The Stagnation-Financialization Paradox?
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Abstract

Building a macro-finance agent-based model with credit and stock market, we investigate how the increasing role of speculative investors in the ownership structure affects managers’ planning horizons and R&D investment-buybacks decisions and, consequently, the resulting macroeconomic dynamics in terms of growth, instability and crisis. Drawing on Keynes’s (1936) characterisation of financial market and Minsky’s (1992) notion of money manager capitalism, the idea is that when the stock market is dominated by a speculative sentiment, managers tend to internalize the short-term view of speculative investors and accommodate their demand for high equity returns, by diverting corporate resources from R&D investment towards share buybacks in order to boost the stock price. Simulation results show that the increasing orientation towards shareholder value leads to a lower and less volatile growth in the real sector, but a higher growth in the financial sector, giving rise to what we call a ‘stagnation-financialization paradox’. Yet, in order for this scenario to manifest, it is necessary that the configuration of ownership structure and the degree of market concentration are such that the corporate sector can generate and then distribute a sufficient amount of profits to support the stock price, despite a slowing real economy. Conversely, if the fraction of speculators is too large, the economic growth is so low that the fall in profits drags buybacks spending down, and so does the stock market.

Keywords: Macroeconomics, Agent-Based Model, Heterogeneous Expectations, Finance, Innovation, Share buybacks

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1 Introduction

Over the last three decades, the advanced economies have experienced a decline in the investment rate, accompanied by a slowdown in the growth rate of output and productivity. Summers (2014) argues that, despite the enormous scale of the financial bubble in the pre-2008 period, western economies “had manifested unsatisfactory growth in output and employment since that time”, advocating the hypothesis of a new secular stagnation. Gutiérrez and Philippon (2016) point out that in the U.S. corporate sector investment remained weak despite high and increasing profitability and market valuation: the average (net) investment-operating surplus ratio passed from 20% between 1962 and 2001 to 10% between 2002 and 2015. In addition, these authors stress that the investment gap is associated with a marked reduction in market competition, a substantial increase in total payouts, as well as a growing influence of institutional ownership. In fact, while investment was faltering, U.S. firms have distributed an increasing share of profits to shareholders in form of dividend payments and, most importantly, share buybacks. Lazonick et al. (2014) find that, in the period between 2003 and 2012, the companies in the S&P500 spent 54% of their earnings on share buybacks, while another 37% was absorbed by dividend payment. Consistent with Gutiérrez and Philippon’s (2016) findings, Gaspar et al. (2012) link the increasing propensity to buyback stocks to the rise of short-term investors in the ownership structure. In particular, the proportion of U.S. equity held by institutional investors jumped from 10% in 1953 to 70% in 2006 (Gillan and Starks, 2007), with the lion’s share going to short-term actively-managed mutual funds (Davis, 2008).¹ Far from being a homogeneous group, indeed, institutional investors differ considerably in terms of time horizon and portfolio behavior. Empirical evidence seems to suggest that, whilst the rise of institutional ownership, by tightening governance and closely monitoring managers activity, may promote innovative effort and firm’s long-run performance (Aghion et al., 2013; Bena et al., 2017), short-term investors, by affecting managers’ planning horizons, create incentives to reduce R&D spending to meet short-term earnings goals (Bushee, 1998; Brossard et al., 2013) and to increase share buybacks to boost stock price (Almeida et al., 2016; Gutiérrez and Philippon, 2016).²

The aim of this paper is twofold: on the one hand, in order to provide a comprehensive understanding of these facts, we propose a narrative that combines Minsky’s (1992) view of money manager capitalism with Keynes’s (1936) description of financial market in the light of the ongoing process of ‘financialization’ of the economy (Epstein, 2005; Krippner, 2005; Hein et al., 2015); on the other, drawing on this theoretical framework, we develop an agent-based model to assess the impact of the increasing role of speculative investors in the

¹For an overview on the evolution of corporate ownership and the rise of institutional investors, see Gillan and Starks (2007), Davis (2008) and Fichtner et al. (2017)
²Accordingly, by focusing on 293 companies in the S&P500, Lazonick (2007) documents that, from 2003 to 2006, while total R&D expenditures increased from $99.7 billion to $120.4 billion (+21%), total repurchases increased from $78.8 billion to $280.8 billion (+256%).

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ownership structure on managers’ investment decisions and, consequently, on the macroeconomic dynamics in terms of growth, instability and crisis.

According to Minsky (1992), since the mid-1980s, the development of western economic systems has reached a stage in which, in a context of separation between ownership and control whereby companies’ shares are publicly traded on the stock market, the vast proportion of equity ownership is held by institutional investors, or money managers, whose goal is to collect savings from individuals and invest in financial assets in order to maximize their portfolio returns. To avoid the risk of fire sales and ensuing hostile takeovers, corporate managers are forced to embrace the view of “shareholder value”, i.e. maximizing the stock market value of the company (Fama and Jensen, 1983; Jensen, 2001). As the share for short-term investors in the ownership structure grows, however, the tendency to maximize shareholder value may lead to “a wild rush toward short-term profits” (Pasinetti, 2012) and a shift in the mode of allocation of corporate resources from “retain-and-reinvest” to “downsize-and-distribute” (Lazonick and O’sullivan, 2000) - fostering what some have called the “financialization of non-financial corporations” (Stockhammer, 2004; Orhangazi, 2008; Davis, 2018; Tori and Onaran, 2018).

In Minsky’s view, the emergence of money manager capitalism made the well-known Keynes’s (1936) distinction between speculation vs enterprise even more relevant today than it was in his time (Whalen, 2017). Lord Keynes argues that the inevitable result of unfettered capital markets is the predominance of speculation over enterprise, whereby the majority of market participants are not concerned with “making superior long-term forecasts of the probable yield of an investment over its whole life, but with foreseeing changes in the conventional basis of valuation a short time ahead of the general public.” Under these circumstances, as acknowledged by proponents of behavioral finance (Shefrin, 2001; Baker and Wurgler, 2013), the emphasis on the maximization of shareholder value, instead of increasing the long-term value of the company, leads managers to adopt a short-term view and eventually undertake corporate decisions aimed at boosting the stock price in the short run, at the cost of jeopardising prospective competitiveness and economic viability.

From a macroeconomic standpoint, we believe that, given the growing influence of institutional investors in the stock market, the source of economic instability arising from real-financial relations is to be investigated not only in the credit channel between firms and banks, but also in the interaction between shareholders and managers. With this in mind, we develop an agent-based model rooted in the financial accelerator framework (Delli Gatti et al., 2010; Riccetti et al., 2013), which stresses the role of credit in shaping short-term business fluctuations, incorporating a stock market, that affects what Keynes would call the ‘state of long-term expectations’ and thus long-term economic

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3In the frequently-cited passage in Chapter 12 of his *General Theory*, Keynes states that: “Speculators may do no harm as bubbles on a steady stream of enterprise. But the position is serious when enterprise becomes the bubble on a whirlpool of speculation. When the capital development of a country becomes the buy product of the activities of casino, the job is likely to be ill-done.”
dynamics. In particular, by retrieving and re-interpreting Keynes’s (1936) distinction between speculation and enterprise, we assume that the stock market is populated by heterogeneous groups of investors, that is speculative and patient, who differ with respect to their beliefs about the impact of share buybacks on future price, as in Dawid et al. (2019). The core of the macro model builds upon the ‘growth+’ version of Delli Gatti et al. (2011), where boundedly rational heterogeneous agents, i.e. households, firms and banks, interact over time in decentralized labor, credit and goods markets, following simple behavioural rules.

Within this setting, we investigate how the increasing influence of speculative investors in the ownership structure - which, for the purpose of our analysis, is taken as exogenous - affects managers’ planning horizons and R&D investment-buybacks decisions and thus the resulting macroeconomic outcomes. The idea is that when the stock market is dominated by a speculative sentiment, managers tend to internalize the short-term view of speculative investors and accommodate their demand for high equity returns, by diverting corporate resources from R&D investment towards share buybacks in order to boost stock price. Yet, the macroeconomic effects of this increasing orientation towards shareholder value are not straightforward. To address this question, we carry out a computational experiment in which the key parameter $\theta$, which defines simultaneously the ownership composition between speculative and patient investors as well as the resources allocation between R&D investment and share buybacks, is varied.

