**Macro Constraints and Micro Expectations: Heterogeneous Entrepreneurs in a Stock-Flow Consistent Model**

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Arguably, stock-flow consistent (SFC) modeling may be seen as the Post-Keynesian equivalent of mainstream’s dynamic stochastic general equilibrium (DSGE) modeling. Where DSGE models clear through price adjustments and are supply-led, in SFC models “product markets clear through quantity adjustments, and the models are *demand-led*”(Godley & Lavoie, 2007: 18). Furthermore, contrary to their DSGE counterparts, SFC models display some crucial, distinctive features: endogenous money, a banking sector and a rigorous tracking of stocks and flows (Godin & Caverzasi, 2015). Basically, causality in DSGE models is said to run from micro decisions to macro phenomena while in SFC models it is the other way round. But in fact, contrary to the agent-based models (bottom-up approach), DSGE develops a representative agent without heterogeneity of behavior.

Yet, there remain unmet challenges in SFC modeling. In particular, things are not so clear-cut in Keynes’s theory as to whether the economy is demand or supply-led, since business-cycles are “mainly due to the way in which the marginal efficiency of capital [*i.e.* the expectation of a prospective yield by entrepreneurs] fluctuates” (Keynes 1936: 313). In matters of investment decisions, entrepreneurs’ instincts, aka “animal spirits”, call the shots. However, up to now, the integration of investment expectations has not been achieved. In usual SFC models, the investment function, crudely defined, is not based on a theory of how expectations are formed. As a first attempt, we have integrated the state of confidence by means of a computed confidence index (Le Heron 2011). Moreover, SFC models are not really microfounded, which is puzzling since Keynes made clear that entrepreneurial decision-making matters.

The purpose of this paper is to address these shortcomings by developing a SFC model with sound microfoundations, derived from a field study and an underlying psychological theory. In particular, our approach implies to assess the heterogeneity of entrepreneurs, since the argument goes that entrepreneurs have to think differently from one another in order to innovate, create markets and make profits (Casson 2000, 2005, Metcalfe 2006). Fundamental uncertainty strips information of its objective meaning, for it has to be interpreted: were information symmetrical, two rational entrepreneurs would nonetheless form diverging expectations. Thus, animal spirits have to be different. Our model is an attempt to be based on an assessment of such a heterogeneity. One feature of our model is that the macro causalities end up constraining the heterogeneous individual decisions, thus somehow homogenizing them (top-down approach).

The rest of the paper proceeds as follows. In section 1, we introduce our former field study and its underlying theoretical framework. Then, we present the heterogeneity of entrepreneurs we derived from it. In section 2, we present our SFC model. We focus on variables pertaining to entrepreneurial decision-making. Section 3 deals with our experiments that can highlight individual and macroeconomic dynamics. We conclude by proposing the outlines of a research agenda.

# Section 1. Integrating the heterogeneity of entrepreneurs

Oddly enough, DSGE and SFC models share a common feature: representative agents. In the SFC models, the focus is on macro variables, and their relations to other macro variables. The aggregation of production and investment functions is not studied. Yet, interactions matter, since depending on which interactions take place, the macro results may be different. Furthermore, the same causes may not have the same consequences, it may depend on the individuals. The interplay of micro decisions and macro variables is a black box. We address these shortcomings by including the interactions of heterogeneous entrepreneurs. However, not all entrepreneurs differ from one another. Some entrepreneurs resemble other entrepreneurs, while being different from the rest of entrepreneurs. In other words, there may be families of entrepreneurs; among all this diversity, there may be recognizable patterns, groups of entrepreneurs that behave similarly. This is the first teaching of our field study: there are “ideal types” of entrepreneurs; the diversity of entrepreneurial behavior may be clustered around a definite number of representative entrepreneurs. Instead of having one representative entrepreneur, we have several. First, we will briefly present our theoretical background on which our field study is based, then the field study proper. Finally, we will introduce our ideal types of entrepreneurs.

## The Theoretical background

The goal of our field study was to evaluate the diversity of entrepreneurs in terms of animal spirits. Providing a thorough discussion of animal spirits is beyond the scope of this paper. Instead, we will briefly sketch what animal spirits are. Keynes (1936) depicted them, alternatively, as “spontaneous optimism”, “sentiment”, “whim”, “urge to action”, “nerves”, “spontaneous activity”. This definition pertains to both sides of investment expectations: prediction (“optimism”, later on defined as an over-estimation) *and* decision (“urge to action”, “spontaneous activity”). Because “our knowledge of the future is fluctuating, vague and uncertain” (Keynes 1937: 213), entrepreneurs rely on affective expectations: “it is our innate urge to activity which makes the wheels go round, our rational selves […] often falling back for our *motive* on *whim* or *sentiment*” (Keynes 1936: 163, our emphasis, see also Akerlof & Shiller 2009, Marchionatti 1999, Dow & Dow 2011). Hence, we assessed entrepreneurs’ motives and emotions as a way to cope with fundamental uncertainty. Austrian economists also stressed the importance of uncertainty and see entrepreneurs’ heterogeneity as a way to cope with it. For them, entrepreneurship is about the exercise of judgment under uncertainty and profits are the reward for better decision-making (Foss et alii. 2007). As Frank Knight argued (1921: 311), “profit arises out of the inherent, absolute unpredictability of things”. So to speak, markets would pick the best ideas and innovations, in a process akin to natural selection. We need heterogeneous entrepreneurs in order to test new ideas and new knowledge correlations; heterogeneity is vital for economic dynamics (Metcalfe 2006). We supplemented Austrian and Keynes’s views with a modern psychological theory developed by Walter Mischel, “interactionism”, according to which it is the context that drives people to expect depending on their “personality system” (*i.e.* the interplay of motivations, traits and thinking styles, see Lainé 2016). Consequently, we asked entrepreneurs to evaluate the force of the contexts that drive them to invest.

