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THE EFFICIENCY OF FISCAL MEASURES IN PREVENTING OUT-MIGRATION FROM NORTH FINLANDⁱ

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Abstract

In this paper we introduce a computable general equilibrium (CGE) model for the Finnish regional economy, RegFin. This multi-sector and interregional model characterizes economic activity in the regions of Lappi, Pohjois-Pohjanmaa, Kainuu, Keski-Pohjanmaa and the rest of Finland. We consider the macroeconomic effects of a regional policy applied to North Finland that is similar to tax reforms which have been implemented in Norway. Tax incentives affect individual choices regarding both migration and employment. We also study a value-added tax reform where labour costs are exempted from the tax base. Our simulations seem to indicate that the regional differentiation of the employers' social security contributions and the value-added tax reform could be effective tools of regional policy.

Key words: payroll taxation, value-added taxation, CGE modelling, RegFin regional model.

JEL: C68, R11, R13.

Wirksamkeit steuerlicher Maßnahmen bei der Prävention einer Abwanderung aus Nordfinland

Thomas F. Rutherford and Hannu Törmä

Abstract

In diesem Beitrag stellen wir ein berechenbares allgemeines Gleichgewichtsmodell namens RegFin für die finnische Regionalwirtschaft vor. In diesem multisektoralen und interregionalen Modell wird die

wirtschaftliche Tätigkeit in den Regionen von Lappi, Pohjois-Pohjanmaa, Kainuu, Keski-Pohjanmaa sowie im übrigen Finnland charakterisiert. Wir untersuchen die makroökonomischen Auswirkungen einer Regionalpolitik für Nordfinnland, die den in Norwegen umgesetzten Steuerreformen ähnelt. Steuerliche Anreize wirken sich auf individuelle Entscheidungen hinsichtlich der Migration und des Arbeitsverhältnisses aus. Ebenso untersuchen wir eine Reform der Mehrwertsteuer, bei der die Lohnkosten nicht steuerlich veranschlagt werden. Unsere Simulationen scheinen darauf hinzuweisen, dass eine regionale Differenzierung der Sozialbeiträge von Arbeitgebern sowie eine Reform der Mehrwertsteuer wirksame Instrumente der Regionalpolitik darstellen könnten.

Key words:

Lohnsteuer

Mehrwertsteuer

CGE-Modelle

Regionalmodell RegFin

JEL: C68, R11, R13.

La eficacia de las medidas fiscales en la prevención de la emigración desde el norte de Finlandia

Thomas F. Rutherford and Hannu Törmä

Abstract

En este artículo introducimos un modelo de equilibrio general computable (EGC) para la economía regional de Finlandia (RegFin). Este modelo multisectorial e interregional define la actividad económica en las regiones de Lappi, Pohjois-Pohjanmaa, Kainuu, Keski-Pohjanmaa y el resto de Finlandia. Aquí consideramos los efectos macroeconómicos de una política regional aplicada al norte de Finlandia que es similar a las reformas fiscales que se han aplicado en Noruega. Los incentivos fiscales afectan a las opciones individuales con respecto a la emigración y al empleo. También analizamos una reforma del impuesto sobre el valor añadido en la que los costes laborales estén exentos de la base impositiva. Nuestras simulaciones parecen indicar que la diferencia regional en las contribuciones a la seguridad social por parte de los empresarios y la reforma del impuesto sobre el valor añadido podrían ser herramientas eficaces de la política regional.

Key words:

Tributación sobre los salarios

Impuesto de valor añadido

Modelo CGE

Modelo regional RegFin

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JEL: C68, R11, R13.

1. Introduction

Finland experienced an economic boom from 1985 to 1990, but when the 'bubble' in the finance and housing markets burst, there was a loss of 15% in GDP between 1991 and 1995. This caused severe problems for many regions, especially in the eastern and northern parts of the country. The population of North Finland subsequently decreased by over 33 000 inhabitants between 1990 and 2002. At the end of 2002 there were 715 000 people living in the four northern regions of Lappi, Pohjois-Pohjanmaa, Kainuu and Keski-Pohjanmaa, representing 14% of the Finnish population of 5.2 million. The unemployment and net outward migration figures reveal the severity of the problems.

(Table 1 here)

Unemployment figures suggest that the economy was at full capacity for all regions in 1990, but over 1991-95 unemployment rates grew by three to fourfold in North Finland. The situation was worst for Kainuu, where 23.5% of the labour force was without a job in 1997. The turning point came in 1994 when the recovery started from the south. The labour force began to move after new jobs were created. Net outward migration rates have grown considerably in all regions of North Finland since 1994. The situation has been worst for Kainuu and Lappi, where in the worst years 3-6% of the labour force has migrated.