Simulation results show that as the fraction of speculative investors in the stock market ($\theta$) grows, on the one hand, the reduced innovative effort implies a lower and less volatile productivity and output growth; on the other, the enhanced propensity to repurchase shares allows firms to support the stock price in spite of an economic slowdown. This situation gives rise to what we call a ‘stagnation-financialization paradox.’ However, the diverging trends in the real and financial sectors persist as long as the share of speculators does not exceed a certain threshold (i.e. 60%), after which, the stock market begins to drop as well. The reason is that, for high value of $\theta$, the economic growth is so low that the fall in aggregate profits drags buybacks spending down, despite their increase in relative in terms, determining the decline in the financial market. Therefore, share buybacks can effectively support stock price despite a slowing real economy resulting from a decline in innovative activity as long as corporate profits are sufficiently high. Further simulation exercises highlight that, in order for this scenario to manifest, it is necessary that the configuration of the ownership structure and the degree of market concentration emerging from real and financial interactions are such that the corporate sector can generate and then distribute a sufficient amount of profits to sustain the stock price despite a slowing real economy.

Finally, this paper provides a modelling framework to study the role of interactions between real and financial factors in the determination of short-term business fluctuations as well as long-term economic development. On the one hand, consistent with Minsky’s (1975) ‘financial instability hypothesis’, business cycles are driven by heterogeneous firms and banks inter-linkages in the credit
market, with the interplay of an evolving market structure: firms leverage and
banks exposure, by promoting the formation of big firms, boost production,
but eventually increase the financial instability that is conducive to economic
crises. On the other hand, the long-term economic development is determined
by managers-shareholders interaction in the stock market: a growing fraction of
speculative investors creates incentives for managers to increase share buybacks
at the cost of lower R&D investment, with negative effects on productivity and
output growth, while the impact on the stock market is more ambiguous and
could be represented by an inverted U-shaped relationship.

The model belongs to the growing body of literature on agent-based models
(ABM) in macroeconomics (Dawid and Delli Gatti, 2018; Dosi and Roventini,
2019). In particular, this paper contributes to the stream of literature on macro
ABMs with financial accelerator, which study the impact of leverage and credit
network on the emergence of systemic risk, financial fragility and economic fluc-
tuations (Delli Gatti et al., 2010; Riccetti et al., 2013; Assenza et al., 2015).
On the financial side, in addition to the credit market, our model includes an
explicit formalization of an artificial stock market, whose fundamental variables
driving the share price dynamics (i.e. buybacks and dividend streams) are en-
dogenously generated from the interaction of heterogeneous agents in decentral-
ized markets. This distinguishes our setup from financial market models where
dividend streams are assumed to follow an exogenously given stochastic process
(Hommes, 2006; Chiarella et al., 2009). This experiment was first performed by
Dawid et al., (2019), who, starting from an industrial organization framework,
build a financial market with heterogeneous expectations upon a decentralized
corporate sector in order to analyze the relationship between share-based remu-
neration, managers’ investment-buybacks decisions and economic performance,
both at firm and industry level. With this paper, we aim to export and extend
the core of their analysis into a simple macroeconomic framework in order to
explore the effects of financialization, here defined as an increasing role of spec-
ulative investors in the ownership structure, on the economy as a whole. To
the best of our knowledge, this paper represents one of the first macroeconomic
agent-based models incorporating a stock market that exercises a pro-active
role on agents behavior and economic dynamics. Similar works include Riccetti
et al. (2016), in which a stylized stock market constitutes the third factor of the
financial accelerator mechanism, on top of leverage and credit network, adding
a further layer of instability to the system, as well as the family of models born
from the EURACE project: for example, Dawid et al. (2012) and Van der Hoog
et al. (2008), where a minimalistic stock market is formalized through an index
share containing all firms in the economy, and Cincotti et al. (2010), who de-
velop a clearing house with daily determination of market clearing prices. Yet,
in none of these models the stock market directly interferes with firm’s decision
making process, but acts as a mere reflection of its financial situation or at most
amplifies the effects of a shock that originates in other sectors, as in Riccetti
et al. (2016). Additionally, by modelling a relatively simple innovation-driven
productivity growth process, this paper shares similar features with evolution-
ary agent-based models with innovation dynamics and endogenous growth, such
as Dawid et al. (2008), Dosi et al. (2010) and Caiani et al. (2019). In most of the works in this field, however, the financial side of the economy is either missing (Russo et al., 2007) or solely composed of a credit market (Dosi et al., 2013). Nonetheless, the importance of the relationship between finance and innovation is widely recognized in the field of innovation economics (Dosi, 1990; Lazonick and Mazzucato, 2013; Dosi et al., 2016). In particular, Mazzucato and Wray (2015) point out that, given the uncertain, collective and cumulative character of the innovation process, technological change requires a long-term, committed and patient capital. Our model aims to integrate these features by developing a simple framework in which the firm’s propensity to innovate and repurchase shares depends on the market sentiment resulting from the ownership composition between speculative and patient investors.

The rest of the paper is organized as follows: Section 2 and 3 present the model setup and the analytical framework. Section 4 shows the emergent properties of baseline model and discusses the results from the sensitivity analysis used to address our research question. Section 5 concludes.

2 Model setup

2.1 The environment

The economy is populated by four classes of agents, that is workers \( (h = 1, \ldots, H) \), shareholders \( (k = 1, \ldots, K) \), firms/managers \( (i = 1, \ldots, I) \) and banks \( (b = 1, \ldots, Bk) \), which interact over a time span \( (t = 1, \ldots, T) \) in four different markets:

- labor market: firms demand labor supplied by workers;
- credit market: firms demand loans from banks to finance the production costs in excess of internal funds;
- stock market: shareholders trade firms’ shares based on expectations on future returns, while firms can issue and repurchase shares;
- consumption good market: both workers and shareholders demand a homogeneous consumption good produced by firms employing only labor.

The model consists of different blocks: the core macro part builds upon Macroeconomic from the Bottom-Up by Delli Gatti et al. (2011); the stock market is based on Brock and Hommes (1998), with the features introduced by Dawid et al. (2019), concerning the link between market sentiment and managers’ decisions.

As standard in the agent-based literature (Dawid and Delli Gatti, 2018), in each and every markets agents are heterogeneous and boundedly rational in the way discussed by Simon (1972): because of incomplete information and limited computational ability, individuals follow simple but reasonable behavioural rules (i.e. heuristics) in the search for satisfactory outcomes.
An important feature of agent-based models is that aggregate outcome emerges from the micro behavior of heterogeneous agents interacting in decentralized markets. As such, the way in which the structure of interactions is formalized is paramount for the model dynamics (Delli Gatti et al., 2018). In this respect, we follow a well-established procedure in macro agent-based literature based on the search-and-matching mechanism, similar to the one extensively described in Riccetti et al. (2015). In labor, credit and good markets, each period individuals from the demand and the supply side are picked and randomly matched according to some specific protocols, which will be described later on. The stock market, instead, is modelled by means of a traditional asset pricing model with mean-variance optimization setup. Also in there, however, agents are not fully rational, but undertake decisions on the basis of heterogeneous expectations, along the lines described in the behavioural finance literature (Hommes, 2006; Chiarella et al., 2009, for a review).

2.2 The sequence of events

In the following lines, the sequence of events is described.

1. At the beginning of the period, based on expected demand and relative competitiveness, each firm determines the desired level of price and production, as well as the required workforce.

2. Labor market opens. If the required workforce is greater than the current one, firms post job vacancies on the labor market at a given wage. After the labor matching, some businesses fulfill their labor demand, while others may end up with unfilled vacant positions. In the latter case, the planned production will be scaled down to meet the actual labor force; at the same time, some workers may remain unemployed.

3. Credit market opens. If internal funds are lower than production costs (i.e. wage bill), companies can access to a credit market to cover the ‘financing gap’. Credit conditions depend on the financial situation of the borrowing firms as well as on the credit availability of the lending banks, which have to comply with a capital requirement. After the matching process, if borrowing firms fail to collect enough resources to cover the financing gap, some workers will be fired and remain unemployed.

4. Firms produce a homogeneous consumption good by using only labor.

5. Consumption good market opens. Producers try to sell the output to consumers, both workers and shareholders. Asymmetric information and search costs imply that firms may end up with excess supply (while others with an excess demand). In this case, they get rid of unsold goods at zero costs - there is no inventory accumulation in the warehouse;

6. Once the good market closes, managers collect revenues and calculate gross profits, after deducting wages and interest payments. A fixed fraction of profits is allocated between share buybacks and R&D investment,
depending on the stock market sentiment, $\theta$, i.e. fraction of speculative investors.