## The empirical study

Our taxonomy is based on the results of a previous empirical study (Lainé 2016), which consisted of questionnaires sent in 2013 to 8,000 entrepreneurs from two industrial sectors (namely wine & spirits and apparel). We obtained 289 complete answers, that we analyzed through two different methods of clustering, so as to ascertain we did not have a statistical artifact. Entrepreneurs differed from one another in terms of the contexts they are sensitive to (some invest more in cases of a fall in interest rates, others more readily invest when they enjoy higher profits, etc.), their favorite sources of finance (external or internal), the profit shares that accrue to shareholders, the type of investment (capacity or productivity)… As this study was thorough and involved too many parameters for modeling purposes, we had to make choices as to which parameters to retain. First and foremost, since our research objective was to analyze the importance of heterogeneous expectations proper, we did not include variables that may imply to model financial markets such as “the propensity to invest when alternative investments (*i.e.* bonds, shares…) yield less returns”. Another item was impossible to model: the forecasts of experts (some entrepreneurs tended to rely on them). Furthermore, due to our focusing only on the heterogeneity of investment, we did not dare modeling the heterogeneity of production functions, hence the removal of the variable “propensity to invest in cases of a cost increase”. Finally, due to the complexity of modeling entrepreneurs who invest more than the others in cases of a fall in profits or sales revenues, we dropped the variables pertaining to this kind of situation. Consequently, on the remaining variables, we had 10 different kinds of entrepreneurs left (out of the 11 outlined in the empirical study).

## Introducing our 10 ideal-types of entrepreneurs

All in all, our ideal types of entrepreneurs may differ in terms of motivations, investment objectives, the kind of circumstances that spur them most to invest (as compared to the others), and their favorite source of finance (if anything).

### The Explorer (E)

Like Fitzcarraldo, she is the “conquistador of the impossible”. Always on the move, obsessed nights and days by her schemes and grand ideas, she knows no rest. Whimsical, impulsive, subject to upsurges of devastating anger, she is made for the most ruthless struggles. Of all entrepreneurs, she is the one who relies the most on her animal spirits. She is endowed with great visions and swift intuitions. In her mind, failure is not an option: she always goes to the utmost end of her ideas, no matter how bizarre they may sound to the crowd, be it at the cost of bankruptcy or mockery. Relentlessly, she intends to push her limits. She takes all risks, for entrepreneurship is a life style, an overflow of energy, a never-ending quest. As a result, she is rather indifferent to money and social status. Her motivations are to explore new paths and test untried ideas.

She doesn’t care about uncertainty, since it is part of life and what entrepreneurship is all about. She will strongly respond to adverse circumstances, since she sees them as the forerunner of decay: not moving would imply to accept her demise. Therefore, in case of a fall in sales revenues, market shares and/or profits, she will invest more than her counterparts.

An historical case in point of such an entrepreneur is Howard Hughes.

### The Financier (F)

Of all entrepreneurs, she is the most rational. Strongly uncertainty-averse, she relies on a probability calculus in order to derive mathematical expectations. Master of her emotions, she tries to gather as much news as possible (experts’ forecasts, medias, etc.) so that she may decide on the most rational basis. Neutral towards risk, the neoclassical manager invests so as to maximize profits.

When she realizes that something went wrong somehow, she is susceptible to abandon a project without second thoughts and switch to another, more promising one: she won’t be subject to a sunk cost fallacy. The circumstances that spur her to invest are those outlined by standard theory: a fall in interest rates, a rise in profits, a lesser yield of alternative investments and the will to positively respond to shareholders’ demands.

An historical case in point of such an entrepreneur is Andrew Carnegie.

### The Builder (B)

This entrepreneur is the entrepreneur of very long, patient undertakings, the ones that could stretch their consequences in the most remote future, even beyond her own life. Endowed with an iron will, she believes that there is nothing perseverance could not overcome. She likes to think about her business in its most minute details. She always expects the worst, so as to better thwart it. Consequently, she won’t take much risk and she will try to tame uncertainty by calculus, even if this calculus does not necessarily have a probabilistic nature. She more readily thinks in terms of affordable losses rather than expected returns. Very leery about the most speculative constructions of the human mind, wisely aware of the pitfalls of bright ideas, she won’t invest in order to launch new products or services. Instead, she will invest so that her company may improve its productivity or raise its productive capacity. She became entrepreneur out of love of money and the will to found an empire.

Since money is what makes the business world go round, she will be very sensitive to self-financing and a fall in interest rates. She is also obsessed by cost-control. In case of a cost increase, she will invest more than her counterparts. Besides, she will look at a fall in sales revenues as a major threat, one that needs to be decisively taken care of.

### The Paternalistic Manager (Pa)

He is a man of second thoughts, brooding his opinion and irritation, haunted by his past failures and paralyzed by the fear of loss. He readily views his company as a big family, of which he is the head. Since he believes an individual is shaped by trials and ordeals, he extensively relies on his experience and the safest trials. Pessimistic, calm and strongly risk-averse, he does not trust easily.

Overall, he under-invests. Above all, he tries to reduce uncertainty and secure his projects. Engaging a hefty sum requires a lot of thinking and tinkering. When a new contract is signed, the prospect is concrete. Then, he finally overcomes his natural reluctance to take a chance. Whenever he can, he tries to appeal to markets in order to finance his projects (by issuing bonds).

### The Hero (H)

There is nothing this entrepreneur relishes most than the thrill of competition. The business wars stimulate her. She intends to conquer and enjoys success for the sake of success. Her aim is to exist in the eye of the beholder, to achieve something spectacular – and reach glory. A self-confident entrepreneur, the hero is constantly on the lookout, trying to stand out from the masses of ordinary business makers. She is little inclined to regret or nostalgia. She looks forward, for everything is to be started afresh, and revamped. The hero is a natural-born, charismatic leader. She always tries to think big.

