple employment protection. JF_{jc}^* can be rewritten as $JF_{jc}^* = JF_j^* + JF_c^*$. The key identifying assumption is that these two effects can be decomposed in an additive way. This is however a fair assumption since, as Bassanini (2010) shows through a simple analysis of variance on job and worker flows using our same dataset, 38% of the cross-country/cross-industry variation in gross job reallocation rates is explained by country-specific effects and about 40% by industry-specific effects⁷. Large part of the total variance of JF^* can, therefore, be decomposed in these two additive components. On the other hand, λ is a function of some institutions that affect adjustment costs, such as EP provisions. We can, therefore, rewrite λ as $\lambda_j + f(EPL_c)$, decomposing the probability of adjustment in some industry specificities and a function of EP strictness.

These are the conclusions and the assumptions we are going to exploit in our empirical specification. Taking the simplest case ($f(EPL_c) = EPL_c$), equation (1.4) can now be rewritten as:

$$JF_{jc} = \lambda_j JF_j^* + EPL_c \times JF_j^* + \lambda_j JF_c^* + EPL_c \times JF_c^*$$

Or keeping notations simple:

$$JF_{jc} = D_j + D_c + EPL_c \times JF_j^* \tag{1.5}$$

where D_j is a industry specific constant and D_c is a country-specific constant, the latter capturing other factors that are unlikely to affect adjustment costs and that are unlikely to have a different impact across industries⁸.

⁷A caveat must be added: the analysis of variance is obviously done on JF_j and not on JF_j^* which is a counterfactual we cannot observe.

⁸For example, institutions affecting the likelihood that second-earners quit a job (institutions affecting partners' geographical mobility, taxes on second earners and childcare expenditures affecting post-maternity participation of women, etc.).

So far we have talked about job flows but our subject of interest is worker flows. OECD (2009) and Bassanini (2010) have shown with comparable data that worker flows are a linear combination of job flows and churning flows, $WF_{jc} = JF_{jc} + C_{jc}$. Bassanini (2010) and Centeno et al. (2009) have shown that churning flows C_{jc} do not vary across countries. Moreover Bassanini (2010) regresses total worker reallocation on total job reallocation and he obtains a coefficient estimate of 0.98, insignificantly different from unity. In other words, a one-percentage-point increase in job reallocation is associated with an equal increase of worker reallocation, with no increase in churning.

In conclusion, we can re-write $JF_{jc} = WF_{jc} - C_{jc}$ where C_{jc} are churning flows and therefore the conclusions of the model hold true also for worker flows. The equation (1.5) can finally be rewritten⁹ as:

$$WF_{jc} = D_j + D_c + EPL_c \times WF_j^* \quad (1.6)$$

and this is the equation we are going to estimate.

1.2.3 The identification strategy

From (1.6) we find that the impact of EPL_c varies according to the “natural” level of reallocation, i.e. the level in the absence of adjustment costs, of each sector, JF^* . The regulation is legally the same for all firms and sectors as it is established at national level, but its impact may be different because of technology characteristics or type of knowledge management required or different dynamics of aggregate shocks. We use this difference, to implement a difference-in-difference approach following the seminal paper by Rajan and Zingales (1998) and exploiting more the within-country dimension since not all industries are constrained in the same way by EPL as we have shown in the simple model. Bassanini et al. (2009) speak about EPL-binding industries to define those industries that have a relatively high natural propensity to adjust their human resources through layoffs. Micco and Pages (2006) and Haltiwanger et al. (2014) comparing job turnover show that there is little cross-country

⁹This is valid insofar C_{jc} is not a completely different function of JF_{jc} or EPL_c , but there are no reasons to think so.

variability in the ranking of industries with reference to their propensity to adjust on the external labor market, suggesting that some common features among industries shape this propensity. A difference-in-difference approach between countries and EPL-binding and EPL-non binding industries can help to minimize the possible endogeneity and omitted variable problems. A diff-in-diff approach allows controlling for all omitted policies that, either by affecting labor supply only or affecting homogenously labor demand in all industries, are unlikely to have a differential effect on different industries.

We estimate equation 1.6 by:

$$WF_{jc} = X_{jc}\beta + \delta B_j * EPL_c + D_j + D_c + \epsilon_{jc} \quad (1.7)$$

where WF_{jc} is a rate of worker reallocation (total worker reallocation, excess worker reallocation, etc. see next section) in industry j and country c , B_j is WF_j^* in equation 1.6, the “natural” level of reallocation of each industry and δ is the parameter of interest and gives the sign of the demand effect.

The identification assumption is twofold. On the one hand, the effect of EPL on worker reallocation is proportional to the “natural” propensity of each industry to adjust on the external labor market where their propensity is measured by estimated worker reallocation rate of each industry in the absence of EPL. On the other hand it is assumed that the impact of other policies and institutions is not proportional to the estimated worker reallocation rate, which is a priori plausible for most of the policies. Including country- and sector-specific effects D_c and D_j , therefore, the effect of these other policies can be easily controlled for. In addition, for a number of policies, we control directly for their effect in a sensitivity analysis, by allowing their impact to interact with the natural propensity of firms to adjust on the external market.

There is a third assumption in our identification strategy, that employment protection regulation is the same for all sectors in a specific country. This is not the case for all countries in the sample, in particular for Belgium and France where collective agreements play some role in setting respectively the length of notice period and the length of trial period. This sectoral variation may thus invalidate our identification assumption. However, our empirical results are valid to the exclusion of these countries

(in fact, results are valid to the exclusion of up to 3 countries at the time). Secondly, these specific subindicators weigh relatively little in the total indicator. The delay to start a notice, for instance, weights $1/6$ in EPR, $5/42$ in EPRC and $5/72$ in the overall EPL index. The length of the trial period, for instance, weights $1/15$ in EPR $(1/5)*(1/3)$ and $1/21$ in EPRC $(1/5)*(1/3)*(5/7)$ and $1/36$ in the overall EPL index. In conclusion, sectoral differences in specific measures of EPL would vary relatively little the total stringency. Third, sectoral variation of EPL would bias the results if they are a monotonic function of the natural level of reallocation, meaning that they are constantly higher (or lower) for sectors with higher propensity to reallocate. If, on the contrary, sectoral variations are not a monotonic function of the natural level of reallocation then they would simply add some noise to our estimation and increase our standard errors. Finally, and most importantly, the results are confirmed by the time series analysis where the sectoral dimension plays no role in the identification.

The main challenge of the identification strategy is to find a correct measure of worker reallocation required by each industry in the absence of legislation as a benchmark: in order to do so we have to build a counterfactual measure of reallocation at $EPL=0$ where firms would be free to adjust their employment level at will. Drawing from the seminal study on financial development by Rajan and Zingales (1998), Micco and Pages (2006) and Haltiwanger et al. (2014) and Bassanini et al. (2009) use the US data on job flows to proxy for firm's characteristics in the absence of distortions due to EPL. The US have, indeed, the lowest level of EPL according to the OECD index which makes them a useful benchmark. In the absence of US data, Cingano et al. (2010) use UK turnover rates for the same purpose.

Following this method, then, they estimate the difference-in-difference estimation using US as baseline benchmark (the WF_j^* in the model) and equation (1.7) becomes:

$$WF_{jc} = X_{jc}\beta + \delta US_j * EPL_c + D_j + D_c + \epsilon_{jc} \quad (1.8)$$

The standard way of choosing the United States, where the indicator EPL is close to zero, to construct the benchmark measure might however be problematic. First, the composition of industries in terms of more disaggregate sub-industries may differ between the United States and other countries in the sample. Second,

US reallocation rates might be affected by specific US institutional features. For instance, unemployment insurance premia in the United States are, in part, dependent on past layoffs (experience-rating). It cannot be excluded that, despite very weak dismissal regulations, experience-rating imposes significant additional costs on firms firing workers, which might differ across industries, thereby acting like endogenous additional firing restrictions.

We address this issue in two ways in a sensitivity analysis. First, we experiment with UK reallocation rates instead of US rates. The argument supporting this choice is that the United Kingdom is the country with the second laxest dismissal regulations, according to OECD indicators. However, Ciccone and Papaioannou (2010) have shown that measurement error originating from country-benchmarking can bias the estimates of δ if the benchmark reflects, among other factors, idiosyncratic shocks. For instance, if patterns of worker reallocation across industries in the benchmark country correlate more closely to reallocation patterns in countries with lax regulations than in countries with strict regulations for reasons unrelated to regulation itself, then one might incorrectly attribute the cross-country differences in the inter industry distribution of reallocation rates to an effect of EPL on gross flows. To circumvent the problem, as a second robustness exercise, we follow the procedure suggested by Ciccone and Papaioannou (2010), which involves instrumenting $B_j EPL_c$ through a two-step procedure. In a first step we obtain predicted industry slopes of EPL from the estimation of the following regression:

$$WF_{jc} = \kappa_j * EPL_c + D_j + D_c + \epsilon_{jc} \quad (1.9)$$

Then the interaction of EPL and predicted industry-specific slopes ($\kappa_j * EPL_c$) is used as an instrument for $B_j EPL_c$ and equation 1.7 is estimated through standard two-stage least squares.

Rigorously speaking, the approach adopted here allows us identifying only differential effects between binding and other industries. This provides us with some indication on the direction of the average effects of EPL across all industries, subject to the identification assumption that the effect of EPL in non-binding industries is of the same sign and smaller than that in EPL-binding industries (or zero). For compar-

ison purposes, it is also possible to derive a rough quantitative estimate of the direct effect of regulations for the average industry by simply multiplying δ as obtained from equation 1.7, by the average value of B . This is equivalent to assuming further that dismissal regulations would have no effect in a hypothetical industry whose benchmark measure B would be equal to 0. However, our estimate might underestimate the true average effect of dismissal regulations. In fact, general equilibrium effects, and in particular those related to labour supply, might be similar across industries and be swept away by aggregate dummies. For example, high EPL, by reducing opportunities for outsiders, could discourage youth to participate in the labour market, thereby depressing hirings and separations in all industries, since young workers have typically high mobility.¹⁰ In order to check that these homogenous effects play a minor role and our estimates still provide useful quantitative measures of the average magnitude of the effect of dismissal regulations, we also complement our analysis by estimating more standard cross-country/time-series specifications on annual data. More precisely, we estimate the following general specification:

$$WF_{jct} = X_{jct}\beta + \gamma EPL_{ct} + D_j + D_c + D_t + \epsilon_{jct} \quad (1.10)$$

where γ captures the overall effect of EPL for the average industry.¹¹ Obviously, this cross-country/time-series specification is likely to suffer from the standard problems of endogeneity and omitted variables mentioned above. Nevertheless we can use it as a useful benchmark to assess the extent to which B represent an underestimate of the true effect of EPL. In fact, if additional, homogenous general equilibrium effects of EPL were essentially minor, one would expect the estimate of γ to be close to that of δB obtained by estimating equation 1.7.

¹⁰By contrast, one could expect that older workers are more likely to search for jobs in industries in which they have more work experience. If this is the case, a more flexible labour market, brought about by laxer EPL, would create more opportunities for firms in those industries to fill their vacancies. This would still represent a general equilibrium effect, but it would be industry-specific and therefore captured by our identification strategy.

¹¹We cluster errors at the country-by-time level.

1.3 The Data

We construct harmonised data on gross worker flows for 24 OECD countries and 24 business-sector industries (so the public sector is excluded) at, approximately, the 2-digit level of the ISIC rev. 3 classification.¹² The period covered by our data is 1995-2007. However, only few countries are available for the whole period. Due to data limitations (see below), we define worker flows in term of one-year transitions. In other words, hirings equal the number of workers who are with one employer at time t , but were not with that employer one year before (that is at $t - 1$), and separations equal the number of workers who were with the firm at $t - 1$, but not at t .¹³

Our main sources of data are labour force surveys (LFS hereafter) of various OECD countries.¹⁴ LFS data contain information on industry, employment, job tenure, type of contract plus standard individual characteristics such as gender, age and education. These variables are comparable across countries or can easily be made comparable - such as in the case of education, if attainment is grouped into three categories. Since workers with less than one year of job tenure are clearly new hires according to the above definition, we can reconstruct separations at the industry level by exploiting the following standard identity:

$$S_{jct} = H_{jct} - \Delta E_{cjt} \quad (1.11)$$

where S , H and E are separations, hirings and employment, respectively, in country c , industry j and time t and Δ represents one-year differences. In words, in

¹²For issues of data reliability, agriculture, mining and fuel are excluded.

¹³In one alternative, frequently-used definition, gross worker flows are computed over a specified period based on a full counting of all events during that period - i.e. every time a worker is hired or separates during the period. Nonetheless, our definition is not uncommon in the literature (see e.g. Abowd et al., 1999, Golan et al., 2006, and Davis et al., 2006). However, the choice of the definition is not entirely neutral: as shown by Hall (1995), a large fraction of job spells last no more than few days, and hiring and separations associated with these spells are by and large excluded by the definition retained here, therefore the reader must bear in mind that our results do not necessarily generalise to any definition. Nevertheless, one-year transitions are typically used in the analysis of gross job flows and in the literature on reallocation and efficiency (see the references in the introduction), so that our results can be directly compared with those in that literature.

¹⁴More precisely, we use the European Labour Force Survey for European Union countries, Iceland, Norway, Switzerland and Turkey, the bi-annual January Displaced workers/Job tenure supplement of the Current Population Survey, for the United States (even years only), and the Canadian Labour Force Survey for Canada.

each industry, separations can be derived as the difference between new hires and employment changes. The problem is that the industry dimension is not taken into account in the LFS sampling design, so that industry employment levels obtained by aggregating individual LFS data might exhibit spurious fluctuations from one year to another. Therefore, following the procedure suggested by OECD (2009), we draw industry-level employment levels and changes from EU KLEMS and OECD STAN, which are derived from national accounts and are the most reliable cross-country comparable sources for industry-level data. We then write hirings as:

$$H_{jct} = H_{jct}^L (E_{jct} / E_{jct}^L) = h_{jct}^L E_{jct} \quad (1.12)$$

where the superscript L indicates LFS variables, E without superscript stands for employment from EU KLEMS or STAN and $h_{jct}^L = H_{jct}^L / E_{jct}^L$ is the share of workers with less than one year of tenure as drawn from LFS. We then use this definition for hirings to compute separations using equation 1.11. Total gross worker reallocation will then be defined as the sum of H and S as standard.

LFS contain also some information on employment and job characteristics one year before, based on retrospective questions. In particular, respondents are asked whether they were in employment one year before and, in the case of a positive answer, which was the industry and whether their employer was the same. If the employer one year before the survey was not the same as at the time of the survey we have a separation according to our definition. Therefore, we could have used this information to aggregate directly separations at the industry-level. However, non-respondents to this question are likely to be much less frequent if the worker has not changed employer. Therefore, separation rates would be underestimated and the accounting identity (1.11) would not hold (see OECD, 2009, for a more extensive discussion). By contrast, we can use this information to construct rates of different types of transitions using rescaling rules similar to (1.12). Job-to-job separations JJS - that is, the number of employees at time t that changed employer between $t - 1$ and t , classified according to their industry in $t - 1$ - will be obtained as $JJS_{jct} = JJS_{jct}^L (S_{jct} / S_{jct}^L)$ where, again, the superscript L indicates LFS variables,

j stands for the industry of origin and S is defined from equation (1.11).¹⁵ Job-to-jobless separations $J2JL$ will then be defined as the difference between S and JJS . Using a similar re-scaling rule we then derive same-sector job-to-job separations SS - that is, the number of employees at time t that changed employer between $t - 1$ and t but remained in the same industry - as $SS_{jct} = SS_{jct}^L (JJS_{jct} / JJS_{jct}^L)$ and other sector separations OS as the difference between JJS and SS . SS and OS are key variables of interest in our analysis, insofar as we want to know whether dismissal regulations have a stronger effect on the reallocation of workers within industries or across industries. As all these definitions are based on one-year transitions, job-to-job separations include a certain amount of transitions leading to short jobless spells between $t - 1$ and t .

Consistent with the literature (see e.g. Davis et al., 1997), we then construct rates for all these flow variables by dividing flow totals (that is hirings, separations, or other type of transitions) by average industry employment in $t - 1$ and t . Tables 1.1 and 1.2 present average worker flow rates by country and industry for the period 2000-2007, which approximately corresponds to a full business cycle and where we have a similar number of observations in all countries and industries, making statistics more comparable.

¹⁵ JJS^L is the number of employees that in the LFS wave of time t reported that they changed employer between $t - 1$ and t , classified according to the industry they declared they were in at time $t - 1$. SS^L (see below) is the number of these respondents that declared to have remained in the same industry.

Table 1.1: *Gross worker flows by country, 2000-2007 (percentages)*

	Hiring rate	Separation rate	Job-to-job sep. rate	Job-to-jobless sep. rate	Same-sector sep.	Same-sector sep. rate (permanent)	Other-sector sep. rate
Austria	14.9	15.03	9.87	4.94	6.84	5.7	3.03
Belgium	14.84	14.95	10.21	4.73	5.04	4.2	5.17
Canada	21.24	20.18					
Czech Republic	14.37	13.78	8	5.77	4.21	2.93	3.79
Denmark	22.15	23.3	13.36	9.76	8.09	7.08	5.27
Finland	20.08	19.75	12.19	7.53	7.15	4.31	5.04
France	16.28	16.5	10.11	6.97	4.9	3.13	5.21
Germany	14.44	15.47	8.47	7.01	6.58	4.67	1.89
Greece	11.89	11.74	6.52	5.22	4.24	2.74	2.28
Hungary	13.8	13.29	7.23	6.06	3.72	3	3.51
Iceland	28.54	26.92	23.18	3.27	11.66	10.67	11.52
Ireland	18.79	17.56					
Italy	12.97	12.04	7.73	4.32	4.87	3.41	2.86
Netherlands	18.73	17.65					
Norway	14.77	16.47	12.34	4.19	4.53	3.58	7.82
Poland	18.12	16.61	7.26	9.38	4.53	1.52	2.73
Portugal	14.44	14.64	8.12	6.52	4.21	1.97	3.9
Slovakia	13.54	12.28	6.24	5.94	3.53	2.93	2.71
Slovenia	13.45	13.2	8.55	4.81	6.37	3.57	2.18
Spain	22.29	19.38	10.75	8.5	6.69	1.78	4.06
Sweden	15.9	16.12	7.96	7.07	3.64	2.52	4.33
Switzerland	16.17	15.82					
Turkey	30.12	25.79	16.32	9.47	9.57	7.83	6.75
United Kingdom	19.5	21.16					
United States	21.21	22.11					

Table 1.2: *Gross worker flows by industry, 2000-2007 (percentages)*

<i>Isic Rev.1 code</i>	Industry label	HR	SR	J2J	J2JLR	SSR	OSR	US REAL
15-16	Food , beverages and tobacco	17.85	18.84	11.18	7.6	5.85	5.33	39.34
17-19	Textiles, leather and footwear	13.8	19.82	8.51	10.24	4.8	3.7	45.59
20	Wood and manuf. of wood and cork	17.74	17.82	10.76	6.89	5.55	5.2	43.66
21-22	Pulp, paper, printing and publishing	14.84	16.54	9.22	6.96	4.8	4.42	36.57
24	Chemicals and chemical products	12.29	13.28	7.17	5.84	3.37	3.8	30.44
25	Rubber and plastics	15.76	15.12	8.38	5.94	3.84	4.53	35.85
26	Other non-metallic mineral products	14.39	14.71	7.91	6.15	3.98	3.93	38.65
27-28	Basic metals and fabricated metal	15.22	14.03	7.75	5.32	4.4	3.34	35.48
29	Machinery, not elsewhere classified	13.97	13.92	7.79	5.27	3.8	3.99	33.64
30-33	Electrical and optical equipment	15.9	16.65	9.16	6.85	4.96	4.2	36.97
34-35	Transport equipment	13.92	13.72	7.27	5.83	3.77	3.5	30.34
36-37	Other manufacturing; Recycling	16.77	17.34	9.8	6.58	4.88	4.93	43.52
40-41	Electricity, gas and water supply	8.45	9.74	4.77	4.8	2.5	2.26	18.29
45	Construction	24.47	21.9	14.52	7.41	11.06	3.46	58.56
50	Motor vehicles: sales and repair	19.61	17.91	11.23	5.32	6.55	4.68	59.49
51	Wholesale trade, excl. motor vehicles	18.32	16.45	10.47	5.5	5.65	4.82	42.13
52	Retail Trade, except of motor vehicles	25.36	23.2	13.38	8.11	7.83	5.55	65.59
55	Hotels and restaurants	34.86	32.49	20.65	10.31	13.65	7.01	88.41
60-63	Transport and storage	16.14	15.04	9.43	4.93	6.17	3.26	42.64
64	Post and telecommunications	14.21	14.76	7.7	6.28	3.66	4.04	31.28
65-67	Financial intermediation	13.3	12.32	7	4.38	4.62	2.38	42.18
70	Real estate activities	18.97	16.12	8.63	6.55	4.9	3.73	49.29
71-74	Other business services	23.54	19.08	12.05	5.8	7.54	4.51	48.46

Notes: HR: hiring rate; SR: separation rate; J2J: job-to-job separation rate; J2JLR: Job-to-jobless separation rate; SSR: Same-sector separation rate; OSR: Other-sector separation rate; US REAL: US total worker reallocation.

Table 1.3: *Explanatory variables used in cross-sectional regressions*

<i>Employment protection legislation</i>					
	Mean	Std. Dev.		Mean	Std. Dev.
EPRC	2.47	0.59	Difficulty of dismissal	2.62	0.97
EPR	2.14	0.88	Definition of unfair dismissal	1.68	1.86
EPC	3.19	0.69	Lenght of trial period	3.97	1.36
Procedural inconveniences	2.14	1.05	Compensation for unfair dism.	2.42	1.37
Notice/Severance pay	1.79	1.01	Possibility of reinstatement	2.39	1.91
<i>Other control variables</i>					
	Mean	Std. Dev.		Mean	Std. Dev.
% temporary workers	9.94	8.08	ARR	27.62	13.41
% self employed	12.2	10.39	PMR	1.62	0.46
% Low education	28.29	19.45	Coll. bargaining coverage	62.78	26.2
% Middle education	53.48	18.27	Corporatism	2.13	0.89
% Age 15-24	12.37	6.7	Tax wedge	35.1	8.12
% Age 25-34	26.76	5.84	Home ownership rate	62.88	14.04
% Age 55+	10.49	4.55	ALMP intensity	31.54	25.09
% Women	32.45	16.94	Output gap	0.44	0.59

Notes: EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. EPR: Indicator of employment protection legislation for regular contracts, excluding provisions for collective dismissals. EPC: Indicator of additional employment protection provisions for collective dismissals. PMR: Product market regulation. ARR: Average replacement rate. Data are averaged over the 2000-2007 period.

This is also the sample we will use for the cross-sectional difference-in-difference analysis (see the previous section). Hiring and separation rates in the country with the greatest rates (Turkey) are almost three times larger than in the country with the lowest rates (Greece). Interestingly, an even larger variation is observed across industries. The same pattern emerges for job-to-job transitions and, in particular, same-sector transitions, while job-to-jobless separations are less variable across both countries and industries.¹⁶ Two other interesting facts emerge from the table: first, job-to-job transitions are more frequent than job-to-jobless transitions, except in textile, leather and footwear manufacturing, which however contracted massively in the period of interest, and electricity, gas and water supply; second, the majority of job-to-job transitions occur within industries even at this relatively fine-grained disaggregation of the business sector,¹⁷ suggesting industry segmentation of the labour markets, possibly due to the fact that industry-specific human capital is accumulated with job experience (see e.g. Neal, 1995).

Labour and product market institutions come from OECD sources. In particular, we consider two main indicators of stringency of dismissal regulations: employment protection for regular workers, excluding collective dismissals (EPR) and including collective dismissals (EPRC). The latter is obtained as a weighted average of EPR and additional regulation for collective dismissals (EPC), with weights 5/7 and 2/7. EPRC better captures all aspects of dismissal regulations but is available only since 1998; therefore we will use EPR as a surrogate of EPRC in the time-series analysis on the 1995-2007 sample. A further breakdown of components of EPR is also used. All indicators vary from 0 to 6 from the least to the most stringent. To grasp a quantitative perception of what these numbers imply, 1 point of the EPRC indicator corresponds to slightly more than the difference between the values for the United Kingdom and the United States, the countries with the lowest indicators, and almost half of the difference between the United States and the OECD average. By contrast, in this chapter we do not consider regulations concerning temporary contracts, whose effects, in some specifications, are simply controlled for by including the share

¹⁶For example, the standard deviation of job-to-job separations is twice as large as that of job-to-jobless separations.

¹⁷Belgium, France, Norway and Sweden are exceptions to this pattern.

Table 1.4: *Descriptive statistics (time-series sample)*

	Mean	Std.Dev.
Total reallocation rate (%)	33.79	13.52
Separation rate (%)	16.69	6.9
Hiring rate (%)	17.1	7.3
Same-sector job-to-job separation rate (%)	5.32	3.39
Other-sector separation rate (%)	3.77	2.38
Job-to-jobless separation rate (%)	6.17	3.04
Same-sector separations, leading to permanent contract (%)	3.63	2.46
Same-sector separations, leading to temporary contract (%)	1.76	2.02
EPR (1-6)	2.08	0.87
ARR (%)	28.61	12.99
Tax wedge (%)	32.88	9.27
Corporatism (1-3)	2.1	0.89
Union density (%)	34.88	21.1
PMR	0.84	1.47
Temporary workers (%)	9.07	7.15
Self employed (%)	12.84	11.38
Women (%)	32.66	16.58
Low educated (%)	30.63	19.67
Med. Educated (%)	50.93	17.49
age: 15-24 (%)	12.38	6.74
age: 25-34 (%)	26.58	5.59
age: 35-54 (%)	50.16	7.42
age: >55 (%)	10.87	4.54
Δ employment gap (%)	0.377	3.665

Notes: EPR: Indicator of employment protection legislation for regular contracts, excluding provisions for collective dismissals. ARR: average unemployment benefit replacement rate. PMR: Product market regulation. employment gap is the difference between the current and average growth rates of employment (the latter computed over the period 1990-2007).

of employees under those contracts. The main reason is that the degree of enforcement might be particularly heterogeneous across countries as regards regulation for temporary contracts. In fact, enforcement of employment protection legislation is mainly dependent on individuals who consider themselves as victims and lodge a complaint. While potential plaintiffs are well identified and able to react in the case of dismissals, victims of breaches of legislation on temporary contracts (particularly in the case of violations of hiring restrictions under such contract typology) are a much vaguer group. As a result, indicators of legal restrictions concerning hiring of temporary workers appear to be a bad predictor of their share in total employment (see e.g. OECD, 2010).

Other indicators, like the “World Bank Doing Business” database or the “Economic Freedom of the World” database could also be used, as for instance Haltiwanger et al. (2008) do, or even some survey data among business executives like Feldmann (2009) does. However, Venn (2009) shows that rankings among OECD countries are not particularly affected using alternative measures of employment protection or different weights for the 21 subcomponents of OECD EPL indicator (Venn finds coefficients of correlation between 0.75 and 0.97).

UB generosity is measured on the basis of average gross replacement rates, defined as average unemployment benefit replacement rate across two income situations (100% and 67% of average worker earnings), three family situations (single, with dependent spouse, with spouse in work) and three different unemployment durations (first year, second and third years, and fourth and fifth years of unemployment). The source is the OECD Benefits and Wages database. Even years are interpolated.

Indexes of anti-competitive product market regulation come from the OECD Regulatory Database. They vary from 0 to 6 from the least to the most restrictive. The time-series is based only on the aggregation of regulatory changes for few detailed industries. See Wölfl et al. (2009) for more details on subcomponents.

Trade union density is defined as the percentage of employees who are members of a trade-union. ALMP expenditures are defined as public expenditures on active labour market programmes per unemployed worker as a share of GDP per capita. In order to minimise the effect of the cycle on this variable, raw data are regressed on the

output gap (drawn from the OECD EO database) and only the residual is included in estimated specifications. The source of these variables is the OECD Employment Database.

The tax wedge considered in this chapter is the wedge between the labour cost for the employer and the corresponding net take-home pay of the employee for couples with two children and averaged across four income situations. It is expressed as the sum of personal income tax and all social security contributions as a percentage of total labour cost. The time series refers only to a single-earner couple with two children earning 100% of average worker earnings. The source is the OECD Taxing Wages Database.

Home ownership is defined as the ratio of home-owners in the adult population. Collective bargaining coverage is the share of workers covered by a collective agreement, in percentage. The degree of corporatism takes values 1 for decentralised and uncoordinated wage-bargaining processes, and 2 and 3 for intermediate and high degrees of centralisation/co-ordination, respectively. The source of these variables is Bassanini and Duval (2009).

Our identification assumption assumes that other labour market institutions than EPL are not proportional to the estimated reallocation rate in the absence of EPL. However, they can have a direct effect. Table 1.5 summarizes the expected effects of each LM institution and the main theoretical arguments behind.

1.4 Empirical Results

1.4.1 Cross-sectional results

Baseline results

We start our analysis by estimating the impact of the stringency of dismissal regulations, as measured by EPRC, on various types of worker flows averaged across 2000-2007, using our difference-in-difference strategy à la Rajan and Zingales. In Tables 1.6 and 1.7, we consider the simplest possible specifications of 1.7, that is: i) without controls except for country and time dummies; and ii) including standard worker characteristics such as gender, age classes, educational attainment and the

Table 1.5: *Expected effects of LM institutions on workers flows*

	Expected effect	Main theoretical arguments
EPR	-	Reduced firings and hirings (Bentolila and Bertola, 1990)
Unemployment benefit	?	Increased unemployment duration (OECD, 2006) and improved job matching (Marimon and Zilibotti, 1999) reduce worker flows but by increasing the reservation wage, UB will increase the sensitivity of job-matches to productivity shocks (Mortensen and Pissarides, 1994; 1999)
Tax wedge	-	Taxes decrease job creation and increase job destruction (Pissarides, 2000)
Corporatism	?	Lower job creation but higher sensitivity of job-matches to productivity shocks (Mortensen and Pissarides, 1994; 1999)
Union density	-	Lower job creation and higher job satisfaction, job security (lower quits).
Product market regulation	?	Reduced job creation (OECD, 2009a) but also in presence of higher fixed costs firms might have greater sensitivity to productivity shocks (Asplund and Nocke, 2006)
Home ownership	-	Reduced mobility (Blanchflower and Oswald, 2013)

share of self-employed and temporary workers,¹⁸ all expressed in percentage of total employment. In Table 1.6 we look at standard measures of worker flows (total reallocation, hirings and separations). In all specifications the interaction between EPRC and US worker reallocation is negative and significant, consistent with a negative impact of dismissal regulations on flows. Remarkably, point estimates are almost

¹⁸The inclusion of the share of temporary workers deserves particular attention. Indeed, one would expect that dismissal regulations affect particularly the separation rate of workers with permanent contracts. Ideally, therefore, one would like to restrict the sample by excluding temporary workers. However, the type of contract before the transition is not available in EULFS data. As a second best, we include the share of temporary workers as a control. However, we worry that the relationship between worker flows and temporary employment might be non-linear (see, for example, Costain et al., 2010) so that including a simple linear control might not be sufficient. We therefore experiment with the inclusion of a polynomial in the share of temporary employment up to the fifth degree and, reassuringly, we find that all terms except the linear one are always insignificant, while our main estimates remain stable. As a further sensitivity analysis, as a robustness test we replicate our analysis for a coarser partition of industries and a smaller number of countries using microdata from the European Community Household Panel (ECHP), where the information on contract status before the transition is available. As expected, our findings suggest that the impact of dismissal regulations on separations is more significant for permanent workers.

unaffected by the presence of standard controls, which is reassuring taking into account that some of these confounding factors are potentially endogenous. Taking these estimates at face value, considering that US worker reallocation is 43.2% in the average industry (see Table 1.1), one would predict a one-point reduction of EPRC from the OECD average - that would correspond to a significant reform in historical terms -¹⁹ to be associated with an increase in both hirings and separations of 2.2-2.7 percentage points in the average industry, that is an increase of about 15%.²⁰

We look at other types of transition in Table 1.2. There is no evidence that EPRC has any impact on job-to-jobless transitions or other-sector job-to-job transitions. By contrast, stricter regulations for regular workers appear to reduce considerably the rate of job-to-job transitions within the same industry.²¹ Comparing estimates, it appears that about 80% of the effect of EPRC on separations is accounted for by the negative relationship between EPRC and same-sector job-to-job separations. This result can be viewed as consistent with our finding on hirings: in countries with lighter legislation, not only do workers separate more often in binding industries than in other industries, but also firm hiring incentives are stronger and hiring rates higher in these industries. This suggests that, in these industries, separating workers have more opportunities to find another job in the same industry when regulations are less strict.

In addition, our data allows us to decompose same-sector separations by type of contract in the new job.²² Re-estimating the specifications of Table 1.7 separately for same-sector transitions to permanent and to temporary jobs, we obtain coefficients

¹⁹For example, the 2003 reform of severance payments in Austria, which is often cited as an example of significant reform, entailed a reduction of only 0.55 points in the indicator (see for example Bassanini et al., 2009).

²⁰This prediction is valid if we assume that the effect of EPRC is zero at zero US worker reallocation. More rigorously, our estimates suggest that, in a country with EPRC one-point below the average, inter-industry differences in terms of hirings and separations are larger by about 15% than at the OECD average.

²¹Moreover, if equations for different dependent variables are simultaneously estimated, cross-equation statistical tests suggest that the coefficients of EPRC are significantly different across equations. More precisely, chi-square test statistics of the difference between the coefficients of EPRC in the regressions for SSR and OSR are 4.33 and 6.93 for specifications without and with controls, respectively. In the case of the difference between coefficients for J2JLR and SSR, chi-square test statistics are 3.91 and 4.57 for specifications without and with controls, respectively. All these statistics are significant at the 5% level.

²²Unfortunately, as mentioned before, information on the type of contract in the previous job is not available.

Table 1.6: *Baseline difference-in-difference results (standard worker flows: total, hirings and separations)*

Dep. variable	(1) REAL	(2) REAL	(3) HR	(4) HR	(5) SR	(6) SR
EPRC x US REAL	-0.123*** (0.039)	-0.108*** (0.026)	-0.061*** (0.020)	-0.052*** (0.014)	-0.063*** (0.021)	-0.056*** (0.015)
Temporary (%)		0.611*** (0.041)		0.327*** (0.019)		0.284*** (0.027)
Age: 15-24 (%)		0.493*** (0.067)		0.271*** (0.034)		0.223*** (0.039)
Age: 25-34 (%)		0.245** (0.109)		0.148*** (0.054)		0.097 (0.065)
Age: >54 (%)		-0.116 (0.119)		-0.091 (0.061)		-0.024 (0.073)
Low educated (%)		0.137** (0.062)		0.070** (0.031)		0.067* (0.036)
Med. Educated (%)		0.056 (0.049)		0.033 (0.025)		0.023 (0.031)
Self employed (%)		0.039 (0.040)		0.036* (0.020)		0.003 (0.026)
Women (%)		-0.029 (0.040)		-0.020 (0.019)		-0.009 (0.026)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	528	528	528	528	528	528
R-squared	0.843	0.921	0.856	0.935	0.789	0.859

Notes: Robust standard errors in parentheses. REAL: Total worker reallocation rate. HR: Hiring rate. SR: Separation rate. J2JLR: job-to-jobless separation rate. SSR: same-sector separation rate. OSR: other-sector separation rate. EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. Data are averaged over the 2000-2007 period. Average US REAL is 43.2%. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.7: *Baseline difference-in-difference results (other type of separations)*

Dep. variable	(1) J2JLR	(2) J2JLR	(3) SSR	(4) SSR	(5) OSR	(6) OSR
EPRC x US REAL	-0.003 (0.018)	0.007 (0.015)	-0.048*** (0.017)	-0.043*** (0.016)	-0.015 (0.014)	0.002 (0.010)
Temporary (%)		0.118*** (0.022)		0.154*** (0.023)		0.005 (0.012)
Age: 15-24 (%)		0.086** (0.036)		0.063* (0.034)		0.136*** (0.028)
Age: 25-34 (%)		0.032 (0.040)		0.023 (0.038)		0.018 (0.028)
Age: >54 (%)		-0.005 (0.048)		-0.055 (0.049)		-0.014 (0.037)
Low educated (%)		0.042** (0.021)		0.063*** (0.020)		-0.013 (0.015)
Med. Educated (%)		0.050*** (0.019)		0.021 (0.017)		-0.026* (0.015)
Self employed (%)		0.005 (0.016)		0.014 (0.015)		0.008 (0.014)
Women (%)		-0.002 (0.016)		-0.020 (0.018)		0.003 (0.012)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	415	415	415	415	415	415
R-squared	0.674	0.736	0.784	0.844	0.768	0.810

Notes: Robust standard errors in parentheses. REAL: Total worker reallocation rate. HR: Hiring rate. SR: Separation rate. J2JLR: job-to-jobless separation rate. SSR: same-sector separation rate. OSR: other-sector separation rate. EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. Data are averaged over the 2000-2007 period. Average US REAL is 43.2%. *** p<0.01, ** p<0.05, * p<0.1.

of -0.042 and 0.011, respectively, in the specification with controls, and -0.059 and 0.011, respectively, in the specification without controls.²³ In other words, the whole effect on same-sector job-to-job separations is due to transitions to permanent jobs. To the extent that stricter EPRC is expected to discourage only hiring on permanent contracts, this finding can be explained as a reflection of the effect of EPRC on hiring behaviour in the same way as before.

Overall, these findings suggest that countries with laxer legislation regulating permanent contracts are likely to have larger gross flows, probably including more dismissals.²⁴ But the additional separations brought about by laxer regulations essentially lead to rapid re-employment within the same industry in jobs characterized by permanent contracts. Indeed, countries with fewer dismissal restrictions are not characterized by more transitions (including job losses) leading to job-to-jobless transitions and/or situations in which separating workers have to accept precarious jobs or jobs in different industries, with the consequent likely loss of human capital.²⁵ These findings are consistent with some recent literature on the perceived degree of job security: Clark and Postel-Vinay (2009) find that perceived job security in both permanent and temporary jobs is positively correlated with unemployment benefit generosity, while the relationship with EP strictness is negative: workers feel less secure in countries where jobs are more protected.

Robustness checks

We argued that one of the key advantages of our difference-in-differences approach is that it allows us controlling for other aggregate confounding factors, including other institutions and policies, some of which are not easy to quantify. This claim is correct

²³Standard errors are 0.013, 0.013, 0.014 and 0.010, respectively.

²⁴For evidence concerning dismissals based on five countries, see OECD (2009).

²⁵As mentioned before, there is an extensive literature showing that industry-changes following displacement bring about a significant loss of valuable industry-specific human capital (see references mentioned in the introduction). However, displacement account for a small fraction of separations (see e.g. OECD, 2009). As our data concern total separations, we might worry that there might be a significant amount of job-to-job transitions across industries that would not entail losses of human capital. In particular, this would be the case for moves across industries of workers that remain in the same occupation. In order to explore this question, we have access to 5-quarter rotating panels for UK LFS from 2005 to 2008. Defining transitions in the same way as in our main dataset and using a 4-digit classification of occupations and our same partition of industries, we find that 40% of same-sector transitions maintain the same 4-digit occupation, while this is the case in only 7% of other-sector transitions. This appears consistent with the idea that other-sector transitions often involve the loss of specific skills.

provided that the impact of aggregate institutions on gross worker flows does not vary, on average, between EPL-binding and other industries. In order to provide evidence in support of our identification assumption, we augment our preferred specification with interactions between US reallocation rates and several aggregate indicators of labour market institutions and product market regulations that are typically used in aggregate unemployment equations (see e.g. Bassanini and Duval, 2009).²⁶ Tables 1.8 and 1.9 show results from the estimation of various specifications with, alternatively, total reallocation and same-sector separations as dependent variables. As institutional covariates are not always available for the countries for which we have gross worker flow data, we start with the simplest specifications including only indicators that are available for the largest number of countries, and progressively include additional covariates, available for an increasingly smaller sample²⁷. Consistent with our identification assumptions, we find no robust association between other institutions and differences in worker flows between EPL-binding and other industries (as shown by the lack of significant coefficients on the interactions between institutions and US reallocation rates).²⁸ By contrast, and reassuringly, estimated effects of EPRC do not appear to be sensitive to the specification.²⁹

As noted above, US reallocation rates could be affected by specificities of US institutions and industrial structure and this might bias our estimates. As a first robustness check we replace US with UK reallocation rates and re-estimate our speci-

²⁶These are: the average labour tax wedge, the average unemployment benefit replacement rates (averaged across different durations and family situations), the level of corporatism in collective bargaining, the share of workers covered by collective agreements (including administrative extension), the rate of home-ownership and the ratio of spending in active labour market programmes per unemployed to GDP per capita. Following the literature (e.g. Bassanini and Duval, 2009), we also add an indicator of the degree of stringency of anti-competitive product market regulation. All indicators are drawn from OECD databases.

²⁷As a robustness test, we have also estimated both Tables using the smallest sample size. Despite losing more than one third of total observations results are still valid and, if anything, slightly bigger in magnitude. The main variable of interest does not suffer from sample selection. Also all other institutional variables show no significant sample selection bias. Only PMR in the estimations of total reallocation rate turns out to have a significant negative effect at 5% level.

²⁸The coefficients of product market regulation (in Table 1.8) as well as of the tax wedge (in Table 1.9) are partial exceptions. However, these exceptions occur only in specifications with several covariates. Given the high correlation across different institutional indicators (see e.g. Bassanini and Duval, 2009), this result is likely due to multicollinearity. As a matter of fact, when these institutions are included one-by-one in the specifications of Tables 1.8 and 1.9, they turn out insignificant.

²⁹We also run a sensitivity analysis to check that our results are robust to the choice of the estimation sample. We verify that the estimation of the effect of EPRC on worker flows is not driven by a single country or industry, excluding them one-by-one.

Table 1.8: *Including institutional controls: total worker reallocation rates*

Dep. variable	(1) REAL	(2) REAL	(3) REAL	(4) REAL	(5) REAL
EPRC x US REAL	-0.103*** (0.027)	-0.112*** (0.027)	-0.110*** (0.028)	-0.129*** (0.031)	-0.111*** (0.031)
PMR x US REAL	-0.052 (0.055)	-0.030 (0.056)	-0.026 (0.058)	-0.122 (0.095)	-0.105** (0.050)
ARR x US REAL		0.002 (0.001)	0.002 (0.001)	-0.001 (0.003)	-0.001 (0.004)
Tax wedge x US REAL			-0.001 (0.002)	0.003 (0.004)	-0.001 (0.005)
Corporatism x US REAL				-0.029 (0.026)	0.003 (0.029)
Coll. Barg. Cov. x US REAL				0.002 (0.002)	0.003 (0.002)
Home Ownership x US REAL				-0.002* (0.001)	
ALMP Intensity x US REAL					-0.001 (0.001)
Country dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Worker characteristics	Yes	Yes	Yes	Yes	Yes
Observations	528	508	508	341	409
R-squared	0.921	0.923	0.923	0.940	0.924

Notes: Robust standard errors in parentheses. REAL: Total worker reallocation rate. SSR: same-sector separation rate. EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. PMR: Product market regulation. ARR: Average replacement rate. Data are averaged over the 2000-2007 period. Average US REAL is 43.2%, and its standard deviation is 14.4%. Workers' characteristics are those indicated in Table 1. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.9: *Including institutional controls: same-sector job-to-job separations*

Dep. variable	(1) SSR	(2) SSR	(3) SSR	(4) SSR	(5) SSR
EPRC x US REAL	-0.047*** (0.016)	-0.044*** (0.016)	-0.049*** (0.017)	-0.056*** (0.016)	-0.038** (0.017)
PMR x US REAL	-0.021 (0.027)	-0.019 (0.035)	-0.009 (0.037)	-0.008 (0.050)	-0.035 (0.026)
ARR x US REAL		0.000 (0.001)	0.000 (0.001)	-0.002* (0.001)	-0.002 (0.002)
Tax wedge x US REAL			-0.002 (0.001)	-0.004** (0.002)	-0.002 (0.002)
Corporatism x US REAL				0.017 (0.014)	0.022* (0.012)
Coll. Barg. Cov. x US REAL				0.001 (0.001)	0.001 (0.001)
Home Ownership x US REAL				-0.001 (0.001)	
ALMP Intensity x US REAL					-0.000 (0.001)
Country dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Worker characteristics	Yes	Yes	Yes	Yes	Yes
Observations	415	395	395	250	318
R-squared	0.845	0.853	0.855	0.898	0.884

Notes: Robust standard errors in parentheses. REAL: Total worker reallocation rate. SSR: same-sector separation rate. EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. PMR: Product market regulation. ARR: Average replacement rate. Data are averaged over the 2000-2007 period. Average US REAL is 43.2%, and its standard deviation is 14.4%. Workers' characteristics are those indicated in Table 1.6. *** p<0.01, ** p<0.05, * p<0.1.

fications by excluding UK worker flows from the sample (to avoid circularity). Results obtained this way are remarkably similar (Tables 1.10 and 1.11, Columns 1 and 2), in particular if account is taken for the fact the mean and variance of UK reallocation rates are smaller.³⁰ Alternatively, as proposed by Ciccone and Papaioannou (2010), we instrument the interaction between EPRC and the US reallocation rate with the product of EPRC and predicted industry-specific slopes, the latter obtained by fitting equation 1.10 with total reallocation rates as dependent variable and excluding the United States from the sample.³¹ Re-assuringly, results are stronger but qualitatively similar to those obtained with our baseline models (Table 1.10 and 1.11, Columns 3 and 4).³²

Breaking down dismissal regulations

So far we have considered only the overall index of employment protection for individual and collective dismissals. However, our data allow us to dig further into the relationship between worker flows and different types of dismissal restrictions, thereby shedding light on the effect of specific regulations on worker flows. Looking at the separate impact of each kind of provision can better inform policy-makers on the likely consequences of reforming specific regulations.³³

We first disentangle regulations for individual dismissals from the additional provisions applying to collective dismissals (Column 1 in Tables 1.12 and 1.13). Both indicators attract a negative and significant coefficient. Additional provisions for collective dismissals play a particularly important role in the case of same-sector

³⁰Taking these estimates at face value, a 1-point increase in EPL would entail an increase of reallocation rates of 20% and same sector separations of 40%, against 15% and 40%, respectively, as obtained when US reallocation rates are used as benchmark.

³¹Bassanini et al. (2009) use the US distribution of dismissal rates to proxy the propensity of industries to adjust on the external labour market in the absence of adjustment costs. The justification behind that choice is that dismissal restrictions are likely to be particularly binding in industries that cannot rely on the natural attrition of staff to make the required workforce adjustments. Our results are also robust to the replacement of our benchmarks with this alternative one.

³²The fact that point estimates are not smaller when 2SLS estimators are used instead of OLS suggests that, in countries with laxer EPL, the distribution of employment across industries is no closer to that of the United States than in countries with strict EPL. This is consistent with the results of Bassanini et al. (2009) who find that EPL has no impact on the distribution of employment across industries.

³³Nonetheless, in drawing conclusions from the results, it must be kept in mind that the greater the disaggregation of EPL indexes, the greater the measurement error. Furthermore, different provisions might be complementary or substitutable to each other. This issue is, however, beyond the scope of this chapter.

Table 1.10: *Alternative proxies for the industry's reallocation propensity: total worker flows*

	(1)	(2)	(3)	(4)
Benchmark	UK REAL	UK REAL	US REAL	US REAL
Method	OLS	OLS	2SLS	2SLS
Dep. variable	REAL	REAL	REAL	REAL
EPRC x US REAL	-0.174*** (0.065)	-0.167*** (0.043)	-0.211*** (0.044)	-0.198*** (0.033)
Temporary (%)		0.617*** (0.041)		0.641*** (0.040)
Age: 15-24 (%)		0.486*** (0.067)		0.453*** (0.063)
Age: 25-34 (%)		0.243** (0.112)		0.256** (0.104)
Age: >54 (%)		-0.162 (0.122)		-0.112 (0.116)
Low educated (%)		0.146** (0.063)		0.131** (0.059)
Med. Educated (%)		0.063 (0.050)		0.045 (0.047)
Self employed (%)		0.053 (0.041)		0.049 (0.039)
Women (%)		-0.027 (0.041)		-0.030 (0.038)
Country dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
F-test on instrument			120.8***	136.1***
Observations	505	505	528	528
R-squared	0.840	0.921	0.841	0.919

Notes: Robust standard errors in parentheses. REAL: Total worker reallocation rate. SSR: same-sector separation rate. EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. 2SLS estimates are obtained by instrumenting EPRC x US REAL by the interaction of EPRC and industry-specific slopes in an equation where REAL is regressed on EPRC and country and industry dummies. Data are averaged over the 2000-2007 period. Average US and UK REAL are 43.2% and 40.4%, respectively, with standard deviation 14.4% and 10.4%, respectively. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.11: *Alternative proxies for the industry's reallocation propensity: same sector separations*

	(1)	(2)	(3)	(4)
Benchmark	UK REAL	UK REAL	US REAL	US REAL
Method	OLS	OLS	2SLS	2SLS
Dep. variable	SSR	SSR	SSR	SSR
EPRC x US REAL	-0.063** (0.025)	-0.063*** (0.023)	-0.064*** (0.017)	-0.054*** (0.016)
Temporary (%)		0.156*** (0.023)		0.156*** (0.021)
Age: 15-24 (%)		0.061* (0.034)		0.060* (0.031)
Age: 25-34 (%)		0.022 (0.038)		0.023 (0.036)
Age: >54 (%)		-0.060 (0.048)		0.015 (0.014)
Low educated (%)		0.065*** (0.020)		0.062*** (0.019)
Med. Educated (%)		0.023 (0.017)		0.020 (0.016)
Self employed (%)		0.015 (0.015)		-0.053 (0.046)
Women (%)		-0.018 (0.018)		-0.019 (0.017)
Country dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
F-test on instrument			72.8***	79.3***
Observations	415	415	415	415
R-squared	0.784	0.845	0.783	0.844

Notes: Robust standard errors in parentheses. REAL: Total worker reallocation rate. SSR: same-sector separation rate. EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. 2SLS estimates are obtained by instrumenting EPRC x US REAL by the interaction of EPRC and industry-specific slopes in an equation where REAL is regressed on EPRC and country and industry dummies. Data are averaged over the 2000-2007 period. Average US and UK REAL are 43.2% and 40.4%, respectively, with standard deviation 14.4% and 10.4%, respectively. *** p<0.01, ** p<0.05, * p<0.1.

job-to-job transitions. Taking estimates at face value, a 1-point reduction in both indicators - in both cases almost one half of the difference between the United States and the OECD average - is estimated to be associated with an increase in same-sector separations almost twice as large as what would occur if only regulations for individual dismissals were reformed.

When the effect of regulations for individual dismissals is further decomposed, neither procedural inconveniences, including notification delays and procedures, nor notice periods and severance payments appear to have any significant impact (cf. Columns 2 and 3 in Tables 1.12 and 1.13). These results appear consistent with micro studies for Portugal and Sweden that find no significant impact of exemptions from procedural requirements for dismissals (see Martins, 2009; von Below and Thoursie, 2010). By contrast, the difficulty of dismissals, including the stringency of the definition of unfair dismissal and its consequences, appears negatively and significantly associated with both total worker reallocation and same-sector job-to-job separations, at least when insignificant indicators are excluded from the specification (Columns 2 to 4 in Tables 1.12 and 1.13). More precisely, the indicator of difficulty of dismissals is the average of four components: the definition of unfair dismissal; the length of trial period under which a worker can be fired “at will”; the compensation due in the case of conviction for unfair dismissal; and the extent of reinstatement following unfair dismissals. Disentangling further among these provisions we find that the frequency at which reinstatement is ordered by courts (when dismissals are judged unfair) is the only component that is significantly associated with total flows and same-sector job-to-job transitions (Columns 5 in Tables 1.12 and 1.13). This might explain why employment protection is perceived to be extremely rigid in a country like Italy (e.g. Ichino et al., 2003), despite a relatively low score as regards overall EPL concerning individual dismissals. Italy appears, in fact, to score the highest as regards the extent of reinstatement according to OECD indicators. Finally, we also find that the length of the trial period is negatively associated with total flows, at a level of significance close to 10%, although this variable appears unrelated with same-sector separations. Indeed, and perhaps not surprising, repeating the specifications of Tables 1.12 and 1.13 for hirings and total separations, we find this variable

Table 1.12: *Detailed dismissal regulations: total worker flows*

Dep. variable	(1) REAL	(2) REAL	(3) REAL	(4) REAL	(5) REAL
Reg. on individual dismissal	-0.076*** (0.019)				
<i>Of which</i>					
Procedural Inconvenience		-0.016 (0.031)			
Notice/Severance pay		-0.011 (0.015)	-0.012 (0.014)		
Difficulty of dismissal		-0.048* (0.029)	-0.059*** (0.018)	-0.061*** (0.017)	
<i>Of which</i>					
Definition of unfair dismissal					-0.008 (0.009)
Length of trial period					-0.025 (0.016)
Compensation for unfair dism.					0.009 (0.013)
Possibility of reinstatement					-0.032*** (0.008)
Reg. on collective dismissal	-0.047** (0.021)	-0.043* (0.024)	-0.038* (0.020)	-0.035* (0.020)	-0.020 (0.022)
Country dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Worker characteristics	Yes	Yes	Yes	Yes	Yes
Observations	528	528	528	528	528
R-squared	0.920	0.921	0.921	0.921	0.924

Notes: Robust standard errors in parentheses. REAL: Total worker reallocation rate. SSR: same-sector separation rate. All regulation variables are multiplied by US REAL. Data are averaged over the 2000-2007 period. Average US REAL is 43.2%. Workers' characteristics are those workers' covariates that are significant in specifications of Table 1.6. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.13: *Detailed dismissal regulations: same sector separations*

Dep. variable	(1) SSR	(2) SSR	(3) SSR	(4) SSR	(5) SSR
Reg. on individual dismissal	-0.033*** (0.012)				
<i>Of which</i>					
Procedural Inconvenience		-0.012 (0.015)			
Notice/Severance pay		-0.005 (0.006)	-0.006 (0.006)		
Difficulty of dismissal		-0.015 (0.014)	-0.021** (0.010)	-0.021** (0.010)	
<i>Of which</i>					
Definition of unfair dismissal					-0.004 (0.004)
Length of trial period					-0.000 (0.008)
Compensation for unfair dism.					-0.005 (0.009)
Possibility of reinstatement					-0.008* (0.004)
Reg. on collective dismissal	-0.027*** (0.009)	-0.026*** (0.010)	-0.022*** (0.007)	-0.019*** (0.006)	-0.017* (0.010)
Country dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Worker characteristics	Yes	Yes	Yes	Yes	Yes
Observations	415	415	415	415	415
R-squared	0.843	0.844	0.843	0.842	0.843

Notes: Robust standard errors in parentheses. REAL: Total worker reallocation rate. SSR: same-sector separation rate. All regulation variables are multiplied by US REAL. Data are averaged over the 2000-2007 period. Average US REAL is 43.2%. Workers' characteristics are those workers' covariates that are significant in specifications of Table 1.6. *** p<0.01, ** p<0.05, * p<0.1.

to be significantly correlated with hiring but not with separations.

Breaking down by workers' groups

It is also quite unlikely that the direct partial-equilibrium impact of institutions on gross flows be the same for all demographic or skill group. In the case of the main gross flow measures, available data can be disaggregated further by gender, age classes and educational attainment for a number of countries, even if at the price of greater measurement error. The analysis of Table 1.6 can therefore be replicated by controlling more directly for these characteristics through a series of dummies and by checking cross-group differences in the impact of those institutions that appear to be significant in Table 1.6. Average estimated effects of EP in Table 1.14 remain consistent with those reported in Table 1.6. Reallocation patterns concerning high-skilled workers appear to be somewhat less robustly affected by EP (Table 1.14). This result might reflect the fact that, in all countries, expanding industries tend to have a large, growing demand for skilled labour (see Bassanini and Marianna, 2009) and suggest that EP provisions have a smaller effect on these industries. Similarly, it appears that stringent regulations have a particularly depressing impact on gross worker flows involving youth and, to a more limited extent, women. These findings appear consistent with the idea that EP for regular workers has a particularly negative effect on the job perspectives of outsiders, a group in which women and youth tend to be over-represented (see e.g. OECD, 2006).

1.4.2 Time-series results

The approach we followed up to now cannot capture general equilibrium effects if they do not differ, on average, between EPL-binding and other industries. If these effects are large, using coefficients in Tables 1.6 to 1.13 to predict the impact of reforms of dismissal regulations would likely underestimate the true effect. In order to check whether this is the case, we estimate equation 1.10 on annual cross-country/cross-industry/time-series data for the period 1995-2007. By identifying the effect of institutions through over-time variations only, it is possible, in principle, to capture their overall impact resulting from both general and partial equilibrium

Table 1.14: *EPL and worker reallocation, cells by country, industry, gender, age, education*

Heterogeneous impact by:	(1) Gender	(2) Age	(3) Education
EPR x men	-1.755 (0.032)		
EPR x women	-3.192** (0.031)		
EPR x 15-24		-7.038*** (0.038)	
EPR x 25-34		-2.701** (0.032)	
EPR x 35-44		-1.228 (0.03)	
EPR x 45-54		0.070 (0.033)	
EPR x 55-64		-0.414 (0.037)	
EPR x Low			-3.407*** (0.027)
EPR x Medium			-3.041** (0.028)
EPR x High			-0.35 (0.031)
PMR	yes	yes	yes
% temporary	yes	yes	yes
Country	yes	yes	yes
Industry	yes	yes	yes
Gender	yes	yes	yes
Age	yes	yes	yes
Education	yes	yes	yes
Observations	10838	10838	10838
R-squared	0.74	0.75	0.74

Notes: OLS estimates. US reallocation rate, used as benchmark. EPR: index of employment protection for regular workers. PMR (sectoral): industry-specific index of anti-competitive product market regulation. Education are education dummies for 3 levels of highest completed educational attainment: low - less than upper secondary -, medium - upper secondary and some post-secondary -, high - tertiary level of education. Aggregate variables multiplied by the benchmark, with reported estimates referring to estimated coefficients of the interaction terms multiplied by the average benchmark. Robust standard errors, adjusted for clustering on countries and years. *** p<0.01, ** p<0.05, * p<0.1.

effects.³⁴ However, additional restrictions for collective dismissals are unavailable prior to 1998. We use therefore the index of EPL for regular workers excluding additional provisions for collective dismissals (EPR), which appears to be a good proxy for the overall degree of stringency of EPL for regular workers, as the two indexes are closely correlated in the subsample in which both are available.³⁵

As labour reallocation rates are well known to increase in downturns (see e.g. Davis et al., 2006), we control for the difference between the current and average growth rates of employment (the latter computed over the period 1990-2007 for each industry and country). Consistent with the literature we find that bad economic conditions are associated with fewer hirings and greater separations (Table 1.15). As one would expect, downturns are particularly correlated with an upsurge of job-to-jobless transitions (Column 7). Anti-competitive product market regulations appear to be associated with smaller worker flows of any type as theory would suggest (e.g. Hopenhayn and Rogerson, 1993). We also find that union density is associated with a greater share of job-to-job transitions, in particular those leading to permanent contracts. Finally, and more important, our time-series estimates confirm that stringent dismissal regulations depress both hiring and separations (Table 1.15, Columns 1 to 3). Estimated effects appear somewhat larger - point estimates of time-series coefficients are about 20% higher than those derived from coefficients of Table 1.6 - but differences are not large enough to claim that they are significantly different. Overall, these results suggest that additional general equilibrium effects, not captured by difference-in-difference estimates, are probably minor.