7. In the stock market, speculative and patient investors compute optimal assets demand depending on their expectations of future returns. A Walrasian auctioneer collects all investors’ demand schedules and sets the market clearing price so that the excess demand is null. After observing the prevailing market price, shareholders adjust their portfolio. Every four time periods, firms are allowed to issue new shares on the market, the amount of which depends on the cumulative sum of previously repurchased shares and the individual firm’s financial condition.

8. After dividends are paid, enterprises update their net worth, augmented by retained profits, and shareholders update their financial wealth, augmented by dividends and capital gains. If the net worth turns negative, firms go bankrupt and exit the market, while lending banks write off a bad debt from their equity. As a consequence of repeated companies’ defaults, bank’s capital may turn out to be negative too. A new string of firms/banks replace the bankrupted ones.

3 Markets

3.1 Price and production

At the beginning of each period, based on past sales and relative deviation from average price, the $i$-th firm sets the desired level of price and production. Because of asymmetric information and search costs, consumers can explore only a limited subset of the market. Therefore, they may end up buying the consumption good from a firm even if its price is not the lowest. This implies that each firm can exert a certain degree of market power over price and quantity decisions. Following Delli Gatti et al. (2011), we assume that the firm can decide to adjust either the quantity or the price to changing business conditions - not both simultaneously. Price is determined according to the full-cost principle, whereby a mark-up is charged over the unit labor cost. The mark-up, $\mu_{i,t}$, is composed by two parts: one constant, $\bar{\mu}$, and the other flexible, $\hat{\mu}_{i,t}$ - the latter being the control variable through which firms adjust their price. This allows us to maintain the price-quantity decision rule as in Delli Gatti et al. (2011) and, at the same time, provide an explicit formalization of cost structure and mark-up underlying the determination of price.

\[
Y_{i,t}^d = D_{i,t+1}^e = \begin{cases} 
Y_{i,t}(1 + \rho \cdot U(0,1)) & \text{if } \Delta_{i,t} = 0 \text{ and } P_{i,t} > P_t \\
Y_{i,t}(1 - \rho \cdot U(0,1)) & \text{if } \Delta_{i,t} > 0 \text{ and } P_{i,t} < P_t 
\end{cases} 
\]  

\[
\hat{\mu}_{i,t} = \begin{cases} 
\hat{\mu}_{i,t-1}(1 + \rho \cdot U(0,1)) & \text{if } \Delta_{i,t} = 0 \text{ and } P_{i,t} < P_t \\
\hat{\mu}_{i,t-1}(1 - \rho \cdot U(0,1)) & \text{if } \Delta_{i,t} > 0 \text{ and } P_{i,t} > P_t 
\end{cases} 
\]
Equation (1) states that in case of excess demand - i.e. no unsold goods from the previous period ($\Delta_{i,t} = 0$) - , the $i$-th firm will either review upwards the expected demand ($D_{i,t+1}^e$) and consequently adjust the desired scale of production ($Y_{i,t}^d$), if the individual price, $P_{i,t}$, is greater than the average price on the market, $P_t$, or increase the price, by augmenting the mark-up, $\tilde{\mu}_{i,t}$, if the price deviation is negative. Conversely, in case of excess supply - i.e. positive unsold goods from the previous period ($\Delta_{i,t} > 0$) - the $i$-th firm will review downwards the expected demand if the individual price is already lower than the average price, or decrease the mark-up, if the individual price is larger than the average price. Note that price and quantity adjustment is marginal and equal to an idiosyncratic random variable from a uniform distribution multiplied by a constant ($0 < \rho < 1$), defining the speed of adjustment.

$$\mu_{i,t} = \bar{\mu} + \tilde{\mu}_{i,t}$$

(2)

$$P_{i,t} = (1 + \mu_{i,t}) \frac{w_{i,t}}{\alpha_{i,t}}$$

(3)

Once the desired (flexible) mark-up is set, the final good price is computed by applying the resulting (total) mark-up from equation (2) to the unit labor cost, as given by the ratio between nominal wage and productivity in equation (3).

The $i$-th firm carries out the production of a homogeneous consumption good with a constant return to scale technology by employing only labor; $\alpha_{i,t}$ is the labor productivity.

$$Y_{i,t} = \alpha_{i,t} L_{i,t}$$

(4)

$$\alpha_{i,t+1} = \alpha_{i,t} + \epsilon_{i,t}$$

(5)

In line with the ‘growth+’ version of Delli Gatti et al. (2011) and following the literature on endogenous growth macro agent-based models (Dawid et al., 2012; Dosi et al., 2010), labor productivity evolves over time according to a first-order autoregressive stochastic process, where the expected improvements depend on firm’s R&D intensity, given by the ratio of R&D expenditure over total sales. In this way, output growth evolves endogenously triggered by productivity-enhancing R&D investment. It must be stressed that, since R&D expenditure is a function of realized profits, there is a strong link between the evolution of firms’ financial conditions, productivity and market shares: higher profits imply larger R&D spending and greater productivity improvements, which eventually improve firm’s competitiveness, sales and growth opportunity.

### 3.2 Labor market

From equation (4), we can derive the labor demand, as a function of planned production and productivity. Labor demand corresponds to the workforce needed for fulfilling the desired level of production for a given productivity level.
The level of required workforce is then compared with the actual workforce:

\[ L_{i,t}^d = \frac{Y_{i,t}^d}{\alpha_{i,t}}. \]  

(6)

The required workforce is then compared with the actual workforce: \( L_{i,t}^o = L_{i,t-1} - \hat{L}_{i,t-1} \), where \( L_{i,t-1} \) is the current number of employees at firm \( i \), and \( \hat{L}_{i,t-1} \) is the number of employees whose contract has just expired. If the required workforce is larger than the actual one, the firm creates a number of vacancies \( J_{i,t} \) to post on the labor market:

\[
J_{i,t} = \max(L_{i,t}^d - L_{i,t}^o, 0). \]  

(7)

The contractual wage offered by firm \( i \) is determined in the following way:

\[
w_{i,t} = \begin{cases} 
\max(\bar{w}, w_{i,t-1}) & \text{if } J_{i,t} = 0 \\
\max(\bar{w}, w_{i,t-1}(1 + \xi_{i,t})) & \text{if } J_{i,t} > 0,
\end{cases}
\]  

(8)

where \( \bar{w} \) is the minimum wage, adjusted every four time periods to the level of price inflation, and \( \xi_{i,t} \) is an idiosyncratic shock from an uniform distribution on the interval \( (0, H_w) \). Meaning that if the firm \( i \) is searching for new people to hire \((J_{i,t} > 0)\), the posted wage will be reviewed upwards; nonetheless, it cannot fall below the minimum wage. Workers inelastically supply one unit of labor per period.

The interaction between firms and workers on the labor market is based on a matching process defined as follows: each unemployed worker contacts \( Z_t \) randomly chosen companies starting from the one that offers the highest wage, until vacant positions are available. Due to asymmetric information and search costs that prevent workers from visiting the whole range of enterprises, market inefficiencies may arise. For example, some workers may remain unemployed if job applications are not enough to absorb the entire labor force (i.e. involuntary unemployment), or some firms might not be able to fill all vacant positions if the posted wage is too low compared to that of competitors. In the latter case, the scale of planned production will be reviewed downwards to meet the actual labor force.

3.3 Credit market

The corporate financial structure is characterized by a hierarchical system of financing sources, ranked according to their corresponding degree of risk and relative cost. To finance their business, firms rely firstly on internal funds (i.e. net worth) and secondly on external funds, that is proceeds from bank credit, upon which an interest rate is charged. As we will see in section 4.5, equity issuance is also allowed, the purpose of which is to re-balance the firm’s capital structure after that several share buybacks take place, thus preventing the equity from going to zero. It follows that in this model the primary function of the stock market is to meet financing rather than production needs. Such a classification of financial structure - i.e. internal funds, bank credit and equity issuance -
is not only coherent with Minsky’s (1975) financial theory of investments, but finds also support in the theory of imperfect information in equity markets, e.g. Greenwald et al. (1984) and Stiglitz (1985). These authors stress that, in presence of imperfect capital markets, firms that need to raise external funds firstly resort to bank lending, and only later to equity issuance, in that the latter would send a bad signal about “the quality of the firm” to investors, causing the stock price to fall.

