Financial Markets and the Allocation of Capital: The Role of Productivity

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Abstract

Traditional measures of credits allocative efficiency focus on the Q-theory of investment, empirically proxied by the elasticity of credit to firms' value added. This paper develops a simple alternative model that focuses on productivity and delivers clear predictions for the elasticity of credit to current and future productivity, depending on capital market frictions. When applied to a novel firm-level dataset set up by the EU-System of Central Banks, the proposed measure leads to normative statements about the efficiency of credit allocation across the largest Eurozone economies, changing the conclusions that one would reach based on traditional empirical applications of Q-theory.

JEL: G10, G21, G31, D92, F3, O16.
Keywords: Bank Credit, Capital Allocation, Productivity, Credit Constraints.

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1 Introduction

The efficient allocation of capital is a key element for the success of an economy. In advanced countries outstanding credit to non-financial corporations is about 90% of GDP (Figure 1); clearly the allocation of such a large amount of funds is a first order issue. In fact, one of the main channels through which financial development accelerates economic growth is exactly by improving the allocation of capital. This is a traditional argument that several authors have suggested, including Bagehot (1873), Goldsmith (1969), McKinnon (1973), Shaw (1973), Greenwood and Jovanovic (1990), Beck et al. (2000), and Levine (2005).

There is an extensive literature on the theoretical mechanisms through which financial markets improve capital allocation is extensive (Levine, 2005). Boyd and Prescott (1986) show that financial intermediaries reduce the costs of acquiring information about firms, managers and market conditions, reducing the asymmetries between lenders and borrowers, thereby improving resource allocation. Stiglitz and Weiss (1983) and Jensen (1986) argue that to the extent that providers of capital can monitor firms, this will make managers maximise firm value, improving the efficiency of capital usage. Finally, Boyd and Smith (1992) highlight that financial intermediaries facilitate the pooling of savings, allowing for better exploitation of economies of scale and overcoming investment indivisibilities; this improves resource allocation and boost technological innovation.

However, how can we empirically measure the efficiency of the market in allocating capital? The classical approach is rooted in the Q-theory of investment: efficieny requires financing firms with a market value below the replacement value as this gap (Tobin's Q) signals that profits are expected to rise. Accordingly, the faster the market can direct funds towards high-Q firms, the higher the efficiency in capital allocation at any point in time. Data limitations, however, typically make Q-theory based measures of efficiency hard to compute for a large set of industries and countries; for this reason, alternative measures have been proposed. Among them, the most influential one is arguably associated with seminal work by Wurgler (2000) who, in the wake of Hubbard (1998), suggests to use the elasticity of investment growth (proxying growth in financing) to value added growth (proxying growth in investment opportunities). In particular, Wurgler (2000) shows that, for a large sample of countries and industries, value added growth is positively correlated with Tobin's Q. Hence, higher elasticity of investment growth to value added can be reliably interpreted as an indicator of better allocative efficiency as funds are more quickly reallocated to sectors offering higher opportunities. This approach has been used extensively in the finance literature, including, among others, works by Beck et al. (2007), Hartmann et al. (2007), Morck et al. (2011), and Lee et al. (2016).

A different approach is followed, instead, in the macroeconomic and growth literature, where the efficient allocation of capital has been analysed mainly through the lenses of 'productivity', i.e. value added per factor input rather than value added per se (see, e.g., Hsieh and Klenow, 2009; Gopinath et al., 2017). The underlying idea is that funds are efficiently allocated when their alternative uses generate the same value added for given amounts of factor inputs, or equivalently when the value of the marginal productivity of each factor is equalized across alternative uses. Any deviation from equalization is interpreted as a signal of allocative inefficiency, and the speed at which deviations are arbitraged out is taken as an indicator of how well the market works. In this respect, higher elasticity of financing growth to productivity growth would be an apter measure of efficient capital allocation than higher elasticity to value added growth.

Our aim is to compare and assess the different implications of the finance and macro approaches to the measurement of capital allocative efficiency. Our interest is motivated by the prominent role that productivity has for long-term growth and, ultimately, by the need of better understanding the link between finance and growth also from a macroeconomic point of view. In so doing, we rely on a novel dataset that allows us to tease out the specific relation between bank financing and productivity growth at firm level for a rich set of industry in the largest economies of the Eurozone before and after the global financial crisis.

We proceed in two steps. First, we propose a simple theoretical framework that can be used to provide guidance on how to interpret the elasticity of credit to productivity at the firm level. A key insight of the proposed model is that the sign and the absolute size of the elasticity crucially depends on the extent of credit frictions. This is due to the presence of two opposing effects of productivity growth that arise when credit markets are less than complete. We consider the case of an entrepreneur who pursues short-term and long-term investment projects with the latter requiring credit. Projects are subject to productivity shocks and the entrepreneur is also subject to liquidity shocks that may kill profitable long-term projects before they can actually deliver any return. Credit constraints limit the amount of bank money the entrepreneur can borrow to face the liquidity shocks so that she has to rely on own money set aside from the cash flow generated by her short-term projects.

In this setup, due to credit constraints, positive productivity shocks to short-term projects have two effects. On the one hand, they make short-term projects more appealing than long-term ones in terms of intertemporal investment choices, thereby reducing the entrepreneur's demand of credit to finance long-term projects ('opportunity cost effect'). On the other hand, positive productivity shocks to short-term projects increase the short-term cash flow and thus the entrepreneur's ability to keep long-term projects alive in case of liquidity shocks, thereby raising the entrepreneur's credit demand to support those projects ('liquidity effect'). The net effect of short-term productivity growth on bank credit growth is therefore ambiguous, being positive with severe credit constraints and negative with mild ones, as in the former case the liquidity effect dominates, while in the latter it is dominated by the opportunity cost effect. Accordingly, the elasticity of bank credit to short-term productivity can be positive or negative; the more positive it is, the lower the efficiency of bank credit allocation. Differently, positive productivity shocks to long-term projects have only an opportunity cost effect, raising the entrepreneur's demand of credit to support long-term investment: the elasticity of bank credit to long-term productivity is positive no matter how severe credit constraints are; the more positive it is, the higher the efficiency of bank credit allocation.

In the second step, we bring the predictions of our theoretical framework to firm-level data on France, Germany and Italy over the periods 1995-2012, 1997-2012 and 2001-2012 respectively. This allows us to provide a comprehensive analysis of the relation between bank credit growth and productivity growth since the late 1990s and, through the lenses of the model, to make normative statements about the efficiency of credit allocation across countries, between small and large firms, as well as before and after the global financial crisis. We do so by exploiting the novel firm-level dataset of the Competitiveness Research Network (CompNet) set up by the EU System of Central Banks. A unique feature of this source is that it provides comparable indicators of detailed firm-level characteristics across a large set of European Union (EU) countries. We also leverage the associated research network using data separately managed by the Banque de France for France, the Deutsche Bundesbank for Germany and the national statistical institute ISTAT for Italy.

