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Asymmetric Information, Borrowing Constraints, and Economic Growth*

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Abstract

This paper analyzes the role of asymmetric information in economic growth in a macro-dynamic model with limited financial contract enforcement. Creditworthiness of entrepreneurs (borrowers) is imperfect, and they can pledge only up to a fraction of the investment project's revenue. In this model, borrowing constraints endogenously emerge because of this enforcement problem. The major finding is that if a more productive entrepreneur tends to suffer from a severer agency problem (i.e., trade-offs between entrepreneurs' productivity and creditworthiness), the national income can be higher in the case with asymmetric information between borrowers and lenders than in the case without this.

JEL classification : E44, D82, O11, O16, O41

Keywords: Asymmetric information, borrowing constraints, economic growth

1 Introduction

Recent studies on the macroeconomics of credit market imperfection have considered asymmetric information or limited contract enforcement as fundamental sources of credit market frictions (Azariadis and Smith 1998; Matsuyama 2005, 2007). This strand of literature has shown that credit market imperfections cause macroeconomic fluctuations and underdevelopment traps, and thus may generate welfare loss. In doing so, existing models focus on each of these two sources

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of credit market frictions. The present study explores interactions between private information and limited contract enforcement in the credit market and their macroeconomic consequences in a dynamic general equilibrium model.

The model which I used in the paper is based on Matsuyama's (2007) model with the enforcement problem, where entrepreneurs (borrowers) can pledge only up to a fraction of the investment project's revenue and borrowing constraints can emerge because of this kind of enforcement problem. Two types of entrepreneurs exist in the model, the productive hi-tech and the less productive low-tech, and they differ in creditworthiness (i.e., the fractions of project revenue that entrepreneurs can pledge depends on their type). That is, some people can pledge a larger fraction of project returns than other people. This study introduces asymmetric information in a credit market; the types of entrepreneurs can be private information. In this setting, I examine how the asymmetric information affects the severity of enforcement problems and whereby macroeconomic performances of the economy.

The major finding of the paper is that the heterogeneity of borrowers' creditworthiness plays a critical role in determining a relationship between asymmetric information in credit markets and economic growth. This paper shows that asymmetric information in a competitive credit market normally enhances capital accumulation and the long-run national income through changes in the composition of credit quality, whereas, counterintuitively, it rather *promotes* economic development if trade-offs between productivity and creditworthiness exist.[1] In addition, even without such trade-offs, it *may* foster economic development if a degree of heterogeneity of borrowers' creditworthiness is sufficiently high. This paper eventually concludes that the heterogeneity of borrowers' imperfect creditworthiness is critical in economic development with asymmetric information.

I should here emphasize that my purpose is not to challenge results obtained in the existing literature. Rather, it is to shed light to the importance of creditworthiness heterogeneity explicitly, and thereby to specify an additional mechanism, through which asymmetric information affects, both positively and negatively, capital accumulation and economic growth through changes in the composition of credit quality.

The economic explanation for why the asymmetry of information counterintuitively can increase macroeconomic performances is as follows. Asymmetric information reduces two bor-

[1] This implies that a highly productive agent might have lower creditworthiness. Economic intuitions behind this case are discussed later.

rowing constraints for both types into a single constraint, which is that all entrepreneurs, hi-tech and low-tech, borrow the same amount because lenders cannot distinguish their types. If trade-offs between productivity and creditworthiness exist, less productive producers face lax borrowing constraints; i.e., the bad are more likely to be selected (a kind of adverse selection). In this case, asymmetric information eliminates the adverse selection by equalizing the hi-techs and low-techs, causing a credit switch to more productive hi-tech projects. In other words, such "adverse" adverse selection implies an almost "natural" selection. This results in enhanced growth and steady-state national income.

