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Introduction

According to Keynes, the instincts of entrepreneurs (aka their “animal spirits”) account for the great bulk of business cycles. On the face of it, animal spirits pertain to non-probabilistic investment expectations. Given the heavy focus of mainstream economics on probabilistic reasoning, it is hardly surprising to notice how little this concept has been explored. In this regard, animal spirits are tantamount with irrationality, and there is not much to say about them. When New Keynesians incorporate animal spirits in their models, they view them as irrational beliefs causing random shocks. For instance, Roger Farmer (2019) sets a general equilibrium framework where animal spirits trigger markets fluctuations: “our animal spirits model is similar to any dynamic stochastic general equilibrium model” with the qualification that it is “augmented by a belief function” (Farmer 2019: 69) subject to random walks. Or, when they solely explore the concept, like Akerlof and Shiller (2009), they extend it to include every psychological feature that makes decisions irrational. To the best of our knowledge, the remark put forward by Dow & Dow (2011: 3) still rings true nowadays: “identification of animal spirits with ‘black box’ irrationality has been a central feature of the way in which the concept has been used in the mainstream literature since Keynes”. Nonetheless, Keynes had a more positive view of animal spirits (without them, entrepreneurs would be paralyzed by doubts), even though he acknowledged they may also engender wild fluctuations. What would be irrational is to stick to methods (like mathematical expectations) which cannot be applied by lack of relevant data, because the future is fundamentally uncertain (Davidson 1991, 1996). Thus, we need to improve our understanding of how animal spirits work. The black box ought to be opened. As Keynes himself pointed out, “our conclusions must mainly depend upon the *actual observation* of markets and business *psychology*” (1936: 148, emphasis added). Fortunately, many Post-Keynesians have carefully studied animal spirits on theoretical terms (e.g. Marchionatti 1999, Dequech 1999, Dow 2011). And yet, with the exceptions of Matthews (1991) and Laine (2017), very few scholars go beyond Keynes’s texts so as to incorporate modern insights from psychology or neuroscience. Anyway, to the best of our knowledge, there has been almost no empirical study on animal spirits.

Our paper aims to fill this gap. It will offer a theoretical development of the notion, enriched by insights of psychology and neuroscience, in order to empirically test it. While our theoretical proposal partly builds on previous research, our field study may be the first of its kind. An entire school year of would-be entrepreneurs from a business school played a very realistic business game simulation during a whole week, as part of their curriculum. They had to take all managerial decisions, among which investment decisions. We gave them questionnaires with a view to measuring their animal spirits, and we gathered all the results of the simulation. Thus, we were able to analyze the panel data in order 1) to test which factors influence most investment decisions of entrepreneurs (“real” ones like profits, capacity utilization, etc., or “psychological” ones, i.e. animal spirits); 2) to assess the contribution of each and every factor to these investment decisions.

The paper is organized as follows. The first part will deal with the theory of animal spirits, in Keynes’s writings as a starting point; then, we will incorporate insights from psychology and

neuroscience. The second part will present the research design. The third part will analyze the results. Finally, a discussion about the limitations of this work and directions of future research closes the paper.

1. Theoretical framework: how do animal spirits work?

The main contribution of this paper being empirical, a thorough theoretical discussion is beyond its scope. However, we will try to present the main points and outline all the issues that remain controversial. First and foremost, we will reflect on Keynes's analysis. Then, we will go on by drawing on modern psychology and neuroscience on the basis of the indications left by Keynes.

1.1. Keynes's point of view

Of course, profitability is about numbers. Any time they can, managers calculate their expected profits before undertaking any production or investment project. Nevertheless, an investment ties the company for at least five or ten years, if not decades. At this time horizon, "our knowledge of the factors which will govern the yield of an investment some years hence is usually very slight and often negligible" (Keynes 1936: 150). If one was to rely on calculations, they would be spurious, because of the "extreme precariousness of the basis of knowledge on which our estimates of prospective yield have to be made" (*Ibid.*: 149). The remoter the future, the more uncertain. "Human decisions affecting the future, whether personal or political or economic, cannot depend on strict mathematical expectation, since the basis for making such calculations does not exist" (*Ibid.*: 162). That's why Keynes asserted that entrepreneurs rely on their "animal spirits" instead. Indeed, the whole chapter 12 of the *General Theory* seems to be built on the opposition between "psychological expectation" (what animal spirits perform) and "mathematical expectation" (the "weighted average of quantitative benefits multiplied by quantitative probabilities"), or, alternatively, "animal spirits" vs. "reasonable calculation". It is clear, throughout the book that, in Keynes's view, what is not "logical" may be called "psychological". Thus, even though he maintained, in chapter 11 of the *General Theory*, that managers perform such a calculation (named "marginal efficiency of capital", with the qualification, though, that it concerned "*expected* profits", not actual ones), it seems safe to assert, following Shackle (1967: 130): "chapter 11 shows us the arithmetic of the marginal efficiency of capital [...] chapter 12 reveals the hollowness of all this". This should not be taken to mean that managers never calculate, since "our rational selves choose between the alternatives as best we are able, calculating where we can, but often falling back" (Keynes, 1936: 162) on animal spirits.