Our empirical findings reveal a clear divide between the Eurozone 'core' (France and Germany) and its 'periphery' (Italy), with the former exhibiting a significantly more efficient allocation of credit than the latter, as captured by the relative strength of the opportunity cost effect with respect to the liquidity effect. Importantly, if we had relied on the classical measure based on the elasticity between investment growth and real value added growth, we would have reached the opposite conclusion, as Italy would have been assessed as more efficient than Germany. We also find that credit tends to be allocated more efficiently across small than across large firms, and some evidence that the efficiency of credit allocation in the Eurozone slightly improves after the global financial crisis.

Our paper not only contributes to the aforementioned literature on the efficiency of capital allocation, but also to the literature on finance and economic growth such as King and Levine (1993), Levine (1997), Rajan and Zingales (1998), Guiso et al. (2004), Levine (2005), Ciccone and Papaioannou (2006), and Beck et al. (2008). Finally, it speaks to the literature on resource misallocation in Europe, such as Gopinath et al. (2017), Calligaris et al. (2017), and Benigno and Fornaro (2014). These works argue that capital misallocation, especially after the introduction of the Euro, contributed to the productivity slowdown of countries in Southern Europe. Our findings on the allocation of bank credit are consistent with that view.

The rest of the paper is structured as follows. Section 2 introduces the theoretical model to be used as a guide to interpreting and testing the interaction between bank credit and productivity. Section 3 presents the empirical specifications. Section 4 discusses the corresponding empirical results. Section 5 checks their robustness. Section 6 concludes.

2 Credit and Productivity

This section develops a simple model of firm-level investment that can offer guidance in determining the degree of efficiency in credit allocation with an emphasis on firm productivity. We consider an entrepreneur who lives for two periods, t ('short term') and $t+1$ ('long term') and maximizes the linear intertemporal utility function

$$U_t = \Pi_t + \beta \Pi_{t+1}, \tag{1}$$

where Π_t and Π_{t+1} are consumption ('dividends' or simply 'profits') in periods t and $t+1$ respectively, expressed in units of a numeraire good and $\beta \in (0,1)$ is a discount factor.

The entrepreneur starts period t with given endowments of labor L and human capital H. Following Aghion et al. (2010), human capital consists of a set of skills and know-how that the entrepreneur can use to produce intermediate capital goods ('capital') to be combined with labor for the supply of a final good either in period t ('short-term capital' K_t) or in period $t+1$ ('long-term capital' Z_t). The final good is chosen as numeraire.

The technology needed to transform human capital into capital goods is available only in period t and is linear: $K_t + Z_t = \theta H$ with $\theta > 0$. Units of human capital are chosen such that $\theta H = 1$, which allows us to interpret K_t and Z_t as the shares of short-term and long-term capital. Once produced, short-term capital K_t is ready to use in period t whereas long-term capital Z_t needs additional tooling at cost ηZ_t to be paid in period t for use in period $t+1$ with $\eta \in (0,1)$. This cost is paid in units of numeraire and has to be paid upfront before final production takes place in period t. It can thus be incurred only through borrowing $F_t = \eta Z_t$ from the financial markets as there is no cash flow available yet.

After K_t has been produced, final production takes place in period t according to the Cobb-Douglas production function

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \tag{2}$$

with capital intensity $\alpha \in (0, 1)$ and labor input $L_t = L$, which we set to one by choice of units ($L = 1$). Given that the final product is the numeraire, $Y_t = A_t K_t^{\alpha}$ is also the cash flow generated by the entrepreneur in period t. Final production in period $t + 1$ uses an analogous Cobb-Douglas technology employing again labor and long-term rather than short-term capital:

$$Y_{t+1} = A_{t+1} Z_t^{\alpha} L_{t+1}^{1-\alpha}, \tag{3}$$

which, given $L_{t+1} = L_t = L = 1$, simplifies to $Y_{t+1} = A_{t+1} Z_t^{\alpha}$. Central parameters of interests for our analysis are A_t and A_{t+1}, which measure the total factor productivity of the entrepreneur and thus her ability to transform given amounts of inputs into final output. We assume a deterministic trajectory for the entrepreneur 's technology so that not only A_t but also A_{t+1} is known with certainty already at time t.

The tooling cost is not the only reason for borrowing. At the end of period t, after the final production in t has taken place, but $t + 1$ has not started yet, the entrepreneur is hit by a liquidity shock of size S_t randomly drawn from a continuous probability distribution. This distribution has c.d.f. $\Phi(S) = (S/S_{\max})^{\phi}$ for $S \in [0, S_{\max}]$ and $\phi > 0$ so that larger ϕ implies higher probability of large shocks. If the entrepreneur does not meet the shock, her activity terminates and production in period $t + 1$ does not take place. We assume that there is a secondary market for long-term capital so that the entrepreneur is always able to exactly repay F_t with risk-free interest R_t upon liquidation of her activity. The liquidity shock can be met by using own cash flow if the entrepreneur has set aside enough from first period production Y_t, or by raising additional funding B_t from the capital markets at risk-free interest rate R_t.

As in Aghion et al (2010), in order to characterize S_t as a pure liquidity shock, we assume that, if the entrepreneur meets S_t at the end of period t, in period $t+1$ she will receive a payment equal to $(1+R_t)S_t$. This allows us to focus on investment trajectories that would be always worthwhile pursuing by the enterpreneur in the absence of the liquidity shock. Indeed, with such payment it will always be in the entrepreneur's interest to meet the liquidity shock as long as she has enough resources. As linear utility (1) implies $1+R_t=\beta^{-1}$, at the end of period t the net value of meeting the liquidity shock is

$$\left(Y_{t+1}+\beta^{-1}S_t\right)-\left(1+R_t\right)S_t=Y_{t+1}>0. \tag{4}$$

We consider two cases for the working of capital markets. When capital markets are 'complete', positive continuation value (4) implies that the entrepreneur can raise as much external funding as she needs to meet the liquidity shock. The liquidity shock is therefore immaterial for the entrepreneur's allocation of human capital between short-term and long-term capital goods supplies. In this case, in the two periods the entrepreneur faces the following budget constraints. In period t, profits (Π_t), the tooling cost (ηZ_t) and the liquidity shock (S_t) have to be matched by own cash flow (Y_t) or external finance (F_t and B_t):

$$\Pi_t+\eta Z_t+S_t=Y_t+F_t+B_t, \tag{5}$$

with $F_t=\eta Z_t$. In period $t+1$, profits (Π_{t+1}) and repayments with interest

($F_t\,(1+R_t)$ and $(1+R_t)B_t$) have to be matched by cash flow from production (Y_{t+1}) and reinstated liquidity with interest ($(1+R_t)S_t$):

$$\Pi_{t+1} + F_t\,(1+R_t) + (1+R_t)B_t = Y_{t+1} + \beta^{-1}S_t. \tag{6}$$

When capital markets are 'incomplete', the entrepreneur faces a borrowing constraint at the end of period t that prevents her from raising any additional funding ($B_t = 0$). Hence, she may meet the liquidity shock only with own cash flow Y_t.

The entrepreneur's program is then to maximize her payoff (1) subject to the budget constraints (5) and (6), taking into account the technological possibilities for intermediate production ($K_t + Z_t = \theta H$) and final production ((2) and (3)), as well as the borrowing possibilities ($F_t = \eta Z_t$ and B_t) at common interest rate ($R_t = \beta^{-1} - 1$). When capital markets are incomplete, the entrepreneur also faces an additional borrowing constraint ($B_t = 0$).