There are some arguments in favour of regional policies which staunch out-migration. The fiscal federalism literature states that, for instance, without intervention, congestion and fiscal externalities can lead to inefficiencies in the spatial allocation of labour and capital. Dixon et al., 2005 studied these and other regional policy measures using their Commonwealth/State Funding (CSF) CGE model for Australia. It might be possible that some features of their model could be incorporated into RegFin. One aspect that we will develop is the migration block to better take into account the fact that the spatial pattern has become more and more mosaic in Finland. Second, when labour out-migrate, there will be sunk costs in the

1 infrastructure. Lastly, there are unfavorable demographic changes because those moving are usually
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3 families with small children.
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8 Economists admit that one cannot control the market economy in the long run. Some decision makers,
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10 however, think that the government should try to do something in the short run. Many economic and so-
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12 cial problems might be avoided if there was enough adjustment time for both the sender and receiver re-
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14 gions. The regional government in North Finland have no means themselves to cope with the serious
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16 problems. Most of the municipalities have growing negative budget balances, so the only way to do
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18 something is to rely on the goodwill of the national government. There are, however, no guarantees that
19
20 public policies against out-migration and unemployment are effective. This was demonstrated in Giesecke
21
22 and Madden, 2003 where the Australian FEDERAL-F CGE model was used to test whether it would be
23
24 possible to apply government fiscal policy, in a budget-neutral setting, to stop the GDP share of Tasmania
25
26 from decreasing. One result was that the phasing out of the payroll tax over five years would increase the
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28 GRP and employment only slightly because rising wages would offset the other more favourable effects.
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37 The present government agreement states that regional policy measures will be used to reduce the high
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39 rate of out-migration from the north. We do not know a priori if this is a good or bad policy objective, but
40
41 there are tools for studying the effects of alternative policies to achieve this objective. Political decision
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43 makers clearly lack the quantitative tools and policy assessment services at the regional level in Finland
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45 for their value-based decisions.
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51 **2. Regional CGE modelling**

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56 CGE modelling has gained much attention during the last thirty years. Partridge and Rickman (1998) is
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58 the most comprehensive survey article of regional and multiregional CGE models to date. In their foot-
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60 note 1 they mention five surveys for mostly national models on taxation policy, international trade, the
development policy of LDC, energy and environmental issues in their critical analysis. Partridge and

1 Rickman also list the key features of some 28 regional CGE models in their Table 1, of which over a
2 dozen are multi-regional. There are also several sub-national models. Despotakis and Fisher, 1988 is an
3 early example and a clear presentation of a CGE model for the Californian economy comparing the use of
4 generalized (flexible) and ordinary (fixed) Leontief production functions.
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12 In footnote 2 of Partridge and Rickman, 1998 is a reference to Kraybill, 1993, who mentions a handful of
13 early multi-regional models and gives a short survey, although his emphasis is on comparing CGE to in-
14 put-output models. An early example is Jones and Whalley, 1989, who constructed a static model for six
15 Canadian regions. Also Liew, 1984 developed a Leontief-type multi-region model for Australia. Today
16 we have several multi-regional CGE models. Just recently in 2003, the Review of Urban & Regional De-
17 velopment Studies published three regional CGE model articles. The research topic of Schwarm and Cut-
18 ler, 2003 was small city and town SAMs, Giesecke and Madden, 2003 presented a large-scale dynamic
19 multi-regional model, and Diao et al., 2003 investigated China's integration into the WTO using a CGE
20 model.
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37 The CoPS modelling team of the University of Melbourne, Australia has developed several regional CGE
38 models. The MONASH model (Dixon and Rimmer, 2002 and Horridge et al., 1996) has 56 regions and
39 has been developed from the older ORANI model. MMRF-Green has six states and two territories. Fi-
40 nally, the TERM model has 57 regions in a bottom-up manner. These three dynamic regional CGE mod-
41 els have been used in a multitude of applications of Australian national and regional policies. Other well-
42 known regional CGE models are the Scottish two-region AMOSRUK model (Ferguson et al., 2004) and
43 the Brazilian 27-region B-Maria model (Haddad, 2004).
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56 Our work on the REGional model for the FINnish economy (RegFin) started in 1994 when we con-
57 structed a miniature version (Törmä and Sihvonen, 1997). In 1998 we constructed a model for twelve
58 "lääni" regions to consider the welfare and reallocation effects of government finance cuts (Törmä and
59 Rutherford, 1998). The RegFin model is a descendent of our GemFin model, which operates at the na-
60

1 tional level (Törmä and Rutherford, 1993, Törmä, Rutherford and Vaittinen, 1995 and Vaittinen 2004).

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3
4 The design of the model is presented in the following table.