2 The Model

The basic model used here is the Diamond overlapping generations model with two period lives. The economy produces a single final good, using the constant returns to scale technology, $Y_t = F(K_t, L_t)$, where K_t is physical capital and L_t is labor. The final good in period t is consumed in period t or allocated to investment projects. Define $y_t \equiv Y_t/L_t = F(K_t/L_t, 1) = f(k_t)$, where $k_t \equiv K_t/L_t$. $f(k)$ satisfies $f'(k) > 0 > f''(k)$. The markets are competitive, and thus factor rewards for K and L are equal to $R_t = f'(k_t)$ and $w_t = f(k_t) - k_t f'(k_t) \equiv W(k_t) > 0$. I assume that $W(k)/k$ is strictly decreasing in k, with $\lim_{k\to 0} W(k)/k = \infty$ and $\lim_{k\to+\infty} W(k)/k = 0$, which holds for many standard production functions, including a Cobb–Douglas, $f(k) = k^\alpha,\ \alpha \in (0,1)$. They are both paid in the final good. I assume for simplicity that capital is fully depreciated in one period.

In each period, new generations of workers and entrepreneurs are born in the economy, and they live for two periods. The sizes of each generation are normalized to be L and unity, respectively. Each worker supplies one unit of labor in the final production and earns $w_t = W(k_t)$ in the first period (young period). They have no plans to start any investment project, so that they save all their earnings (become lenders) and earn the gross return r_{t+1} per unit in a competitive credit market. In the second period (old period), they consume $r_{t+1}w_t$. Each entrepreneur owns an investment project. Within each generation, entrepreneurs are divided into two types. A fraction $p \in (0,1)$ of young entrepreneurs is hi-tech entrepreneurs; these agents are endowed with advanced, more productive investment technology. The other fraction $1-p$ is low-tech young entrepreneurs, who own traditional, less productive investment technology. The hi-tech entrepreneurs' production function is $x^h = a(z^h)^\beta$, where $a > 1$, and the low-tech entrepreneurs' is

$x^l = (z^l)^\beta$. In the first period, they finance an investment project by borrowing z_t^i $(i = l,\ h)$ units of final good and start up their investment project. Each entrepreneur can run only one project, and each project converts z_t^i units of final good in period t into x_{t+1}^i units of physical capital in period $t+1$. They earn the project revenue $R_{t+1}x_{t+1}^i$ minus repayment obligation $r_{t+1}z_t^i$ and consume this in the second period. I first analyze the case where workers/lenders can observe the types of entrepreneurs.

Since aggregate saving is $S_t = LW(k_t)$, the credit market clearing condition is represented by

$$LW(k_t) = pz_t^h + (1-p)z_t^l. \tag{1}$$

The capital stock is given as

$$K_{t+1} = px_t^h + (1-p)x_t^l. \tag{2}$$

I turn to the investment decisions. Each entrepreneur maximizes the earning attained in the second period; i.e., $\max_{z_t^i} R_{t+1}x_t^i - r_{t+1}z_t^i$, subject to the production functions presented above. The solutions to this problem can be easily derived as

$$z_t^{h*} = \left(\frac{aR_{t+1}\beta}{r_{t+1}}\right)^{\frac{1}{1-\beta}}, \tag{3}$$

$$z_t^{l*} = \left(\frac{R_{t+1}\beta}{r_{t+1}}\right)^{\frac{1}{1-\beta}}. \tag{4}$$

Although these points maximize the second-period consumption of the entrepreneurs, they may not be able to invest as they want because of the borrowing constraint. I use a simple specification of credit market imperfections presented by Matsuyama (2000, 2004, 2007). Assume that the entrepreneur, after borrowing z_t^i, can refuse to honor his/her repayment obligation, $r_{t+1}z_t^i$, if it is greater than the cost of default. I assume the cost of default of a type i entrepreneur to be a fraction of investment project revenue $\lambda_i R_{t+1}x_t^i$. The parameter $1-\lambda_i \in (0,1)$ captures the degree of the severity of the agency problem faced by type i entrepreneurs. Then, the borrowing constraints faced by hi-tech and low-tech entrepreneurs can be written as

$$z_t^h \leq \left(\frac{\lambda_h aR_{t+1}}{r_{t+1}}\right)^{\frac{1}{1-\beta}} \equiv \hat{z}_t^h, \tag{5}$$

$$z_t^l \leq \left(\frac{\lambda_l R_{t+1}}{r_{t+1}}\right)^{\frac{1}{1-\beta}} \equiv \hat{z}_t^l. \tag{6}$$