By substituting the budget constraints into (1), with incomplete markets the entrepreneur's program boils down to the maximization of

$$U_t = Y_t - \eta Z_t + \beta\Phi\,(Y_t)\,Y_{t+1}, \tag{7}$$

where $\Phi\,(Y_t)$ is the probability of surviving the liquidity shock, given that the largest shock the entrepreneur can afford to meet with own cash flow is $S_t = Y_t$. With complete markets there is no such constraint and the probability of meeting the shock is always $\Phi = 1$ no matter how large the shock is. Further substituting the final production functions (2) and (3) into (7) gives

$$U_t = A_t K_t^{\alpha} - \eta Z_t + \beta\Phi\,(A_t K_t^{\alpha})\,A_{t+1} Z_t^{\alpha}, \tag{8}$$

with $\Phi = 1$ when financial markets are complete. As the solution of the entrepreneur's program will reveal, a crucial implication of expression (8) is that with incomplete markets a positive productivity shock raising productivity A_t in period t increases the return to capital both in period t and in period $t+1$, whereas with complete markets it increases the return to capital only in period t. In the latter case, a standard 'opportunity cost effect' is at work that increases the incentive to invest in short-term capital K_t. In the former case, the opportunity cost effect is also at work but it is counterbalanced by an opposite 'liquidity effect', by which larger A_t increases the cash flow in period t and, through this channel, the entrepreneur's ability to meet the liquidity shock (Y_t rises). Hence, whereas with complete capital markets larger A_t makes the entrepreneur increase her supply of short-run capital K_t to the detriment of long-run capital $Z_t = 1 - K_t$, with incomplete capital markets it may lead to the opposite outcome whenever the increase in the probability of surviving thanks to more liquidity available is strong enough. When this happens, the liquidity effect dominates the opportunity cost effect.

Given that the tooling cost of long-term capital is covered by borrowing ($F_t = \eta Z_t$), a further implication is that a positive productivity shock in period t *decreases* borrowing with complete markets. Differently, with incomplete markets a positive productivity shock in period t *increases* borrowing whenever the associated liquidity effect is strong enough, as in this case the ability to meet the liquidity shock is tied to productivity through cash flow. This ambiguity does not arise, instead, for productivity shocks happening in period $t+1$ as these shocks have no bearing on cash flow in period t and thus do not have any liquidity effect.

Further comparison between complete and incomplete markets sheds additional light on how the liquidity effect works. With complete markets the entrepreneur is able to achieve her unconstrained optimal amount of long-term capital Z_t^*. Differently, with incomplete markets the chosen (cash-flow) constrained optimal amount Z_t is below the optimal target: $Z_t < Z_t^*$. In this case, though larger A_t makes the unconstrained Z_t^* fall due to the opportunity cost effect, the constrained Z_t can actually rise as long as, by increasing available cash flow, larger A_t increases Z_t towards the falling but still larger target Z_t^*.

Formally, given (8) and $\Phi = 1$, with complete markets the entrepreneur solves the following Lagrangean problem:

$$\max_{K_t, Z_t} = A_t K_t^{\alpha} - \eta Z_t + \beta A_{t+1} Z_t^{\alpha} + q_t \left(1 - K_t - Z_t\right),$$

where q_t is the Lagrangean multiplier on the human capital resource constraint. Given (8) and $\Phi = \left(A_t K_t^{\alpha} / S_{\max}\right)^{\phi}$, with incomplete markets she solves instead the problem:

$$\max_{K_t, Z_t} = A_t K_t^{\alpha} - \eta Z_t + \beta A_{t+1} \left(A_t K_t^{\alpha} / S_{\max}\right)^{\phi} Z_t^{\alpha} + q_t \left(1 - K_t - Z_t\right),$$

where $\left(A_t K_t^{\alpha} / S_{\max}\right)^{\phi}$ is the probability of meeting the liquidity shock given cash flow $A_t K_t^{\alpha}$ in period t. Larger ϕ implies larger positive impact of higher productivity A_t on that probability. The FOCs of these problems determine the optimal level of long-term capital Z_t (to which corresponds the optimal level of borrowing $F_t = \eta Z_t$) as the solution the following equation:[1]

$$\frac{\alpha A_t \left(1 - Z_t\right)^{\alpha - 1} - \eta}{\alpha A_t Z_t^{\alpha - 1}} = \beta \frac{A_{t+1}}{A_t} \left[\left(S_{\max}\right)^{-\phi} A_t^{\phi} \left(1 - Z_t\right)^{\alpha\phi} \left(1 - \phi \frac{Z_t}{1 - Z_t}\right)\right], \tag{9}$$

where in the case of complete markets the bracketed term equals 1 as the probability of meeting the liquidity shock is constant and equal to 1.[2]

[1]See the Appendix for a detailed derivation.

[2]The bracketed term is also equal to 1 when ϕ goes to 0 as in the limit the probability of

Given $\alpha \in (0, 1)$, the left-hand side of (9) is an increasing function of Z_t whereas its right-hand side is a decreasing function of Z_t as long as both sides are positive. Hence, parameter conditions that ensure that the left-hand and right-hand sides of (9) cross in the relevant range $Z_t \in (0, 1)$ also imply that the corresponding value of long-term capital is the unique solution to (9).

Figure 2 and **Figure 3** provide a graphical local representation of the solution of (9) with complete and incomplete markets respectively. In both figures the solid line LHS refers to the left-hand side of (9), which is increasing in Z_t and is the same for both complete and incomplete markets. In **Figure 2** the solid line RHS^c refers to the right-hand side of (9) with complete contracts (i.e. with the bracketed term equal to 1) and it is flat as no Z_t appears on that side when the probability of meeting the liquidity shock is 1. The entrepreneur's optimal choice with complete contracts is initially determined by point A at the crossing between LHS and RHS^c. When A_t increases, LHS shifts up to LHS' whereas RHS^c does not move. The corresponding new optimal choice is then determined by the new crossing A^c between LHS' and RHS^c, which is associated with a fall of long-term capital from Z_t to Z_t^c.

In **Figure 3** the solid line RHS refers to the right-hand side of (9) with incomplete contracts and accordingly it is decreasing in Z_t. The entrepreneur's optimal choice with incomplete contracts is again initially determined by point A at the crossing between LHS and RHS. When A_t increases, LHS shifts up to LHS' as in Figure 2. However, with incomplete markets, the final outcome in terms of long-term capital and borrowing is ambiguous because there are three cases. First, for $\phi = 1$, larger A_t does not affect RHS as with complete markets, due to the fact that the liquidity effect is not at work. Second, for $\phi < 1$, larger A_t shifts RHS down to RHS' so that the new optimal choice corresponds to point A' with *lower* long-term capital Z_t'. Hence, in this second case the

liquidity shocks of positive size goes to 0.

qualitative behaviour of the model is also the same as with complete markets, this time due to the fact that the opportunity cost effect dominates the liquidity effect. The reason for this is that, when ϕ is small, larger A_t has a small impact on the probability of meeting the liquidity shock . Third, for $\phi > 1$, larger A_t shifts RHS up to RHS$''$ so that the new optimal choice corresponds to point A$''$ with *higher* long-term capital Z_t''. In this third case it is the liquidity effect that dominates the opportunity cost effect as, when ϕ ¿1, larger A_t has a higher impact on the probability of meeting the liquidity shock.