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8 (Table 2 here)

9 10 11 12 13 **3. Structure of the RegFin regional model**

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18 RegFin is built using the blueprint of a well-established computable general equilibrium model. Its
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20 uniqueness comes from the fact that the data base has never before been used in a CGE model. The model
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22 emphasizes Finnish institutions and the mechanisms of national government economic finance toward the
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24 regional economies. Two of perhaps the most serious economic problems of North Finland have been
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26 denoted and modelled: unemployment and net migration. North Finland and the rest of Finland are co-
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28 dependent through the allocation of labour, via domestic export and import and through net migration.
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34 The model is static, representing a benchmark equilibrium calibrated to regional economic activity and
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36 calculating a “counterfactual equilibrium” in which labour, capital, consumption and trade respond to a
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38 new set of policy instruments. The model calculates only the new equilibrium, and the path from the old
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40 to the new equilibrium is not revealed. It is, however, possible to perform comparative-static calculations,
41
42 which are of much value for regional policy analysis. The study of the dynamic evolution of the economy
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44 would require at least a recursive version examining a sequence of static equilibriums. We have plans to
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46 include dynamics, but here we concentrate on the static model.
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53 We deal here with an equilibrium model where all markets clear and all budget constraints are binding.
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55 There is perfect competition assumed together with constant returns to scale in regional production. La-
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57 bour markets are an exception to the equilibrium condition, as we allow for unemployment. We are aware
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59 that RegFin has the flavour of a disequilibrium model. Due to including unemployment, it could be con-
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sidered as a computable quasi-Walrasian flex-price model. We feel, however, that it is reasonable to treat

1 and call it a CGE model because we use the wage curve theory where wages, employment and unem-
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4 ployment are jointly determined. Our sensitivity analyses also indicated that including unemployment
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6 does not change the other simulation results to an extent that would change the interpretation. RegFin has
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8 been implemented with the GAMS (Brooke et al. 2005) and MPSGE (Rutherford, 1998) software. The
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10 model is solved with the PATH algorithm.
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15 **Modelling unemployment**

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20 There are several approaches to modelling unemployment. One approach is presented in Horridge et al.,
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22 1999 where unemployment can be treated either endogenously or exogenously. In the first case, the la-
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24 bour and migration block of the model specifies regional labour supply. With labour supply determined,
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26 the labour market and regional migration block determine regional unemployment rates given regional
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28 labour wage differentials. With given regional unemployment rates and regional labour supply, regional
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30 employment is determined as a residual. Fixing wage differentials determines the demand for labour so
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32 that with regional labour supply given, the model will determine regional unemployment as a residual. In
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34 the second case, regional wage differentials and unemployment rates are exogenously specified.
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41 Gillespie et al., 2002 use a labour market closure where real consumption wage is negatively related to
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43 regional unemployment rate. Wages are determined in accordance with this regional wage curve. Real
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45 wages partly determine employment, so unemployment is the difference between regional labour force
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47 and regional employment.
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53 Our specification of unemployment is based on the wage curve relation formulated by Blanchflower and
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55 Oswald, 2006. They consider two regions within a country and assume that region A's unemployment
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57 rate is double that of region B. The wage-curve finding states that a worker's wage will then be 10%
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59 lower in Region A than the wage of an identical worker in Region B. The mathematical specification for
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the relationship parameter ϕ is of the form:

$$(1) \quad 2 = 0.9^\varphi \implies \varphi = \log(2)/\log(0.9) = -6.6$$

Blanchflower and Oswald postulate that the wage curve is valid in over one hundred countries, including Finland. This assumption means that we set the following constraint on unemployment.

$$(2) \quad ur_r = (pl_r/pc_r)^\varphi$$

Here ur is the unemployment rate, pl is the wage rate, pc is the consumer price index, and r refers to the regions.

The constraint states that when the labour markets become tight, the demand for labour increases and unemployment decreases, and real wages will increase. This negative relation is evident especially after 1994 when Finland began to recover from the deep recession.

Modelling net migration

There are many possibilities for the migration equation. One way was introduced in Jones and Whalley, 1989, which was based on location-specific preferences in reacting to regional income differences. Ferguson et al., 2004 used an equation wherein migration was determined by the real consumption wage ratio and the unemployment rate ratio between the regions. This was also the case in Gillespie et al., 2002. Also, Harrigan and McGregor, 1989 and McGregor et al., 1995 show how net migration can be modelled in a CGE model. We follow their example and assume that net migration relative to the lagged labour force is a function of standard of living and unemployment differentials. The migration model is linear and of the form:

$$(3) \quad netmig_i/force_{t-1,i} = \alpha + \beta (grp_i/grp_j) - \delta (ur_i/ur_j) + e$$