Time-series estimates also confirm that the effect of dismissal regulations on same-sector job-to-job transitions accounts for most of their effect on separations (Column 4). Moreover, within these transitions, those leading to an permanent contract are the most affected by the stringency of regulations (Column 5). By contrast job protection regulations appear to have no significant effect on other types of separations (Columns 6 and 7). In contrast with cross-sectional estimates, however, the coeffi-

³⁴Nevertheless, as discussed in Section 1.2, the main disadvantage of this approach is that omitted institutions and policy endogeneity might bias our estimates.

³⁵Similarly, collective bargaining coverage is not available in time series, for this reason we substitute union density for that variable. By contrast, no change in corporatism is observable in our indicators over the sample period. Therefore, this variable is collinear to country fixed effects.

cient of EPR in the regression for job-to-jobless separations is imprecisely estimated so that, rigorously speaking, we cannot claim, on the basis of the results presented in Table 1.15, that the impact of EPR on job-to-jobless separations is significantly smaller than that on same-sector job-to-job transitions.

We perform two types of robustness checks on these data. First, one could argue that different stages in the industry life-cycle might be associated with different rates of gross job and worker flows. Moreover, in different countries, industries are composed of different sub-industries that might be characterized by heterogeneous rates of transitions. In order to check that these types of composition effects do not affect our results, we re-estimate Table 1.15 by including country-by-industry and industry-by-time dummies, and obtain virtually the same results.

Second, we have implicitly assumed so far that the impact of EPL on worker reallocation is linear (see also the model). Although this is a standard and never-tested assumption in the literature (see e.g. Gomez-Salvador et al., 2004, Messina and Vallanti, 2007, Haltiwanger et al., 2014, Cingano et al., 2010), it is correct only if the microeconomic process generating individual hirings and separations can be approximated by a linear probability model. However, this is not necessarily true, and this approximation could be particularly bad in our case taking into account that worker reallocation can vary by a factor of three across industries and countries (see Tables 1.1 and 1.2). In these conditions a probit model for individual hirings and separations would be a more credible approximation of the probability of making an individual transition.

Table 1.15: *Time series results: linear model*

Dependent Variable	(1) REAL	(2) HR	(3) SR	(4) SSR	(5) SSR (permanent)	(6) OSR	(7) J2JLR
EPR	-6.06*** (1.96)	-2.96*** (0.98)	-3.10*** (0.98)	-1.79** (0.70)	-1.34*** (0.49)	0.34 (0.83)	-1.40 (0.86)
ARR	-0.07 (0.06)	-0.04 (0.03)	-0.03 (0.03)	-0.05* (0.03)	-0.03 (0.02)	-0.02 (0.03)	0.04 (0.05)
Union density	-0.13 (0.17)	-0.06 (0.09)	-0.06 (0.08)	0.10* (0.05)	0.07* (0.04)	0.01 (0.05)	-0.07 (0.06)
Tax wedge	-0.10 (0.11)	-0.05 (0.06)	-0.05 (0.06)	-0.08** (0.04)	-0.04 (0.02)	0.00 (0.04)	0.04 (0.05)
PMR	-0.70*** (0.19)	-0.29*** (0.10)	-0.41*** (0.10)	-0.22** (0.09)	-0.30*** (0.08)	-0.16** (0.07)	-0.23*** (0.07)
Δ employment gap	-0.63*** (0.04)	0.18*** (0.02)	-0.81*** (0.02)	-0.19*** (0.02)	-0.13*** (0.02)	-0.20*** (0.02)	-0.39*** (0.02)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,966	2,966	2,966	1,940	1,905	1,940	1,986
R-squared	0.772	0.806	0.776	0.535	0.559	0.582	0.627

Notes: Clustered standard errors at country-by-time level in parentheses. REAL: Total worker re-allocation rate. HR: Hiring rate. SR: Separation rate. SSR: same-sector separation rate. OSR: other-sector separation rate. J2JLR: job-to-jobless separation rate. EPR: Indicator of employment protection legislation for regular contracts, excluding provisions for collective dismissals. ARR: average unemployment benefit replacement rate. PMR: Product market regulation. Δ employment gap is the difference between the current and average growth rates of employment (the latter computed over the period 1990-2007). Workers' characteristics are those indicated in Table 1.6. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.16: *Time series results: GLM*

Dependent Variable	(1) HR	(2) SR	(3) SSR	(4) SSR (permanent)	(5) OSR	(6) J2JLR
EPR	-0.136*** (0.044)	-0.128*** (0.044)	-0.179*** (0.066)	-0.154** (0.066)	0.028 (0.120)	-0.124 (0.077)
ARR	-0.001 (0.001)	-0.001 (0.001)	-0.006* (0.003)	-0.004 (0.003)	-0.003 (0.004)	0.002 (0.004)
Union density	-0.003 (0.004)	-0.003 (0.004)	-0.010** (0.004)	-0.005 (0.004)	-0.002 (0.005)	0.003 (0.004)
Tax wedge	-0.002 (0.002)	-0.001 (0.002)	-0.023** (0.009)	-0.040*** (0.011)	-0.030*** (0.010)	-0.021*** (0.006)
PMR	-0.013*** (0.004)	-0.020*** (0.005)	0.012** (0.006)	0.010** (0.005)	0.003 (0.006)	-0.002 (0.005)
Δ employment gap	0.008*** (0.001)	-0.034*** (0.001)	-0.021*** (0.002)	-0.019*** (0.002)	-0.026*** (0.002)	-0.032*** (0.002)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Worker characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,966	2,966	1,940	1,905	1,940	1,986

Notes: Generalized (inverted-probit) linear model, estimated by quasi-maximum likelihood. Reported coefficients refer to parameters of equation 1.13. Clustered standard errors at country-by-time level in parentheses. HR: Hiring rate. SR: Separation rate. SSR: same-sector separation rate. OSR: other-sector separation rate. J2JLR: job-to-jobless separation rate. EPR: Indicator of employment protection legislation for regular contracts, excluding provisions for collective dismissals. ARR: average unemployment benefit replacement rate. PMR: Product market regulation. Δ employment gap is the difference between the current and average growth rate of employment (the latter computed over the period 1990-2007). Workers' characteristics are those indicated in Table 1.6. *** p<0.01, ** p<0.05, * p<0.1.

Therefore, we also estimate a generalised linear model (GLM), issued by the aggregation of a probit model for individual transitions. This model also allows us to take into account the fractional nature of the dependent variable but still does not completely relax the linearity assumption. We use a quasi-maximum likelihood estimator (QMLE), where the quasi-likelihood function is the binary choice log likelihood, as suggested by Papke and Wooldridge (1996):³⁶

$$E(WF_{jct}) = G(X_{jct}\beta + \gamma EPL_{ct} + D_c + D_j + D_t) \quad (1.13)$$

where G is the inverse-probit function and WF stands for either hiring or separation rates (also disentangled by type). Reassuringly, no significant difference from Table 1.15 appears (Table 1.16) (though also the GLM model has still some restrictions since EPL is linear). If any, the effect on EPR on same-sector job-to-job separations appears stronger.

1.4.3 Checking at individual level

In a final robustness test we use data from the European Community Household Panel (ECHP) to replicate our baseline estimates by excluding employees on temporary contracts before the separation. However, due to data availability, this can be done only for a much coarser partition of industries and smaller number of countries. The ECHP is a longitudinal survey modelled on the British Household Panel Survey (BHPS). This survey provides a wealth of information on individual income and socio-economic characteristics for a number of EU countries. Due to the common questionnaire, the information contained in the ECHP is, in principle, comparable across countries and it is meant to be representative both in cross-sections and longitudinally. However, given the limited number of observations, some caution

³⁶Papke and Wooldridge (1996) show that QMLE estimators of this kind yield consistent estimates of equation 1.13 independently of any assumption on the error term, for which a robust variance estimator can be easily devised. In addition, in contrast to the more classical weighted-least-square (WLS) estimation of a linear model with log-odd transformation of the dependent variable, the GLM specification does not require adjustment for boundary values (such as zeros) and can be estimated when fractional data are obtained by sample averages in samples of unknown size that cannot therefore be used to construct weights, as is the case for the data used in this chapter (see Bassanini and Brunello, 2011, for an application of a similar model to cross-country LFS data at the industry level).

is required when drawing cross-country comparisons. For each worker we identify that a separation has taken place by exploiting the information on the date of start of the current job and the date of the interview. In this way we are able to identify separations between t and $t + 1$ year for each wave. This information is also cross-checked across waves as well as using data on the end date of the previous job, and we drop the few individuals with inconsistent responses. Our panel covers 11 countries between 1995 and 2001. Given that the industry information is less detailed than in LFS data, the business-sector is disaggregated in only 13 industries. We therefore aggregate US reallocation rates at this level of aggregation and match them with our database and with data on employment protection. Then we estimate the following simple linear probability model:

$$T_{ijct} = X_{it}\beta + \delta B_j EPL_c + D_{ct} + D_j + \epsilon_{ijct} \quad (1.14)$$

where T is an indicator variable taking value 1 if a transition of a given type occurred between time t and $t + 1$ for an individual i who was in country c and industry j at time t . Other variables are as in Sections 1.2 and 1.4.1, except the D s that represent country-by-time and industry fixed effects. As errors are likely to be correlated within countries and industries and over time, we cluster errors at the country-by-industry level. Finally, in order to obtain estimates that can be compared with those in Section 1.4.1, we limit additional controls to those that are included in the specifications of that section and multiply estimated coefficients by 100.

Table 1.17 presents results obtained by estimating equation 1.14 on the full sample of employees, including both temporary and permanent workers. When occurrence of any type of separation is used as dependent variable, the estimated coefficient of the interaction between EPRC and the US reallocation rate is close to those reported in Table 1.6 if no additional control is included, while it is slightly smaller but more significant if controls, including contract type, are included. In the case of same-sector separations, estimates appear close to those reported in Table 1.6. Overall, Table 1.17 suggests that we can meaningfully compare estimates obtained from the ECHP with those obtained with our main dataset.

Excluding employees on fixed-term contracts yields slightly smaller but more sig-

Table 1.17: *Baseline difference-in-difference results estimated on the ECHP*

Dep. Variable	(1) S	(2) S	(3) SS	(4) SS
EPRC x US REAL	-0.061* (0.031)	-0.037** (0.015)	-0.041* (0.023)	-0.035** (0.015)
Country-by-year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Other controls	No	Yes	No	Yes
Observations	91,339	90,256	91,339	90,256
R-squared	0.030	0.137	0.025	0.066

Notes: The sample includes only wage and salary employees. Estimated coefficients multiplied by 100. Robust standard errors, clustered on country and industries, in parentheses. REAL: Total worker reallocation rate. S: dummy variable equal to 1 in the case of a separation. SS: dummy variable equal to 1 in the case of a same-sector separation. EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. Other controls include: gender, 6 age classes, 3 educational-attainment classes and temporary contract status. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

nificant estimates for both all separations and same-sector separations (Table 1.18). This can be explained by the fact that, as expected, EPRC is not a good predictor of the separation hazard for temporary workers. By contrast, the estimated coefficient of the interaction between EPRC and the US reallocation rate is small and insignificant in the case of both other-sector transitions and job-to-jobless transitions. Statistical tests also show that the effect on same-sector separations is significantly different from that of other type of separations. Overall, these results confirm that our findings on the association between EPRC and separations is most likely due to its impact on separation hazards for employees on permanent contracts.

1.5 Conclusions

In this chapter we have looked at the impact of dismissal regulations on different types of gross worker flows, defined as one-year transitions, using both a difference-in-difference approach à la Rajan and Zingales - in which the impact of regulations is identified by exploiting likely cross-industry differences in the impact of firing re-

Table 1.18: *Baseline difference-in-difference results estimated on the ECHP*

Panel A: No controls, except for country-by-year and industry dummies				
Dep. variable	(1) S	(2) SS	(3) OS	(4) J2JL
EPRC x US REAL	-0.048** (0.020)	-0.030** (0.013)	-0.012 (0.010)	-0.006 (0.004)
Country-by-year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Other controls	No	No	No	No
Observations	81,316	81,316	81,316	81,316
R-squared	0.016	0.011	0.011	0.003
Panel B: Other controls				
Dep. variable	(1) S	(2) SS	(3) OS	(4) J2JL
EPRC x US REAL	-0.028*** (0.011)	-0.025** (0.010)	0.001 (0.008)	-0.004 (0.004)
Country-by-year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
Observations	80,456	80,456	80,456	80,456
R-squared	0.047	0.022	0.030	0.005

Notes: The sample includes only permanent employees. Estimated coefficients multiplied by 100. Robust standard errors, clustered on country and industries, in parentheses. REAL: Total worker reallocation rate. S, SS, OS and J2JL are dummy variables equal to 1 in the case of a separation, a same-sector separation, an other-sector separation and a job-to-jobless separation, respectively. EPRC: Indicator of employment protection legislation for regular contracts, including provisions for collective dismissals. Other controls include: gender, 6 age classes and 3 educational-attainment classes. *** p<0.01, ** p<0.05, * p<0.1.

strictions - and standard time-series analysis - in which the effect of regulations is identified through regulatory changes over time. In order to do so we construct a unique dataset including cross-country comparable hiring and separation rates by type of transition for 24 OECD countries and 23 business-sector industries. We find that the more restrictive the regulations, the smaller the rate of job-to-job transitions, while no significant effect is detected as regards job-to-job transitions involving an industry change and/or job-to-jobless transitions - that is, situations in which a worker is with one employer at $t - 1$ and jobless at t . Estimated effects appear significant from an economic point of view: taking our estimates at face value implies that reducing the indicator of employment protection for regular contracts from the OECD average to the level of the United States entails an increase in the rate of same-sector job-to-job transitions by about 60%. We also assess the importance of different regulatory provisions and find that the practice of reinstatement in the case of unfair dismissal plays a crucial role in shaping gross worker flows: the more frequent this practice and the smaller are the flows. Our results do not necessarily imply that relaxing dismissal regulations brings about an increase in dismissals. Indeed our data do not allow distinguishing dismissals from voluntary quits and there is some evidence that stricter employment protection depresses the latter (see e.g. Gielen and Tatsiramos, 2012). However, our results are consistent with the idea that if reforms liberalising dismissal regulations yield an increase in dismissals, they also increase the job finding rate following displacement.

Thus, our results can have potentially important policy implications in a domain of fierce public debates such as the ones on employment protection legislation: this chapter cautiously suggests that those displaced workers that would not have been displaced in the absence of deregulation tend to find relatively quickly another job. What is more, our evidence indicates that most of the additional transitions induced by regulatory changes will occur across jobs within the same industry, with therefore limited destruction of industry-specific human capital and likely no negative effects on reallocation efficiency. Overall, labour market reforms reducing employment protection while indeed increasing labour reallocation, and hence reducing worker stability, would not harm their job opportunities but on the other hand increase the relatively

more efficient and positive kind of reallocation, i.e. within the same sector, where skills (and wages) can be preserved and valued, and towards permanent contract.

In conclusion, assessing more directly the impact of dismissal regulations on the efficiency of the reallocation process appears a much needed and promising avenue for future research. Moreover, as many countries have significantly reformed employment protection for permanent contracts in recent years, individual longitudinal data should be mobilised to explore more directly the trajectories of displaced workers in the aftermath of regulatory reforms. Finally, country-specific studies at sectoral level might provide further evidence, especially in the case of countries where collective bargaining plays an important role also in defining employment protection regulation.

Part II

Minimum Wages in Europe

CHAPTER 2

A VARIETY OF MINIMUM WAGES IN EUROPE

This second part of the thesis (Chapters 2, 3 and 4) is based on the ETUI report “*Minimum wages in Europe: does the diversity of systems lead to a diversity of outcomes?*” and the papers “*Sharp Teeth or Empty Mouths? Revisiting the Minimum Wages Bite with Sectoral Data*” forthcoming in *British Journal of Industrial Relations* and “*Minimum Wage Systems and Earnings Inequalities: Does Institutional Diversity Matter?*”, forthcoming in *European Journal of Industrial Relations*, all joint with Stephan Kampelmann and François Rycx.

2.1 Introduction

Few economic policies have sparked academic debates as long-lasting and as passionate as those on minimum wages. Since 1915, several generations of empirical economists have tabled evidence and counter-evidence on the question of whether a statutory wage floor is harmful for employment at the bottom of the labour market. For a long time the majority of labour economists stuck to the basic model of perfectly competitive labour markets and its prediction that binding minimum wages are inefficient, predicting that they would lead to higher levels of unemployment. But the new measurement techniques (for example, natural experiments) and new

datasets (for example, matched employer-employee microdata) that appeared during the 1990s have led many economists to reconsider their verdict on minimum wages. Today, the consensus in much of the literature is that employment effects induced by binding wage floors are, in most cases, so small in relation to other fluctuations in employment that it is difficult to identify them with the available statistical material. Where employment effects are found to be significant they apply only to certain subgroups that are particularly sensitive to lower-tail wage developments (such as young workers). To some extent, it appears that the impressive volume of the minimum wage debate boils down to “much ado about nothing”, or rather, to “much ado about something too small to be clearly identified”.

But since the mid-2000s a new minimum wage debate has stirred up much controversy in Europe, and this time the opposition between different camps of labour economists is mirrored not only by differences in opinions among policymakers from different countries, but also by vivid debates within the trade union movement. The spark for this new debate has not been the employment effect, but the question of whether there is a case for a harmonised minimum wage policy at the European level.

On 10 January 2013, Jean-Claude Juncker, at that time Prime Minister of Luxembourg and outgoing president of the Eurogroup (the group of countries belonging to the Eurozone), told the European Parliament that Europe needs “*a basis of social rights for workers, minimum social rights for workers, including of course one essential thing, a minimum wage - a legally compulsory minimum wage in the Eurozone member states*”. Indeed, the issue of harmonising wage floors among European countries has been on the table in the European institutions for several years. Juncker himself already proposed it in 2006¹ and discussed it again during the electoral campaign for the European Parliament in 2014. A similar argument has been put forward by the Party of European Socialists, which called for “decent minimum wages” by introducing an “*EU target for the minimum wage in terms of GNP per capita*”.² A general reference has also been inserted in the manifesto for the EU elections in 2014: “*We will introduce decent minimum wages across Europe, established either by law or*

¹Speech to the biennial conference of German Catholics, 27/05/2006.

²Rasmussen and Delors (2006) ‘The New Social Europe’, Report presented to the 7th PES Congress, Porto, 7-8 December 2006.

through collective bargaining". The European Commission also put forward a similar idea in the "Employment Package" in April 2012 and it is continuing to work on it. A European approach to minimum wage policies is also being discussed within the European Trade Union Confederation.

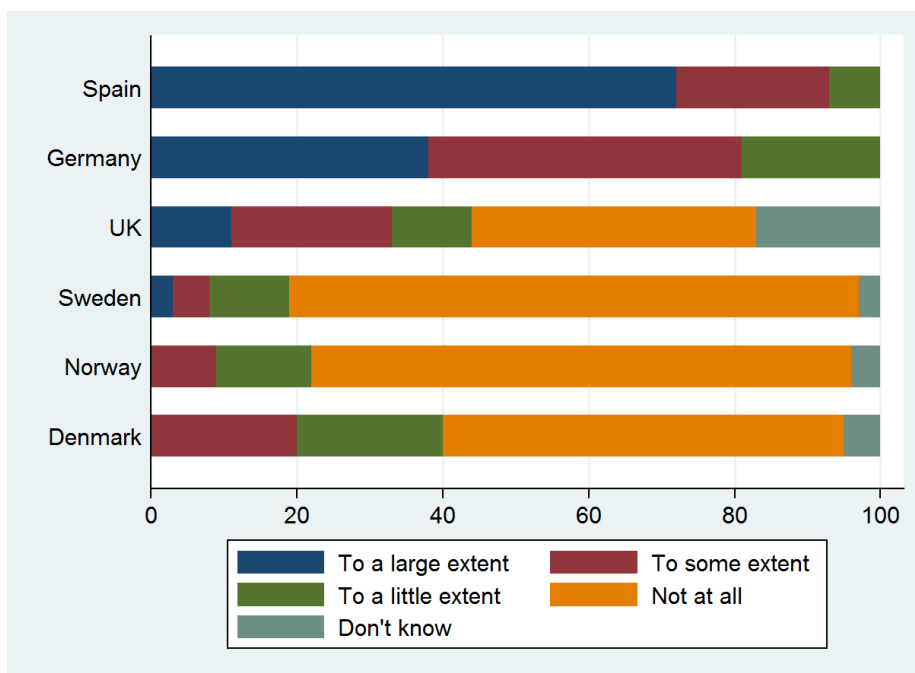
Some academics have also pushed for the introduction of a European minimum wage. Most notably, in 2005 a group of eminent scholars on minimum wages signed a public call for a European minimum wage "of at least 60 per cent of the average national wage" (Schulten et al., 2005). The possibility of a minimum wage - or at least some common rules - at EU level has also been raised and discussed by Vaughan-Whitehead (2010). The magazine *The Economist* in 2012 dedicated a column to the minimum wage debate and, referring to a joint ILO-IMF-OECD-World Bank report, concluded that "*evidence is mounting that moderate minimum wages can do more good than harm [...] The definition of moderate is 30-40% of the median wage*".³

While the EU has no official competence to issue directives or regulations concerning wage policies, it can promote its agenda through recommendations and the Open Method of Coordination (that is, by setting objectives that are politically but not legally binding). The EU therefore has little leverage to implement a European approach to minimum wages, even though the European Commission has used its competence on social issues to recommend the introduction of minimum wages, for instance by recommending wage floors in order to close the gap between male and female wages in Austria (EC, 2005; Hermann, 2005). At member State level, France has long spearheaded the campaign for a European minimum wage and recently released a report (Brischoux et al. 2014) putting forward several proposals on how this could be achieved.

In addition to a lack of competence at the European Commission, another factor that has worked against a European approach is the absence of a clear consensus at the European level concerning whether the benefits of harmonising policies in this area outweigh the costs. Trade unions, for instance, are far from unanimous in their support for European legislation that would impose statutory minimum wages everywhere in Europe. In particular, many countries where there is no statutory

³"*The argument on the floor*", 24/11/2012.

Figure 2.1: *Do the trade unions of Europe want European minimum-wage regulations? (%)*



Source: Eldring and Alsos (2012).

minimum wage are against a European scheme. Objections are notably very strong in Austria, Italy, and the Nordic countries (see Eldring and Alsos, 2012 for a detailed discussion). On the other hand, trade unions in countries such as Germany and Spain favour a European approach to the issue (see Figure 2.1).

The usual argument put forward by both employers and the unions against a statutory minimum wage is that it could undermine the autonomy of the social partners and thereby jeopardise the entire bargaining process. Unions in particular fear a weakening of collective bargaining or exposing workers to political arguments in which minimum wages could become one of the adjustment variables. And ultimately, unions fear that a statutory minimum wage without sectoral agreements, which would probably be closer to wages in the lowest paid sector to avoid negative effects on employment, will reduce wages across the entire economy and therefore also in sectors where unions are strong. Many unions therefore advocate a minimum wage for workers not covered by collective agreements, but often insist more on the extension of collective bargaining than on statutory minima. The most notable exception is Germany where the Government, following long discussions inside unions,

adopted in 2014 a statutory minimum wage to counterbalance the effect of decreasing coverage of collective agreements and the increase in mini-jobs (low-wage jobs).

Much of the antagonism inspired by the idea of a harmonised minimum wage policy in Europe stems from the fact that the current minimum wage arrangements differ widely among European countries. On one hand, a European minimum wage is seen as desirable in countries without effective statutory minima and where collective bargaining agreements also fail to provide sufficient protection from wage dumping - Germany is arguably in such a position. On the other hand, countries with apparently effective collective bargaining institutions perceive a European approach as a threat to an established and functioning system. What both advocates and opponents of a European minimum wage policy lack is empirical evidence that compares the different national arrangements with respect to their impact on a series of labour market outcomes. It is the objective of this second part of the thesis to provide not only a conceptual framework to think about the different trade-offs associated with alternative minimum wage policies, but also to present empirical evidence on the link between policy options and labour market outcomes.

An important step towards an evidence-based debate on European minimum wage policies is to acknowledge and frame the institutional diversity of minimum wage systems within the EU. While some experts recognise the methodological difficulties that arise from the patchwork of *national arrangements*, extant frameworks that allow us to think about the diversity within Europe still struggle with the multitude of national wage policies. Indeed, focusing on the term *minimum wage policy* is misleading as it tends to narrow down the question to fixing a wage floor at a certain rate. As Askenazy (2014) has recently argued comparing minimum wages in France, UK and the US, “*nominal rates provide a very crude picture of minimal compensation and of actual employer cost (...) The extent of their coverage, enforcement procedures, and how the wage is defined differ widely between countries. Taking these parameters into account can even alter the comparative hierarchy based on nominal rates alone*”. In fact, minimum wage policies include the process in which statutory rates are set (Are they negotiated by social partners? Are the social partners merely consulted? Does the State fix the rate unilaterally?); the level at which the minima are set (Does

the same rate apply to all workers in the economy? Are different minima negotiated at the sectoral level?); the legal and quasi-legal extension mechanisms (Are there tools that allow the State to extend negotiated minima to workers who are not directly represented? Does the State make use of these tools?). Because it is the combination of these institutional arrangements that determines jointly the labour market impact of a given minimum rate, it is preferable to think about our task as understanding differences between minimum wage systems. Arguably the most disappointing feature of the minimum wage debate that captured so many spirits during the better part of the twentieth century is that it almost completely failed to recognise the importance of institutional diversity. To be fair, this failure can only partially be attributed to the weakness of abstract and atemporal approaches to labour market problems; it is also due to the more practical difficulty of access to datasets that accurately reflect the institutional diversity of minimum wage systems. It is, for example, far more time-consuming to collect data on minimum wages at the sectoral level - which is perhaps one of the reasons why the empirical literature has focused almost entirely on countries in which minima are set at the national level.

In this second part of the thesis we have tried to strike a balance between acknowledging the importance of institutional diversity, on the one hand, and the constraints imposed by the available statistical material and quantitative econometric methods, on the other. To do so, we have left the beaten track of conventional analyses: our empirical results are not only informed by qualitative data on national systems, but we have also collected minimum rates from more than 1,100 sectoral-level agreements across Europe. This effort notably allowed us to assess the labour market performance of the minimum wage systems in Austria, Belgium, Denmark, Finland, Germany and Italy - all countries that are both absent from other empirical studies and among the main protagonists of the minimum wage debate at the European level.

The results of the three chapters of this second part of the thesis clearly underline the importance of thinking about the European debate as a choice between different minimum wage systems rather than about the choice of a certain rate to be harmonised across the Union. Crucially, we are able to show empirically what many practitioners long suspected: the combination of sectoral minimum rates and high

levels of collective bargaining coverage can, at least for certain outcomes, be regarded as constituting a functional equivalent to a binding statutory minimum wage at the national level. Our regression results notably suggest that both higher collective bargaining coverage and a national statutory minimum wage are significantly associated with lower levels of inequality.

But there are also trade-offs. Minimum wage systems with statutory rates at the national level are related to relatively lower wage floors. This is evidence in favour of an argument frequently put forward by trade unions from the Nordic countries claiming that sectoral-level bargaining allows workers to obtain higher relative minima. We also show that relative rates are positively related to the degree of collective bargaining coverage, another factor that is frequently assumed by scholars and practitioners alike but rarely put to an empirical test.

This, however, is only part of the story. In systems without statutory minima, the higher rates enjoyed by insiders appear to come at a cost for outsiders: we show that, all other things being equal, the higher the level of the minimum wage relative to the median wage, the more workers earn wages that are actually below the prevailing minimum. What is more, our findings indicate that minimum wage systems differ with respect to the proportion of workers that are either uncovered or whose wages violate existing minimum rules. A system with a national statutory minimum fares better in this respect than a system with sectoral-level minima, although higher levels of collective bargaining can offset this difference to some extent. Again, national statutory minima and sectoral-level collective bargaining coverage appear to be functional equivalents.

The central message of this second part of the thesis is that both the academic and the policymaking community could render the European minimum wage debate more relevant if they framed the current discussion as a choice between alternative systems rather than a choice of any particular rate for Europe as a whole.

2.2 Defining minimum wages

One of the key propositions of this second part of the thesis is that the concept of a *minimum wage* not only refers to statutory wage floors defined at the national level, but also extends to minimum wages that are defined at the sectoral or occupational level. It is unquestionably true that the national statutory minimum wage has received much more attention in the literature in disciplines such as labour economics or industrial relations, to such an extent that other types of wage floor are hardly ever analysed. Indeed, instead of examining the impact that the difference between nationally and sectorally defined minimum wages might have on a range of labour market outcomes, the literature focuses almost entirely on data collected within the group of countries with national statutory minimum wages. This does not mean that no aspect of the process through which minima are determined has ever been scrutinised: Boeri (2012) for instance, has shown that national wage floors that are legislated unilaterally by the government are typically lower than those settled with closer involvement of the social partners.

While the process during which national minima are set seems therefore to lead to significantly different outcomes in terms of the relative level of wage floors, most scholars have overlooked the much more fundamental issue of whether the minimum is defined for the entire labour force (in the case of a national statutory minimum wage with no exemptions) or only a part of it (for instance, by a sectoral minimum that binds only trade union members). This is particularly problematic because the impact of the difference between national and sectoral minima on a range of labour market outcomes is potentially much more important, for instance when it comes to their respective influence on the level of wage floors (an issue discussed by Grimshaw and Bosch, 2013) and the number of workers paid at or below it, but also the impact on more general issues, such as overall or inter-sectoral inequality.

In this chapter, we show that the distinction concerning whether wage floors are set at the national or at the sectoral (occupational) level gives rise to a series of hypotheses regarding their impact on key labour market outcomes. The issues addressed by our hypotheses are admittedly not new: in fact, they correspond to the intuitive understanding of the wage setting process revealed by anecdotal evidence

from conversations and published statements by trade unionists, employer representatives and policymakers in the context of the debate on a European minimum wage (see Introduction). For instance, many practitioners are convinced that trade unions are able to obtain higher minimum wages if they negotiate at the sectoral than at the national level. This intuition, however, may or may not be true and so far lacks any empirical proof that we are aware of, the sample used by Grimshaw and Bosch (2013) being too small to allow for econometrically sound conclusions. To be sure, the opposite relationship is also plausible: some trade unions may have lower bargaining power when they negotiate at the sectoral level, so that at least in certain parts of the economy the collectively negotiated wage floors might be lower compared to a situation in which the minimum is determined through a negotiation at the national level. By compiling a representative sample of sector- and national-level minima from different types of minimum wage systems, Chapter 3 of this thesis is the first to be able to shed empirical light on these issues.⁴

There are strong reasons why the wage floors in sectoral-level collective agreements should be considered minimum wages, the most obvious being that common usage often refers to them explicitly as *minimum wages*. To give some examples, the collective agreement signed on 27 June 2007 in the Belgian chemical industry refers to a given amount by stating that “*ce salaire horaire minimum correspond au niveau le plus bas applicable, à savoir à la fonction de manoeuvre ordinaire*”.⁵ Also, the administrators of the German Mindestlohn datenbank compiled by the Wirtschafts- und Sozialwissenschaftliche Institut (WSI) clearly state that “*Tariflöhne sind Mindestlöhne*”.⁶ For the case of Austria, Hermann (2005) calls sectoral-level wage floors *minimum wages* by saying that “*in Österreich stellt der Mindestlohn die niedrigste Lohngruppe in den jeweiligen Kollektivverträgen dar*” (p. 8).⁷

As can be inferred from these examples, practitioners and minimum wage experts refer to sectoral wage floors as *minimum wages*. More precisely, it is the wage assigned

⁴To be sure, one could of course extend the logic of minimum wages to the company level, or for that matter even to different pay scales within individual plants. We think that such an approach hardly corresponds to the prevailing notion of a minimum wage as providing a general wage floor for a large group of workers.

⁵“*This hourly minimum wage corresponds to the lowest level, i.e. the one of ordinary workers.*”

⁶“*Wages in collective agreements are minimum wages.*”

⁷“*In Austria the minimum wage is the lowest wage group in the respective collective agreements.*”

to the lowest category in collectively negotiated pay scales that should be interpreted as the relevant minimum wage: for all workers covered by a given agreement, it is in principle not possible to pay any of them below the rate that has been negotiated for the very bottom of the pay scale.

While this definition of a sectoral minimum wage is relatively straightforward, it should be noted that the elaborate categorisations that are found in many collective agreements render the identification of a given sectoral minimum wage relatively complicated. Indeed, in most agreements different pay scales co-exist: a separate pay scale is often defined for blue- and white-collar workers; specific scales are included for apprentices or young workers who enter the labour market; and even where a unique pay scale exists it is often differentiated by several variables, such as occupational groups, work-post nomenclatures (i.e. specific occupations) and seniority levels. In order to come closest to the conception of sectoral minimum wages as “the pay rate defined for the lowest wage category”, our database contains information on the pay rate of the lowest of any category that figures in all of the pay scales in a collective agreement, with the exception of pay scales for apprentices and young workers. In practice, in the vast majority of agreements this boils down to the pay rate that applies to workers with no seniority and who are classified in low-status occupations at the bottom of organisational hierarchies (*manœuvre ordinaire* in the example from Belgium quoted above).

2.3 The diversity of minimum wage systems in Europe

The literatures in industrial relations and labour economics provide rich traditions in the analysis of minimum wages. The former school tends to frame wage floors as institutions that can be analysed as the outcome of interactions between a set of actors (mainly the state, employer representatives and trade unions) and other institutions (wage setting processes, laws and so on). Parts of this literature also take into account the social norms and beliefs that the involved actors have about minimum wages and their impact on different labour market outcomes. By contrast, labour economics

typically treats minimum wages as market imperfections that give rise to a deviation from outcomes that would come about in the absence of “artificial” wage floors or ceilings. One of the basic predictions of these models is that a binding minimum wage fails to clear the labour market and thereby creates a situation in which more workers would be willing to work (and fewer employers willing to hire) compared to a situation without minimum wages (see our discussion on employment effects).

The approach in this second part of the thesis is closer to the tradition in industrial relations in that we distinguish between different institutional features of minimum wage systems and analyse their relationships with key labour market outcomes. While it is a priori also possible to formulate hypotheses on these relationships with the help of labour market models that treat minimum wages as market imperfections, we show that the observed outcomes can be accounted for by the institutional diversity between minimum wage systems.

The institutionalist literature on minimum wages so far has focused almost exclusively on systems in which wage floors are defined by national statutory minimum wage legislations. The focus of this literature has therefore been to account for different outcomes (such as the relative level of statutory minimum wages) by looking at differences between statutory systems, either across countries or across time. Existing empirical evidence notably shows that in countries with statutory minimum wages a higher level of collective bargaining coverage is associated with relatively higher levels of minimum wages (Grimshaw and Bosch, 2013). This might be due to the fact that countries with higher collective bargaining coverage tend to have more egalitarian wage structures in which the median lies closer to the minimum wage, leading in turn to a higher Kaitz Index. Another explanation is that a higher level of collective bargaining coverage is associated with stronger trade-union influence on the level of the statutory minimum wage (for example, in negotiations by tripartite commissions). On any account, the level of statutory minimum wages tends to be positively related to the degree to which trade unions are involved in the setting process at the national level (Boeri, 2012; Eyraud and Saget, 2005; Funk and Lesch, 2005).

This second part of the thesis aims at analysing minimum wages not only in

countries with statutory minimum wages at the national level, but also in countries in which wage floors are determined at the sectoral or occupational level through collective bargaining. Even though collectively agreed minimum wages are sometimes considered to be “functional equivalents” of statutory wage floors (Schulten et al., 2006), we are interested in whether the two types of system lead to different labour market outcomes. Unfortunately, empirical evidence comparing the two systems is extremely rare and our study fills a major gap in this area.

Given the importance of both features, we therefore propose to distinguish European countries with the help of a typology including:

- Collective bargaining coverage (we distinguish between low, medium and high coverage): the degree of coverage has been shown to influence the relative level of minimum wages, but also other labour market outcomes (especially inequality and low pay).
- National statutory minimum wage versus sectoral collectively bargained minima: whether minimum wages are determined nationally as statutory wage floors or through collective bargaining at sectoral or occupational level might impact on a range of labour market outcomes, including the relative level of minima and different measures of inequality.

It should be noted that these two features of minimum wage systems are not entirely independent of each other. Indeed, a range of studies underline that the centralisation and coverage of collective bargaining tends to be higher in countries without statutory minima (Schulten et al., 2006; Vaughan-Whitehead, 2010; Eldring and Alsos, 2012; OECD, 2012a). This observation is confirmed by our data: collective bargaining coverage is 29 percentage points higher in countries in which minimum wages are determined through collective bargaining at the sectoral level. One reason for this might be that statutory minimum wages are indeed functional equivalents protecting workers against low wages in the absence of effective protection through collective bargaining. In other words, statutory minimum wages can be the consequence of low levels of collective bargaining if policymakers see them as an instrument to protect otherwise vulnerable workers. This explanation seems to account for the minimum

wage policies adopted by Central and Eastern European countries where collective bargaining institutions were so weak during the transition to capitalist labour markets that almost all countries installed statutory wage floors in order to protect workers against excessive wage dumping.

To be sure, it is possible to build a typology with more features in order to capture more of the institutional diversity between countries. For instance, one might split up the group of countries with statutory minimum wages according to the process through which the wage floors are determined (automatic adjustment to inflation, as in Belgium or France; bi- or tripartite negotiations, as in Estonia or Ireland; and determination by the state after consultation with the social partners, as in Portugal). Some experts on the institutional diversity that underpin minimum wage arrangements indeed stress the heterogeneity of “a host of different arrangements and national models” (Eyraud and Saget, 2005; p. 2). The behaviour of the involved actors might also lead to different outcomes within the same type of minimum wage system. The strategy of the Austrian trade union confederation of defining every four years a universal minimum wage target and, consequently, campaigning for the introduction of this target in sectoral agreements is a case in point (cf. Hermann, 2006). Even though there is no statutory minimum wage and bargaining takes place at the sectoral level in Austria, national campaigns such as the *Kampagne 1.000-Euro-Mindestlohn* that was decided by the congress of the trade union confederation in 2003 introduce a degree of centralisation into an otherwise decentralised minimum wage system without necessarily changing the institutional set-up. Indeed, the presentation of the national minimum wage systems in Section 2.3.1 illustrates considerable heterogeneity among national models.

While therefore somewhat desirable on theoretical grounds, taking all the diversity on board leads inevitably to heavy data requirements when it comes to empirical hypothesis testing: the finer the distinctions between national models, the more observations and inter-category variability are required in order to produce statistically sound results. Confronted with this trade-off, we decided to focus on the two basic features of minimum wage systems cited above (namely, collective bargaining coverage and the opposition between statutory and collectively bargained minima). The

main rationale for this choice is that the combination of these two features has not yet been studied - a striking gap in the literature given that many practitioners and scholars of minimum wages would agree that they are likely to give rise to different labour market outcomes.

2.3.1 The sample of countries

In order to be able to compare the performance of different types of minimum wage systems, the empirical analysis in Chapters 3 and 4 is based on a representative sample of eighteen European countries. The country sample has been selected in order to include (a) countries with and without national statutory minimum wages; (b) different levels of collective bargaining coverage; (c) countries from different sub-regions (Nordic countries, Southern Europe, Continental Europe, Central and Eastern Europe); and (d) both small and big countries. The complete sample includes Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Portugal, Romania and the United Kingdom.

In this section we provide a descriptive overview of the minimum wage systems in each of these countries, focussing on the two main features of these systems we identified above (i.e. the level at which the minimum wage is set and the degree of collective bargaining coverage). In other words, we provide qualitative information on how our two main explanatory variables are embedded in specific minimum wage systems in each of the countries under analysis. The qualitative information in these descriptions stems from a range of sources, including the ILO database on minimum wages, the EIRO country profiles on industrial relation systems and the country overviews in Schulten et al. (2006), Vaughan-Whitehead (2010), Eldring and Alsos (2012), Grimshaw et al. (2013) and a series of other articles cited below. The figures on collective bargaining coverage have been taken from Visser (2011) and refer to total coverage (that is, including coverage at the firm and sectoral levels); information on extension mechanisms has been completed with data from Eurofound (2011). A summary table including all countries is provided at the end of this section.

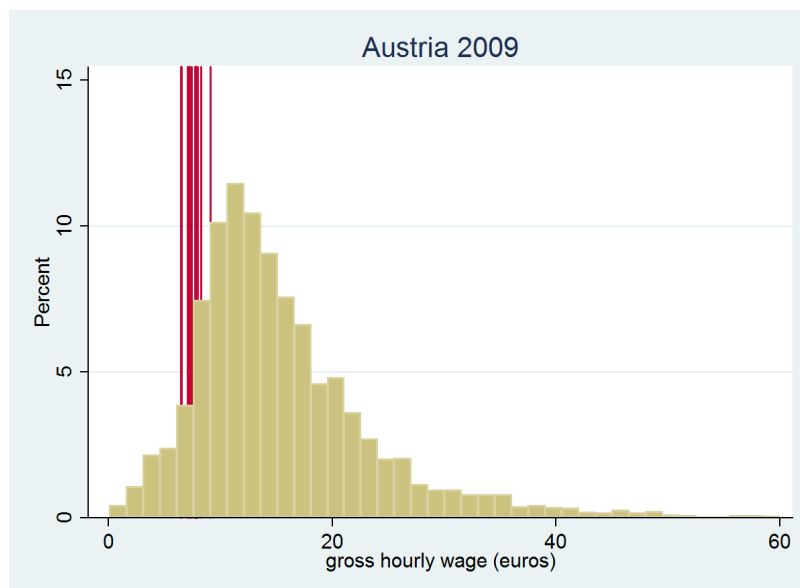
Given that the micro-data we use in the empirical part of this chapter refers to labour markets during the period from 2007 until 2009, the description of minimum

wage systems also concentrates on this period. Since the financial crisis in 2007-2008 and the ensuing “Great Recession”, however, a few countries have implemented legislative and institutional changes that have affected their respective minimum wage systems (OECD, 2012b). Some of these changes have been designed as a response to the crisis and mounting political pressure from international institutions. For instance, the systems in Hungary and Romania recently underwent institutional changes, which we describe below. This being said, the typical response to the crisis since 2009 has consisted in freezing existing minimum wage rates rather than changing the institutional features of the underlying minimum wage systems (cf. Schulten, 2012). This means that our conclusions drawn from our institutional analysis covering data from 2007-2009 are likely to be unaffected by more recent developments.

Austria Austrian minimum wages are defined in collective bargaining agreements (*Kollektivverträge*) at different levels: local, regional and sectoral. There is a statutory minimum wage in parts of the public sector, but its rate is negotiated between the social partners. Since 1991 the minimum wage included in many collective agreements has been oriented towards a common national target defined by the congress of the trade union confederation (*ÖGB Bundeskongress*), but despite this target the minima continue to differ widely between sectors (Hermann, 2006). Under certain conditions, an agency within the Ministry of Labour (*Bundeseinigungsamt*) can impose wage floors in certain branches and extend collective agreements. The Austrian system is regarded as both stable and effective due to the mandatory membership of all private enterprises in the Austrian Federal Economic Chambers (*Wirtschaftskammern*) that sign the collective agreements, an arrangement in which virtually all workers are covered by sector-specific minima (Eldring and Alsos, 2012). According to the database managed by the main trade union confederation (KV System ÖGB), around 450 collective agreements are negotiated every year in Austria.

Belgium Sectoral-level collective bargaining forms the core of Belgium’s minimum wage system, but the country differs from the Nordic or German models in that in Belgium a national statutory minimum wage plays an important role as well. The national minimum wage (*salaire minimum interprofessionnel*) is negotiated between the social partners in national councils (the *Conseil central de l’économie* and the

Figure 2.2: *Wage distribution and minimum wages in Austria*

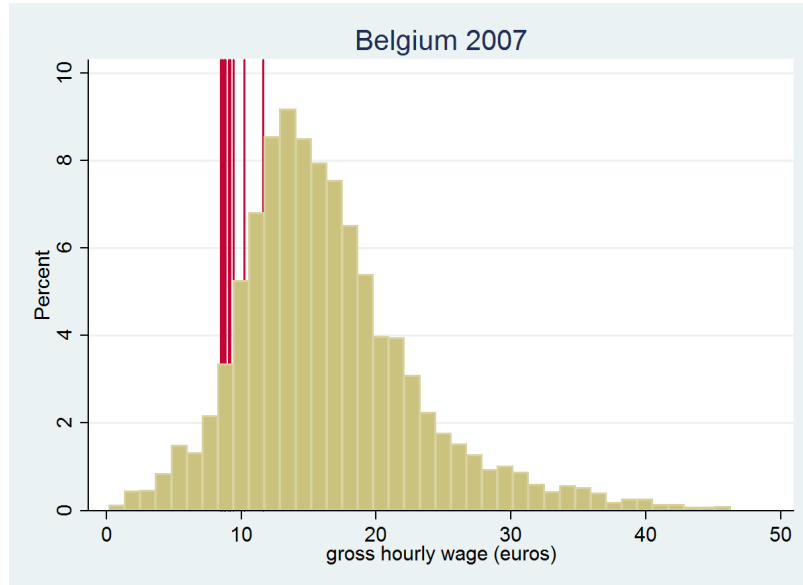


Source: AT-SILC; current 2009 euros; vertical lines represent sectoral minima.

Conseil national du travail). The sectoral-level agreements are negotiated in one of more than hundred Commissions Paritaires. Given that these commissions are segregated by occupational status (in most sectors blue- and white-collar workers belong to separate commissions), workers at the same firm typically belong to several bargaining commissions and different minima may apply within the same firm. Public-sector employees and apprentices are exempted from the national statutory minimum wage and are covered by specific agreements. At the national level, reduced rates have been defined for workers below 22.5 years (see interprofessional agreements CCT No. 43 and No. 50). Belgium's high collective bargaining coverage (around 96 per cent) stems from the practice that all collective agreements are extended to all workers by Royal Decree.

Bulgaria The Bulgarian system is based on a national statutory minimum wage determined by the government; its rate is defined after consultation with employers and unions (tripartite agreements) and legislated by decree. No category of workers is exempted from the statutory minimum, but apprentices may receive slightly lower rates during a fixed training period. While the national minimum therefore applies to all workers, collective bargaining coverage is low in Bulgaria (around 20 per cent). The different characteristics of the Bulgarian minimum wage system (national statutory

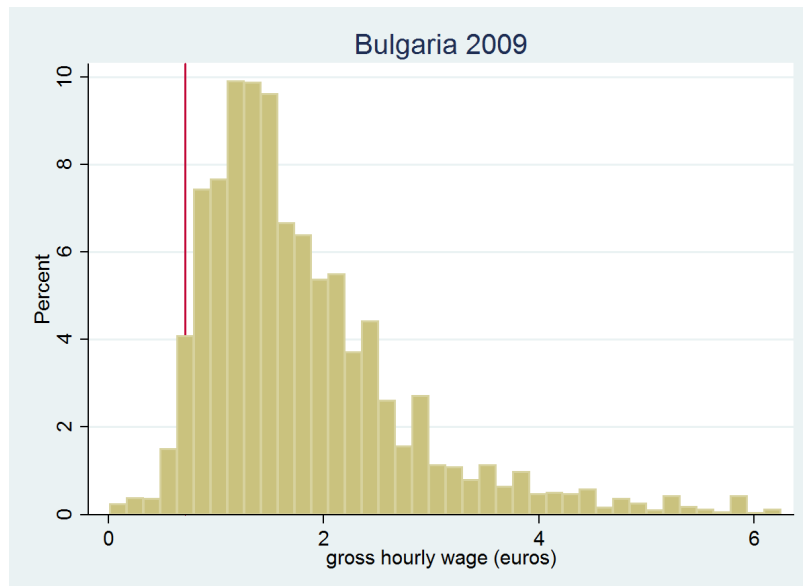
Figure 2.3: *Wage distribution and minimum wages in Belgium*



Source: BE-SILC; current 2007 euros; vertical lines represent sectoral minima.

minimum with few exceptions and reduction combined with low bargaining coverage) are typical of central and eastern European countries.

Figure 2.4: *Wage distribution and minimum wage in Bulgaria*

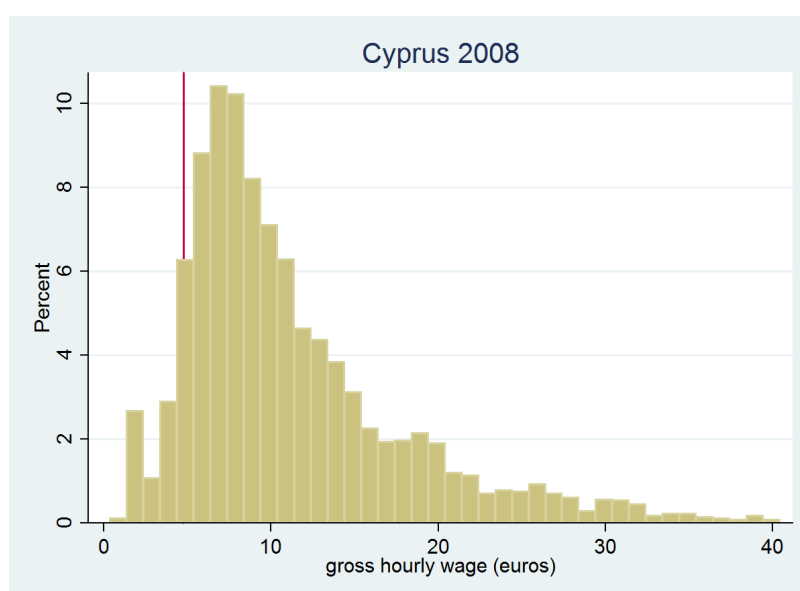


Source: BG-SILC; current 2009 euros; vertical line represents national statutory minima.

Cyprus Cyprus has neither a national statutory minimum wage nor sectoral ones. The government (since 1941) sets minimum wage rates for specific occupations in which union density and union coverage are low and employees have weak bargain-

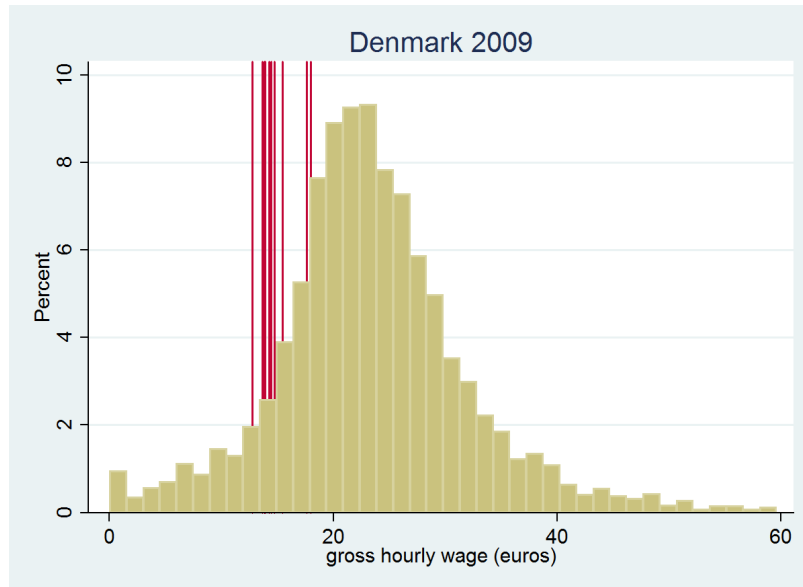
ing power (sales staff, clerical workers, auxiliary health care staff, auxiliary staff in nursery schools and schools). In July 2008 this rate was extended to guards and caretakers working in clinics, private hospitals and nursing homes. The tripartite Labour Advisory Board, including the government as well as employers' and workers' representatives, makes recommendations on the rates to be adopted by minimum wage legislation. Reduced rates apply during the first six months of employment. Cyprus stands out from most other European countries in that the absence of a statutory minimum wage is not counterbalanced by high collective bargaining coverage (only around 54 per cent of workers are covered). With regard to its minimum wage system the country is therefore similar to Germany.

Figure 2.5: *Wage distribution and minimum wage in Cyprus*



Source: CY-SILC; current 2008 euros; vertical line representd average occupational minima.

Denmark In Denmark, there is no national statutory minimum wage rate. Minimum wages are set in sectoral collective agreements between the employers' association DA (*Dansk Arbejdsgiverforening*) and the confederation of trade union workers LO (*Landsorganisationen*). There are no formal extension procedures for private-sector agreements (Lismoen, 2006). The collective bargaining coverage in Denmark is relatively high (around 80 per cent), but significantly less universal than in other countries with collectively bargained minima, such as Austria, Belgium and Finland. Collective agreements are not extended in Denmark (Eldring and Alsos, 2012).

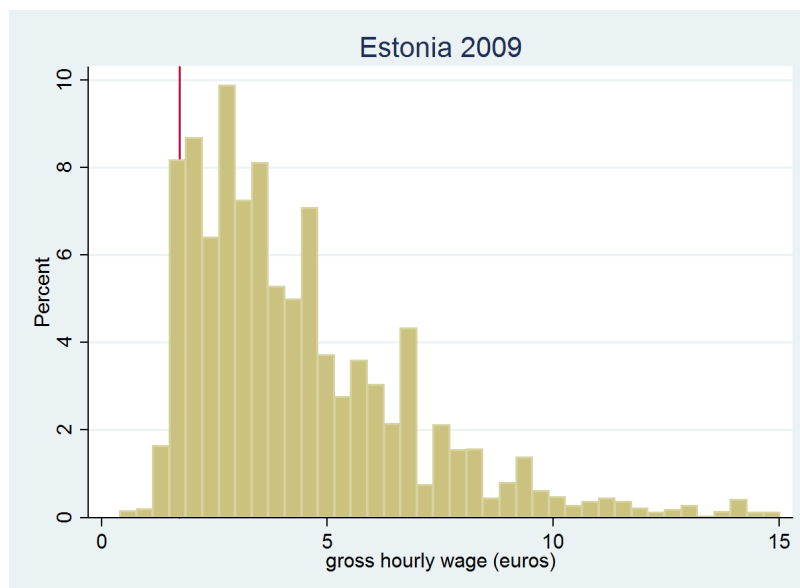
Figure 2.6: Wage distribution and minimum wage in Denmark

Source: DK-SILC; current 2009 euros; vertical lines represent sectoral minima.

Estonia Since 1991 the Estonian state has set a national statutory minimum wage by decree. This national rate is revised annually and based on a bipartite agreement between employers and unions. Even among central and eastern European countries Estonian collective bargaining coverage is very low (around 20 per cent), which means that the national statutory minimum wage is highly relevant for most parts of the economy. Due to the weak coverage of sectoral bargaining, Grimshaw and Bosch (2013) argue that the Estonian minimum wage has a large impact on the country's wage structure.

Finland In Finland there is no national statutory minimum wage rate but collective agreements have defined the minimum wages at the sectoral level since the beginning of the 1970s. Members of the employer confederations are obliged to follow the collective agreement signed by their respective confederation. Employers can also make independent agreements with the trade unions. Normally, terms of employment are concluded at sectoral level with *erga omnes* applicability. Non-organised employers have to observe the collective agreement that sets minimum terms and conditions of employment within their area of employment. Such employers are not allowed to pay lower wages than those stipulated in the collective agreements. There are currently around 170 sectoral contracts, each typically defining separate minima

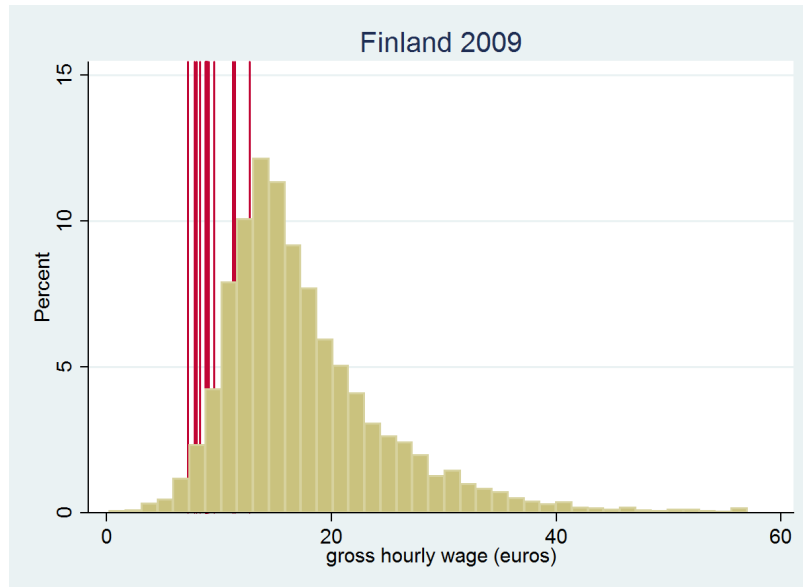
Figure 2.7: *Wage distribution and minimum wage in Estonia*



Source: EE-SILC; current 2009 euros; vertical line represents national statutory minima.

for different work posts. There is also some regional variation of minima, with different rates applying outside the Helsinki region. Only 10 per cent of Finnish workers are not covered by collectively agreed minima, a group that consists mainly of self-employed individuals. Contrary to the case of Denmark, extension mechanisms of collective agreements exist and are widely applied in Finland (Eldring and Alsos, 2012).