Whether financial markets are complete or incomplete has, instead, no bearing on the qualitative impact of an increase in future productivity A_{t+1} on long-term capital and borrowing. Graphically, if A_{t+1} increased, the right-hand side of (9) would shift up both with complete and incomplete markets. As a result, Z_t would increase in both cases, leading to more long-term capital and more borrowing.

We can summarise these findings as:

Proposition 1. If productivity growth in period t leads to an increase (decrease) in borrowing in period t, the associated liquidity effect is strong (weak) and the inefficiency in capital allocation due to incomplete financial markets is more (less) pronounced. Differently, productivity growth in period $t+1$ always leads to an increase in borrowing in period t irrespective of the degree of financial market incompleteness.

Proposition 1 highlights that the contemporaneous net effect of productivity growth on bank credit growth is ambiguous, being positive with severe credit constraints and negative with mild ones: the liquidity effect dominates in the former case and is dominated by the opportunity cost effect in the latter. Accordingly, the sign and the absolute size of the contemporaneous elasticity of bank credit growth to productivity growth can be used to assess the efficiency of the allocation of credit across firms. A positive sign of the elasticity signals low efficiency, the more so the larger its absolute value. Differently, a negative sign of the elasticity signals high efficiency, the more so the larger its absolute value.

In the next section we will use these insights to assess and compare the efficiency of the credit allocation across firms in the three largest Eurozone economies since the late 1990s.

3 Data Description

We use a novel firm-level dataset based on the CompNet database (www.compnet.org) kick-started by the European Central Bank (ECB). A unique feature of this source is that it provides comparable indicators of detailed firm-level characteristics across a large set of European Union (EU) countries. Firm-level data are extremely sensitive and are handled by different national institutions under severe confidentiality requirements that typically make the creation of pooled cross-country firm-level datasets very hard. CompNet has managed to reduce the shortcomings of this situation for research by agreeing with the different national institutions a common protocol on how harmonized indicators should be defined and produced for detailed categories of firms. It has also created a network of researchers in the different national institutions that cooperate in the production of additional specific ouputs that are not included in the shared database.

Our analysis leverages both the CompNet database and the associated research network using data separately managed by the Banque de France for France, the Deutsche Bundesbank for Germany and the national statistical institute ISTAT for Italy. These institutions combine multiple sources of national administrative data (such as financial statements, fiscal forms, firm surveys, employment registries) to offer complete and detailed overviews of firm characteristics in the corresponding countries.

Table 1 shows the number of years, the number of firms and the original source of data by country. Even though variables are harmonised across countries, there are still some differences in terms of years of coverage and number of firms available. Nonetheless, this incomplete overlap pales in front of the representativeness of the sample and the richness of available variables, which are unique cross-country characteristics of the CompNet database.[3] In particular, for France, Germany and Italy Table 1 reveals that the firms in the sample cover between 27% and 43% of value added in national accounts and between 20% to 36% of total employment. Table 2 reports, instead, the employment distributions by firm size class in CompNet and Eurostat, highlighting remarkable sample representativeness for all three countries as the two distributions are very similar.

For each firm in the sample we have information on various measures of 'productivity', such as total factor productivity (TFP), marginal product of capital and labor productivity, as well as data on real value added. Firm-level TFP is computed using the approach of Wooldridge (2009), which hinges on previous work by Olley and Pakes (1996) and Levinshon and Petrin (2003).[4] The marginal product of capital is defined as the ratio of real value added over capital stock accounting for the firm-level elasticity of capital in the production function. Labor productivity is defined as real value added per employee. Finally, real value added is computed using country-sector specific deflators.

For each firm we also have information on bank credit, leverage and return on

[3]A detailed overview of the CompNet database can be found in Lopez-Garcia and di Mauro (2015).

[4]See Appendix A.2 for additional details on how TFP is estimated from firms' balance sheets.

assets. Bank credit corresponds to the entry 'liabilities to financial institutions'. in firm's balance sheets.[5] Returns on assets are defined as operating profit/loss over total assets. Leverage is the ratio of total debt to total assets.

4 Econometric Specification

The traditional empirical approach to assess the efficiency of credit allocation is to regress the growth rate of investments (a proxy for credit) on the growth rate of real value added (a proxy for investment opportunities) at the industry level (Wurgler, 2000). The size of the resulting estimated elasticity of investment to real value added measures how fast credit is directed to its most promising uses and thus how efficiently credit is allocated at any point in time.

Our empirical approach is close to the traditional approach, but it aims to bring it forward in three main respects. First, we are able to look at credit directly without having to use investment as a proxy. Second, we can run the analysis at the firm level rather than at the industry level, thus capturing the within-sector dimension of allocative efficiency. Third, we bring productivity growth into the main picture as an aspect of investment opportunities that may be important for the assessment of efficient capital allocation across firms.

Following the implications of the model proposed in Section 2, our main specification investigates the relations of credit growth with current and future productivity growth separately. For comparison with the traditional approach, we also run the same specification using current and future real value added growth. The specification is run independently for each country (given that, as discussed in Section 3, data cannot be pooled) with yearly time frequency.

[5] We do not have data on issued shares and data on bonds are scarce. This should not introduce any relevant bias in our results as the number of firms that issue bonds in our sample is very limited.

Specifically, omitting the country index for parsimonious notation, we run the following regressions for firm i in year t:

$$\begin{aligned} CreditGrowth_{it} &= \beta_0 + \beta_1 ProductivityGrowth_{it} \\ &\quad + \beta_2 GrowthWithInternalFunds_{it} \\ &\quad + \beta_3 Leverage_{it-1} + \delta_t + \psi_i + \epsilon_{it} \end{aligned} \tag{10}$$

and

$$\begin{aligned} CreditGrowth_{it} &= \alpha_0 + \alpha_1 ProductivityGrowth_{it+1} \\ &\quad + \alpha_2 GrowthWithInternalFunds_{it} \\ &\quad + \alpha_3 Leverage_{it-1} + \delta_t + \psi_i + \epsilon_{it}. \end{aligned} \tag{11}$$

Analogous regeressions are also run replacing productivity growth with real value added growth. In (10) and (11) the main coefficients of interest are β_1 and α_1 as these capture the relation of credit growth with current and future productivity growth respectively. The regressions are saturated with a series of controls and fixed effects to account for possibly relevant aspects our simple model abstracts from. In particular, 'Leverage$_{t-1}$' is introduced as a proxy of firm financial health and controls for its risk profile. 'GrowthWithInternalFunds$_{it}$' controls for different demand of credit across firms and refers to the maximum level of growth that a firm can attain without external finance. This measure depends on the firm's return on assets (ROA) and is computed following the 'percentage of sales' approach to financial planning (Higgins, 1977; Guiso et al., 2004) to obtain a firm-level measure of external financial dependence.[6] The time dummy δ_t captures shocks common to all firms while the firm fixed effect

[6] Specifically, we define: GrowthWithInternalFunds$_{it}$ $= ROA/(1-ROA)$. In Higgins (1977) this is called 'maximum rate of internally financed growth' and is used to derive 'FinancialDemand$_{it}$'$= 1 - ROA/(1-ROA)$.