1 The variable netmig is net migration, lforce is labour force, grp is gross regional product (GRP) per cap-
2 ita, ur is unemployment rate, e is the error term, and i and j refer to the regions.
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8 We assume that the rise in the GRP differential correlates positively with the standard of living differen-
9 tial. The parameter β has a positive sign, so we assume a priori that the rise in the standard of living in a
10 region will increase net migration (in-migration – out-migration) toward that region. The unemployment
11 differential, parameter δ , is assumed to correlate negatively with net migration into the region. So the pa-
12 rameter for this term should have a negative sign.
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23 In order to establish parameters for the migration equation we examined a pooled cross section and time
24 series data covering the period 1990-1999. Data from all 20 Finnish regions ($n = 200$) provided the fol-
25 lowing estimates for the parameters (significance): $\beta = 0.013$ (10%) and $\delta = -0.008$ (5%) with $F = 14.686$
26 (1%) and $R^2 = 0.106$. The signs are correct, but the explanatory power could be better. After writing this
27 article, we estimated the equation again with a larger data set ($n = 300$), and R^2 rose to 0.67. The coeffi-
28 cient values did not change, but their significance became much better. This relationship determines net
29 migration in the model. Moisio, 1999 summarizes other Finnish research concerning net migration.
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41 Consumption

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46 Apart from labour market disequilibrium and endogenous migration, RegFin is a conventional general
47 equilibrium model. Final demand within each region arises from a representative consumer. Data prob-
48 lems at the regional level prevent us from specifying more households. The representative consumer owns
49 all labour and capital endowments of the regional economy. He sells them at the factor markets, earning
50 factor income to finance his private consumption, which is also dependent on real consumer prices. The
51 representative consumer maximizes a CES (Constant Elasticity of Substitution) utility function defined
52 over the consumption of regional and national products. The representative consumer also pays taxes and
53 receives subsidies and transfers from both the regional and national governments.
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4 Central government is divided into two interrelated decision makers: the national and regional govern-
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6 ments. Both public agents collect fees and taxes to finance the provision of public goods and services. All
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8 relevant tax categories such as output and factor taxes or personal income taxes both at the national and
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10 regional level as well as subsidies and transfers are included in the model data base.
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13 14 15 **Production**

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20 Firms are assumed to minimize their production costs. There are 37 sectors per region (see Appendix).
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22 Each region produces for its own use, to satisfy the demand from the other regions, and to participate in
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24 domestic and foreign trade. Regional production is modelled through CES production functions with la-
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26 bour and capital as primary inputs. Intermediate factor use is modelled through an input-output model
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28 (Leontief structure).
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34 35 **Foreign and domestic trade**

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39 Foreign and domestic trade has been modelled assuming that domestic and foreign goods of the same
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41 sector are qualitatively different. Armington's assumption (see Armington, 1969) of regionally differenti-
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43 ated products is thus used to explain the cross-hauling of domestic and foreign goods. Domestic goods are
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45 produced jointly with exports according to a CET (Constant Elasticity of Transformation) technology.
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47 Imports compete with domestic goods. Foreign imports are used by the regions to satisfy domestic de-
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49 mand for foreign goods.
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Equilibrium conditions

Since RegFin is an equilibrium model, it has several conditions that specify the equality of demand and supply. There is a market-clearing equation for each good and factor. We employ a long-run neoclassical closure in which the trade balance (current account) is exogenous and there is a flexible real exchange rate. The labour market closure is based on a wage curve, so wage, employment and unemployment are jointly determined. Capital stocks are mobile within but not across regions. Final consumption is determined by a conventional neoclassical framework in which consumers maximize welfare subject to the budget constraint. Inter-regional domestic trade is balanced through the income constraints with the relative prices of goods produced in different regions determined endogenously. In the public sector closure, it was assumed that the regional provision of public goods and services is constant in North Finland. The rest of Finland will compensate for the shortfalls in regional tax revenues by lump-sum transfers. It is important to note that our simulation results might be sensitive regarding the choice of the closure.

Benchmark data

The five regions in the RegFin model are Lappi, Pohjois-Pohjanmaa, Kainuu, Keski-Pohjanmaa and the rest of Finland. We have used official data from both regional and national accounts of Statistics Finland. The same is true for income and expenditure data. A linked set of social accounting matrices (SAMs) were constructed and based on the latest input-output study from 1995. This is also the benchmark year from which RegFin was calibrated. Finally, elasticity values are frequently used literature estimates, and the values are in the range (0 to 4). We conducted some sensitivity analyses of the results by altering the elasticity values. These results are reported in Section 6: Sensitivity analysis.

4. The Norwegian regional policy model

Norway has established an action zone for Northern Troms and Finnmark. The law has been in effect from the year 1990. The objective was to reverse the negative trend that was especially obvious in the 1980s. This included a lack of jobs, a poor economy in business and industry, insufficient qualified personnel and decreasing population figures. The action zone is a superstructure for the following specific measures introduced there: exemption from payroll tax, reduction in the charge on electricity consumption for both commercial enterprises and households, exemption from the investment tax on building and construction work, reduction in personal income tax, increase in child benefits and a release from back payments of loans from the National Education Loan Fund.