France France has had a national statutory minimum wage since the 1950s. The SMIC (*Salaire minimum interprofessionnel de croissance*) is set by legislation and covers all workers except those in the public sector, apprentices, young workers and persons with certain disabilities, for whom different rates apply. There are two ways in which the national minimum wage rate (SMIC) may be adjusted. First, the SMIC is indexed to the consumer price index (CPI): when it increases by at least 2 per cent, the SMIC is increased by the same percentage. Second, and independent of the first method, the government sets a new SMIC by decree on 1 July each year, following the opinion and related report of the National Committee on Collective Agreements. The National Committee on Collective Agreements is made up of four government representatives and an equal number of persons from the most representative workers' and employers' organisations. Despite low union density, collectively agreed wages

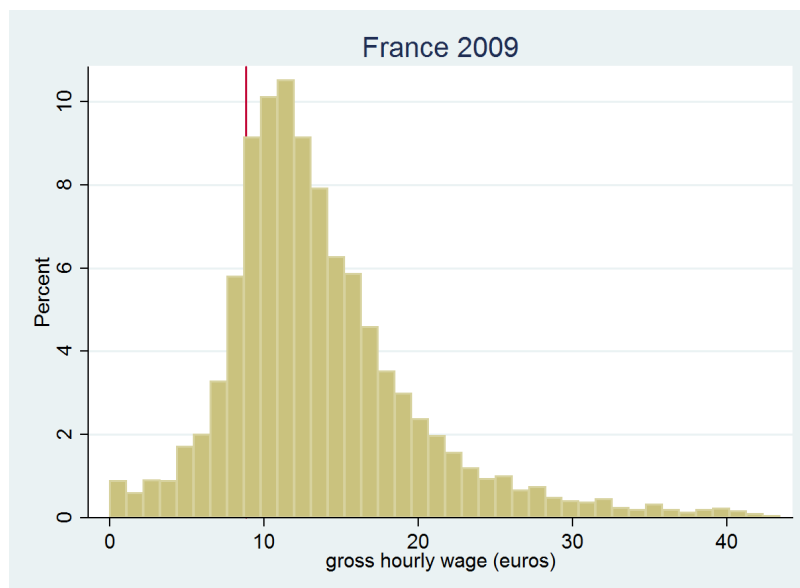
Figure 2.8: *Wage distribution and minimum wages in Finland*

Source: FI-SILC; current 2009 euros; vertical lines represent sectoral minima (in Helsinki for those sectors that have subminima outside Helsinki).

defined in sectoral agreements (*Conventions collectives de travail*) apply to almost all workers due to the fact that all agreements are extended by the government. However, the specific minimum wages agreed through collective bargaining are in many cases irrelevant since they are often lower than the SMIC (Gautié, 2010; Eldring and Alsos, 2012: 50).

Germany Similar to the case of Cyprus, the German minimum wage system until 2014 has been characterised by the absence of a national statutory minimum wage and relatively weak collective bargaining coverage: only workers in companies bound to collective agreements (*tarifgebundene Unternehmen*) are effectively protected. The state can, however, intervene in several ways in minimum wage setting: Article 5 of the Collective Agreement Act (*Tarifvertragsgesetz*) makes it possible to extend collectively agreed minima to all workers; the Posted Workers Act (*Arbeitnehmerentsendegesetz*) makes it possible to extend collective agreements that cover more than 50 per cent of employees in a sector, a method that has been applied in cleaning, construction, laundries, electrical work, care services, mining and postal services; if collective agreements cover less than 50 per cent of workers in a sector, the Act relating to minimum working conditions (*Mindestarbeitsbedingungengesetz*)

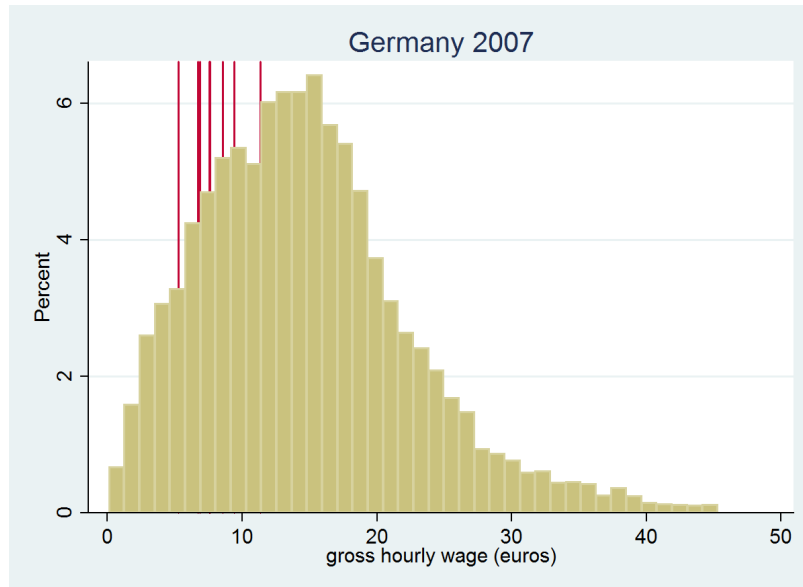
Figure 2.9: *Wage distribution and minimum wage in France*



Source: FR-SILC; current 2009 euros; vertical line represents national statutory minima.

permits introducing minimum wages through an agreement in a tripartite commission. Despite these mechanisms, only 640 of the 64,300 agreements registered in 2008 have been extended (Eurofound, 2011: 2). Collective bargaining coverage continues to weaken and has called the German model of protection against low pay into question: between 1998 and 2010, collective bargaining coverage declined from 73 to 63 per cent in western Germany and from 63 to 50 per cent in eastern Germany. The coverage at sectoral level is even lower, so that more than half of all German workers are not covered by national or sectoral minima. This is why Schulten (2006) argues that the German collective bargaining agreements currently cannot be regarded as functional equivalents of statutory minimum wages. The declining bargaining coverage has led German trade union to reconsider the idea of a statutory minimum wage and to start campaigning for it. As a result, on 1st January, 2015 Germany will introduce a national minimum wage of 8.50 euros. Lower rates are allowed until 2016 in sectors where collective agreements already exist. By 2017, at the latest, 8.50 euros will also be paid in these cases. The minimum wage does not apply to young workers below 18 or to long-term unemployed people during the first six months after re-employment.

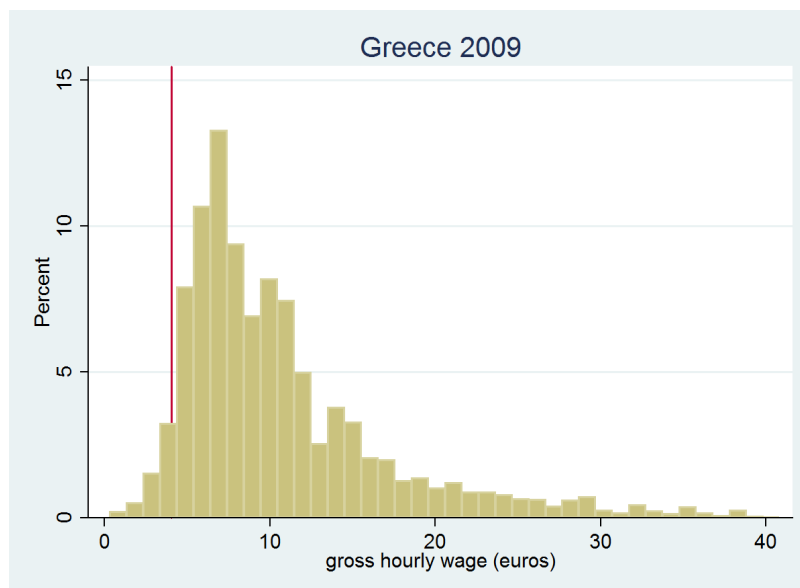
Greece Greece has a national statutory minimum wage fixed in a National Gen-

Figure 2.10: *Wage distribution and minimum wages in Germany*

Source: DE-SILC; current 2007 euros; vertical lines represent sectoral minima.

eral Collective Agreement (EGSSE) that is concluded between the Greek General Confederation of Labour and the Federation of Greek Industries and General Confederation of Greek Small Businesses and Trades. During negotiations on a new EGSSE, the social partners submit their proposals on a wage increase. The two main parameters taken into account in determining the increase are estimated inflation and GDP growth. The minimum wage does not differ by categories of worker. However, a worker's level of education, years of employment and family status are used to determine their total wage. Despite low trade union density (less than 25 per cent), the existence of effective extension mechanisms has led to relatively high coverage rates (around 65 per cent). Recent changes in the legislation have, however, somewhat restricted the scope of extension mechanisms (Eurofound, 2011).

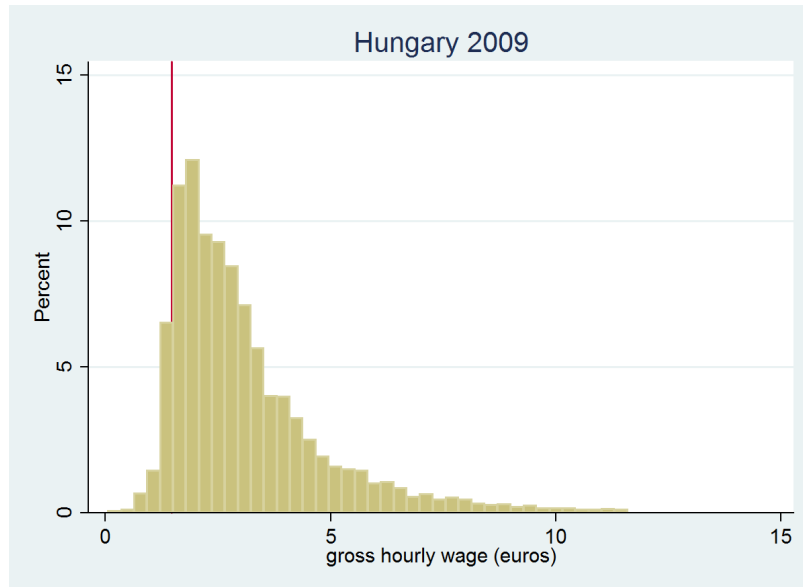
Hungary Since 1991, the Hungarian government has fixed statutory minimum wages following tripartite agreements in the National Interest Reconciliation Council (OÉT). Except for a higher rate for skilled workers, there are no exemptions or differentiations (Funk and Lesch, 2005). Collective bargaining agreements can, at least in principle, lead to increases in minimum wages at the sectoral level. However, union density and collective bargaining coverage are both notoriously low (17 and 34 per cent, respectively). What is more, compliance with sectoral-level agreements

Figure 2.11: *Wage distribution and minimum wage in Greece*

Source: EL-SILC; current 2009 euros; vertical line represents national statutory minima.

appears to be weak outside the public sector and utilities (Grimshaw and Bosch, 2013). Since 2012 there have been changes in way in which the social partners are able to affect the national statutory minimum wage. The Hungarian Parliament passed a law on 4 July 2011 that effectively incorporates the tripartite OÉT along with other institutions in a new National Economic and Social Council (NGTT). According to Komiljovics (2011), council members have no decision-making rights and can only make proposals to the government. In effect, the cabinet alone can now decide on wage and employment-related regulations. Even though the NGTT officially functions as an advisory instead of a consultative body, Szabó (2013) also points out that it is “toothless”.

Ireland Ireland has a national statutory minimum wage. It is set in an Order by the Minister for Enterprise, Trade and Employment following a national economic agreement among economic and social interests or following a recommendation of the Labour Court (Nolan, 2010). An examination of the national minimum wage rate by the Labour Court must include consultation with representatives of employees and employers in the private and public sector of the economy. If agreement is reached between the parties on the appropriate hourly rate of pay of employees, that rate is recommended to the Minister. If no agreement is reached, the Labour Court may

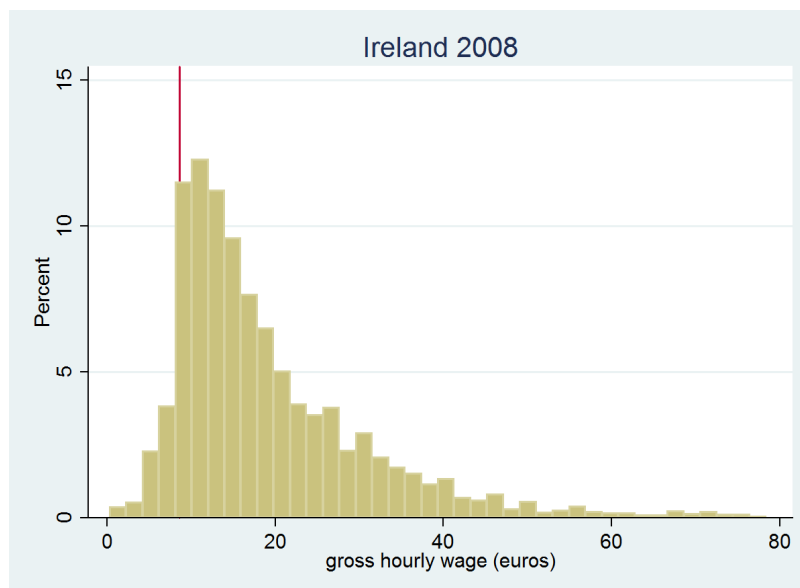
Figure 2.12: *Wage distribution and minimum wage in Hungary*

Source: HU-SILC; current 2009 euros; vertical line represents national statutory minima.

still make a recommendation concerning the hourly rate of pay, based on certain factors. The statutory minima in Ireland are differentiated and lower rates exist for young workers, trainees and newly hired staff. There are only a few sectoral-level agreements, so that for most workers the statutory minimum represents the relevant wage floor, an exception being the construction sector. Collective bargaining coverage is modest (44 per cent).

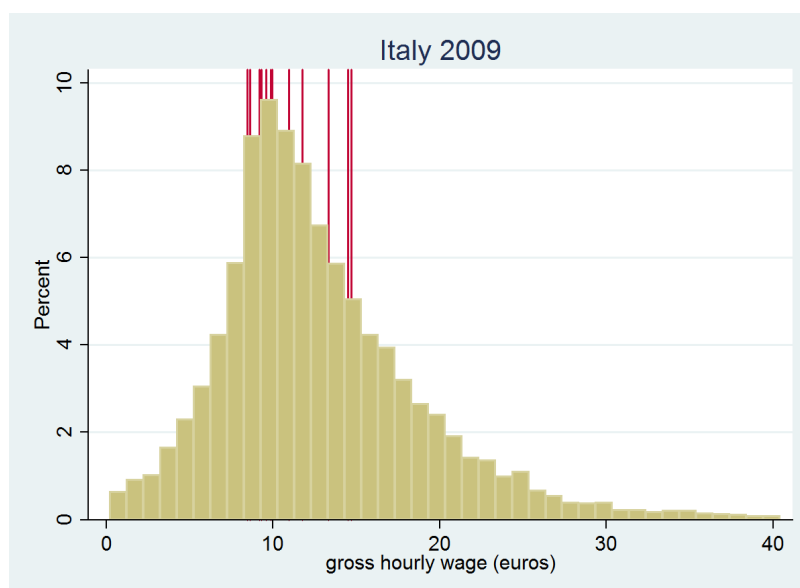
Italy There is no national statutory minimum wage rate in Italy. Minimum wage rates are set in binding sectoral collective agreements that generally are valid only for the companies and employees affiliated to the associations that sign the collective agreement; according to Eurofound (2011), there are no extension mechanisms in Italy. That said, courts usually refer to collectively agreed minimum pay rates in order to assess the appropriateness of actual wages in individual disputes, according to Article 36 of the Constitution (Megale et al., 2007). As a result, even workers who are not covered should receive wages at least equal to the minimum rates determined in collective agreements. Indeed, collective bargaining coverage in Italy is high compared to the country's union density (80 percent and 35 percent, respectively). Collective agreements are usually determined for a period of four years and the provisions concerning pay levels are renegotiated every two years.

Figure 2.13: *Wage distribution and minimum wage in Ireland*



Source: IE-SILC; current 2008 euros; vertical line represents national statutory minima.

Figure 2.14: *Wage distribution and minimum wages in Italy*

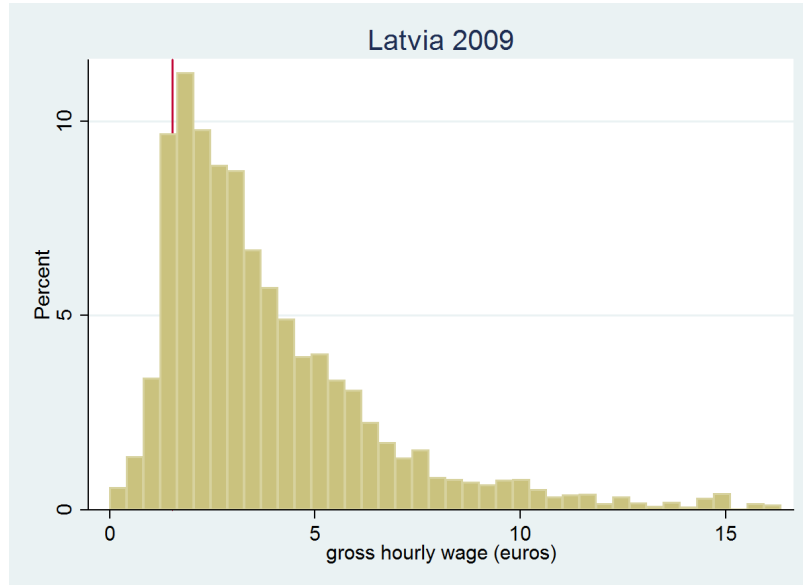


Source: IT-SILC; current 2009 euros; vertical lines represent sectoral minima.

Latvia The Latvian statutory minimum wage is determined by the State after consultation with employers and unions. There is some leverage for the government to extend minima negotiated through collective bargaining, notably a law that extends agreements if the employer organisation represents more than 50 per cent of the workers in a sector (Eurofound, 2011). However, the existing extension mechanisms

rarely apply, so that the country's low trade union density (15 per cent) translates into weak collective bargaining coverage (25 per cent). As in the other central and Eastern European countries, the statutory wage floor represents the most relevant protection against low pay for the vast majority of Latvian workers.

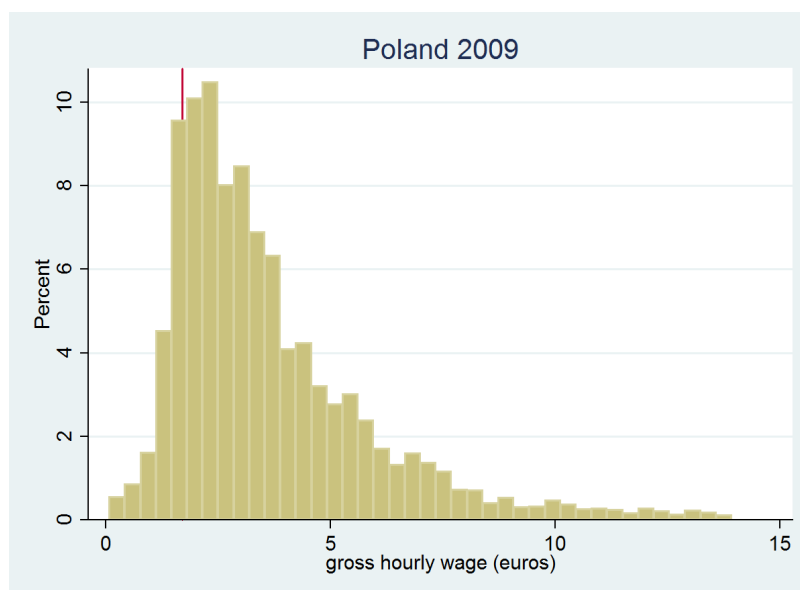
Figure 2.15: *Wage distribution and minimum wage in Latvia*



Source: LV-SILC; current 2009 euros; vertical line represents national statutory minima.

Poland Poland has a national statutory minimum wage. The minimum wage is negotiated every year within the Tripartite Commission (government, employers and employee representatives) and it is based on a proposal by the government (Wallusch, 2010). The level of the minimum wage is fixed in accordance with the projected global average annual consumer price index. If the level of the minimum wage in the year of negotiations is less than half of the level of average earnings, the minimum wage increases by two-thirds of the projected real GDP growth rate. If the Commission does not reach a consensus, the government sets the minimum wage. The minimum wage level set by the government cannot be less than the level included in the proposal presented to the Tripartite Commission. Like other central and eastern European countries, collective bargaining coverage is relatively low, at an estimated 30 per cent.

Portugal Portugal has had a national statutory minimum wage (*Salário Mínimo Nacional*, SMN) since 1974. Later, the SMN was renamed the guaranteed monthly

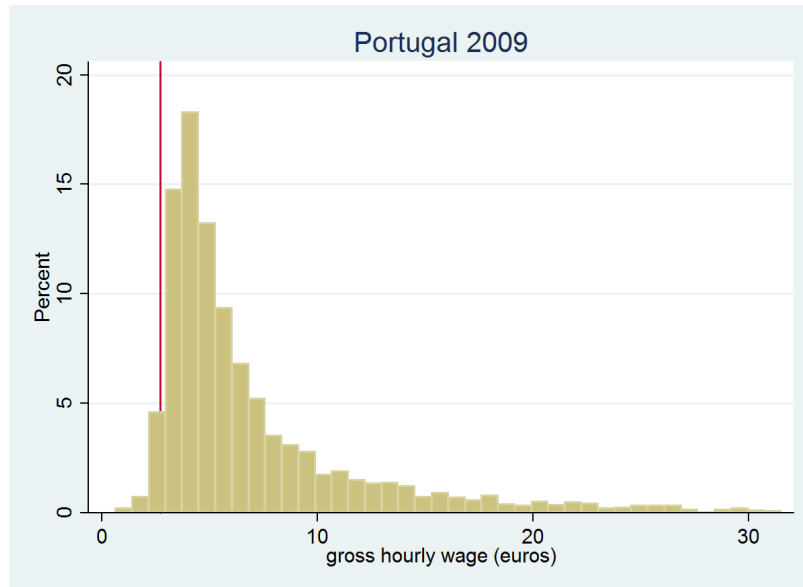
Figure 2.16: *Wage distribution and minimum wage in Poland*

Source: PL-SILC; current 2009 euros; vertical line represents national statutory minima.

minimum payment (*Remuneração Mínima Mensal Garantida*, RMMG). The government sets the national minimum wage rate after consultation with the Committee for Social Consultation of the Economic and Social Council (*Comissão Permanente de Concertação Social do Conselho Económico e Social*), which is a tripartite body. At first, the SMN was not differentiated for various groups of workers. In 1977-1978, the government created a differentiated SMN with specific minimum wages for agriculture and domestic workers that was considerably below the general SMN. In 1991, the SMN for agriculture was integrated into the general rate and in 2004 the differentiation system was abolished. Extension of collective bargaining agreements is “common practice” in Portugal (Eurofound, 2011), but due to the low trade union density of only 15 per cent the overall collective bargaining coverage remains relatively low (38 per cent).

Romania In Romania, until 2011 the government set a national statutory minimum wage rate following consultation with the social partners. Within the group of central and eastern European countries, trade union density is the highest in Romania (33 per cent); what is more, the country’s labour law provides for effective and widely used extension mechanisms so that Romania’s collective bargaining coverage is the highest in the region (70 per cent). In 2011, the Romanian government introduced

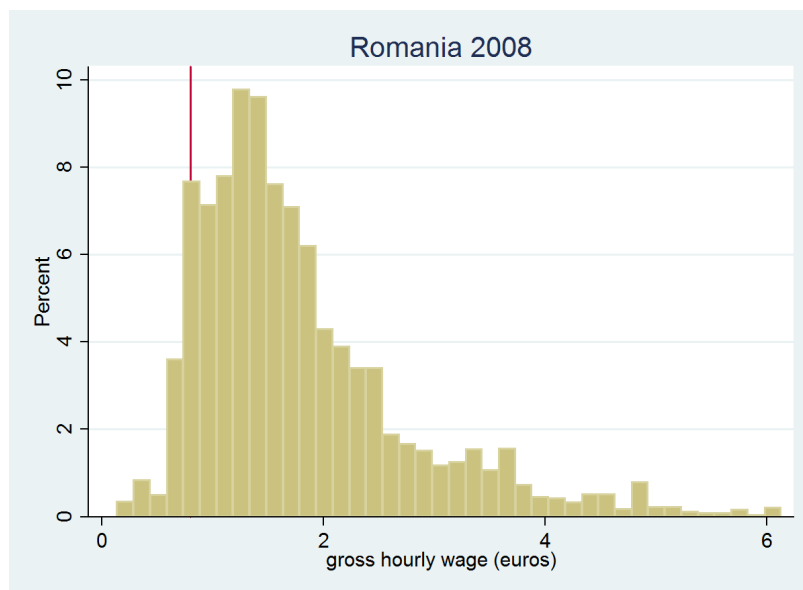
Figure 2.17: *Wage distribution and minimum wage in Portugal*



Source: PT-SILC; current 2009 euros; vertical line represents national statutory minima.

the so-called Social Dialogue Act (SDA), thereby essentially abolishing cross-sectoral collective agreements, which formerly also defined the terms for minimum wages. What is more, the SDA curbed the legal extension of collective agreements so that the relatively high level of bargaining coverage are likely to decrease to the levels observed in neighbouring countries (cf. Triff, 2013).

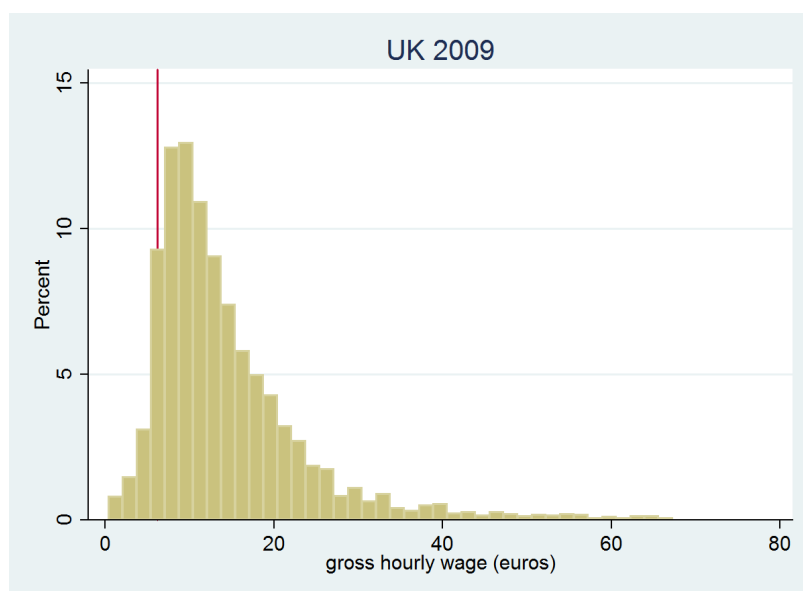
Figure 2.18: *Wage distribution and minimum wage in Romania*



Source: RO-SILC; current 2008 euros; vertical line represents national statutory minima.

United Kingdom The United Kingdom has had a national statutory minimum wage since 1997. The Secretary of State determines the national minimum wage following the Low Pay Commission’s recommendation. This Commission comprises an independent chair and nine members (three employers, three employees and three independents). Before making a recommendation, the Low Pay Commission must consult employers’ representatives, workers’ representatives and any other body or person they think fit. There are lower rates for young workers and apprentices. Collective bargaining agreements at the sectoral level hardly exist and no legal extension mechanism is available. The collective bargaining coverage of 34 per cent mainly stems from firm-level agreements.

Figure 2.19: *Wage distribution and minimum wage in the UK*



Source: UK-SILC; current 2009 euros; vertical line represents national statutory minima.

Due to the historical contingencies and the diversity of institutional arrangements at the national level (Eyraud and Saget, 2005), each country in our sample is unique with regard to its minimum wage system. This being said, focusing on the two basic features of these systems - namely, the existence or absence of a national statutory minimum wage and the degree of collective bargaining coverage - allows us to distinguish minimum wage systems in respect of the (potential) protection against low pay that they provide (see Table 2.1).

Three types of protection against low pay can be identified:

Table 2.1: *Overview of minimum wage systems*

	Low bargaining coverage	High bargaining coverage
Sectoral/occupational MW	No protection	Equivalent protection
National statutory MW	Equivalent protection	Dual protection

Table 2.2: *Overview of countries according to their minimum wage systems*

	Low bargaining coverage	Medium coverage	High coverage
Sectoral/occup. MW		Cyprus, Germany	Austria, Finland, Denmark, Italy
National statutory MW	Latvia, United Kingdom, Ireland, Bulgaria, Estonia, Hungary, Poland	Romania, Greece, Portugal	Belgium, France

Notes: Low: <50%; medium: 50-75%; high: >75%.

1. No protection: a minimum wage system that has neither a statutory minimum wage nor sectoral/occupational agreements that cover most of the workforce is likely to offer no or only weak protection against wage dumping or excessively low wages.
2. Equivalent protection: statutory minimum wages and sectoral agreements with high coverage are sometimes regarded as functional equivalents (Schulten, 2006) providing an intermediate level of protection against low pay. Empirical evidence for the equivalence of the two types of minimum wage system is, however, so far not available.
3. Dual protection: a combination of a statutory wage floor and wide collective bargaining coverage provides arguably the strongest protection against low wages.

Table 2.2 applies this two-by-two grid to the eighteen countries in our sample. The empty square in the upper left corner means that all European countries provide at least some level of protection against low pay. Twelve of the eighteen countries in our sample are classified into one of the two squares associated with equivalent

levels of protection: Latvia, United Kingdom, Ireland, Bulgaria, Estonia, Hungary, Portugal and Poland have a statutory minimum wage but low levels of collective bargaining coverage, while Austria, Finland, Denmark and Italy have no statutory minima but high coverage. Belgium and France are associated with dual protection, although in practice the French system provides no more protection than the two groups with equivalent protection, given that sectoral-level agreements often contain minimum rates that are actually below statutory wages (see above). The four remaining countries occupy intermediate positions: Romania and Greece arguably provide somewhat stronger protection than the majority of countries with statutory minimum wages due to their relatively high levels of bargaining coverage. Conversely, the low coverage rates in Cyprus and Germany could mean that their minimum wage systems provide lower levels of protection compared to the other countries without statutory minimum wages. The weak position of the German minimum wage system in our table explains, at least in part, the debate on the introduction of a national minimum wages in this country which has brought the German government to introduce a national minimum wage as of 2015.

2.3.2 Data sources

Statutory and collectively bargained minimum rates

For all countries with statutory minimum wages except Cyprus, information on the level and evolution of wage floors has been collected from the March 2012 edition of the *WSI Mindestlohndatenbank*. The minimum rates have been collected and converted into euro amounts for all years with available microdata (see below). This step leads to 28 country-year observations from countries with statutory minimum wages at the national level.

In light of the institutional set-up of the seven countries in our sample that do not have a national statutory minimum wage (Austria, Belgium,⁸ Cyprus,⁹ Denmark,

⁸Belgium actually has a national minimum wage, but in addition to this statutory floor the collectively bargained minimum wages constitute the relevant minimum for most workers (see the country profile in Section 2.3.1). We have thus collected information on both the interprofessional and the sectoral-level minima and matched each individual to the minimum rate that corresponds to his or her profile. The inclusion of this special case in our sample has no consequences for the conclusions drawn from our empirical analysis (see robustness test in the empirical analysis).

⁹Cyprus is a special case in that the minimum wage is not defined at the sectoral, but at the

Finland, Germany and Italy), access to minimum wage data is considerably more problematic. Indeed, this information had to be collected manually from sectoral-level collective bargaining agreements. More precisely, we extracted from each agreement the wage assigned to the lowest category in collectively negotiated pay scales. While this definition of a sectoral minimum wage is straightforward, it should be noted that the elaborate categorisations that are found in many collective agreements render the identification of a given sectoral minimum wage relatively complicated. Indeed, in most agreements different pay scales co-exist: separate nomenclatures are often defined for blue- and white-collar workers; specific scales are included for apprentices or young workers who enter the labour market; and even where a unique pay scale exists it is often differentiated by variables such as occupational groups, work-post nomenclatures and seniority levels. In order to come closest to the conception of sectoral minimum wages as “the pay rate defined for the lowest wage category”, our database contains information on the pay rate of the lowest of any category that figures in all the pay scales in a collective agreement, with the exception of pay scales for apprentices and young workers. In practice, in the vast majority of agreements this boils down to the pay rate that applies to workers with no seniority and who are classified in low-status occupations at the bottom of organisational hierarchies (*manœuvre ordinaire*, *Hilfsarbeiter* and so on).

It should be noted that the number of collective agreements signed in most countries is substantial: in Germany alone there are around 64,300 valid agreements, although most of them are signed at the company and not at the sectoral level. We therefore decided to collect minimum rates from a representative sample of collective agreements in each country and to use them to compute average minima at the one-digit level of the Statistical Classification of Economic Activities in the European Community (NACE). We notably extracted minimum rates from around 325 collective agreements from Austria (referring to wages in 2009); 150 from Belgium (wages in 2007); 105 from Denmark (wages in 2007, 2008 and 2009); 210 from Finland (wages in 2007, 2008 and 2009); 80 from Germany (wages in 2007); and 240 from Italy (wages in 2007, 2008 and 2009). In order to ensure the representativity of the

occupational level. For the period under analysis a single rate applied to around 10 occupational groups in Cyprus. We used data on these rates for 2007 and 2008 taken from EIRO country reports.

sectoral-level minima in the final dataset, the calculation of average minimum rates at the one-digit level of the NACE takes into account the relative employment shares of the more than 1,100 sampled sectors. This procedure produced 169 sector-year observations from countries without statutory minima.

The absolute levels of average minimum wages in each country are summarised in Table 2.3. We observe a wide span ranging from less than 2 euros per hour in the six Central and Eastern European countries in our sample to minima that are more than five times higher in Denmark and Italy. Table 2 also shows the average Kaitz index in each country over the period 2007-2009. The average levels of Kaitz indices are closer to each other than the absolute minima: the majority of national Kaitz indices lie between 45 and 55 percent. We also observe that the Central and Eastern countries have the lowest minimum wages in both absolute and relative levels (Kaitz indices often below 50 percent); but the regional differentiation is less clear than for the absolute levels given that Poland and Hungary have somewhat higher levels, whereas Portugal displays a value below 50 percent. All observations from countries without statutory minimum wages lie above 50 percent, including an extremely high value for Italy. In fact, the high Kaitz indices for Italy indicate that sectoral minima appear to lie relatively close to the corresponding median wages.

Table 2.3: *Descriptive statistics of main variables at the country level (2007-2009)*

	Obs. per year	SILC waves	Statutory MW	Collective bargain- ing coverage	Average MW (€)	Average Kaitz index	% work- ers <75% of MW	% of women	Blue col- lar (ISCO 11-34)	White collar (ISCO 41-52)	Managers (ISCO 61-93)	ISCED levels 0,1,2	ISCED levels 3,4	ISCED levels 5,6
Austria	5,409	2010	No	0.76	7.67	0.59	0.06	0.47	0.35	0.33	0.32	0.15	0.65	0.19
Belgium	5,438	2008	Yes	0.64	9.32	0.63	0.06	0.44	0.40	0.31	0.30	0.21	0.37	0.42
Bulgaria	5,399	2008-10	Yes	0.33	0.63	0.42	0.01	0.50	0.35	0.28	0.37	0.14	0.55	0.31
Cyprus	3,429	2008-09	No	0.23	4.65	0.52	0.05	0.50	0.41	0.28	0.31	0.17	0.40	0.43
Germany	10,744	2008	No	0.56	7.61	0.60	0.12	0.48	0.47	0.27	0.26	0.10	0.54	0.36
Denmark	4,373	2008-10	No	0.52	14.21	0.65	0.08	0.47	0.43	0.24	0.33	0.22	0.46	0.32
Estonia	5,453	2008-10	Yes	0.10	1.61	0.43	0.01	0.56	0.49	0.20	0.31	0.09	0.50	0.41
Finland	9,399	2008-10	No	0.79	8.92	0.59	0.03	0.51	0.45	0.26	0.29	0.13	0.47	0.41
France	9,863	2009-10	Yes	0.48	8.63	0.71	0.08	0.47	0.43	0.25	0.32	0.20	0.44	0.36
Hungary	7,690	2008-10	Yes	0.26	1.52	0.54	0.02	0.49	0.37	0.26	0.37	0.13	0.61	0.27
Ireland	3,681	2008-09	Yes	0.34	8.48	0.54	0.04	0.44	0.40	0.31	0.29	0.24	0.37	0.39
Italy	13,450	2008-10	No	0.82	10.50	0.90	0.19	0.45	0.35	0.29	0.36	0.34	0.48	0.17
Latvia	5,644	2008-10	Yes	0.30	1.30	0.41	0.03	0.55	0.45	0.22	0.33	0.12	0.55	0.34
Poland	10,730	2008-10	Yes	0.23	1.66	0.53	0.04	0.52	0.41	0.24	0.34	0.07	0.62	0.31
Portugal	4,216	2008-10	Yes	0.78	2.57	0.48	0.02	0.49	0.27	0.30	0.43	0.59	0.22	0.19
Romania	5,269	2008-09	Yes	0.14	0.75	0.45	0.01	0.46	0.38	0.26	0.36	0.11	0.63	0.25
United Kingdom	6,866	2008-10	Yes	0.28	6.90	0.57	0.03	0.46	0.41	0.31	0.28	0.13	0.53	0.35
Countries with sectoral MW	8,052	-	No	0.78	9.54	0.65	0.13	0.48	0.39	0.27	0.34	0.22	0.48	0.30
Countries with national MW	6,263	-	Yes	0.47	3.39	0.50	0.06	0.49	0.34	0.26	0.40	0.20	0.52	0.29
Total	6,792	-	-	0.56	5.21	0.55	0.08	0.48	0.35	0.26	0.38	0.20	0.51	0.29

Notes: EU-SILC waves 2008-2010, ECS, WSI Mindestlohndatenbank and authors' calculations.

Collective bargaining coverage

Since our dataset includes information on minimum wages at the sectoral level, it was also necessary to collect data on collective bargaining coverage at the same level. While data on country-level coverage is widely available, we had to compute comparative sectoral collective bargaining coverage from survey data. For this purpose we used the 2009 wave of the European Company Survey, a large-scale organisational survey carried out by the European Foundation for the Improvement of Living and Working Conditions (Eurofound) every 5 years. The survey contains on average 905 company-level observations from 30 countries. In order to estimate sectoral collective bargaining coverage in the 18 countries in our sample, we used the information on a) the proportion of employees within companies covered by collective bargaining; b) whether collective bargaining refers to the company, sectoral or national level; and c) whether employers are able to pay salaries below the levels fixed by collective bargaining agreements. We then used this information to calculate averages at the one-digit NACE level of the proportion of employees who are covered by sectoral or national bargaining agreements.

The national averages of this variable are listed in Table 2.3. The collective bargaining coverage is 31 percentage points higher in countries in which minimum wages are determined through collective bargaining at the sector level, probably reflecting the co-evolution of the two features (cf. Grimshaw, 2013). But even if coverage and statutory floors may be historically related, over short time periods they can arguably be treated as being independent since it is costly and politically difficult to switch from one system to another (in Germany the debate on the introduction of a national minimum wage started in the mid-2000s). This short-run exogeneity is relevant for this study because the regressions we run include both the coverage rate and the existence of a national minimum rate as explanatory variables. Since our sample includes three years (2007-2009), the potential long-run interdependence between coverage rates and statutory minima is less of a concern in our case.

Earnings and individual characteristics

The representative micro-level data we used stem from the harmonised survey of European Statistics on Income and Living Conditions (SILC). For the 17 countries in

our sample, we used the available waves collected in 2008, 2009 and 2010 containing information on income variables for the years 2007-2009. The EU-SILC data contain labour market information for a range of European countries and are designed as a household-level survey allowing one to calculate inequality and poverty indicators, in particular the so-called Laeken indicators such as the poverty rate, in-work poverty, or the Gini index (see Atkinson et al., 2002). The EU-SILC data contain detailed information on job characteristics such as earnings, employment type, and employer characteristics. On average, the micro-level information in our sample is based on 6,792 individual observations per country and year (for the number of observations per country see Table 2.3).

The income variable used in the regression analysis is gross hourly wages. The latter have been calculated at the individual level by dividing gross monthly income - i.e. monthly income before the deduction of taxes and including social contributions paid by the employee - by the working hours the individual declared for the corresponding income period. We calculated this variable for all workers in the SILC except for individuals who declared themselves self-employed; our analysis therefore includes individuals working part-time and all salaried employment. This is slightly different from other studies on minimum wages, which look only at full-time workers or focus exclusively on individuals paid hourly wages as opposed to monthly salaries (Schulten et al., 2006; Vaughan-Whitehead, 2010; Bureau of Labor Statistics, 2012). The precision of our earnings measure therefore depends on the quality of both the income and the hours measures in SILC.

Alternative data could be found in the European Structure of Earnings Survey (SES). The SES has been conducted every four years since 2002, and collects representative and harmonized data on wages in enterprises with more than 10 employees in all sectors except agriculture, fishing, public administration, education, health and community and social services. This survey provides very precise information on wages and hours worked as declared by employers. In the context of minimum wage research, especially the imperfect measurement of working hours has received particular attention (Hermann, 2006). In SILC, both numerator and denominator of the wage variable are self-reported survey data and therefore subject to the usual

disclaimers.¹⁰

While sometimes criticised as being less precise than administrative data collected from company records or fiscal authorities, our earnings measure taps into the information of the individuals actually working on the job and who therefore have knowledge on unrecorded working hours that by definition is not available in administrative records. In the context of research on minimum wages, an important advantage of survey data is that employers may have incentives not to disclose if they pay wages that are below prevailing minimum rates. For instance, the case studies in Grimshaw (2013) suggest that employers in the security sector circumvent minimum wage legislation by declaring artificially low working hours so that monthly full-time wages appear to be compliant with existing minima. This means that noncompliance is arguably much more difficult to measure with company records or payroll figures communicated to tax authorities than with survey data. Table 2.3 shows the national averages for the share of workers below minimum wages defined as individuals earning less than 75 percent of the prevailing wage floor (the impact of alternative thresholds is discussed in the robustness checks). There is no clear regional stratification with respect to this variable.

Moreover, we tend to prefer SILC to SES since the latter does not include small enterprises nor many important sectors of the economy. The exclusion of small enterprises is specially problematic because low-paid workers are overrepresented in such companies.¹¹

2.4 An overview of the EU variety

A common observation in comparative studies of minimum wages in Europe is that absolute levels of wage floors differ considerably across countries and that these differences persist even after controlling for the international disparities in purchasing power (Schulten et al., 2006). We have represented the absolute size of statutory and

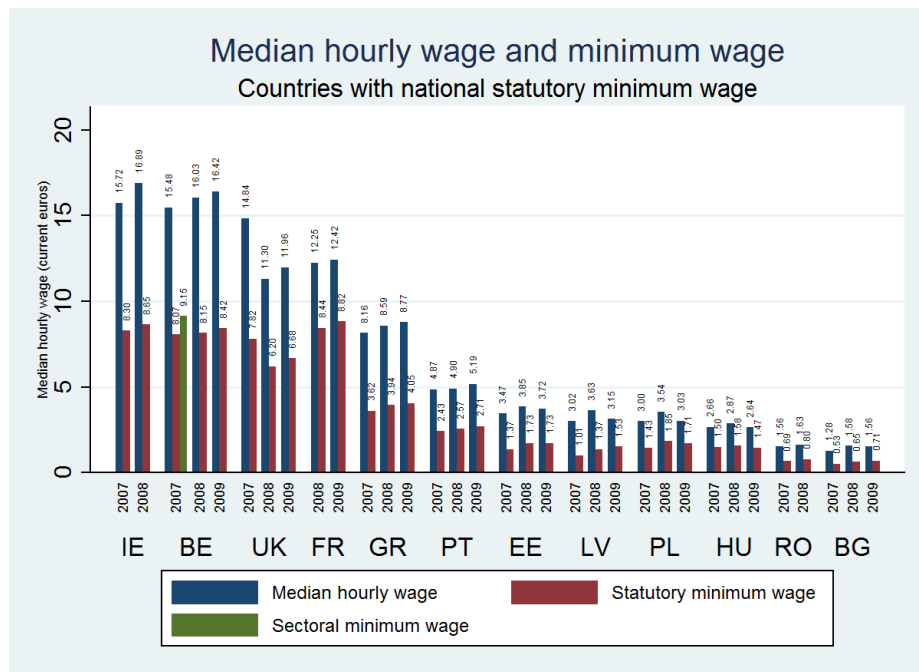
¹⁰Working hours self-declared in SILC differ from those declared by employees in SES, notwithstanding the different sample, by maximum $\pm 5\%$. Therefore over (or under) declaration is on average quite limited.

¹¹Eurofound (2014) shows that in most countries excluding small companies tends to reduce the proportion of workers falling below the 60% of the median threshold.

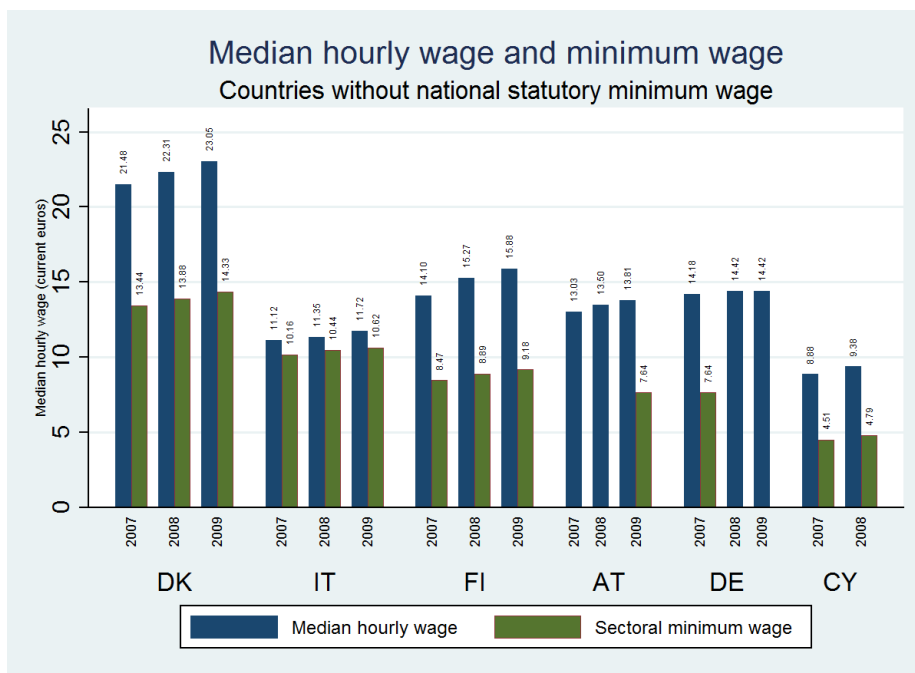
sectoral minima in Figure 2.20 (countries with statutory wage floors) and Figure 2.21 (countries without a statutory floor). We indeed observe a wide span ranging from less than 2 euros per hour in the four Central and Eastern European countries in our sample to minima that are more than five times higher in Denmark and Italy.

It is of course also well-known that some of the absolute differences in minimum rates can be accounted for by intra-European variations in productivity. In the two figures we have also plotted the median wage for each year and each country so as to compare them directly with the prevailing minimum rate. The result is an obvious relationship between the absolute amounts of minimum wages and corresponding minimum wages: wage floors are lowest (highest) in countries where the general wage level as measured by the median wage is also low (high).

Figure 2.20: *Median hourly wage and minimum wage*



The Kaitz Index is the ratio between minimum and median wages (for a more detailed discussion see section 3.2.1 in Chapter 3) and its values are shown in Figure 2.22 (countries with statutory wage floors) and Figure 2.23 (countries without statutory floors). For the latter group of countries the bar shown in the graph corresponds to the weighted average of sectoral Kaitz indices and therefore masks the intersectoral variations of minimum wages in these countries. A first observation from the comparison of Kaitz indices is that their levels are close to each other: the

Figure 2.21: *Median hourly wage and minimum wage*

majority of national Kaitz Indices lies between 45 and 55 per cent. We also observe that most Central and Eastern countries not only have the lowest minimum wages in both absolute and relative levels (Kaitz indices below 50 per cent), but the regional differentiation is less clear than for the absolute levels, given that Poland has higher levels in 2008 and 2009, whereas Greece and Ireland (in 2008) also display values below 50 per cent. All observations from countries without statutory minimum wages lie above 50 per cent, including extremely high values for Italy. In fact, the Kaitz indices for Italy of around 90 per cent indicate that sectoral minima appear to lie close to the corresponding median wages.

The “bite” of the minimum wage not only refers to the relative level of wage floors but can also be measured by looking at the number of individuals that are paid below or near the prevailing rates. A graphical representation of these shares can be found in Figure 2.24 (countries with national statutory minima) and Figure 2.25 (countries without statutory minima). Depending on the type of minimum wage system, the figures show the share of individuals that receive wages below or exactly equal to the minimum prevailing in their country (blue bars) or sector (green bars). A larger proportion of individuals below the corresponding minimum can be interpreted as an indicator of a lower bite due to the existence of imperfect coverage or non-compliance

Figure 2.22: *Kaitz indices by country and year*

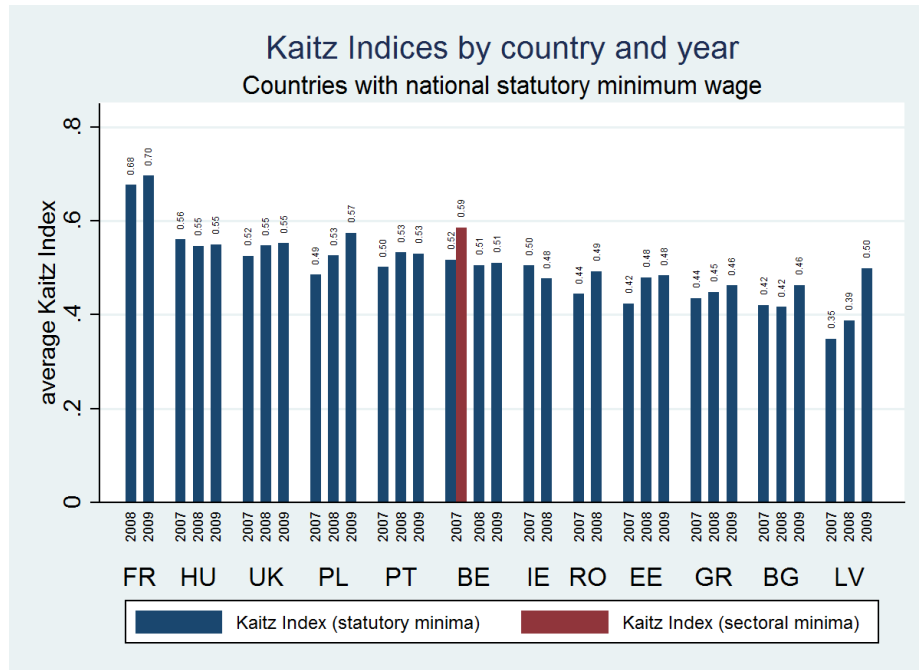
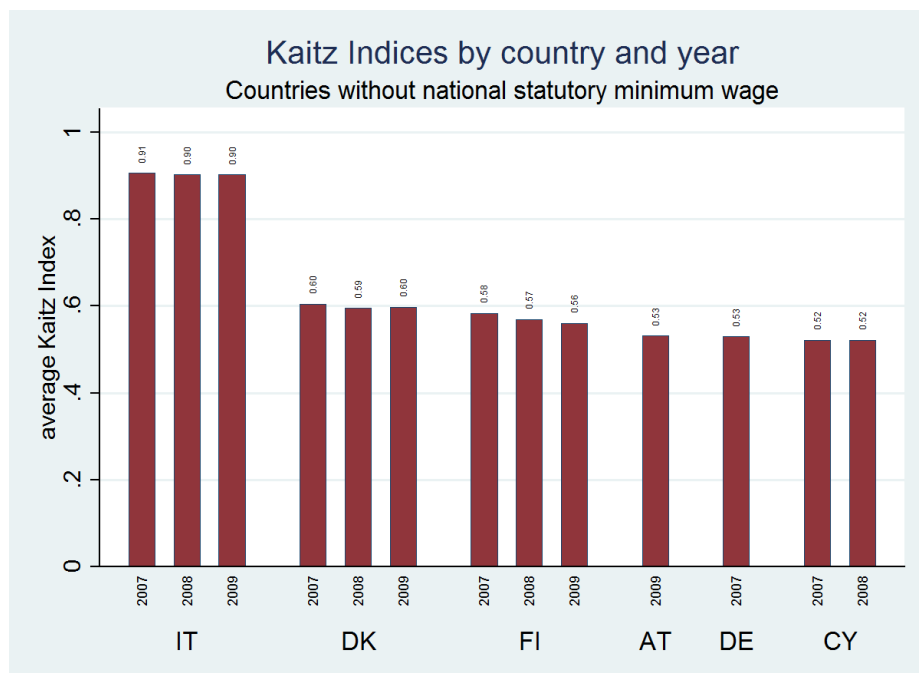


Figure 2.23: *Kaitz indices by country and year*

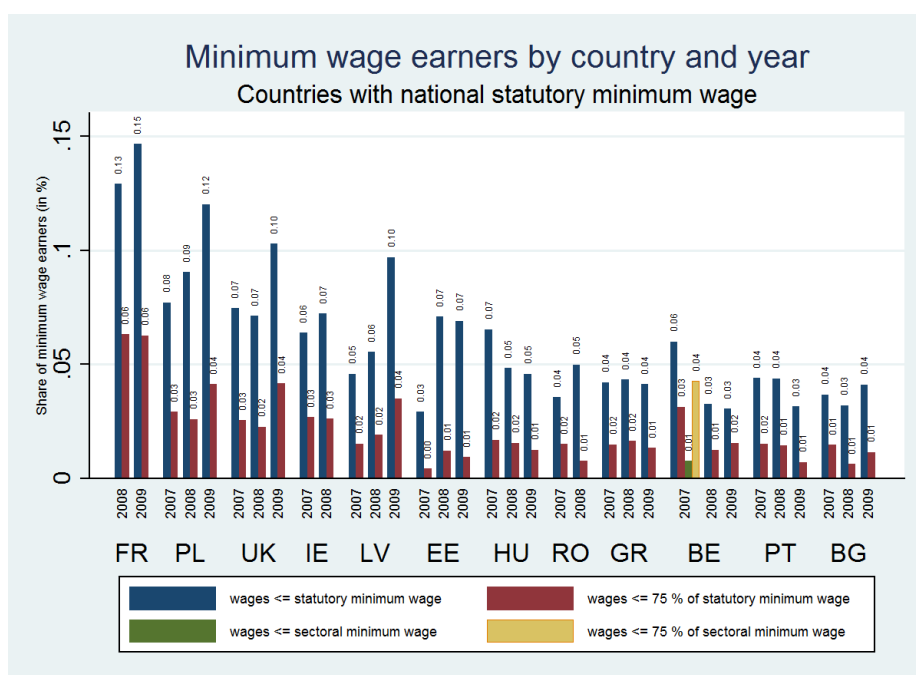


with minimum wage rules.

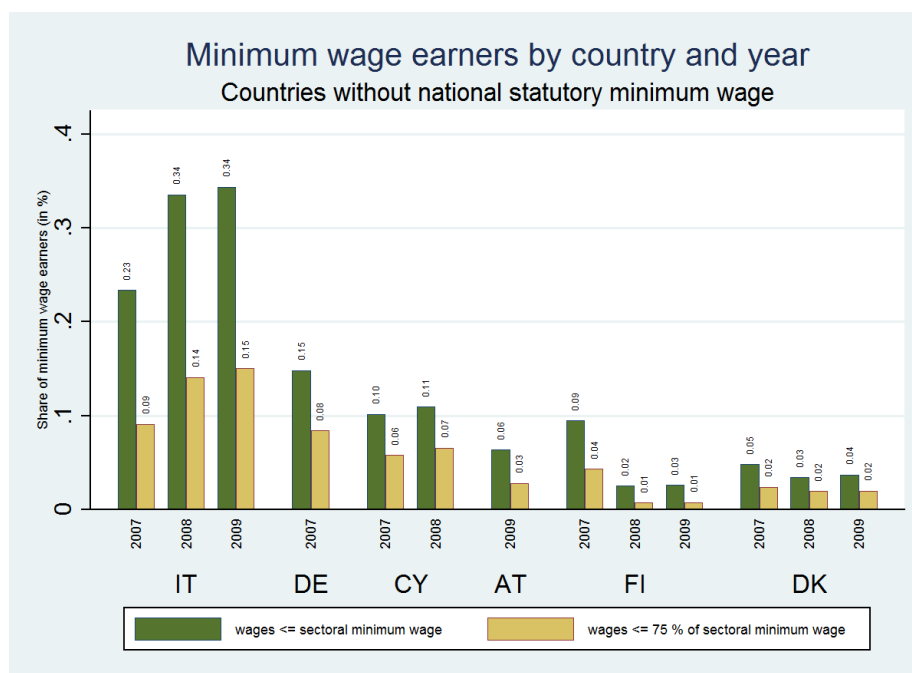
Contrary to the case of the absolute and relative levels of minimum wages, the graphs suggest that there is no clear regional stratification when it comes to the share of individuals paid at or below minimum wages. The Central and Eastern European

countries are scattered across the range in Figure 2.24, from shares of less than 4 per cent in Bulgaria to around 10 per cent in Poland. The bite of minimum wages in Portugal and Greece seems to be rather high (relatively few people are paid below prevailing minima), while the incidence of workers that are uncovered or in violation of existing rules is apparently higher in France, the United Kingdom and Ireland. As for the countries without national statutory minimum wages, we observe a difference between the two Nordic countries, where the shares are below 5 per cent for most years, and the other countries, with a relatively high proportion of employment with wages below or exactly equal to minimum wages.