ψ_i absorbs the firm's time invariant characteristics that may affect credit provision but are not in the model (such as skills and human capital) as well as the intrinsic external financial needs of the specific sector the firm operates in.[7] In the baseline specification, productivity is measured as TFP while we use the marginal product of capital and labor productivity to check robustness.

Three remarks on specification (10) and (11) are in order. First, when looking at β_1 and α_1 through the lenses of Proposition 1, we expect α_1 to be positive while the sign and absolute size of β_1 is informative about constraints that hamper an efficient credit allocation: negative β_1 signals efficiency, the more so the larger it is; positive β_1 signals inefficiency, the more so the larger it is in absolute value.

Second, reverse causality might appear to be a concern as credit may lead to a contemporaneous change in productivity and also affect future productivity. However, our main objective is not to identify causality, but to look at β_1 and α_1 as coefficients that capture the equilibrium relation between productivity and credit. Moreover, as we show in Appendix A.2, the measure of capital that we use to compute TFP is a function of past investments, which implies that the estimated productivity at time t does not depend on capital, and thus on credit, at time t. While this mitigates the concern of reverse causality for β_1 in equation (10), credit at time t could still affect capital at time t and thus measured productivity at time $t+1$. This concern of reverse causality for α_1 in equation (11) could also be someway mitigated if one considers that, as stressed by Wurgler (2000), capital might need up to two years since installation before becoming productive.

Third, in regression (11) as in the model we do not draw a distinction between unobserved future expected productivity growth and its observed realizationl. The two measures would be equivalent only if banks had perfect foresight. As

[7] We also tried to add sector-time dummies but results barely changed.

this is unlikely to hold in reality, it introduces some measurement error in the independent variable of interest and generates an attenuation bias in the estimates. In this respect, our results can be seen as providing a lower bound for the elasticity of credit to expected productivity as well as for the elasticity differences across countries.

5 Empirical Results

Table 3 presents our main results. The first row shows the elasticity of credit to TFP and real value added by country at t and $t+1$.[8] For France and Germany the table reveals a significant negative elasticity of credit to current productivity ($\beta_1 < 0$) and a significant positive elasticity of credit to future productivity ($\alpha_1 > 0$). For Italy, the elasticity of credit to future productivity is again significantly positive though smaller in size ($\alpha_1 > 0$). However, that turns out to hold also for the elasticity of credit to current productivity ($\beta_1 > 0$). According to Proposition 1, this is evidence that the opportunity cost effect of current productivity growth dominates in France and Germany while its liquidity effect dominates in Italy. For this reason credit allocation appears to more efficient in the former countries than in the latter. Moreover, as the size of the coefficients is larger for France than for Germany, credit allocation appears to be more efficient in France than in Germany.

Interestingly, the second row of Table 3 shows also that, if we had relied on the traditional assessment of efficient credit allocation based on the relation between credit growth and current real value added growth, we would have reached quite different and possibly misleading conclusions. In particular,

[8] For ease of exposition, we present only the main coefficients of the regressions. The full tables of these regressions are reported in Appendix A.3.

Germany exhibits an elasticity of credit to current real value added not significantly different from zero, compared to significantly positive elasticities of 17% and 11% for France and Italy respectively. Therefore, following the traditional approach we would have concluded that credit is allocated more efficiently in Italy than in Germany. This does not seem to be plausible as one would need to explain why firms in Germany are more credit constrained than firms in Italy.

Table 4 extends the analysis by looking at differences between large and small firms.[9] The table shows that the baseline results are qualitatively confirmed across firm size classes for both measures and all three countries. The only exception concerns large firms in Italy, for which the elasticities of bank credit to current and future productivity are not significantly different from zero. While the lack of significant correlation between credit growth and current productivity growth could be interpreted through the model in terms of offsetting opportunity cost and liquidity effects, the insignificant relation of credit growth with future productivity growth is hard to explain unless Italian firms and banks do not have productivity growth in their radar when demanding and supplying external finance. Turning to France and Germany, Table 4 reveals significant differences in the magnitude of the coeffcients between small and large firms. The elasticity of credit to productivity is inversely correlated with firm size, which suggests that bank credit is allocated more efficiently across small than large firms. A possible explanation for this finding is that relational banking may matter more for large firms. Given that large firms are cross-selling clients for which credit represents only one of many financial services they may ask from banks, these could choose to finance also less promising projects by such firms provided that the overall business relation remains profitable. Nonetheless, while this strategy can be individually optimal from a bank's perspective, it still has macroeconomic implication in terms of credit misallocation from an

[9] The threshold between small and large firms that we apply is 50 employees.

aggregate productivity perspective. A second possible explanation is that large firms are less dependent from bank credit than small firms thanks to better access to capital markets. A third explanation could be that the average commitment and complexity of credit to larger firms is higher so that it might be more complicated to reallocate credit between large than small firms.

6 Robustness Checks

In this section we focus on two main issues. First, we analyse the robustness of our findings to alternative measures of firm productivity. Second, we check whether the global financial crisis plays any role in shaping those findings.

It might be argued that the marginal revenue product of capital (MRPK) rather than TFP is the relevant measure of productivity from the point of view of banks. Moreover, TFP as well as the marginal product of capital could be more difficult to compute for credit institutions than labor productivity. Table 5 reports the estimates of β_1 and α_1 from regressions (10) and (11) when TFP is replaced by MRPK and labor productivity ('LProd') as measures of firm productivity. We find that for France and Germany the results are virtually unchanged. Credit at time t exhibits significant negative elasticity ($\beta_1 < 0$) with respect to both measures at time t and significant positive elasticity ($\alpha_1 > 0$) at time $t+1$. In the case of Italy the same holds for labor productivity both at t and $t+1$, but only at $t+1$ for MRPK as the elasticity of credit to MRPK is significantly negative. That said, the absolute sizes of the Italian elasticities of credit to MRPK are both an order of magnitude smaller than the French and German ones, confirming that credit is less efficiently allocated in Italy than in France and Germany. Moreover, they are so small that, even though statistically different from zero, they are hardly different from zero from an economic point of view.

Turning to the global financial crisis, Table 6 splits the sample between pre-2008 and post-2009 periods. From a qualitative viewpoint, the results for all three countries do not change before and after the crisis. They change, however, from a quantitative viewpoint. For Germany there is some evidence of credit allocation becoming slightly more effcient after the crisis, as the elasticities of credit to TFP at time t and $t+1$ become larger in size. The opposite is observed for France, although the sizes of the French elasticities remain significantly larger than the German one. Differently, for Italy there is virtually no change between the two periods. These results suggest that the baseline findings are not driven by the global financial crisis.