Thus, "most, probably, of our decisions [...] can only be taken as a result of animal spirits" (*Ibid.*: 161). Animal spirits perform two things: they *estimate* the prospective yields of an investment, and they *decide* whether to undertake it or not. As a matter of fact, when Keynes wrote about investment expectations, it encompassed these two dimensions: "estimating the prospects of investment" (*Ibid.*: 161), "spontaneous optimism", a phrase used three times (later on in the *General Theory*, optimism referred to an overestimation), on the one hand; "innate urge to activity" (*Ibid.*: 162), "spontaneous activity" (*Ibid.*: 161), "spontaneous urge to action" (*Ibid.*: 161) on the other. Since animal spirits are opposed to "calculation" it is clear that they estimate in another fashion, that we may call "qualitative". Furthermore, Keynes very wording had obvious emotional overtones: "optimism", "sentiment", "whim", "hysteria", "nerves", "delicate balance of spontaneous optimism", "fears of loss", "hopes of profit"... Consequently, it seems that these instincts of entrepreneurs use emotions

in order to navigate in an uncertain world. They estimate both by appealing to emotions and qualitative thinking. How do they decide? At first glance, the decision rule might seem pretty simple: undertake the best investment project, that is the most profitable one. And yet, owing to the fundamental uncertainty enveloping the future, managers do not know whether their estimation is sensible or not. If they relied on an ill-founded estimation, they would face troubles. In practice, they have to assess the quality of their estimation. This is what Keynes called “confidence”, the subjective “likelihood of our best forecast turning out quite wrong” (Keynes 1936: 148). Thus, managers should believe their investment will succeed and they should also believe that this belief is correct. Not only do investment expectations depend on forecasts about prospective yields but also “on the *confidence* with which we make this forecast”, that is its subjective degree of truth. The decision rule managers apply is: follow your feeling of confidence. To sum up: in order to invest, entrepreneurs should be both optimistic (according to their forecasts, their investment will likely be profitable) and confident (their forecast is sufficiently underpinned).

We may wonder whether we do not overemphasize the importance of animal spirits in investment decisions. After all, the phrase is used only three times by Keynes, and only in one of the eight sections of Chapter 12 of the *General Theory*. First of all, if the exact wordings are used only three times, the idea is conveyed much more often, and it is undoubtedly one of the key factors in his theory. Indeed, it is the whole chapter which revolves around animal spirits, for “long-term expectations” (the title of the chapter) is what animal spirits implement in their two dimensions: a forecast, and a decision. In chapter 18, one of the three “fundamental psychological factors” are “psychological expectation of future yield from capital-assets”, that is animal spirits. And in chapter 22, Keynes is abundantly clear: the business cycle “is mainly due to the way in which the marginal efficiency of capital fluctuates” (recall that animal spirits are behind this efficiency). As a matter of fact, most of the uses of the words “psychology” or “psychological” throughout the book in fact refer to them, and there are 57 occurrences of these words. Second, the second section of chapter 12 sketches briefly how entrepreneurs expect (they make a forecast and a confidence assessment), which is an introduction to animal spirits: since there is radical uncertainty (section 3), they have no choice but to draw on conventions (section 4), which themselves are in part construed by animal spirits (“sudden fluctuation of opinion”, “mass psychology”, section 5), and on animal spirits *per se* (section 7). Indeed, animal spirits partly judge on the basis of conventions, but conventions are not the focus of this empirical study.

To the best of our knowledge, the following points remain controversial. When introducing the discussion about “confidence”, Keynes referred to his previous work on judgment under uncertainty, the *Treatise on Probability* (for a good analysis, see O’Donnell 1990 and Carabelli 1988), clearly equating “confidence” with what he used to call “weight of arguments” (see also Anderson and Goldsmith 1997). Nonetheless, Keynes took a logical stance in this book, namely “probability” was a rational link between a conclusion and a premise everybody should make provided they had the same knowledge (see Lawson 1988). His approach was normative (what is valid thinking? what are the conditions and limitations of probabilistic reasoning?) while in the *General Theory* it was descriptive (how do actual people expect?). Whether Keynes’s thought in this regard displayed continuity (O’Donnell, 2003; Gerrard, 1992) or not (Bateman 1987, 1991, Davis 1994, Gillies 2003) remains a moot point. In particular (but not only), this issue concerns the link between the “weight of arguments” of the *Treatise on Probability* (i.e. the degree of completeness of relevant information, see Runde 1990)