Figure 2.24: *Minimum wage earners by country and year*



Besides non-coverage and non-compliance there is, however, another explanation for wages below prevailing minima, namely errors in the reporting of wages or working hours. Indeed, if we assume that the survey values with respect to both variables fluctuate around their true values, some observations will be falsely recorded as hourly wages below the minimum. While it is difficult to measure the exact incidence of reporting errors, one way to address this issue is to redefine the indicator of the minimum wage bite as the share of individuals earning hourly wages that are below or equal to 75 per cent of the corresponding minimum wage. This measure can therefore be interpreted as an indicator of the share of employment that is paid

Figure 2.25: *Minimum wage earners by country and year*

significantly below existing wage floors. The corresponding values are represented by the red bars (countries with statutory minima) or the yellow bars (countries without statutory minima) in Figure 2.24 and Figure 2.25. These values are arguably less prone to measurement errors: only if the measurement error in the earnings or hours variable exceeds 25 per cent is an individual erroneously counted as belonging to this group (or in the extreme case of an overestimation of hours worked and an underestimation of hourly wage, we consider a measurement error of maximum 11% in both variables). On average, this definition leads to values that are less than half of the employment shares discussed above, pointing to a substantial proportion of individuals who declare that they are paid within 25 per cent of the minimum wage. The two indicators are, however, closely linked: the correlation coefficient between the two indicators is above 92 per cent. Comparing Figure 2.24 and Figure 2.25, we see that the link between the two measures differs between the two types of countries: by and large, the number of jobs with wages significantly below prevailing minimum wages appears to be higher in the group of countries without statutory minimum wages. Indeed, the share of individuals with wages that are at least 75 per cent lower than their corresponding minimum wage is on average 2 percentage points higher in countries without statutory minimum wages. It should be noted, however, that

these averages are prone to omitted-variable biases because they fail to account for cross-country variations in the composition of the labour force; as a consequence, the topic of variations in the minimum wage bite will be explored further in the next sections.

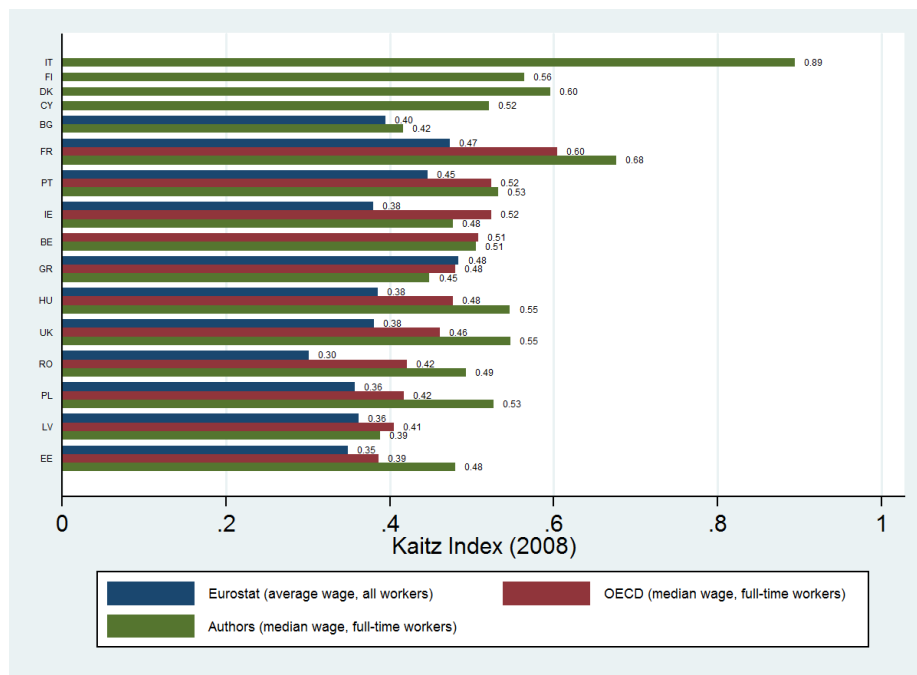
2.5 Comparison with other datasets

By and large, available sources consistently report the same absolute levels of minimum wages in countries with statutory wage floors: in general, the absolute minimum rates reported by the WSI Mindestlohn datenbank, Eurostat and the OECD coincide. Figures on the relative level of minimum wages across countries are, however, more divergent, for several reasons: first, the denominator used to compute Kaitz indices is not the same in all data sources (see detailed discussion in Chapter 3). Eurostat presents minimum wages relative to the average wage, ²³ while the OECD also uses median wages as denominator; second, the reference group for which the relative level of minimum wages is calculated may also differ. Eurostat uses the average wages of the entire labour force as denominator, while the OECD figures are based only on full-time workers. The Kaitz index is sensitive to these changes since the inclusion of part-time workers is typically associated with lower average (and median) wages and therefore to relatively higher levels of the index. In general, the level of minimum wages appears to be lower if compared to the average than to the median wage.

The definition of the Kaitz index we used in our regression analysis contains elements from both the OECD and the Eurostat definition: we compute the index using median wages (like the OECD), but we include all workers and not only full-time workers (like Eurostat). While the first choice is preferred practice in the empirical literature given that the median wage is less sensitive to outlying values (Boeri, 2012), the second reflects our concern to examine the impact of minimum wages for the entire labour force and not only for fulltime workers. Ignoring part-time workers is particularly problematic when discussing minimum wage policy as part-time workers represent a significant share of minimum wage earners (Rycx and Kampelmann, 2012).

Figure 2.26 compares the values of Kaitz indices according to three sources: Eurostat, OECD and our own calculations based on a combination of data from EU-SILC, the WSI Mindestlohn datenbank and hand-collected information from collective agreements. All indices refer to 2008. Unsurprisingly, the Eurostat figures are consistently smaller compared to the two other sources, a finding that can be attributed to the use of average instead of median wages as denominator.

Figure 2.26: *Minimum wage earners by country and year*



For the sake of comparability, the figures from the OECD and our own calculations are based on the same definitions, namely, median wages as denominator and full-time employees as reference group. Even so, the two sources do not coincide: six of the 11 countries for which we can compare Kaitz indices in 2008 differ by more than 5 percentage points. However, only two countries (Poland and Estonia) display indices that differ by more than 10 percentage points. The correlation coefficient between the Kaitz index in the two sources is 0.68, which indicates that, by and large, the two sources point in the same direction and the observed differences of 5-10 percentage points can probably be attributed to differences between the underlying earnings surveys.

CHAPTER 3

INSTITUTIONAL DIVERSITY AND THE SECTOR-LEVEL MINIMUM WAGE BITE

3.1 Introduction

By and large, the academic literature on minimum wages has been dominated by protracted debates on the size of potential employment effects, especially in the United States (Brown et al., 1982; Card and Krueger, 1995; Cahuc and Zylberberg, 2004; Neumark et al., 2013). The link between different minimum wage institutions and labour market outcomes has hardly been studied until very recently (Boeri, 2012; Grimshaw et al., 2014). Despite scarce evidence, some academics and policy-makers have nevertheless started to push for the introduction of a European minimum wage (see Introduction to Chapter 2) without, however, being able to compare the empirical performance of different minimum wage systems in terms of the degree of protection that minimum wages are supposed to provide.

Focussing on the minimum wage bite, the objective of this chapter is to present empirical evidence on key characteristics of alternative minimum wage systems: first, we are able to verify whether collectively bargained sector-level minima are higher compared to statutory minima at the national level - a claim that is sometimes found

in the literature but has so far not been examined with cross-country and cross-sectoral data covering different minimum wage systems (Eyraud and Saget, 2005; Funk and Lesch, 2005; Boeri, 2012; Grimshaw and Bosch, 2013); second, we test whether statutory minima tend to have a broader coverage than collectively bargained minima - an intuitive hypothesis based on the observation that the collective bargaining typically does not cover all workers in the sector and that non-compliance might have a lower incidence if it is enforced by law; third, by comparing the bite of minimum wages in different systems, we are able to test if high collective bargaining coverage and a national statutory minimum can be considered at a certain level as “functional equivalents” (Schulten, 2012). While all three hypotheses are highly relevant for European minimum wage policy, this chapter is the very first to provide empirical evidence on their validity by using a unique dataset which is representative of the institutional diversity of minimum wages in Europe.

The chapter is structured as follows. In the following section we discuss the concept and measurement of minimum wage “bite”. Section 3.4 discusses the empirical strategy and the results. Section 3.5 concludes.

3.2 The minimum wage *bite*

3.2.1 The Kaitz index

When scholars or practitioners evaluate the impact of a given wage floor, they frequently refer to this impact as the “bite” of a minimum wage. This notion is often measured in terms of the “Kaitz index” (Kaitz, 1970). A direct comparison of absolute levels of minimum wages is not meaningful if countries differ in terms of labour productivity, prices or wage levels. The Kaitz index addresses this issue and is defined as the ratio of the minimum wage to the average wage of the working population. The index is thus a measure of the “bite” of the minimum wage: small values indicate that the wage floor is a long way from the centre of the earnings distribution and its impact therefore potentially low; conversely, a high Kaitz index reveals that the minimum wage is close to the centre of the distribution and that it potentially affects a larger number of employees.

Given that this chapter studies the performance of different minimum wage systems, it is crucial that the Kaitz indices are comparable. In order to ensure their comparability, our indices reflect the following methodological choices.

First, our Kaitz indices are based on median wages instead of average wages. The reason for this is that countries with higher wage dispersion also have lower minimum wages (OECD, 1998) and that a Kaitz index based on median earnings is less affected by the shape of the overall wage distribution than an index based on average earnings.

Second, since we analyse the impact of minimum wages at the sectoral level, we calculate Kaitz indices based on the sectoral-level median wage. In the case of countries in which wage floors are determined at the sectoral level, both the numerator and the denominator include sectoral-level information. In particular, the Kaitz indices used in the chapter are defined as the ratio of the (sectoral or national) minimum wage to the median wage of the working population in each of the one-digit sectors of the NACE. While many of the sectoral collective bargaining agreements are signed at subsector level, the one-digit NACE is the most detailed sectoral classification available in the EU-SILC database used in the chapter. Prior to calculating the one-digit Kaitz indices, this limitation constrained us to compute employment-weighted averages of the sub-sectoral minima. While some intra-sectoral variation of minima is lost by averaging within one-digit sectors, computing Kaitz indices for one-digit sectors allows to account for much of the within-country differences between sectors regarding both minimum rates and median wages. In the case of countries in which wage floors are determined at the sectoral level, both the numerator and denominator of the sectoral Kaitz indices include sectoral-level information. In the case of countries with a national statutory wage floor and no sectoral differentiation, only the denominator (i.e. the median wage) varies between sectors. In countries with sectoral minimum rates this can be represented mathematically as follows:

$$KI_{j,c,t} = \frac{MW_{j,c,t}}{\overline{W}_{j,c,t}}$$

and in countries with national statutory minima:

$$KI_{j,c,t} = \frac{MW_{c,t}}{\overline{W}_{j,c,t}}$$

where $KI_{i,c,t}$ is the Kaitz index relative to sector j in country c at year t , $MW_{i,c,t}$ ($MW_{c,t}$ in countries with a national minimum) the corresponding minimum wage and $\overline{W}_{j,c,t}$ the median wage. The Kaitz indices used in the country-level regressions in Chapter 4 are employment-weighted averages of the different Kaitz indices computed at the one-digit NACE level:

$$KI_{c,t} = \sum_{j=1}^N \phi_{j,c,t} KI_{j,c,t}$$

where $\phi_{j,c,t}$ is the share of employment in industry j of country c at year t .

Rather than averaging the sectoral Kaitz indices within each country, an alternative way to think about minimum wages at the country level is to use the lowest sectoral minimum rate in each country in the regression analysis. We therefore included in Chapter 4 a robustness test in which the Kaitz index at the country level corresponds to the ratio between the lowest sectoral minimum wage in country c at year t and the median wage in the corresponding country during the same year:

$$KI_{c,t} = \frac{\text{Min}(MW_{j,c,t})}{\overline{W}_{c,t}}$$

Third, we test whether our results are sensitive to the exclusion of young workers, for whom lower minima are defined in some countries.

Fourth, our Kaitz indices use gross earnings, including social benefits and other benefits. This means that our measures yield information on the impact of the relative size of the minimum wage as it is commonly defined (in other words, including benefits) but before taxes. Indeed, the Kaitz index can lead to flawed comparisons if net earnings are used instead of gross earnings: the net index risks capturing cross-country differences as regards the progressivity of tax systems rather than the relative level of the minimum wage as such.

Fifth, Dolado et al. (1996) argue that it is more advisable to analyse changes of minimum wages over time, especially in situations of considerable institutional

diversity between countries. In order to account for differences between national labour markets, our dataset includes not only contains cross-country variability, but also within-country variability (between sectors and across time).

3.2.2 The employment spike

The Kaitz index alone cannot give a complete picture of the minimum wage bite: a relatively high index does not necessarily mean that many workers are actually paid at or above the minimum wage. A second indicator for the minimum wage bite is the employment spike that measures the proportion of jobs that are clustered at the minimum wage (Teulings, 2003). If the wage distribution shows a visible spike at the level of the minimum wage this is interpreted as a strong bite: the wage floor is high enough to have an actual impact on the shape of the wage distribution.

While the employment spike can be theoretically defined as the proportion of jobs paid exactly at the minimum wage, the measure has to be slightly modified when working with survey data. In this chapter we work with data on monthly earnings and monthly work hours so that the variable hourly wages, which is the ratio of the two, is subject to some noise. It would not be sensible to define the employment spike as the proportion of employees that are exactly paid at the minimum wage. Instead, we have defined the employment spike as the proportion of employees in the close vicinity of the minimum wage, using alternatively an interval of 1 and 5 percent above and below the prevailing wage floor.

3.2.3 The share of individuals below the minimum wage

Even if a relatively high Kaitz index is combined with a visible employment spike at the wage floor does not necessarily mean that the minimum wage bite is always strong: it could still be the case that many workers are actually paid below the minimum wage. There are many factors that could lead to either a substantial fraction of jobs that are not covered by prevailing minimum wage rules or the occurrence of hourly wages that are not compliant with existing legislation or collective agreements. The case study evidence evaluated by Grimshaw et al. (2013) documents the extent of noncompliance in several European low-pay sectors and distinguishes between dif-

ferent forms of noncompliance ranging from *outright noncompliance* and *exploitative wages* to *silent acceptance* of subminimum pay by weak trade unions (Grimshaw et al., 2013; p. 233-234). While it is therefore true that a high Kaitz index and a visible employment spike are like sharp teeth indicating a strong “bite” of the minimum wage, one also has to check whether the mouth of minimum wage rules is not empty due to issues such as noncompliance and/or noncoverage.

A complementary heuristic for the analysis of the minimum wage bite is therefore the distribution of workers with respect to the minimum wage. In this chapter, we use the proportion of jobs below the minimum wage as a third indicator: the more workers are paid below the existing wage floor in each sector, the lower the bite of the minimum wage. In systems with national statutory minima this share can be interpreted as a measure of noncompliance, whereas for collectively bargained minima it represents both noncompliance and/or noncoverage in the sector at hand. Differences between the two systems in the proportion of employees below the prevailing minima can therefore either stem from variations in compliance - for instance if the enforcement and information on applicable rates was higher in the case of national statutory minima - or the fact that collective bargaining almost always leaves some pockets of uncovered workers.

There is little comparative research on the amount of jobs below prevailing minima; in particular, we are not aware of any research that links the incidence of such jobs to the characteristics of minimum wage systems. For the case of German sectoral agreements analysed by Bosch and Weinkopf (2012), the interviewed experts and companies report incidence of non-compliance in all sectors, but the extent of non-compliance has not been quantified. Figures computed by the US Bureau of Labor Statistics, however, give an idea of the size of the underlying phenomenon in the United States: according to statistics on the distribution of workers paid at hourly rates in 2011 (a group that comprises around 75 million individuals), 1.7 million earned exactly the prevailing Federal minimum wage of \$ 7.25 per hour. The number of workers below the minimum wage was 2.2 million. Together, these 3.8 million workers with wages at or below the Federal minimum made up 5.2 percent of all hourly-paid workers (Bureau of Labor Statistics, 2012). While the bite of the US

Fair Labor Standards Act is therefore apparently substantial in light of 1.7 million jobs earning exactly the prevailing minimum wage, the fact that even more workers earn wages below the wage floor qualifies this conclusion.

3.3 Institutional diversity and the minimum wage bite

In this section we discuss how the different institutional features of minimum wage systems described in the previous chapter might be related to the minimum wage bite. The institutionalist literature on minimum wages so far has focused almost exclusively on systems in which wage floors are defined by national statutory minimum wage legislations. The focus of this literature has therefore been to account for different outcomes (such as the relative level of statutory minimum wages) by looking at differences between statutory systems, either across countries or across time. Existing empirical evidence notably suggests that in countries with statutory minimum wages a higher level of collective bargaining coverage is associated with relatively higher levels of minimum wages (Eyraud and Saget, 2005; Funk and Lesch, 2005; Boeri, 2012; Grimshaw and Bosch, 2013). This might be due to the fact that countries with higher collective bargaining coverage tend to have more egalitarian wage structures in which the median lies closer to the minimum wage, leading in turn to a higher Kaitz Index. Another explanation is that a higher level of collective bargaining coverage is associated with stronger trade-union influence on the level of the statutory minimum wage (for example, in negotiations by tripartite commissions).

In this chapter we extend the analysis to countries in which wage floors are determined at the sectoral or occupational level through collective bargaining. In particular, we hypothesise that different types of minimum wage systems are associated with varying degrees of minimum wage bite:

- Weak bite: a minimum wage system that has neither a statutory minimum wage nor sectoral/occupational agreements that cover most of the workforce is likely to be associated with relatively low minimum wages, no visible employment spike and a considerable proportion of jobs paid below prevailing minima.

- Intermediate bite: statutory minimum wages and sectoral agreements with high coverage are sometimes regarded as “functional equivalents” (Schulten, 2012): each of the two features alone is likely to ensure that a substantial share of workers is covered by prevailing minima. Empirical evidence for the equivalence of the two types of minimum wage system is, however, so far not available.
- Strong bite: a combination of a statutory wage floor and wide collective bargaining coverage is likely to be associated with relatively higher minima and fewer uncovered jobs.

Table 3.1: *Hypothesised relationships between institutional features and their bite*

	Low bargaining coverage	High bargaining coverage
	- Low KI	- High KI
	- No employment spike at MW	- Possible employment spike at MW
No statutory MW	- Many workers not covered by MW	- Intermediate coverage of MW
	<i>Hypothesis: weak bite</i>	<i>Hypothesis: intermediate bite</i>
	<i>Example: Cleaning sector in Germany</i>	<i>Example: Manufacturing sector in Sweden</i>
	- Intermediate KI	- High KI
	- Possible employment spike at MW	- Visible employment spike at MW
Statutory MW	- Intermediate coverage of MW	- All workers are covered
	<i>Hypothesis: intermediate bite</i>	<i>Hypothesis: strong bite</i>
	<i>Example: Manufacturing sector in Bulgaria</i>	<i>Example: Construction sector in Belgium</i>

3.4 Empirical analysis

We now turn to the description of our baseline regression models. The dependent variable in our first model is $KI_{j,c,t}$, the Kaitz index in sector j of country c in year t (Equation 3.1); the second model explains the employment spike around the minimum wage in sector j of country c in year t (Equation 3.2); the dependent variable in the

third model is the share of workers earning less than 75 percent of the prevailing wage floor in sector j of country c in year t (Equation 4.3):

$$KI_{j,c,t} = \beta_1 NMW_c + \beta_2 CBC_{j,c,t} + \beta_3 [NMW_c * CBC_{j,c,t}] + \delta_j + \delta_t + X_{j,c,t} \lambda + \epsilon_{j,c,t} \quad (3.1)$$

$$Spike_{j,c,t} = \beta_1^\circ NMW_c + \beta_2^\circ CBC_{j,c,t} + \beta_3^\circ [NMW_c * CBC_{j,c,t}] + \delta_j^\circ + \delta_t^\circ + X_{j,c,t} \lambda^\circ + \epsilon_{j,c,t}^\circ \quad (3.2)$$

$$\%Below_{j,c,t} = \beta_1^* NMW_c + \beta_2^* CBC_{j,c,t} + \beta_3^* [NMW_c * CBC_{j,c,t}] + \delta_j^* + \delta_t^* + X_{j,c,t} \lambda^* + \epsilon_{j,c,t}^* \quad (3.3)$$

The main explanatory variables on which we will focus in the discussion are the two key features of minimum wage systems, namely the existence of a national statutory minimum wage ($NMW_{j,c,t}$) and the degree of collective bargaining coverage at the sectoral level ($CBC_{j,c,t}$).

All three indicators of the minimum wage bite are defined as proportions: the Kaitz index is defined as a percentage of the median wage, the employment spike at and the share of employment below the prevailing minimum wage are defined as shares of the total employment in the sector. Proportions are bounded between 0 and 1 and give rise to specific measurement problems. In this chapter we use OLS but also the method proposed by Papke and Wooldridge (1996) and implement a maximum likelihood estimator with logit link function and a Bernoulli distribution that takes the nature of fractional response variables into account. It should be noted, however, that the Kaitz index is not necessarily bounded below 1 because the minimum wage can exceed the median wage. This is, for instance, the case in several sectors in Italy in which collective bargaining coverage is extremely low and trade unionists are able to negotiate wage floors for unionised workers that are actually above the median wage. As a consequence, we have dropped all values above 1 so that the sample is reduced from 533 to 520 observations when using the Kaitz index as dependent variable (results suggest that the small reduction of the sample used for the estimation of Equation 3.1 does not bias our results).

We are able to control for some of the cross-country differences that are not captured by the distinction between minimum wage systems and the variables $NMW_{j,c,t}$ and $CBC_{j,c,t}$ by including the vector $X_{i,j,t}$. It contains the composition of the labour

force in terms of occupational composition and educational attainment, which is likely to be related to the dependent variables in equations 3.1 to 3.3 and not controlled for in some recent empirical studies due to lack of data (e.g. in the cross-country analysis conducted by Boeri (2012)). More precisely, our regressions control for variations in the respective shares of blue-collar workers, white-collar workers and managers based on ISCO categories and three levels of educational attainment based on ISCED categories (for the definitions see Table 2.3). In light of the fact that many minimum wage earners are women (see Rycx and Kampelmann, 2012), it is also important to account for intra-European variations in the share of women within the labour force, a measure that ranges in our sample from 44 percent in Ireland to 56 percent in Estonia (see Table 2.3). Other compositional factors that vary across countries and for which we control in the regression analysis in the next section are: the share of the public sector employment in the country; the share of fixed-term contracts; the age composition (we distinguish between six age groups: 15 to 24 years; 25 to 29; 30 to 34; 35 to 44; 45 to 59; and above 60 years); and variations in the national share of jobs with less than 35 working hours per week. The models including control variables also contain sector dummies and year dummies in order to capture structural and business cycle effects.

We are aware of the potential endogeneity issue and we will not interpret the results of our estimations as causal. It is not easy to solve this issue since we have no natural experiment in our sample, finding a convincing IV is not trivial and the time span available is very short. However, the fact that no country in our sample has changed its fixing regime over time (Germany will be the first in January 2015) but minimum wage rates, on the other hand, are adjusted typically at yearly frequencies should reduce the distortions associated with the initial choice of the fixing regime. Another estimation issue relates to the potential endogeneity of the collective bargaining coverage. For example, the high proportion of uncovered workers in certain German sectors motivated the German Ministry of Employment to install mandatory extensions of collective bargaining agreements which would therefore increase the CBC variable. However, while such endogeneity cannot be excluded over long periods of time, circumstantial evidence suggests that the CBC can be treated

as exogenous in our sample covering a shorter interval of only three years. In the German case, the occurrence of subminimum employment in several sectors has triggered years of policy discussions and has so far only led to extension policies in a small number of sectors via the *Arbeitnehmer-Entsendegesetz*.

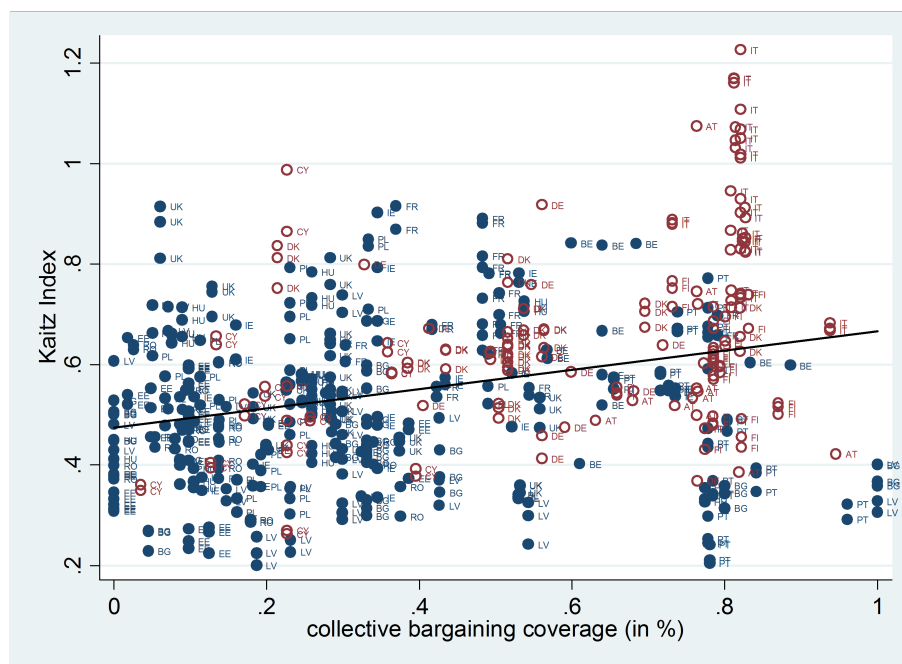
3.4.1 The minimum wage bite I: Kaitz index

Many practitioners would argue that the Kaitz index is likely to be positively correlated with the extent of collective bargaining coverage (see Table 2.3). It should be noted, however, that it is unclear whether collective bargaining coverage affects the numerator or the denominator of the index: on the one hand, higher coverage is likely to be associated with higher bargaining power and more favourable terms in collective agreements defining sectoral bargaining; in some countries with statutory minima wider bargaining coverage might also improve trade union power in the process of setting the national minimum wage. But higher coverage also increases the share of workers falling under collective agreements and therefore leads to a more compressed wage distribution in general.

Another common hypothesis among many trade unionists and scholars is that the Kaitz index tends to be lower in systems with a national statutory minimum wage. The underlying reasoning is that the wage structure in these systems tends to be less compressed compared to systems in which minima are defined in collective bargaining, an argument that is backed up by the empirical literature (Autor et al., 2010; Brown, 1999), but also that the setting of a higher minimum wage itself can contribute to a more compressed wage structure in systems with collective bargaining. In this section we provide empirical evidence allowing to test for the relationships between the Kaitz index, on the one hand, and institutional features (existence of statutory minimum wage and collective bargaining coverage) on the other.

Figure 3.1 suggests a positive relationship between collective bargaining coverage and the sectoral Kaitz index. But the figure also reminds us that the countries without statutory minimum wages (hollow dots on Figure 3.1) have generally higher level of collective bargaining coverage. We used a simple regression framework to isolate the two effects; the dependent variable in this model is the Kaitz index at the

Figure 3.1: *Collective bargaining coverage and average Kaitz indices by industry across countries and years*



Note: Full dots represents sectors in countries with a statutory minimum wage, hollow dots represent sectors in countries without a statutory minimum wage.

sectoral level, the main independent variables are the existence of a national statutory minimum wage and collective bargaining coverage (see Tables 3.2 and 3.3). Regression results indicate that sectoral Kaitz indices are negatively related to the existence a national statutory minimum wage: statistically significant marginal effects are equal to -0.11 in columns 1 and 2. Higher collective bargaining coverage is associated with higher Kaitz indices in column 1 excluding the set of control variables. Column 2, however, includes all control variables and the corresponding marginal effect is positive but not statistically significant.

Columns 1 and 2 do not account for the potential interaction between a national statutory minimum wage and collective bargaining coverage. Columns 3 and 4 address this issue by including a corresponding interaction variable (the Chi-squared statistic (Wald test) suggests that column 4 improves the estimation of column 3; a formal test comparing the coefficients of determination of OLS estimates suggests that this improvement is statistically significant).

Changes in marginal effects, when moving from columns 1-2 to columns 3-4, are

Table 3.2: *Sector-level regressions with Kaitz index as dependent variable, OLS results.*

	(1) Kaitz	(2) Kaitz	(3) Kaitz	(4) Kaitz
National minimum wage (NMW)	-0.13*** (0.02)	-0.12*** (0.01)	0.03 (0.04)	0.04 (0.03)
Collective bargaining cov. (CBC)	0.09*** (0.03)	0.03 (0.02)	0.31*** (0.06)	0.23*** (0.04)
Interaction NMW*CBC			-0.30*** (0.07)	-0.30*** (0.05)
Control variables:				
Sex ratio	No	Yes	No	Yes
Part-time ratio	No	Yes	No	Yes
% public employment	No	Yes	No	Yes
Age composition	No	Yes	No	Yes
Educational composition	No	Yes	No	Yes
Occupational composition	No	Yes	No	Yes
Sector dummies	No	Yes	No	Yes
Year dummies	No	Yes	No	Yes
Constant	0.61*** (0.02)	0.43*** (0.15)	0.47*** (0.04)	0.32** (0.14)
Adj. R-squared	0.18	0.65	0.21	0.67
Observations	533	533	533	533
F	52.58	44.32	37.61	50.14
p	0.00	0.00	0.00	0.00

Table 3.3: *Sector-level regressions with Kaitz index as dependent variable, Fractional logit results (marginal effects).*

	(1) Kaitz	(2) Kaitz	(3) Kaitz	(4) Kaitz
National minimum wage (NMW)	-0.11*** (0.02)	-0.11*** (0.01)	-0.01 (0.04)	0.01 (0.03)
Collective bargaining cov. (CBC)	0.06* (0.03)	0.03 (0.03)	0.20*** (0.06)	0.18*** (0.04)
Interaction NMW*CBC			-0.19*** (0.07)	-0.23*** (0.05)
Control variables:				
Sex ratio	No	Yes	No	Yes
Part-time ratio	No	Yes	No	Yes
% public employment	No	Yes	No	Yes
Age composition	No	Yes	No	Yes
Educational composition	No	Yes	No	Yes
Occupational composition	No	Yes	No	Yes
Sector dummies	No	Yes	No	Yes
Year dummies	No	Yes	No	Yes
Observations	520	520	520	520
Log pseudo-likelihood	-243.1	-228.7	-242.7	-228.3
χ^2 statistic (joint significance)	84.2	937.1	90.3	1013.7
p-value (χ^2 statistic)	0.00	0.00	0.00	0.00

quite intuitive: first, the dummy variable for the national statutory minimum wage becomes insignificant and the negative effect of the national minimum wage is captured by a large and significantly negative marginal effect associated to the interaction variable; second, the marginal effect measuring the impact of collective bargaining coverage is now significant and much higher than in columns 1 and 2. We interpret these results as indicators for: (a) a much stronger link between collective bargaining coverage and the sectoral Kaitz index in systems without a national statutory minimum wage, and (b) for the claim that at equal levels of collective bargaining coverage, systems with national statutory minima are associated with lower Kaitz indices (e.g. in the case of a coverage rate of 50 percent, column 3 suggests that the difference is equal to $-0.105 = -0.01 - 0.19 \cdot 0.5$).

The negative relationship between higher levels of collective bargaining coverage and sectoral Kaitz indices in systems with statutory minima, suggested by column 4, can be interpreted in terms of union behaviour: once a statutory wage floor is established, unions appear to bargain for wages above the minimum. If successful, this strategy could create a kind of “ripple effect” in which statutory floors are related to higher wages in the upper parts of the wage structure, leading in turn to a relative decrease of the minimum wage with respect to the median wage (i.e. a reduction of the Kaitz index).

3.4.2 The minimum wage bite II: employment spike

A higher Kaitz index is often interpreted as indicating that the underlying minimum wage has a higher bite. The information on the relative size of the minimum wage should, however, be compared with information on the employment spike at the minimum wage. The higher this share, the deeper the minimum wage bites into the wage distribution.

We define the employment spike as the proportion of employment clustered within an interval of ± 5 percent around the minimum wage. In our sample, average sectoral spikes lie between 4.2 and 4.5 percent in systems without statutory minima and between 3.0 and 4.1 percent in systems with statutory wage floors.

The regression results are presented in Tables 3.4 and 3.5. The relationship be-

Table 3.4: *Sector-level regressions with the employment spike (i.e. the share of workers receiving wages in the interval of +/- 5 percent around the minimum wage) as dependent variable, OLS results.*

	(1)	(2)	(3)	(4)
NMW	-0.01*	-0.00	0.03***	0.03***
	(0.00)	(0.00)	(0.01)	(0.01)
CBC	0.00	-0.00	0.06***	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)
NMW*CBC			-0.07***	-0.06***
			(0.01)	(0.01)
Constant	0.04***	-0.06	0.01	-0.09**
	(0.00)	(0.04)	(0.01)	(0.04)
Control variables:				
Sex ratio	no	yes	no	yes
Part-time ratio	no	yes	no	yes
% public employment	no	yes	no	yes
Age composition	no	yes	no	yes
Education	no	yes	no	yes
occupation	no	yes	no	yes
Sector dummies	no	yes	no	yes
years dummies	no	yes	no	yes
Observations	533	533	533	533
Adj. R-squared	0.01	0.36	0.06	0.39
F	2.71	12.39	12.31	13.89
p-value	0.07	0.00	0.00	0.00

Table 3.5: *Sector-level regressions with the employment spike (i.e. the share of workers receiving wages in the interval of +/- 5 percent around the minimum wage) as dependent variable, Fractional logit results (marginal effects).*

	(1)	(2)	(3)	(4)
NMW	-0.01*	-0.00	0.03***	0.02***
	(0.08)	(0.08)	(0.23)	(0.25)
CBC	0.00	0.00	0.06***	0.04***
	(0.14)	(0.19)	(0.31)	(0.35)
NMW*CBC			-0.07***	-0.05***
			(0.35)	(0.40)
Control variables:				
Sex ratio	no	yes	no	yes
Part-time ratio	no	yes	no	yes
% public employment	no	yes	no	yes
Age composition	no	yes	no	yes
Education	no	yes	no	yes
occupation	no	yes	no	yes
Sector dummies	no	yes	no	yes
years dummies	no	yes	no	yes
Observations	533	533	533	533
Pseudo-likelihood	-68.98951	-65.89214	-68.55963	-65.68775
χ^2 (joint sign.)	5.76	406.76	37.41	462.54
p-value (χ^2)	0.06	0.00	0.00	0.00

tween the collective bargaining coverage and the employment spike seems to be very small, if existent at all. In columns (1) and (2) the presence of a statutory minimum wage and the collective bargaining coverage have no significant effect. When we add the interaction effect between the presence of a statutory wage floor and collective bargaining coverage in columns (3) and (4) we find a positive but quite small effect of a statutory minimum wage on the share of people paid at the minimum wage. Statutory minimum wages, as was somehow already clear in the descriptive charts in Chapter 2, provide a more common wage floor than wages fixed at sectoral level. In those countries without a statutory minimum wage, a higher collective bargaining coverage correlates with higher share of workers paid at the minimum wage.

3.4.3 The minimum wage bite III: share of subminimum workers

Even if many workers are clustered around the minimum wage, the bite of the latter would have to be relativised if a substantial number of employees actually earns wages below prevailing wage floors. Indeed, the higher this share, the lower is the effective bite of the minimum wage.

Regression results in Tables 3.6 and 3.7 show estimations for models with the share of individuals earning less than 75 percent of prevailing minima as dependent variable.

Overall, our preferred specification is column 4 which also accounts for the potential interaction effect between the presence of a national statutory minimum wage (NMW) and the degree of collective bargaining coverage at the sectoral level (CBC). Due to the presence of an interaction, the interpretation of the explanatory variables is not straightforward; in order to clarify our results, we will discuss each of the main variables in turn.

As for the existence of a national statutory minimum wage (NMW), the net effect on the share of below-minima earners is negative in all models. Models in columns 1 and 2 suggest that this share is around 4-5 percentage points lower in countries with statutory minimum wages. In columns 4 and 5 the marginal effect of NMW is captured by the interaction with CBC.

Table 3.6: *Sector-level regression with share of workers below minimum wage as dependent variable, OLS results.*

	(1)	(2)	(3)	(4)
NMW	-0.05*** (0.01)	-0.05*** (0.01)	-0.01 (0.02)	-0.00 (0.02)
CBC	0.03*** (0.01)	0.00 (0.01)	0.09** (0.03)	0.06** (0.03)
NMW*CBC			-0.08** (0.04)	-0.09*** (0.03)
Constant	0.07*** (0.01)	0.04 (0.08)	0.03 (0.02)	0.01 (0.08)
Control variables:				
Sex ratio	no	yes	no	yes
Part-time ratio	no	yes	no	yes
% public employment	no	yes	no	yes
Age composition	no	yes	no	yes
Education	no	yes	no	yes
Occupation	no	yes	no	yes
Sector dummies	no	yes	no	yes
Years dummies	no	yes	no	yes
Observations	533	533	533	533
Adj. R-squared	0.18	0.48	0.19	0.50
F	34.17	11.83	23.37	12.16
p-value	0.00	0.00	0.00	0.00

Table 3.7: *Sector-level regressions with the share of workers earning less than 75 percent of prevailing minimum wages as dependent variable, Fractional logit results (marginal effects).*

	(1)	(2)	(3)	(4)
NMW	-0.05*** (0.13)	-0.04*** (0.13)	-0.02 (0.39)	-0.02* (0.29)
CBC	0.03*** (0.24)	0.00 (0.25)	0.05** (0.54)	0.02 (0.40)
NMW*CBC			-0.03 (0.57)	-0.03** (0.42)
Control variables:				
Sex ratio	no	yes	no	yes
Part-time ratio	no	yes	no	yes
% public employment	no	yes	no	yes
Age composition	no	yes	no	yes
Education	no	yes	no	yes
Occupation	no	yes	no	yes
Sector dummies	no	yes	no	yes
Years dummies	no	yes	no	yes
Observations	533	533	533	533
Pseudo-likelihood	-76.67212	-68.80594	-76.54615	-68.73376
χ^2 (joint sign.)	122.24	1018.86	133.19	1089.05
p-value (χ^2)	0.00	0.00	0.00	0.00

In column 4 of Table 3.6, the marginal effect for the interaction between NMW and the collective bargaining coverage equals -0.09. Given that the marginal effect of CBC is 0.06, this means that the level of collective bargaining coverage has only a small influence on the proportion of below-minimum earners in systems without statutory national minimum (the null hypothesis that the sum of the regression coefficients associated to CBC and the interaction between CBC and NMW is equal to zero can actually not be rejected at the 10 percent significance level).

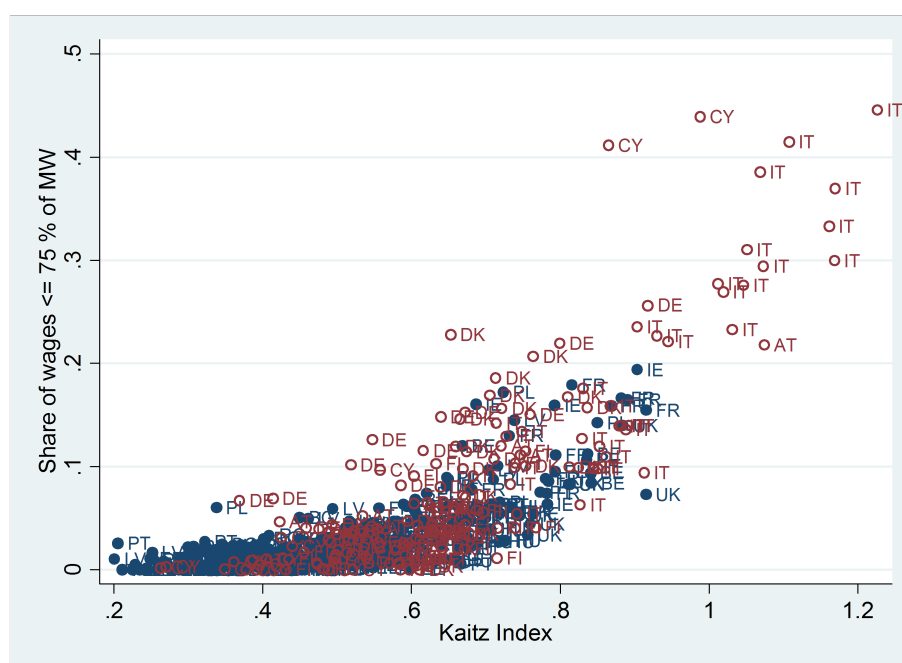
Looking at the net effect of all three variables containing the NMW dummy, our preferred specification confirms that the share of individuals earning wages below prevailing minima tends to be lower in countries with statutory minima. If we suppose, for example, collective bargaining coverage of 70 percent, the marginal effect on the proportion of subminimum workers would be $(0.06 - 0.09) * 0.7 = -0.021$; the corresponding proportion in a system without national wage floor would be $0.06 * 0.7 = 0.042$. We therefore estimate that in this case subminimum employment is around 6 percentage points higher in systems without a national minimum wage (one could repeat this numerical example with other sensible rates of collective bargaining coverage).

A corollary conclusion that can be drawn from Table 3.7 is that collective bargaining coverage (CBC) is up to a certain point a “functional equivalent” to NMW in that it decreases the proportion of individuals below prevailing minima but never as much as the presence of statutory minimum wage. As mentioned above, this effect of CBC is only observed in systems without a national statutory minimum wage, which is quite intuitive.

Finally, how is this third indicator of the minimum wage bite related to the Kaitz index? Figure 3.2 plots the shares of employees with wages below 75 percent of the corresponding minimum wage against the Kaitz index in each sector. We observe a positive relationship between the two variables. This suggests that a higher relative level of the minimum - an outcome typically favoured by trade unions - might have a downside if it is systematically associated with a higher share of individuals who are paid below the minimum wage. Moreover, Figure 3.2 indicates that the incidence of below-minimum wages is higher in countries without national minima (hollow

dots on Figure 3.2) - again an expected result. Surprisingly, the trade-off between a higher relative minimum wage and higher effective coverage is hardly ever discussed by either practitioners or scholars, arguably because data on this phenomenon were so far not available. We believe that this is a serious shortcoming and could lead to flawed policies: indeed, the graphical relationship in Figure 3.2 suggests a substantial trade-off.

Figure 3.2: *Sector-level shares of workers earning less than 75 percent of prevailing minimum wages and sector-level Kaitz indices*



Note: Full dots represents sectors in countries with a statutory minimum wage, hollow dots represent sectors in countries without a statutory minimum wage.

3.4.4 Robustness tests

We have run a large number of robustness tests and alternative specifications. None of these tests modifies substantially the estimation results presented above. In this section we focus on what are arguably the most relevant robustness tests and examine whether our conclusions are modified: if regressions are estimated without countries with outlying values or systems; if we use alternative thresholds to measure the employment spike and subminimum employment; once apprentices and very young workers are excluded from the sample; and, finally, if we use alternative data

on collective bargaining coverage. The estimation results presented in the preceding section are fairly insensitive to all four tests.

Exclusion of outlying observations

Some of the sectors in our sample display levels of the Kaitz index that exceed 90 percent. This is notably the case of single sectors in Austria, Cyprus, France, Germany and the UK and for several Italian sectors. Given that the average Kaitz index in our sample is 55 percent, we have tested whether our estimations are sensitive to the exclusion of these outliers (columns 2 and 7 in Tables 3.8 and 3.9 and column 2 in Table 3.12 and 3.13). The results of this test show that the estimates are broadly confirmed if we eliminate Kaitz indices above 90 percent from the sample (only OLS results in Table 3.12 lose significance).

A second set of outlying observations concerns the case of Belgium. The specificity of this country's minimum wage system is that it combines a national statutory minimum with high levels of collective bargaining coverage and binding wage floors defined in sectoral agreements. While the French system also combines a national minimum with sectoral bargaining, collective agreements in France often fail to increase the minima above the national level - indeed, many collective agreements include wage floors below the SMIC that are therefore not relevant minima (Gautié, 2010). The interpretation of the Belgian figures on sectoral minima is therefore slightly different compared to other countries in our sample, a difference that makes it worthwhile to test whether our conclusions change if Belgium is dropped from the sample. The results of this test correspond to columns 3 and 8 in Tables 3.8 and 3.9 and column 3 in Table 3.12 and 3.13. As can be seen, the estimated point estimates are clearly not sensitive to the exclusion of Belgium as none of them deviates substantially from the values in the baseline model.

More in general, given the relatively limited sample size, one could fear that results could be driven by a single country. Estimated coefficients resulting from the elimination of countries one-by-one from the sample are strongly robust.

Table 3.8: *Kaitz index. Robustness tests, OLS.*

	(1) Baseline	(2) Excl. Kaitz > 0.9	(3) Excl. Belgium	(4) Excl. <18 years	(5) CBC from ICTWSS	(6) Baseline	(7) Excl. Kaitz > 0.9	(8) Excl. Belgium	(9) Excl. <18 years	(10) CBC from ICTWSS
National minimum wage (NMW)	-0.12*** (0.01)	-0.09*** (0.01)	-0.13*** (0.01)	-0.12*** (0.02)	-0.08*** (0.02)	0.04 (0.03)	0.02 (0.03)	0.03 (0.03)	0.05 (0.03)	-0.16** (0.07)
Collective bargaining cov. (CBC)	0.03 (0.02)	0.03 (0.02)	0.02 (0.02)	0.02 (0.03)	0.15*** (0.03)	0.23*** (0.04)	0.18*** (0.04)	0.22*** (0.04)	0.23*** (0.05)	0.07 (0.09)
Interaction NMW*CBC						-0.30*** (0.05)	-0.22*** (0.05)	-0.31*** (0.05)	-0.31*** (0.05)	0.10 (0.09)
Control variables:										
Sex Ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Part-Time Ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
% Public Employment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age Composition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educational Composition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational Composition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.43*** (0.15)	0.52*** (0.14)	0.46*** (0.16)	0.50** (0.19)	0.35** (0.14)	0.32** (0.14)	0.43*** (0.14)	0.36** (0.15)	0.38** (0.19)	0.45*** (0.16)
Adj. R-squared	0.65	0.61	0.65	0.63	0.67	0.67	0.63	0.68	0.66	0.67
Observations	533	511	520	533	533	533	511	520	533	533
F	44.32	41.84	42.30	39.32	48.99	50.14	43.32	48.26	44.28	49.98
p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: SILC waves 2008-2010; European Company Survey 2009 for collective bargaining coverage at sector level; WSI Mindestlohndatenbank for statutory minimum wages; authors' calculations. Significance levels: * p<0.1, ** p<0.05, ***p<0.01

Table 3.9: *Kaitz index. Robustness tests, fractional logit results (marginal effects).*

	(1) Baseline	(2) Excl. Kaitz > 0.9	(3) Excl. Belgium	(4) Excl. <18 years	(5) CBC from ICTWSS	(6) Baseline	(7) Excl. Kaitz > 0.9	(8) Excl. Belgium	(9) Excl. <18 years	(10) CBC from ICTWSS
National minimum wage (NMW)	-0.11*** (0.01)	-0.10*** (0.01)	-0.12*** (0.01)	-0.10*** (0.01)	-0.06*** (0.02)	0.01 (0.03)	0.02 (0.03)	0.01 (0.03)	0.03 (0.03)	-0.20*** (0.06)
Collective bargaining cov. (CBC)	0.03 (0.03)	0.03 (0.02)	0.02 (0.03)	0.04 (0.03)	0.18*** (0.03)	0.18*** (0.04)	0.19*** (0.04)	0.18*** (0.04)	0.21*** (0.04)	0.03 (0.08)
Interaction NMW*CBC						-0.23*** (0.05)	-0.23*** (0.05)	-0.24*** (0.05)	-0.26*** (0.05)	0.10 (0.09)
Control variables:										
Sex ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Part-time ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
% public employment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age composition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educational composition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational composition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	520	511	507	520	520	520	511	507	520	520
Log pseudo-likelihood	-228.7	-225.6	-223.1	-229.3	-227.9	-228.3	-225.2	-222.6	-228.7	-227.8
χ^2 statistic	937.1	959.2	891.6	858.8	1,115.6	1,013.7	1,002.9	1,021.5	935.0	1,161.1
p-value (χ^2 statistic)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: SILC waves 2008-2010; European Company Survey 2009 for collective bargaining coverage at sector level; WSI Mindestlohndatenbank for statutory minimum wages; authors' calculations. All regressions include NACE 1-digit sectors from 17 European countries. Heteroscedasticity and autocorrelation consistent standard errors are reported between parentheses. Significance levels: * p<0.1, ** p<0.05, ***p<0.01

Alternative thresholds for employment spike and proportion of sub-minimum workers

The second robustness test reported here is concerned with the validity of our additional indicators for the minimum wage bite, namely the employment spike and the share of subminimum workers. To the extent that both income variables and the hours measure are prone to measurement errors, it might be worthwhile to assess whether our results are sensitive to alternative definitions of these indicators.

To address this issue, we have experimented with alternative thresholds for both indicators. For the case of the proportion of subminimum workers, our baseline threshold of 75 percent allows for an error margin of 25 percent in wage of working hours recording (or, in the extreme case, to an overestimation of hours worked by 11% and an underestimation of hourly wage by 11%) before workers are falsely counted as being not covered and/or not compliant with existing minima. An alternative threshold of 85 percent below the prevailing sectoral minima allows for a smaller error margin of only 15 percent (column 6 in Tables 3.12 and 3.13). The estimated marginal effects of this robustness test do not differ much from our baseline model. To assess the robustness of our definition of the employment spike, we have re-estimated our baseline regressions (using an interval of ± 5 percent around the minimum wage) with a smaller interval of ± 1 percent around the minimum wage (columns 2 and 4 in Table 3.13). The results confirm the small positive marginal effect of NMW on the employment spike.

Impact of young workers and apprentices

Many countries and sectors differentiate applicable minima according to the employment status and age of individuals. Due to the practical difficulty of identifying reduced rates for apprentices and young workers in all country- and sectoral-level minima included in our database, we have not been able to collect all prevailing sub-rates so that our results might be biased if the incidence of differentiated rates is high or extremely heterogeneous across minimum wage systems; Kaitz indices might be overestimated if reduced rates apply for a substantial part of the labour force.

In order to examine the scope of this issue, we have rerun all regressions after excluding apprentices and workers younger than 18 years from the SILC. While this

Table 3.10: *MW Spike. Alternative bandwidth, OLS results.*

	(1) $\pm 5\%$	(2) $\pm 1\%$	(3) $\pm 5\%$	(4) $\pm 1\%$
NMW	-0.00 (0.00)	0.00** (0.00)	0.03*** (0.01)	0.01*** (0.00)
CBC	-0.00 (0.01)	0.00 (0.00)	0.04*** (0.01)	0.01** (0.00)
NMW*CBC			-0.06*** (0.01)	-0.01** (0.00)
Control variables:				
Sex ratio	yes	yes	yes	yes
Part-time ratio	yes	yes	yes	yes
% public employment	yes	yes	yes	yes
Age composition	yes	yes	yes	yes
Education	yes	yes	yes	yes
occupation	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes
years dummies	yes	yes	yes	yes
Constant	-0.06 (0.04)	-0.03 (0.02)	-0.09** (0.04)	-0.03* (0.02)
Observations	533	533	533	533
Adj. R-squared	0.36	0.16	0.39	0.17
F	12.39	6.02	13.89	6.36
p-value	0.00	0.00	0.00	0.00

Table 3.11: *MW Spike. Alternative bandwidth, GLM results.*

	(1) ± 5%	(2) ± 1%	(3) ± 5%	(4) ± 1%
NMW	-0.00 (0.08)	0.33** (0.14)	0.02*** (0.25)	1.14** (0.45)
CBC	0.00 (0.19)	0.18 (0.29)	0.04*** (0.35)	1.20** (0.61)
NMW*CBC			-0.05*** (0.40)	-1.37** (0.69)
Control variables:				
Sex ratio	yes	yes	yes	yes
Part-time ratio	yes	yes	yes	yes
% public employment	yes	yes	yes	yes
Age composition	yes	yes	yes	yes
Education	yes	yes	yes	yes
occupation	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes
years dummies	yes	yes	yes	yes
Observations	533	534	535	536
Log pseudo-likelihood	-65.89214	-22.77338	-65.68775	-22.7429
χ^2 stat.	406.76	148.24	462.54	170.88
p-value (χ^2)	0.00	0.00	0.00	0.00

procedure does not directly measure the impact of reduced rates on indicators such as the Kaitz index, it has the merit of assessing whether our conclusions regarding the rest of the labour force are robust. The regression outputs of this test correspond to columns 4 and 9 in Tables 3.8 and 3.9 column 4 in Tables 3.12 and 3.13. In light of the stability of all marginal effects we conclude that the existence of sub-minima for young workers and apprentices does not affect our baseline results. The results for the model with the proportion of workers below prevailing minimum are also very similar with this sensitivity test.

Alternative data on collective bargaining coverage

Our data on sectoral collective bargaining coverage stems from the European Company Survey (see Section 2.3.2). An alternative and widely used reference for information on collective bargaining coverage is Jelle Visser's Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS), a standard benchmark in the literature on labour market institutions that in turn compiles information from various international surveys and country-

specific sources (Visser, 2011). The major drawback of the ICTWSS for the question addressed in this chapter is that the database only contains the national collective coverage; in contrast to the ECS, it does not allow to account for sector-level heterogeneity in coverage. This means that sectoral-level regressions with the ICTWSS collective bargaining information rely on the assumptions that the proportion workers covered only at the sectoral level does not differ systematically across sectors and countries.

Despite this limitation and due to the ICTWSS's status as standard reference, we have used ICTWSS data corresponding to all country-year observations in our sample in order to test the robustness of our results. A comparison of the collective bargaining coverage in the ICTWSS and the ECS shows that the two are strongly correlated: the highly significant correlation coefficient between the two coverage variables equals 0.60 and means that the ECS variable is on average lower than the ICTWSS. This is not surprising given that the latter contains also bargaining coverage at the company level whereas we defined our ECS variable as including only higher levels of bargaining.

In the specification without interaction variable (column 5 in Tables 3.8 and 3.9), the marginal effect for the existence of a national statutory minimum wages is smaller when based on the ICTWSS data compared to the baseline model, whereas the size of the marginal effect for collective bargaining coverage is higher and statistically significant. By contrast, in the specifications with interaction variables (column 10), the marginal effect for the national minimum wage is larger and significantly negative with the ICTWSS whereas the interaction and the collective bargaining variable are not significantly different from zero in column 10.

Tables 3.12 and 3.13 show the robustness tests for the specifications with the share of workers below the minimum wage as dependent variable; column 5 corresponds to the regression based on the ICTWSS data for (national) collective bargaining coverage. While in this case the negative effect of NMW is evident in the main effect and not in the interaction, the magnitude of the total effect using OLS is the same as in the specification with sectoral ECS data (a bit higher, 0.14 vs 0.11, using GLM).

We have also tried to estimate the same regressions in Table 3.13 using “union

Table 3.12: % workers below MW. Robustness tests, OLS results.

	(1) Baseline	(2) Excl. Kaitz > 0.9	(3) Excl. Belgium	(4) Excl. <18 years	(5) CBC from ICTWSS	(6) Workers <85% MW
NMW	-0.00 (0.02)	-0.02 (0.01)	-0.00 (0.02)	-0.01 (0.02)	-0.11*** (0.04)	0.01 (0.02)
CBC	0.06** (0.03)	0.02 (0.02)	0.06** (0.03)	0.06** (0.03)	-0.06 (0.04)	0.10*** (0.03)
NMW*CBC	-0.09*** (0.03)	-0.02 (0.02)	-0.10*** (0.03)	-0.11*** (0.03)	0.07 (0.05)	-0.14*** (0.03)
Controls:						
Sex Ratio	Yes	Yes	Yes	Yes	Yes	Yes
Part-Time Ratio	Yes	Yes	Yes	Yes	Yes	Yes
% public empl.	Yes	Yes	Yes	Yes	Yes	Yes
Age	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.01 (0.08)	0.16** (0.06)	0.01 (0.08)	0.02 (0.08)	0.11 (0.08)	-0.01 (0.09)
Observations	533	511	520	533	533	533
Adj. R-squared	0.50	0.43	0.50	0.48	0.49	0.54
F	12.16	11.66	11.69	11.96	11.97	14.10
p-value	0.00	0.00	0.00	0.01	0.00	0.00

Table 3.13: % workers below MW. Robustness tests, fractional logit results.

	(1) Baseline	(2) Excl. Kaiz > 0.9	(3) Excl. Belgium	(4) Excl. <18 years	(5) CBC from ICTWSS	(6) Workers <85% MW
NMW	-0.02* (0.29)	-0.02* (0.27)	-0.02* (0.27)	-0.02* (0.27)	-0.16*** (0.52)	-0.01 (0.27)
CBC	0.02 (0.40)	0.02 (0.36)	0.02 (0.36)	0.03 (0.36)	-0.05*** (0.60)	0.04** (0.36)
NMW*CBC	-0.03** (0.42)	-0.01 (0.39)	-0.01 (0.39)	-0.02 (0.39)	0.07*** (0.66)	-0.06*** (0.41)
Controls:						
Sex ratio	Yes	Yes	Yes	Yes	Yes	Yes
Part-time ratio	Yes	Yes	Yes	Yes	Yes	Yes
% public empl.	Yes	Yes	Yes	Yes	Yes	Yes
Age	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	533	511	520	532	533	533
Pseudo-likelihood	-68.73376	-59.23	-59.23	-68.48	-68.49	-85.97
χ^2 stat.	1089.05	576.3755	576.3755	1039.248	1039.249	1255.298
p-value (χ^2)	0.00	0.00	0.00	0.01	0.00	0.00

density” (i.e. the number of workers currently enrolled as members of a union as a proportion of all those employees potentially eligible) instead of collective bargaining coverage. Results are different but broadly consistent: we find no significant effect on the Kaitz index, a negative effect on the employment spike around the minimum wage value and a negative one on the share of workers paid below the prevailing minimum wage. However, we firmly believe this is not the good indicator since irrespective of the rate of union density what matters here is the extension *erga omnes* of collective agreements.