Several possibilities exist *a priori*. Here, I restrict myself to the most interesting case where two constraints bind. If $\max\{\lambda_h, \lambda_l\} < \beta$ (i.e., the efficiency of the credit markets is very low),

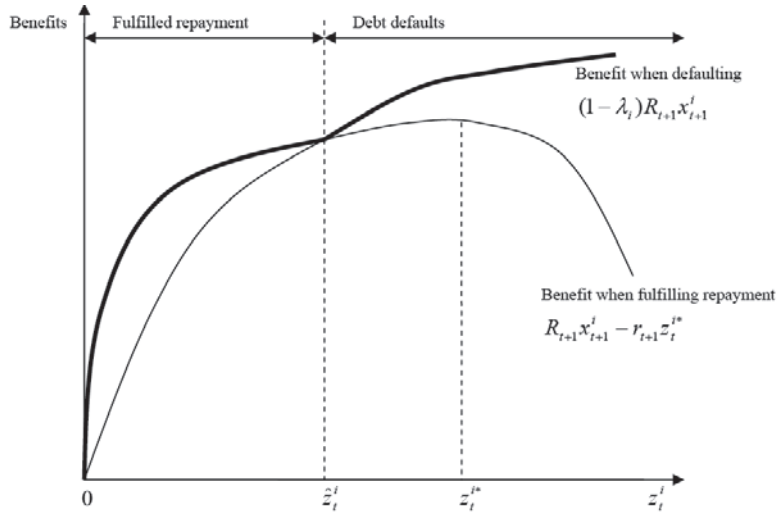

Figure 1: Benefit is increasing in z

both borrowing constraints must bind; i.e., $(z_t^h, z_t^l) = (\hat{z}_t^h, \hat{z}_t^l)$ holds in equilibrium (see (3)–(6)). This is because this assumption ensures that $\hat{z}_t^i < z_t^{i*}$ and then more borrowing is better for all entrepreneurs; i.e., the benefit monotonically increases with borrowing as indicated with the heavy line in Figure 1.[2] Entrepreneurs therefore borrow *as much as possible*.

Each type of lender borrows up his/her borrowing limit; i.e., $z_t^i = \hat{z}_t^i$. Then, I have

$$x_t^l = (\hat{z}_t^l)^\beta \quad \text{and} \quad x_t^h = a(\hat{z}_t^h)^\beta.$$

It follows that the credit market equilibrium condition (1) can be expressed as

$$LW(k_t) = p\left(\frac{\lambda_h a R_{t+1}}{r_{t+1}}\right)^{\frac{1}{1-\beta}} + (1-p)\left(\frac{\lambda_l R_{t+1}}{r_{t+1}}\right)^{\frac{1}{1-\beta}}. \tag{7}$$

From (2), the per-worker capital stock in period $t+1$ can be expressed as

$$k_{t+1} = L^{-1}\left[ap\left(\frac{\lambda_h a R_{t+1}}{r_{t+1}}\right)^{\frac{\beta}{1-\beta}} + (1-p)\left(\frac{\lambda_l R_{t+1}}{r_{t+1}}\right)^{\frac{\beta}{1-\beta}}\right]. \tag{8}$$

From (7) and (8), I have the following law of motion for k_t:

$$k_{t+1} = \zeta W(k_t)^\beta, \tag{9}$$

[2]If λ_i is high enough to violate this assumption, $\hat{z}_t^i > z_t^{i*}$ holds and thus the benefit of type-i entrepreneurs is not monotonic in borrowing, z_t^i. Suppose a sharp downward shift in the benefit curve when defaulting, $(1-\lambda_i)R_{t+1}x_{t+1}^i$, in Figure 1.

where

$$\zeta \equiv \frac{a^{1/(1-\beta)} p \lambda_h^{\beta/(1-\beta)} + (1-p)\lambda_l^{\beta/(1-\beta)}}{L^{1-\beta}\left[a^{1/(1-\beta)} p \lambda_h^{1/(1-\beta)} + (1-p)\lambda_l^{1/(1-\beta)}\right]^{\beta}}.$$

The evolution of the economy where asymmetric information does not exist follows (9). Since W is assumed to be a well-behaved function, the economy, for any initial value of K, converges monotonically toward its steady state, k^*, given by $k^* = \zeta W(k^*)$.