After the labor market closes, firms update the level of actual workforce and compute the corresponding wage bill. If internal funds are lower than the wage bill, the firm resorts to the credit market in order to fill the “financing gap”. The credit demand is then given by the positive difference between wage bill \( (W_{i,t}) \) and internal funds \( (NW_{i,t}) \), as shown in the following equation:

\[
D_{i,t} = \max(W_{i,t} - NW_{i,t}, 0) \quad (9)
\]

In every time period, the \( b \)-th bank sets the total credit supply, \( D^*_b,t \), that is the maximum amount of credit to be supplied to borrowing firms, defined as a multiple of its equity base:

\[
D^*_b,t = \frac{E_{b,t}}{v} \quad (10)
\]

where \( 0 < v < 1 \) is the loan-to-value ratio, or alternatively the maximum allowable leverage of the bank (Delli Gatti et al., 2011). Therefore, the parameter \( v \) can be interpreted as a capital requirement, constant and uniform across banks, set by a regulatory authority. In this way, credit supply is constrained by bank’s capital, thereby is endogenous to the business cycle. The effective amount of loan received by the borrowing firm will be determined in the matching process.

Following the literature on the financial accelerator (Kiyotaki and Moore, 1997; Bernanke et al., 1999), the contractual interest rate, \( r_{b,i,t} \), proposed at time \( t \) by the lending bank \( b \) to the borrowing firm \( i \), is computed taking into account the borrower’s default risk, defined as a mark-up over a given policy rate, \( \bar{r} \).\(^4\) The mark-up is a function of the borrower’s financial fragility, as measured by her leverage: the higher the leverage, the greater the perceived borrower’s risk, the higher the interest rate requested by banks on an unit of loan.

\[
r_{b,i,t} = \bar{r}(1 + \phi(l_{i,t})), \quad \phi > 0 \quad (11)
\]

\[
l_{i,t} = \frac{D_{i,t}}{D_{i,t} + MV_{i,t}} \quad (12)
\]

In this model, since companies are publicly listed, the measure used by banks to assess the financial situation of the borrower is the market leverage ratio,

\(^4\)To ensure that the proposed interest rate is heterogeneous among banks, the constant policy rate is multiplied by a random component on the support \((0, H_b)\), so that firms can actually choose the cheapest offer.
under the hypothesis that the loan requested is granted. This is determined by the ratio of debt over company’s assets value, equal to liabilities plus market value of equity, as shown in equation (12). Following the literature on empirical corporate finance, we do not use market but book value of debt in that firms do not issue bonds, but only shares are priced on the market.

The interaction between firms and banks takes place through the matching process: each firm can visit $Z$ randomly chosen banks, rank them in ascending order based on the proposed interest rate and present the “credit applications” (i.e. credit demand) starting from the bank charging the lowest price. At this point, banks collect the credit applications sent by borrowers, sort them in ascending order based on their financial situation (i.e. market leverage ratio) and extend loans starting from the one with lowest leverage, until the total credit supply defined by the capital requirement is reached.

At the end of the period, the banks’ equity is updated by profits, consisting in the difference between interest revenue on extended loans minus losses resulting from bad debt of bankrupt companies - assuming that banks pay no interest on customer deposits.

$$E_{b,t+1} = E_{b,t} + \pi_{b,t} \quad (13)$$

$$\pi_{b,t} = \sum_{i \in \Omega} r_{b,i,t} \hat{D}_{b,i,t} - BD_{b,t} \quad (14)$$

where $\Omega$ is bank $b$’s portfolio loans, $r_{b,i,t} \hat{D}_{b,i,t}$ is the interest revenue on actual towards firm $i$, $BD_{b,t}$ represents the $b$-th bank’s losses or bad debt, given by insolvent borrower’s equity split among lending banks depending on their relative exposure in terms of extended loan.

### 3.4 Consumption good market

The household consumption behavior follows a two-stage process, a standard procedure in agent-based macroeconomics as documented by Dawid and Delli Gatti (2018). In the first place, agents choose the consumption budget, that is the amount of resources (income or wealth) to be allocated to consumption expenditure; afterwards, the composition of the bundle of consumption goods is determined.

In the goods market, consumers are both workers and shareholders, who demand a homogeneous consumption good supplied by firms. Workers’ consumption budget, $C_{h,t} = c^{\lambda} W_{h,t}$, is a fixed fraction of financial wealth, determined by the sum of labor income - if the worker $h$ is currently employed - and accumulated past savings. Because shareholders’ income (i.e. dividends plus capital gains) accrues at the end of the period, their consumption budget, $C_{k,t} = c^{\mu} W_{k,t-1}$, is a linear function of past financial wealth, whose evolution is illustrated in section (4.5) on the stock market.

The choice of the consumption good to buy is is governed by a (quasi) random search mechanism: households are allowed to explore a subsection of
the marketplace and to choose among a range of products depending on their relative price. The search goes on until the entire consumption budget is spent. More specifically, each consumer can visit a list of $Z_c$ suppliers, including their “favorite” firm, while the other $Z_c-1$ are randomly chosen. The “favorite” firm is defined as the largest unit that agents have had the chance to visit in the previous periods.

In this way, the choice of partner selection by consumers is not purely random, but based on a preferential attachment mechanism. The role of the latter is twofold: on the one hand, consumers endeavor to insure against the risk of being rationed and ending up with involuntary savings; on the other, it strengthens the link between heterogeneous firms’ financial conditions, productivity and market competitiveness, creating the conditions for the emergence of big corporations that control large market shares. Once the list is complete, consumers rank the visited firms in ascending order based on individual prices and spend their consumption budget starting from the cheapest good. If the consumption budget is not entirely spent at the first firm, she will move to the second firm in the ranking, and so on.

$$C_t = \sum_{h=1}^{H} C_{h,t} + \sum_{k=1}^{K} C_{k,t}$$

$$Y_t = C_t$$

Given the absence of a capital good sector, aggregate demand amounts to aggregate consumption, obtained by summing up all the individual demands from both groups of households. By accounting identity, aggregate demand is then set equal to aggregate production.

### 3.5 Stock market

The stock market draws on an asset pricing model with wealth-based portfolio dynamics, featured by bounded rationality and heterogeneous expectations, in line with the literature spurred by Brock and Hommes (1997) and reviewed, among others, by Chiarella et al. (2009). In particular, we owe a great debt to Dawid et al. (2019), especially for what concerns the formalization of investors’ expectations and their link with managers’ investment decisions. However, contrary to Dawid et al. (2019), whose model is rooted in an industrial organization framework, our stock market is inserted into a broader fully-fledged macro agent-based model.

The stock market is populated by $M$ investors split into two groups: speculative and patient investors. Let $\theta \in (0, 1)$ be the fraction of speculative investors in the ownership structure, which, for the purpose of our analysis, is taken as exogenous, uniform and constant over time. We can think of $\theta$ as a regulatory parameter to be shifted in order to assess the impact of different compositions of ownership structure on managers’ investment decisions and macroeconomic dynamics.
Following Dawid et al. (2019), we assume that companies’ shares are traded in separate markets, not to deal with multi-asset portfolios. The evolution of the number of shares outstanding, \( N_{i,t} \), is defined as:

\[
N_{i,t+1} = N_{i,t} - B_{i,t}/Q_{i,t} + EI_{i,t}
\]  

(17)

where \( B_{i,t}/Q_{i,t} \) is the amount of repurchased shares (in volume) and \( EI_{i,t} \) is the equity issuance. In order to prevent equity from being wiped out by continuous buybacks, firms are allowed to issue new shares and thereby collect proceeds from the market. To assess and disentangle the effects on market valuation of changes in price from changes in volume, we model the process of equity issuance in two ways: in the first one, at the end of each period firms issue the same amount of repurchased stocks so that the number of outstanding shares is constant over time; in the second one, every four time periods firms issue the amount of shares that has been previously repurchased adjusted for a parameter depending on firm’s financing needs, as shown in equation (18). In the second case, the number of shares can vary over time according to individual firm’s financing needs.

\[
EI_{i,t} = CB_{i,t}(1 + \pi_{EI_{i,t}})
\]

(18)

where \( CB_{i,t} = \sum_{j=1}^{4} B_{i,t+1-j}/Q_{i,t+1-j} \) is the cumulative sum of repurchased shares of firm \( i \) over the last four periods, while \( \pi_{EI_{i,t}} = 1 - e^{-\zeta ff_{i,t}} \) is the degree of equity adjustment. The latter is a function increasing with the firm’s financial fragility, \( ff_{i,t} = W_{i,t} - NW_{i,t} \), given by the percentage difference between production costs and net worth.