and “confidence” as defined in the *General Theory*. Does the former account for the latter, as Carabelli (1988) claims, or is confidence more subjective than that (since Keynes’s focus shifted from how should people expect to how they actually expect)? We would like to contend that confidence goes far beyond the amount of information (and may have indeed little to do with it), as evidenced by psychology and neuroscience (e.g. Koellinger et al. 2007, Moran et al. 2015, Lebreton et al. 2019). Another divisive issue regards the distinction drawn by Keynes between estimation (of prospective yields) and decision (the “urge to action”), which becomes “uncertainty perception” and “willingness to face uncertainty” in Dequech’s analysis (1999, 2005). According to him, “animal spirits” could be considered as “optimism not based on any knowledge” (Dequech 1999: 420). This resonates strangely with the views of mainstream economists for whom they are synonymous with the flip of a coin. We beg to differ. We would contend that animal spirits use whatever evidence at their disposal. They do not decide at random. Keynes warned that “We should not conclude from this that everything depends on waves of irrational psychology” (Keynes 1936: 162). Animal spirits do perform an expectation. Indeed, in chapter 18 of the *General Theory*, Keynes referred to animal spirits by writing “*psychological expectation* of future yield from capital-assets” (emphasis added). He also made clear that such an expectation is based on facts: “It is reasonable, therefore, to be guided to a considerable degree by the facts about which we feel somewhat confident, even though they may be less decisively relevant to the issue than other facts about which our knowledge is vague and scanty” (*Ibid.*: 148). Moreover, in the *Treatise on Probability*, Keynes maintained that, in a context of uncertainty, people mainly implement a qualitative judgment. This judgment stems from an analogical reasoning, which consists of inferences on the basis of similarities between events, objects or ideas. Because they are similar they should share some common properties, and a generalization is possible. Interestingly, when expounding their “case-based decision theory”, Gilboa and Schmeidler (1995) quote Hume, whose thoughts had a tremendous influence on Keynes (Skidelsky 2004), and cite the *Treatise on Probability*. Indeed, their theory is very much in tune with Keynes’s, in that they substitute similarity judgments for probability assessments. However, no matter how insightful, their axiomatic approach has savagian resonance and there is still a mathematical function to maximize (even though the result is only satisfactory from an objective point of view).

1.2. A Modern theory of animal spirits

Let’s summarize Keynes’s point of view: there are two ways to expect, calculation and logic on the one hand, animal spirits on the other; animal spirits estimate the prospective yield of an investment in a qualitative way which draws on emotions, and decide on the basis of the feeling of confidence, which stems from a subjective assessment of the quality of this estimation.

Let’s enrich and deepen this point of view by appealing to modern psychological theories. By doing so, we follow Keynes’s plea for drawing on “*actual observation* of markets and business *psychology*”. We may connect his views with the prevailing theories of duality of reasoning (e.g. Sloman 1996, Frederick and Kahneman 2005, Evans 2008). In spite of all their differences, these theories seem to share the common belief that people are of two minds: reason (or “system 2” in their terminology) and intuition (“system 1”). In this regard, animal spirits would fall within “system 1”. “System 1” thinking mainly consists of heuristics (“rules of thumb” and mental shortcuts), analogical reasoning and affective reasoning (Slovic and ali 2002, see also Evans 2008 for a good synthesis). Albeit this remains controversial, most proponents of the duality of reasoning seem to put forward “system 1” is the default mode of thinking: it would work all the time, rapidly, automatically and unconsciously

(Kahneman 2011). Some scholars (Thompson et al. 2011) have proposed that, save for the times our conscious will commands the use of “system 2” to solve a task, the human mind would automatically implement “system 1” reasoning; then, it would also try to assess the quality of this reasoning; such assessment would trigger a feeling of confidence; when confidence is high, the mind would go on with “system 1” thinking; when it is low, it would switch to “system 2”. These modern findings are strikingly in tune with Keynes’s views: the feeling of confidence stems from a metacognition (i.e. a cognition about the quality of the cognition carried out to assess prospective yields); animal spirits (akin to “system 1”) operate most of the time (“a large proportion of our activities”, “human decisions affecting the future, whether personal or political or economic” depend on animal spirits wrote Keynes [1936: 161]).

If we are right in connecting animal spirits to “system 1” reasoning, what can we learn by importing the insights of psychology? Undeniably, behavioral economics has extensively studied heuristics so far. However, to the best of our knowledge, the vast majority of heuristic studies dealt with lotteries, consumption and financial decisions; no attempt seem to have been made to shed light on *productive investment* expectations. And studies of analogical reasoning appear to be in their infancy, despite the ground-breaking works of Fauconnier and Turner (2003) and Hofstadter and Sander (2013) – see also Bartha 2016 for a synthetic presentation. For the time being, not much could be said about them when it comes to investment decisions. We can only point out that people commonly think by comparing the present situation to situations that happened in the past. Whenever they see similarities, they tend to conclude that similar events will follow (see also above). This is how we would spontaneously project into the future. So far, no matter how insightful in general, these theories seem to have little bearings on investment expectations. This is not the case of the affective reasoning, for emotions have been considerably studied recently. We may turn to one popular theory in the field of neuroscience, namely “the somatic marker hypothesis”, and another one due to a prominent psychologist, late Walter Mischel, “interactionism”.

Emotions constitute so to speak an action program, transmitted by evolution, so that we may quickly deal with our surroundings as efficiently as possible (Damasio 2009). They consist of alterations of the body writ large (it could only be changes in hormone levels or blood pressure), which considerably accelerate and influence expectations (Damasio 2010). Whenever something happens, its consequences for us are marked in our body (“soma” meaning “body” in ancient Greek). These positive and negative records comprise the “somatic markers” (Bechara et al., 2000, Bechara and Damasio 2005). Whenever the same situation recurs (or a similar one), our mind would automatically connect factual memories to these records, thus prompting the same emotions again. So to speak, emotions are guides for action. “[S]omatic markers do not deliberate for us. They assist the deliberation process by highlighting some options (either dangerous or favorable), and eliminating them rapidly from subsequent consideration. You may think of it as a system for automated qualification of predictions” (Damasio, 1994: 174). Indeed, emotions “provide a metric for the decision maker in weighing various options for action or choice” (Phelps, 2009). They serve to rapidly predict the possible outcomes of our decisions. Since they store, by experience, the link between events and their consequences, they are useful for the intelligence of our decisions. In the famous Iowa Gambling Task, people whose brain was impaired to such extent they could not feel emotions were unable to transform their intellectual understanding of the game into an efficient decision (Bechara et al. 2000, Bechara and Reimann 2010).