To conclude, the regressions based on the ICTWSS data confirm a negative relationship between the existence of a national statutory minimum wage and the Kaitz index and provide additional evidence for the hypothesis that a higher level of collective bargaining coverage is associated with higher Kaitz indices. By contrast, the ICTWSS data fails to capture the interaction between collective bargaining coverage and the national wage floor. The relationships in our baseline specification with the share of workers with subminimum wages are also confirmed by the alternative regression with ICTWSS data. One should, however, bear in mind that the ICTWSS data do not capture inter-sectoral variation, especially the interaction between the national wage floor and sectoral minimum wage coverage are therefore likely to be misrepresented.

3.5 Conclusions

This chapter provides an empirical and theoretical contribution to relatively recent debates on minimum wage policy in Europe (Grimshaw et al., 2014). We add to the theoretical literature in this field by proposing a straightforward typology that distinguishes European minimum wage systems with respect to two key institutional features, namely (i) the existence of a national statutory minimum wage and (ii) the degree of collective bargaining coverage at the sector level. This typology is a useful tool to generate hypotheses about the relationships between different institutional configurations and the “minimum wage bite”. While commonly associated with the size of the minimum wage relative to the median wage, we argue that cross-country

analysis of minimum wage institutions requires that the Kaitz index has to be complemented with two additional heuristics in order to obtain a nuanced picture of the “bite”. We advocate using the employment spike at the minimum wage and the proportion of workers earning wages below the prevailing minima as complementary indicators: having sharp teeth (i.e. a high Kaitz index) is clearly not enough to have a strong “bite” in empty-mouthed system (i.e. few workers actually earn minimum wages and/or many are even paid below).

The empirical contribution of the chapter addresses the almost complete absence of comparative data on sector-level minima. This absence renders the policy discussion in Europe prone to flawed assumptions about the performance of different minimum wage systems. We have overcome this gap through extensive data collection combining micro-data from household and company surveys with institutional information and created a unique database with minimum wages collected from more than 1,100 collective bargaining agreements. By analysing the outcome of key labour market institutions across Europe, the chapter therefore adds to the institutional literature by not only arguing that “institutions matter”: we use comparative sector-level data from a wide range of European countries to show how and which institutions matter.

Several important conclusions emerge from our analysis. First, our regression results provide empirical backing for the standard narrative put forward by trade union representatives according to which (i) relatively higher levels of minimum wages can be obtained by boosting the coverage of collective bargaining and (ii) national statutory minima are associated with relatively lower minimum wages. Moreover, some descriptive evidence suggests a policy trade-off that has so far been almost completely neglected: in our data, higher level of minimum wages correlate with a higher proportion of individuals who actually earn wages below the prevailing minimum - an observation that we attribute to non-compliance in systems with statutory floors and non-compliance and/or non-coverage in systems with sectoral collective bargaining. However the share of people paid below the prevailing minimum wage can be attenuated either by installing a national statutory minimum wage or, more weakly, by higher levels of collective bargaining, a finding that confirms the “functional equiva-

lence” of these institutions (Schulten, 2012). Finally, pulling the evidence for all three indicators of the minimum wage bite together, our analysis can be used to render European policy discussions more intelligible. Recalling the summary table presented in Chapter 2 (see below), most sectors in Scandinavian countries (but also a few highly unionised sectors in Germany), for instance, are situated in the upper-right corner of the table in which the absence of statutory minima is combined with high collective bargaining coverage. Introducing a statutory wage floor in these sectors would probably not improve the minimum wage bite. Unsurprisingly, the Scandinavian trade unions are extremely critical regarding the prospect of a European statutory minimum wage. By contrast, an increasing number of sectors in Germany, but also in Italy and Austria, have lost collective bargaining coverage and moved from the upper right to the upper left corner of the table. Our evidence suggests that a statutory minimum wage is likely to improve the minimum wage bite in these sectors.

Overview of minimum wage systems

	Low bargaining coverage	High bargaining coverage
Sectoral/occupational MW	No protection	Equivalent protection
National statutory MW	Equivalent protection	Dual protection

The data therefore shows that the new minimum wage debate reflects to a large extent institutional diversity, both between and within European countries: depending on the health of collective bargaining, a statutory minimum wage is likely to strengthen the bite in some sectors at the risk of weakening it in others. As is often the case, the policy challenge is to find a compromise between these conflicting interests.

CHAPTER 4

INSTITUTIONAL DIVERSITY AND EARNINGS INEQUALITIES

4.1 Introduction

The chief aim of a minimum wage is to set a floor at the bottom of the wage distribution to protect the most vulnerable workers. Put differently, the primary goal is to curb wage inequalities. Yet, “there is very limited research explicitly focused” on this issue (Grimshaw, 2013: 3). The third chapter of this second part of the thesis dedicated to minimum wages in Europe contributes to a better understanding of how European diversity in terms of minimum wage regulations affects wage inequalities. We explore how far statutory minimum wages and sectorally bargained minima affect wage inequality, and how the two modes of regulating the labour market are interrelated. Given data limitations, the vast majority of empirical studies has overlooked countries where minimum wages are set through collective agreements at sectoral level, so that this chapter is one of the first to link this type of institutional diversity of minimum wage systems to outcomes in terms of inequality. To do so, we use the data on minimum wages and household surveys described in the two previous chapters.

We start our analysis with a brief review of the literature regarding the relation between wage floors and distributive outcomes. Section 4.3 presents the analytical framework. In section 4.4 we present our regression results and robustness tests. Section 4.5 concludes.

4.2 Review of the literature

Minimum wages are typically designed to protect the most vulnerable workers. They can have a role in sustaining income, reducing in-work poverty and curbing wage inequalities. A rise in minimum wages can have conflicting effects on income inequality. On the one hand, some people at the bottom of the distribution receive higher wages; on the other, it can lead to individuals being excluded from employment. Freeman (1996) reviews the distributional consequences of minimum wages and concludes that if not too high, they can improve the well-being of low-wage earners and limit earnings inequality. Butcher et al. (2012) develop a model of wage-posting by employers where the labour supply to an individual employer is not perfectly elastic. Their model predicts that wage inequality will be affected by the minimum wage, as it defines the level of the wage floor and generates spillover effects associated with job losses and “wave effects” on earnings above the prevailing minimum. These spillovers, however, would dissipate as one moves up the wage distribution, since higher up the distribution the minimum wage has little impact.

Empirical results usually show that minimum wages reduce wage inequality (Brown, 1999; Manning, 2003; OECD, 1998; Rubery, 2003). For the USA, Di Nardo et al. (1996) and Lee (1999) find that the fall in the real value of minimum wages explains a big share of the increase of the lower tail wage inequality in the USA during the 1980s, and Autor et al. (2010) confirm the overall conclusion of previous estimates. Keese (1998) and Lucifora et al. (2005) show that minimum wages reduce wage inequalities in Europe. In contrast, the European Commission (2008) analyses the effects of a range of wage-setting variables on wage dispersion in EU countries and finds no significant effect of minimum wages. At the more micro-level, Butcher et al. (2012) estimate a structural model taking both direct and spillover effects into

account, and find that the introduction of the UK National Minimum Wage explains more than 50 per cent of the decline in wage inequality in the bottom half of the wage distribution between 1998 and 2010. Their results also confirm that spillovers are larger in low-wage segments.

This chapter explicitly focuses on the link between different minimum wage systems and distributional outcomes. As already discussed Boeri (2012) is one of the few to compare different institutional settings in 66 countries by looking at the process of determination of statutory minimum wages and its effects on minimum wage levels. He finds that a minimum imposed by legislation without consultation with the social partners is significantly lower than a wage floor set after formal consultations but does not analyse the effect on distributive outcomes. According to the European Commission (2008), EU member states that have not introduced a statutory minimum wage possess particularly strong bargaining institutions and actors; while in countries with statutory minima, strong bargaining institutions would drive up the level of minimum wages.

Previous research has devoted great attention to minimum wages and their effects on earnings inequalities. The current consensus suggests that minimum wages help reduce wage inequalities and, if not too high, improve the well-being of low-paid workers. It should be noted, however, that because of data limitations the vast majority of empirical studies has overlooked countries where minima are set by sectoral collective agreements. The potentially divergent outcomes of different minimum wage systems are thereby largely ignored.

4.3 Analytical framework

In this chapter we are interested in whether the two types of systems described in Chapter 2 and 3 lead to different outcomes in terms of earnings inequalities. As far as we know, this question has not been addressed elsewhere.

Again we distinguish European countries with the help of a typology with two main components. The first is collective bargaining coverage, since this has been shown to influence both the relative level of minimum wages and also earnings in-

equalities. The second is the mechanism of minimum wage setting: whether minimum wages are determined nationally as statutory floors or through collective bargaining at sectoral level is likely to affect earnings inequalities.¹

It should be noted that these two features of minimum wage systems are not entirely independent, and act in a complementary fashion (Grimshaw and Rubery, 2013). Indeed, a range of studies underline that the centralization and coverage of collective bargaining tends to be higher in countries without statutory minima (Schulten et al., 2006; Eldring and Alsos, 2012; OECD, 2012; Vaughan-Whitehead, 2010). One reason is that statutory minima are thought to protect workers against low wages in the absence of effective protection through collective bargaining. In other words, statutory minimum wages can be the consequence of low levels of collective bargaining if policy-makers see them as an instrument to protect otherwise vulnerable workers. This explanation seems to account for minimum wage policies adopted in Central and Eastern Europe, where collective bargaining institutions were so weak during the transition to capitalist labour markets that almost all countries installed statutory wage floors in order to protect workers against excessive wage dumping.

A central objective of minimum wage systems is to reduce wage inequality (Grimshaw and Rubery, 2013). Yet it is not straightforward to define precisely what is meant by “inequality”. Therefore, three complementary aspects are examined in this chapter: overall wage inequality, measured by the Gini index; wage inequality between industries, assessed through a Theil decomposition;² and effective coverage measured by the share of people paid below the minimum wage.

How are the different features of minimum wage systems related to these outcomes? In general, one might expect that more inclusive collective bargaining systems will be associated with lower levels of inequality: the compression of the overall wage structure is thus likely to be related to the share of employment covered by collective agreements. However, if union representatives only address the interests of

¹Like Boeri (2012), we also considered whether the national statutory minimum wage is set through a consultation or bargaining process. Regression results taking this additional information into account do not affect our conclusions.

²The Theil index is widely used to decompose total inequality into within- and between-group inequality. It is based on a formal similarity between distributions of probabilities and wage shares. We computed inter-sectoral Theil inequality as a share of total inequality in each country. This step is necessary given that only relative values of Theil inequality are comparable between countries.

workers covered by collective bargaining and achieve higher wage rates for *insiders* (those covered) at the expense of lower rates for *outsiders*, the overall effect might be higher inequality. In particular, low levels of coverage might encourage union leaders to ignore outsider interests, which could lead to higher levels of wage inequality in the lower tail of the wage distribution. Even relatively stable and effective systems like the Austrian model, where obligatory membership in the *Kammer* system obliges all employers to adhere to collective bargaining agreements, leave more and more groups in the labour force uncovered, in particular new kinds of self-employed individuals (Hermann, 2006). If many workers are not covered, then negotiated minimum wages can increase inequality and strengthen the divide between *insiders* and *outsiders*. It should be noted, however, that the lower wages of *outsiders* are not necessarily a consequence of the bargaining behaviour of insiders, but could also directly reflect the low pay offered by employers.

As regards the mechanism of minimum wage setting, it appears reasonable to assume that inequalities will be smaller in the presence of a national minimum wage than when wage floors are bargained at sectoral level (Grimshaw and Rubery, 2013). Indeed, the former mechanism is more likely to reduce wage dispersion in the lower tail of the distribution provided that non-compliance is limited. This idea is largely supported by the empirical literature on statutory minimum wages (Autor et al., 2010; Brown, 1999; Di Nardo et al., 1996; Lee, 1999).³ Since a national minimum wage is by definition the same for all workers regardless of sector, inter-industry wage inequality is also expected to be lower. This idea is supported by Hermann (2005: 12), who argues that the Austrian system of sectoral agreements leads to considerable inequality between sectors, an outcome that is qualified as a “grave disadvantage of the existing system”. Finally, one might assume that the share of workers paid below prevailing minima will be lower in countries with statutory minimum wages, as wage floors are set by law and information on their levels is probably more easily available to both employers and workers. In addition, it appears reasonable to hypothesize that

³The consequences for lower-tail inequality of the two types of systems can easily be illustrated graphically (see Figures 2.8 and 2.19 in Chapter 2). Comparing the examples of Finland and the United Kingdom in 2009, the lower tail of the Finnish wage distribution displays some dispersion around the vertical lines representing sectoral minimum wages; this contrasts with the clean cut induced by the national minimum wage in the UK’s wage distribution.

higher collective bargaining coverage will lead to fewer workers paid below existing floors, especially in systems where the latter are bargained at sectoral level (Grimshaw et al., 2013).

4.4 Empirical analysis

Using all 44 country-year observations in our sample, Tables 4.1 to 4.3 show results for different variants of the following models:

$$\begin{aligned} Gini_{c,t} = & \alpha + \beta_1 NMW_c + \beta_2 CBC_{c,t} + \beta_3 (NMW_c * CBC_{c,t}) + \beta_5 Kaitz_{c,t} \\ & + \beta_5 (Kaitz_{c,t})^2 + X_{c,t} \delta + \tau_t + \epsilon_{c,t} \end{aligned} \quad (4.1)$$

$$\begin{aligned} Theil_{c,t} = & \alpha^\circ + \beta_1^\circ NMW_c + \beta_2^\circ CBC_{c,t} + \beta_3^\circ (NMW_c * CBC_{c,t}) + \beta_5^\circ Kaitz_{c,t} \\ & + \beta_5^\circ (Kaitz_{c,t})^2 + X_{c,t} \delta^\circ + \tau_t^\circ + \epsilon_{c,t}^\circ \end{aligned} \quad (4.2)$$

$$\begin{aligned} \%Below_{c,t} = & \alpha^* + \beta_1^* NMW_c + \beta_2^* CBC_{c,t} + \beta_3^* (NMW_c * CBC_{c,t}) + \beta_5^* Kaitz_{c,t} \\ & + \beta_5^* (Kaitz_{c,t})^2 + X_{c,t} \delta^* + \tau_t^* + \epsilon_{c,t}^* \end{aligned} \quad (4.3)$$

where the dependent variables denote respectively the Gini index (overall wage inequality), the between-group Theil index (inter-industry wage inequality), and the proportion of people earning less than 75% of the corresponding minimum wage (at the national or NACE one-digit level) in country c at year t . NMW is a dummy variable equal to 1 if the country has a statutory minimum wage and 0 otherwise (no country changed systems during the period under investigation). CBC measures collective bargaining coverage. The interaction between NMW and CBC enables us to test whether, as hypothesized, bargaining coverage has a stronger negative impact on wage inequality in countries with sectoral wage floors. The Kaitz index is defined as the ratio of the minimum wage to the median wage of the working population.⁴ It reflects the “bite” of the minimum wage: small values indicate that the floor is a long

⁴A more detailed description of the computation of Kaitz indices is provided in section 3.2.1.

way from the centre of the earnings distribution and its impact therefore potentially low; conversely, a high Kaitz index reveals that the minimum wage is close to the centre of the distribution and that it potentially affects a larger number of employees. *Ceteris paribus*, we thus expect wage inequality indicators to depend negatively on the Kaitz index. Equation 4.1 also includes the square of the Kaitz index as an additional explanatory variable. This allows us to detect any non-linear relationship between the relative level of the minimum wage and the dependent variables and to increase the precision of our estimates. A quadratic relationship could appear if, for instance, the effect of a change in the minimum wage has a stronger incidence on our inequality measures when the initial minimum rate is further away from the median wage; conversely, the closer the initial minimum wage is to the centre of the wage distribution, the smaller the impact on inequality could become. $X_{c,t}$ is a vector of control variables, comprising time-varying country-specific characteristics. The latter include information (taken from EU-SILC data) on shares of workers by occupation (3 categories), education (3 categories) and sex. τ_t denotes year dummies that control for business cycle effects. $\epsilon_{c,t}$ is the usual error term. The data used are described in Chapter 2.

The results should be interpreted with caution, notably because the lack of variability in institutional variables, the short time span and the relatively small samples. Though, without claiming causality, the results in this chapter contribute to the European minimum wage debate as they provide first empirical evidence regarding the distributive outcomes of different minimum wage systems beyond the traditional division between countries with and without a statutory national minimum wage.

4.4.1 Overall wage inequality

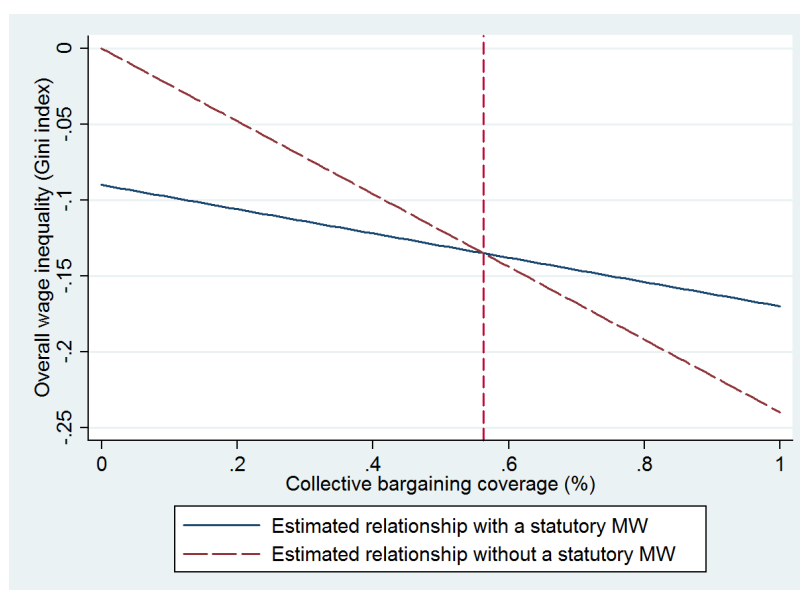
Table 4.1 shows pooled OLS results of the estimation of equation 4.1 with the Gini index (overall wage inequality) as dependent variable. Columns 1 to 5 report regression coefficients for our main variables of interest when moving progressively from a parsimonious to a more complete specification. Standard errors are robust to heteroscedasticity and autocorrelation.

The national minimum wage (NMW) and collective bargaining coverage (CBC)

Table 4.1: *Overall wage inequality (Gini index)*

	(1)	(2)	(3)	(4)	(5)
NMW	0.03** (0.01)	0.03** (0.01)	-0.09** (0.04)	-0.10*** (0.03)	-0.11*** (0.03)
CBC	-0.10*** (0.03)	-0.12*** (0.02)	-0.24*** (0.05)	-0.24*** (0.03)	-0.23*** (0.03)
NMW*CBC			0.16*** (0.05)	0.17*** (0.04)	0.19*** (0.04)
Kaitz index				-0.13*** (0.03)	-0.47** (0.19)
Kaitz index squared					0.26* (0.14)
Sex ratio	No	Yes	Yes	Yes	Yes
Occupational controls	No	Yes	Yes	Yes	Yes
Educational controls	No	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	Yes	Yes
Constant	0.35*** (0.02)	0.18 (0.20)	0.13 (0.17)	0.48** (0.19)	0.52** (0.19)
Adj. R-squared	0.57	0.72	0.76	0.80	0.81
Observations	44	44	44	44	44
F-test	26.43	15.38	16.10	23.71	24.74
p-value	0.00	0.00	0.00	0.00	0.00

Figure 4.1: *Visual representation of the relationship estimated in column 3 of Table 4.1*



variables are systematically significant. The interaction effect between the two, reported in columns 3-5, is also highly significant. In the most complete specifications (the last three models), the coefficient on NMW stands at -0.10, which means that overall wage inequality is approximately 10 percentage points smaller in countries with a statutory minimum wage. Moreover, estimates suggest that the Gini index decreases on average by 2.3 percentage points following a 10 percentage point increase in CBC. However, in countries with statutory minima the impact of CBC on wage inequality is found to be much more limited. Indeed, the interaction effect between CBC and NMW almost entirely offsets the coefficient associated to CBC. According to the results in column 5, a 10 percentage point increase in CBC decreases wage inequality by only 0.4 percentage points in countries with statutory minima. The two systems can be considered as “functional equivalents”: according to our preferred estimation in column 5 of Table 4.1 the “break-even” point (see Figure 4.1) is reached for collective bargaining coverage at 56.25%. Above that value systems with minimum wages fixed at sectoral level reduce more wage inequality than systems with statutory minimum wage. The reverse for countries where CBC is lower than 56.25%.

As expected, we also find that wage inequality is lower where the minimum wage is closer to the centre of the overall wage distribution. Indeed, column 4 indicates that a 10 percentage points increase in the Kaitz index decreases wage inequality on average by 1.3 percentage points. Results in column 5 shows, in addition, that the relationship between these variables is quadratic. Results indeed suggest that overall wage inequality diminishes as the Kaitz index increases but at a decreasing rate. Put differently, the farther the minimum wage is from the median wage, the stronger the (negative) relation between the Kaitz and Gini indices.

4.4.2 Inter-industry wage inequality

Table 4.2 reports pooled OLS estimates of equation 4.2 with the between-group Theil index (inter-industry wage inequality) as dependent variable. In other words, coefficients in Table 4.2 represent the relationship between the main characteristics of minimum wage regimes and inter-industry wage inequality. The regression results suggest that both NMW and CBC are negatively correlated with inter-industry wage

inequality. Regression results in columns 3-5 suggest that inter-industry wage inequality is between 12 and 16 percentage points smaller in countries with a statutory minimum wage, such as the Central and Eastern European countries in our sample. Moreover, estimates show that a 10 percentage points increase in CBC decreases the inequality between sectors by around 2 percentage points. This suggests that minimum wage regimes with high collective bargaining coverage, such as the Scandinavian countries, can curb inter-industry wage inequality through higher collective bargaining coverage but never as much as a statutory minimum wage can do (see Figure 4.2).

What is more, results of column 5 suggest that CBC has little impact on inter-industry wage inequality in countries with statutory minima. For the British minimum wage regime, for instance, this could imply that higher collective bargaining coverage is unlikely to have a significant effect on between-sector inequality. Indeed, the coefficient associated to the interaction variable between NMW and CBC is positive and almost equal (in absolute value) to that on CBC. As regards the Kaitz index, as with the regression results in Table 4.1, it appears to have a negative and convex impact on inter-industry wage dispersion. An increase of the Kaitz index from 0.4 to 0.5, for instance, is found to decrease the Theil index by 2.7 percentage points.

Figure 4.2: *Visual representation of the relationship estimated in column 3 of Table 4.2*

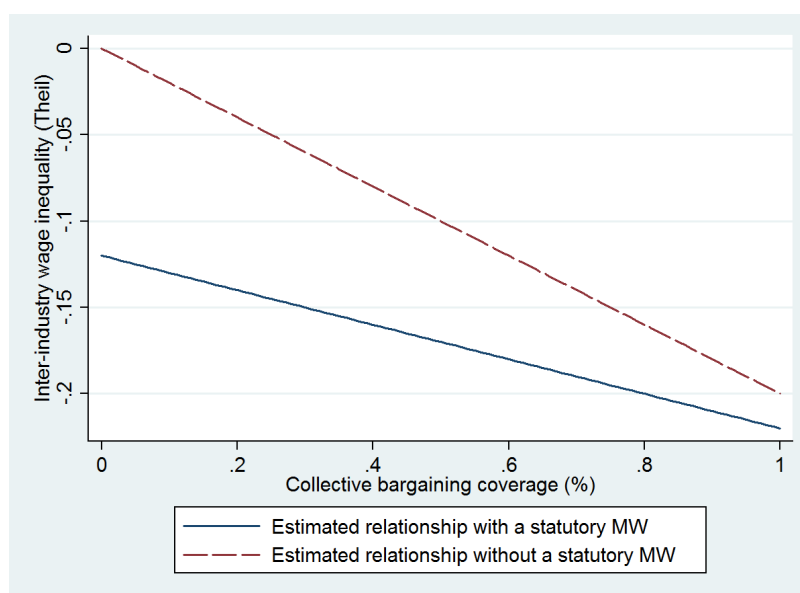


Table 4.2: *Inter-industry wage inequality (Theil decomposition)*

	(1)	(2)	(3)	(4)	(5)
NMW	-0.01 (0.03)	-0.05*** (0.02)	-0.12** (0.06)	-0.12** (0.06)	-0.16*** (0.05)
CBC	-0.01 (0.05)	-0.13*** (0.03)	-0.20*** (0.05)	-0.20*** (0.05)	-0.20*** (0.05)
NMW*CBC			0.10 (0.08)	0.10 (0.08)	0.16** (0.08)
Kaitz index				-0.03 (0.07)	-0.96*** (0.33)
Kaitz index squared					0.71*** (0.25)
Sex ratio	No	Yes	Yes	Yes	Yes
Occupational controls	No	Yes	Yes	Yes	Yes
Educational controls	No	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	Yes	Yes
Constant	0.12*** (0.05)	0.49 (0.32)	0.46 (0.32)	0.56 (0.39)	0.67* (0.37)
Adj. R-squared	-0.05	0.55	0.55	0.54	0.59
Observations	44	44	44	44	44
F-test	0.03	27.94	35.98	34.74	27.07
p-value	0.97	0.00	0.00	0.00	0.00

4.4.3 Share of workers paid below prevailing minima

Table 4.3 shows regression results for equation 4.3, i.e. using as dependent variable the share of workers earning less than 75 percent of the corresponding minima. In other words, the coefficients represent the relationship between the main characteristics of minimum wage regimes and below-minima workers. Findings are in line with those obtained for overall and inter-industry wage inequalities (and they are also consistent with estimates at sectoral level as shown in Section 3.4.3). Indeed, they highlight that the incidence of workers earning less than 75 percent of the minimum wage: is on average between 12 and 15 percentage points smaller in the presence of NMW; diminishes on average by around 1.6 percentage points following a 10 percentage points increase in the CBC of a country with sectoral-level minima; is almost not influenced by CBC in countries with a NMW; and depends negatively (but at a decreasing rate given the significance of the quadratic term) on the level of the Kaitz index, which again suggests that the underlying effect is stronger the further the minimum wage is from the median wage. Also in this case statutory minimum

Table 4.3: *Proportion earning less than 75 percent of the corresponding minimum wage*

	(1)	(2)	(3)	(4)	(5)
NMW	-0.03** (0.01)	-0.02 (0.01)	-0.14*** (0.03)	-0.12*** (0.03)	-0.15*** (0.03)
CBC	0.01 (0.02)	-0.03 (0.03)	-0.15*** (0.04)	-0.16*** (0.04)	-0.16*** (0.04)
NMW*CBC			0.16*** (0.05)	0.15*** (0.04)	0.19*** (0.04)
Kaitz index				0.19*** (0.05)	-0.48*** (0.13)
Kaitz index squared					0.51*** (0.12)
Sex ratio	No	Yes	Yes	Yes	Yes
Occupational controls	No	Yes	Yes	Yes	Yes
Educational controls	No	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	Yes	Yes
Constant	0.05*** (0.02)	0.72*** (0.25)	0.67** (0.25)	0.16 (0.20)	0.24 (0.18)
Adj. R-squared	0.25	0.39	0.46	0.69	0.80
Observations	44	44	44	44	44
F-test	3.93	3.29	8.69	7.26	11.81
p-value	0.03	0.01	0.00	0.00	0.00

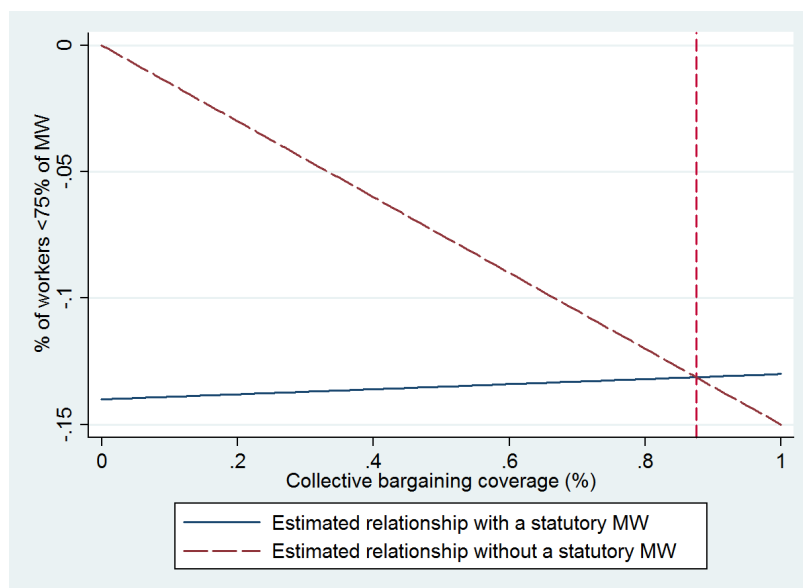
wage and collective bargaining coverage can be considered “functional equivalent”: according to our preferred estimation in column 5 of Table 4.3 the tipping point (see Figure 4.3) is reached for collective bargaining coverage at 87.5%.

4.4.4 Robustness tests

Findings so far suggest that both a statutory national minimum wage and, in countries with sectoral- minima, a higher CBC are significantly associated with lower levels of (overall and inter-industry) wage inequality and a smaller fraction of workers earning less than 75 percent of the prevailing minima. As suggested by Schulten et al. (2006), it thus appears that the combination of sectoral minimum rates and high CBC can be regarded as a “functional equivalent” to a binding national minimum wage, at least for earnings inequalities.

We now focus on what are arguably the most relevant robustness tests and examine whether our conclusions are stable. First, we check the robustness of our

Figure 4.3: Visual representation of the relationship estimated in column 3 of Table 4.3



estimations when regressions are run without countries with outlying values or systems, or when apprentices and very young workers are excluded from the sample. Next, we use an alternative threshold to measure the proportion of individuals paid below prevailing minima.

The Italian case is peculiar because its sectoral Kaitz indices are particularly high and in some cases even higher than 1 (a minimum wage higher than the median), indicating a high incidence of non-compliance or exclusion (20 percent of Italian workers are paid below the rates fixed by sectoral agreements). It therefore appears that the high Kaitz indices we observe for Italy should be interpreted with caution since their effective impact is relatively small compared to all other countries in our sample. In any case, results in columns 3, 7 and 11 of Table 4.4 show that our conclusions are not affected by the exclusion of Italy.

As for Belgium, the specificity of this country's minimum wage system is that it is the only one offering effective dual protection against low wages: it combines a national statutory minimum with high collective bargaining coverage and binding wage floors defined in sectoral agreements. While the French system also combines a national minimum with sectoral bargaining, collective agreements in France often fail to increase the minima above the national level (many collective agreements include

wage floors below the SMIC). The interpretation of the Belgian figures on sectoral minima is therefore slightly different compared to other countries in our sample, a difference that makes it worthwhile to test whether our conclusions change if Belgium is dropped from the sample. Findings in columns 4, 8 and 12 of Table 4.4 show that conclusions are not affected by the exclusion of Belgium.

Many countries and sectors differentiate applicable minima according to the employment status and age of individuals. This is notably the case for apprentices and employees younger than 18, and reflects the opinion shared by many policy-makers and social partners that lower rates for these groups could curb negative employment effects. The practical difficulty of identifying reduced rates for apprentices and young workers in all national and sectoral minima creates a potential bias in our database. In order to examine the scope of this issue, we have rerun all regressions after excluding apprentices and younger workers from the EU-SILC. As shown in columns 2, 6 and 10 of Table 4.4, results are not affected if apprentices and young workers are eliminated from our sample.

We also test the validity of our findings relative to the share of workers paid below the prevailing wage floors. To the extent that both the earnings variable and the hours measure are prone to measurement errors, it might be worthwhile to assess whether our results are sensitive to alternative definitions of this indicator. To address this issue, we have experimented with an alternative threshold, namely the share of workers earning less than 85 percent of the prevailing minima. Again, the estimated coefficients, shown in table 4.5, do not significantly differ from our baseline model.

Finally, we examined the stability of our results to an alternative way of thinking about the country-level Kaitz index in systems with sectorally bargained minimum wages.

Table 4.4: *Robustness tests excluding apprentices and young workers, Italy and Belgium*

	Overall wage inequality (Gini)				Inter-industry wage inequality (Theil)				Share of workers paid less than 75% of MW			
	(1) Baseline	(2) Excl. youth	(3) Excl. IT	(4) Excl. BE	(5) Baseline	(6) Excl. youth	(7) Excl. IT	(8) Excl. BE	(9) Baseline	(10) Excl. youth	(11) Excl. IT	(12) Excl. BE
NMW	-0.11*** (0.03)	-0.11*** (0.03)	-0.13*** (0.03)	-0.11*** (0.03)	-0.16*** (0.05)	-0.16*** (0.05)	-0.19*** (0.05)	-0.15** (0.05)	-0.15*** (0.03)	-0.14*** (0.03)	-0.15*** (0.03)	-0.15*** (0.03)
CBC	-0.23*** (0.03)	-0.24*** (0.03)	-0.23*** (0.03)	-0.23*** (0.03)	-0.20*** (0.05)	-0.20*** (0.05)	-0.19*** (0.06)	-0.18*** (0.05)	-0.16*** (0.04)	-0.15*** (0.04)	-0.16*** (0.04)	-0.16*** (0.03)
NMW*CBC	0.19*** (0.04)	0.19*** (0.04)	0.23*** (0.05)	0.19*** (0.05)	0.16** (0.08)	0.16** (0.07)	0.23*** (0.08)	0.16* (0.08)	0.19*** (0.04)	0.19*** (0.04)	0.19*** (0.04)	0.19*** (0.04)
Kaitz index	-0.47** (0.19)	-0.48** (0.19)	0.55 (0.36)	-0.47** (0.19)	-0.96*** (0.33)	-0.96*** (0.33)	0.73 (0.67)	-0.97*** (0.32)	-0.48*** (0.13)	-0.21 (0.23)	-0.48*** (0.13)	-0.49*** (0.13)
Kaitz index squared	0.26* (0.14)	0.28* (0.14)	-0.79** (0.36)	0.27* (0.14)	0.71*** (0.25)	0.71*** (0.25)	-1.06 (0.66)	0.72*** (0.25)	0.51*** (0.12)	0.24 (0.23)	0.51*** (0.11)	0.53*** (0.11)
Sex ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.52** (0.19)	0.46** (0.2)	0.21 (0.19)	0.52** (0.19)	0.67* (0.37)	0.66* (0.38)	0.18 (0.32)	0.68* (0.38)	0.24 (0.18)	0.15 (0.18)	0.24 (0.19)	0.19 (0.17)
Adj. R-squared	0.81	0.82	0.84	0.81	0.59	0.60	0.64	0.60	0.80	0.58	0.80	0.82
Obs.	44	44	41	43	44	44	41	43	44	44	41	43
F-test	24.74	25.59	23.1	23.5	27.07	28.65	42.04	23.25	11.81	7.46	11.48	13.30

Table 4.5: *Share of workers earning less than 85 percent of the corresponding minimum wage*

	(1)	(2)	(3)	(4)	(5)
NMW	-0.04** (0.02)	-0.02 (0.02)	-0.16*** (0.04)	-0.13*** (0.04)	-0.17*** (0.04)
CBC	0.02 (0.02)	-0.05 (0.04)	-0.18*** (0.05)	-0.19*** (0.05)	-0.19*** (0.05)
NMW*CBC			0.18** (0.07)	0.16*** (0.05)	0.21*** (0.05)
Kaitz index				0.29*** (0.06)	-0.65*** (0.17)
Kaitz index squared					0.72*** (0.15)
Sex ratio	No	Yes	Yes	Yes	Yes
Occupation	No	Yes	Yes	Yes	Yes
Education	No	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	Yes	Yes
Constant	0.07*** (0.02)	1.01*** (0.34)	0.95** (0.35)	0.17 (0.27)	0.29 (0.25)
Adj. R-squared	0.21	0.38	0.42	0.71	0.82
Obs.	44	44	44	44	44
F-test	3.18	2.89	6.78	7.33	14.13
p-value	0.05	0.01	0.00	0.00	0.00

Rather than computing the average Kaitz index across sectors as we do in our benchmark model (a measure that emphasises representativeness), one could also argue that the relevant Kaitz index in these countries corresponds to the ratio between the minimum wage of the sector with the lowest wage floor and the national median wage (a measure that emphasises the lowest minimum wage in the country without taking into account that this rate is not necessarily representative of the entire spectrum of sectoral minima).

Using this alternative index as explanatory variable leaves most of our benchmark results unchanged: not only are the coefficients corresponding to the institutional features of minimum wage regimes (existence of a statutory minimum, collective bargaining coverage, interaction between the two) robust; but also the sign of the coefficients of the benchmark and alternative Kaitz indices are very similar. However, because of higher standard errors the coefficients of the alternative Kaitz index are not always statistically significant (results are provided in Table 4.6).

Table 4.6: *Regression results using an alternative Kaitz index (i.e. the ratio between the lowest sectoral (NACE 1 digit) minimum wage and national median wage)*

[illegible]

4.5 Conclusions

Minimum wages have reappeared on policy agendas across Europe. There are several factors that have contributed to this trend. On the one hand, in the richer EU countries the successive waves of enlargement have led to streams of low-wage immigration which are sometimes perceived as a threat to existing wage differentials. A stricter wage policy at national or European level is seen by many as an attractive instrument to curb the resulting downward pressure on wages. On the other hand, the proportion of workers that are covered by collective agreements is dwindling in most Member States. Advocates of statutory minimum wages see them as an alternative mechanism that could substitute for collective bargaining in protecting workers against low wages.

These developments, among others, have fuelled a debate at European level as to whether it is desirable to implement a harmonized rate in all EU countries. We have argued that this debate lacks so far not only a framework to render the opposing positions between different minimum wage institutions more intelligible, but the debate also lacks crucial empirical evidence as to the labour market outcomes associated with different minimum wage systems.

In this chapter, we have explored the link between different institutional features of minimum wage systems and earnings inequalities across European countries. To do so, we used a combination of harmonized micro-data, data on national statutory minimum wages and coverage rates, and information on minimum rates in sectoral agreements. This effort notably allowed us to assess the distributive outcomes of the minimum wage systems in Austria, Belgium, Cyprus, Denmark, Finland, Germany and Italy, all of which are both absent from other empirical studies and among the main protagonists of the minimum wage debate at European level.

Our results clearly underline the importance of viewing the European debate as a choice between different minimum wage systems rather than a choice of a certain rate to be harmonized across the EU. Crucially, we are able to show empirically what many practitioners long suspected: the combination of sectoral minimum rates and high coverage of collective bargaining can, at least for earnings inequalities, be regarded as a functional equivalent to a statutory minimum wage at national level. Controlling for

Kaitz indices, compositional and year effects, regression results suggest indeed that both a national statutory minimum wage and, in countries with sectoral minima, higher collective bargaining coverage are significantly associated with lower levels of (overall and inter-industry) wage inequalities and a smaller fraction of workers paid below prevailing minima.

If the policy objective at European level is to reduce the types of wage inequalities analysed in this chapter, our results suggest that this goal can be achieved through different minimum wage-setting mechanisms, so that institutional harmonization at European level may not be necessary. A possible way forward in the current European debate is therefore to think about which EU-wide targets for the minimum wage (but potentially also in terms of wage inequality) could be implemented through instruments such as the Open Method of Coordination that apply the principle of subsidiarity and allow for considerable institutional diversity as to how targets can be met.

This said, our results should be interpreted with caution, notably because the lack of variability in institutional variables does not allow us to apply panel data techniques. Nevertheless, they contribute to the European minimum wage debate as they provide first empirical evidence regarding the distributive outcomes of different minimum wage systems beyond the traditional division between countries with and without a statutory national minimum wage.

Part III

Age, Gender and Education Diversity

CHAPTER 5

THE HETEROGENEOUS EFFECTS OF WORKFORCE DIVERSITY IN BELGIUM

This chapter is based on the paper “*The Heterogeneous Effects of Workforce Diversity on Productivity, Wages and Profits*” joint with Stephan Kampelmann and François Rycx and published in *Industrial Relations: A Journal of Economy and Society*, vol. 53(3) (pp. 430-477) in 2014.

5.1 Introduction

Efficient management of human resources (HR) is a key issue for firms’ economic success. It does not only consist in dealing appropriately with single workers’ demands, bureaucratic procedures or institutional settings. Properly managing HR also (and perhaps mostly) implies finding the right workforce mix and to make the most of workers’ skills. A diverse workforce, with respect to education, experience or physical stamina, is often needed due to the variety of tasks that have to be performed within firms. Labour diversity may also benefit firm productivity if it fosters complementarities (e.g. between high- and low-skilled workers), generates spillovers (e.g. knowledge transfers between more and less experienced workers), makes the

workplace more enjoyable (e.g. educational/skills diversity could be appreciated by employees) or stimulates demand (e.g. customers may prefer companies that have a diverse workforce).¹ The downside of diversity, however, is that it may lead to misunderstandings, communication problems, personal conflicts or negative reactions from stakeholders that undermine performance (Akerlof and Kranton, 2000; Becker, 1957; Choi, 2007; Lazear, 1999).

Today's labour force is getting more and more heterogeneous: ageing, migration, women's increased labour participation and technological change are key drivers of this phenomenon (Ilmakunnas and Ilmakunnas, 2011; Kurtulus, 2012; Parrotta et al., 2014a). Moreover, in many countries companies are under legislative pressure to diversify their workforce either through quotas or affirmative action. Workforce diversity has thus become an essential business concern. Firms have to manage diversity both internally (i.e. among management and staff) and externally (i.e. by addressing the needs of diverse customers, suppliers or contractors). As a result, an increasing number of firms employ a "diversity manager" whose task is to ensure that diversity does not hamper productivity but contributes to attaining the firm's objectives. From the workers' point of view, labour diversity may also generate benefits or losses. The latter may be the result of a more (or less) enjoyable working environment, but they may also derive from a higher (or lower) wage. According to competitive labour market theory, workers are paid at their marginal revenue products. Hence, if labour diversity affects productivity, it may also influence workers' earnings.

The empirical evidence regarding the impact of labour diversity on productivity is very inconclusive and studies on wage effects are exceedingly rare (Ilmakunnas and Ilmakunnas, 2011). Moreover, findings must often be interpreted with caution because of methodological and/or data limitations. Only few papers examine how the diversity-productivity nexus is influenced by specific work environments. This is problematic since the optimal degree of diversity is likely to depend on the characteristics of the production unit, for instance the knowledge-intensity and technological

¹In the HR literature, "diversity management" refers to policies and practices that seek to include people within a workforce who are considered to be, in some way, different from those in the prevailing constituency. It usually refers to dimensions such as gender, age, sexual orientation, religion, ethnicity, social origin and physical appearance.

content of production (Arun and Arun, 2012; Parrotta *et al.*, 2014b; Pull *et al.*, 2012) or the size of the firm (Fiegenbaum and Karnani, 1991; Konrad and Linneham, 1995; Levy and Powell, 1998; Rynes and Rosen, 1995; Stahl *et al.*, 2010).

The aim of this chapter is threefold. First, we put the relationship between labour diversity (measured through education, age and gender) and firm productivity to an updated test, using detailed Belgian linked employer-employee panel data for the years 1999-2006. These data offer several advantages. The panel covers a large part of the private sector, provides accurate information on average productivity (i.e. on the average value added per hour worked) and allows to control for a wide range of worker and firm characteristics. It also enables us to compute various diversity indicators and to address important methodological issues such as firm-level invariant heterogeneity and endogeneity (using both the generalized method of moments (GMM) and Levinsohn and Petrin (2003) estimators). A second aim is to examine how the benefits or losses of labour diversity are shared between workers and firms by estimating the impact of diversity on mean hourly wages and productivity-wage gaps (i.e. profits)² at the firm level. Finally, we investigate the link between diversity and productivity in different work environments defined by the technological and knowledge intensity (we use three complementary taxonomies developed by Eurostat (2012) and by O'Mahony and van Ark, 2003) and firm size.

This chapter and the next one will (unfortunately) not cover one important dimension of diversity: ethnicity. This is often the first type of diversity most people would refer to. Data on ethnicity are not available to researchers in Europe because very stringent rules apply. Data on (self-declared) ethnicity are on the opposite available in many surveys in the US (Census, Current Population Survey, etc.). To circumvent this lack of information, European researchers have used the nationality, the first name or the language spoken to infer the ethnic origins. All these data have some shortcomings but at different degrees represent the best proxies available in the EU. Unfortunately none of these proxies is available in the datasets used in this chapter and the following one. However, it is important to clarify that ethnicity is not the only type of diversity to be considered: companies in the EU which have

²By definition, the gap between productivity and wages corresponds to the gross operation surplus (i.e. profits).

signed national “diversity charters”³ usually commit to promote diversity and equal opportunities in terms of ethnic origin but also sexual orientation, gender, education, age, disability and religion. In this chapter we focus on three specific features: age, education and gender.

The remainder of this chapter is organized as follows. A review of the literature is presented in the next section. Sections 5.3 and 5.4 respectively describe our methodology and data set. The impact of workforce diversity on productivity, wages and productivity-wage gaps across work environments is analysed in Section 5.5. The last section discusses the results and concludes.

5.2 Review of the literature

5.2.1 Workforce diversity and firm productivity

There are different economic forces underlying the relationship between workforce diversity and productivity. As highlighted by Alesina and La Ferrara (2005), these forces may derive from: individual preferences (either people may attribute positive (negative) utility to the well-being of members of their own group (of other groups) or they may value diversity as a social good), individual strategies (even when individuals have no taste for or against diversity, it may be more efficient, notably in the presence of market imperfections, to interact preferably with members of one’s own group), or the characteristics of the production function (i.e. the complementarity in individual inputs).

Theoretical predictions regarding the optimal workforce composition are mixed. Lazear (1999) follows the production function approach and develops a theoretical model in which a global (i.e. multinational) firm is presented as a diverse (i.e. multi-cultural) team. He argues that labour diversity is beneficial for firm performance if skills and information sets are group-specific. More precisely, he demonstrates theoretically that the gains from diversity are greatest when three conditions are fulfilled: a) individuals have completely disjoint skills and information sets, b) the

³Diversity charters in the EU have been signed in Austria, Belgium, Germany, Spain, Italy, France, Sweden, Poland, Ireland, Finland and Luxembourg.

latter are all relevant for the tasks that have to be performed within the firm, and c) individuals are able to communicate and understand each other.

The organizational demography literature stresses the importance of social similarity for interaction, communication and cohesion among the workforce (Pfeffer, 1985). For instance, diversity in terms of age, education or gender decreases social similarity and could hamper job satisfaction, communication and firm performance. In contrast, social comparison theory posits that people evaluate and compare their opinions and abilities with those of similar others, like individuals of the same age, education or gender (Festinger, 1954). More precisely, individuals may strive to outperform the members of their comparison group (Pelled et al., 1999), which in turn leads to rivalry and conflicts that could undermine organizational performance (Choi, 2007). But social similarity can also be beneficial: a decision may be of better quality when it is the outcome of a confrontation between competing views (Grund and Westergaard-Nielsen, 2008), and rivalry among similar workers may encourage workers to produce more effort in the context of intra-firm “tournaments” (Lazear and Rosen, 1981).

Productivity effects of workforce diversity are likely to vary across work environments (Stahl et al., 2010). In particular, they may differ with respect to the knowledge intensity and high-tech content of the production. Firms which depend on the exploitation of new opportunities and the development of successful innovations may benefit more from diversity than traditional firms (Prat, 2002). The greater complexity of tasks within innovative sectors is also perceived as a feature likely to foster diversity-related benefits (Jehn, 1995; Stewart, 2006): provided that workforce diversity increases the set of ideas and potential solutions to a given problem, it may stimulate the innovative capacity of firms and hence their productivity (Parrotta et al., 2014b). In addition, the HR literature stresses that firms in innovative sectors may benefit from the promotion of diversity as it potentially broadens the talent pool, widens perspectives and enlarges the customer base (Cox and Blake, 1991; Yang and Konrad, 2011). Finally, Askenazy and Caroli (2010) have shown that ICT makes the workplace safer and less risky, therefore reducing tensions and strains linked to the adoption of innovative workplace practices and thus creating a better work environ-

ment.

Productivity effects of workforce diversity may also vary according to firm size. In general, workers are likely to be relatively more responsive to the dissimilarity of their close co-workers with whom they interact more frequently. As a consequence, the effects of diversity might be more pronounced in smaller firms in which all workers interact with each other more often (Stahl et al. 2010) and work organization is less rigid (Fiegenbaum and Karnani, 1991; Levy and Powell, 1998). In bigger firms, the diversity of the entire labour force is probably less likely to trigger productivity effects than diversity within teams or departments in which people interact more often. In addition to the frequency of interactions, another factor related to firm size is the capacity to manage diversity. Smaller firms may be less efficient regarding diversity management as their HR departments (if existent) may typically screen workers less systematically during the hiring process, allocate workers to less optimal positions, face more difficulties to recruit diverse workers (Carrington et al. 2000; Chay, 1998; Holzer, 1998) and devote less resources to diversity management (Konrad and Linnehan, 1995; Rynes and Rosen, 1995). The possibilities to relocate workers inside the company in case of disputes are also likely to be more limited in smaller organizations.

In what follows we examine more closely a range of specific arguments for why age, educational or gender diversity may impact firm productivity.

Age diversity

Younger workers are thought to learn faster (Skirbekk, 2003) and to have better cognitive and physical abilities (Hoyer and Lincourt, 1998). Conversely, age is positively correlated with job experience and knowledge about intra-firm structures, relevant markets and networks (Czaja and Sharit, 1998; Grund and Westergaard-Nielsen, 2008, Leonard and Levine, 2003). These two sets of skills are complementary in many production processes, so that age diversity may generate productivity gains for firms able to harness various age-specific skills. The impact of age diversity is also sensitive to firms' working environment (Göbel and Zwick, 2012). It has notably been argued that the complementarity between younger and older workers is higher in knowledge-intensive firms (Cataldi et al., 2011).

Whether the net effect on productivity is positive depends on whether the gains of age complementarities outweigh the costs that come with a more diverse workforce. Lazear (1999) and Jehn et al. (1999) argue that the net effect is likely to be negative for demographic diversity, defined as heterogeneity in terms of age, gender or ethnicity: age diversity may notably increase communication costs within the labour force, reduce peer pressure (Lazear, 1999), decrease social ties and lead to more absenteeism and turnover (Ilmakunnas et al., 2010).

Educational diversity

Educational diversity enhances firm productivity if there is sufficient mutual learning and collaboration among workers with different educational backgrounds (Hamilton et al., 2004). The gains associated to educational diversity are typically greater if the skills of different educational groups are both relevant and complementary for the tasks performed within the firm (Lazear, 1999).

The effect of educational diversity may also depend on work environments. Jehn et al. (1999), for instance, argue that group performance is more likely to benefit from educational (i.e. task-related) diversity if: i) the tasks that have to be accomplished within a group are complex rather than routine, and ii) the output is of innovative character. These results suggest that the benefits of diversity are more likely to outweigh the costs in high-tech or knowledge-intensive sectors than in more traditional industries.

Gender diversity

Explanations for a potential relationship between gender diversity and firm productivity notably refer to concepts of group efficacy and identity. Social cognitive theory examines how the efficacy of a group (i.e. “a group’s belief in their conjoint capabilities to organize and execute the courses of action required to produce given levels of attainments” (Bandura, 1997: 477)) affects its performance. Mixed gender groups can foster the impact of group efficacy on performance (Lee and Farh, 2004). The argument is that gender diversity is likely to increase the heterogeneity in the values, beliefs and attitudes of the members of a group, which in turn may stimulate critical thinking and prevent the escalation of commitment, i.e. inflated perception of group efficacy resulting in poor decision making.

Akerlof and Kranton (2000) introduce the concept of identity (i.e. a person's sense of self) into an economic model of behaviour to study how identity influences economic outcomes. Taking gender as an illustration of identity, the authors highlight that social categories such as “men” and “women” are associated to prescribed behaviours and ideal physical characteristics. In the context of work, they argue that a woman doing a “man's job” (e.g. truck driver or carpenter) may deteriorate the self-image of her male co-workers. As a result, women in male-dominated occupations might suffer from a strong hostility and be discriminated against by their male counterparts.⁴ They predict that increasing gender diversity may negatively affect firm performance, especially if men constitute a socially “dominant” group (Haile, 2012). Under the hypothesis that the workforce is less gender-balanced and the environment more “macho” in traditional companies than in high-tech/knowledge intensive firms, above arguments suggest that gender diversity will have a less favorable impact on performance in the former group of companies. This prediction could also be supported by the fact that high-tech/knowledge intensive sectors rely increasingly on inter-personal or “soft” skills (that might be more effectively provided by women) and require generally less physical stamina than traditional (private sector) firms, e.g. construction companies (Arun and Arun, 2002; Webster, 2007).

5.2.2 Previous empirical studies

Harrison and Klein (2007: 1199) emphasized that the empirical evidence regarding the performance effects of workforce diversity is “weak, inconsistent or both”. This statement remains to a large extent valid. Indeed, findings are still quite inconclusive and often difficult to interpret due to methodological and/or data limitations.

The impact of workforce diversity on productivity can be analysed at the aggregate (e.g. firm, plant) or disaggregate (e.g. team, individual) level. Both approaches have their caveats and advantages.

Given that the effects of diversity are ultimately driven by individual behaviour

⁴The same reasoning can of course be applied to men employed in female-dominated occupations, e.g. nurses or primary school teachers. This case is, however, less relevant in our sample given that we work with empirical data covering the private sector and that female-dominated occupations are more frequent in the public sector (see Section 5.4).

and micro-level interactions, disaggregate approaches are in a better position to observe the mechanisms that link labour force diversity to labour productivity. Undoubtedly, micro-level information such as the composition of teams and the interaction patterns of individual employees constitute a precious source of empirical knowledge about diversity. Focusing on the individual or workplace level generally implies working with case studies based on personnel records from single companies or small samples of workers in specific occupations. Despite its high heuristic value, this type of empirical material has generally the disadvantage of limited external validity. Indeed, one of the main limitations of disaggregate studies is that they generally rely on “small samples of workers in narrow occupational fields that often lack a longitudinal component” (Kurtulus, 2011: 685) and that “individual-level productivity measures are available only in very special cases” (Ilmakunnas and Ilmakunnas, 2011: 226). Moreover, the measurement of productivity poses additional conceptual and methodological challenges that can hardly be addressed in disaggregate studies. As noted by Vandenberghe (2011), “productivity is in essence a firm-level phenomenon” in which the contribution of each individual, or even of groups of individuals, can often not be disentangled from the overall process of joint value creation within a firm (Kampelmann and Rycx, 2012). As a consequence, “individual workers’ productivity is hardly ever observed” and “the alignment of productivity and pay at the individual level is hard to assess” (Vandenberghe, 2011). Moreover, in disaggregate studies it is methodologically difficult to account for issues such as the simultaneity of productivity and input variations that have attracted considerable attention in the literature on productivity measurement (Van Beveren, 2010). Despite these limitations, micro-level data have been used - mostly in the HRM literature - to measure the effects of diversity on outcomes such as ratings of group effectiveness, financial indicators, organizational commitment, turnover, creativity and frequency of communication. The implications of these studies are still widely debated (Jackson et al., 2003), but two main views emerge from the HRM literature. A first strand supports the “business case for diversity” (Cox, 1993) according to which diversity pays off and thus represents a compelling interest for employers. Other papers reject this hypothesis and depict diversity as “a process loss” and conclude that diversity leads

to more conflicts, increased absenteeism and turnover (Stahl et al., 2010).

We argue that studies using aggregate data provide a complementary angle on the productivity effects of personnel diversity. The nature of aggregate empirical data tends to confound the underlying individual-level mechanisms, to the point that they can be criticised for hiding behavioural phenomena inside a black box. However, working with firm-level aggregates allows to apprehend diversity at the collective level while resolving numerous issues related to productivity measurements (Vandenberghe, 2011). Firm-level data notably enables us: i) to estimate the relationships between firm-level labour diversity⁵ and statistically reliable measures of plant- or firm-level productivity (e.g. total factor productivity (TFP) or value-added) and ii) the use of large representative datasets. The use of more aggregate data tends to prevail in diversity studies carried out by labor economists, increasingly using linked employer-employee data covering large parts of the economy. While the empirical literature on diversity in labor economics is substantially less voluminous compared to the HRM literature, it has so far also led to mixed conclusions.

In general, the comparison of aggregate and disaggregate approaches in the empirical literature reveals several trade-offs. From an econometric point of view, the measurement of productivity and the external validity of results tend to be more robust in aggregate studies based on firm-level diversity and performance measures. Conversely, disaggregate studies are likely to foster our understanding of the interpersonal mechanisms linking diversity and productivity. Especially in large entities the use of firm-level aggregates can mask intra-firm variations in the way that workers in different units or departments are exposed to diversity. While our study focuses on the advantages of firm-level aggregates, it is therefore important to make use of hypotheses and insights generated by studies conducted at the micro-level and to analyse potential biases inherent to aggregate data (see Section 5.5.3).

In the remainder of this section, we briefly review results from earlier empirical

⁵It can be argued that the performance of a firm-level diversity measure in terms of capturing actual interactions between diverse workers decreases with firm size. While workers in small firms are likely to be exposed to the entire diversity within the establishment, in big firms there may be a difference between overall firm-level diversity and the diversity within the groups in which most of the social interactions occur (e.g. departments or teams). This issue will be explored further in Section 5.5.3.

studies, concentrating on those that: a) use either detailed personnel records from individual companies or large representative linked employer-employee data and, b) address the productivity effects of at least one of the diversity dimensions investigated in this chapter, i.e. education, age and gender.⁶

Evidence based on case studies

A series of papers investigates the diversity-performance nexus using case studies, often based on personnel records from single companies. Hamilton et al. (2004) use weekly data from a Californian garment manufacturing plant for the years 1995-1997. Their results indicate that teams with greater diversity in workers' abilities and composed of only one ethnicity (namely Hispanics) are more productive (i.e. sew more garments per day). In contrast, team heterogeneity in workers' age is found to decrease productivity. Yet, results for team demographics (age and ethnicity) should be considered with caution as they become insignificant when applying fixed effects (FE). Leonard and Levine (2006) rely on longitudinal data (collected in 1996-1998) from a low-wage service-sector employer with establishments (retail stores or restaurants) throughout the U.S. They study the influence of demographic (race, gender and age) diversity between a workgroup and its customers and within a workgroup on an indirect measure of productivity, namely individual turnover within workgroups. Results (controlling for individual FE) show that diversity does not consistently predict turnover. In contrast, belonging to a numerical minority with respect to co-workers and customers, especially with respect to race, often leads to higher turnover. Kurtulus (2011) uses detailed personnel records of a large U.S. firm in the health service industry for the years 1989-1994. Her FE estimates highlight that diversity within organisational divisions with respect to age, firm tenure and performance is associated with lower labour productivity as measured through subjective evaluation by managers. In contrast, worker's performance appears to be influenced positively by intra-divisional wage inequality.