These measures have been effective. Eikeland and Pedersen, 1997 have estimated that the number of jobs increased by 3813 or 8.4 percent of the total jobs in the area. They also find that industrial investment has increased since 1990 as has the economic solidity of the enterprises. They report that the population increased by 1921 persons. Unemployment has fallen but is still higher than the average of the country. The supply of qualified personnel to the public sector has also improved.

The political decision makers in the four northern regions of Finland have closely followed what has been done in Norway. In a situation in which they cannot do much to improve their economic situation, they have been lobbying for similar regional economic measures. This is of course a zero-sum game toward the rest of Finland, which should finance these measures.

The literature on the efficiency of indirect and direct taxes is vast. Good references are Creedy (1999; 2001) and the wide range of literature they review. Creedy's (2001) analysis does not, however, cover large multi-industry CGE models such as ours. Another good source is Alm et al. (2006), which emphasises the global context of tax reforms. Results from tax incidence analysis emphasise the effect of payroll taxes on the supply and demand of labour. The reform changes the indirect cost of labour, but changes in

1 wages will have an affect on labour demand. On the other hand, changed wages can have an influence
2
3 on the supply of labour, so the final answer to how employment will change remains uncertain.
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7 Gruber (1997) reviews previous research and reports mixed results concerning to which extent the payroll
8 tax is shifted to wages. His own finding for Chile suggests that the incidence is fully on labour, with only
9 little effect on employment. Fullerton and Metcalf (2002) state that empirical testing of payroll tax inci-
10 dence in the US has proved that both employer and employee shares are fully borne on labour. The large
11 tax literature survey of Kesselman and Cheung (2004) confirm these findings for Canada. This evidence
12 suggests that introducing a payroll tax will result in lower wages and removing it in higher wages. Fuller-
13 ton and Metcalf (2002) point, however, to the result of Fuchs, Krueger and Poterba (1998), who find that
14 the median belief among economists about the payroll tax is that 20% of the burden is borne by employ-
15 ers. All in all, we should see an increase in wages when we lower labour-related production costs in our
16 simulations.
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33 In our analysis we have decided to focus on the employers' social security contributions. These are pay-
34 roll taxes as they relate directly to the firm's wage bill with constant percentages. The following chapter
35 reports the results from our model simulations in which we decrease the payroll tax rate. We also study a
36 value-added tax reform where labour costs are exempted from the tax base. Both of these reforms reduce
37 the indirect costs of labour, and we test whether they could decrease unemployment and out- migration.
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39 In each of our simulations we calculate the costs to the national and regional governments. Both of these
40 measures are of interest for the decision makers of North Finland.
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4. Empirical findings

Employers' social security contributions as a means of regional policy

We carried out a range of simulations of decreases in payroll taxes (employers' social security contributions), starting with a 10 per cent cut and proceeding in 10 per cent intervals (i.e. -10%, -20%, ..., -50%).

We report results below for the case of a halving of payroll taxes in North Finland.

(Table 3 here)

We first look at the demand side of the regional economy. The payroll tax reform would lower the indirect costs of labour. The demand for labour would increase because, with the initial factor price ratio, capital would be substituted by labour. This would increase labour incomes and create a short-run increase in aggregate demand that would create economic growth in North Finland. In the long run, both wages and capital rent would increase because of the increase in aggregate demand. The relative factor price ratio would be in favour of capital limiting the growth of the demand for labour. Capital demand and rent would increase both because of the favourable change in the factor price ratio and the increase in economic growth. An increase in capital rent and capital demand would, on the other hand, mean an increase of capital incomes. The disposable incomes of regional consumers would increase. This would further boost aggregate demand and strengthen economic growth, which would have positive multiplier effects on factor and disposable incomes, creating a circle of growth.

On the supply side, the producers would increase their aggregate supply when effective labour costs decrease. Our results seem to indicate, however, that the demand effects would outweigh the supply effects, so consumer prices would increase.