Thus, “Somatic marking enables individuals to make parsimonious decisions based on previous learned experience, without recourse to laborious and time-consuming calculation each time a decision has to be faced” (Carter and Pasqualini 2004: 902). That’s why certain economists have considered emotions to work as a *satisficing* mechanism à la Herbert Simon: “By restricting the range of options considered (reducing the load on short and long term memory), by focusing on certain variables (certain stimuli receive higher ranking order), and by initiating and terminating the evaluation process (working as a satisficing mechanism), emotions supplement the insufficiencies of reason” (Hanoch 2002: 7). It is the overload of emotions which could be detrimental, not emotions *per se* (Mercer 2010).

So, the question arises: what triggers emotions? There is always an episodic element and an enduring one involved. The episodic element consists of an “emotionally competent stimulus”, what Damasio (2005) also called an “inducer”, be it “primary” (it comes from the outer world) or secondary (it stems from the inner world, e.g. flights of fancy or remembrances). To better comprehend the enduring element, we now turn to Mischel’s “interactionism”.

He considers the “personality system” as a context-dependent generative process of emotions (Mischel 2004 – see also Chell 2008, who applied this theoretical framework to managers). The two main components of such a system are motivations (the set of enduring goals) and traits. Traits are stable patterns that vary across situations which “mediates how the individual selects, construes and processes information and generates behaviors” (Mischel and Shoda 1995: 246). For instance, a frightful individual will not always be frightened, nor would he/she always be frightened in a certain class of situations; he/she will be more likely to be frightened when this class of contexts occurs than other people. In other words, traits increase or decrease the likelihood of what individuals expect in similar contexts. Thoughts are affect-laden; motivations and traits help generate emotions and thus drive our expectation process to a certain extent. Consequently, “it becomes possible to account simultaneously for both the invariant qualities of the underlying personality and the predictable variability across situations in some of its characteristic behavioral expressions” (Mischel and Shoda 1995: 246).

To sum up, it is the interplay between the “personality system” and “inducers” which would generate emotions. Thus, we need to assess entrepreneurs’ motivations and traits so as to better comprehend the way they expect in matters of productive investments.

Of course, we do not pretend they are the only existing theories; our purpose is merely to draw on solid insights from other sciences which share the same subject matter. As in the field of economics, there is no consensus in psychology and neuroscience. For one thing, we may doubt that a consensus could ever be reached. Besides, the fact that there is no consensus does not imply that the criticisms are pertinent. Rebutting them is beyond the scope of this paper. Please remind that the main contribution of this paper is empirical. We take Keynes’s theory a little bit further by importing compatible insights from other sciences that have received wide support and, on this basis, we implement a field study. We do not claim to offer a comprehensive overview of all psychological theories, which could be, in and of itself, the topic of a full-fledged paper.

Finally, we should dispel a possible confusion between animal spirits and what has been called “risk preference” in the literature. Our claim is twofold: not only do animal spirits perceive and construe risk, but they also have the same determinants. “Risk preference” is defined with reference to objective

probabilities. Yet, what matters is the subjectivity of entrepreneurs. For sure, part of what may be considered as risk preference merely stems from optimism (overestimation of chances of success). There would still be something like “risk preference” if two entrepreneurs had the same assessment of their likelihood of success and only one of them undertakes the investment. But animal spirits also pertain to the subjective disposition to act on the basis of their subjective estimation (“confidence”). Consequently, they also account for the differences in entrepreneurial behaviors regarding the same levels of subjective risks. Thus, what is ascribed to “risk preference” should instead be ascribed to animal spirits. Moreover, on an empirical basis, when scholars interview managers, it appears that “there is little inclination to equate the risk of an alternative with the variance of the probability distribution of possible outcomes that might follow the choice of the alternative ... risk is not primarily a probability concept” (March and Shapira 1987: 1407). They invest whenever they deem risk is controllable, which is not the same as subjective risk-loving. In the end, we would like to claim that the “personality system” and “inducers” determine risk preferences. Thus, it would be superfluous to have a specific item for them, and all the more so as we focus on the subjectivity of entrepreneurs.

2. Research design

We conducted a business simulation along with a survey among the entire 4th school year of a French business school specialized in entrepreneurship, EDC Business School, located in the business district of La Défense, Paris. As a matter of fact, this very school is ranked first when it comes to entrepreneurship in various professional renowned rankings (such as *L'Etudiant* and *Le Point*). About 20-25% of each and every school year end up being actual entrepreneurs.