Risk and uncertainty are no deterrent to her, since they are opportunities to prove her bravery. As regards the circumstances that spur her most to invest, a rise in sales revenues and the expansion of the market seem to have a special grip on her.

### The Inventor (I)

Usually, the inventor is said to be weird, awkward, lost in her thoughts. This entrepreneur has thousand thoughts in a day; she undertakes dozens of projects at a time. Most of them won’t end up anywhere. Novel ideas hold sway over her; she is fascinated by new technologies. There is nothing she values most than ingenuity. Creating is a vital need for the inventor. Any time a new idea crosses her mind, she has to experiment and develop it. Profitability cannot be the major concern of her company. Fundamentally optimistic, she doesn’t have much of an eye for business details.

Therefore, she won’t bother much if she doesn’t have the means to fulfill her projects. In adverse circumstances like a fall in profits or sales revenues, she will invest less than the others. She will wait until the situation improves. The inventor readily places herself at the cutting edge of innovation. Above all, innovating implies to be independent, since misunderstandings are rife when someone is well ahead of her time. Consequently, the inventor will less frequently take advantage of a fall in interest rates and will invest more in cases of a market expansion or a rise in sales revenues.

An historical case in point of such an entrepreneur is Thomas Edison.

### The Craftsman (A)

The craftsman is the typical entrepreneur from the “old times”. Making money is not her primary objective. She is very dedicated to her customer and has high moral standards. Her pride is to produce something perfect, for the enjoyment of her clients. She may lack self-confidence and control over her emotions, but she follows through her ideas and schemes. The craftsman is cagey about uncontrolled flights of fancy and enthusiasm. She is reluctant to grow, since she tends to view such expansion as an increased risk of bankruptcy.

As regards investment decisions, she seeks safe guarantees and sound foundations. Overall, she under-invests. To finance her projects, she will more readily borrow money from the bank than issue new stocks. She won’t follow shareholders’ demands and will be more sensitive to situations of rising profits.

### The Mogul (S)

Relishing luxury, prone to expenses, this entrepreneur intends to live gleefully a life of delights. Pleasure is her vocation, enjoyment her driving force. She loves money, not for itself, but for the delights it enables. The mogul has delusions of grandeur. She more often works for big companies. She wants to secure a social status, to lead and be admired. This explosive temperament seeks to seduce. As an entrepreneur keen on lavish expenses, her business obsession is to grow big.

Nothing jeopardizes most her peculiar life style than the prospect of a decline. More than the others, she will invest more in situations of a fall in profits and sales revenues. Albeit the mogul does not implement a probability calculus, she strives to get as much informed as she can. Thus, she will rely more on experts’ forecasts. Discounting them would be a sign of an unbearable casualness. In order to finance her projects, the mogul will balk at applying a bank loan and will rather issue new bonds.

### The Prophet (P)

Above all, the prophet wants to change the world and take up a challenge. An inspired entrepreneur, she follows her visions and intuitions. Although she may not be the most creative, she is the most able to turn innovations into economic processes or products. She goes where others don’t. Of all entrepreneurs, she is the most schumpeterian: she has the “will to conquer” and “found a private kingdom”; she feels the “joy of creating” because “there is nothing else she can do”. Unlike the inventor, she does not feel the urge of experimenting new ideas relentlessly and she gets to the bottom of things. She tries to grasp the key elements of the market and see the future. The prophet is not happy merely to respond to circumstances, but to shape them. Her curiosity cannot be tamed. She tries to stay informed of everything regarding economical, technological and social evolutions.

The prophet invests very often in order to launch new products or to perfect previous products. She won’t hesitate much to increase the productive capacity of her company. Because the demise may be swift and merciless in innovative markets, she will strongly react in cases of adverse circumstances (fall in profit, sales revenues and market shares). When it comes to finance, the prophet favors the market (bonds and stocks) and is more reluctant to borrow money from the bank.

### The Gambler (J)

The gambler has one big thrill: taking risks. Not only does it send shivers down her spine, but she loves them uncontrollable. Unlike the hero, she does not seek glory, and unlike the explorer, she does not view risks as the inevitable consequence of economic activity. She values risk for the sake of risk itself. This thrill seeker places pleasure and enjoyment on top of everything. She is capable of staking her whole career or fortune on a single investment. The gambler is, par excellence, the entrepreneur of lightning successes and dramatic failures. Success is not enough; when she happens to know it, sooner or later she will succumb to the siren call of risk. Uncertainty is the gambler’s surest ally. Despair is nothing but a word. She considers troubled times as full of opportunities, waiting to be seized. This highly-educated entrepreneur view management as a mix of riddles and board games.

The gambler relies heavily on her gut feelings. Compared to her counterparts, she over-invests. Ordeals stimulate her, uncertainty is her goad. Thus, in difficult times, (i.e. fall in profits, sales revenues or market shares), she will invest more than the others.

The following table 1 summarizes the differences between our ten ideal-types of entrepreneurs.