Note that if firm \( i \) is financially fragile (\( ff_{i,t} > 0 \)), that is whenever the wage bill is greater than internal funds (\( W_{i,t} > NW_{i,t} \)), the degree of equity adjustment is positive (\( \pi_{EI_{i,t}} > 0 \)). Therefore, in order to cover the funding shortage, the firm will issue relatively more shares than the amount previously repurchased (\( EI_{i,t} > CB_{i,t} \)), with \( \zeta \) being the intensity of adjustment - and vice versa if the firm is financially sound (\( ff_{i,t} < 0 \)).

Based on a standard mean-variance optimization setup, shareholders myopically maximize a wealth-based utility function to compute the optimal asset demand, \( z_{k,i,t} \). The wealth dynamics of investor \( k \) in firm \( i \) is defined as:

\[
W_{k,i,t+1} = (R - c^k)W_{k,i,t} + (Q_{i,t+1} + d_{i,t+1} - RQ_{i,t})z_{k,i,t}
\]

(19)

where \( R = 1 + r \) is the gross returns of a virtual risk-free bond, \( c^k \) is the marginal propensity to consume out of wealth, while the last term is the excess return of the risky asset, \( z_{k,i,t} \), i.e. firm \( i \)'s shares. This component includes future share price, \( Q_{i,t+1} \), and future dividend per share, \( d_{i,t+1} \).

With a CARA utility function, the optimal demand of shares turns out to be a function of the expected mean and variance of future returns:

\[
z_{k,i,t} = \frac{E_{k,i}(Q_{i,t+1} + d_{i,t+1} - (1 + r)Q_{i,t})}{\bar{a}\sigma^2_{i,t}}
\]

(20)
where $\alpha$ is a constant risk aversion coefficient and $\hat{\sigma}_{i,t}^2$ the conditional variance. The expected standard deviation is assumed to be proportional to the past dividends and share price, adjusted by a scaling parameter:

$$\hat{\sigma}_{i,t} = E_{i,t}(\sigma) = \hat{\sigma}(d_{i,t-1} + Q_{t-1}). \quad (21)$$

As indicated by the subscript $k$ in the expectation operator of equation (16), financial investors have heterogeneous expectations about future asset returns. In particular, each investor's type is defined according to their expectations about the impact of share buybacks on future stock price: positive for speculators ($\chi_s > 0$), negative for patients ($\chi_p < 0$).

$$E_{k,i,t}[Q_{i,t+1}] = Q_{i,t-1} \left(1 + \chi_k \frac{B_{i,t}}{Q_{i,t}N_{i,t}}\right) \quad (22)$$

where $k \in \{s, p\}$, $Q_{i,t-1}$ is the share price in $t-1$ and $\frac{B_{i,t}}{Q_{i,t}N_{i,t}}$ is the fraction of repurchased shares in real terms. By definition, speculators are transient traders, focused on the short-term revaluations of their investments; therefore, they interpret share buybacks as a positive signal that the company is willing to return cash to shareholders. Patient investors, instead, are more concerned with the long-run growth and viability of the company: they would prefer managers to invest in productive activities and thus expect buybacks to have a negative impact on future returns.

The expectations on future dividends, $E_{i}[d_{t+1}]$, are homogeneous among investors and determined according to the following adaptive rule:

$$E_{i}[d_{t+1}] = \hat{d}_{i,t+1} := (1 - \phi) \cdot E_{t-2}[d_{t-1}] + \phi \cdot d_{i,t-1} \quad (23)$$

Because dividends are paid out at the end of the period, the expectation of future dividends depends on the dividend payment in $t-1$.

Let $A_{k,i,t-1}$ denote the stock holdings of investor $k$ in firm $i$ at the end of the previous trading session. It follows that the net demand for shares boils down to:

$$\Delta A_{k,i,t} = z_{k,i,t} - A_{k,i,t-1} \quad (24)$$

Therefore, $\Delta A$ indicates the amount of firm $i$’s shares investors are willing to trade (to buy if positive, to sell if negative) at time $t$ conditional on price $Q$, as formulated in Bottazzi et al. (2005).

After collecting all the investors’ demands, a Walrasian auctioneer sets the market clearing price such that the excess demand is equal to zero. Taking into account that also managers engage in market operations through shares buybacks and that equity issuance takes place at the end of the period, the market clearing condition reads:

$$M \left[\theta \Delta A_{s,i,t} + (1 - \theta) \Delta A_{p,i,t} \right] + \frac{B_{i,t}}{Q_{i,t}} - EI_{i,t-1} = 0. \quad (25)$$

Considering that at the beginning of the period the number of shares $N_{i,t}$ is equal to $M[\theta A_{s,i,t-1} + (1 - \theta) A_{p,i,t-1}] + EI_{i,t-1}$, by rescaling the risk aversion
coefficient by the number of traders \( a = \tilde{a}/M \), after some algebra, the market clearing condition can be rewritten as

\[
\frac{\hat{d}_{i,t+1} + Q_{i,t-1} \left( 1 + \left[ \theta k^*_s + (1 - \theta) k^*_p \right] \frac{B_{i,t}}{Q_{i,t}N_{i,t}} \right) - (1 + r)Q_{i,t}}{a\hat{\sigma}_{i,t}^2} = N_{i,t} - B_{i,t}/Q_{i,t}.
\]

Solving for the share price \( Q_{i,t} \), the market clearing condition boils down to the following second-order equation:

\[
(1 + r)Q_{i,t}^2 - (\hat{d}_{i,t+1} + Q_{i,t-1} - a\hat{\sigma}_{i,t}^2N_{i,t})Q_{i,t}B_{i,t} \left( \frac{\left[ \theta k^*_s + (1 - \theta) k^*_p \right] Q_{i,t-1} + a\hat{\sigma}_{i,t}^2}{N_{i,t}} \right) = 0
\]

Let us define \( X_{1,i,t} \) and \( X_{2,i,t} \), respectively, the second and the third factors in the expression above:

\[
X_{1,i,t} = \hat{d}_{i,t+1} + Q_{i,t-1} - a\hat{\sigma}_{i,t}^2N_{i,t} \tag{26}
\]

\[
X_{2,i,t} = \frac{\left[ \theta \chi_s + (1 - \theta) \chi_p \right] Q_{i,t-1}}{N_{i,t}} + a\hat{\sigma}_{i,t}^2 \tag{27}
\]

The market-clearing price is given by the positive root of the quadratic equation:

\[
Q_{i,t} = \frac{X_{1,i,t} + \sqrt{X_{1,i,t}^2 + 4(1 + r)X_{2,i,t}B_{i,t}}}{2(1 + r)} \tag{28}
\]

Note that the impact of stock buybacks on the share price is increasing with \( \left[ \theta \chi_s + (1 - \theta) \chi_p \right] \) in \( X_{2,i,t} \). This expression can be interpreted as the average market sentiment on share buybacks and depends on the ownership composition between patient and speculative investors, \( \theta \). If the stock market is dominated by speculative investors (\( \theta > 0.5 \)), there is a positive average market sentiment around share buybacks and therefore managers will have more incentives to distribute profits to shareholders through share repurchases.

### 3.6 Profits, investment and payout policies and net worth

When the consumption good market closes, the \( i \)-th firm collects revenues and computes realized profits, \( \Pi_{i,t}^* \), after deducting wages and interest payments:

\[
\Pi_{i,t}^* = P_{i,t}Y_{i,t} - w_{i,t}L_{i,t} - r_{i,t}^b D_{i,t}. \tag{29}
\]

If profits are positive, managers have to decide how to allocate a fraction \( \gamma \) of the surplus between R&D investment and share buybacks, depending on the market sentiment \( \theta \), i.e. the fraction of speculative investors in the stock market.

\[
B_{i,t} = \theta \gamma \Pi_{i,t} \tag{30}
\]

\[
RD_{i,t} = (1 - \theta) \gamma \Pi_{i,t}. \tag{31}
\]
The idea is that when the stock market is dominated by a speculative sentiment (high $\theta$), managers internalize short-term view of shareholders and “cater” their demand for high equity returns by diverting resources from R&D investment to stock buybacks to boost stock price. Indeed, when speculative investors dominate the market, there is a positive average market sentiment around stock buybacks: given the prevailing form of ownership structure, managers foresee that share price will increase following a share repurchase program. On the other hand, when the majority of investors is patient (low $\theta$), managers’ ability to “time” the market is limited. Consequently, they will prefer to reinvest profit in the production process, by increasing R&D expenditure, even though the stochastic nature of productivity improvements does not guarantee immediate gains.