7 Conclusions

This paper contributes to the literature on the measurement of efficient capital allocation by credit markets. Focusing on bank credit and firm productivity, it has extended the traditional approach that assesses allocative efficiency through the elasticity of investment to real value added. In particular, we have proposed a new methodology based in a simple model of investment linking the signs and absolute sizes of the elasticities of credit to current and future productivity to the harshness of credit constraints. the model highlights that the contemporaneous net effect of productivity growth on bank credit growth is ambiguous: positive with severe credit constraints and negative with mild ones as a liquidity effect dominates in the former case and an opportunity cost effect dominates in the latter. In light of model, a positive elasticity of credit to contemporaneous productivity growth signals low efficiency, the more so the larger its absolute value; a negative elasticity signals instead high efficiency, the more so the larger its absolute value.

We have used this conceptual framework to assess the efficiency of credit allocation in the three largest Eurozone (France, Germany and Italy), exploiting a unique micro dataset based on the CompNet database created by the ECB. This dataset has allowed us to estimate the elasticity of credit to current and future productivity and real value added at the firm level. For France and Germany we have found significantly negative elasticity of credit to current productivity and significantly positive elasticity of credit to future productivity. Also for Italy the elasticity of credit to future elasticity, though smaller, has been found again significantly positive. However, the elasticity of credit to current productivity has turned out to be also significantly positive. Reading these results through the lenses of our model suggests that credit allocation is more effiecient in France and Germany than in Italy. While this finding is hardly surprising, it should be seen as a promising feature of our new methodology, given that we have also shown that the traditional approach based on real value added rather than productivity delivers the opposite and arguably implausible conclusion that credit is more efficiently allocated in Italy than in Germany.

When comparing different firm size classes, we have found that the elasticity of credit to productivity is generally higher for small than large firms, suggesting that credit is allocated more efficiently among the former than the latter. This is an important finding as large firms represent a dominant share of employment and value added in our sample economies.

Finally, we have shown that our results are robust to alternative measures of productivity, and hold qualitatively both before and after the global financial crisis. The estimated elasticities of credit to productivity are nonetheless quantitatively different in the pre- and post-crisis periods. In Germany credit allocation appears to become more efficient after the crisis while the opposite pattern is observed in France. Differently, in Italy there is virtually no change between the two periods.