⁶For extended reviews of the literature see e.g. Horwitz and Horwitz (2007), Ilmakunnas and Ilmakunnas (2011) and Roberge and van Dick (2010).

Evidence based on linked employer-employee data

Another strand of the literature relies on linked employer-employee data (LEED). Barrington and Troske (2001) examine the impact of plant-level diversity with respect to age and gender on plant-level productivity (i.e. value-added and sales per worker and TFP) in the manufacturing, retail trade and services industry. Based on cross-sectional LEED for 1999, their OLS estimates reject the hypothesis that workforce diversity would be detrimental for the productivity of U.S. plants. Grund and Westergaard-Nielsen (2008) use LEED for the Danish private sector over the period 1992-1997. Their FE estimator suggests that firms with a medium age dispersion obtain the highest value-added and profits per employee.

The studies of Navon (2009), Ilmakunnas and Ilmakunnas (2011) and Parrotta et al. (2014a) are more directly comparable to our investigation as they not only control for firm time-invariant unobserved heterogeneity but also for endogeneity. Navon (2009) relies on LEED for the Israeli manufacturing industry over the period 2000-2003 and employs semi-parametric estimation techniques developed by Olley and Pakes (1996, hereafter OP) and Levinsohn and Petrin (2003, hereafter LP) to control for plant FE and endogeneity. He finds that within-plant educational diversity among higher educated workers, measured as the variability in academic disciplines in which the latter obtained their university degrees, is beneficial for plant-level added value. Ilmakunnas and Ilmakunnas (2011) investigate whether firms and employees benefit from diversity using Finnish LEED covering the industrial sector (i.e. mining, manufacturing, energy and construction) for the years 1990-2004. Plant-level regressions (estimated with FE, generalized methods of moments (GMM) and OP estimators) show that TFP depends positively (negatively) on age (educational) diversity. In contrast, the latter variables turn out to be statistically insignificant when the authors estimate wage regressions for individuals. Parrotta et al. (2014a) use register-based LEED covering most of the Danish private sector between 1995 and 2005. Their results are based on an estimator developed by Akerberg et al. (2006) and show that diversity in education (ethnicity, age and gender) enhances (deteriorates) firm's value added.⁷ Moreover, dividing industries into two groups according

⁷A few recent papers (e.g. Vandenberghe, 2011) test for gender wage discrimination and investigate with LEED how the share of women within firms influences the latter's productivity and

to their aggregate level of R&D expenditures, they find no evidence that the impact of diversity is different for firms in high-tech industries (i.e. in industries with above-average R&D expenditures), although the latter are typically thought to require more creative thinking and problem-solving skills.⁸

This chapter contributes to this literature by investigating how diversity with respect to education, age and gender affects productivity, wages and productivity-wage gaps at the firm level. We also examine how the diversity-productivity-wage nexus varies according to the knowledge-intensity and high-tech status of firms and whether estimates are sensitive to firm size. Our empirical approach relies on longitudinal LEED from the Belgian private sector, uses various diversity indicators, controls for a large set of covariates and implements both GMM and LP estimation techniques. This approach differs from natural or quasi-natural experiments in which the intra-firm diversity would be the result of a truly exogenous shock. While natural experiments have of course very attractive features in that they allow to clearly identify the effects of changes in firm diversity in a specific context, it also has its downsides such as limited external validity. On any account, it should be noted that the approach presented in this chapter controls for a range of measurement issues that improve considerably the reliability of estimation results compared to existing research. For instance, the consequential issue of simultaneity and of time-invariant unobserved firm heterogeneity is rarely addressed in previous studies.

labour costs. Yet, results from these studies are not straightforward to interpret from a diversity perspective. Indeed, whether a growing share of women corresponds to more or less gender diversity depends on the initial intra-firm proportion of women.

⁸In a companion paper, Parrotta et al. (2014b) merge the Danish LEED set with information on firms' innovation ability for the years 1995-2003. Using an instrumental variable approach, they find that ethnic diversity within firms is valuable for the latter's capacity to innovate. In contrast, educational, age and gender diversity turn out to be statistically insignificant. Based on similar data for the period 1980-2002 and controlling for endogeneity, Marino et al. (2012) show in addition that intra-firm diversity in terms of education and ethnicity (age and gender) increases (decreases) workers' transition probability from employment to self-employment, i.e. their propensity to become entrepreneurs.

Table 5.1: *Main empirical studies on workforce diversity and firm performance (at company level or using LEED)*

Study	Country and year	Firm/Sector	Performance indicator	in-	Charact. ered	Consid-	Diversity index	Method	Results
Company level									
Hamilton et al. (2004)	USA (1995-1997)	Garment manufact.	Piece rate production (at individual and team level)		Worker abilities, age, ethnicity		Ability: ratio of the maximum to the minimum average individual productivity levels of the team members; Age: std.dev.; Ethnicity: % of Hispanic	OLS Median FE	Ability: positive effect. Age: negative. Ethnicity: positive. (but for age and ethnicity not robust)
Kurtulus (2011)	Multinational (1989-1994)	Health services	Worker performance evaluation		Demographic (age, race, gender) and non demographic (education, work function, firm tenure, division tenure, performance and wages)		Dissimilarity	OLS FE	Age, firm tenure and performance: negative effect. Wage: positive effect.
Leonard and Levine (2006)	USA (1996-1998, monthly)	Large retail firm	Monthly sales		Age, race, gender		Gender and race: Herfindahl; Age: std. Dev.	OLS FD	Age: negative. Race and gender: not significant.
LEED									
Barrington and Troske (2001)	USA (1990)	Manufact., retail trade and services	Value-added and total sales per capita		Payroll and occupation		Unique index	OLS	No significant relationship

cont.

cont.

Study	Country and year	Firm/Sector	Performance indicator	in-	Charact.	Consid-	Diversity index	Method	Results
Grund and Westergaard-Nielsen (2008)	Denmark (1992-1997)	All	Value-added per capita		Age structure (mean and dispersion)		Std. Dev.	OLS FE	U-shaped relation with firm performance
Ilmakunnas and Ilmakunnas (2011)	Finland (1995-2004)	All	TFP (+ wages for workers)		Age, education		Std. Dev., dissimilarity, Blau and two dimensional age-education index	OLS FE GMM OP	Age positive on TFP and wage and education negative on TFP.
Navon (2009)	Israel (2000-2003)	Manufacturing	Value-added		Knowledge (type of degree)		Herfindahl	OLS LP OP	Positive effect of knowledge diversity
Parrotta et al. (2010)	Denmark (from 1994 for construction, 1995 for manufacturing, 1998 for wholesale trade, 1999 for services to 2005)	All	TFP (estimated with Wooldridge (2009) approach)		Cultural background, skills/education and demographics		Herfindahl	IV	Positive for skills/education; mixed for demographics and ethnicity

Notes: FE: fixed effects; FD: first differences; OP: Olley and Pakes (1996) method; LP: Levinsohn and Petrin (2003) method.

5.3 The theoretical framework and the estimation strategy

5.3.1 The theoretical framework

In this chapter we study the impact of workforce diversity by estimating a production function and a wage equation, both expanded by the specification of a labour-quality component. This technique was pioneered by Hellerstein and Neumark (1995) and further refined and applied in Hellerstein et al. (1999) and by many others with respect to groups of workers in terms of age (e.g. Cataldi et al., 2011), age and gender (e.g. Vandenberghe, 2012), type of contract (e.g. Cataldi et al. 2012), occupations (e.g. Kampelmann and Rycx, 2012), but also gender wage discrimination (Vandenberghe, 2011). In this chapter, we apply it to analyse the impact of workforce diversity on productivity and wages.

In order to estimate the impact of workforce diversity on productivity, we start by taking a function linking a range of inputs of firm i to its added value Y_i :

$$Y_{i,t} = F(K_{i,t}, QL_{i,t}) \quad (5.1)$$

where $K_{i,t}$ represents the firm's capital stock and $QL_{i,t}$ is a quality of labour term. The latter allows introducing a heterogeneous labour force into the value-added function.

There is an abundant econometric literature on the estimation of relationships like that depicted in Equation (5.1). Various authors have proposed different specifications, allowing e.g. for different elasticities of substitution between the factors of production, in order to reflect more accurately the production process inside the firm. However, our focus is not on the production process itself, but rather on the comparison between workforce characteristics and diversity. We therefore use a simple Cobb-Douglas version of Equation (5.1), with substitution elasticities equal to one and the assumption of firms operating at the efficiency frontier. Such assumptions do not appear problematic as previous firm-level studies have shown that productivity coefficients obtained with a Cobb-Douglas structure are robust to other functional specifications (see, e.g. Hellerstein and Neumark, 2004). Equation 5.2 is the basic

(Cobb-Douglas) value-added function:

$$\log(Y_{i,t}) = \log(A_{i,t}) + \alpha \log(K_{i,t}) + \beta \log(QL_{i,t}) \quad (5.2)$$

where $A_{i,t}$ is a Hicks-neutral technological factor and the parameters α and β are the respective marginal productivities of each input factor.

The key variable in this production function is the quality of labour $QL_{i,t}$. Following Iranzo et al. (2008), Q , the quality of labour (or efficiency of the labour force), can be expressed as a CES function of workers' characteristics c (in our case, age, education and gender):

$$Q(c) = \left[\frac{1}{N} \sum_{i=1}^N c_i^\gamma \right]^{\frac{1}{\gamma}} \quad (5.3)$$

As Iranzo et al. (2008) show, the importance of workforce diversity (they refer to skill dispersion) can be seen more clearly by approximating eq. (5.3) through a Taylor expansion as a function of the first and second moments of workforce characteristics distribution:

$$Q(c) = \bar{c} + \frac{1}{2}(\gamma - 1) \frac{\sigma^2}{\bar{c}} \quad (5.4)$$

Therefore, in our empirical specification, we are going to estimate a value-added function where we control for the first and second moments of workforce characteristics of interest and a set of other controls. To ensure the consistency and the comparability of the results we also estimate an extended Mincer wage equation at firm level⁹ on the same set of variable of interest and controls.

Our empirical approach is based on the separate estimation of an added value function and a wage equation at the firm level. The latter provide parameter estimates for the impact of labour diversity (with respect to education, age and gender) on average productivity and wages, respectively. Given that both equations are estimated on the same sample with identical control variables, the parameters for marginal products and wages can be compared and conclusions can be drawn on how the benefits or losses of diversity are shared between workers and firms. This technique was pioneered by Hellerstein and Neumark (1995) and refined by Hellerstein et

⁹Ilmakunnas and Ilmakunnas (2011), the only other paper looking also at the impact of workforce diversity on wages, estimate productivity at firm level and wages at the individual level.

al. (1999), Hellerstein and Neumark (2004), Aubert and Crépon (2009) and van Ours and Stoeldraijer (2011). It is now standard in the literature on the productivity and wage effects of labour heterogeneity (see e.g. Cataldi et al. 2012; Göbel and Zwick 2012; Vandenberghe 2013).

The estimated firm-level productivity and wage equations are the following:

$$\text{Log}(VA/h)_{i,t} = \alpha + \beta_1 A_{i,t}^\sigma + \beta_2 E_{i,t}^\sigma + \beta_3 G_{i,t}^\sigma + \beta_4 \bar{A}_{i,t} + \beta_5 \bar{E}_{i,t} + \lambda X_{i,t} + s_i + y_t + \epsilon_{i,t} \quad (5.5)$$

$$\text{Log}(W/h)_{i,t} = \alpha^* + \beta_1^* A_{i,t}^\sigma + \beta_2^* E_{i,t}^\sigma + \beta_3^* G_{i,t}^\sigma + \beta_4^* \bar{A}_{i,t} + \beta_5^* \bar{E}_{i,t} + \lambda^* X_{i,t} + s_i + y_t + \epsilon_{i,t}^* \quad (5.6)$$

The dependent variable in equation (5.5) is firm i 's value added in hourly terms, obtained by dividing the total value added by the firm i in period t by the total number of hours worked that have been declared for the same period. In equation (5.6), the dependent variable is firm i 's average hourly gross wage (including premia for overtime, weekend or night work, performance bonuses, commissions, and other premia). It is obtained by dividing the firm's total wage bill by the total number of work hours.

Estimating equations (5.5) and (5.6) yields insights into the size and significance of the effect of diversity on productivity wage, but it does not allow to test directly whether the difference between the value added and wage coefficients is statistically significant. A simple method to obtain a test for the significance of productivity-wage gaps has been proposed by van Ours and Stoeldraijer (2011). We apply a similar approach and estimate a model in which the difference between firm i 's hourly value added and average wage is regressed on the same set of explanatory variables as in equations (5.5) and (5.6).

$$\log(VA-W)_{i,t} = \alpha^* + \beta_1^* A_{i,t}^\sigma + \beta_2^* E_{i,t}^\sigma + \beta_3^* G_{i,t}^\sigma + \beta_4^* \bar{A}_{i,t} + \beta_5^* \bar{E}_{i,t} + \lambda^* X_{i,t} + s_i + y_t + \epsilon_{i,t}^* \quad (5.7)$$

being $\log(VA-W)_{i,t} = \text{Log}(\text{ValueAdded}/\text{hours})_{i,t} - \text{Log}(\text{wages}/\text{hours})_{i,t}$. The β^* s, in this case, estimate the size and significance of productivity-wage gap for each diversity dimension.

The main variables of interest are $A_{i,t}^\sigma$, $E_{i,t}^\sigma$, $G_{i,t}^\sigma$, being respectively age diver-

sity, education diversity and gender diversity which capture the effect of diversity on productivity and wages. $\bar{A}_{i,t}$ and $\bar{E}_{i,t}$ are respectively average age and years of education.¹⁰ $X_{i,t}$ represents other controls (mean age, mean years of education, share of non-standard employees, share of white collars, share of part-timers, share of workers with at least 10 years of tenure, firm size and firm capital). s_i are sector dummies and y_t year dummies. $\epsilon_{i,t}$ and $\epsilon_{i,t}^*$ represent the error terms.

Therefore, β_1 , β_2 and β_3 are the coefficient of interest: in equation (5.5) they represent the impact of workforce diversity in terms of respectively age, education and gender on average firm level hourly productivity. In equation (5.6), β_1^* , β_2^* and β_3^* represent the impact of workforce diversity on the average firm level hourly wage.

5.3.2 The measurement of diversity

The three firm-level diversity indicators used in this third part of the thesis (i.e. the standard deviation, the average dissimilarity index and the alternative gender diversity index) are conceptually and mathematically relatively similar and can be regarded as robustness tests for our regression results.¹¹ In particular, all three diversity indicators share the property that diversity is maximal in case of a symmetrical bi-modal distribution with the modes occurring at the extreme values of the attribute under study (i.e. when observations are equally split between the modes); conversely, the minimum of all three indicators is reached when all workers belong to the same group.

More in detail, the standard deviation used in this chapter and the following one refers to “the standard, or mean square, deviation from the arithmetic mean, i.e., the square root of the arithmetic average of the squares of deviations from the arithmetic mean” (Dalton, 1920). For the N employees i in firm j , this can be expressed as:

$$SD_j = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N}} \quad (5.8)$$

¹⁰The share of women (or men) is not included because in the case of Belgium it is highly collinear with $G_{i,t}^\sigma$ and both variable lose significance when included together.

¹¹To avoid multicollinearity, the effect of the three diversity indicators is estimated in separate regressions.

where x_i denotes the characteristic (age, education or gender) of individual i . We follow conventional use and employ the absolute standard deviation, which means that standard deviations of variables with different units cannot be compared directly.

The second diversity indicator is the dissimilarity index (already quite popular in diversity research in psychology and human resource management but less in economics), or Euclidean distance, which is a measure of relational demography¹². The Euclidean distance between two points $X_1 = (x_{1,1}, x_{1,2}, \dots, x_{1,n})$ and $X_2 = (x_{2,1}, x_{2,2}, \dots, x_{2,n})$ in a Euclidean n -space is defined as:

$$\overline{X_1 X_2} = \sqrt{(x_{1,1} - x_{2,1})^2 + \dots + (x_{1,n} - x_{2,n})^2} = \sqrt{\sum_{d=1}^n (x_{1,d} - x_{2,d})^2} \quad (5.9)$$

Considering the diversity between two employees in terms of a given characteristic is analogous to computing their Euclidean distance in a one-dimensional space. The Euclidean distance between the two employees is equal to the absolute difference between their coordinates:

$$\overline{X_1 X_2} = \sqrt{(x_1 - x_2)^2} = |x_1 - x_2| \quad (5.10)$$

The dissimilarity index for employee i can be interpreted as the square root of the arithmetic mean of all Euclidean distances in a one-dimensional space. Formally, this can be written as follows:

$$DI_{i,j} = \sqrt{\frac{\sum_{k=1}^{N_j} (x_{i,j} - x_{k,j})^2}{N_j}} = \sqrt{(x_{i,j} - \bar{x}_j)^2 + VAR(x_j)} \quad (5.11)$$

where N_j is the number of individuals in firm j . In other words, $DI_{i,j}$ is the square root of the average Euclidean distance of the worker i with respect to all co-workers in the firm j . Note that equation (5.11) includes the trivial distance of the focal worker to itself, which is by definition always zero. A convenient feature of $DI_{i,j}$ is that it can be rewritten in terms of the difference between the worker i and the arithmetic mean, on the one hand, and the variance within firm j on the other hand (see the

¹²The dissimilarity index allows the diversity effects to vary according to the degree to which the individuals are different from their peers.

development in equation (5.11)). This manipulation reveals the relationship between the $DI_{i,j}$ and the standard deviation: if $x_{i,j}$ corresponds to age and if employee i has exactly the average age in firm j , then $DI_{i,j}$ of this individual is equal to the standard deviation of age in firm j . If the age of the individual is below or above the arithmetic mean, then his or her $DI_{i,j}$ is higher than the standard deviation. The maximum $DI_{i,j}$ corresponds to either the oldest or youngest individual in firm j (depending on which one is further away from the mean). The dissimilarity index can be interpreted as capturing “relational demography”, i.e. how separate the individual i is from the other employees in firm j and is widely used in the literature on diversity (Harrison and Klein, 2007; Riordan and Wayne, 2008).

Computing the arithmetic mean of the individual dissimilarity indices yields the firm-level dissimilarity index used by Ilmakunnas and Ilmakunnas (2011). The main difference between the (absolute) standard deviation and the firm-level dissimilarity index is that the latter can be decomposed into individual-level dissimilarities because the firm-level index is simply the arithmetic mean over all N_j individuals in firm j :

$$DI_j = \frac{\sum_{i=1}^{N_j} \sqrt{\frac{\sum_{k=1}^{N_j} (x_{i,j} - x_{k,j})^2}{N_j}}}{N_j} = \frac{\sum_{i=1}^{N_j} \sum_{k=1}^{N_j} |x_{i,j} - x_{k,j}|}{N_j^2} \quad (5.12)$$

The firm-level dissimilarity index DI_j in equation (5.12) is thus the average Euclidean distance between all possible dyads in a one-dimensional Euclidean space, including the trivial distances of the points with themselves. Rewriting the expression in absolute values shows that DI_j corresponds to the “absolute mean difference”, a measure of inequality defined by Corrado Gini in 1912.

In addition to the standard deviation and dissimilarity index of gender, in line with standard practice in the literature (see e.g. Hoogendoorn et al., 2013), we also computed the following alternative dissimilarity index GDI_j based on the shares of women and men in firm j , $S_{W,j}$ and $S_{M,j}$, respectively. It can be written as follows:

$$GDI_j = S_{W,j}S_{M,j} = S_{W,j}(1 - S_{W,j}) \quad (5.13)$$

Both the SD_j and the DI_j are not unit-free, i.e. results for attributes that are

measured in different units cannot be directly compared. Consider the diversity attribute x ranging from a lower bound l to an upper bound u . For the case of age, this range could be equal to the interval $[16; 64]$. The minimum of both the standard deviation and the dissimilarity index is equal to zero and corresponds to the absence of intra-firm variation on attribute x (e.g. all individuals have the same age). The maximum value of the standard deviation is equal to $(u-l)/2$, whereas the maximum of the dissimilarity index is $(u-l)/\sqrt{2}$. As a consequence, the range of the dissimilarity index is slightly bigger compared to the standard deviation. For both indicators the maxima are reached when firm j 's workforce is perfectly polarised into two equal-sized groups with the characteristics u and l , respectively (i.e. a bi-modal distribution with modes equal to the upper and lower bounds of the attribute x). For example, if firm j has 10 employees whose age ranges from 16 to 64 years, then both SD_j and DI_j peak when half of the employees are 16 and the other half 64 years old: in this case, the SD_j would be equal to 24 $[= 64 - 16/2]$ and the DI_j 33.94 $[= (64 - 16)/\sqrt{2}]$.

Given that both indicators attain their peak under the same conditions and in light of their general conceptual and mathematical similarities, Harrison and Klein (2007) conclude that “there is no particular advantage of either operationalization over the other, save for researcher familiarity with SD”.

As for the GDI_j , its minimum value corresponds to a firm composed with either only male or only female workers, in which case the indicator equals zero. Its maximum is reached when all employees of firm j are distributed evenly among the two sexes. The indicator then equals 0.25 $(= 0.5 \cdot 0.5)$. As a consequence, the range of the GDI_j is $[0;0.25]$. Given that each firm j is characterised by only one gender share, it is not possible to calculate a standard deviation or dissimilarity index on this variable. The gender standard deviation and dissimilarity index have been calculated with a dummy variable for sex that takes the value of one if the employee is a women and zero otherwise. The range (and maximum value) of the GDI_j therefore differs with respect to the standard deviation and the dissimilarity index, which are 0.5 $[= (1 - 0)/2]$ and 0.71 $[= (1 - 0)/\sqrt{2}]$, respectively. The GDI_j is nevertheless conceptually similar to the other two indicators: its minimum corresponds to the absence

of variability in the attribute x and the maximum to a bi-modal distribution.

In addition to testing robustness, the inclusion of the three indicators for diversity allows for better comparability with other studies: the standard deviation is a widely used indicator with high familiarity (Harrison and Klein, 2007); the average Euclidean distance on which the dissimilarity index is based has been included given that this measure is frequently used in the literature on diversity (Ilmakunnas and Ilmakunnas, 2011); finally, the alternative diversity measure based on sex shares is widely used in the literature on gender diversity (Hoogendoorn et al., 2013).¹³ The three dimensions of diversity in the model may also interact. We have tested for interdependent effects of age, gender and educational diversity using interaction variables and the faultlines approach (as described in Van Knippenberg et al. (2011)) and found no substantial evidence for interdependencies.

5.3.3 The estimation method

Equations (5.5) and (5.6), as well as the productivity-wage gap in (5.7), can be estimated with different methods: pooled ordinary least squares (OLS), a fixed-effect (FE) model, the generalized method of moments (GMM) estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998), or a more structural approach suggested by Levinsohn and Petrin (2003, hereafter LP). This being said, pooled OLS estimators of productivity models have been criticized for their potential “heterogeneity bias” (Aubert and Crépon 2003: 116) due to the fact that firm productivity depends to a large extent on firm-specific, time-invariant characteristics that are not measured in micro-level surveys (advantageous location, firm-specific assets like the ownership of a patent, or other firm idiosyncrasies).

One way to remove unobserved firm characteristics that remain unchanged during the observation period is by estimating a FE model. However, neither pooled OLS nor the FE estimator address the potential endogeneity of our explanatory variables.¹⁴ Yet, labour diversity is likely to be endogenous. Indeed, any shock in wages

¹³Although many studies on diversity make use of Euclidean distances, the exact definitions and notations of the employed indicators can differ. For example, some authors prefer to compute only N-1 distances and exclude the trivial distance between the focal worker and itself - an issue that has little empirical incidence in our case given that our sample does not include very small firms.

¹⁴Expected biases associated to OLS and the relatively poor performance and shortcomings of

or in productivity levels might generate correlated changes in the firm's workforce and in labour productivity that are not due to changes in the firm's workforce composition per se. For instance, one might expect that a firm undergoing a negative productivity shock would prefer not to hire new staff, which would increase the age of the workforce and affect the age diversity index. Similarly, during economic downturns, firms may be more likely to reduce personnel among women and less educated workers as adjustments costs are often lower for these categories of workers due to their relatively lower wages and/or tenure. In order to control for this endogeneity and for the presence of firm fixed effects, we estimated our model using system GMM (GMM-SYS) and LP estimators, respectively.

The GMM-SYS approach boils down to simultaneously estimating a system of two equations (one in levels and one in first differences) and to relying on internal instruments to control for endogeneity. More precisely, diversity variables¹⁵ in the differenced equation are instrumented by their lagged levels and diversity variables in the level equation are instrumented by their lagged differences (Göbel and Zwick, 2012). The implicit assumption is that changes (the level) in (of) the dependent variable - productivity or wages - in one period, although possibly correlated with contemporaneous variations (levels) in (of) diversity variables, are uncorrelated with lagged levels (differences) of the latter. Moreover, changes (levels) in (of) diversity variables are assumed to be reasonably correlated to their past levels (changes). One advantage of GMM-SYS is that time-invariant explanatory variables can be included among the regressors, while the latter typically disappear in difference GMM. Asymptotically, the inclusion of these variables does not affect the estimates of the other regressors because instruments in the level equation (i.e. lagged differences of diversity variables) are expected to be orthogonal to all time-invariant variables (Roodman, 2009). In order to find the correctly specified model, we start with the moment conditions that require less assumptions and increase the number of instruments progressively (Göbel and Zwick, 2012). To examine the validity of additional instruments, we apply the Hansen (1982) test of over-identifying restrictions. In the FE estimator in the context of firm-level productivity regressions are reviewed in Van Beveren (2010).

¹⁵By "diversity variables", we mean diversity variables *stricto sensu* and other endogenous input factors.

addition, the Arellano-Bond (1991) test for serial correlation (i.e. for second-order autocorrelation in the first differenced errors) is used to assess whether estimates are reliable. Practically, we choose the model with the lowest number of lags that passes the Hansen and Arellano-Bond tests.

As an alternative to the GMM-SYS method, Olley and Pakes (1996) have developed a consistent semi-parametric estimator. This estimator, particularly well suited for panels with small t and big N , controls for endogeneity and firm fixed unobserved heterogeneity by using the employer's investment decision to proxy for unobserved productivity shocks. The intuition is that firms respond to time-varying productivity shocks observed by managers (and not by econometricians) through the adjustment of their investments. Put differently, profit-maximizing firms react to positive/negative productivity shocks by increasing/decreasing their output, which requires more/less investments (or intermediate inputs, see below). The OP estimation algorithm relies on the assumptions that there is only one unobserved state variable at the firm level (i.e. its productivity) and that investments increase strictly with productivity (conditional on the values of all state variables). This monotonicity condition implies that any observation with zero investment has to be dropped from the data, which generally leads to a sharp decrease in sample size. To avoid this drawback, Levinsohn and Petrin (2003) use intermediate inputs (i.e. inputs such as energy, raw materials, semi-finished goods, and services that are typically subtracted from gross output to obtain added value) rather than investments as a proxy for productivity shocks. Given that firms typically report positive values for intermediate inputs in each year, most observations can be kept with the LP approach. An additional argument for using intermediate inputs rather than investments is that the former may adjust more smoothly to the productivity term than the latter, especially if adjustment costs are an important issue. For instance, *"if adjustment costs lead to kink points in the investment demand function, plants may not respond fully to productivity shocks, and some correlation between the regressors and the error term can remain"* (Petrin et al., 2004: 114). Intermediate inputs would thus provide a better proxy for unobserved productivity shocks. In the basic LP model, labour is a fully variable and capital a fixed input. Given our focus on diversity, the variable inputs in our setup include first

and/or second moments of workforce characteristics. Assuming that intermediate inputs depend on capital and the unobservable productivity shocks, this relationship can be solved for the productivity term (Ilmakunnas and Ilmakunnas, 2011). When relying on the LP estimation algorithm, standard errors are computed using a bootstrap approach taking the panel structure of the data into account (Petrin et al., 2004).

5.4 Data and descriptive statistics

Our empirical analysis is based on a combination of two large data sets covering the period 1999-2006. The first, carried out by Statistics Belgium, is the *Structure of Earnings Survey* (SES). It covers all firms operating in Belgium which employ at least 10 workers and with economic activities within sections C to K of the NACE Rev.1 nomenclature.¹⁶ The survey contains a wealth of information, provided by the management of firms, both on the characteristics of establishments (e.g. sector of activity, number of employees) and their workers (e.g. age, education, sex, tenure, gross earnings, paid hours, occupation).¹⁷

¹⁶It thus covers the following sectors: (i) mining and quarrying (C), (ii) manufacturing (D), (iii) electricity, gas and water supply (E), (iv) construction (F), v) wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (G), (vi) hotels and restaurants (H), (vii) transport, storage and communication (I), (viii) financial intermediation (J), and ix) real estate, renting and business activities (K).

¹⁷The SES is a stratified sample. The stratification criteria refer respectively to the region (NUTS-groups), the principal economic activity (NACE-groups) and the size of the firm. The sample size in each stratum depends on the size of the firm. Sampling percentages of firms are respectively equal to 10, 50 and 100 percent when the number of workers is lower than 50, between 50 and 99, and above 100. Within a firm, sampling percentages of employees also depend on size. Sampling percentages of employees reach respectively 100, 50, 25, 14.3 and 10 percent when the number of workers is lower than 20, between 20 and 50, between 50 and 99, between 100 and 199, and between 200 and 299. Firms employing 300 workers or more have to report information for an absolute number of employees. This number ranges between 30 (for firms with between 300 and 349 workers) and 200 (for firms with 12,000 workers or more). To guarantee that firms report information on a representative sample of their workers, they are asked to follow a specific procedure. First, they have to rank their employees in alphabetical order. Next, Statistics Belgium gives them a random letter (e.g. the letter O) from which they have to start when reporting information on their employees (following the alphabetical order of workers' names in their list). If they reach the letter Z and still have to provide information on some of their employees, they have to continue from the letter A in their list. Moreover, firms that employ different categories of workers, namely managers, blue- and/or white-collar workers, have to set up a separate alphabetical list for each of these categories and to report information on a number of workers in these different groups that is proportional to their share in the firm's total employment. For example, a firm with 300 employees (namely, 60 managers, 180 white-collar workers and 60 blue-collar workers) will have to report information on 30 workers (namely, 6 managers, 18 white-collar workers and 6 blue-collar workers). For more details

The SES provides no financial information. It has therefore been merged with a firm-level survey, the *Structure of Business Survey* (SBS). The SBS, also conducted by Statistics Belgium, provides information on financial variables such as firm-level material inputs, investments, added value and gross operating surplus. The coverage of the SBS differs from that of the SES in that it does not cover the whole financial sector (NACE J) but only Other Financial Intermediation (NACE 652) and Activities Auxiliary to Financial Intermediation (NACE 67). The merger of the SES and SBS datasets has been carried out by Statistics Belgium using firms' social security numbers.

Information in the SES refers to the month of October in each year, while data in the SBS are measured over entire calendar years from January until December. To avoid running a regression where information on the dependent variable (collected for the entire calendar year) precedes the recording of the explanatory variables (collected in October), all explanatory variables in Equations (1) and (2) have been lagged by one year. In this way, information on diversity indices is recorded in October in year t and used to explain firm-level productivity and wages during the calendar year $t+1$. The imperfect synchronization of SBS and SES data might introduce some fuzziness into our estimates since we cannot exclude the occurrence of external events influencing productivity or wages in the intermediate period. This concern could only be completely eliminated if we had firm-level information on the average diversity for the entire calendar year. This being said, even if this information was available, there is a compelling argument for using asynchronized information on diversity and productivity: it is difficult to conceive how changes in diversity could generate immediate effects, so that potential productivity effects are more likely to occur after a certain adjustment period. The slightly asynchronised use of SBS and SES data is therefore arguably the best option in light of data availability and productivity dynamics.

As a consequence, our sample contains firms that are observed in at least two consecutive years and thus over-represents medium-sized and large firms given that sampling percentages of firms in our data increase with the size of the latter. Next, we exclude workers and firms for which data are missing or inaccurate.¹⁸ Finally, we

see Demunter (2000).

¹⁸For instance, we eliminate a (very small) number of firms for which the recorded value added

drop firms with less than 10 observations, the reason for this being our use of the first and second moments of workers' characteristics at the firm level.¹⁹ Our final sample consists of an unbalanced panel of 7,463 firm-year-observations from 2,431 firms. It is representative of all medium-sized and large firms in the Belgian private sector, with the exception of large parts of the financial sector (NACE J) and the electricity, gas and water supply industry (NACE E).

Table 5.2 sets out the means and standard deviations of selected variables. We observe that firms have a mean value added per hour worked of 61.06 EUR and that workers' mean gross hourly wage stands at 17.14 EUR. As regards diversity indicators, we find that the intra-firm standard deviation (the dissimilarity index) reaches respectively 9.33 (12.61) for age, 1.90 (2.54) for education, and 0.35 (0.46) for gender. For comparison, Ilmakunnas and Ilmakunnas (2011) report similar standard deviations (and average dissimilarity indices) for Finland of 10.04 (13.67) for age and 1.93 (2.71) for education.

Employees in our sample have on average 11.44 years of education, are 38.42 years old, and are essentially concentrated in the manufacturing industry (57 percent), wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (12 percent), construction (10 percent) and real estate, renting and business activities (11 percent). Moreover, firms employ on average 132 full-time equivalent workers, 27 percent of women, 45 percent of white-collar workers, 61 percent of workers with less than ten years of tenure, 4 percent of workers with a fixed-term employment contract, and 2 percent of part-time workers.

5.5 Empirical results

5.5.1 Benchmark specification

The Tables 5.3 and 5.4 show results using OLS and the FE estimators. OLS show a negative productivity effect of age diversity and a positive productivity effect of educational diversity. Gender diversity is not statistically significant from zero in the

was negative.

¹⁹This restriction is unlikely to affect our results as it leads to a very small drop in sample size. The average number of observations per firm in each year is equal to 35 in our final sample.

Table 5.2: *Descriptive statistics at the firm level (1999-2006)*

	All firms		HT/KIS firms		Non-HT/KIS firms	
	Mean	sd	Mean	sd	Mean	sd
Hourly wage (€)	17.14	5.39	18.38	5.68	16.64	5.18
Value-added per hour (€)	61.06	458.61	64.49	239.1	59.71	520.2
Average age (years)	38.42	4.19	37.45	4.35	38.8	4.07
Std. deviation of age	9.33	1.82	9.01	2.01	9.45	1.73
Age diss. index	12.61	2.52	12.16	2.77	12.79	2.39
Average education (years)	11.44	1.76	12.32	1.79	11.09	1.62
Std. deviation of education	1.9	0.84	1.79	0.77	1.94	0.86
Education diss. index	2.54	1.15	2.4	1.05	2.6	1.18
Women (%)	0.27	0.24	0.33	0.25	0.24	0.23
Std. deviation of gender	0.35	0.15	0.38	0.14	0.34	0.16
Gender diss. index	0.46	0.22	0.51	0.2	0.45	0.22
Workers with tenure ≥ 10 years (%)	0.39	0.24	0.33	0.25	0.42	0.24
White-collar workers (%)	0.45	0.34	0.62	0.36	0.39	0.31
Part-time (< 30 h/week, %)	0.02	0.07	0.02	0.06	0.02	0.07
Fixed-term employment (%)	0.04	0.1	0.05	0.12	0.04	0.09
<i>Sector (%)</i>						
Mining and quarrying (C)	0.01	0.09	0	0	0.01	0.11
Manufacturing (D)	0.57	0.49	0.53	0.5	0.59	0.49
Electricity, gas and water supply (E)	0	0.06	0	0	0.01	0.07
Construction (F)	0.1	0.29	0	0	0.13	0.34
Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (G)	0.12	0.33	0	0	0.17	0.37
Hotels and restaurant (H)	0.02	0.13	0	0	0.02	0.16
Transport, storage and communication (I)	0.06	0.24	0.05	0.21	0.07	0.25
Financial intermediation (J)	0.01	0.11	0.05	0.21	0	0
Real estate, renting and business activities (K)	0.11	0.31	0.38	0.49	0	0.01
Capital stock (€)	244,287	2,117,000	489,790	3,946,000	147,644	292,979
Investments (€)	18,543	254,447	40,205	476,648	10,019	24,221
Size of the firm (FTE)	131.85	336.37	203.76	551.76	116.63	267.12
Nb of obs.	7,463		2,108		5,355	
Nb of firms	2,431		679		1,778	

Notes: euros at 2006 constant prices. The sum of HT/KIS and non-HT/KIS firms exceeds the total number of firms due to a small number of them changing category during the observation period.

OLS specification. By contrast, the fixed-effect estimator performs very poorly and is not able to pick up any significant productivity effect of diversity. This is arguably due to the fact that the FE estimator exploits only the variation within firms over time and reflects the relatively short average length of our panel (most firms are only observed over two or three years). In other words, the FE estimator does not use the substantial cross-sectional variation in our panel and therefore provides a very weak identification of the coefficients. Notably the fact that the FE coefficients are insignificant in both the productivity and wage equations suggests that absence of diversity effects is due to insufficient variability rather than correctly reflecting inexistent productivity effects.

Table 5.3: *OLS estimations with standard deviation*

	(1)	OLS (2)	(3)	(4)	FE (5)	(6)
	VA/h (ln)	W/h (ln)	VA-W gap (ln)	VA/h (ln)	W/h (ln)	VA-W gap (ln)
Age SD	-0.009* (0.005)	-0.010*** (0.002)	0.001 (0.005)	0.004 (0.003)	0.000 (0.001)	-0.000 (0.001)
Education SD	0.037*** (0.010)	0.034*** (0.004)	0.003 (0.008)	0.004 (0.006)	0.001 (0.003)	-0.001 (0.003)
Gender SD	-0.089 (0.064)	-0.163*** (0.027)	0.074 (0.055)	0.026 (0.056)	0.037 (0.023)	0.037* (0.022)
Age average	0.013*** (0.003)	0.013*** (0.001)	-0.000 (0.003)	0.003 (0.002)	0.001 (0.001)	0.000 (0.001)
Education av.	0.096*** (0.007)	0.062*** (0.003)	0.034*** (0.005)	-0.001 (0.004)	0.000 (0.002)	0.001 (0.002)
Observations	7463	7463	7463	7463	7463	7463
Number of firms	2431	2431	2431	2431	2431	2431
R-squared	0.245	0.407	0.112	0.032	0.126	0.162

Notes: Clustered standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Regressions include worker and firm characteristics (% non open-ended, % part-time, firm size, % workers with > 10 years of tenure, % white collars), industry (8 dummies) and time dummies (7).

Given the above mentioned econometric issues associated with pooled OLS and FE estimations, the rest of the chapter reports findings based on the GMM-SYS and LP estimators. Table 5.5 shows the impact of diversity indicators (the standard deviation and the dissimilarity index, respectively) on productivity, mean wages and productivity-wage gaps at the firm-level.

Table 5.4: *OLS estimations with dissimilarity index*

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
	VA/h (ln)	W/h (ln)	VA-W gap (ln)	VA/h (ln)	W/h (ln)	VA-W gap (ln)
Age diss.	-0.007* (0.004)	-0.007*** (0.001)	0.000 (0.003)	0.003 (0.002)	0.000 (0.001)	0.003 (0.002)
Education diss.	0.028*** (0.007)	0.025*** (0.003)	0.003 (0.006)	0.003 (0.004)	0.001 (0.002)	0.002 (0.005)
Gender diss.	-0.058 (0.046)	-0.115*** (0.019)	0.058 (0.040)	0.020 (0.039)	0.025 (0.017)	-0.006 (0.042)
Age average	0.013*** (0.003)	0.013*** (0.001)	-0.000 (0.003)	0.003 (0.002)	0.001 (0.001)	0.002 (0.002)
Education av.	0.096*** (0.007)	0.062*** (0.003)	0.034*** (0.005)	-0.001 (0.004)	0.000 (0.002)	-0.001 (0.004)
Observations	7463	7463	7463	7463	7463	7463
Number of firms	2431	2431	2431	2431	2431	2431
R-squared	0.245	0.407	0.112	0.032	0.126	0.008

Notes: Clustered standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Regressions include worker and firm characteristics (% non open-ended, % part-time, firm size, % workers with > 10 years of tenure, % white collars), industry (8 dummies) and time dummies (7).

GMM-SYS estimates are reported in columns (1) to (6). To examine their reliability, we first apply the Hansen and Arellano-Bond tests. For all specifications, they respectively do not reject the null hypothesis of valid instruments²⁰ and of no second-order autocorrelation in the first differenced errors. Results in columns (1) and (2) suggest that age and gender diversity have a significant negative influence on productivity. More precisely, they indicate that if age diversity increases by one standard deviation, productivity on average decreases by 4 percent.²¹ Such a change in diversity is equivalent to an increase in the standard deviation of age of 1.82 years and an increase in the dissimilarity index of 2.52 years. To give a numerical example of a hypothetical firm with four employees, such a change roughly corresponds to a shift from workers aged 25, 40, 45, and 55 years to workers aged 25, 40, 45 and 60 years. The mean impact on productivity of a standard deviation increase in gender diversity (that is by respectively 0.15²² and 0.22 for the standard deviation

²⁰First and second lags of explanatory variables (except time dummies) are used as instruments.

²¹ $-0.022 \times 1.82 = -0.04 = -4\%$ and $-0.016 \times 2.52 = -0.04$.

²²A change of 0.15 in the standard deviation of gender corresponds roughly to the case of a firm

and dissimilarity index) is also estimated at about minus 4 percent.²³ Concerning education diversity, we find that the regression coefficient is positive but statistically insignificant in both specifications.

LP estimates, reported in columns (7) and (8), confirm that age and gender diversity appear to be harmful for productivity. Point estimates indeed suggest that an increase in these variables of one standard deviation hampers productivity on average by 1.3 and 1.7 percent, respectively. As regards the coefficient on educational diversity, it is still positive but now also significantly different from zero. More precisely, results suggest that when educational diversity increases by one standard deviation (that is by respectively 0.84²⁴ and 1.15 years for the standard deviation and dissimilarity index), productivity on average rises by approximately 2.7 percent.

Findings in columns (3) and (4) show that GMM-SYS regression coefficients associated to diversity indices are of the same sign and order of magnitude in the wage and productivity equations. While age and gender diversity are found to depress mean workers' wages, the opposite result is found for educational diversity. Results in columns (5) and (6) further indicate that educational and gender diversity have a non-significant impact on the productivity-wage gap. Gains (losses) due to educational (gender) diversity thus appear to be shared "competitively" between workers and firms so that profits remain unaffected. In contrast, age diversity is found to have a stronger negative impact on productivity than on wages. More precisely, results show that an increase of one standard deviation in the age diversity index decreases the productivity-wage gap (i.e. profits) on average by about 2.3 percent.

in which the share of women increases from 15 to 50%.

²³ $-0.260 \cdot 0.15 = -0.039 = -3.9\%$ and $-0.176 \cdot 0.22 = -0.039$.

²⁴An increase of 0.84 in the standard deviation of educational attainment is roughly similar to the change of a workforce of five individuals with 8, 9, 10, 10 and 12 years of education to a workforce with 6, 9, 10, 10 and 12 years of education.

Table 5.5: *GMM-SYS and LP estimation results for the entire sample*

	GMM-SYS				LP			
	Value added/hour (ln) (1)	Value added/hour (ln) (2)	Mean wage/hour (ln) (3)	Mean wage/hour (ln) (4)	VA-W gap (ln) (5)	VA-W gap (ln) (6)	Value added/hour (ln) (7)	Value added/hour (ln) (8)
Standard deviation age	-0.022*** (0.008)		-0.010*** (0.004)		-0.013* (0.007)		-0.007** (0.003)	
Age dissimilarity		-0.016*** (0.006)		-0.007*** (0.003)		-0.009* (0.005)		-0.005* (0.003)
Standard deviation education	0.009 (0.015)		0.017** (0.007)		-0.008 (0.013)		0.032*** (0.008)	
Education dissimilarity		0.007 (0.011)		0.012** (0.005)		-0.005 (0.010)		0.024*** (0.006)
Standard deviation gender	-0.260** (0.102)		-0.140** (0.055)		-0.120 (0.094)		-0.113* (0.064)	
Gender dissimilarity		-0.176** (0.076)		-0.097** (0.041)		-0.079 (0.069)		-0.075* (0.039)
Average age	0.011*** (0.003)	0.011*** (0.003)	0.009*** (0.001)	0.009*** (0.001)	0.002 (0.003)	0.002 (0.003)	0.010*** (0.002)	0.010*** (0.002)
Average education	0.077*** (0.007)	0.077*** (0.007)	0.046*** (0.003)	0.046*** (0.003)	0.032*** (0.006)	0.032*** (0.006)	0.075*** (0.006)	0.075*** (0.005)
Hansen over-identification test, p-value	0.765	0.767	0.152	0.172	0.487	0.480		
Arellano-Bond test for AR(2), p- value	0.123	0.124	0.370	0.356	0.560	0.561		
Nb. of obs.	7,463	7,463	7,463	7,463	7,463	7,463	7,461	7,463
Nb. of firms	2,431	2,431	2,431	2,431	2,431	2,431	2,431	2,431

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments.

Table 5.6: *GMM-SYS and LP estimates for the entire sample using the share of women times the share of men as gender diversity index*

	GMM-SYS				LP			
	Value added/hour (ln)		Mean wage/hour (ln)		VA-W (ln)		Value added/hour (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation age	-0.022*** (0.008)		-0.009*** (0.004)		-0.013* (0.007)		-0.007 (0.005)	
Age dissimilarity		-0.016*** (0.006)		-0.007*** (0.003)		-0.009* (0.005)		-0.005* (0.003)
Standard deviation education	0.008 (0.015)		0.016** (0.007)		-0.008 (0.013)		0.031*** (0.010)	
Education dissimilarity		0.006 (0.011)		0.012** (0.005)		-0.005 (0.010)		0.023*** (0.006)
Share of women * share of men	-0.390* (0.229)	-0.389* (0.229)	-0.234** (0.115)	-0.230** (0.116)	-0.156 (0.197)	-0.159 (0.197)	-0.160 (0.109)	-0.162* (0.090)
Average age	0.011*** (0.004)	0.011*** (0.004)	0.009*** (0.001)	0.009*** (0.001)	0.002 (0.003)	0.002 (0.003)	0.010*** (0.002)	0.010*** (0.003)
Average education	0.077*** (0.007)	0.077*** (0.007)	0.046*** (0.003)	0.046*** (0.003)	0.031*** (0.006)	0.031*** (0.006)	0.075*** (0.007)	0.075*** (0.007)
Hansen over-identification test, p-value	0.866	0.840	0.117	0.140	0.468	0.461		
Arellano-Bond test for AR(2), p-value	0.131	0.130	0.349	0.343	0.564	0.564		
Number of observations	7,463	7,463	7,463	7,463	7,463	7,463	7,461	7,463
Number of firms	2,431	2,431	2,431	2,431	2,431	2,431	2,431	2,431

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments.

Table 5.7: *GMM-SYS and LP estimation results including nonlinearities*

	Testing for nonlinearities at the 33rd percentile				Testing for nonlinearities at the 66th percentile				Testing for nonlinearities at 33rd and 66th percentiles			
	GMM-SYS		LP		GMM-SYS		LP		GMM-SYS		LP	
	Value-added (1)	Wage (2)	Gap (3)	Value-added (4)	Value-added (5)	Wage (6)	Gap (7)	Value-added (8)	Value-added (9)	Wage (10)	Gap (11)	Value-added (12)
Std. dev. age	-0.022* (0.013)	-0.005 (0.006)	-0.017 (0.011)	-0.006 (0.004)	-0.023** (0.011)	-0.009* (0.005)	-0.014 (0.010)	-0.003 (0.006)	-0.046*** (0.017)	-0.009 (0.007)	-0.037** (0.015)	-0.006 (0.007)
Std. dev. education	0.032 (0.020)	0.003 (0.010)	0.028 (0.018)	0.035*** (0.008)	-0.010 (0.016)	0.013 (0.009)	-0.023 (0.015)	0.042*** (0.012)	-0.035 (0.031)	-0.010 (0.014)	-0.024 (0.030)	0.038* (0.020)
Std. dev. gender	-0.233** (0.109)	-0.145** (0.060)	-0.088 (0.101)	-0.082 (0.058)	-0.278*** (0.099)	-0.180*** (0.057)	-0.098 (0.091)	-0.178*** (0.062)	-0.387*** (0.123)	-0.203*** (0.068)	-0.185 (0.113)	-0.133 (0.084)
Std. dev. age*p33	0.001 (0.003)	-0.002 (0.001)	0.003 (0.002)	0.001 (0.001)					0.010*** (0.003)	-0.001 (0.002)	0.010*** (0.003)	0.001 (0.002)
Std. dev. education*p33	-0.012 (0.012)	0.011* (0.006)	-0.022** (0.010)	0.005 (0.007)					0.017 (0.021)	0.015* (0.009)	0.001 (0.020)	0.003 (0.014)
Std. dev. gender*p33	0.004 (0.060)	-0.012 (0.034)	0.016 (0.052)	-0.076* (0.039)					0.147* (0.075)	0.014 (0.041)	0.132** (0.066)	-0.040 (0.056)
Std. dev. age*p66					0.001 (0.002)	-0.001 (0.001)	0.001 (0.002)	-0.001 (0.001)	0.012** (0.005)	-0.001 (0.002)	0.013*** (0.005)	0.000 (0.003)
Std. dev. education*p66					0.015 (0.009)	0.006 (0.005)	0.009 (0.009)	-0.005 (0.008)	0.033 (0.025)	0.023** (0.011)	0.010 (0.023)	-0.002 (0.014)
Std. dev. gender*p66					0.018 (0.066)	0.034 (0.031)	-0.016 (0.055)	0.080* (0.045)	0.163 (0.105)	0.057 (0.052)	0.106 (0.088)	0.044 (0.069)
Average age	0.011*** (0.003)	0.009*** (0.001)	0.002 (0.003)	0.011*** (0.002)	0.011*** (0.003)	0.009*** (0.001)	0.001 (0.003)	0.011*** (0.002)	0.011*** (0.003)	0.010*** (0.001)	0.002 (0.003)	0.011*** (0.002)
Average education	0.078*** (0.007)	0.047*** (0.004)	0.031*** (0.006)	0.079*** (0.006)	0.079*** (0.008)	0.047*** (0.003)	0.032*** (0.006)	0.079*** (0.007)	0.080*** (0.007)	0.048*** (0.004)	0.032*** (0.006)	0.079*** (0.006)
Hansen test, p-value	0.735	0.069	0.809		0.669	0.339	0.413		0.711	0.176	0.685	
AR(2) test, p-value	0.125	0.339	0.588		0.123	0.355	0.565		0.107	0.374	0.595	
Number of observations	7,463	7,463	7,463	7,463	7,463	7,463	7,463	7,463	7,463	7,463	7,463	7,463
Number of firms	2,431	2,431	2,431	2,431	2,431	2,431	2,431	2,431	2,431	2,431	2,431	2,431

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments. HT/KIS = 1 if the firm belongs to a high-medium tech/knowledge intensive sector, according to the taxonomy developed by Eurostat (2012). p3 (p66) is a dummy variable that takes the value one if the variable is greater than the 33rd percentile (66th percentile). When p33 and p66 are included simultaneously, p33 takes the value one if the variable is greater than the 33rd percentile and smaller than the 66th percentile. The dependent variables are respectively: i) the value-added (i.e. the value added per hour worked (ln)), ii) the wage (i.e. the mean wage per hour worked (ln)), and iii) the gap (i.e. value added-wage gap (ln)).

Results presented in Table 5.5 remain quite stable when replacing the gender standard deviation/dissimilarity index by an alternative indicator, namely the share of women times the share of men within firms.

We also tested for a non linear relationship between the dependent variables (productivity, wages and productivity-wage gaps) and diversity indices. Therefore, we respectively include diversity indices in level, squared (and cubed) and used dummy variables to test for structural breaks notably at the 33rd and 66th percentiles of the distribution of the diversity indices. Results show no evidence of nonlinearities.

5.5.2 Does the technological/knowledge environment matter?

HT/KIS nomenclature

The diversity-productivity-wage nexus is likely to vary across different work environments. Various theoretical arguments (reviewed in section 5.2.1) suggest in particular that the former may differ between knowledge intensive sectors and more traditional industries. Given the scarcity of empirical evidence on this issue, in this section we first present estimates of our model for two distinct types of firms: those belonging to high-medium tech/knowledge intensive sectors (HT/KIS) and those that do not. The subdivision of firms is based on a taxonomy developed by Eurostat (2012) that classifies manufacturing industries (at NACE 2- and/or 3-digit level) according to their degree of technological intensity (primarily assessed through the ratio of R&D expenditures to value added) and services (at NACE 2-digit level) according to their degree of knowledge intensity (i.e. the share of tertiary educated people in the activity).

HT/KIS firms are found in the following sectors: Aerospace (NACE 353); Computers, office machinery (NACE 30); Electronics-communications (NACE 32); Pharmaceuticals (NACE 244); Scientific instruments (NACE 33); Motor vehicles (NACE 34); Electrical machinery (NACE 31); Chemicals (NACE 24); Other transport equipment (NACE 352+354+355); Non-electrical machinery (NACE 29); Water transport (NACE 61); Air transport (NACE 62); Post and telecommunications (NACE 64); Financial intermediation, except insurance and pension funding (NACE 65); Insurance and pension funding, except compulsory social security (NACE 66); Activities

auxiliary to financial intermediation (NACE 67); Real estate activities (NACE 70); Renting of machinery and equipment without operator and of personal and household goods (NACE 71); Computer and related activities (NACE 72); Research and development (NACE 73); Other business activities (NACE 74); Education (NACE 80); Health and social work (NACE 85); Recreational, cultural and sporting activities (NACE 92). Non-HT/KIS firms are found in the following sectors: Rubber and plastic products (NACE 25); Shipbuilding (NACE 351); Other manufacturing (NACE 362 through 366); Non-ferrous metals (NACE 274+2753/54); Non-metallic mineral products (NACE 26); Fabricated metal products (NACE 28); Petroleum refining (NACE 23); Ferrous metals (NACE 271 through 273+2751/52); Paper printing (NACE 21+22); Textile and clothing (NACE 17 through 19); Food, beverages, and tobacco (NACE 15+16); Wood and furniture 20+361); Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel (NACE 50); Wholesale trade and commission trade, except of motor vehicles and motorcycles (NACE 51); Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (NACE 52); Hotels and restaurants (NACE 55); Land transport; transport via pipelines (NACE 60); Supporting and auxiliary transport activities; activities of travel agencies (NACE 63); Public administration and defense; compulsory social security (NACE 75); Sewage and refuse disposal, sanitation and similar activities (NACE 90); Activities of membership organization n.e.c. (NACE 91); Other service activities (NACE 93); Private households with employed persons (NACE 95); Extra-territorial organizations and bodies (NACE 99).

Applied to our sample, this taxonomy classifies 679 firms as HT/KIS and 1,778 as non-HT/KIS firms.²⁵ As shown in Table 5.2, these two types of firms differ along several dimensions. Both the average hourly value added and wage are higher in HT/KIS compared to non-HT/KIS firms, confirming the intuition that HT/KIS firms are in general more productive. Moreover, HT/KIS firms are found to have a significantly larger capital stock and to invest more. Differences in age, educational and occupational composition also exist: the workforce of HT/KIS firms is on average much more

²⁵The sum of HT/KIS and non-HT/KIS firms (2,457) is greater than the total number of firms in the baseline model (2,431). This is due to a small number of firms that changed NACE codes during the period 1999-2006. Suppression of these firms does not affect our conclusions.

concentrated in white collar occupations (62 vs. 39 percent), somewhat more educated and slightly younger compared to non-HT/KIS firms. Interestingly, HT/KIS firms are also characterised by a more feminine labour force (33 vs. 24 percent). Both HT/KIS and non-HT/KIS employment is predominantly concentrated in the manufacturing sector (respectively around 53 and 59 percent). Yet, while almost 40 percent of HT/KIS employment is found in real estate, renting and business activities and financial intermediation, about a third of non-HT/KIS workers is employed in the construction and wholesale and retail trade industry (including repair of motor vehicles, motorcycles and personal and household goods).

To formally test for differences between HT/KIS and non-HT/KIS firms, we add to our benchmark specification: i) a dummy variable that indicates if the firm is classified as HT/KIS, and ii) interactions between this HT/KIS dummy and first and second moments of age, education and gender variables.

Results based on GMM-SYS and LP estimators are reported in Tables 5.8 and 5.9. The reliability of GMM-SYS estimates is supported by the outcomes of the Hansen and Arellano-Bond tests. For all specifications, they respectively do not reject the null hypothesis of valid instruments²⁶ and of no second-order autocorrelation in first differenced errors.

Overall, GMM-SYS and LP estimates again suggest that age (educational) diversity is detrimental (beneficial) for firm productivity. Moreover, given that interaction effects with the HT/KIS dummy variable are systematically insignificant, it appears that the size of the elasticity between productivity and diversity in age and education does not depend on firms' technological environment and knowledge-intensity. Furthermore, results indicate that age and educational diversity have a similar impact on wages and productivity. On the whole, they thus suggest that profitability (i.e. the productivity-wage gap) does not depend on the diversity of the workforce in terms of education or age.

²⁶Yet, it should be acknowledged that Hansen over-identification tests for the firm-level wage regressions are significant at the 5% level (p-values are respectively equal to 0.055 and 0.065). Therefore, results for wages should be interpreted with caution.