### Summary

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Finan** | **Builder** | **Pater** | **Hero** | **Mogul** | **Prophet** | **Craft** | **Invent** | **Gambler** | **Explorer** |
| **Favorite Finance** |
| **Self-Finance** |  | **++** | **-** |  |  |  |  | **+** |  |  |
| **Bank** |  | **+** |  |  | **-** | **-** | **+** | **-** |  |  |
| **Stocks** |  |  |  |  |  | **+** | **-** | **-** |  |  |
| **Bonds** |  |  | **+** |  | **+** | **+** |  | **-** |  |  |
| **Investment Objectives** |
| **Innovation** |  | **-** |  |  |  | **+** | **-** | **++** |  | **+** |
| **Productivity** |  | **+** | **-** |  | **+** |  | **-** |  |  |  |
| **Produc Capacity** |  | **+** | **-** |  |  | **+** | **-** |  |  |  |
| **Reaction function** |
| **Risk-taking** |  | **-** | **- -** |  |  |  |  | **++** | **++** | **+** |
| **Rise profit** | **++** | **++** | **-** |  |  |  | **-** | **+** |  |  |
| **Rise sales** |  | **+** | **-** | **++** |  |  | **-** |  |  |  |
| **Interest rate** | **+** | **+** | **-** |  |  |  |  |  |  |  |
| **Forecasts** |  |  | **-** |  | **+** |  | **-** |  |  |  |
| **Alternative** | **++** |  | **-** |  |  |  |  |  |  |  |
| **Expansion** |  |  | **- -** | **+** |  |  | **-** | **+** |  |  |
| **Shareholders** | **+** |  |  |  |  |  | **-** |  |  |  |
| **Profit fall** |  |  | **-** |  | **+** | **+** | **-** | **-** | **+** | **+** |
| **Sales fall**  |  | **+** | **-** |  |  | **+** | **-** | **-** | **++** | **+** |
| **Shares fall** |  |  | **-** |  | **+** | **+** |  |  | **+** | **+** |
| **Cost (Inflation)** |  | **+** |  |  | **+** |  |  |  |  |  |

**Table 1. The heterogeneity of entrepreneurs**

How to read this table: one “+” means that the variable is significant (*i.e.* the entrepreneur differs with respect to this variable); two “+” means that the variable is extremely significant (*i.e.* more than 60% of the variance for this variable is accounted for the fact of belonging to this group of entrepreneurs); the signification of “-” is pretty much the same: the variable is significant, except that the entrepreneur has a lower value than the average.

Section 2. The SFC model

Given the aim of the paper, we shall develop more specifically the features concerning the investment decision of entrepreneurs[[1]](#footnote-1). The economy contains five sectors: government, firms, households, private banks and central bank. SFC modeling is based on two tables: the transactions matrix (flows, appendix 1) and the balance sheet matrix (stocks, appendix 2). The complete dynamic model (appendix 3) contains about 10 behavior equations, even if there are near 300 equations in the complete model.

The national income (*Y*) adds the household consumption (*C*), investment of the firms (*I*) and the public expenditure (*G*). The rate of growth of the national income is *gry*.

## Investment of entrepreneurs

All production must be financed. However, current production is financed by the working capital of entrepreneurs (retained earnings) and by contracted revolving funds granted by banks at the current rate of interest. These two factors constitute a shock absorber to possible monetary rationing by banks. Let us proceed to examine the gross supply (ϕ) and the net supply (Δ*L*) of finance by banks – that is to say, the new flow of money, as opposed to the existing stock of money (*D*). Also, there is a stock of money demand equal to transaction, precaution, finance and speculative motives, whereas the desired gross finance demand (ϕ*d*) represents the new flow of financing required by firms for the desired investment (*Id*) and for the redemption of the debt (amortization = *amortL*) minus the undistributed profits (*Pu*). Thus the internal funds of firms (*IF*) represent the undistributed profits (*Pu*) minus the redemption of the debt (*amortL*). Assuming a closed economy, demand for money can be satisfied by banks, either by the stock markets or by credit. At the end of the period, net financing demand (Δ*LD*) can be constrained by net money supply from banks (Δ*L*). Δ*D* determines monetary creation in the period, issued from loans (*L*) to firms and Treasury bonds (*B*) to Government.

The investment function is the most important one in a growth model. The stock of capital (*K*) increases with the flow of net investment (*I*) that is financed by the total of the corporate retained profits of firms and by external funds from commercial banks (gross finance = ϕ). Firms prefer self-financing (Eichner, 1976), because borrower’s risk begins with external funds. The self-financing of firms corresponds to the net retained profits, that is the retained earnings (*Pu*) minus the redemption of the debts of firms (*amortL*). Firms borrow money from banks to finance investments (loan at variable rate) (*L*).

 I ≡ ϕ + IF (1)

 IF = Pu – amortL(2)

 amortL = al ⋅ L-1  (3)

In this model, we differentiate between the effective investment (*I*) and the desired investment of firms (*ID*). The banks finance the latter totally or in part according their lender’s risk (*LR*) (see equations 23). A rationing in investment financing can exist (ϕ < ϕ*d* or *I* < *ID*).

 ID = grkD . K-1 (4)

 ϕd = Id – IF (5)

The desired rate of accumulation (*grkD*) is a function of an exogenous state of confidence (γ*0*), the rate of cash flow (*rcf*), the capacity utilisation rate (*u*) and by the financial conditions, which are measured by the long-term interest rate (*il*) and by the level of indebtedness (*Lev*). An interesting feature is the behavior towards risk (γ5), which was defined in our field study as the investment behavior according to the context: in times of difficulty, some entrepreneurs wish to invest more so as to get out of trouble. We consider they take more risks. Conversely, some wish to invest less. They are then said to be risk-averse. In times of boom, risk-takers invest less, although the situation is safer. In fact, their behavior is “counter-cyclical”. The behavior of their counterparts, who invest much only when the economic situation seems safe, is “pro-cyclical”. Thus, γ5 is related to another variable designed to represent a conventional level of appropriate macroeconomic context, that is the context which is considered by the business climate to be safe (AVR, in our model).

 grkD = γ0 + (γ1 ⋅ rcf-1) + (γ2 ⋅ u-1) – (γ3 ⋅ il) – (γ4 ⋅ Lev) + (γ5 ⋅ AVR) With γi: constant (6)

Where the rate of cash flow is defined as the ratio of retained profits to capital and the rate of capacity utilisation as the ratio of output to full capacity output (*Yfc*) :

 rcf = Pu /K (7)

 u = Y /Yfc  (8)

The capital to full capacity ratio (σ) is defined as a constant:

 Yfc = K-1 ⋅ σ With σ: constant (9)

The level of indebtedness is the ratio of firm debt (*Lf*)to capital.