During an entire week at the end of April 2018, the whole school year played an engrossing, very realistic “Business Game Strategy”, designed by McGraw Hill. They did nothing else. Students were divided into competing teams at random and had to manage one company per team. Each company began with the exact same features (cash, productive capacities, equity, labor force, etc.). Besides, exogenous parameters were kept constant (i.e. government policies did not vary, and there was no shift in the economic environment). The companies operated in an industrial market, shoe manufacturing. This market was always on the rise, but its rate of growth considerably varied from one year to the next. There was no macroeconomic shock. Thus, the risks of running the businesses were mainly microeconomic ones, namely do we beat our competitors? do we make better decisions? It is safe to assert that the risk-return structure of the game was not one of high risks-high returns, in the absence of varying government policies and macroeconomic shocks. The game setting was quite thorough and complex. To mention but a few, students had to take production, freightage, marketing, investment and financing decisions. They could locate production units everywhere in the world, which implied they could also disinvest (provided someone was willing to purchase their factory). To help them in their decision process, students could check many parameters (regarding their companies and their competitors): sales revenues, number of units sold, gross profits, return on equity, market expectations, debt, capacity utilization, earnings per share, dividends per share, buybacks... From four to five students comprised the 29 companies of the game. These 29 companies represented the entire market. They were never aware of the game’s algorithm, nor were the teachers. They had just somewhat vague experts’ forecasts about the possible evolution of the market in the years to come.

The week was divided as follows. The first day was a test. Given the intricacies of the game, it was necessary. Afterwards, seven annual decisions had to be taken, at a pace of two decisions a day. The last half-day was devoted to a presentation of the results in front of “the shareholders” (i.e. the other students). Thus, we collected the data of the 7 years (sales revenues, return on equity, debt, etc.) for 29 companies. Investment decisions took one year to be completed. In other words, when a company decided to build a plant somewhere, it took one year to finish the construction. The end of the game was known beforehand by everybody. Therefore, everybody knew for a fact that there was no point in investing during the last year of the game.

Since the game was very realistic, the players had access to information about other players’ results and some of their strategic decisions. Each round (purported to correspond to one year in the game’s timeline), they could have an overview of the main financial results: sales revenues, market shares, profits, capacity utilization, dividends per share, credit ratings... These results could be broken down by market segments (there were three segments: wholesale, private label, and internet sales), and by continents (since all companies operated on a global market, with different strategies in different places). Furthermore, some of the strategic information about the competitors was also available: prices of the shoes in every segment and every place, quality of the shoes, number of models offered, marketing expenditures, number of retail outlets utilized, plants bought and sold... However, most of the vital information was kept secret, as it is the case in real life: money spent to improve the quality of the products, human resources decisions (wage change, incentive pay, implementation of best practices...), energy efficiency, the exact proportion of recycled packaging, the time schedule and conditions of bank loans, the days of inventory, the cost structures of the companies, etc. Consequently, there was an interaction among players, in that they all had access to information about other player’s decisions. There was no interaction in that cartels were forbidden (and pointless, given the highly competitive nature of the game), and there was no real communication between players from different companies (except for the usual bragging and spreading of false rumors). This is precisely what we aimed at: assessing the behavior of animal spirits in context.

Before the game, students were given questionnaires, designed with a view to assessing their animal spirits. Remember the objectives of our field study: 1) to determine whether subjective factors pertaining to animal spirits weigh more in investment expectations than objective factors (like profits, debt, sales revenues, etc.) ; 2) to disentangle the contribution of each and every factor. Here, the simulation recorded the data comprising our objective factors. Thus we needed to assess these animal spirits. Our theoretical discussion highlighted the need to break down animal spirits into personality traits and motives. In any field study or econometric work, one of the most dangerous bias is that of the omitted variables. In order to avoid it, we elaborated comprehensive questionnaires, that is we included all the variables which previous literature and field studies showed they might be relevant to investment decisions or risk-taking in general. As was previously discussed, a trait is what generates an emotion given a certain class of contexts. Emotions have been extensively studied in psychology and entrepreneurship. Some of them influence investment or risk-taking. As a result, we should include questions designed to measure the traits generating the four basic emotions (fear, anger, joy, sadness – see Welpe et al 2012), since fearful and sad people usually take less chances than the others, while joyful and angry people usually take more chances (see Lerner and Keltner 2001, Foo 2011, Bazerman and Moore 2009). We should also include self-confidence, because it leads to overestimation and risk-taking behavior (Krueger Jr and Dickson 1994, March and Shapira 1992,

Hirshleifer et al. 2012), and all the more so as entrepreneurs tend to display overconfidence (Cooper et al. 1988). Moreover, optimism matters, since it is tantamount to overestimation (recall that Keynes repeatedly used the phrase “spontaneous optimism”), as well as the tendency to feel regret, which leads to underestimation and risk-aversion (Arora, Haynies, Laurence 2013, see also the theoretical model of Loomes and Sugden 1987). We may add pride (Berlin 2015), and a trait which may encompass many of the emotional phrases used by Keynes like “whim”, “digestions” and “reactions to the weather”: emotivity. Finally, since it has great influence on investment decisions, we also measured creativity (Fillis and Rentschler 2010, Hirshleifer et al. 2012). Note that the link of some of these variables with investment is not always obvious. For instance, what was previously established is the link between the four basic emotions and risk-taking in general. While investment implies such a dimension, we are rather unsure whether risk-averse individuals would necessarily shy away at investing. For sure, they may more carefully consider their choices, but does it imply that they would invest less than the others? If, owing to their trait, they have a more substantial basis upon which to rest their expectations, they would be less paralyzed by doubts and thus invest more.