Table 5.8: *GMM-SYS and LP estimation results for different technological/knowledge environments (HT/KIS nomenclature) with standard deviation*

		GMM-SYS		LP
	Value added/hour (ln)	Mean wage/hour (ln)	VA-W gap (ln)	Value added/hour (ln)
	(1)	(2)	(3)	(4)
Standard deviation age	-0.022** (0.010)	-0.011** (0.005)	-0.011 (0.009)	-0.001 (0.005)
Standard deviation education	0.011 (0.022)	0.001 (0.010)	0.010 (0.021)	0.025*** (0.009)
Standard deviation gender	-0.327** (0.136)	-0.172** (0.068)	-0.155 (0.123)	-0.194*** (0.069)
Standard deviation age*HT/KIS	0.011 (0.026)	0.006 (0.012)	0.005 (0.024)	-0.014 (0.009)
Standard deviation education*HT/KIS	-0.007 (0.056)	0.039* (0.022)	-0.047 (0.049)	0.033 (0.024)
Standard deviation gender*HT/KIS	0.716* (0.398)	0.174 (0.139)	0.542 (0.361)	0.343** (0.147)
Average age	-0.005 (0.016)	0.003 (0.008)	-0.008 (0.014)	0.008*** (0.003)
Average education	0.055 (0.043)	0.002 (0.020)	0.053 (0.040)	0.063*** (0.005)
Average age*HT/KIS	0.035* (0.021)	-0.001 (0.010)	0.036** (0.018)	0.006 (0.004)
Average education*HT/KIS	0.066 (0.064)	0.064** (0.029)	0.002 (0.053)	0.037*** (0.010)
HT/KIS	-2.552*** (0.981)	-0.934** (0.453)	-1.618* (0.868)	-0.691*** (0.213)
Hansen over-identification test, p-value	0.177	0.055	0.334	
Arellano-Bond test for AR(2), p-value	0.117	0.458	0.499	
Number of observations	7,463	7,463	7,463	7,461
Number of firms	2,431	2,431	2,431	2,431

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments. HT/KIS = 1 if the firm belongs to a high-medium tech/knowledge intensive sector, according to the taxonomy developed by Eurostat (2012).

Table 5.9: *GMM-SYS and LP estimation results for different technological/knowledge environments (HT/KIS nomenclature) with dissimilarity index*

	GMM-SYS			LP
	Value added/hour (ln)	Mean wage/hour (ln)	VA-W gap (ln)	Value added/hour (ln)
	(1)	(2)	(3)	(4)
Age dissimilarity	-0.017** (0.007)	-0.007** (0.003)	-0.009 (0.007)	-0.001 (0.003)
Education dissimilarity	0.006 (0.016)	0.001 (0.007)	0.019*** (0.007)	0.019*** (0.007)
Gender dissimilarity	-0.230** (0.100)	-0.119** (0.050)	-0.112 (0.089)	-0.142*** (0.039)
Age dissimilarity*HT/KIS	0.011 (0.019)	0.004 (0.009)	0.007 (0.017)	-0.010 (0.007)
Education dissimilarity*HT/KIS	-0.001 (0.040)	0.026 (0.016)	-0.028 (0.034)	0.023 (0.017)
Gender dissimilarity*HT/KIS	0.527* (0.283)	0.121 (0.102)	0.406 (0.255)	0.261*** (0.091)
Average age	-0.003 (0.016)	0.003 (0.008)	-0.006 (0.014)	0.008*** (0.003)
Average education	0.048 (0.042)	0.002 (0.019)	0.046 (0.039)	0.064*** (0.007)
Average age*HT/KIS	0.034 (0.021)	-0.000 (0.010)	0.034* (0.018)	0.006 (0.004)
Average education*HT/KIS	0.073 (0.064)	0.062** (0.029)	0.011 (0.052)	0.037*** (0.013)
HT/KIS	-2.635*** (0.972)	-0.896** (0.452)	-1.739** (0.860)	-0.689*** (0.212)
Hansen over-identification test, p-value	0.192	0.065	0.306	
Arellano-Bond test for AR(2), p-value	0.116	0.442	0.502	
Number of observations	7,463	7,463	7,463	7,463
Number of firms	2,431	2,431	2,431	2,431

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments. HT/KIS = 1 if the firm belongs to a high-medium tech/knowledge intensive sector, according to the taxonomy developed by Eurostat (2012).

We find remarkable results regarding the consequences of gender diversity on productivity. Indeed, while gender diversity is still found to hamper firms' productivity in more traditional sectors, firms belonging to high-medium tech/knowledge intensive sectors appear to be significantly more productive when employing a more gender-balanced workforce. More precisely, estimates suggest that if gender diversity - measured respectively through the standard deviation and dissimilarity index - increases by one standard deviation, productivity increases (decreases) on average by between 2.5 and 6 percent (3 and 5 percent) in HT/KIS firms (non-HT-KIS firms). Besides, results show that gender diversity has no significant influence on the productivity-wage gap in both types of environments.

KIA and ICT nomenclatures

To examine the robustness of these results, we used two alternative taxonomies enabling to distinguish between knowledge-intensive industries and more traditional sectors. The first alternative taxonomy is Eurostat's classification of Knowledge Intensive Activities (KIA). It differs from the HT/KIS classification in that it applies the same methodology to all sectors of industries and services. Moreover, it focuses solely on the level of education of the labour force. Both the HT/KIS and KIA nomenclatures classify service industries as knowledge intensive if the share of tertiary educated workers represents more than one third of total employment.²⁷ In our specification, being HT/KIS or KIA is therefore potentially correlated with our explanatory variables *average education* and *educational diversity*, which could dilute the measurement of the actual impact of education on the dependent variables. To check if this problem affects our conclusions, we also use an alternative classification of industries that is not directly based workers' educational level, namely the ICT

²⁷KIA firms are found in the following sectors: Manufacture of coke, refined petroleum products and nuclear fuel (NACE 23); Manufacture of chemicals and chemical products (NACE 24); Manufacture of office machinery and computers (NACE 30); Manufacture of radio, television and communication equipment and apparatus (NACE 32); Manufacture of medical, precision and optical instruments, watches and clocks (NACE 33); Air transport (NACE 62); Financial intermediation, except insurance and pension funding (NACE 65); Insurance and pension funding, except compulsory social security (NACE 66); Activities auxiliary to financial intermediation (NACE 67); Computer and related activities (NACE 72); Research and development (NACE 73); Other business activities (NACE 74); Public administration and defence; compulsory social security (NACE 75); Education (NACE 80); Health and social work (NACE 85); Activities of membership organizations n.e.c. (NACE 91), Recreational, cultural and sporting activities (NACE 92); Extra-territorial organizations and bodies (NACE 99).

Table 5.10: *Correlation coefficients between HT/KIS, KIA and ICT taxonomies*

	HT/KIS	KIA	ICT
HT/KIS	1		
KIA	0.59	1	
ICT	0.49	0.22	1

classification developed by O'Mahony and van Ark (2003). The latter classifies industries according to their ICT capital intensity at the NACE 3-digit level. Industry groups are based on whether they produce ICT goods and services and whether they intensively use ICT or not.²⁸

Results based on KIA and ICT classifications are shown in Tables 5.11 and 5.12. They are very similar to those obtained on the basis of the HT/KIS classification. This is quite remarkable, particularly given that correlation coefficients between HT/KIS, KIA and ICT taxonomies are not very high (see Table 5.10).

Overall, results again highlight that productivity depends positively (negatively) on educational (age) diversity. Moreover, they show that gender diversity is detrimental (beneficial) for firm added value in traditional (knowledge/ICT intensive) industries. In line with our benchmark specification (see Table 5.8), results also indicate that age (educational) diversity has a negative (no significant) impact on firm

²⁸ICT firms are found in the following sectors: Clothing (NACE 18); Printing and publishing (NACE 22); Mechanical engineering (NACE 29); Other electrical machinery and apparatus, except insulated wire (NACE 31); Other instruments, except scientific instruments (NACE 33); Building and repairing of ships and boats (NACE 351); Aircraft and spacecraft (NACE 353); Furniture, miscellaneous manufacturing; recycling (NACE 36-37); Wholesale trade and commission trade, except of motor vehicles and motorcycles (NACE 51); Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (NACE 52); Financial activities, except insurance and pension funding (NACE 65); Activities auxiliary to financial intermediation (NACE 67); Renting of machinery and equipment (NACE 71); Legal, technical and advertising (NACE 741-743); Office machinery (NACE 30); Insulated wire (NACE 313); Electronic valves and tubes (NACE 321); Telecommunication equipment (NACE 322); Radio and television receivers (NACE 323); Scientific instruments (NACE 331); Communications (NACE 64); Computer and related activities (NACE 72). Non-ICT firms are found in the following sectors: Quarrying (NACE 14); Food, drink and tobacco (NACE 15-16); Textiles (NACE 17); Leather and footwear (NACE 19); Wood and products of wood and cork (NACE 20); Pulp, paper and paper products (NACE 21); Mineral oil refining, coke and nuclear fuel (NACE 23); Chemicals (NACE 24); Rubbers and plastics (NACE 25); Non-metallic mineral products (NACE 26); Basic metals (NACE 27); Fabricated metal products (NACE 28); Motor vehicles (NACE 34); Construction (NACE 45); Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel (NACE 50); Hotels and restaurants (NACE 55); Inland transport (NACE 60); Water transport (NACE 61); Air transport (NACE 62); Supporting and auxiliary transport activities; activities of travel agencies (NACE 63); Real estate activities (NACE 70); Other business activities (NACE 749).

profits. As regards the influence of gender diversity on the productivity-wage gap, results depend on whether we use the ICT or KIA nomenclatures. In the former case, profits do not depend on whether the labour force is gender-balanced or not. In the latter, gender diversity is found to increase (decrease) profits in firms belonging to knowledge intensive (traditional) sectors.

5.5.3 Does the diversity effect vary according to firm size?

The effect of diversity may vary according to firm size. To formally test for differences between small and big firms, we interact the first and second moments of age, education and gender variables with firm size. Secondly we also add to our benchmark specification: i) a dummy variable indicating if the firm employs more than 500 workers, and ii) interaction effects between this dummy and the first and second moments of age, education and gender variables.²⁹

Results based on GMM-SYS and LP estimators are reported in Tables 5.13, 5.14, 5.15 and 5.16. The reliability of GMM-SYS estimates relative to the productivity and gap equations is supported by the Hansen and Arellano-Bond tests. GMM-SYS results for the wage equation should be interpreted with caution as the p-value associated to the Hansen test is below 0.05. Our regression results suggest that interaction effects between firm size and diversity variables are either not significant or quantitatively very small. Taken at face value, they indicate that the effects of diversity do not substantially depend on firm size.

²⁹We also examined alternative specifications fixing the threshold for firm size respectively at 100, 200, 250 and 300 workers. In addition, we tested for interaction effects with firm size in technological/knowledge intensive sectors and more traditional industries (using respectively the HT/KIS, KIA and ICT nomenclatures). Results support our conclusion, namely that the diversity-productivity-wage nexus does not substantially vary with firm size.

Table 5.11: *GMM-SYS and LP estimates using the KIA taxonomy*

	GMM-SYS			LP
	Value added/hour (ln) (1)	Mean wage/hour (ln) (2)	VA-W (3)	Value added/hour (4)
Standard deviation age	-0.020** (0.008)	-0.004 (0.004)	-0.016** (0.007)	-0.005 (0.004)
Standard deviation education	0.017 (0.015)	0.013* (0.007)	0.005 (0.014)	0.024*** (0.009)
Standard deviation gender	-0.329*** (0.107)	-0.080 (0.055)	-0.249** (0.103)	-0.137** (0.069)
Standard deviation age *KIA	-0.000 (0.027)	-0.018* (0.010)	0.018 (0.023)	-0.005 (0.012)
Standard deviation education*KIA	-0.021 (0.042)	0.017 (0.020)	-0.038 (0.034)	0.039 (0.024)
Standard deviation gender*KIA	0.696** (0.330)	0.025 (0.140)	0.671** (0.288)	0.133 (0.148)
Average age	0.002 (0.003)	0.008*** (0.001)	-0.006* (0.003)	0.004* (0.002)
Average education	0.063*** (0.008)	0.031*** (0.004)	0.031*** (0.007)	0.059*** (0.006)
Average age *KIA	0.031*** (0.008)	0.007** (0.003)	0.024*** (0.007)	0.024*** (0.005)
Average education*KIA	0.037** (0.014)	0.038*** (0.007)	-0.001 (0.012)	0.051*** (0.010)
KIA	-1.605*** (0.340)	-0.448*** (0.159)	-1.156*** (0.301)	-1.459*** (0.211)
Hansen over-identification test, p-value	0.639	0.001	0.674	
Arellano-Bond test for AR(2), p-value	0.161	0.375	0.590	
Number of observations	7,463	7,463	7,463	7,463
Number of firms	2,431	2,431	2,431	2,431

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments. KIA = 1 if the firm belongs to a knowledge intensive industry, according to the taxonomy developed by Eurostat (2012).

Table 5.12: *GMM-SYS and LP estimates using the ICT taxonomy*

	Value added/hour (ln) (1)	Mean wage/hour (ln) (2)	VA-W (3)	Value added/hour (4)
Standard deviation age	-0.039*** (0.011)	-0.013*** (0.005)	-0.026*** (0.009)	-0.003 (0.006)
Standard deviation education	0.008 (0.016)	0.017** (0.008)	-0.008 (0.015)	0.033*** (0.010)
Standard deviation gender	-0.362*** (0.124)	-0.186*** (0.065)	-0.176 (0.114)	-0.208*** (0.069)
Standard deviation age *ICT	0.051** (0.024)	0.012 (0.011)	0.040** (0.020)	-0.005 (0.008)
Standard deviation education*ICT	0.017 (0.037)	0.008 (0.018)	0.009 (0.032)	0.000 (0.019)
Standard deviation gender*ICT	0.533** (0.265)	0.237* (0.138)	0.295 (0.233)	0.366*** (0.118)
Average age	0.019*** (0.004)	0.010*** (0.002)	0.009*** (0.003)	0.010*** (0.003)
Average education	0.067*** (0.008)	0.036*** (0.004)	0.031*** (0.007)	0.060*** (0.006)
Average age *ICT	-0.025*** (0.007)	-0.002 (0.003)	-0.023*** (0.005)	-0.002 (0.004)
Average education*ICT	0.036** (0.015)	0.032*** (0.007)	0.004 (0.012)	0.042*** (0.012)
ICT	-0.184 (0.313)	-0.481*** (0.149)	0.297 (0.269)	-0.482** (0.226)
Hansen over-identification test, p-value	0.553	0.088	0.183	
Arellano-Bond test for AR(2), p-value	0.063	0.336	0.509	
Number of observations	7,463	7,463	7,463	7,463
Number of firms	2,431	2,431	2,431	2,431

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments. ICT = 1 if the firm belongs to a sector using or producing intensively ICT (information and communication technology) goods and services, according to the taxonomy developed by O'Mahony and van Ark (2003).

Table 5.13: *GMM-SYS and LP estimation results including interaction effects with firm size with standard deviation*

		GMM-SYS		LP
	Value added/hour (ln)	Mean wage/hour (ln)	VA-W gap (ln)	Value added/hour (ln)
	(1)	(2)	(3)	(4)
Standard deviation age	-0.023** (0.011)	-0.014*** (0.005)	-0.010 (0.009)	-0.0040 (0.005)
Standard deviation education	-0.012 (0.022)	0.020** (0.010)	-0.032* (0.018)	0.027*** (0.010)
Standard deviation gender	-0.261** (0.113)	-0.061 (0.063)	-0.200** (0.100)	-0.194*** (0.075)
Standard deviation age * firm size	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Standard deviation education * firm size	0.000 (0.000)	0.000 (0.000)	0.000* (0.000)	0.000** (0.000)
Standard deviation gender * firm size	0.000 (0.000)	0.000 (0.000)	0.000* (0.000)	0.000** (0.000)
Average age	0.018*** (0.004)	0.013*** (0.002)	0.005 (0.003)	0.014*** (0.003)
Average education	0.058*** (0.009)	0.045*** (0.004)	0.013* (0.007)	0.068*** (0.007)
Average age * firm size	-0.000** (0.000)	-0.000*** (0.000)	-0.000 (0.000)	-0.000*** (0.000)
Average education * firm size	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000** (0.000)
Hansen over-identification test, p-value	0.404	0.002	0.692	
Arellano-Bond test for AR(2), p-value	0.159	0.584	0.693	
Number of observations	7,463	7,463	7,463	7,461
Number of firms	2,431	2,431	2,431	2,431

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments.

Table 5.14: *GMM-SYS and LP estimation results including interaction effects with firm size with dissimilarity index*

		GMM-SYS		LP
	Value added/hour (ln)	Mean wage/hour (ln)	VA-W gap (ln)	Value added/hour (ln)
	(1)	(2)	(3)	(4)
Age dissimilarity	-0.017** (0.008)	-0.001** (0.004)	-0.007 (0.006)	-0.002 (0.003)
Education dissimilarity	-0.007 (0.016)	0.015** (0.007)	-0.022* (0.013)	0.021*** (0.007)
Gender dissimilarity	-0.176** (0.088)	-0.039 (0.048)	-0.137** (0.075)	-0.136** (0.058)
Age dissimilarity * firm size	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Education dissimilarity * firm size	0.000 (0.000)	0.000 (0.000)	0.000* (0.000)	0.000* (0.000)
Gender dissimilarity * firm size	0.000 (0.000)	-0.000 (0.000)	0.000* (0.000)	0.000* (0.000)
Average age	0.018*** (0.004)	0.013*** (0.002)	0.005 (0.003)	0.014*** (0.003)
Average education	0.058*** (0.009)	0.045*** (0.004)	0.013* (0.007)	0.068*** (0.007)
Average age * firm size	-0.000** (0.000)	-0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Average education * firm size	0.000*** (0.000)	0.000 (0.000)	0.000** (0.000)	0.000** (0.000)
Hansen over-identification test, p-value	0.478	0.002	0.713	
Arellano-Bond test for AR(2), p-value	0.164	0.569	0.698	
Number of observations	7,463	7,463	7,463	7,461
Number of firms	2,431	2,431	2,431	2,431

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments.

Table 5.15: *GMM-SYS and LP estimation results including interaction effects for big firms, i.e. firms employing more than 500 workers*

	GMM-SYS			LP
	Value added/hour (ln)	Mean wage/hour (ln)	VA-W gap (ln)	Value added/hour (ln)
	(1)	(2)	(3)	(4)
Standard deviation age	-0.017*	-0.004	-0.013	-0.005
	(0.009)	(0.004)	(0.008)	(0.004)
Standard deviation education	0.006	0.021***	-0.015	0.035***
	(0.013)	(0.007)	(0.012)	(0.008)
Standard deviation gender	-0.225**	-0.101*	-0.124	-0.097
	(0.112)	(0.060)	(0.099)	(0.066)
Std. dev. age * size > 500	-0.025	-0.025	0.001	-0.008
	(0.040)	(0.017)	(0.035)	(0.017)
Std. dev. education * size > 500	0.047	0.005	0.042	0.036
	(0.039)	(0.019)	(0.034)	(0.027)
Std. dev. gender * size > 500	0.155	-0.108	0.263	0.200
	(0.453)	(0.198)	(0.412)	(0.198)
Average age	0.014***	0.010***	0.004	0.011***
	(0.003)	(0.001)	(0.003)	(0.002)
Average education	0.074***	0.049***	0.026***	0.075***
	(0.006)	(0.003)	(0.004)	(0.006)
Average age * size > 500	-0.006	0.004	-0.009	-0.003
	(0.010)	(0.005)	(0.008)	(0.008)
Average education * size > 500	0.047**	0.016**	0.030*	0.046**
	(0.020)	(0.008)	(0.016)	(0.022)
Size > 500	-0.108	0.002	-0.110	-0.414
	(0.475)	(0.242)	(0.431)	(0.416)
Hansen over-identification test, p-value	0.736	0.003	0.681	
Arellano-Bond test for AR(2), p-value	0.114	0.692	0.655	
Number of observations	7,463	7,463	7,463	7,461
Number of firms	2,431	2,431	2,431	2,431

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments.

Table 5.16: *GMM-SYS and LP estimation results including interaction effects for big firms, i.e. firms employing more than 500 workers*

	GMM-SYS			LP
	Value added/hour (ln)	Mean wage/hour (ln)	VA-W gap (ln)	Value added/hour (ln)
	(1)	(2)	(3)	(4)
Age dissimilarity	-0.012* (0.007)	-0.000 (0.001)	-0.009 (0.006)	-0.003 (0.003)
Education dissimilarity	0.005 (0.010)	0.001 (0.002)	-0.011 (0.009)	0.026*** (0.006)
Gender dissimilarity	-0.146* (0.084)	0.027 (0.017)	-0.076 (0.074)	-0.066** (0.031)
Age dissimilarity * size > 500	-0.022 (0.030)	-0.006* (0.003)	-0.000 (0.026)	-0.005 (0.011)
Education dissimilarity * size > 500	0.030 (0.028)	-0.004 (0.005)	0.029 (0.024)	0.026 (0.017)
Gender dissimilarity * size > 500	0.062 (0.325)	-0.097*** (0.037)	0.175 (0.286)	0.137 (0.140)
Average age	0.014*** (0.003)	0.001 (0.001)	0.004 (0.003)	0.011*** (0.002)
Average education	0.074*** (0.006)	-0.001 (0.002)	0.026*** (0.004)	0.075*** (0.007)
Average age * size > 500	-0.005 (0.010)	-0.000 (0.002)	-0.009 (0.008)	-0.003 (0.007)
Average education * size > 500	0.047** (0.020)	0.003 (0.003)	0.030* (0.016)	0.046** (0.019)
Size > 500	-0.043 (0.486)	0.100 (0.091)	-0.097 (0.429)	-0.413 (0.361)
Hansen over-identification test, p-value	0.748	0.004	0.658	
Arellano-Bond test for AR(2), p-value	0.115	0.684	0.650	
Number of observations	7,463	7,463	7,463	7,463
Number of firms	2,431	2,431	2,431	2,431

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments.

5.5.4 Interdependencies between diversity dimensions

Analyzing several diversity dimensions, we may have interdependencies between the different dimensions that should be taken into account. We have tested for interdependencies between the three diversity dimensions analysed in the paper. We notably i) computed the pairwise correlations; ii) estimated regressions including interaction variables; and iii) tested for interdependencies using the faultlines approach.

First, Tables 5.17 and 5.18 show the bilateral correlations between age, gender and educational diversity as measured by the standard deviation and dissimilarity index, respectively. Despite being all statistically significant, none of the pairwise correlations exceeds 0.15 and especially the link between age and gender diversity appears to be weak. This suggests that the three dimensions of diversity are not highly correlated.

Table 5.17: *Correlation between diversity measured by standard deviation*

	Education diversity	Age diversity	Gender diversity
Education diversity	1		
Age diversity	0.147***	1	
Gender diversity	0.108***	-0.045***	1

Table 5.18: *Correlation between diversity measured by dissimilarity index*

	Education diversity	Age diversity	Gender diversity
Education diversity	1		
Age diversity	0.149***	1	
Gender diversity	0.102***	-0.051***	1

Second, Table 5.19 looks at interdependencies through the use of interaction variables in the regression analysis. The interactions between age and gender as well as between education and gender are not significantly different from zero in the productivity, wage and profit equations. By contrast, the interaction between age and education, which also showed the highest pairwise correlation, has a slightly negative but statistically significant coefficient in the productivity and gap equations. This suggests the negative productivity effect of age diversity rises modestly as education diversity increases.

Table 5.19: *GMM-SYS estimations with interactions.*

	(1) Value added/hour (ln)	(2) Mean wage/hour (ln)	(3) VA-W gap (ln)		(1) Value added/hour (ln)	(2) Mean wage/hour (ln)	(3) VA-W gap (ln)
Age std. dev.	-0.017*** (0.006)	-0.008** (0.003)	-0.009* (0.006)	Age diss.	-0.013*** (0.005)	-0.005** (0.002)	-0.007* (0.004)
Edu std. dev.	0.014 (0.013)	0.020*** (0.007)	-0.006 (0.012)	Edu diss	0.009 (0.009)	0.014*** (0.005)	-0.005 (0.008)
Gender std. dev.	-0.122 (0.093)	-0.093* (0.049)	-0.030 (0.080)	Gender diss	-0.075 (0.072)	-0.062* (0.037)	-0.013 (0.060)
Age std. dev.	-0.005** (0.002)	0.000 (0.001)	-0.005*** (0.002)	Age diss	-0.003*** (0.001)	0.000 (0.000)	-0.003*** (0.001)
*Edu std. dev.	-0.009 (0.012)	-0.005 (0.006)	-0.004 (0.011)	*Edu diss	-0.005 (0.007)	-0.003 (0.003)	-0.002 (0.006)
Age std. dev.	0.022 (0.050)	0.017 (0.022)	0.004 (0.044)	Age diss	0.016 (0.027)	0.010 (0.012)	0.006 (0.024)
*Gender std. dev.	0.016*** (0.004)	0.012*** (0.002)	0.004 (0.003)	*Gender diss	0.016*** (0.004)	0.012*** (0.002)	0.004 (0.003)
Edu average	0.082*** (0.008)	0.051*** (0.003)	0.032*** (0.006)	Edu average	0.082*** (0.008)	0.051*** (0.004)	0.031*** (0.006)
Observations	7463	7463	7463	Observations	7463	7463	7463
Number of firms	2431	2431	2431	Number of firms	2431	2431	2431
P-value Hansen test	0.799	0.020	0.842	P-value Hansen test	0.783	0.021	0.850
P-value AR(2)	0.140	0.411	0.568	P-value AR(2)	0.141	0.404	0.570

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported between brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include first and second lags of explanatory variables (except time dummies) as instruments.

It should be noted, however, that estimates in this regression suffer from multicollinearity (VIF above 10) so that the result of a small interdependence between age and educational diversity should be considered with caution.

Third, we have estimated faultline indicators following the methodology described in Van Knippenberg et al. (2011). We notably use the square of the coefficient of determination derived from a firm-level regression of one diversity dimension with respect to another (age diversity vs. education diversity; age diversity vs. gender diversity; education diversity vs. gender diversity). This indicator allows capturing how much of the variance in one diversity dimension is explained by the other. It also has the advantage of a meaningful scale: a value of 0 is interpreted as no faultline (and hence no relationship) and 1 a complete faultline (full overlap).

The results of estimations using the faultline approach are presented in Tables 5.20 and 5.21 (diversity measured respectively with the standard deviation and dissimilarity index). They show no consistent evidence for the presence of faultlines across diversity indicators. Only the estimates based on the Levinsohn and Petrin estimator and using the standard deviation as diversity indicator suggest a significant and positive interdependence between age and education diversity and a negative interdependence between education and gender diversity.

5.6 Discussion and conclusion

This chapter estimates the impact of workforce diversity (in terms of education, age and gender) on productivity, wages and productivity-wage gaps (i.e. profits). It contributes significantly to the existing literature as it is one of the first studies: i) to use large representative data (i.e. Belgian linked employer-employee panel data covering most private sector firms over the period 1999-2006), ii) to address important methodological issues such as firm-level invariant heterogeneity and endogeneity, iii) to examine how the benefits or losses of labour diversity are shared between workers and firms (i.e. to extend the analysis to wages and productivity-wage gaps), iv) to investigate whether the diversity-productivity-wage nexus depends on the degree of technological/knowledge intensity of firms, v) to test whether results vary according

Table 5.20: *Estimation results with standard deviation using faultline approach*

	GMM-SYS			LP
	VA/h (ln) (1)	W/h (ln) (2)	VA-W gap (ln) (3)	VA/h (ln) (4)
Age std. dev.	-0.020** (0.008)	-0.007** (0.004)	-0.013* (0.007)	-0.006*** (0.001)
Education std. dev.	0.013 (0.014)	0.023*** (0.007)	-0.010 (0.013)	0.034*** (0.009)
Gender std. dev.	-0.148 (0.118)	-0.084 (0.059)	-0.064 (0.105)	-0.076*** (0.010)
Faultline age&edu	-0.018 (0.057)	-0.022 (0.023)	0.004 (0.051)	0.019*** (0.005)
Faultline age&gender	-0.006 (0.072)	-0.043 (0.031)	0.036 (0.065)	-0.027 (0.065)
Faultline edu&gender	-0.001 (0.052)	0.037 (0.026)	-0.038 (0.046)	-0.038*** (0.014)
Age average	0.014*** (0.003)	0.012*** (0.001)	0.003 (0.003)	0.011*** (0.002)
Education average	0.084*** (0.008)	0.051*** (0.003)	0.033*** (0.006)	0.078*** (0.002)
Observations	7463	7463	7463	7461
Number of firms	2431	2431	2431	2431
P-value Hansen test	0.253	0.030	0.330	
P-value AR(2)	0.156	0.311	0.594	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors are reported in brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include 1st and 2nd lags of explanatory variables (except time dummies) as instruments.

Table 5.21: *Estimation results with dissimilarity index using faultline approach*

	GMM-SYS			LP
	VA/h (ln) (1)	W/h (ln) (2)	VA-W gap (ln) (3)	VA/h (ln) (4)
Age diss	-0.014** (0.006)	-0.005* (0.003)	-0.009* (0.005)	-0.004* (0.003)
Education diss	0.010 (0.010)	0.017*** (0.005)	-0.007 (0.009)	0.026*** (0.007)
Gender diss	-0.087 (0.086)	-0.055 (0.042)	-0.032 (0.076)	-0.050 (0.053)
Faultline age&edu	-0.019 (0.057)	-0.022 (0.023)	0.004 (0.051)	0.018 (0.040)
Faultline age&gender	-0.011 (0.072)	-0.044 (0.031)	0.033 (0.065)	-0.029 (0.038)
Faultline edu&gender	-0.006 (0.052)	0.035 (0.026)	-0.042 (0.045)	-0.040 (0.030)
Age average	0.014*** (0.003)	0.011*** (0.001)	0.003 (0.003)	0.011*** (0.002)
Education average	0.084*** (0.008)	0.051*** (0.003)	0.033*** (0.006)	0.078*** (0.005)
Observations	7463	7463	7463	7461
Number of random	2431	2431	2431	2431
P-value Hansen test	0.254	0.0361	0.328	
P-value AR(2)	0.158	0.302	0.597	

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors are reported in brackets. Regressions also control for: % workers with 10 years of tenure or more, % white-collar workers, % employees with a fixed-term contract, % part-time workers, firm size and capital stock, industries (8 dummies), and years dummies (7). AR(2) refers to second-order autocorrelation in first-differenced errors. GMM-SYS specifications include 1st and 2nd lags of explanatory variables (except time dummies) as instruments.

to firm size.

Findings, based on the generalized method of moments (GMM) and Levinsohn and Petrin (2003) estimators, show that educational diversity is beneficial for firm productivity and wages. In contrast, age and gender diversity are found to hamper firm-level added value and average earnings. The magnitude of these effects is relatively big: estimates notably suggest that when age or gender diversity (educational diversity) increases by one standard deviation, productivity drops (rises) on average by around 4 percent (almost 3 percent). Yet, the consequences of gender diversity are found to depend on the technological/knowledge intensity of firms. Gender diversity generates gains in high-tech/knowledge intensive sectors: productivity is found to rise on average by between 2.5 and 6 percent following a one standard deviation increase in gender diversity. The reverse result is obtained in more traditional industries. Overall, findings do not point to sizeable productivity-wage gaps associated with educational and gender diversity. Age diversity, on the opposite, is generally found to decrease firm's profitability.

Belgium is no exception regarding the labour market trends that affect diversity (ageing, increase in education levels and female labour market participation) in most OECD countries. Our estimations for Belgium suggest that the effects of these changes are also similar to those found in other economies. Results are notably in line with those obtained for Denmark by Parrotta et al. (2014a) showing a negative effect of demographic diversity (age, gender and ethnicity) and a positive one of educational diversity. Also Navon (2009) finds a positive effect of education diversity in Israel. Negative effects of age diversity are also in line with those found for the U.S. at company level by Hamilton et al. (2004), Kurtulus (2011) and Leonard and Levine (2003). The latter also find insignificant (or no substantial) evidence of the impact of gender diversity on sales, which is similar to our results for profits that do not account for the knowledge intensity of firms (gender diversity is significant in high-tech/knowledge intensive sectors). Our findings only contrast with those of Ilmakunnas and Ilmakunnas (2011) for Finland who show a positive effect of age diversity and a negative one of educational diversity.

How can these findings be interpreted? Results from our benchmark specification

showing that educational (age and gender) diversity improves (hamper) firm productivity are consistent with the theoretical predictions of Lazear (1999) and Jehn et al. (1999) highlighting that diversity benefits productivity if the gains of a more diverse workforce in terms of complementary skills and information sets outweigh additional costs related to communication and conflicts. Moreover, they argue that this condition is unlikely to be satisfied for demographic diversity (heterogeneity in terms of e.g. age and gender) but may well be fulfilled for educational (i.e. task related) heterogeneity. In line with our results, they indeed suggest that mutual learning and collaboration among workers with different educational backgrounds may be sufficient to enhance efficiency. Results for gender and age diversity are more in line with the conclusions of the organizational literature (see e.g. Pfeffer, 1985), which emphasize the importance of social similarity (notably in terms of gender and age) to stimulate interaction, communication and cohesion among the workforce.

Interaction effects between gender diversity and the technological/knowledge environment of firms can be reconciled with the predictions of Prat (2002) and Jehn *et al.* (1999). The latter argue that the benefits of diversity are more likely to exceed the costs when the work environment is predominantly characterized by complex (rather than routine) tasks, negative complementarities (i.e. workers' actions are substitutes in the firm's payoff function) and innovative (rather than functional) output. Given that these features are more likely to be encountered in high-tech/knowledge intensive sectors than in more traditional industries, they may contribute to the explanation of our results. Although our approach differs from Kurtulus (2011) in that we look at diversity effects in different sectors while Kurtulus assesses the impact of diversity in different occupational groups (finance, marketing, operations, etc) within the same establishment, our findings are analogue to Kurtulus' observation that "it is evident that the impact of worker dissimilarity on worker performance is quite different for workers in different occupations".

Akerlof and Kranton (2000)'s model, introducing the concept of identity into an economic model of behavior, may also explain why productivity effects of gender diversity differ across environments with varying technological/knowledge intensity. The authors argue that gender diversity may negatively affect firm perfor-

mance, especially if men constitute a socially “dominant” group (Haile, 2012). Given that the workforce is less gender-balanced (see Table 5.2) and the environment potentially more “macho” in traditional companies (e.g. construction) than in high-tech/knowledge intensive firms, their arguments appear to be in line with our results. Empirical findings are also consistent with the observation that high-tech/knowledge intensive sectors increasingly rely on inter-personal or “soft” skills (that may be more effectively provided by women) and generally require less physical stamina than traditional firms, e.g. construction companies (Arun and Arun, 2002; Webster, 2007).

Overall, our results regarding the impact of gender and educational diversity on the productivity-wage gap suggest that gains and losses associated with diversity are shared “competitively” between workers and firms so that profits remain unaffected. In contrast, firm profitability is found to depend negatively on age diversity. According to Cataldi et al. (2012), older workers tend to be over-paid in Belgian private sector firms while young workers are under-paid. Hence, the negative effect of age diversity on profitability is likely to derive from the fact that: i) increases in age diversity are essentially the consequence of an aging workforce, and ii) the over-payment of older workers may outweigh the underpayment of younger workers (as suggested by Cataldi et al., 2011).

Finally, our findings suggest that the effects of diversity do not substantially vary with firm size. This echoes the estimates by Kurtulus (2011), who measures similar diversity effects of gender and education across different firm sizes. By contrast, the study finds that the negative age effect is stronger in smaller units, a result that could be specific to the US retail firm analysed by Kurtulus (firms of different sizes also appear to differ with respect to diversity effects of race, occupational functions and performance dissimilarity, i.e. variables that we have not focused on in this chapter). One way to interpret our estimates according to firm size is that our indicators of firm-level diversity are relatively good proxies for the social interactions within smaller units in the firm (such as divisions, departments or teams). This could be the case if in many firms the diversity of smaller units reflects the overall diversity of firm’s entire personnel. It should, however, be noted that firm size might be correlated with other features that could influence the relationship between diversity and productivity. For

instance, bigger firms may have more efficient HR departments leading to better job matches, more flexibility to transfer workers from one job to another in case of disputes and more resources to implement diversity management policies. While this chapter provides evidence that diversity effects are relatively similar in small and big firms, future micro-level studies are needed to corroborate whether the size of a production unit affects the difference between team- and firm-level diversity. On any account, our results suggest that firm-level diversity is an important explanatory variable for firm productivity independent of firm size.

While diversity is thought to be beneficial in much of the literature in HRM and while personally we would be very much in favour of fostering diversity at the workplace, our findings suggest that in certain cases diversity may be detrimental for both companies and workers. The objective of this chapter is not to identify an “optimal” level of diversity. On the one hand the level of diversity in the workplace is imposed by demand and supply factors such as the type and number of workers available in the labour force or the type of tasks to be performed. On the other, the “desirable” level of diversity is something to be defined at societal level. In this chapter we are limited to simply describing the effects of diversity on a measure of firms’ performance and workers’ wage. If one believes to our results, age and gender diversity tend on average to have a negative effect on firms’ productivity while education diversity has a positive one. However, consequences of diversity are found to substantially depend on the firm’s environment: production in high-tech/knowledge intensive sectors is more likely to benefit from gender diversity than those in more traditional industries. Accordingly, the latter could learn from best practices implemented in the former to make gender diversity work. More generally, personnel measures aimed at improving the impact of age diversity on economic outcomes deserve special attention. Our estimates indeed highlight that the size of the effects associated with diversity (in terms of age, but also gender and education) is substantial and effective diversity management thus remains crucial for a firm’s success.

CHAPTER 6

WORKFORCE DIVERSITY, MANAGERS AND SHAREHOLDERS IN FRANCE

6.1 Introduction

In 2004 a group of French companies launched a Diversity Charter to ban discrimination in the workplace and implement adapted human resources policies. Many French firms, then, committed to diversify workforce composition in terms of gender, age, education and ethnicity to obtain the diversity label. The promoters of the French Charter clearly state that diversity is aimed to “*improve the financial performance*” of the companies, because “*over the long term, a diverse team provides a better understanding of the needs of different customer bases, helps penetrate new markets, develop the company’s capacity for innovation and gives greater flexibility during times of change*”. For instance, Danone on its website clearly presents diversity as a source of performance: “*Danone has set itself priorities: to promote equality between women and men, to encourage the mixing of generations, to support the representation of cultures and nationalities, to improve variety in career paths and qualifications. [...] Diversity benefits the company and stimulates creativity and innovation. Diversity also helps to align the expectations of employees with those of*

consumers and, more generally, to those of society as a whole". This example shows the increasing attention of French companies to the issue of diversity management not only in terms of ethnicity but also age, education and gender. This is not only a concern for big multinationals like Danone as it appears that the signatory companies of the French Diversity Charter are primarily SMEs and micro-enterprises. However, as we have seen in the previous chapter the empirical evidence regarding the impact of workforce diversity on productivity and wages is quite limited and inconclusive and, to our knowledge, no paper specifically focuses on France. Therefore more work is needed to properly inform human resource management policies.

Chapter 5 has shown that the theoretical literature (see Section 5.2.1) posits that labour diversity is good if it fosters complementarities, generate spillovers, improve firms' standing with the customers or improve the overall working environment. However, diversity can also increase misunderstandings, conflicts or forms of workplace segregation which result in a negative effect on firm's performance. The empirical literature (see Section 5.2.2) so far confirms that both positive and negative effects can coexist according to the type of diversity dimension considered (notably demographic characteristics vs. skill/education diversity) or the type of working environment.

In this chapter we extend the analysis to the role of managers and shareholders. As Bloom et al. (2014) conclude in a recent survey, "*studying the causes and implications of variation in productivity across firms has become an important theme (...) [but researchers] have mostly ignored management as a factor behind differences in productivity*". They find that around a quarter to a third of cross-country and within-country TFP gaps appear to be management related. Managers, indeed, exercise the day-to-day control of running the business. They can have idiosyncratic sympathies or incompatibilities with some workers. We might expect that managers will go along better with employees who are more similar to them. For instance previous literature has found that a greater representation of women at top management levels has a positive effect on female workers' career outcomes (Bell et al., 2008; Matsa and Miller, 2011; Kunze and Miller, 2013). When workers and supervisors are similar, mentoring may be more effective (Athey, Avery and Zemsky, 2000) or managers may be better equipped at interpreting signals of productivity from similar workers (Flabbi et al.

2014).¹ On the opposite the “queen bee syndrome” literature which originated in the 1970s (Staines et al. 1974) posits an incompatibility between similar workers.² According to this literature women in top management positions, particularly in male-dominated occupations, may intentionally hinder other women’s career perspectives to avoid competition. A third stream of literature suggests that managers may be more inclined to promote diversity and seek the advancement of similar co-workers, but their bosses or shareholders can hold that against them. Hekman et al. (2014) find in both field and laboratory samples that white male leaders who value diversity are rewarded by their supervisors with better performance evaluations, whereas minority and female leaders who value diversity are penalized with worse performance ratings. Hence, this suggests that managers who engage in diversity-increasing behaviors can be penalized with lower performance ratings for doing so and hence refrain from promoting diversity not because they perceive similar workers as a threat as the “queen bee” syndrome would suggest, but because it is better for their own career prospects. This can be reconciled with the “queen bee” syndrome since as Sheryl Sandberg writes, “*queen bees internalized the low status of women and in order to feel worthy themselves wanted only to be associated with men. Often these queen bees were rewarded for maintaining the status quo*” (2011, p. 164). If this is true, then, those who appoint and reward them can play a significant role in defining company’s policies and attitude towards diversity, i.e. the shareholders.

Indeed, contrary to managers, shareholders do not usually run directly the company (with the quite frequent exception of family firms) but they choose the managers. The economic literature has worked on principal-agent problems since many decades but only Méon and Szafarz (2011) have modeled the process of hiring decisions in terms of a standard principal-agent problem where shareholders look only for profits and managers are taste-based discriminators. They find that a performance-based contract can moderate managers’ propensity to discriminate but not com-

¹On another dimension, Aslund et al. (2014) find that similarity matters in the decision of hiring and they show that immigrant managers in Sweden are more likely to hire immigrant workers.

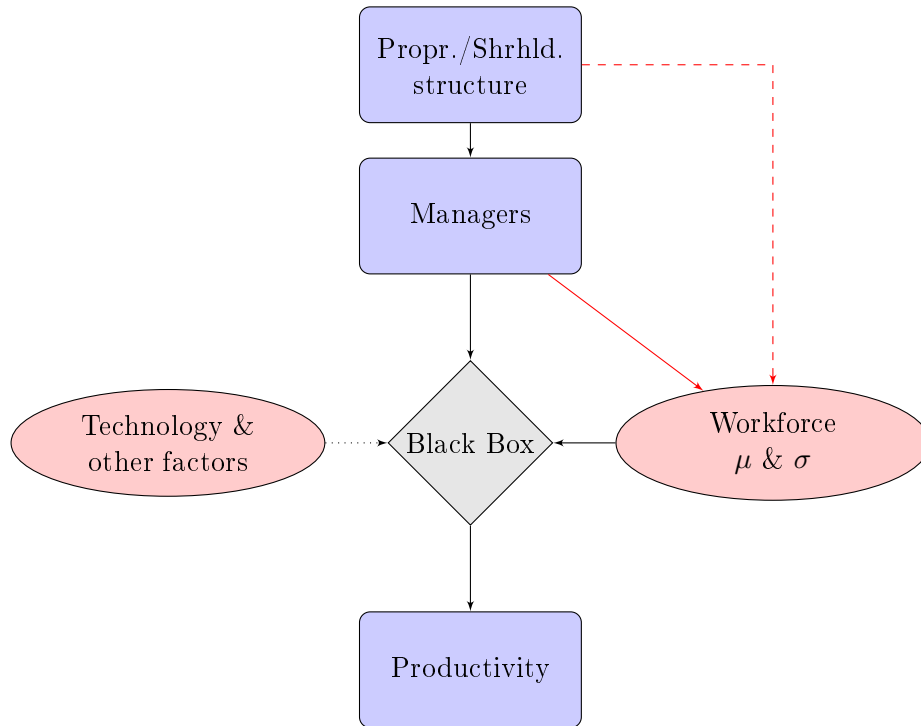
²“Queen been” mainly refers to gender, but other terms in the literature such as “tokens” or “cat fights” (e.g. Jones and Palmer, 2011) reflect the same concept in a broader way: if women are used as tokens they are in competition since only one woman is “allowed” to ascend to the senior ranks in any particular company.

pletely. However, not all shareholders care only about profits but they may also want to define the overall company's culture and values and therefore diversity in the firm. There is an increasing literature on the ownership structure and firm performance (e.g. Demsetz and Villalonga, 2001; Margaritis and Psillaki, 2010) or on the impact of ownership forms on HR practices (e.g. Braun and Warner, 2002; Cooke and Saini, 2010). Diversity can become a matter of concern for shareholders if they see it as a value as such or even just for social or political correctness (i.e., Cox and Blake 1991; Thomas 2004). Cooke and Saini (2010) find that diversity management in India varies according to the type of ownership form: in particular public-owned companies tend to replicate more traditional norms while Indian or foreign multinationals are more open to diversity and more effective HR management. Ellis and Keys (2013) report that some companies even give formal incentives to managers to diversify the workforce: *"3M Company's Board Compensation Committee reviews the company's policies and practices with respect to workforce diversity and equal employment opportunities. Lockheed Martin Corporation considers continued improvement in diversity initiatives when calculating annual bonus payments for its CEO and named executive officers. Southern Company indicates that its annual incentive program, which has 27,000 participants including its executive officers, measures performance relative to five operational goals, one of which is diversity/inclusion"*. Similar incentives are reported also at Goldman Sachs and Merrill Lynch (Kulik, 2014). Different shareholders can therefore give different indications and/or incentives to executives.

We could summarize the relationship between the shareholder/proprietary structure of the firm, the managers and the diversity-productivity nexus like in the graph shown in Figure 6.1. Productivity is the result of several factors inside a black box (the firm): workforce composition (both the average characteristics μ , and the diversity σ), technology (capital), and other determinants (geography, institutions, etc.). In this chapter we try to isolate the effect of workforce characteristics and diversity. Usually hiring and managing human resources is (mainly) a task for managers. However, shareholders can also influence workforce diversity when defining company's values and culture.

The literature exploring the specific nexus between proprietary structure and

Figure 6.1: *The relationship between proprietary/shareholders structure, managers, and the diversity-productivity nexus (only relations of interest are drawn)*



workforce diversity is almost absent. Ono and Odaki (2011), Mum and Jung (2013) and Olcott and Oliver (2014) have studied the effect on foreign ownership on gender in Japan, a traditionally male-dominated economy. In this case, opening up companies to foreign shareholders with different values improves prospects for women in these firms. Similar results are found by Fukase (2013) in Vietnam and by Dammert et al. (2013) in China. Even on family firms, where the literature is fairly rich, there are no studies on diversity management as such. The closest papers concentrate on the effect on women, but mostly women engaging as managers in their family business. Since family firms tend to focus less on strict profit maximisation and “*allow more latitude for personal concerns*” (Cole, 1997), “*they have the potential to be especially productive environments for women. However, as carriers of family culture and processes that may contain gender bias, they can also be the last bastion of resistance to cultural change*” (Hollander and Bukovitz, 1990).

The aim of this second chapter on age, education and gender diversity is, therefore, threefold. First, we compare the previous literature to France and, as done for Belgium, we also examine how the benefits and losses are shared between workers

and employers. Secondly we extend the literature by examining the role of managers' characteristics. Third, we also test the role of different proprietary structures. Only very few papers look into these dimensions, even though in the public debate they are often deemed to be very relevant.

The remainder of this chapter is organised as follows: the next section presents the empirical framework. The following section describes the data used and presents some descriptive statistics. We then present the baseline results and the estimates by managers' characteristics and proprietary structure of the firm. The final section discusses the results and concludes.

6.2 Empirical framework

The empirical results presented in this chapter follow closely those presented in the previous one. They are based on the separate estimation of a value added function and a wage equation at the firm level. The latter provide parameter estimates for the impact of labour diversity (with respect to education, age and gender) on average productivity and wages, respectively. Given that both equations are estimated on the same samples with identical control variables, the parameters for marginal products and wages can be compared and conclusions can be drawn on how the benefits or losses of diversity are shared between workers and firms. This technique was pioneered by Hellerstein and Neumark (1995) and refined by Hellerstein et al. (1999), Hellerstein and Neumark (2004), Aubert and Crépon (2009) and van Ours and Stoeldraijer (2011). It is now standard in the literature on the productivity and wage effects of labour heterogeneity (see e.g. Cataldi et al. 2012; Göbel and Zwick 2012; Vandenberghe 2013).

The estimated firm-level productivity and wage equations are the following:

$$\log \left(\frac{VA}{L} \right)_i = \alpha + \beta_1 A_i^\sigma + \beta_2 E_i^\sigma + \beta_3 G_i^\sigma + \beta_4 \bar{A}_i + \beta_5 \bar{E}_i + \beta_6 \%women + \lambda X_i + \epsilon_i \quad (6.1)$$

$$\log \left(\frac{W}{L} \right)_i = \alpha^* + \beta_1^* A_i^\sigma + \beta_2^* E_i^\sigma + \beta_3^* G_i^\sigma + \beta_4^* \bar{A}_i + \beta_5^* \bar{E}_i + \beta_6^* \%women + \lambda^* X_i + \epsilon_i^* \quad (6.2)$$

The dependent variable in equation (6.1) ($\frac{VA}{L}_i$) is firm i 's added value per worker,

obtained by dividing the total added value (at factor costs) of the firm i by the total number of workers. The dependent variable in equation (6.2) ($\frac{W}{L}_i$) is firm i 's average gross wage. It is obtained by dividing the firm's total wage bill (total sum of gross wages of an establishment excluding employers' contributions) by the total number of workers.

Labour diversity indicators with respect to education, age and gender (E_i^σ , A_i^σ and G_i^σ) are the main variables of interest. As in the previous chapter, we use the second moment (standard deviation) of workforce characteristics (education, age and gender). Moreover we also compute an alternative gender diversity index, i.e. the share of women times the share of men within firms (Hoogendoorn et al., 2013) to test the robustness of our results.

In line with earlier empirical work, we also add workers' average age and education and the share of women at the firm-level (respectively \bar{A}_i , \bar{E}_i and % women) among regressors in equations (1) and (2). The vector X contains the share of part-time workers, the fraction of workers with a fixed-term employment contract, workers' tenure, the percentage of white-collar workers, firm size (i.e. the number of employees) and the log of capital per employee, 10 industry dummies, 21 region dummies, and the interaction of industry and region dummies.

As in the previous chapter to test directly whether the difference between the value added and the wage coefficients for a given diversity indicator is statistically significant we follow van Ours and Stoeldraijer (2011) by estimating a model in which the difference between firm i 's value added and wage (i.e. the hourly gross operating surplus) is regressed on the same set of explanatory variables as in equations (6.1) and (6.2). This produces coefficients for the diversity indicators and directly measures the size and significance of their respective productivity-wage gaps.

6.3 Data and descriptive statistics

The data we use come from several sources as it is necessary to combine information on productivity, wages and a wide set of firms' and workers' characteristics.

The first data source that we use is the 2011 wave of the *Reponse (RElations PRO-*

fessionnelles et NégociationS d'Entreprise) survey. The sample is a random selection from the exhaustive INSEE establishment records, excluding agriculture and public-sector enterprises, and is stratified by establishment size. Reponse has three components: i) a face-to-face interview with a representative of the management (4023 interviews); ii) a face-to-face interview with a worker representative, when there is one in the firm (2433 interviews); iii) a postal survey of employees drawn from among the pool of employees of all companies participating in the survey (18,536 returns over 62,445 shipments). For the sake of this research we will use the first and the third components of the survey. Reponse is primarily designed to provide consistent information to the French Ministry of Labour on labour relations and on the internal organization and recent technological changes in production. Reponse has been used extensively in previous economic research (e.g. Caroli and Van Reenen 2001; Askenazy et al. 2006; Bassanini et al. 2013). Questions about firm ownership and manager characteristics, as well as establishment characteristics were asked to one top manager per establishment in face-to-face interviews with survey enumerators. Answers by managers to Reponse have been proved to be quite reliable (Askenazy and Grenet, 2009) in this respect.

The Reponse dataset has been matched by the database provider (DARES) with social security records (*Déclarations Annuelles de Données Sociales*, DADS) to obtain precise information on gender and age composition of the workforce.

Education categories in Reponse (from the employee part) have been converted in years of education following this table of conversion:

No diploma	0
Certificat d'études	5
Brevet des collèges	9
CAP-BEP	11
Baccalauréat	12
BAC + 2	14
BAC + 3 ou + 4	15
>BAC + 4	17

We have further matched the Reponse (and DADS) data with information on productivity (defined as valued added per worker at the firm level) and wage bills from the RISK database which contains publicly-available company accounts (i.e., *liasse*

fiscale) that firms must provide to the commercial courts (i.e., *greffes des tribunaux de commerce*). The RISK database is not exhaustive because firms may choose to keep secret their corporate information and incur a (small) fine as a consequence (in fact, we lose around half of the initial Reponse sample).

After merging the two data sets and omitting missing observations or observations with negative value-added, the final sample consists of 1164 firms covering all sectors and regions in France (except Corsica and overseas territories) in 2011. Our final sample does not differ much from the initial Reponse one (only the share of women, the share of temporary and part-time workers are slightly lower) and it is representative of sectoral and regional labour force composition in France. The only two exceptions are the manufacturing sector which is overrepresented in Reponse (31 percent compared to 18 percent in the French Labour Force Survey) and professional activities which are underrepresented in Reponse (10 percent compared to almost 19 percent).

Table 6.1: *Descriptive statistics of the main variables of interest*

Variable	Mean	SD	Min	Max
Value added per worker ('000)	96.81	638.8	3	20388
Average wage per workers ('000)	38.55	122.8	8.02	4138
Average age	40.23	4.27	22.14	51.63
Average education	10.91	3.37	0	17
% women	0.34	0.25	0.02	0.94
Std. dev. of age	11.92	2.42	4.95	23.67
Std. dev. of education	2.59	2.44	0	12.02
Std. dev. of gender	0.82	0.08	0.71	0.98
Dissimilarity of age	8.91	6.41	0	31.18
Dissimilarity of education	3.31	3.11	0	14.72
Dissimilarity of gender	0.33	0.36	0	0.87
% temporary workers	0.11	0.69	0	1
% part time workers	0.1	0.23	0	1
Firm size	685	1708	25	10000
Workers Tenure	12.51	7.04	1	42
% white collar	0.37	0.37	0	1
Capital ('000)	190	1,230	0.095	30,700

Table 6.1 sets out the mean, standard deviation, the minimum and the maximum of selected variables. We observe that in 2011 firms have a mean value added per worker of 96,810 euros and that workers' mean gross wage stands at 38,550 euros. As

regards diversity indicators, we find that the intra-firm standard deviation reaches respectively 11.92 for age, 2.59 for education, and 0.82 for gender. Employees in our sample have on average 10.91 years of education, they are 40.23 years old, and are essentially concentrated in the manufacturing industry (34 percent), wholesale and retail trade, repair of motor vehicles, motorcycles (17 percent), construction (13 percent), transport (11 percent), and professional, scientific and technical activities (10 percent). 18 percent of firms are located in the region of Ile-de-France (Paris) and the rest is more or less evenly spread in the other 20 regions.

Moreover, firms employ on average 685 workers, 34 per cent of women, 37 percent of white-collar workers, 12.51 years of mean tenure, 11 percent of workers with a fixed-term employment contract, and 10 percent of part-time workers.

Variation across French regions is quite limited and no significant regional trends emerge as it can be seen in Table 6.2. Not surprisingly the Paris region (Ile de France) has a relatively younger, more educated and more feminine workforce and also slightly more homogenous in terms of education and gender while being among the most diverse in terms of age. Historically more traditional regions like Alsace and Lorraine have an older, less educated and less feminine workforce.

There is bigger variability across sectors (see Table 6.3) with more women in the education/health sector, finance and insurance and real estate, better educated workers in information and communication, finance and real estate. Younger workers are found in hotels and restaurant and relatively older in real estate. Age diversity is higher in hotels and restaurants and construction and relatively lower in real estate. Educational diversity is higher in manufacturing and relatively lower in information and communication while gender diversity is higher in construction and transport (mainly due to the lower presence of women) and lower in hotel and restaurants and real estate.

6.3.1 Managers' and shareholders' characteristics

In the second part of the chapter we are going to analyse the role of top managers' characteristics and their interaction with workforce characteristics. We take as top manager the respondent to the manager questionnaire of Reponse who has no more

Table 6.2: *Descriptive statistics by regions*

<i>Region</i>	<i>Mean age</i>	<i>Mean educa- tion</i>	<i>% women</i>	<i>Age di- versity</i>	<i>Education diversity</i>	<i>Gender diversity</i>
Alsace	41.45	9.86	0.28	11.27	2.62	0.82
Aquitaine	40.17	10.78	0.38	11.77	2.39	0.82
Auvergne	41.11	10.82	0.37	11.36	2.66	0.82
Bretagne	40.32	11.07	0.36	11.65	2.29	0.81
Bourgogne	42.27	10.31	0.36	11.54	3.21	0.82
Centre	40.16	10.53	0.34	11.78	2.63	0.82
Champagne- Ardenne	40.74	8.85	0.36	11.65	3.40	0.83
Franche-Comte	40.63	10.94	0.35	11.95	3.02	0.81
Ile de France	39.88	12.80	0.39	12.02	2.00	0.79
Languedoc- Roussillon	40.55	10.80	0.30	11.81	2.65	0.83
Limousin	42.03	11.03	0.39	10.93	2.02	0.81
Lorraine	41.01	9.71	0.29	11.76	2.65	0.83
Midi-Pyrenees	40.57	11.09	0.30	11.57	2.10	0.82
Nord-Pas de Calais	40.01	11.25	0.30	12.30	2.56	0.84
Basse Normandie	39.89	9.47	0.30	11.42	3.11	0.84
Haute Normandie	39.13	9.95	0.34	12.91	3.04	0.84
Pays de la Loire	39.83	10.77	0.31	11.85	2.68	0.83
Picardie	39.62	9.68	0.28	12.15	3.35	0.83
Poitou Charentes	40.18	10.37	0.30	11.78	2.57	0.84
Provence-Alpes- Cote d'Azur	39.39	10.79	0.35	12.73	2.81	0.81
Rhone Alpes	40.11	10.63	0.32	12.00	2.83	0.82

Table 6.3: *Descriptive statistics by sector*

<i>Sector</i>	<i>Mean education</i>	<i>% women</i>	<i>Mean age</i>	<i>Age di- versity</i>	<i>Education diversity</i>	<i>Gender diversity</i>
Manufacturing (C)	10.47	0.29	41.15	11.11	3.04	0.82
Construction (F)	8.96	0.13	38.99	13.42	2.82	0.91
Retail trade (G)	11.08	0.46	38.97	12.48	2.2	0.78
Transport (H)	9.44	0.21	41.95	10.83	2.85	0.86
Hotels & restau- rants (I)	9.54	0.56	32.3	16.91	2.29	0.74
Information and communication (J)	14.52	0.44	39.26	11.54	1.66	0.76
Finance and insur- ance (K)	12.28	0.74	39.82	11.95	2.28	0.76
Real estate (L)	12.02	0.59	43.1	10.59	2.18	0.75
Professional act. (M)	11.99	0.5	39.34	12.35	2.36	0.79
Education, Health, Arts (P-S)	11.46	0.77	39.21	12.69	2.53	0.85

than one hierarchical level above him or her (this corresponds to presidents, managing directors or heads of human resources).