1 The payroll tax reform would create strong economic growth in North Finland. GRP and welfare,
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3 measured with the traditional Equivalent Variation (EV) measure, would increase considerably. Eco-
4
5 nomic growth would also decrease unemployment, and 14 000 jobs would be secured. Economic growth
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7 and the decrease of unemployment would cause net migration from the North to the rest of Finland to
8
9 decrease. Halving of the payroll taxes would decrease net migration and foster immigration by about
10
11 1057 people. The reform would slightly strain economic growth and welfare and increase unemployment
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13 somewhat in the rest of Finland.
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20 The reform would be positive for the regional governments of North Finland because the increase of net
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22 income would be FIM 504 million. If the payroll taxes were halved, it would cost the national govern-
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24 ment FIM 2249 million. If the national government collected the surplus of the regional government, the
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26 net cost of the national government would be FIM 1745 million or FIM 2441 per capita.
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31 32 **Value-added tax as a tool of regional policy**

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37 Our second simulation was about the value-added tax. We studied a reform where labour costs would be
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39 exempted from the tax base. The value-added tax would be based entirely on the use of capital. This re-
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41 form would benefit labour-intensive sectors. We report here a case where the reform would be fully car-
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43 ried out in North Finland.
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48 (Table 4 here)
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53 Implementation of the reform would mean that the effective capital rent would already increase in the
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55 short run because the entire value-added tax burden would be on capital. On the other hand, the reform
56
57 would mean that producers would not have to pay value-added tax on the use of labour. As the effective
58
59 labour costs decrease, the demand for labour would increase in the short run as dearer capital would be
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1 substituted by labour. These relative price and demand changes would mean increasing the short-run
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4 factor and disposable incomes and an increase in aggregate demand.
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8 In the long run this economic growth would further increase capital rent and capital incomes. All this
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10 would boost economic growth, and a positive growth circle would materialize through multiplier effects.
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13 On the supply side, producers increase their supply when effective labour costs decrease. Our results
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15 seem to indicate that the supply effects would outweigh the demand effects because consumer prices
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17 would decrease.
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22 The value-added tax reform would also produce considerable economic growth and welfare in North
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24 Finland. Unemployment and net outward migration would decrease as aggregate demand increases. The
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26 other factor that would decrease unemployment would be the increase of capital rent with respect to con-
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28 sumer prices. Dearer capital would be substituted by labour, unemployment would decrease, and 8 000
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30 jobs could be secured. By means of the value-added tax reform one could decrease net outward migration
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32 and foster immigration by about 668 people. The reform would strain somewhat economic growth and
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34 welfare, and increase unemployment somewhat in the rest of Finland.
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41 The regional government would benefit from the value-added tax reform. The total benefit would be FIM
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43 423 million. The cost to the national government would be FIM 2535 million. If the national government
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45 collected the surplus of the regional government, the net cost would be FIM 2112 million or FIM 2954
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47 per capita.
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53 We now return to the comparison of our results with the findings of previous studies. Our results for the
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55 payroll tax reform are partly in line with previous evidence. Wages would increase if the payroll tax rates
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57 were lowered. Our results suggest, however, that the burden is not totally on labour but that capital rent
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59 would also increase. The primary production inputs would share the burden, and the share of labour
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1 would be greater than that of capital. In the value-added tax reform, almost all the burden is on capital
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3 because labour is no longer in the tax base.
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8 **6. Sensitivity analysis**

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12 A number of elasticities of transformation and substitution in the model are based on limited empirical
13 evidence. In the following we report some sensitivity analyses. In the experiments the corresponding elas-
14 ticities took the values 0, 1, 2 and 4. All runs were done for both means of regional policy.
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19 We concluded from the sensitivity analyses that our results are in most cases not too sensitive with re-
20 spect to the elasticity values. There was only little variation in the results with respect to the transforma-
21 tion elasticity between domestic and export goods and the substitution elasticity between domestic and
22 imported goods or the substitution elasticity of regional and national goods. The results are most sensitive
23 with respect to the substitution elasticity of capital and labour.
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36 The key variables, unemployment and net migration, seem to be most sensitive with respect to the value
37 of the substitution elasticity of capital and labour. We found out, however, that differing elasticity values
38 did not change the sign of the key results. In a long-run analysis we might rule out the elasticity value
39 zero. In this case the variations of the results become narrower. The sensitivity of the results should be
40 kept in mind when making conclusions from this study.
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50 **7. Conclusions**