I now introduce private information into the model. Assume that the types of entrepreneurs are private information; i.e., lenders cannot observe the types of borrowers. Two possibilities exist: one where hi-tech entrepreneurs can offer more pledgeable revenue and hence borrow more than the low-tech ones (i.e., $\hat{z}_t^h > \hat{z}_t^l$), and one where there are *trade-offs* between productivity and pledgeability and hence the low-techs can borrow more than the hi-techs (i.e., $\hat{z}_t^h < \hat{z}_t^l$).

I characterize the first case where $a\lambda_h > \lambda_i$. If lenders set the borrowing limit to $\hat{z}_t^l : \hat{z}_t^l < \hat{z}_t^h$, all the entrepreneurs (including hi-tech and low-tech) borrow up this limit and never have the incentive to default their debt. The credit market condition should be changed as $LW(k_t) = z_t^l$, implying

$$LW(k_t) = \left(\frac{\lambda_l R_{t+1}}{r_{t+1}}\right)^{\frac{1}{1-\beta}}, \tag{10}$$

and per-worker capital stock would be

$$k_{t+1} = L^{-1}\left[ap + (1-p)\right]\left(\frac{\lambda_l R_{t+1}}{r_{t+1}}\right)^{\frac{\beta}{1-\beta}}. \tag{11}$$

These two equations are easily combined into a single equation:

$$k_{t+1} = \zeta_1 W(k_t)^{\beta}, \tag{12}$$

where $\zeta_1 \equiv [ap + (1-p)]/L^{1-\beta}$. This is the law of motion for k in the case of $a\lambda_h > \lambda_l$; i.e., the hi-techs can offer more pledgeable revenue.

Next, I turn to the case of $a\lambda_h < \lambda_l$. There are trade-offs between productivity and pledgeability; the hi-techs produce more capital goods while the low-techs offer more pledgeable revenues per unit of investment, which makes the low-techs potentially better lending outlets for the lenders. Such trade-offs between productivity and pledgeability can be important, as emphasized in Matsuyama (2007), when the hi-tech entrepreneurs, who use cutting-edge, hard-to-learn technologies, might be subjected to more severe agency problems than the low-tech entrepreneurs,

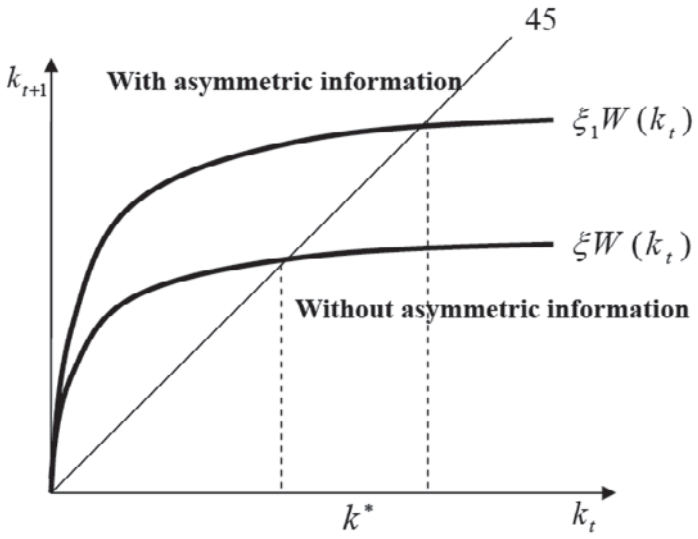

Figure 2: Growth with and without asymmetric information

who use well-established, easier-to-learn technologies.[3] Lenders cannot distinguish between the entrepreneurs, and thus offer a single borrowing limit, $\hat{z}_t^h$, to prevent them defaulting. It is easy to verify that, in this case, the law of motion for k is still represented by (12).