As for entrepreneurial motives, there is a huge literature on the topic. First of all, Schumpeter (1934) outlined four basic motives: “founding a private kingdom”, “the joy of creating”, “delight in ventures” and “to succeed for the sake of success itself”. Modern entrepreneurship further highlighted the need for achievement (Brockhaus 1982, Shane 2004), the need for autonomy and independence (Shane et al. 2003, Hughes 2006), power and status (Carsrud and Brännback 2011), along with financial motives (Robichaud et al. 2014), and the desire to change the world (Yitshaki and Kropp 2016). Apart from this, there is also an intrinsic motivation in running a company (Wadeson 2006). Again, note that the link with investment expectations is not always obvious. Take for instance the “need for achievement”. Does it imply to invest more than the others or less? We expect our results to shed some light on the issue.

We ensured each questionnaire was properly filled. Students had to gauge their personality traits on a ten-grade scale and to rank their motives. When it comes to self-evaluation, the risk of bias is not to be underestimated. To limit this risk as much as possible, we devised a ploy. Traits were divided into a subgroup of 5 qualities and 4 flaws. The total of their assessments should add up to 28 when it came to the qualities and 22 when it came to the flaws. By so doing, we enticed them to be as objective as possible: if they wanted to give a high grade to one of their traits, it implied they had to give a bad one to some other trait. Thus, they had to carefully consider their assessments. Any time students somehow got their math wrong, we asked them to reassess. As for their motives, students had to pick at most three of them and rank them. For instance, one could pick just one motive while his/her neighbor could rank one motive first and two other motives on an equal footing second.

The 5 “qualities” were: optimism, self-confidence, courage (in fact, we included this item so as to gauge its opposite, the tendency to succumb to fear), joy and creativity. The 4 “flaws” were: regret, pride, anger and emotivity.

At the end of the game, students were given short questionnaires, so as to know who were the team leaders (the question was open) and what was the degree of cohesion of the team. Since the question was open, they could name from one to four leaders. We considered the leaders were the actual decision-makers when it came to investment decisions. Consequently, we averaged the values of their traits and motives as a proxy for the animal spirits of their companies. Most of the time,

respondents named two leaders. Furthermore, we could not preclude on a priori grounds that the team's cohesion could have an impact on the decision making process. That's why we also included a question to evaluate it.

Our first objective is to assess which factors are more important in the determination of investment expectations: psychological ones (animal spirits) or real ones (like profits or capacity utilization)? So far, we have discussed the psychological variables. What about the real ones? They are very classical, since they have been studied and known for decades. Thus, we include: profits, capacity utilization (e.g. Setterfield 2019), sales revenues (e.g. Sawyer 2012), debt and, also, money given to or received from shareholders, be it in the form of dividends or buybacks (e.g. Stockhammer 2013). Indeed, many scholars (e.g. Lazonick and O'Sullivan 2000) argued that in an era of financialization shareholders' incomes are increased at the expense of investments.

3. Results

In our model, we have two groups of explanatory variables. The first one is time-invariant: all the variables pertaining to animal spirits (traits and motivations do not change within a week). The second one is time-variant. Thus, our model built on panel data is a random-effect model of the form:

$$I_{it} = \alpha_o + \alpha_1\beta_{i1} + \alpha_2\beta_{i2} + \dots + \alpha_k\beta_{ik} + \gamma s_{it-1} + \theta P_{it-1} + \delta u_{it-1} + \rho d_{it-1} + \pi h_{it-1} + \mu_i + \varepsilon_{it}$$

With company i ($i = 1, 2, \dots, 29$), time t ($t = 1, 2, \dots, 7$), β the k factors standing for animal spirits ($k = 1, 2, \dots, 19$), I the investment of the company, s the sales revenues of the company, P its profits (measured by its return on equity), u its rate of capacity utilization, d its financial debt (measured as a percentage of its total assets) and h the net sums given to shareholders. Note that h might be negative if the company receives more money from shareholders (equity increase) than it gives in the form of dividends and buybacks.

In every model, there is a trade-off between bias and variance. The bias mainly stems from the omitted variables and the variance from the number of variables included in the model. The more variables you include, even if they add very little to the explanatory power of the model, the greater the variance (consequently, the estimators are less precise), *and* the lesser the risk of omitted variables, and vice versa. Here, we wanted to be as unbiased as possible, which enticed us to be as comprehensive as possible (to include all variables which may be relevant). Therefore, we have good reasons to believe our explanatory variables to be uncorrelated with ε_{it} . As a first step, we ran a Hausman-Taylor estimation of our dynamic model, following the procedure set forth by Hausman and Taylor in their seminal article of 1981. Then, we had a look at the non-significant variables in order to perform a stepwise regression by backward elimination. We performed Fisher tests so as to see whether, when removed, one variable or, provided that this variable was collinear with some other (the R^2 linking them was above the R^2 of the model), one group of collinear variables resulted in a significant loss of explanatory power. If such was the case, we left the variables in the model. Finally, we removed only the cohesion of the team, and three motives, namely "money", "joy of creating and innovating" and "intrinsic motivation to run a business".