This can be thought of as a reduced form of an optimization problem in which managers have to decide how to efficiently allocate corporate resources between alternative real-financial investments in order to maximize the market value of the company, as in Dawid et al. (2019). This view is supported by findings from behavioural corporate finance (e.g. Baker and Wurgler (2013)) according to which ‘rational’ managers adapt their decisions in response to swings in market sentiment determined by ‘irrational’ investors. Moreover, with this analytical framework, we provide a simple formalization of the idea put forth, among others, by Lazonick and Mazzucato (2013) and Dosi et al. (2016) according to which technological progress needs a patient and committed finance, focused on the long-term viability of the company rather than short-term financial performance.

At the end of period $t$, managers pay out a fraction $\delta$ of the remaining profits to shareholders as dividends, while $(1-\delta)$ is retained and accumulated to net worth:

$$Div_{i,t} = \delta (1 - \gamma) \Pi_{i,t}^*$$

$$NW_{i,t+1} = NW_{i,t} + (1 - \gamma)(1 - \delta)\Pi_{i,t}.$$ (33)

3.7 Bankruptcy, entry and exit dynamics

Once dividends are paid, the net worth of firms is augmented by retained earnings, while the financial wealth of shareholders is augmented by dividends and capital gain. Should the company incur in a loss that is greater than past accumulated earnings, net worth becomes negative and the firm must declare bankruptcy. To ensure the equality of the number of agents in the model, bankrupted firms are replaced with a string of new entrant ones, whose initial endowments reflect the scale of a representative (average) agent in the market. Due to firms’ defaults, also banks accumulate losses resulting from non-performing loans, causing a deterioration of their capital. In times of financial turmoils, it may happen that bank’s equity turns out to be negative as a result of repeated failures. In this case, the bank is bailed out by the Government and replaced with a copy of a randomly selected bank.
Table 1: Parameter setting

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T$</td>
<td>Number of time periods</td>
<td>1000</td>
</tr>
<tr>
<td>$I$</td>
<td>Number of firms</td>
<td>100</td>
</tr>
<tr>
<td>$H$</td>
<td>Number of workers</td>
<td>1000</td>
</tr>
<tr>
<td>$Bk$</td>
<td>Number of banks</td>
<td>10</td>
</tr>
<tr>
<td>$J$</td>
<td>Number of shareholder per firm</td>
<td>10</td>
</tr>
<tr>
<td>$M$</td>
<td>Number of total shareholders ($J*I$)</td>
<td>1000</td>
</tr>
<tr>
<td>$c_w$</td>
<td>Propensity to consume of workers</td>
<td>0.80</td>
</tr>
<tr>
<td>$c_s$</td>
<td>Propensity to consume of shareholders</td>
<td>0.20</td>
</tr>
<tr>
<td>$\rho$</td>
<td>Maximum growth rate of prices/quantities</td>
<td>0.1</td>
</tr>
<tr>
<td>$H_w$</td>
<td>Maximum growth rate of wages</td>
<td>0.05</td>
</tr>
<tr>
<td>$Z_l$</td>
<td>Number of trials in the labor market</td>
<td>4</td>
</tr>
<tr>
<td>$Z_g$</td>
<td>Number of trials in the good market</td>
<td>2</td>
</tr>
<tr>
<td>$Z_c$</td>
<td>Number of trials in the credit market</td>
<td>2</td>
</tr>
<tr>
<td>$\nu$</td>
<td>Capital requirement</td>
<td>0.8</td>
</tr>
<tr>
<td>$\bar{r}$</td>
<td>basic interest rate</td>
<td>0.02</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>Rate of reinvested profits</td>
<td>0.2</td>
</tr>
<tr>
<td>$\delta$</td>
<td>Rate of dividend payout</td>
<td>0.2</td>
</tr>
<tr>
<td>$\mu$</td>
<td>Mark-up, fixed component</td>
<td>0.05</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>Intensity of equity adjustment</td>
<td>0.1</td>
</tr>
<tr>
<td>$\chi_s$</td>
<td>Impact factor speculative</td>
<td>0.2</td>
</tr>
<tr>
<td>$\chi_p$</td>
<td>Impact factor patient</td>
<td>-0.2</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Standard deviation coefficient</td>
<td>10</td>
</tr>
<tr>
<td>$\bar{a}$</td>
<td>CARA risk coefficient</td>
<td>0.1</td>
</tr>
<tr>
<td>$\bar{r}$</td>
<td>rate of return on risk-free asset</td>
<td>0.1</td>
</tr>
<tr>
<td>$\theta$</td>
<td>fraction of speculative investors</td>
<td>0.1</td>
</tr>
</tbody>
</table>

4 Simulation results

In this section, we explore the macroeconomic properties of the model presented above by means of computer simulations. First, we simulate a baseline version of the model based on the parameter setting displayed in Table 1. Following a standard procedure in the agent-based literature, the purpose of this exercise is to empirically validate the model by identifying the constellation of parameters that allows to reproduce a wide set of stylized facts. Afterwards, we conduct a sensitivity analysis to address the main research question of this paper: how does a shift in ownership structure from patient to speculative investors affect manager’s investment decisions and the resulting macroeconomic dynamics. In doing so, we analyse the behavior of fundamental macroeconomic variables in response to changes in parameter $\theta$, i.e. the fraction of speculative investors in the stock market.

4.1 Baseline scenario

For the baseline version, we assign $\theta = 0.1$ (low propensity to buyback, high R&D intensity) in order to reproduce and further inspect the results of Delli Gatti et al. (2011). Figure 1 displays a set of macroeconomic variables obtained from one simulation for a time span of 1000 periods - for expository purposes, only the last 600 time periods are reported.

The dynamics of aggregate output follows a boom-and-bust cycle along an
increasing trend, driven by endogenous productivity growth, associated with cyclical movements in unemployment and leverage - panels (c) and (f), respectively. The pattern of economic activity is characterized by the interplay between financial factors and evolving market structure. In the boom-phase of the business cycle, positive expectations of future demand encourage firms to take on more debt and expand their production by hiring new workers. The following reduction in unemployment boosts aggregate demand and profits which further improves firms' expectations and economic activity. However, in line with Minsky’s (1986) ideas, “stability is destabilizing”: the increase in aggregate leverage makes the economic system more financially fragile and sensitive to idiosyncratic shocks, such as a fall in profits or an increase of the interest rate. The economic cycle is reversed when a number of large firms fail to meet their financial obligations and are forced to exit the market, with contagion effects spreading through the whole economy. When a big firm declares default, in fact, its workers are fired, resulting in higher unemployment rate and weaker aggregate demand. Consequently, surviving firms struggle to sell their output on the goods market and will more likely incur in losses that force them to downsize the labor costs and the scale of production, exacerbating the downturn phase of the cycle. Moreover, the bankruptcy of large firms causes a deterioration of bank’s equity, which, in turn, leads to worsening credit conditions for surviving firms, on the one hand, and increasing probability of banks’ default, on the other - panels (d) and (e). The period of tranquility is restored as the wave of bankruptcies clears the market from highly indebted agents, giving way to the
emergence of new firms with more healthy balance sheets.

The financial accelerator is not the only driving force of business fluctuations in endogenous growth models like this one. By looking at the bottom-right panel in figure 1, in fact, it becomes clear that a prominent role is also played by endogenous changes in the market structure: the evolution of market concentration - as measured by the Herfindahl-Hirschman index - closely mirrors the dynamics of aggregate output. More precisely, figure 2 shows that periods of booms are associated with the emergence of few big firms (left-hand side) which control large market shares (right-hand side), whereas their defaults foreshadow upcoming recessions and lead to a (temporary) restoration of a more competitive dynamism.

This pattern arises from the complex interaction between heterogeneous financial conditions of individual firms and preference-biased consumers behavior in the goods market. Recall that output growth is driven by productivity growth stochastically depending on innovative investments. The latter, in turn, depends on firm’s financial situation: the higher the profits, the greater the expenditure in R&D, the faster the productivity improvements.

By reducing the unit labor cost, increases in productivity foster firm’s competitiveness, resulting in a larger market share, higher sales and greater growth opportunity. As the firm’s size grows, it will have better chances to be visited by households during the searching process in the goods market, whose consumption preferences tend to favor big firms to be sure they can spend their entire consumption budget (see the preferential-attachment scheme in Section 4.4). The preferential attachment consumption behavior, therefore, acts as a reinforcing mechanism of the link between firm’s financial conditions, size and growth opportunity, giving rise to the emergence of a small number of giant corporations holding vast shares of the market. This impacts the dynamics of the business cycle, as discussed above, as well as on other cross-sectional outcome, such as the shape of firms size and growth rate distribution.
Figure 3: Mean values of aggregate output and market value by $\theta$, in absolute level (left-hand side) and growth rate (right-hand side).