Table 6.4 shows that 27 percent of the managers in our sample are women, they are on average 45.9 year-old, they have 12.36 years of education (corresponding to the “*Bac*”, the high-school diploma) and a mean tenure in the firm of 14.63 years.

Table 6.4: *Top manager characteristics*

	Mean	std. Dev.
Woman top manager (%)	27	44
Age manager (years)	45.9	8.99
Education of the manager (years)	12.36	10.03
Tenure of the manager (years)	14.63	3.13

We are also going to analyse the interaction of shareholder who can define companies’ business culture and values with workforce diversity. Reponse provides us with information on the proprietary structure of the firm. We distinguish between firms owned by an individual or a family, firms listed on the stock exchange, firms owned by foreigners or firms where workers own part of the shares. These four types of shareholders are not fully independent one from the other (see Table 6.5): almost 14% of firms is owned by an individual or a family and also listed on the stock exchange.

Around 4% are owned by foreigners and listed on the stock exchange. Finally 18.6% of the firms in the sample does not fall in any of these categories: these are notably firms where there are no shareholders, or where the Gouvernement or local authorities are the shareholders (less than 5%), or where French financial or non-financial institutes are the shareholders.

Table 6.5: *Proprietary structure of the firms in the sample*

Proprietary structure	Freq.	Percent
Individual/Family	513	44.07
Family listed on stock exchange	161	13.83
Listed on stock exchange	88	7.56
Foreigners	86	7.39
Listed and foreigners	46	3.95
Workers	27	2.32
Family and workers	9	0.77
Family and foreigners	7	0.6
Listed and workers	6	0.52
Family, listed and foreigners	3	0.26
Family, listed and workers	1	0.09
None of the above	217	18.64
Total	1164	100

Notes: None of the above include 34 firms without shareholders, 20 firms owned by the Government or local authorities, 41 by French financial institutes, 67 by French non-financial institutes and 34 others (not specified).

6.4 Results

6.4.1 Baseline results

We start by estimating equations 6.1 and 6.2 and the difference between the two by OLS. Robust standard errors are reported in parenthesis. Table 6.6 shows the impact of age, education and gender diversity on productivity, mean wages and productivity-wage gaps. In Table 6.7 workers' and firms' characteristics are added together with industry and region dummies to control for regional and sectoral specificities. Finally, dummies by sectors in each region are also added to increase the precision of sectoral and local characteristics.

Table 6.6: *Baseline OLS results without controls*

	VA/L	W/L	Gap	VA/L	W/L	Gap	VA/L	W/L	Gap
Age diversity (sd)	-0.02*** (0.01)	-0.03*** (0.01)	0.00 (0.01)				-0.03** (0.01)	-0.03** (0.01)	-0.01 (0.01)
Education diversity (sd)	-0.00 (0.01)	-0.01** (0.01)	0.01 (0.01)				0.02** (0.01)	0.00 (0.01)	0.01* (0.01)
Gender diversity (sd)	-0.86*** (0.25)	-0.31 (0.19)	-0.55*** (0.21)				-1.06*** (0.32)	-0.19 (0.23)	-0.87*** (0.25)
Mean age				0.01** (0.00)	0.01*** (0.00)	-0.00 (0.00)	-0.01 (0.01)	-0.00 (0.01)	-0.01 (0.01)
Mean education				0.04*** (0.01)	0.04*** (0.00)	0.00 (0.01)	0.04*** (0.01)	0.04*** (0.00)	0.00 (0.01)
% women				-0.19* (0.10)	-0.11* (0.06)	-0.08 (0.09)	-0.38*** (0.12)	-0.15* (0.08)	-0.23*** (0.09)
Constant	5.06*** (0.25)	4.03*** (0.18)	1.03*** (0.21)	3.28*** (0.18)	2.63*** (0.13)	0.65*** (0.14)	5.29*** (0.58)	3.68*** (0.46)	1.61*** (0.53)
R-squared	0.03	0.04	0.01	0.07	0.11	0.00	0.11	0.13	0.02
Observations	1164	1164	1164	1164	1164	1164	1164	1164	1164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6.7: *Baseline OLS results with controls*

	VA/L	W/L	Gap	VA/L	W/L	Gap	VA/L	W/L	Gap
Age diversity (sd)	-0.03*** (0.01)	-0.03*** (0.01)	-0.01 (0.01)	-0.04*** (0.01)	-0.03*** (0.01)	-0.01 (0.02)	-0.04*** (0.01)	-0.02** (0.01)	-0.01 (0.02)
Education diversity (sd)	0.02** (0.01)	0.00 (0.01)	0.01* (0.01)	0.02** (0.01)	0.00 (0.01)	0.02** (0.01)	0.01** (0.01)	-0.00 (0.01)	0.02** (0.01)
Gender diversity (sd)	-0.05 (0.30)	0.46* (0.24)	-0.51* (0.26)	-0.16 (0.29)	0.41* (0.22)	-0.58** (0.28)	-0.50* (0.29)	0.16 (0.19)	-0.65** (0.29)
Mean age	-0.01** (0.01)	-0.00 (0.01)	-0.01 (0.01)	-0.02** (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.02** (0.01)	-0.00 (0.01)	-0.01* (0.01)
Mean education	0.02** (0.01)	0.02*** (0.00)	-0.00 (0.01)	0.01 (0.01)	0.01*** (0.00)	-0.00 (0.01)	0.02** (0.01)	0.01*** (0.00)	0.00 (0.01)
% women	-0.26** (0.11)	-0.06 (0.07)	-0.19* (0.10)	-0.22** (0.10)	-0.03 (0.08)	-0.20* (0.11)	-0.30*** (0.10)	-0.12* (0.07)	-0.18* (0.10)
Temporary workers	0.00 (0.02)	-0.03 (0.02)	0.03** (0.02)	0.01 (0.02)	-0.02 (0.02)	0.03** (0.01)	0.01 (0.02)	-0.03** (0.01)	0.04* (0.02)
Part time	0.06 (0.07)	-0.04 (0.06)	0.09 (0.07)	0.06 (0.07)	-0.00 (0.06)	0.07 (0.07)	0.12 (0.09)	0.01 (0.06)	0.10 (0.09)
Firm size	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Tenure	-0.01** (0.00)	-0.00** (0.00)	-0.00 (0.00)	-0.01** (0.00)	-0.00** (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
White collar	0.12* (0.06)	0.13*** (0.04)	-0.01 (0.06)	0.11 (0.07)	0.09** (0.04)	0.02 (0.07)	0.09 (0.08)	0.08* (0.04)	0.01 (0.09)
Capital/worker	0.30*** (0.03)	0.18*** (0.03)	0.13*** (0.04)	0.32*** (0.03)	0.18*** (0.03)	0.14*** (0.04)	0.31*** (0.03)	0.18*** (0.03)	0.12*** (0.04)
Sector dummies	no	no	no	yes	yes	yes	yes	yes	yes
Regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
Sector*Region dummies	no	no	no	no	no	no	yes	yes	yes
Constant	3.42*** (0.50)	2.53*** (0.39)	0.90* (0.54)	3.55*** (0.49)	2.86*** (0.34)	0.69 (0.53)	3.64*** (0.50)	2.69*** (0.36)	0.96* (0.53)
R-squared	0.34	0.29	0.08	0.40	0.38	0.10	0.47	0.52	0.18
Observations	1164	1164	1164	1164	1164	1164	1164	1164	1164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

We can observe that results are overall very stable and that our preferred specification with all the controls explains around 50 percent of the cross-firm variability in productivity and mean-wages. Around 11-13 percent of this variability is explained by the first and second moments of workforce characteristics alone, while the other firms' and workers' controls add about 20 percent more and the sector and region dummies further add 20 percent.

Findings show that age and gender diversity have a negative effect on firm's productivity while educational diversity has a positive effect. More precisely, results in column 7 indicate that when age diversity increases by one standard deviation (2.42 years), productivity on average decreases by 9.6 percent.³ When gender diversity increases by one standard deviation (that is by 0.08 which roughly correspond to the case of a firm in which the share of women doubles from 15 to 30 percent), productivity on average decreases by 4 percent.⁴

On the contrary, when education diversity increases by one standard deviation (2.44 years), productivity on average increases by 2.4 percent. Column 8 shows that an increasing age diversity reduces mean wages by 4.84 percent while education and gender diversity have no significant effect on gender. Therefore this asymmetry between productivity and wages generates a positive productivity-wage gap (which results in higher profits for firms) for education diversity and a negative one (and hence reduced profits) for gender diversity.

Similar results are obtained using the Gender Diversity Index, i.e. the share of women times the share of men within firms (Hoogendoorn et al., 2011), instead of gender standard deviation (see Table 6.8). The results are also robust to the use of the "percent maximum standard deviation", an alternative indicator developed by Delhey and Kohler (2011) to correct for the structural dependency of standard deviation to the mean.⁵

³-0.04*2.42 = -0.096 (i.e. point estimate*standard deviation)

⁴-0.50*0.08 = -0.04

⁵The theoretical maximum of the standard deviation depends on the mean (a problem of structural dependency). If following the example by Delhey and Kohler (2011), we consider four firms which all have education standard deviations of 2.0, but at different levels of mean years of education: 5, 6, 7, and 8 (with the minimum being 0 and the maximum 17). These mean levels correspond to varying maximum standard deviations of 7.74, 8.12, 8.36 and 8.48. The logic applied is that the identical dispersion of 2.0 captures different proportions of the maximum possible dispersion - to be precise, 25.8%, 24.6%, 23.9%, and 23.5%, respectively. Thus, rather than being identically diverse

Table 6.8: *Baseline OLS results with Gender Diversity Index*

	VA/L	W/L	Gap
Age diversity (sd)	-0.04*** (0.01)	-0.02** (0.01)	-0.01 (0.02)
Education diversity (sd)	0.01** (0.01)	-0.00 (0.01)	0.02** (0.01)
Gender diversity index	-0.59* (0.34)	0.18 (0.22)	-0.77** (0.35)
Mean age	-0.02** (0.01)	-0.00 (0.01)	-0.01* (0.01)
Mean education	0.02** (0.01)	0.01*** (0.00)	0.00 (0.01)
% women	-0.29*** (0.10)	-0.12* (0.07)	-0.18* (0.10)
Temporary workers	0.01 (0.02)	-0.03** (0.01)	0.04 (0.02)
Part time	0.12 (0.09)	0.01 (0.06)	0.10 (0.09)
Firm size	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Tenure	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
White collar	0.09 (0.08)	0.08* (0.04)	0.01 (0.09)
Capital/worker	0.31*** (0.03)	0.18*** (0.03)	0.12*** (0.04)
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.14*** (0.46)	2.85*** (0.35)	0.29 (0.53)
R-squared	0.47	0.52	0.18
Observations	1164	1164	1164

Notes: Robust standard errors in parentheses. ***
p<0.01, ** p<0.05, * p<0.1.

Increasing the mean age and the share of women also contributes to reduce firm's productivity while increasing workers' mean education is positive for firm's productivity. Similar results are found for mean wages: age diversity and the share of women negatively affect mean wages, while mean education has a positive effect. Women are paid less than men but, if we believe to these results, less than what their negative effect on productivity would suggest. This is consistent with the results obtained for France by Crépon et al. (2003) who find that women are paid less but are also less productive while older workers tend to be overpaid with respect to their productivity. The results on the wage gap for women are also in line with Meurs and Ponthieux (2000) who use an Oaxaca-Blinder decomposition and find that the unexplained wage gap once controlling for hours worked and other observed characteristics is 4.2% which goes up to 16% when excluding education, experience, social and occupational category, tenure, type of contract, number of children and marital status. Our point estimates lie in between the unexplained and the partially explained wage gaps and confirm the plausibility of our estimations.

It is interesting to notice that other firms' and workers' observed characteristics show no significant effect on productivity and wages. The only exception is the log of capital per worker which exactly reflects the coefficients of a Cobb-Douglas production function (around 0.33), tentatively comforting our choice of the functional form of the production function.

6.4.2 IV estimations

OLS estimators are likely to suffer from potential heterogeneity and endogeneity bias. To correct for endogeneity we can try to find an instrument to proxy for the workforce composition that does not directly affect firm's productivity. Previous literature has used as an instrument the workforce composition in the other firms of the same sector (e.g. Cheng et al. 2014; Hawn and Kang, 2013; Della Malva and

(the conclusion when we accept the standard deviations of 2.0 at their face value), the four firms in our example are in fact characterized by different degrees of workforce diversity. This problem is relevant for extreme values, for instance when the average age or education is very low, or very high and when using in tight scales. The same example on a 0-10 scale would yield more significantly different proportions, i.e. 40%, 41%, 44%, and 50%. In our setting the problem of structural dependency is therefore relatively less important than in Delhey and Kohler (2011) because the scales are longer, 0-17 for education and 18-75 for age, and mean extreme value not common.

Santarelli, 2013; Forman et al., 2010; Yang and Steensma, 2014). When defining its workforce, a firm is to some extent constrained by its own technology and work content that might require younger or more experienced workers, skilled or unskilled workers, more men or more women. Therefore, using the workforce composition of other firms in the same sector to proxy for the composition of the focal firm may provide a satisfying first-stage (which can also be statistically tested). It is more difficult to ensure that the instrument also satisfies the exclusion restriction, i.e. that the instrument does not have a direct causal effect on the outcome and in particular that it does not fall in a typical Manski reflection problem.⁶ However, we believe that by excluding the focal firm and by controlling for sectoral and regional dummies and sector-by-region dummies we are able to net out some potential endogeneity of the instrument (some unobserved factors that affect both the other firms' workforce composition and the productivity of the firm of interest). On top of this we will also test for overidentifying restrictions to test the validity of the instrument, i.e. that they are uncorrelated with the error term. To test for overidentifying restrictions the equations must not be exactly identified and hence we need more instruments than endogenous variables. As a consequence, we also add as instrument the average dissimilarity index of other firms in the same sector computed using the individual data of Reponse on a sample of workers working in each establishment. This information is not very precise since it covers just a very small sample (18,536 respondents in the 4,023 establishments, so 4.6 workers on average by establishment) whereas the DADS data we use to construct establishment standard deviations come from the social security administration and therefore cover all workers. However, even if less precise, such dissimilarity index can be used to further instrument our variables of interest. If it turns out to be too imprecise and hence is a weak instrument, the first stage will alert us. On the other hand there are no reasons to think that the index would perform better or worse in terms of exogeneity than our basic instruments.

Table 6.9 shows the results using as an instrument for firm i 's workforce composition (the first and the second moments of age, education and gender), the mean, the standard deviation and the dissimilarity index of age, education and gender of

⁶The problem arises when one wants to predict the behavior of an individual (or in this case a firm) by the behavior of the group of which he is a member, notably to study the role of peer effects.

the other firms (therefore excluding firm i) in the same sector. IV estimations do not vary if we use just the minimal number of instruments (but, as discussed, we cannot run an overidentifying test).

In order to assess the soundness of this approach we performed a range of statistical tests. The first stage results are very strong (well above the rule of thumb of 10 for the F-test statistics). The weak identification test, whose null hypothesis is that the equation is underidentified, also confirms that the equation is identified. The third test concerns the validity of additional instruments and uses the Hansen (1982) test of overidentifying restrictions. Under the null hypothesis the instruments are valid, i.e. uncorrelated with the error term. With a p-value well above 10 percent we can accept the null hypothesis that the instruments are valid. A final test checks if the workforce composition is indeed endogenous so that an IV approach is warranted. Under the null hypothesis the explanatory variables can actually be treated as exogenous but the null hypothesis is rejected.

The IV results confirm our OLS results in their direction, while the magnitude of the estimated coefficients is only marginally lower. Education diversity, on the other hand, turns out to have no significant effect anymore. When age diversity increases by one standard deviation (2.42 years), productivity on average decreases by 7.2 percent.⁷ When gender diversity increases by one standard deviation (see above), productivity on average decreases by 3.8 percent.⁸ Slightly more different results are found for the mean-wage equation: the IV results show a negative effect of age diversity on wages of the same magnitude as the effect on productivity with no effect on the value-added-wage gap. Education diversity seems to have a small but significant negative effect on wages, thus entailing a small rent for employers: when education diversity increases by one standard deviation, 2.44 years of education, wages decrease by 2.44 percent. More surprisingly gender diversity has a positive effect on wages, though not very big in size: when gender diversity increases by one standard deviation (0.08, e.g. when the share of women doubles from 15 to 30 percent) wages increase by 2.9 percent and this widens the gap in favour of workers.

⁷ $-0.03 \times 2.42 = -0.072$

⁸ $-0.48 \times 0.08 = -0.038$

Table 6.9: *Baseline IV estimates*

	VA/L	W/L	Gap
Age diversity (sd)	-0.03*** (0.01)	-0.03*** (0.01)	0.01 (0.01)
Education diversity (sd)	0.00 (0.01)	-0.01** (0.00)	0.01** (0.01)
Gender diversity (sd)	-0.48** (0.24)	0.37** (0.16)	-0.86*** (0.24)
Mean age	-0.01** (0.01)	-0.01** (0.00)	-0.00 (0.01)
Mean education	0.02*** (0.01)	0.02*** (0.00)	0.00 (0.01)
% women	-0.21** (0.09)	-0.01 (0.06)	-0.20** (0.09)
Firm and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.44*** (0.46)	2.90*** (0.32)	0.55 (0.47)
R-squared	0.46	0.51	0.17
Observations	1164	1164	1164
Weak identification test (F stat)	76.851	76.851	76.851
Overidentification (p-value)	0.4313	0.4131	0.2232
Endogeneity (p-value)	0.0054	0.0000	0.0080
<i>F-tests 1st stage:</i>			
Age diversity (sd)		278.03	
Education diversity (sd)		199.65	
Gender diversity (sd)		240.55	
Mean age		152.68	
Mean education		166.28	
% women		230.47	

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker. Instruments: 1st and 2nd moments of age, gender and education in the other firms of the same sector and age, gender and education dissimilarity.

6.4.3 The role of managers

In the previous section, we have estimated an average effect of diversity on productivity and wages. However, as discussed in the introduction, there might be strong differences according to the type of management or proprietary structure of the firm.

In our analysis on the role of managers we focus on their gender, education and age to see if and how they have a differential impact on the diversity-productivity-wage nexus. To formally test for differences between firms run by women or by more (or less) educated managers or by older (or younger) workers we add to our benchmark specification a control for the gender, the years of education or the age of the top manager and the interaction with these managers' characteristics and the first and second moments of age, education and gender variables.

From an econometric point of view, interacting workforce characteristics with top management characteristic adds another source of endogeneity. Shareholders do not draw managers randomly but carefully choose them. For instance, companies performing better in terms of diversity might more easily pick a woman to manage it or a more educated manager. Correcting for this further source of endogeneity would require another set of instruments which is not available. The following results will therefore present some correlations which should not be interpreted as direct causal effects.

Results in Tables 6.10, 6.11 and 6.12 show no significant differential impact of the gender, education and age of managers with respect to the diversity-productivity-wage nexus. Female top managers are not associated with an increase in productivity or wages of other women and the same for other characteristics. This might be in line with Flabbi et al. (2014) who find that female executives increase the variance of women's wages within firms because of a positive impact on wages at the top of the distribution, and a negative impact on wages at the bottom or, more in general, to the results by Bertrand et al. (2014) who find no significant impact of board quotas on female labor market outcomes in Norway. This can also be the result of women penalized for promoting diversity as Hekman et al. (2014) find: managers' characteristics, hence, do not play a role since promoting diversity is not rewarded.

On the contrary, we find that a woman top manager is associated with a strong

Table 6.10: *Estimations by the gender of the top manager, OLS estimates*

	VA/L	W/L	Gap
Age diversity (sd)	-0.03** (0.01)	-0.03** (0.01)	-0.00 (0.02)
Education diversity (sd)	0.02** (0.01)	-0.00 (0.01)	0.02** (0.01)
Gender diversity (sd)	-0.25 (0.29)	0.20 (0.22)	-0.45 (0.30)
Mean age	-0.01 (0.01)	-0.00 (0.01)	-0.01 (0.01)
Mean education	0.03*** (0.01)	0.01*** (0.00)	0.01* (0.01)
% women	-0.24** (0.10)	-0.12 (0.08)	-0.12 (0.09)
Women top manager	3.04* (1.72)	0.05 (0.70)	2.99* (1.67)
Age diversity (sd) * women top manager	-0.06 (0.04)	0.01 (0.02)	-0.07 (0.04)
Education diversity (sd) * women top manager	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)
Gender diversity (sd) * women top manager	-0.99 (0.63)	-0.03 (0.39)	-0.96* (0.55)
Mean age * women top manager	-0.03 (0.02)	-0.00 (0.01)	-0.02 (0.02)
Mean education * women top manager	-0.05* (0.03)	0.00 (0.01)	-0.05* (0.03)
% women * women top manager	-0.15 (0.30)	-0.02 (0.15)	-0.13 (0.28)
Firm and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.10*** (0.58)	2.57*** (0.41)	0.53 (0.62)
R-squared	0.48	0.52	0.23
Observations	1164	1164	1164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

Table 6.11: *Estimations by the years of education of the top manager, OLS estimates*

	VA/L	W/L	Gap
Age diversity (sd)	-0.04*** (0.01)	-0.03** (0.01)	-0.01 (0.02)
Education diversity (sd)	0.02* (0.01)	-0.00 (0.01)	0.02** (0.01)
Gender diversity (sd)	-0.26 (0.36)	0.32 (0.26)	-0.58 (0.41)
Mean age	-0.02*** (0.01)	-0.00 (0.01)	-0.02** (0.01)
Mean education	0.02*** (0.01)	0.01*** (0.01)	0.01 (0.01)
% women	-0.30** (0.13)	-0.09 (0.09)	-0.21* (0.12)
Education top manager	0.00 (0.00)	-0.01 (0.00)	0.01 (0.00)
Age diversity (sd) * education top manager	0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)
Education diversity (sd) * education top manager	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)
Gender diversity (sd) * education top manager	-0.04 (0.03)	-0.02 (0.02)	-0.02 (0.03)
Mean age * education top manager	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Mean education * education top manager	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)
% women * education top manager	-0.00 (0.02)	-0.00 (0.01)	0.00 (0.02)
Firm and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.68*** (0.54)	2.68*** (0.36)	1.00* (0.57)
R-squared	0.47	0.52	0.19
Observations	1161	1161	1161

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

Table 6.12: *Estimations by the age of the top manager, OLS estimates*

	VA/L	W/L	Gap
Age diversity (sd)	-0.04*** (0.01)	-0.03** (0.01)	-0.00 (0.02)
Education diversity (sd)	0.01 (0.01)	-0.00 (0.01)	0.01 (0.01)
Gender diversity (sd)	-0.52 (0.37)	0.32 (0.27)	-0.84** (0.42)
Mean age	-0.02** (0.01)	-0.00 (0.01)	-0.02 (0.01)
Mean education	0.03*** (0.01)	0.02*** (0.01)	0.01 (0.01)
% women	-0.38*** (0.13)	-0.10 (0.09)	-0.28** (0.12)
Manager age	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Age diversity (sd) * Manager age	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)
Education diversity (sd) * Manager age	0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
Gender diversity (sd) * Manager age	-0.00 (0.01)	-0.01 (0.01)	0.01 (0.01)
Mean age * Manager age	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Mean education * Manager age	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
% women * Manager age	0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
Firm and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.65*** (0.54)	2.66*** (0.37)	1.00* (0.58)
R-squared	0.47	0.52	0.19
Observations	1161	1161	1161

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

positive effect on firms' value-added per capita. This contradicts previous findings by Wolfers (2006), Albanesi and Olivetti (2009), Adams and Ferreira (2009) and Bertrand et al. (2014) but it is in line with Smith et al. (2005) who find that the proportion of women in top management jobs tends to have positive effects on firm performance in Denmark or Flabbi et al. (2014) who find that a strong positive effect of a female CEO on sales per employee, though limited in firms where half of the workers are women or with Dezso and Ross (2012) who find that female representation in top management improves firm performance (but only to the extent that a firm's strategy is focused on innovation). The age and the education of managers also do not have a differential effect on productivity and wages. Having an older manager (then probably also a more experienced one) or a more educated one does not go along with improved productivity or higher wages of a diverse workforce. We also tested for the existence of an effect connected to the manager's tenure (see Table 6.13) to proxy for his/her company-specific experience and again we do not find significant results.

We can conclude that top managers' characteristics do not change the effect of age, gender and education diversity on productivity, wages and productivity-wage gaps. Hence, if one believes these results, having a woman as top manager does not generate positive (nor negative) effects on gender diversity. Nor having an older or younger manager or a more (or less) educated one improves (or worsen) the effect of age and education diversity. Managers' characteristics as such, therefore, seem not to have a significant impact on diversity management.

6.4.4 The proprietary structure of the firm

As discussed in the introduction, shareholders may not only be interested in maximizing profits as most principal-agent models posit, but also play a significant role in defining companies' business culture and values, also with respect to workforce diversity (the dashed arrow in Figure 6.1). In what follows we are going to estimate the effect of diversity on productivity and wages by different proprietary structures of the firm by interacting the workforce characteristics with dummies for firm ownership. We distinguish between firms owned by an individual or a family, firms listed

Table 6.13: *Estimations by the tenure of the top manager, OLS estimates*

	VA/L	W/L	Gap
Age diversity (sd)	-0.04*** (0.01)	-0.03** (0.01)	-0.01 (0.02)
Education diversity (sd)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
Gender diversity (sd)	-0.44 (0.34)	0.20 (0.23)	-0.64* (0.37)
Mean age	-0.02** (0.01)	-0.00 (0.01)	-0.01 (0.01)
Mean education	0.02** (0.01)	0.02*** (0.00)	-0.00 (0.01)
% women	-0.26** (0.11)	-0.09 (0.07)	-0.17* (0.10)
Manager tenure	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Age diversity (sd) * Manager tenure	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)
Education diversity (sd) * Manager tenure	0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
Gender diversity (sd) * Manager tenure	-0.01 (0.02)	-0.00 (0.02)	-0.01 (0.02)
Mean age * Manager tenure	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Mean education * Manager tenure	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
% women * Manager tenure	-0.01 (0.01)	-0.00 (0.00)	-0.00 (0.01)
Firm and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.61*** (0.52)	2.72*** (0.36)	0.90* (0.54)
R-squared	0.47	0.52	0.18
Observations	1161	1161	1161

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

on the stock exchange, firms owned by foreigners or firms where workers own part of the shares. The four types of proprietary structures are not fully independent one from the other. In particular a significant share of firms are owned by a family and also listed on the stock exchange. In our econometric analysis we will focus on the main, and arguably more interesting, categories: family firms, firms listed on the stock exchange, family firms listed on the stock exchange, firms owned by foreigners and firms with workers as shareholders.

Results in Table 6.14 show that in family firms (or firms owned by an individual) age diversity does not have a significantly different effect than in non-family firms while the negative effect for gender diversity cancels out. No significant differences are found for mean age and education or the share of women. Family firms globally do not differ much from non-family firms. If anything they seems not to suffer from the negative effect of gender diversity on firms' value-added. We know from Bassanini et al. (2013) that family firms offer greater job security with reduced dismissal (but with lower wages) and therefore may potentially be a good environment for women (Hollander and Bukovitz, 1990). Interestingly, the point estimate of the family firm dummy is negative as most of previous literature: family firms are less productive than other companies.

On the other hand, Table 6.15 shows that the positive impact of education diversity are concentrated in firms which are listed on the stock exchange: increasing education diversity by one standard deviation (2.44 years) increases productivity by 9.7 percent.⁹ These companies are probably more able than other firms to benefit from mutual leaning and collaboration among workers with different educational tracks, especially if the tasks to be performed are complex (not routine) and the output is innovative (Jehn et al. 1999). On the contrary, gender diversity seems to reduce wages in public listed companies: an increase of gender diversity by one standard deviation (0.08, i.e. from 15 percent to 30 percent) results in a decrease of the mean wage bill by 4.16 percent.¹⁰ The average wage bill also seems to increase with the mean age of the workforce in public listed companies (8.5 percent increase for an increase in mean age by one standard deviation, i.e. 4.27 years).

⁹ $0.04 \times 2.44 = -0.0976$

¹⁰ $(0.37 - 0.89) \times 0.08 = -0.0416$

Table 6.14: *Family firms vs. non-family firms, OLS estimates*

	VA/L	W/L	Gap
Age diversity	-0.07** (0.03)	-0.02 (0.02)	-0.04 (0.03)
Education diversity	0.01 (0.01)	-0.00 (0.01)	0.01 (0.02)
Gender diversity	-1.17** (0.51)	0.23 (0.31)	-1.40** (0.54)
Mean age	-0.03** (0.01)	0.00 (0.01)	-0.03** (0.01)
Mean edu	0.00 (0.02)	0.02*** (0.01)	-0.02 (0.02)
% women	-0.29* (0.17)	-0.09 (0.08)	-0.20 (0.17)
Family	-2.10* (1.26)	0.43 (0.72)	-2.52* (1.35)
Age diversity * family	0.04 (0.03)	-0.00 (0.02)	0.04 (0.04)
Education diversity * family	0.00 (0.02)	-0.00 (0.01)	0.00 (0.02)
Gender diversity * family	0.97* (0.59)	-0.12 (0.35)	1.09* (0.58)
Mean age * family	0.02 (0.02)	-0.00 (0.01)	0.02 (0.02)
Mean edu * family	0.02 (0.02)	-0.01 (0.01)	0.03 (0.02)
% women * family	0.03 (0.22)	-0.03 (0.11)	0.06 (0.22)
Firms and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	5.12*** (1.08)	2.36*** (0.64)	2.76** (1.15)
R-squared	0.47	0.52	0.19
Observations	1164	1164	1164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

Table 6.15: *Firms listed on the stock exchange, OLS estimates*

	VA/L	W/L	Gap
Age diversity (sd)	-0.03*** (0.01)	-0.03*** (0.01)	-0.00 (0.02)
Education diversity (sd)	0.01 (0.01)	-0.01 (0.01)	0.01 (0.01)
Gender diversity (sd)	-0.30 (0.29)	0.37* (0.22)	-0.67** (0.29)
Mean age	-0.02** (0.01)	-0.01 (0.01)	-0.01 (0.01)
Mean education	0.02*** (0.01)	0.01*** (0.00)	0.01 (0.01)
% women	-0.31*** (0.11)	-0.10 (0.08)	-0.20** (0.10)
Stock exchange	0.56 (1.28)	-0.62 (0.77)	1.18 (1.35)
Age diversity (sd) * stock exch.	-0.04 (0.04)	0.03 (0.02)	-0.07 (0.05)
Education diversity (sd) * stock exch.	0.04** (0.02)	0.01 (0.01)	0.03 (0.02)
Gender diversity (sd) * stock exch.	-0.35 (0.68)	-0.89** (0.41)	0.54 (0.69)
Mean age * stock exch.	0.01 (0.02)	0.02** (0.01)	-0.02 (0.02)
Mean education * stock exch.	-0.02 (0.02)	0.00 (0.01)	-0.02 (0.03)
% women * stock exch.	0.13 (0.29)	-0.04 (0.15)	0.17 (0.28)
Firm and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.35*** (0.54)	2.75*** (0.39)	0.60 (0.57)
R-squared	0.49	0.52	0.20
Observations	1164	1164	1164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

Results in Table 6.16 show that family firms listed on the stock exchange broadly replicate the same pattern of other firms listed on the stock exchange. Again the positive impact of education diversity is concentrated in family firms which are listed on the stock exchange. The negative effect of family firms on productivity disappears when they are also listed on the stock exchange. These results suggest that public listing requires some characteristics and a mindset that dominate those of an average family firm. We might think for instance, that once listed, firms are more sensitive to profit results and try to make the most of their workers, especially in terms of education composition.

Contrary to the literature on Japan (Mum and Jung, 2013 and Olcott and Oliver, 2014) we do not find any differential impact of foreign ownership on the diversity-productivity-wage nexus (Table 6.17). Diversity in firms owned by foreign entities does not have a different impact than diversity in firms owned by French nationals. France is (very) different from Japan where in the past (but with visible effects until recently) the cultural mainstream considered women only as housewives and mothers and where a foreign-owned company probably had very different values compared to national ones. In France, on the contrary, women labour force participation is 6 percentage points higher than the OECD average and 3 points higher than G7 average and foreign companies probably do not bring considerable differences in human resource management of gender (but also age and education) diversity. The lack of results might also be due to a relatively loose definition of foreign ownership which might not be linked to an effective impact on the company's culture and values (for instance, it is very different if the shareholders are foreign private equity funds or foreign pension funds).

Finally, we also look for differential impact in firms where workers own part of the stocks (we do not know how much of the shares are owned by workers but just that they are among the shareholders). According to the estimates in Table 6.18, age diversity further decreases firm productivity in firms which are owned by workers: when age diversity increases by one standard deviation (2.42 years), productivity decreases by 29 percent.¹¹ Education diversity, on the contrary, does not differ between

¹¹ $(-0.04-0.08)*2.42=-0.2904$

Table 6.16: *Family firms listed on the stock exchange, OLS estimates*

	VA/L	W/L	Gap
Age diversity	-0.04*** (0.01)	-0.03** (0.01)	-0.01 (0.02)
Education diversity	0.01 (0.01)	-0.00 (0.01)	0.01 (0.01)
Gender diversity	-0.38 (0.29)	0.33 (0.20)	-0.71** (0.29)
Mean age	-0.02** (0.01)	-0.00 (0.01)	-0.01* (0.01)
Mean edu	0.01 (0.01)	0.02*** (0.00)	-0.01 (0.01)
% women	-0.28*** (0.10)	-0.10 (0.07)	-0.18* (0.09)
Stock & family	-0.37 (1.43)	0.01 (1.08)	-0.38 (1.31)
Age diversity * stock & family	-0.00 (0.04)	0.02 (0.03)	-0.02 (0.04)
Education diversity * stock & family	0.04** (0.02)	0.02 (0.01)	0.02 (0.02)
Gender diversity * stock & family	-0.54 (1.00)	-1.22*** (0.46)	0.68 (1.01)
Mean age * stock & family	0.01 (0.02)	0.02 (0.02)	-0.01 (0.02)
Mean edu * stock & family	0.03* (0.01)	-0.01 (0.01)	0.04*** (0.01)
% women * stock & family	-0.10 (0.41)	-0.15 (0.19)	0.04 (0.40)
Firms and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.69*** (0.52)	2.59*** (0.37)	1.10** (0.56)
R-squared	0.47	0.52	0.18
Observations	1164	1164	1164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

Table 6.17: *Firms owned by foreign shareholders, OLS estimates*

	VA/L	W/L	Gap
Age diversity (sd)	-0.04*** (0.01)	-0.02** (0.01)	-0.02 (0.02)
Education diversity (sd)	0.01* (0.01)	-0.00 (0.01)	0.02** (0.01)
Gender diversity (sd)	-0.48 (0.30)	0.17 (0.19)	-0.65** (0.31)
Mean age	-0.02** (0.01)	-0.00 (0.01)	-0.02* (0.01)
Mean education	0.01* (0.01)	0.01*** (0.00)	0.00 (0.01)
% women	-0.29*** (0.11)	-0.13* (0.07)	-0.17* (0.10)
Foreign shareholders	-1.44 (1.20)	0.43 (1.01)	-1.87 (1.30)
Age diversity (sd) * foreign shareholders	0.05 (0.04)	-0.01 (0.03)	0.07 (0.04)
Education diversity (sd) * foreign shareholders	0.00 (0.03)	-0.00 (0.03)	0.01 (0.04)
Gender diversity (sd) * foreign shareholders	-0.84 (0.96)	-0.39 (0.73)	-0.45 (0.94)
Mean age * foreign shareholders	0.03 (0.02)	-0.00 (0.02)	0.03 (0.02)
Mean education * foreign shareholders	0.02 (0.03)	0.01 (0.02)	0.00 (0.04)
% women * foreign shareholders	-0.05 (0.32)	0.11 (0.21)	-0.15 (0.36)
Firm and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.75*** (0.53)	2.62*** (0.37)	1.13** (0.57)
R-squared	0.46	0.52	0.18
Observations	1164	1164	1164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

worker-owned firms and the rest of the sample. Gender diversity seems to have a negative impact on wages only in worker-owned firms: an increase by one standard deviation in gender diversity decreases wages by 8.7 percent.¹² These results should be interpreted with even more caution: there is just a small share of firms in our sample (3.69 percent of the total) and hence the possibility that that few “particular” firms drive the results is higher.

Interestingly a firm where workers own part of the stocks is also more productive. We cannot establish a clear direction of the causal effect but this effect is in line with Fauver and Fuerst (2006) who find a positive effect on Tobin’s Q in labour intensive industries but in stark contrast to the strong negative effect found in Gorton and Schmid (2004).

6.5 Discussion and conclusions

This chapter estimates the impact of workforce diversity in terms of age, gender and education on productivity, wages and productivity-wage gap for a sample of French firms. It contributes to the literature by bringing some evidence on the impact of workforce diversity in terms of age, gender and education on productivity and wages to France, one of the largest industrialized countries. It also examines how the benefits or losses of labour diversity are shared between workers and firms (i.e. the analysis is extended to wages and productivity-wage gaps). Secondly, it extends the literature on the diversity-productivity-wage nexus by examining the role of managers’ characteristics and different proprietary structures, using representative data at country-level while most of the previous literature is based on qualitative analyses or case studies.

Findings with OLS and IV, using the workforce composition of other firms in the same sector as an instrument, suggest that on average demographic diversity (age and gender) has a negative effect on productivity while educational diversity has a positive effect. Age diversity has also a negative effect on wages with no significant effect on the productivity-wage gap. Results with IV also find a negative effect of

¹²-1.09*0.08=-0.0872

Table 6.18: *Firms where workers are among the shareholders, OLS estimates*

	VA/L	W/L	Gap
Age diversity (sd)	-0.04*** (0.01)	-0.02** (0.01)	-0.01 (0.02)
Education diversity (sd)	0.01** (0.01)	-0.00 (0.01)	0.02** (0.01)
Gender diversity (sd)	-0.46 (0.30)	0.19 (0.19)	-0.64** (0.30)
Mean age	-0.01** (0.01)	-0.00 (0.01)	-0.01 (0.01)
Mean education	0.02** (0.01)	0.01*** (0.00)	0.00 (0.01)
% women	-0.28*** (0.10)	-0.11* (0.07)	-0.17* (0.10)
Workers shareholders	3.92** (1.74)	1.64 (1.04)	2.28 (1.43)
Age diversity (sd) * workers shareholders	-0.08** (0.04)	-0.02 (0.02)	-0.07* (0.04)
Education diversity (sd) * workers shareholders	0.02 (0.03)	0.00 (0.02)	0.02 (0.02)
Gender diversity (sd) * workers shareholders	-1.44 (1.13)	-1.09* (0.64)	-0.35 (1.01)
Mean age * workers shareholders	-0.04 (0.03)	-0.01 (0.02)	-0.02 (0.02)
Mean education * workers shareholders	-0.01 (0.02)	0.00 (0.01)	-0.01 (0.02)
% women * workers shareholders	-0.56* (0.30)	0.06 (0.21)	-0.63* (0.35)
Firm and workers controls	yes	yes	yes
Sector dummies	yes	yes	yes
Regional dummies	yes	yes	yes
Sector*Region dummies	yes	yes	yes
Constant	3.54*** (0.51)	2.67*** (0.37)	0.88 (0.54)
R-squared	0.47	0.52	0.18
Observations	1164	1164	1164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Worker and firm characteristics include: % non open-ended, % part-time, firm size, mean tenure, % white collars, capital/worker.

education diversity (and hence a positive productivity-wage gap) and a positive one of gender diversity on wages (and hence a negative productivity-wage gap).

The baseline results are in line with the theoretical literature: Jehn et al. (1999) and Lazear (1999) argue that education diversity benefits productivity thanks to mutual learning and spillovers whereas age and gender diversity are likely to hinder firm's productivity because of communication and coordination problems or because of attitudes and social norms in relations to women at work, still quite strong in France (Meurs, 2014).

Moreover, it is interesting to note that these results replicate those obtained in the previous chapter for Belgium. Despite different datasets, time period and econometric techniques we obtain the same results. Moreover, as discussed in the previous chapter, these results are coherent with those found in other developed economies. Parrotta et al. (2014a) show a negative effect of demographic diversity (age, gender and ethnicity) and a positive one of educational diversity in Denmark. Navon (2009) finds a positive effect of education diversity in Israel. Hamilton et al. (2004), Kurtulus (2011) and Leonard and Levine (2003) find negative effects of age diversity in studies at company level in the US. The only exception in the literature is the paper by Ilmakunnas and Ilmakunnas (2011) for Finland which shows a positive effect of age diversity and a negative one of educational diversity.

In this chapter we extend this literature by also looking at the role of managers and the proprietary structure of the firm. Managers are on the front-line in the companies and might have a preference for similar employees and hence favour them, or, on the contrary, suffer from the “queen bee syndrome” and prefer employees different from them. We do not find evidence for any of these theories. Manager's gender, age, education and tenure do not seem to affect how diversity impacts productivity and wage. This result might also tell that in France “diverse” managers refrain from promoting and valuing diversity not because they perceive similar workers as a threat, but because, despite all the public official attitude, it is still better for their own career prospects. If this proves correct, then the impact of diversity on firm's productivity will depend on those who select and reward managers.

Indeed we find some significant differential impact according to the type of share-

holders of the firm. Shareholders, despite not usually running the day-to-day business can influence the values and attitudes towards diversity of a company. They can even put in place forms of remuneration plans linked to diversity objectives like it is reported for Lockheed Martin, Goldman Sachs or Merrill Lynch.

In particular we find that family firms seem to be able to neutralize the negative effect of gender diversity on productivity which we register in other firms. Family firms offer greater job security and potentially a better working environment for both men and women. On the opposite, we find that companies listed on the stock exchange seem better able to reap the benefits of more educational diverse workforce. This can be due to a relatively more efficient human resource management of publicly listed companies for whom pursuing profit maximisation and shareholders value is more important than for family firms. This apply also to family firms which are publicly listed which suggest that by going on the stock exchange they lose their initial characteristics and attitudes of family firms. Finally, foreign owners do not significantly change the impact of diversity on productivity and wages while companies where workers own part of the shares see a negative impact of age diversity.

Overall we can conclude that the company proprietary structure, which is likely to determine the firm-specific culture and values, is somehow more relevant than the characteristics of the managers who run the day-to-day operations for an effective workplace diversity management. So far most of the attention has been put on managers and human resource practices. They are certainly very important but it appears that diversity and diversity management is something deeper than an attitude or a range of initiatives that can be changed by changing managers, for instance hiring younger CEOs or having a woman at the head of the company. The company culture, defined by the shareholders objectives and values, seems to play a stronger role. Those firms which allow more latitude for personal concerns like family firms provide a better environment for gender diversity. On the opposite, in those firms where revenues and profits are subject to a more intense control like in firms listed on the stock exchange, education diversity and its productivity-enhancing effect plays a more important role.

Future empirical research should further explore the link between workplace di-

iversity, manager characteristics and the proprietary structure of the firm. This issue increasingly raises concerns for shareholders and executives. Expensive diversity management plans are advertised online, but so far the evidence of diversity impact on firm performance is still very weak. In particular the focus has been mainly put on managers and human resource practices. Stronger actions on shareholders may prove more effective.

CONCLUSIONS

“There’s more evidence to come yet.”

Alice’s Adventures in Wonderland, Chapter XII

At the end of this research work, I am not sure if Alice’s King can be satisfied with respect to the quantity and quality of evidence provided. In the novel by Lewis Carroll he is clearly not. As anticipated in the introduction, the main objective of this thesis was to shed some new light on labour market institutions and heterogeneity in the labour market and point out a series of relatively neglected or new trade-offs to be considered when designing policies.

The last 25-30 years of academic and political debate on labour market reforms have not exhausted the need for more evidence. Neither has my thesis. On the opposite, the call for evidence is even stronger in a period where the overall paradigm and approach is being revisited.

Highlighting trades-off

In this thesis, we have taken three different angles to reflect the complexity and the heterogeneity of labour market regulations: employment protection legislation,

minimum wages and workforce diversity.

Employment protection legislation

The first institution analysed is employment protection legislation. This is arguably the most contentious labour market institution: the majority of European countries in the last 30 years have tried to reduce dismissal regulations and make the European labour market more similar to the American one. This is an area where economic research has worked quite extensively. I have focused the work on the impact of dismissal regulations on different type of gross worker flows, to understand whether dismissal regulations affect where labour resources are reallocated. It is indeed very different if lower dismissal protection results in increased flows into unemployment or in increased job-to-job transitions. Most of previous research has focused on the impact of employment protection on the stock of employment and unemployment. But behind static numbers there is a very lively dynamics. Every year, more than 20% of jobs are created and/or destroyed on average in the OECD area, and more than 30% of all workers are hired and/or separated from their employers. Labour markets are not a static framework as some textbook models might lead us to think.

To identify causally the effect we have used both a difference-in-difference approach (in which the impact of regulations is identified by exploiting likely cross-industry differences in the impact of firing restrictions) and a more standard time-series analysis (in which the effect of regulations is identified through regulatory changes over time).

We find that the more restrictive the regulations, the smaller the rate of job-to-job transitions, while no significant effect is detected as regards job-to-job transitions involving an industry change and/or job-to-jobless transitions. This finding might explain why higher employment protection in the end does not go along with higher feeling of job security (Clark and Postel-Vinay, 2009). Estimated effects appear significant from an economic point of view: taking our estimates at face value implies that reducing the indicator of employment protection for regular contracts from the OECD average to the level of the United States (so from 2.29 to 0.35) entails an increase in the rate of same-sector job-to-job transitions by about 60%.

We also assess the importance of different regulatory provisions and find that the practice of reinstatement in the case of unfair dismissal plays a crucial role in shaping gross worker flows: the more frequent this practice, the smaller the flows. As discussed in this thesis, this might explain why employment protection is perceived to be extremely rigid in a country like Italy despite a relatively low score as regards overall EPL concerning individual dismissals. Italy appears, in fact, to score the highest as regards the extent of reinstatement according to OECD indicators and the highest proportion of labour cases appealed and among the highest time for decision in labour cases.

From a policy point of view, the results indicate that relaxing dismissal regulations does not necessarily imply an increase in dismissals. Our results are consistent with the idea that if reforms liberalising dismissal regulations yield an increase in dismissals, they also increase the job finding rate following displacement. Thus, our results cautiously suggest that those displaced workers that would not have been displaced in the absence of deregulation tend to find relatively quickly another job. What is more, our evidence indicates that most of the additional transitions induced by regulatory changes will occur across jobs within the same industry, with therefore limited destruction of industry-specific human capital and likely no negative effects on reallocation efficiency.

Minimum wages in Europe

In the second part of the thesis we look at minimum wages in Europe. This used to be quite an old fashioned debate until a few years ago. Today, minimum wages have re-appeared on policy agendas across Europe (but also in the USA). A more aggressive wage policy at the national or European level is often seen by many as an attractive tool to curb the downward pressure on wages that is caused by low-wage immigration, austerity and globalisation. Moreover, collective bargaining coverage is weakening in many countries and the proportion of workers covered by collective agreements is dwindling in most Member States: minimum wages see them as an alternative tool to protect workers against low wages.

These developments have taken different directions across the countries: in Ger-

many, unions and social-democrats started campaigning for, and eventually obtained, a national statutory minimum wage. In the UK unions and Labour ask for an increase in minimum wage. In Italy unions oppose a national minimum wage but they discuss how to better include “precarious workers” in collective bargaining. At European level, some academics, unions, institutions and prominent politicians have started to discuss whether it is desirable to implement a harmonised rate in all EU Member States. The second part of this thesis has argued that this debate so far lacks not only a framework that renders the opposing positions between different minimum wage institutions more intelligible, but also crucial empirical evidence concerning the labour market outcomes associated with different minimum wage systems. Our results clearly underline the importance of thinking about the European debate as a choice between different minimum wage systems rather than the choice of a certain rate to be harmonised across the EU: therefore, we have collected data from more than 1100 sectoral-level agreements across Europe.

Part II shows the combination of sectoral minimum rates and high levels of collective bargaining coverage can, at least for certain outcomes, be regarded as constituting a functional equivalent to a binding statutory minimum wage at the national level. Both higher collective bargaining coverage and a national statutory minimum wage are significantly associated with lower levels of inequality among workers. But there are also trade-offs. Minimum wage systems with statutory rates at the national level are related to relatively lower wage floors. This is evidence in favour of an argument frequently put forward by trade unions from the Nordic countries and from Italy claiming that sectoral-level bargaining allows workers to obtain higher relative minima.

However in systems without statutory minima, the higher rates enjoyed by insiders appear to come at a cost for outsiders: we show that, all other things being equal, the higher the level of the minimum wage relative to the median wage, the more workers earn wages that are actually below the prevailing minimum. What is more, our findings indicate that minimum wage systems differ with respect to the proportion of workers who are either uncovered or whose wages violate existing minimum wage rules. A system with a national statutory minimum fares better in this respect than

a system with sectoral-level minima, although higher levels of collective bargaining coverage can offset this difference to some extent. Again, national statutory minima and sectoral-level collective bargaining coverage appear to be functional equivalents.

Non-coverage and non-compliance are empirically important phenomena in almost all countries. It is therefore worthwhile to reflect upon policies that could render minimum wages easier to monitor and to enforce. The research we conducted for this study made us painfully aware of the practical difficulties associated with gathering information on prevailing minimum rates in a given country, in a given sector and for a particular sector of employment. In many cases, even relatively straightforward operations such as transforming monthly into weekly or hourly minimum rates can be complicated and time consuming. One way to reduce non-compliance and non-coverage might therefore be simply to reduce the informational, search and compliance costs associated with minimum wage rules. These costs are today borne almost entirely by employers and employees and there might be a case for the state to facilitate the dissemination of information about existing minima in all parts of the labour market.

Age, education and gender diversity

The third part of the thesis studies the effect of workplace diversity on productivity, wages and productivity-wage gaps in Belgium and France. As discussed, diversity is not an institution as such (even though it can be considered as a by-product of antidiscrimination legislation) but a matter of concerns for employers and policymakers and the subject of increasing calls for regulations or at least a more attentive management.

Overall, our findings for Belgium and France suggest that while diversity is thought to be beneficial in much of the literature in HRM, in certain cases diversity may be detrimental for both companies and workers. Moreover, consequences of diversity are found to substantially depend on the firm's environment or proprietary structure.

In our analysis for Belgium, we find that using the generalized method of moments (GMM) and Levinsohn and Petrin (2003) estimators, educational diversity is beneficial for firm productivity and wages. In contrast, age and gender diversity are

found to hamper firm-level added value and average earnings. Findings for France with OLS and IV go in the same direction and suggest that demographic diversity (age and gender) has a negative effect on productivity while educational diversity has a positive effect. Age diversity has also a negative effect on wages with no significant effect on the productivity-wage gap. Results with IV also find a negative effect of education diversity (and hence a positive productivity-wage gap) and a positive one of gender diversity on wages (and hence a negative productivity-wage gap).

The magnitude of these effects is relatively big: estimates notably suggest that when age or gender diversity increases by one standard deviation, productivity drops on average by around 4 percent (by 9 percent for age diversity in France). On the opposite when educational diversity increases by one standard deviation, productivity rises by 2-3 percent.

These results are consistent with previous theoretical predictions in the literature highlighting that diversity benefits productivity if the gains of a more diverse workforce in terms of complementary skills and information sets outweigh additional costs related to communication and conflicts. This condition is unlikely to be satisfied for demographic diversity (heterogeneity in terms of e.g. age and gender) but may well be fulfilled for educational (i.e. task related) heterogeneity. In line with our results, they indeed suggest that mutual learning and collaboration among workers with different educational backgrounds may be sufficient to enhance efficiency.

Interestingly, these findings for Belgium and France are very similar to those found in other developed economies: the evidence arising from the small but increasing literature on the impact of workforce diversity on productivity shows so far a remarkable consistency.

Both chapters 5 and 6 find that the consequences of gender diversity are not homogenous across all firms in the economy. The analysis for Belgium shows that gender diversity generates gains in high-tech/knowledge intensive sectors: productivity is found to rise on average by between 2.5 and 6 percent following a one standard deviation increase in gender diversity. The opposite result is obtained in more traditional industries. These results can be explained by referring to the type of tasks to be performed (diversity is more likely to exceed the costs when the work environ-

ment is predominantly characterized by complex rather than routine tasks) or by the “gender identity” of the job (the workplace is more gender-balanced and probably less “macho” in innovative industries than in traditional one). Overall, findings do not point to sizeable productivity-wage gaps associated with educational and gender diversity. Age diversity, on the opposite, is generally found to decrease firm’s profitability. Results for France, show some significant differential impact according to the proprietary structure of the firm. Gender diversity seems to play a slightly more positive effect in family firms than in other firms probably thanks to a better working environment for women which allows more latitude for personal concerns. In firms listed on the stock exchange education diversity has a more beneficial role since these companies are probably more able (and more focused) than other firms to get benefits from workers with different educational tracks. Or, despite controlling for a wide set of workers’ and firms’ characteristic, we cannot exclude that these differences are due to different work content. Finally, foreign owners do not significantly change the impact of diversity on productivity and wages while companies where workers own part of the shares see a negative impact of age diversity.

Limits and steps further

“There’s more evidence to come yet, said the White Rabbit, jumping up in a great hurry”. This thesis does not satisfy the need for evidence on labour market institutions and heterogeneity in the labour market. On the opposite, it probably opens more questions than it answers to.

At the end of each chapter I have developed suggestions for future research. Let me recall briefly the main ones.

Concerning employment protection and worker flows, assessing more directly the impact of dismissal regulations on the efficiency of the reallocation process appears a much needed and promising avenue for future research. In particular, future research should focus on individual work trajectories, especially in the aftermath of a regulatory reform.

Concerning minimum wages, there are many ways in which the empirical research

could be pursued in order to improve our understanding of minimum wage systems (for instance, by detailing more the sectoral differences and likening them to other outcomes, most notably productivity and competitiveness evolutions). But first and foremost, researchers need much more data on wage floors in countries without statutory minimum wages. Our effort was limited to three years and six countries. Some statistical institutes (for instance ISTAT in Italy) collect collective bargained wages on a recurrent basis to monitor their average evolution and use it as a leading indicator for inflation to inform monetary policy decisions. But the very same data (but focusing on the minimum and not the average) could also be used to inform the research on minimum wages.

Finally, concerning workforce diversity, the literature is still very much in its infant stage. Future micro-level studies are needed to corroborate these findings and further develop the link between workplace diversity, firms and manager characteristics. Diversity is an increasing concern for shareholders, executives and policy-makers but so far the evidence is still very weak.

More in general, academic research on labour market institutions suffers from a very important limit. Institutions do not stand alone in the labour market but are often the result of a very delicate equilibrium between different cultural, political and institutional elements. For instance, lower employment protection legislation could be compensated by higher unemployment benefits. As shown in Part II of this thesis, the lack of a statutory minimum wage can be compensated by higher collective bargaining coverage. Labour market institutions also interact with product market regulations, with the functioning of the judiciary system and more in general with the general civic and legislative culture of a country. Analysing the simple direct effect of one institution on the labour market might prove in the end quite useless if not related to the overall institutional framework.

The literature in political science and political economy has developed a series of analyses by clusters of institutions. Peter Hall and David Soskice (2001) for instance developed the stream of the literature on the so-called varieties of capitalism. They looked at industrial relation, wages, productivity, education and training, corporate governance, inter-firm relations and relations with employees and they distinguished

developed countries in two main types: liberal market economies like the USA, UK, Canada, Ireland, etc. and coordinated market economies like Germany, Japan, Sweden, Austria, etc.. The sociologist Gosta Esping-Andersen (1990) developed a similar taxonomy of welfare states identifying three main models according to their organization, stratification and societal integration: the liberal one (like in the US), the corporatist-statist (like in Germany) and the social democratic (Scandinavians).

These taxonomies have the great merit of bringing together different institutional dimensions and looking at the overall coherence of the institutional system. They do not take a single institution in isolation and hence do not fall in the trap of putting the entire fault on one single institution (like some people did wrongly with employment protection in the Nineties) but analyse the overall coherence of institutional setting and reform. But, as most of taxonomies, they are often too simplistic and tend to downscale the great variety inside countries of the same group (e.g. Ireland is undoubtedly not like the USA in many respects. How do these theories explain this fact?). Moreover, these taxonomies are mostly confined to qualitative analysis. Indeed, most of empirical literature in economics has treated institutions independently as if they acted in isolation. In this thesis we have tried to go a bit forward in this respect, notably in the second part on minimum wage where we discuss relatively neglected complementarities and trade-offs of statutory minimum wages with collective bargaining coverage. But a much deeper work is needed in this respect to gauge interdependencies and interactions between institutions. The need for evidence then has not been exhausted. Not at all.

Our research journey does not end like in Alice's Adventures in Wonderland. Just at the point where the Queen wanted her head off, Alice could get away and say: "*Who cares for you? You're nothing but a pack of cards!*". Institutions are often a pack of papers and legislative norms but they matter incredibly to people and play a key role in the overall economic functioning of our countries. Economic research has still a long way to go to fully gauge their functioning and impact of our lives. This can be frightening and discomforting for policy-makers who have to take decisions under a still dense veil of ignorance. But it is also a fascinating challenge for the next decades.

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