We suspect there might be some feedback between the dependent variable, investment, and some of the independent variables, namely "sales revenues" and "capacity utilization". Indeed, the more capital, the greater the productive capacities. Hence, the possible link with "capacity utilization" and

“sales revenues”. Of course, having greater capacities does not imply that one will actually use them; it mainly depends on the efficiency of the sales force and of the business strategy. Still, we cannot rule out, on an a-priori basis, that there might be a link. It is the same when it comes to “sales revenues”: having more capacities enables to sell more. Once again, it depends on the business strategy and the efficiency of the sales force, but the link appears to be obvious. As a result, the dependent variable, investment, may influence some of the independent variables of the subsequent periods. Thus, we have two variables which are somehow linked with the error term μ_i , via the influence of the lagged dependent variable. The Hausman-Taylor estimation is able to cope with such issue. The key condition for using such kind of estimation is that the number of exogenous time-varying variables is at least as large as the number of endogenous time-invariant variables (possibly) correlated with μ_i . Since there is no endogenous time-invariant variable, the condition is fulfilled.

Results from this estimation are shown in tables 1, 2 and 3.

	Optimism	Joy	Fear	Anger	Confidence	Creativity	Regret	Emotivity	Pride
Coefficient	-361.00*	-197.24	364.13*	596.18*	-462.63*	-400.93*	581.99*	623.97**	710.04**
Standard Error	(181.00)	(146.64)	(166.61)	(269.94)	(194.28)	(163.69)	(236.34)	(229.73)	(249.92)

Table 1. Influence of traits on investment

* $p < 0.05$; ** $p < 0.01$

	Found	Glory	Change	Challenge	Status	Achievement	Independence
Coefficient	-336.60*	191.61*	109.29	191.54	-215.98	448.94*	-204.43*
Standard Error	(133.98)	(89.88)	(80.43)	(114.07)	(189.06)	(188.66)	(88.46)

Table 2. Influence of motivations on investment

Note that Schumpeter’s “found a private kingdom”, “succeed for the sake of success itself” and “delight in ventures” have been relabeled into the more modern “found a durable, thriving company”, “reach glory” and “take up a challenge” respectively. Hence the columns.

* $p < 0.05$; ** $p < 0.01$

	Profits	Debt	Sales	Capacity utilization	Shareholders
Coefficient	19.48**	-787.96	-0.00032	-0.6404	-0.00697*
Standard Error	(6.56)	(571.82)	(0.00082)	(6.559)	(0.00346)

Table 3. Influence of real factors on investment

* $p < 0.05$; ** $p < 0.01$

Animal spirits comprise several significant variables. All in all, by far, psychological motives outweigh real factors in investment expectations. Among the psychological motives, traits are more important than motivations. Not only are the “raw” coefficients of traits greater but also their scale is larger (traits are evaluated on a ten-grade scale, while motivations are on a three-grade scale; in other words, when they have the same coefficients, it implies that traits weigh 3.33 times more than motivations). Second, of the ten motivations (recall we discarded three of them as a result of the stepwise regression), only four appear to exert some slight influence on investment expectations. The need for achievement seems to be the most important of them; provided our results are replicable, it would push entrepreneurs to invest, as would the pursuit of glory. Presumably, wanting to achieve something or reach glory distorts the way managers expect; it could make them more impatient. Conversely, wanting to be independent and/or to found a durable company would entice to be more cautious and to invest less.

Furthermore, emotivity and pride seem to be both the most influential and significant traits. “Negative” emotions like fear and regret appear to considerably determine investments expectations. In all likelihood, fearful and regretful individuals would shun excessive risks. Consequently, they would more carefully consider their investment opportunities; they would gather more information and examine their projects more thoroughly (as is evidenced in psychology, see Massoni 2014). Because these emotions would push managers to behave somehow more rationally, they would have a more substantial basis upon which to rest their expectations. Since these emotions give an extra incentive to overcome the uncertainty enveloping investment projects, they could be said to boost investment. More surprising, “positive” emotions like self-confidence and optimism, would deter to invest, at least to some extent. This may seem counter-intuitive. A plausible explanation could be the following. Optimism and self-confidence are multi-faceted. An optimistic or overly confident manager may think he/she would eventually prevail, no matter how adverse or uncertain the circumstances. And since he/she would prevail, there would be little need to invest.