 Lev = Lf/K With μi: constants (10)

Firms pay wages (*W*) to household and taxes (*Tf*) to government. Distributed profits (*Pd*) are a fraction of profits realized (*Pf*) in the previous period:

 W = Y/(1 + ρ) With ρ: constant (11)

 Pf = Y – W – il  . L-1 – TF (12)

 Pd = (1 - sf) . Pf-1 With sf: constant (13)

Since we have ten different types of entrepreneurs, all these equations are duplicated ten times according to the characteristics of these ideal types. Nine variables justify the heterogeneity between entrepreneurs in their investment behavior. We change the exogenous coefficients of these eight variables to reproduce the differences summarized in the table 1:

 - Spontaneous optimism unrelated to the circumstances: γ0

 - Profitability of the firm measured by the rate of cash flow (*rcf*): γ1

 - Rate of utilization of capital (*u*): γ2

 - Long-term rate of interest (*il*): γ3

 - Level of indebtedness (*Lev*): γ4

 - Risk-taking behavior (AVR): γ5

 - Profit share distributed as dividend: 1 - sf

 - Speed of amortization: al

 - Productivity: ρ

The exogenous coefficients of the eight variables (table 2) are calibrated as follows:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Variable** | **Finan** | **Builder** | **Pater** | **Hero** | **Mogul** | **Prophet** | **Craft** | **Invent** | **Gambler** | **Explorer** | **Average** |
| 1 | Animal spirits | 0,05 | **0,035** | **0,02** | **0,06** | 0,05 | 0,05 | 0,05 | 0,05 | **0,08** | **0,07** | 0,05 |
| 2 | Cash flow | **1** | **1** | **0,40** | 0,60 | 0,60 | 0,60 | **0,40** | **0,80** | 0,60 | 0,60 | 0,60 |
| 3 | Rate of utilization of capital | 0,20 | 0,20 | **0,075** | **0,30** | 0,20 | 0,20 | **0,125** | **0,40** | 0,20 | 0,20 | 0,20 |
| 4 | Interest rate | **0,50** | **0,50** | **0,15** | 0,30 | 0,30 | 0,30 | 0,30 | 0,30 | 0,30 | 0,30 | 0,30 |
| 5 | Level of indebtedness  | 0,08 | **0,15** | 0,08 | 0,08 | **0,05** | 0,08 | 0,08 | 0,08 | 0,08 | 0,08 | 0,08 |
| 6 | Dividend/Profit | **0,80** | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | **0,50** | 0,65 | 0,65 | 0,65 | 0,65 |
| 7 | Speed of amortization | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | 0,04 | **0,06** | 0,04 | 0,04 | 0,04 |
| 8 | Productivity | 0,4 | **0,50** | **0,30** | 0,4 | **0,50** | 0,4 | **0,30** | 0,4 | 0,4 | 0,4 | 0,4 |
|  | Innovation |  | - |  |  |  | + | - | ++ |  | + |  |

**Table 2. The heterogeneity of entrepreneurs according 8 variables**

## Consumption of households

We assume that households determine their consumption expenditure (*C*) on the basis of their expected disposable income (Yha) and their wealth from the previous period (*D-1*) consisting entirely of bank deposits (current accountsand time deposits):

 C = (α1 ·Ywa) + (α2 · Yva) + (α3 ·D-1) with αi : constants 1>α1>α2, α3>0 (14)

 Ywa = Yw-1 + θh · (Yw-1 – Ywa-1) with θh: constant (15)

 Yva = Yv-1 + θh · (Yv-1 – Yva-1) (16)

 Yha = Ywa  + Yva  (17)

 Yw = W – Tw (18)

Yv = Pd + Pb + id-1 **⋅** D-1 – Tv (19)

Whereas (Ywa) is the expected disposable income of workers, (Yva) the expected disposable financial income and each (αi) is a propensity to consume. In this model, the expected value of any variable for current period (represented with the superscript *a*) depends on its value of the previous period plus an error correction mechanism where (θ) represents the speed of adjustment in expectations.

 We assume, following the Kaleckian tradition, that wages are mostly consumed while financial income is largely devoted to saving (1>α1>α2>0). This class-based saving behavior is not without consequences in a SFC model where interest payments play a great role. This consumption decision determines the amount that households will save out of their disposable income *Yh*:

 D ≡ D-1 + Yh – C (20)

## Financing by private banks

Banks don’t make loans to households, but firms’ financing is fundamental in a monetary economy of production. Banks only finance projects they consider profitable, but confidence in their judgment is variable and can justify various strategies. Banks examine firms’ productive and financial expectations and also their financial structure. This investigation is made according to their confidence (γ*4*) in the state of long-term expectations of yields on capital assets, influencing what Keynes referred to as ‘animal spirits’. After the study of expected production and of demand of financing that integrates the firm’s borrowing risk, bankers can refuse to finance. Banks experience a lender’s risk(*LR*) when underwriting finance and creating money.

When the lender’s risk is maximum (*LR* = 1), commercial banks refuse to finance the net investment of firms: Δ*L* = 0. Desired investment (*ID*) faces a serious finance rationing. The flow of net investment is only financed by self-funding, that is the retained earnings (*Pu*), minus the amortization of the debt (*amortL*). Thus the money supply (in stock) can be reduced with the redemption of the debt. If the lender’s risk is null (*LR* = 0), desired investment is fully financed: Δ*L* = Δ*LD* or ϕ = ϕ*d*. It corresponds to the horizontalist view of Kaldor (1982).