3 Asymmetric Information and Growth

How does the asymmetric information affect growth and national income? To address this question, I should compare the two dynamic equations, (9) and (12), to examine the role of asymmetric information in the process of economic development. It should be stated that, since W is a well-behaved function, asymmetric information on capital goods producers depresses (enhances) short-run growth rates ($(k_{t+1} - k_t)/k_t$) and the steady-state national income ($Y^* = Lf(k^*)$) if $\zeta > (<)\zeta_1$ holds; see Figure 2. Then, in the case of trade-offs between productivity and pledgeability, I can establish the following proposition.

Proposition 1 *When trade-offs between productivity and pledgeability exist, the steady-state na-*

[3]Note that Matsuyama (2007) considers heterogeneous *investment projects*, which all agents can freely access, whereas I analyze heterogeneous *entrepreneurs*. Also, he does not allow for asymmetric information, but rather examines a variety of nonlinear phenomena in the process of development.

tional income, $Y^* = Lf(k^*)$, is higher in economies with the asymmetric information on capital goods producers, rather than in economies without this.

Proof: It is easy to verify that $\partial\zeta/\partial\lambda_l < 0$ if and only if $\lambda_l > \lambda_h$. Thus, ζ is strictly decreasing in λ_l for $\lambda_l > a\lambda_h > \lambda_h$. Also, $\zeta = \zeta_1$ at $a\lambda_h = \lambda_l$. It follows that $\zeta < \zeta_1$ holds for any λ_l that satisfies $a\lambda_h < \lambda_l < \beta$. ||

Proposition 1 suggests that the asymmetric information is useful for economic development in economies with trade-offs between productivity and pledgeability.[4] This result contrasts with the literature where it is a popular view that the asymmetry of information generates credit rationing, and so reduces economic growth (see Azariadis and Smith, 1999). A recent exception is Shi (1996); however, while he does not allow for the dual heterogeneity of entrepreneurs (in productivity and the severity of agency problems), his focus is rather on the fact that high-risk projects, which generate high-quality capital goods, create faster evolution of knowledge.[5]

The intuition behind Proposition 1 is as follows. A key assumption is the trade-off between productivity and pledgeability. When such a trade-off exists, the more productive hi-tech entrepreneurs who use leading-edge technologies can pledge only a smaller fraction of their revenues than the low-techs.[6] Thus, the hi-techs face a more severe borrowing constraint and less productive producers are more likely to be selected in economies without the asymmetric information.

Now, I introduce asymmetric information on the types of entrepreneurs. As a result, the *composition* of the credit quality is altered and, more specifically, the borrowing constraints for both types are reduced to a single expression. Although lenders, in the case without asymmetric information, prefer to set different (specific) borrowing limits for the hi-techs and the low-techs, they have no alternative but to set the single borrowing limit at $\hat{z}_t^h < \hat{z}_t^l$ because of the asymmetry of information, and then no default occurs. Hence, the presence of asymmetric information equalizes investment sizes of the two types, and so the credit switches from the low-techs to more

[4]Using Romer's (1986) model of endogenous growth, I can also show the positive long-run growth effect of asymmetric information.

[5]Notice that, in my model, any risk does not exist.

[6]One can justify the trade-off case as follows. The cost of default for the hi-techs would be lower than the low-techs due to their technological advantages. Alternatively, it is harder for outside agents (lenders) to capture the technology of the hi-techs than of the low-techs owing to its novelty and technological sophistication. Thus when an hi-tech entrepreneur withdraw his/her services, lenders necessarily incur larger costs for taking over the operation from his/her investment project. This implies stronger bargaining power of the hi-techs in renegotiation of repayment obligation and then their smaller creditworthiness, or equivalently pledgeability.

productive hi-tech ones.[7] Such a change in the credit composition is the important key of the current model. The investment size of the hi-techs increases and, as a consequence, asymmetric information enhances physical capital accumulation (k^*), aggregate production ($f(k^*)L$), and short-run growth ($(k_{t+1} - k_t)/k_t$).