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8 Figures

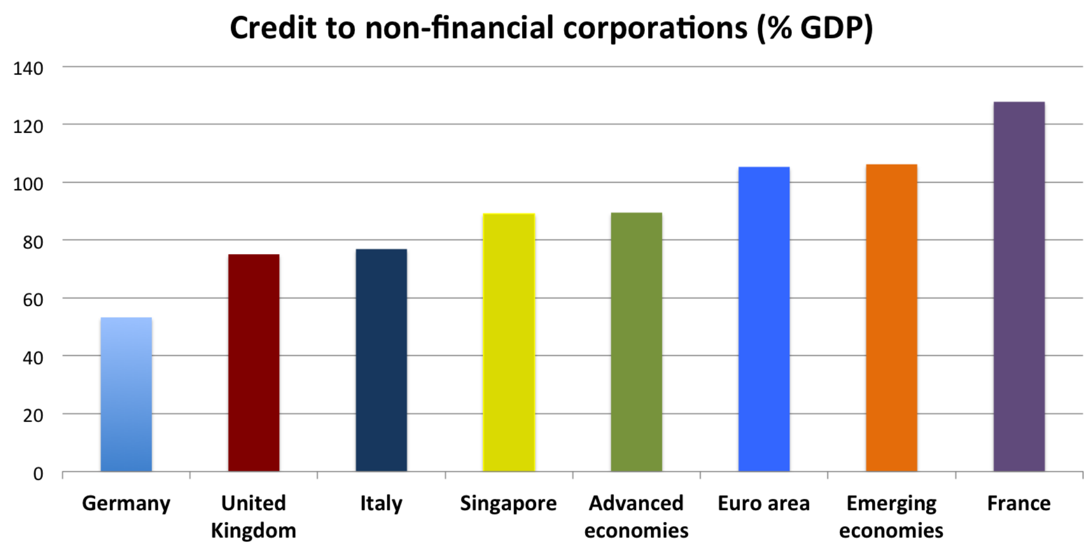

Figure 1: Credit to non-financial corporations

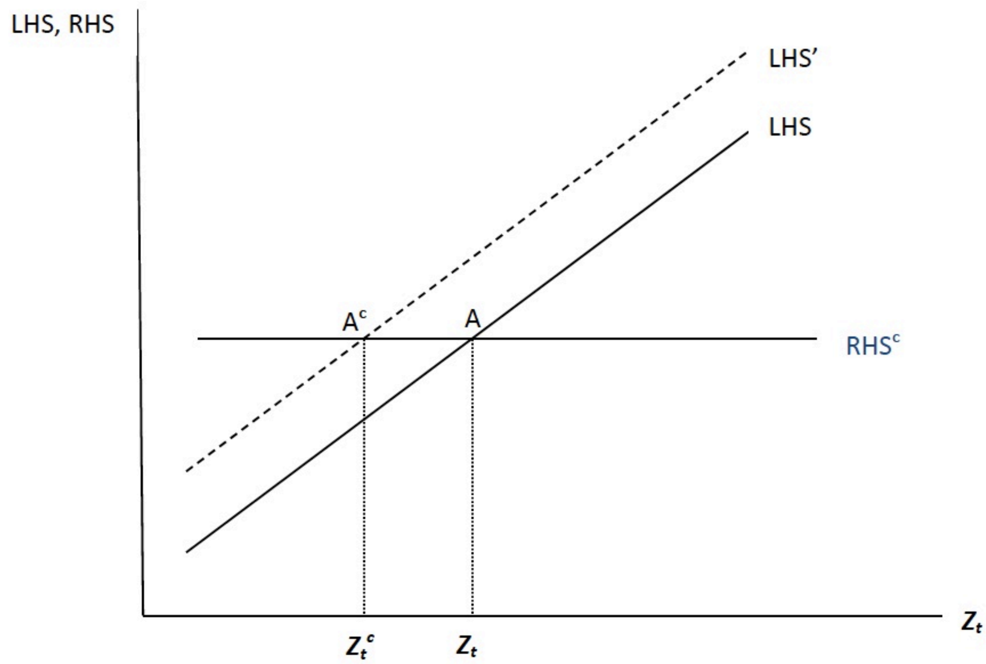

Figure 2: Productivity and borrowing with complete markets

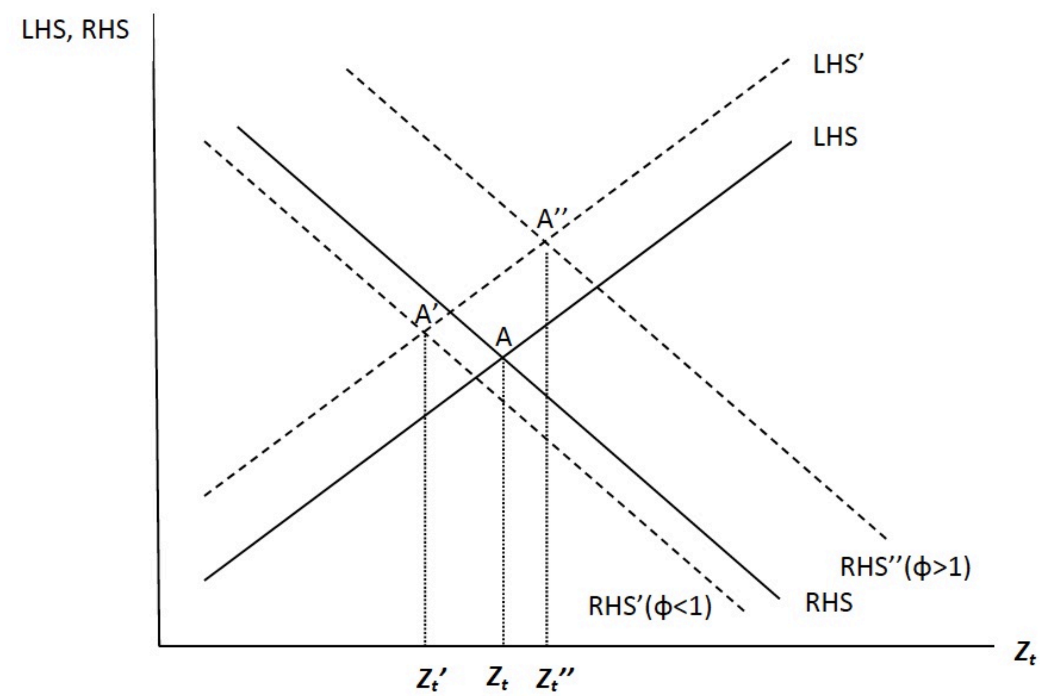

Figure 3: *
Productivity and borrowing with incomplete markets

Tables

Table 1: Sample summary

Country	**France**	**Germany**	**Italy**
Data Source	Banque de France	Bundesbank	ISTAT
Years	1995-2012	1997-2012	2001-2012
Firms	93,569	42,726	393,489
Observations	589,609	184,807	1,721,881
Value added vs Eurostat	43%	32%	27%
Total employment vs. Eurostat	36%	20%	30%

Table 2: Employment distribution by firm size class, CompNet and Eurostat

Size class	**20-49**		**50-249**		**250 +**	
	Eurostat	CompNet	Eurostat	CompNet	Eurostat	CompNet
France	18%	17.7%	24.6%	25%	57.4%	57.3%
Germany	14.9%	14%	29.1%	29.5%	56%	56.5%
Italy	24.1%	24.3%	29.4%	28.9%	46.5%	46.8%

Table 3: Baseline results on loans

Elasticity of credit to:	**France**		**Germany**		**Italy**	
	t	t+1	t	t+1	t	t+1
TFP	-0.27***	0.15***	-0.08***	0.06***	0.02***	0.02***
	(0.01)	(0.01)	(0.007)	(0.008)	(0.001)	(0.001)
RVA	0.17***	0.23***	-0.001	0.09***	0.11***	0.001
	(0.008)	(0.01)	(0.006)	(0.007)	(0.003)	(0.005)

***, **, * Significant at the 1%, 5% and 10% level. *TFP* is total factor productivity and *RVA* is real value added, as defined in Section 3. The elasticities are computed separately by country at time t and $t+1$ using equations (10) and (11). All specifications include controls, time dummies, and firm fixed effects. Standard errors are clustered at the sector level.

Table 4: Results by firm size

Elasticity of credit to		**France**		**Germany**		**Italy**	
		t	t+1	t	t+1	t	t+1
TFP	Small	-0.29***	0.18***	-0.09***	0.08***	0.02***	0.03***
		(0.01)	(0.01)	(0.02)	(0.01)	(0.001)	(0.001)
	Large	-0.22***	0.09***	-0.08***	0.05***	-0.002	0.00
		(0.02)	(0.02)	(0.01)	(0.008)	(0.009)	(0.008)
RVA	Small	0.15***	0.20***	-0.003	0.10***	0.12***	0.01
		(0.01)	(0.01)	(0.01)	(0.02)	(0.002)	(0.007)
	Large	0.22***	0.12***	0.00	0.08***	0.05***	0.003
		(0.01)	(0.02)	(0.009)	(0.008)	(0.01)	(0.002)

***, **, * Significant at the 1%, 5% and 10% level. *TFP* is total factor productivity and *RVA* is real value added, as defined in Section 3. The elasticities are computed separately by country at time t and $t+1$ using equations (10) and (11) for each sub-sample of firm size. All specifications include controls, time dummies, and firm fixed effects. Standard errors are clustered at the sector level.

Table 5: Robustness to alternative productivity measures

Elasticity of credit to:	France		Germany		Italy	
	t	t+1	t	t+1	t	t+1
MRPK	-0.51***	0.08***	-0.24***	0.05***	-0.003***	0.002***
	(0.007)	(0.007)	(0.006)	(0.005)	(0.000)	(0.000)
LProd	-0.17***	0.10***	-0.07***	0.06***	0.05***	0.04***
	(0.008)	(0.01)	(0.006)	(0.007)	(0.001)	(0.001)

***, **, * Significant at the 1%, 5% and 10% level. *MRPK* is the marginal product of capital and *LProd* is labor productivity as defined in Section 3. The elasticities are computed separately by country at time t and $t+1$ using equations (10) and (11). All specifications include controls, time dummies, and firm fixed effects. Standard errors are clustered at the sector level.

Table 6: Results pre- and post-crisis

Elasticity of credit to		France		Germany		Italy	
		t	t+1	t	t+1	t	t+1
TFP	Pre-crisis	-0.32***	0.16***	-0.07***	0.06***	0.01***	0.02***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.002)	(0.001)
	Post-crisis	-0.23***	0.12***	-0.11***	0.09***	0.02***	0.03***
		(0.02)	(0.02)	(0.02)	(0.01)	(0.001)	(0.001)
RVA	Pre-crisis	0.14***	0.26***	0.003	0.09***	0.10***	0.02
		(0.01)	(0.01)	(0.01)	(0.02)	(0.006)	(0.02)
	Post-crisis	0.14***	0.11***	-0.01	0.06***	0.12***	0.01
		(0.01)	(0.02)	(0.02)	(0.01)	(0.003)	(0.02)

***, **, * Significant at the 1%, 5% and 10% level. *TFP* is total factor productivity and *RVA* is real value added, as defined in Section 3. The elasticities are computed separately by country at time t and $t+1$ using equations (10) and (11) for each sub-sample of firm size. All specifications include controls, time dummies, and firm fixed effects. Standard errors are clustered at the sector level

Appendix A.1: Opportunity vs. Liquidity

Given (8) and $\Phi(S) = (S/S_{\max})^{\phi}$, with incomplete markets the entrepreneur solves the following Lagrangean problem:

$$\max_{K_t, Z_t} = A_t K_t^{\alpha} - \eta Z_t + \beta (S_{\max})^{-\phi} (A_t K_t^{\alpha})^{\phi} A_{t+1} Z_t^{\alpha} + q_t (1 - K_t - Z_t)$$

where q_t is the Lagrangean multiplier on the human capital resource constraint. The FOCs with respect to K_t and Z_t are

$$\alpha A_t K_t^{\alpha-1} + \beta (S_{\max})^{-\phi} A_t^{\phi} \alpha \phi K_t^{\alpha\phi-1} A_{t+1} Z_t^{\alpha} = q_t$$

and

$$-\eta + \beta (S_{\max})^{-\phi} A_t^{\phi} K_t^{\alpha\phi} A_{t+1} \alpha Z_t^{\alpha-1} = q_t$$

respectively, which together imply

$$\frac{\alpha A_t K_t^{\alpha-1} + \eta}{A_t \alpha Z_t^{\alpha-1}} = \beta \frac{A_{t+1}}{A_t} \left[(S_{\max})^{-\phi} A_t^{\phi} K_t^{\alpha\phi} \left(1 - \phi \frac{Z_t}{K_t} \right) \right]. \qquad (12)$$

The FOC with respect to q_t recovers the resource constraint

$$1 - K_t - Z_t = 0,$$

which allows us to rewrite (12) as an implicit function of Z_t only:

$$\frac{\alpha A_t (1 - Z_t)^{\alpha-1} - \eta}{\alpha A_t Z_t^{\alpha-1}} = \beta \frac{A_{t+1}^{e}}{A_t} \left[(S_{\max})^{-\phi} A_t^{\phi} (1 - Z_t)^{\alpha\phi} \left(1 - \phi \frac{Z_t}{1 - Z_t} \right) \right].$$

which is equation (9) in the main text.