Table 2: Output and market value growth: mean and standard deviation by $\theta$

<table>
<thead>
<tr>
<th>$\theta$</th>
<th>Y% mean</th>
<th>Y% sd</th>
<th>MV% mean</th>
<th>MV% sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0.464</td>
<td>1.331</td>
<td>1.517</td>
<td>7.031</td>
</tr>
<tr>
<td>0.2</td>
<td>0.434</td>
<td>1.116</td>
<td>1.494</td>
<td>5.937</td>
</tr>
<tr>
<td>0.3</td>
<td>0.421</td>
<td>1.095</td>
<td>1.548</td>
<td>6.197</td>
</tr>
<tr>
<td>0.4</td>
<td>0.430</td>
<td>1.144</td>
<td>1.644</td>
<td>6.676</td>
</tr>
<tr>
<td>0.5</td>
<td>0.434</td>
<td>1.233</td>
<td>1.642</td>
<td>6.887</td>
</tr>
<tr>
<td>0.6</td>
<td>0.419</td>
<td>0.923</td>
<td>1.693</td>
<td>6.742</td>
</tr>
<tr>
<td>0.7</td>
<td>0.381</td>
<td>1.022</td>
<td>1.561</td>
<td>6.042</td>
</tr>
<tr>
<td>0.8</td>
<td>0.371</td>
<td>1.019</td>
<td>1.644</td>
<td>6.593</td>
</tr>
<tr>
<td>0.9</td>
<td>0.326</td>
<td>0.771</td>
<td>1.611</td>
<td>6.178</td>
</tr>
</tbody>
</table>

4.2 Economic analysis

Having established a baseline scenario and investigated its emergent properties, we now address the main research question of the paper: how financialization, here defined as an increasing role of speculative investors in the stock market, affects managers’ investment decisions and the resulting macroeconomic dynamics. In doing so, we carry out a sensitivity analysis by running multiple simulations, one for each value of parameter $\theta$ ranging from 0.1 to 0.9, with step 0.1, and analyse the impact on several macroeconomic variables.5

The mean of aggregate output and market value, both in absolute value and growth rate, in response to changes in parameter $\theta$ are reported in Fig. 3.

It emerges that a larger share of speculative investors implies a lower eco-

5Corner solutions are excluded in that they would produce an outcome significantly different from the baseline scenario, characterized by either a non-growing stationary dynamics, because of the lack of R&D investment ($\theta = 1$), or a collapsing stock market, in case firms would no repurchase shares at all ($\theta = 0$), given the specific formalization of shareholders’ expectations adopted in this model.
Figure 4: Changes in aggregate profits, buybacks and R&D by $\theta$, in ratio to sales (left-hand side) and absolute value (right-hand side).

Economic growth, while the impact on the stock market is less straightforward, represented by a quasi inverted U-shaped curve: as $\theta$ increases, the market value initially grows, reaches a peak at $\theta = 0.6$, and then declines. From Table 2, we notice that also the variables’ volatility largely changes across simulations: the standard deviation of output growth ranges from 1.3% when $\theta = 0.1$ to 0.7% when $\theta = 0.9$, albeit the decline is not monotonic; while the volatility of market value, after an initial jump, is rather flat around 6%. Therefore, we can observe how an increase in the fraction of speculative investors in the ownership structure leads to a lower but less volatile growth in the real sector and, at the same time, a higher growth in the financial sector, as long as the share of speculators does not exceed the threshold of 60%, after which, total market value begins to drop as well. This is what we call a ‘stagnation-financialization paradox’.

To investigate the economic mechanisms underlying the real and financial sector dynamics we start by focusing on the behavior of those variables under the control of managers that are influenced by the stock market sentiment $\theta$: share buybacks and R&D investment. Figure 4 displays the impact of changes in $\theta$ on the aggregate profits, buybacks and R&D, both in ratios (left panel) and levels (right panel). As a measure of profits, we use the fraction of positive reinvested profits, $\gamma \Pi_{i,t}$, which is nothing but the sum of buybacks and R&D; the ratio variables are calculated with respect to sales.

Throughout different simulations runs, the profit to sales ratio is relatively stable, around 7-8%, whereas the propensities to buyback and innovate take opposite directions. This is certainly not surprising but the direct effect of our assumption in equations (30)-(31), according to which, as $\theta$ increases, managers divert corporate resources from R&D to share buybacks to cater to shareholders’ demand in an attempt to boost the stock price. By shifting the attention to the right panel in which variables are expressed in absolute value, however, we notice that, albeit R&D investment steadily declines, the evolution of buybacks is not constantly increasing: for high value of $\theta$, the economic growth is so low that the
fall in profits drags buybacks expenditure down, despite their increase in relative terms. In other words, the relative increase in the propensity to buyback is not able to counteract the fall in actual profits due to sluggish growth, resulting in a stock market decline.

These results bring us to a first preliminary conclusion: share buybacks can effectively support stock price despite a slowing real economy resulting from a decline in innovative activity as long as corporate profits remain sufficiently high.

At this stage, some questions do still arise. First: why, for intermediate values of \( \theta \), corporate profits remain high despite a slowing economic growth? And second: why, for high values of \( \theta \), the economy experiences a lower output volatility? To address these questions, we apply the same simulation experiment to a broader range of macroeconomic variables and study their behavior in response to changes in the stock market sentiment. I would like to emphasise that, especially regarding the first question, there is no a clear-cut answer, but it is possible to identify a combination of factors which, taken together, may be useful in outlining a possible interpretation of the puzzle, or, at least, indicating a potentially interesting direction for future research.

Figure 5 displays simulation results for a set of macroeconomic variables. Three distinct phases depending on different configurations of ownership structure can be identified: (i) low speculative sentiment, when \( \theta < 0.3 \); (ii) medium speculative sentiment, when \( 0.3 < \theta < 0.6 \); (iii) high speculative sentiment, when \( \theta > 0.6 \). Each phase is characterized by a particular growth regime, emerging from the complex interaction of real-financial factors in relation with different forms of ownership structure and related modes of allocation of corporate resources.

Bearing in mind that in this model the technological progress is purely labor-saving, from panels (a)-(d) we notice that, for low values of \( \theta \), a marginal decline in R&D intensity and productivity implies a greater labor demand (or vacancy rate), a lower unemployment rate and higher aggregate sales. This is the primary source of corporate profits when the stock market is dominated by patient investors. Consistent with the results in Table 2, it should be noted that, in the low speculative phase, the economic growth is accompanied by a sustained financial instability, as indicated by the relatively high levels of leverage, default rates and bad debt in panels (g)-(i). As a matter of fact, this scenario is very similar to the baseline version of the model, whereby financial factors are key determinants of business fluctuations and economic crises. Hence, when the stock market is populated by patient investors and corporate resources are mostly reinvested in the production (low speculative phase), the economy is in a dynamic debt-driven growth regime, characterized by high rates of economic growth and volatility.

Thereafter, as the share of speculators in the stock market increases (\( \theta > 0.3 \)), the ongoing decline in the real sector brings about a drop in employment and sales. However, as we have seen, this negative trend is not reflected in the dynamics of profits and stock market, which, on the contrary, keep on rising. In fact, in this second phase, a new phenomena emerges from the complex
Figure 5: Impact of changes in share of speculative investors in the stock market, $\theta$, on a set of macroeconomic variables.

The evolving interaction between real and financial factors: an increased market concentration, as shown by the spike in Herfindahl-Hirschman index in panel (e).

As $\theta$ increases, managers distribute a greater share of profits to shareholders, leading to the stock price to rise. Because of the heterogeneity in firm’s financial conditions, however, the amount of buybacks spending and subsequent increases in market valuation vary significantly across agents. The growing dispersion in share prices is then reflected in the evaluation of firm’s financial situation made by banks on the credit market. Recall that the latter is given by the market leverage ratio - equation (12) - and represents the criterion by which banks select creditworthy borrowers and determine their credit conditions. It follows that, as the importance of market value in the assessment of firm’s financial situation grows, large overvalued firms have more chances to get access to credit, and on more favorable terms, compared to small undervalued ones. In this way, the former become bigger and consolidate their market position against the latter, whose lack of funding represents an obstacle to innovate and become more competitive. In this context, in terms of Baran and Sweezy (1966), the “Schumpeter’s perennial gale of creative destruction has subsided into an occasional mild breeze”. The resulting increased market concentration permits large firms to extract extra profits and support market value in spite of a slowing real economy. Hence, the second `medium speculative’ phase is the one characterized by our paradox, whereby the financial sector can prosper not on a growing economy, but on a stagnant one, as Magdoff and Sweezy (1987) came to envision several years ago.
Finally, when the stock market is almost entirely controlled by speculative investors ($\theta > 0.6$), the economy enters a stage characterized by low growth, weak demand and high unemployment. Because of weak R&D intensity and limited growth opportunities that hinder the emergence of big firms, market structure returns to a more competitive setting. As a result, the corporate sector faces a profit squeeze that inevitably causes a drop in the financial market. Furthermore, the combination of low leverage and low default rates that we can see in panels (g)-(i) suggests that business fluctuations are severely limited, in so far as weak growth opportunities do not encourage firms to take on debt and expand the production. This figure is coherent with the decline in volatility of output growth for increasing levels of $\theta$ shown in Table 2.