 ϕ = ϕ*d* . (1 – LR) With 0 ≤ *LR* ≤ 1 (21)

 ΔL = ϕ – amortL  (22)

In the model, the lender’s risk (*LR*) is measured by the difference between the current leverage ratio and the conventional leverage ratio (amount of indebtedness considered normal) and is impacted by monetary policy that involves a money market risk when fluctuations in the money interest rates (*icb*) occur. The higher the current indebtedness of firms (*L*/*K*) over the accepted indebtedness, the greater the lender’s risk.

 LR = γ4 +a1 ⋅ (lev-1 – levc) + (a2 ⋅ icb) With γ4, a1, a2 et levc: constant (23)

 lev = L/ K (24)

 il = icb + χ1 With χ1: constant χ1 > χ2 (25)

 id = icb - χ2  (26)

The initial structure of interest rates is as follows: *il* = *ib* > *icb* > *id*

Economic activity also depends on the animal spirits of banks. Finance scarcity can only be the consequence of a deliberate choice. ‘Desired scarcity’ of financing is the sign of banks’ liquidity preference.

## Fiscal policy of the government

Government expenditures are only final sales of consumption goods. The government collects taxes from households (TH) on incomes and from firms (TF) and commercial banks (TB) on profits. The government finances any deficit issuing bonds, so that the supply of treasury bonds (*B*) in the economy is identical to the stock of government debt. In other words, it is given by the pre-existing stock of debt plus its current deficit (*DG*). The current deficit of the Government includes the redemption of the National debt. We assume that private banks give limitless credit to government at the long-term rate of interest (*ib*).

Public expenditure (*G*) is always growing at the same rate (*gry*) as the national income (*Y*) with a lag of one year. Tax revenue is proportional to income and hence varies in line with the public expenditure. With the State debt, the global impact is linked to the key interest rate and, then, to the monetary policy. The final effect of the fiscal policy is measured by the government deficit (*DG*). Our economy has a self-stabilizing tendency due to the fiscal policy.

 G = G-1. (1 + gry -1) (27)

 DG = G + (ib-1 . B-1) – (TH + TF + TB) – Pcb – amortB (28)

 TH = Tw + Tv  = τ1 . Yw-1 + τ2 . Yv-1 With τ1, τ2: constant(29)

 TF = τ3 . Pf-1 With τ3: constant (30)

 TB = τ4 . Pb-1 With τ4: constant  (31)

## Central bank

Following the theory of endogenous money (Kaldor, 1982), I assume that the central bank is fully accommodating, fixes exogenously a key rate (*icb*) and provides whatever advances (*REF*) demanded by banks at this rate. It is assumed that banks are obliged by the government to hold reserve requirements (*H*) in high powered money that does not generate interest payments and that must always be a fixed share (the compulsory ratio η) of deposits:

 H = η · D (32)

Since the central bank is collecting interest payments advances while paying out no interest on the notes, it is also making profits Pcb:

 Pcb ≡ icb-1 · REF-1 (33)

It is assumed, in line with current practice, that any profits realized by the central bank are reverted to the government.

The missing identity is the one relative to the capital account of the central bank:

 REF = H (34)

This identity reflects the fact that high-powered money is supplied to the economy through advances to private banks. Of course, this accounting identity must hold invariably. To be sure that the model is stock flow consistent, we have to verify when we solve the model that the numbers issued from simulations do generate H ≡ REF.

Section 3. First experiments

Our purpose is twofold. First, we aim to examine the impact of heterogeneity by comparing the steady states of the economy in the case where we have just one type of entrepreneur in the whole economy. Thus, in accordance with Keynes’s insights on the animal spirits and the importance of investment decisions in business cycles, our model will exhibit “supply-side” features along with the usual demand-led characteristics. We will then examine what happens when we have 10 interacting entrepreneurs. Second, we will study the impact of a demand shock. We will see whether the heterogeneity of entrepreneurs contributes to the recovery, in accordance with Austrian economics insights.

## The economy with homogeneous entrepreneurs

The following table summarizes the different patterns of the economy, depending on the behavior of its homogeneous entrepreneurs, that is as if we had one representative entrepreneur.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Entrepreneur** | **Rate of growth****of GDP** | **Rate of growth****of desired capital** | **Leverage** | **Financing constraint** **by banks**  | **Profit/GDP** | **Firm Debt/GDP** |
| Prophet | 6,66% | 7,43% | 30,40% | 27,40% | 21,04% | 40,79% |
| Hero | 6,99% | 8,62% | 39,93% | 37,06% | 20,82% | 53,91% |
| Gambler | 7,16% | 9,30% | 43,71% | 40,71% | 20,74% | 58,86% |
| Explorer | 6,99% | 8,62% | 39,93% | 36,93% | 20,83% | 53,73% |
| Inventor | **5,88%** | 9,07% | 52,96% | 49,95% | 20,52% | 67,65% |
| Craftsman | 7,85% | 7,90% | **9,57%** | **6,57%** | **17,42%** | **12,01%** |
| Builder | 6,12% | **6,44%** | 22,19% | 19,19% | 24,72% | 36,06% |
| Rational | **5,39%** | 7,70% | 49,33% | 46,33% | 20,87% | 46,12% |
| Paternalistic | 6,11% | **6,11%** | **-9,76%** | **0 %** | **17,73%** | **-9,58%** |
| Mogul | 6,48% | 7,58% | 35,54% | 22,55% | 24,36% | 57,64% |
| **Average** | **6,56%** | **7,88%** | **31,39%** | **29,67%** | **20,90%** | **41,72%** |