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55 The purpose of this paper has been to study tools of regional policy that could be used to restrain unem-
56 ployment and out-migration in North Finland. As a working tool for our analysis we constructed the
57 multi-sector and interregional computable general equilibrium model RegFin. Our main contribution is
58 the fact that our model is still, after a decade, the only bottom-up interregional CGE model in Finland. It
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1 has now been used in twenty applications. The linking of unemployment and net migration to a CGE
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4 model has also been done elsewhere. We feel, however, that they should be included in a case where they
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6 are growing problems, such as in North Finland.
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10 We have run simulations for one of the regional policy measures used in Norway: the employers' social
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12 security contributions (payroll tax). We have also investigated a value-added tax reform where labour
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14 costs would be exempted from the tax base. Some key macro economic results were reported from the
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16 simulations. We emphasize that we do not want to do a comparative social welfare exercise, but just point
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18 to some differences between the two reforms.
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24 Our results seem to suggest that the reduction of the payroll taxes and the value-added tax reform would
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26 both be effective tools of regional policy. They would reduce unemployment and out-migration in North
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28 Finland. The net cost per capita of the national government would, however, be lower for the payroll tax
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30 reform compared to the value-added tax reform. The same is true when we compare the two reforms by
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32 the number of secured jobs and by using the standard EV calculation.
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38 Both reforms would benefit labour intensive industries. The reduction of the employers' social security
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40 contributions produced the most growth in the output and in welfare because this regional policy measure
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42 directly reduces the real price of labour. The regional policy measure, which is "closest" to the problem of
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44 too high labour costs, produced more positive effects for employment and was the "cheapest" when
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46 measured by the net cost per capita of the national government. At the end, we state that any CGE simula-
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48 tion results, including ours, might be sensitive to the modelling details.
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54 The RegFin model should be developed further. There are at least three aspects of the model that should
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56 be investigated. First, the model is static. A dynamic version of the model would reveal the path of the
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58 regional economy from the old to the new equilibrium. Second, we should develop the migration block of
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60 the model further, perhaps estimating a system of equations where the parameter estimates of both in- and

1 out-migration would be jointly determined. Last, the use of econometric estimation of the sectoral elas-
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3 ticities should be increased. Reliable estimates for sectoral capital-labour substitution elasticities would be
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5 valuable.
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10 Halving of the employers' social security contributions or the proposed value-added tax reform are large-
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12 scaled tax reforms that seem to be effective means of regional policy but are hard to put into effect politi-
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14 cally. By means of the RegFin model, a level of the net cost for the national government could be found
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16 that would be politically tolerable. We hope that the model simulations will help the decision makers to
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18 visualize the regional effects of alternative policy measures in restraining unemployment and out-
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20 migration in North Finland.
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27 Finally, we mention that our RegFin simulation results partly influenced the decision of Parliament,
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29 where the 13 northern-most municipalities in the Lappi region were given reductions in the employers'
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31 social security contributions. The new budget law is in effect for three years. The decision makers in
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33 Lappi are pleased with this decision, and they feel that the door to Norway-like regional policy is finally
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35 open.
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Year	Keski-Pohjanmaa	Pohjois-Pohjanmaa	Kainuu	Lappi	Whole of Finland
Unemployment rate, %					
1990	3.0	4.3	6.0	4.9	3.2
1991-94	13.0	14.9	17.1	17.1	12.8
1995-98	12.7	15.9	21.7	20.6	13.5
1999-2002	9.9	12.6	17.4	16.6	9.6
2002	8.0	13.0	16.5	16.2	9.1
Net outward migration, % of labour force					
1990	0.5	1.1	0.8	1.8	0.0
1991-94	0.3	0.5	1.4	1.7	0.0
1995-98	1.4	1.6	2.6	4.7	0.0
1999-2002	1.4	-0.2	2.8	5.8	0.0
2002	0.8	1.0	2.7	3.6	0.0

Table 1. Unemployment and net outward migration in Finland 1990-2002.

1 **Regional CGE Model for Finland**

2 **RegFin**

3 **RegFin**

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7 General Features

- 8
- 9 - computable interregional general equilibrium simulation model
- 10 - static, comparative-static comparisons possible
- 11 - basically Walrasian, price adjustment equilibrates regional economy
- 12 - wage, employment and unemployment are jointly determined according to the wage curve theory
- 13 - net migration as a function of GRP and unemployment differentials
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18 Benchmark data provided by Statistics Finland

- 19 - Lappi, Pohjois-Pohjanmaa, Kainuu, Keski-Pohjanmaa and Rest of Finland as statistical units
- 20 - based on official regional and national account of Statistics Finland
- 21 - regional Social Accounting Matrices (SAMs) are based on regional Input-Output Study 1995
- 22 - benchmark calibrated for 1995
- 23
- 24
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26 Consumption

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- 28 - each region has one representative consumer household which maximizes welfare (CES utility function)
- 29 - public sector is divided into two inter-related agents: national and regional governments which act as separate
- 30 decision makers
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- 32

33 Production

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- 35 - constant returns to scale and perfect competition assumed
- 36 - regional production is modelled through cost minimization of firms
- 37 - labour and capital as primary inputs (CES production function)
- 38 - inter-sectoral inputs are modelled via an input-output model (Leontief structure)
- 39 - 37 sectors per region
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43 Foreign and domestic trade

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- 45 - domestic production and exports modelled as joint products (CET production function)
- 46 - domestic and imported goods assumed qualitatively different (Armington assumption)
- 47 - domestic and foreign export and import included
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51 Taxation and transfers

- 52 - taxes for factors and outputs denoted
- 53 - representative consumer has income taxation
- 54 - regional income and expenditure flows through public budgets denoted
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60 Table 2. Design of the RegFin model.