Appendix A.2: Estimation of Firm-Level TFP

The starting point of the estimation of firm-level TFP is the standard Cobb-Douglas production function for firm i at time t

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{1-\alpha}$$

where Y_{it} is real value added, K_{it} is the real book value of net capital, L_{it} is total employment, and A_{it} is TFP.

Estimating TFP using a standard Cobb-Douglas setting is subject to endogeneity problems between the input levels and the unobserved firm-specific productivity. Following Olley and Pakes (1996) and Levinshon and Petrin (2003), the unobserved firm-specific productivity is controlled for by a proxy derived from a structural model. This proxy is a function of capital and material inputs, approximated by a third-order polynomial as in Petrin et al. (2004).

Specifically, the following regression is estimated on a 2-digit industry level using GMM, with the moments restrictions specified as in Woolridge (2009):

$$\begin{aligned} y_{i(t)} &= \beta_0 + \beta_1 k_{i(t)} + \beta_2 k_{i(t-1)} + \beta_3 m_{i(t-1)} + \beta_4 k_{i(t-1)}^2 + \beta_5 m_{i(t-1)}^2 + \beta_6 k_{i(t-1)}^3 \\ &\quad + \beta_7 m_{i(t-1)}^3 + \beta_8 k_{i(t-1)} m_{i(t-1)} + \beta_9 k_{i(t-1)} m_{i(t-1)}^2 + \beta_{10} k_{i(t-1)}^2 m_{i(t-1)} \\ &\quad + \gamma Year_t + \omega l_{i(t)} \end{aligned}$$

All variables are in logs: $y_{i(t)}$ is real value added of firm i in year t, $k_{i(t)}$ is its real book value of net capital, $m_{i(t)}$ is material inputs, $l_{i(t)}$ is total employment, $Year_t$ is a time dummy. While capital is assumed to take time to build, labor and TFP are simultaneously determined, so labor is instrumented by its first lag. TFP is then computed as

$$TFP_{i(t)} = rva_{i(t)} - \left(\widehat{\beta}_0 + \widehat{\beta}_1 k_{i(t)} + \widehat{\gamma} Year_t + \widehat{\omega} l_{i(t)}\right)$$

Two key assumptions of this methodology are that: i) productivity follows a first-order Markov process; and ii) capital is assumed to be a function of past investments and not current ones. These assumptions imply that productivity shocks at time t do not depend on capital at time t, but only on past productivity realizations. They also imply that an increase in bank credit at time t, even if used for investment, does not affect capital at time t as capital needs time to build up.

Appendix A.3: Complete Tables, Baseline Regression by Country

Table 7: France

Elasticity of credit to:	(1)	(2)	(3)	(4)
TFP_t	-0.27***			
	(0.01)			
TFP_{t+1}		0.15***		
		(0.01)		
RVA_t			0.17***	
			(0.008)	
RVA_{t+1}				0.23***
				(0.01)
$Leverage_{t-1}$	-1.88***	-1.93***	-1.88***	-1.90***
	(0.02)	(0.02)	(0.009)	(0.02)
Maximum internally	-0.56***	-0.61***	-0.77***	-0.62***
financed growth	(0.02)	(0.02)	(0.02)	(0.02)
R2	0.03	0.03	0.03	0.03
Observations	590,985	589,600	724,711	624,086

***, **, * Significant at the 1%, 5% and 10% level. As defined in Section 3 *TFP* is total factor productivity and *RVA* is real value added, Leverage is the ratio of total debt on total assets, Maximum internally financed growth is the maximum level of growth reachable without external finance as defined in Guiso et al. (2004) and Higgins (1977). The elasticities are computed separately by country at time t and $t+1$ using equations (10) and (11). All specifications include controls, time dummies, and firm fixed effects. Standard errors are clustered at the sector level.

Table 8: Germany

Elasticity of credit to:	(1)	(2)	(3)	(4)
TFP_t	-0.08***			
	(0.007)			
TFP_{t+1}		0.06***		
		(0.008)		
RVA_t			-0.001	
			(0.006)	
RVA_{t+1}				0.09***
				(0.007)
$Leverage_{t-1}$	-0.70***	-0.70***	-0.68***	-0.70***
	(0.002)	(0.02)	(0.02)	(0.02)
Maximum internally	-0.002	-0.01	-0.002	-0.008*
financed growth	(0.002)	(0.006)	(0.02)	(0.005)
R2	0.03	0.03	0.03	0.03
Observations	186,015	184,807	267,955	202,574

***, **, * Significant at the 1%, 5% and 10% level. As defined in Section 3 *TFP* is total factor productivity and *RVA* is real value added, Leverage is the ratio of total debt on total assets, Maximum internally financed growth is the maximum level of growth reachable without external finance as defined in Guiso et al. (2004) and Higgins (1977). The elasticities are computed separately by country at time t and $t+1$ using equations (10) and (11). All specifications include controls, time dummies, and firm fixed effects. Standard errors are clustered at the sector level.

Table 9: Italy

Elasticity of credit to:	(1)	(2)	(3)	(4)
TFP_t	0.02***			
	(0.001)			
TFP_{t+1}		0.02***		
		(0.001)		
RVA_t			0.11***	
			(0.003)	
RVA_{t+1}				0.001
				(0.005)
$Leverage_{t-1}$	-1.21***	-1.23***	-1.22***	-1.22***
	(0.008)	(0.008)	(0.003)	(0.008)
Maximum internally	-0.17***	-0.10***	-0.28***	-0.11***
financed growth	(0.009)	(0.01)	(0.01)	(0.01)
R2	0.05	0.04	0.06	0.04
Observations	1,721,881	1,705,251	2,322,067	1,844,144

***, **, * Significant at the 1%, 5% and 10% level. As defined in Section 3 *TFP* is total factor productivity and *RVA* is real value added, Leverage is the ratio of total debt on total assets, Maximum internally financed growth is the maximum level of growth reachable without external finance as defined in Guiso et al. (2004) and Higgins (1977). The elasticities are computed separately by country at time t and $t+1$ using equations (10) and (11). All specifications include controls, time dummies, and firm fixed effects. Standard errors are clustered at the sector level.