**Table 2. The economic patterns of firm with homogeneous entrepreneurs**

As we see, we have very specific patterns owing to the behavior of entrepreneurs. Growth rates range from 5.39% to 7.85%. The variation in the investment rates is even more substantial: from less than 5% to almost 10%... The debt patterns are extremely erratic. In one case (if we had only “paternalistic managers”), entrepreneurs invest less money than they earn, which means that they keep a significant portion of their profits as savings. Incidentally, the overall investment rate is paltry, accumulation is slow, which hampers the growth rate. At the other end of the spectrum, we have bold entrepreneurs (the “inventors”) intent on running into debts to finance their optimistic schemes. Furthermore, this behavior distorts the distribution of income, since interest payments on corporate debt accrue to capitalists who consume a smaller share of their income than workers. All in all, this has consequences on the growth rate, which is smaller than what we might have expected. Clearly, there seems to be limits to self-fulfilling prophecies. Buoyant entrepreneurs cannot drag the whole economy on their own, for there seems to be a point where indebtedness becomes detrimental due to its negative effects on profits and consumption. Conversely, the economy with a higher share of retained earnings and wages (“the craftsman” rationale) displays the higher growth, presumably because then both consumption and investments are high and indebtedness low. It is also noteworthy that the two economies with the highest shares of profit (“Mogul” and “Builder”) have a below average growth rate.

|  |  |  |  |
| --- | --- | --- | --- |
| **Entrepreneur** | **Investment/GDP** | **Consumption/GDP** | **Government/GDP** |
| Prophet | 8,38 % | 54,26 % | 37,36% |
| Hero | 8,80 % | 53,93 % | 37,27% |
| Gambler | 8,99 % | 53,78 % | 37,23% |
| Explorer | 8,79 % | 53,94 % | 37,27% |
| Inventor | 7,15 % | 55,27 % | 37,58% |
| Craftsman | 9,14 % | 53,84 % | 37,02% |
| Builder | 9,37 % | **53,11 %** | 37,52% |
| Rational | **4,79 %** | 57,48 % | 37,73% |
| Paternalistic | **5,65 %** | 56,87 % | 37,48% |
| Mogul | 9,86 % | **52,72 %** | 37,42% |
| **Average** | **8,09 %** | **54,52 %** | **37,39 %** |

**Table 3. Investment and consumption with homogeneous entrepreneurs**

Two other features of our experiments catch the eye and have widespread consequences. First, distribution of income (i.e. inequalities) matters, since at the two ends of the spectrum we have the entrepreneurs whose behavior differ with regard to the profit share they distribute to shareholders. As a matter of fact, the “craftsman”, who gives only half her profits away to shareholders, invests more than her counterparts and takes advantage of a more sustained consumption, since the wealth share of shareholders is the lowest. Conversely, the “rational manager”, who keeps only one fifth of her profits, invests far less than all her counterparts and faces a less dynamic consumption. Interestingly, her debt ratios stand above the average, for the macroeconomic consequences of her behavior thwarts to some extent her unrealistic optimism. Second, the banks are so to speak the referees of our model, since their credit rationing differs widely and also given the major consequences credit rationing has on the distribution of income (recall that interest payments accrue to capitalists, hence lowering the overall propensity to consume).

## The economy with heterogeneous entrepreneurs

Modeling competition in a SFC framework is bound to be a moot point. Since there is no reason to assume that one specific type of entrepreneur is tied to one specific industry/company (so that they are homogeneously distributed across all sectors), we have no reason to assume one of them leads the market and is preferred by consumers. Indeed, consumers choose products/services, not the entrepreneurs that provide them. So, why would their favorite products be provided by one kind of entrepreneurs and not the others? For sure, there are market leaders; some companies have more power and enjoy higher shares of the market. However, our focus is on entrepreneurs, not firms. Thus, we have no reason to assume the leading firms are managed by one specific kind of entrepreneur. By want of empirical studies on this issue, we will refrain from having too strong an assumption.

Furthermore, the SFC framework is macroeconomic par excellence; hence consumption is determined at a macroeconomic level. In this regard, modeling competition amounts to finding a key to allocate consumption among entrepreneurs, because we have no clear data to model the market competition. In all likelihood, such a key cannot stamp out one type of entrepreneur, otherwise we would not have observed her existence in our former empirical study. Consequently, our allocation key must give a sufficient share of the market to each and every type of entrepreneur, so that she may not be jeopardized. Since we cannot properly model consumers’ choice in a SFC framework and we wanted to avoid ad hoc assumptions, we had to elaborate a strategy.

We designed the two *extremum* of the consumption function. At the lower, pessimistic end, consumers do not validate entrepreneurs’ expectations (i.e. they consume regardless of entrepreneurial investment decisions). There is a gap between the macroeconomic consequences of investment and its microeconomic implications: those who invest more and take more risks are not the most successful. At this lower end, we decided that the market shares of entrepreneurs would be constant: one tenth of the total macroeconomic consumption.

At the higher, optimistic end, entrepreneurs have foresight. They predict the market accurately. As a result, the consumption behavior validates their investment expectations. We decided that the allocation key would be proportional to entrepreneurs’ degree of optimism as measured by our variable “growth rate of desired capital”. Furthermore, we included the different propensity to innovate of entrepreneurs: since entrepreneurs correctly guess the market trends, consumers will prefer the products offered by the most innovative entrepreneurs. Thus, we added a coefficient to this allocation key, so as to take heed of innovation. Presumably, the actual consumption pattern would be somewhere between these two *extremum*. For the purpose of our study, we need not know precisely where.

Given our two *extremum* of consumption patterns, we observe little difference in terms of macroeconomic growth (see table 4), despite the remaining differences as regards the other variables. Indeed, there seems to be a macroeconomic convergence, which supersedes the microeconomic diversity. This intuition is confirmed when we have a look at the trajectories of each entrepreneurs’ growth rate (see graph 1).