Table 3. The macro economic effects of halving the social security payments of the employers in North-Finland.

Variable	Keski-Pohjanmaa	Pohjois-Pohjanmaa	Kainuu	Lappi	Rest of Finland	Total
GDP change as %	6.4	7.5	7.6	7.5	-0.5	0.5
EV welfare change, FIM million	333	1992	513	1097	-1776	2158
EV welfare change, %	8.5	10.2	9.7	10.0	-0.7	0.7
Net outward migration, number of people	-106	-549	-131	-271	1057	
Net outward migration, % of population	-0.3	-0.4	-0.3	-0.3	0.1	
Change in unemployment, thousands of workers	-1	-7	-2	-4	1	-15
Change in % unemployment rate	-4.7	-5.0	-5.8	-4.9	0.0	-0.7
Consumer prices, % change [1]	2.8	2.7	2.5	2.7	0.0	
Capital rental rate, % change	2.2	2.6	3.4	2.1	0.0	
Wages rate, % change	5.4	5.4	4.6	4.1	0.0	
Cost to the regional government, FIM million	-39	-214	-68	-151	-33	-504
Cost to the national government, FIM million	20	127	45	103	1955	2249

[1] Consumer prices measured with respect to cost of foreign exchange

Table 4. The macro economic effects of the value-added tax reform implemented in North-Finland.

Variable	Keski-Pohjanmaa	Pohjois-Pohjanmaa	Kainuu	Lappi	Rest of Finland	Total
GDP change as %	5.6	6.4	6.2	6.1	-0.6	0.3
EV welfare change, million FIM million	291	1686	413	893	-2023	1259
EV welfare change, %	7.4	8.7	7.9	8.1	-0.8	0.4
Net outward migration, number of people	-63	-355	-79	-171	668	
Net outward migration, % of population	-0.2	-0.2	-0.2	-0.2	0.0	
Change in unemployment, thousands of workers	-1	-4	-1	-2	0	-8
Change in % unemployment rate	-2.2	-2.7	-2.8	-2.5	0.0	-0.4
Consumer prices, % change [1]	-2.3	-2.6	-2.8	-2.4	-0.1	
Capital rental rate, % change	6.5	7.1	7.4	6.1	0.0	
Wages rate, % change	2.3	2.6	2.0	1.9	0.0	
Cost to the regional government, FIM million	-29	-180	-48	-106	-60	-423
Cost to the national government, FIM million	22	143	50	116	2203	2535

1 Appendix
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7 Regions in this version of the RegFin model in this applicationⁱⁱⁱ
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11 1. Lappi
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13 2. Pohjois-Pohjanmaa
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15 3. Kainuu
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17 4. Keski-Pohjanmaa
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19 5. Rest of Finland
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24 Sectors of the RegFin model
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29 1. Actual agriculture
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31 2. Other agriculture
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33 3. Hunting and fishing
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35 4. Forestry
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37 5. Mining and quarrying
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39 6. Processing of meat and fish
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41 7. Other food manuf.
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43 8. Manuf. of other food beverages and tobacco
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45 9. Manuf. of textiles
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47 10. Manuf. of clothes and leather products
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49 11. Sawing - planing and impregnation of timber
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51 12. Manuf. of other timber and timber products
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53 13. Manuf. of pulp and paper and publishing
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55 14. Manuf. of energy, chemical and rubber and plastic products
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57 15. Manuf. of non-metallic mineral products
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59 16. Manuf. of basic metals and metal products
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17. Manuf. of machinery and instruments

- 1 18. Manuf. of electrical machines and instruments
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- 3 19. Manuf. of medical and fine mechanical products
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- 5 20. Manuf. of vehicles
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- 7 21. Manuf. of other industrial products and recycling
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- 9 22. Production and distribution of electricity, gas and heat
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- 11 23. Refining and distribution of water
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- 13 24. Construction
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- 15 25. Trade
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- 17 26. Hotels and Restaurants
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- 19 27. Traffic
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- 21 28. Keeping of railroads and roads
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- 23 29. Traffic services
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- 25 30. Post and communication
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- 27 31. Financing and insurance
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- 29 32. Real estate
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- 31 33. Business services
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- 33 34. Public administration and obligatory social insurance
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- 35 35. Education
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- 37 36. Health and social services
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- 39 37. Other public and personal services
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14 iii These regions are chosen for the application. All 20 administrative regions of Finland are represented in
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16 the model. With consistent Regional Statistics available in Finland and by using the augmented Flegg
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18 location quotient method (Flegg and Webber, 2000 and Tohmo, 2007), it is also possible to run sub-
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21 regional cases.
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