In light of these results, consistent with the economic tradition rooted in the theories of Keynes and Minsky, there seems to be a trade-off between economic growth and financial stability: higher leverage is associated with higher output growth but also greater financial instability, and vice versa. In absence of appropriate political interventions, it seems not possible to escape from this dilemma. Against this background, the question arises as to which policy mix can better ensure, at the same time, a sound economic growth and a stable financial system.

In the third high speculative phase it would not be proper to refer to a stagnation-financialization paradox in that both real and financial sectors are set to decline. If such a paradox is to exist, therefore, it is necessary that the configuration of the ownership structure and the degree of market concentration are such that the corporate sector can generate and distribute a sufficient amount of profits to support the stock price, despite a slowing real economy. The necessary conditions for this scenario to manifest are: (i) a consistent share of speculative investors in the ownership structure, but not greater than 60%; (ii) an average degree of market concentration relatively high, with a Herfindahl-Hirschman index ranging between 300-500. And this was our second, preliminary conclusion.

4.3 Robustness check

As robustness check, we run 10 Monte Carlo simulations for each level of $\theta$ by setting at every repetition a different random seed. In this way, we are able to control for the effects of the stochastic elements present in the model. From Figures 6 we notice that results are substantially similar to the ones of the original experiment in Figure 3; as expected, the variables' pattern is slightly smoother since we are comparing average values across multiple simulations.

A few minor differences concern the dynamics of the financial market in the bottom part of the graph: the total market value reaches a peak at 0.7, instead of 0.6 as in the previous case; moreover, the variable in absolute level - panel (c) - experiences an increase when $\theta = 0.9$ after a slight decline. When we consider the variables' behavior separately in each MC repetition as in Figure 7, indeed, it emerges that, though the market value experiences more volatility than output across runs, it faces a turning point in the range of $0.6 < \theta < 0.8$. This is generally true, except for three runs, in which the stock market dynamics
Table 3: Mean and standard deviation of output and market value growth rates by $\theta$: Average values across 10 Monte Carlo simulations for 1000 time periods.

<table>
<thead>
<tr>
<th>$\theta$</th>
<th>Y% mean</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sd</td>
<td>0.446</td>
<td>0.434</td>
<td>0.435</td>
<td>0.424</td>
<td>0.412</td>
<td>0.399</td>
<td>0.388</td>
<td>0.348</td>
<td>0.289</td>
</tr>
<tr>
<td>MV% mean</td>
<td></td>
<td>1.525</td>
<td>1.580</td>
<td>1.599</td>
<td>1.612</td>
<td>1.618</td>
<td>1.646</td>
<td>1.649</td>
<td>1.641</td>
<td>1.640</td>
</tr>
</tbody>
</table>

do not reverse for high values of $\theta$, but keep on rising, determining an increase in the average value that we do not observe in the original experiment. This result can be better understood by looking at Figure 8 showing the cross-MC averages of profits, share buybacks and R&D spending by $\theta$. In this simulation set up, for high value of $\theta$, when the economy experiences low growth rates, the fall in aggregate profits does still occur, but it is not large enough to trigger a decline in buybacks spending. Therefore, the relative increase in the propensity to repurchase outweighs the decline in total profits, leading to an increase in the market value.

Table 3 reports the cross-MC simulations averages of mean and standard deviation of output and market value growth by different levels of $\theta$. In this case, as the share of speculators in the stock market increases, the decline in output volatility is even clearer compared to the original experiment, while the financial sector faces a similar trend until $\theta < 0.6$, after which the movements are more erratic, as in the previous case.
Figure 6: Output and market value by $\theta$ in absolute value (left-hand side) and growth rates (right-hand side). Mean and standard deviation across 10 Monte Carlo simulations for 1000 time periods.

Figure 7: Output and market value by $\theta$ in absolute value (left-hand side) and growth rate (right-hand side) in 10 Monte Carlo simulations for 1000 time periods.
Figure 8: Aggregate profits, buybacks and R&D by $\theta$, in ratio to sales (left-hand side) and absolute value (right-hand side). Mean values across 10 Monte Carlo simulations for 1000 time periods.

5 Concluding remarks

In this paper, we have employed a macro-finance agent-based model with credit and stock market to study the impact of a shift in the ownership composition from patient to speculative investors on managers’ planning horizon and investment decisions and the resulting macroeconomic dynamics. The idea is that when the stock market is populated by speculative investors, firms tend to distribute an increasing share of profits to shareholders to boost stock prices, at the cost of lower long-run real investments. Results show that, as the fraction of speculative investors in the stock market increases, the reduced innovative effort implies a lower and less volatile growth in the real sector, while the increased propensity to repurchase shares allows to support stock prices in spite of an economic slowdown - giving rise to what we have called a ‘stagnation-financialization paradox’. Yet, the diverging trends in the real and financial sectors persist as long as the fraction of speculators is not too large, otherwise the rate of economic growth is so low that the consequent fall in aggregate profits drags buybacks spending down, and so does the financial market. Indeed, additional computational exercises reveal that (i) stock buybacks can effectively support the stock price despite a slowing real economy determined by a declining innovative activity only if the corporate profits are sufficiently high; (ii) in order for this to occur, it is necessary that (ii.a) the share of speculative investors in the stock market is not too large and (ii.b) the degree of market concentration is relatively high. Under these conditions, the corporate sector can generate and then distribute a sufficient amount of profits to shareholders in order to curb the depressing tendency in the real sector on the financial market.

From an economic policy perspective, these results arise important distributional concerns and policy implications. If the economy remains stuck in a situation in which the financial sector can prosper on a stagnating economy, shareholders and managers with a share-based remuneration scheme will be bet-
ter off, while workers’ income will deteriorate, resulting in an increasing income disparity amongst individuals and worsening economic performance. On the other hand, we have seen that higher growth rates are associated with greater financial instability and firms and banks defaults. To break this growth-stability trade-off, public authorities ought to design a set of policies, both at macro and micro level, aimed at achieving a sound and sustainable development. This should include: (a) an anti-cyclical management of fiscal and monetary policy in order to mitigate fluctuations in the business cycle; (b) progressive tax can help redistribute income and support aggregate demand; (c) a tax on capital gains (e.g. Tobin tax) intended to foster long-term investment horizon on the financial market and contain speculative behavior; (d) a management incentive structures that aim to prioritize long-term firm performance in place of short-term financial returns.

From a theoretical point of view, our findings should invite us to reflect more deeply on the role of demand side (real) factors, such as market concentration, income distribution and effective demand, in influencing firms’ incentives to invest and to distribute profits. In our model, by contrast, the latter are taken as exogenous and linked via parameter $\theta$ to supply side (financial) factors, that is the form of ownership structure. More precisely, demand determines profits which are then used to finance innovative investment and payout policies, but the resources allocation decision between R&D and share buybacks is regulated only by the ownership composition between patient and speculative investors. This is certainly a strong assumption, based on the idea that, when the ownership structure is dominated by myopic investors seeking short-term capital gains, the tendency to maximize stock market value would induce managers to give away long-term investment projects and rapidly distribute profits to boost stock prices. If this may be true for the individual firm, however, it may be not when we look at the economy as a whole. Indeed, investigating the macroeconomic effects of this micro decision rule allowed us to understand under which conditions the model can generate aggregate properties that are consistent with our hypothesis on individual firm behavior. In other words, the utility of the model lies in its ability to identify the macroeconomic foundations of firms’ microeconomic behavior. An idea for future research would be to relax our main assumption and let firms’ incentives to invest and to distribute profits be two separate, independent decisions, depending not only on market sentiment, but also on demand side (real) factors that the model proves to be relevant, that is market concentration, income distribution and aggregate demand.
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