Besides, most of the real factors seem to have no influence on investment. Provided our results are correct, debt, sales revenues (i.e. past demand) and capacity utilization would not determine it. Indeed, past demand is not indicative of future demand, nor is it of future profitability. Insofar as no company was heavily indebted, debt should not deter from investing. The result concerning capacity utilization may seem surprising. In fact, there is a considerable Post Keynesian literature on the link between investment and capacity utilization on a macro level (see e.g. Hein et al. 2012). We would like to propose five reasons for this discrepancy. First, our enquiry is a microeconomic one. Second, given radical uncertainty, the rate of capacity utilization today cannot be a sound criteria for investment. The problem is the same as with past demand. The fact that this rate is high today does not imply that it will remain high or go back to an appropriate level tomorrow or in five years. The increase in (sales resulting in the increase in) the rate of capacity utilization should be deemed to be sustainable. In turn, it depends on an expectation, presumably performed by animal spirits. If managers were to invest any time their rate of capacity utilization would cross a certain threshold (called the “normal” or “target” rate of capacity utilization in Kaleckian models), there would be no uncertainty. Management would seem to be too easy a task. Third, in the *General Theory*, the investment decision is mainly a psychological one, and there is no mention of the rate of capacity utilization. Four, a perfect adjustment of the rate of capacity utilization may be impossible for purely technical reasons. For instance, to remain at precisely 80% of capacity utilization when, say, your sales are up 10% (or 10,000 units) would require to find an additional factory capable of raising your production by exactly 10% (or 12,500 units). And yet, you may find only factories of a capacity of 8,000 units or 20,000 units. Five, that there may be some correlation at the macro level between investment and the rate of capacity utilization does not imply that the latter causes the former. In fact, the latter may be the consequence of the former: investment decisions (along with the macroeconomic context) bring about fluctuations in the rate of capacity utilization. Whether this macroeconomic regularity is indicative of a microeconomic causality is open to doubt. Note, however, that our results may provide behavioral foundations to the Post Keynesian models which allow for the rate of capacity utilization to vary in the long run, such as the one devised by Setterfield (2019).

Our results give some support to the works on financialization, since the sums given to shareholders deter from investing.

Given the heterogenous units of our variables, a comparison of their respective influence (i.e. real factors vs. psychological ones) is uneasy. Provided our enquiry is replicable and our results correct, there could be a way to overcome this and have a look at the contribution of each factor to the variance of investment decisions. Of course, our results depend on our experimental setting. They only give us reasons to believe. And, in order to derive sound conclusions, our theoretical argument should be correct. Having these limitations in mind, we may consider the semi-partial correlations as reflecting the contribution of each and every factor. Table 4 summarizes these contributions by ascending order.

Factor	Semipartial corr.²
Sales revenues	0.0004
Capacity Utilization	0.0008
Motivation Status	0.0087
Motivation Change	0.0100
Debt	0.0110
Joyfulness	0.0143
Motivation Challenge	0.0200
Shareholders	0.0274
Motivation Glory	0.0293
Optimism	0.0298
Fearfulness	0.0330
Motivation Independent	0.0333
Quick temper (anger)	0.0353
Motivation found	0.0363
Self-confidence	0.0402
Motivation Achievement	0.0408
Regretfulness	0.0420
Creativity	0.0421
Profits	0.0486
Emotivity	0.0513
Pride	0.0540

Table 4. The Contribution of each factor to the variance of investment

All in all, animal spirits seem to outweigh real factors when it comes to investment decisions. Around 15% of the variance accounted for by our variables stems from real factors. Among them, profit is by far the most important and the most significant ($p = 0.3\%$). This leaves 85% for the animal spirits, which could be further broken down: 29% for motivations and 56% for traits. As Keynes contended more than eight decades ago, emotions seem to play a prominent role when it comes to investment decisions.

Finally, one may wonder what is the impact of interaction among players. As a matter of fact, even if Keynes stressed the importance of animal spirits, ascribing the “essential character of the Trade Cycle” to their “cyclical change” (Keynes 1936: 313), he also highlighted the role of conventions and

paid attention to the entire market economy. Clearly, the focus of this paper is not on interaction. This can be seen as a limitation and an invitation for future research. However, it should be noted that the “real factors” (sales revenues, profits, etc.) were the outcomes of these interactions. They were necessarily included in our study as determinants of the “real factors”, even if we are not in a position to disentangle the respective influences of interactions and “interaction-free” real variables. We may even wonder whether it makes sense, since the interest of our field study is to gauge animal spirits in a highly realistic context. Anyway, the influence of interactions remain unclear and could be an issue for future research.

Conclusion

Investment decisions tie the company for decades, and yet there is very little basis for an exact calculation of profits to come. Given this radical uncertainty, entrepreneurs have no choice but to rely on their gut feelings, aka their “animal spirits”. Emotions would help them navigate in a complex and uncertain world. Our enquiry gives some support to this argument. Provided our results are correct, it would seem that emotions determine more investment decisions than all real factors combined, like profits or capacity utilization. However, since our results depend on our experimental setting, they need to be replicated. In particular, there are some obvious limitations: we surveyed only students specialized in entrepreneurship and not actual entrepreneurs; this took place in one specific country (it remains to be seen whether different cultural contexts may yield different results); the sample population could be larger; there was no change in interest rates, thus we are rather unsure whether our results still hold when we allow for such kind of change (maybe the interplay with this new variable may mitigate or enhance the role of other variables); some results, which are counter-intuitive, should give rise to further investigation in order to better comprehend the intricacies involved (especially the role of optimism and self-confidence). In the future, we may specifically study the way these emotions work, along with regret and fear. One fascinating hypothesis that stood out from our enquiry is the role some particular emotions may play in rationality: experiencing some emotions (like regret or fear) would enable to be more rational. This opens an avenue for future research.

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