There is another way to understand this result. My model, *without the asymmetric information*, can exhibit some sort of adverse selection in the sense that the "bad" producers are more likely to be selected. In the situation where the bad are more likely to be selected because of the trade-off between productivity and creditworthiness, the asymmetric information, equalizing the good and the bad, makes the good more likely to be selected than in the original situation where there is no asymmetry information. One might state that it makes the adverse selection *inverted*, and such "adverse" adverse selection implies almost "natural" selection.

Next, I turn to the case *without* the trade-off between productivity and pledgeability: $a\lambda_h > \lambda_l$. Productivity positively relates to pledgeability in this case: the hi-techs can borrow more than the low-techs. The following proposition summarizes the role of asymmetric information on heterogeneous entrepreneurs in economic development when such a positive relation exists.

Proposition 2 *When productivity gap between two types of entrepreneurs, the hi-techs and the low-techs, is small enough to satisfy $a < (1-p)/(p^{1-\beta} - p)$, and when the low-tech entrepreneurs face sufficiently big agency problems (λ_l is sufficiently low), the steady-state national income, $Y^* = Lf(k^*)$, is higher in economies with the asymmetric information on capital goods producers, rather than in economies without this.*

Proof: It is straightforward to show from the proof of Proposition 1 that ζ as a function of λ_l has an inverted-U configuration. Note $\lim_{\lambda_l \to 0} \zeta = ap^{1-\beta}/L^{1-\beta}$ and ζ is maximized at $\lambda_l = \lambda_h < a\lambda_h$. Thus, there exists a threshold value of λ_l, denoted by $\bar{\lambda}_l$, below which $\zeta < \zeta_1$, if $ap^{1-\beta}/L^{1-\beta} < \zeta_1$, noting ζ_1 is independent of λ_l. It is easily shown that $\zeta < \zeta_1$ holds for any $\lambda_l \in (0, \bar{\lambda}_l)$ if $a < (1-p)/(p^{1-\beta} - p)$. It proves Proposition 2. ‖

Proposition 2 implies that informational asymmetry normally hurts economic development in the case *without* the trade-off ($a\lambda_h > \lambda_l$). This implication is much closer to the standard view on the role of asymmetric information in economic performances. However, even in this case, the asymmetry might enhance capital accumulation, short-run growth, and the long-run income when λ_l is very low. This result explicitly depends on the assumption that $a < (1 -$

[7] Note that the hi-techs can only borrow and investment less than the low-techs in the original situation without asymmetric information.

$p)/(p^{1-\beta}-p)$, and, in addition, implicitly on the convex property of production technologies owed by entrepreneurs, as is apparent from the following discussion.

The logic behind Proposition 2 is completely different from that behind Proposition 1, although they are similar in that they both identify the positive role of asymmetric information. If the low-tech entrepreneurs face a seriously big agency problem (i.e., λ_l is sufficiently low), they can only borrow and investment far less than the hi-techs (i.e., $\hat{z}_l$ is sufficiently small relative to $\hat{z}_h$). In this case, due to the convexity of production technologies,[8] marginal productivity of the low-techs is much larger than of the hi-techs. Meanwhile, the emphasis of present study is that asymmetric information affects the *composition* of quality of the credit, providing a credit switch from the hi-techs to the low-techs in the case without the trade-offs. Therefore, also in this case, asymmetric information has a positive effect on aggregate production of the capital good owing to the low-techs' *larger marginal productivity*.[9] On the other hand, there exists another *aggregate* effect that a credit switch to less productive entrepreneurs (i.e., the low-techs) decreases the size of more productive investment by the hi-techs. If the former effect dominates the latter, asymmetric information in the credit market enhances capital accumulation and economic growth.[10]

In what follows, I summarize the results, obtained above, concerning the relationship between asymmetric information, namely, Propositions 1 and 2. Figure 3 depicts the parameter configurations in terms of two important parameters, $\lambda_l \in (0,\beta)$ and $\lambda_h \in (0,\beta)$, each of which captures the severity of agency problems of the low-techs and the hi-techs respectively, given any other parameters constant. The regions marked by P1 and P2 correspond to Propositions 1 and 2

[8]The production function for the low-techs, $x_l = (z_l)^\beta$ is strictly concave, satisfying the Inada condition.