If we compare with the situation that prevails when we have just one type of entrepreneur, we may conclude that competition and interaction between heterogeneous entrepreneurs leads to a higher indebtedness, hence lower profits.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Allocation key** | **Rate of growth****of GDP** | **Rate of growth****of desired capital** | **Financing constraint by bank** | **Profit/GDP** | **Firm Debt/GDP** |
| High end | 6,55% | 7,99% | 61,72% | 21,12% | 48,63% |
| Low end | 6,42% | 7,72% | 61,88% | 20,88% | 43,99% |

**Table 4. The economic patterns with heterogeneous entrepreneurs**

|  |  |  |
| --- | --- | --- |
| **Allocation key** | **Investment/GDP** | **Consumption/GDP** |
| High end | 8,36% | 54,27% |
| Low end | 8,10% | 54,57% |

**Table 5. Investment and consumption with heterogeneous entrepreneurs**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Allocation key** | **Craftsman** | **Builder** | **Explorer** | **Gambler** | **Hero** | **Mogul** | **Inventor** | **Rational** | **Pater** | **Prophet** |
| High end | 4,99% | 7,12% | 14,40% | 14,09% | 10,66% | 13,67% | 17,40% | 3,48% | 2,70% | 11,49% |
| Low end | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |

**Table 6. Market shares of the different entrepreneurs**

At the high end of the consumption pattern, we witness an interesting convergence of the microeconomic growth rates of the heterogeneous entrepreneurs. Of course, such convergence is normal in a SFC framework, otherwise we would not find any steady state. In the long run, if we had an entrepreneur with a higher growth rate than the others, then she would wipe her competitors away. She would end up being the only competitor left. Thus, inherently, entrepreneurs are bound to have the same growth rate at the steady state. What is interesting is the heterogeneity of firms given this macroeconomic constraint. Indeed, firms differ in terms of indebtedness, market shares, profits and capital accumulation.

**The Importance of Being Heterogeneous**

Next, we carry out a demand shock to our model. Our aim is to see whether the interaction of heterogeneous entrepreneurs makes the economy more resilient. Two vital issues are at stake here: do microeconomic interactions matter and does heterogeneity have an impact? We will examine the issue under two angles: the speed of recovery and the total loss of income up to the new steady state.

There are three striking features. First, as compared to the trajectories of the economy when there is only one investment rationale (i.e. homogeneous entrepreneurs behaving in the same fashion), an economy with 10 different interacting entrepreneurs is more resilient. In other words, heterogeneity enables the economy to recover quicker from the shock. Indeed, the economy arrives at its new steady state only 9 periods after the shock. At the very least, it takes from 17 (Craftsman) to 62 periods (Builder) to recover when there are homogeneous entrepreneurs. In fact, two of such economies never arrive at a new steady state, at least during the time span of the model, which allowed for 65 periods after the shock.

Second, the economy suffers less when entrepreneurs are heterogeneous. The following table offers an overview of the loss of income due to the shock in the first ten years after. Recall that all other homogeneous economies have not attained their steady state at this point of time. We measure the difference between the state of the economy 10 years after the shock and the new steady state by a relative output gap, i.e. how far is the actual output from this steady state. At first sight, it may seem that the economy with heterogeneous entrepreneurs interacting ranks third in terms of resilience (i.e. how little the losses are). However, this would be misleading, since the two economies who do apparently better have not arrived at their new steady state at the end of this (arbitrary) period. If we add the loss of income up to when they arrive at such a state, then they incur more losses. Put differently, having heterogeneous interacting entrepreneurs enables the economy to incur less losses.

|  |  |  |
| --- | --- | --- |
|  | **10 year losses** | **Output gap** |
| **Inventor** | -24,52% | 23,79% |
| **Prophet** | -18,68% | 5,77% |
| **Gambler** | -18,74% | 3,05% |
| **Explorer** | -18,73% | 4,00% |
| **Builder** | -22,09% | 13,38% |
| **Hero** | -19,46% | 5,50% |
| **Craftsman** | -13,91% | 1,64% |
| **Mogul** | -19,04% | 3,54% |
| **Rational** | -22,43% | 14,81% |
| **Paternalistic** | -16,23% | 6,02% |
| **Interaction** | -17% | 0,00% |
| **Average** | -19,38% | 8,15% |

Third, it is also interesting to note that, among the homogeneous models, counter-cyclical rationales of investment do not enable to incur less losses. On average, there is not much of a difference between counter-cyclical approaches to investment and pro-cyclical ones. It may be the case that when it comes to homogeneous behavior, the most important parameters lie elsewhere, for instance debt and distribution of profits. As a matter of fact, the “worst” economy seems to be the one where there are only inventors, whose behavior is clearly counter-cyclical, presumably because they try to pay back their debt more rapidly, which would deter profits from being reinvested. The two economies that incur the less losses are the ones with the lowest levels of indebtedness. Furthermore, the “best” economy after the one with heterogeneous entrepreneurs is the one populated only by “craftsmen”, i.e. entrepreneurs who distribute the less dividends and try to reinvest their profits.

## A few words of conclusion

If the economic settings change continuously or on a regular basis (which seems after all a very sensible assumption), then heterogeneity is bound to have a greater impact. Furthermore, it seems also very plausible that the economy will recover more quickly in case of a shock when entrepreneurs are heterogeneous. So to speak, heterogeneity may play the role of a buffer and a lab experiment, enabling the economy to absorb shocks and to test different behavior so as to select the most appropriate ones and re-stabilize more efficiently. Assuredly, the next step of our research will consist of examining the effects of other kinds of shocks. This is the promising prospect enabled by the SFC framework: examining the trajectories of different agents after a shock.

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1. You will find more explanations in Le Heron and Mouakil (2008) and Le Heron (2008, 2009, 2011). Even if this model is a new one. [↑](#footnote-ref-1)