[9]The credit switch to the low-techs implies an increase in the low-tech investment and, at once, an equal decrease in the low-tech investment. It follows from larger marginal productivity of the low-techs that the *marginal* effect of this credit switch is positive for the aggregate production of all the entrepreneurs.

[10]An alternative explanation is possible. Under the presence of the convexity of production possibility frontiers of entrepreneurs, resource distribution should be balanced. Thus, if resource (i.e., the credit) is hardly devoted to the low-techs (i.e., credit distribution is biased to the hi-techs), a credit shift to the low-techs, which is accompanied by asymmetric information, would improve the efficiency of resource distribution. The low-techs, however, are less productive agents. A resource shift to the low-techs, on the other, hurts the efficiency because of the increase in less productive investment. If the former effect, driven by the natural convexity assumption, dominates, and then Proposition 2 holds. Note that the former effect is stronger when λ_l is smaller relative to λ_h (i.e., the distribution of credit is more unbalanced).

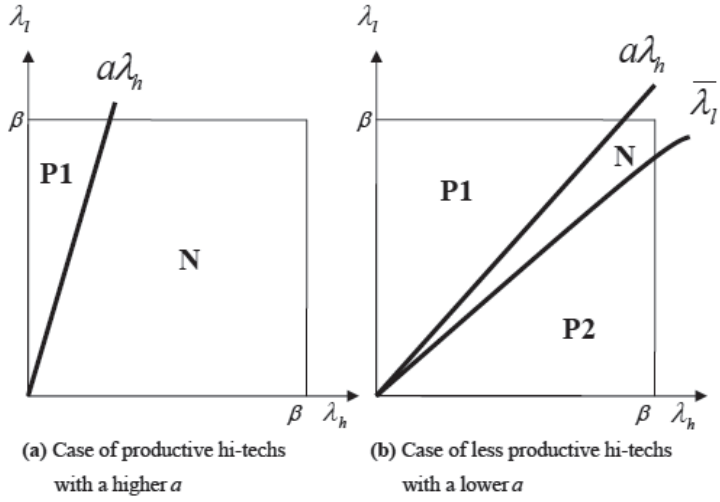

Figure 3: Parameter configurations

respectively, whereas the region N corresponds to the reverse case.[11]

In Regions P1 and P2, with a high and a low λ_l respectively, there is the positive role of asymmetric information of the credit market in economic growth (Propositions 1 and 2), and in Region N it *negatively* affects economic growth.

Two representative cases are shown in Figure 3, depending on the relative productivity, a, and the population of hi-tech entrepreneurs, p.[12] Figure 3(a) depicts the case of a high a and/or a high p, where the hi-techs are more influential in the sense that their technological advantage for the low-techs is huge and/or their share of the population is great. In this figure, a is high enough to violate the condition of Proposition 2 (i.e., $a < (1-p)/(p^{1-\beta}-p)$), and hence Region P2 does not exist. Figure 3(b) is the case of a low a and/or a low p, where the hi-techs are less influential.

In summary, the findings of the current paper is that the heterogeneity of borrowers' creditworthiness is important for the role of asymmetric information in economic development. I show that informational asymmetry in the credit market normally enhances economic development (Region N, Figure 3). However, counterintuitively, there is also an opposite case (Region

[11] More specifically, there exists the trade-off between productivity and pledgeability in Region P1 ($a\lambda_h < \lambda_l$). In Regions P2 and N, such trade-offs do not exist ($a\lambda_h > \lambda_l$). Region P2 corresponds to lower severity of the low-techs' borrowing constraint ($\lambda_l < \bar{\lambda}_l$), whereas Region N to an intermediate range of severity of it ($\lambda_l \in (\bar{\lambda}_l, a\lambda_h)$).

[12] An example of parameter values that correspond to Figure **??** (a) is $\{a = 3, p = 0.2, \beta = 0.9\}$, and Figure **??** (b)'s is $\{a = 1.1, p = 0.2, \beta = 0.9\}$.

P, Figure 3): the role of asymmetric information can be positive when the degree of productivity heterogeneity, captured by a, is lower and/or, more importantly, the degree of creditworthiness heterogeneity, captured by $|\lambda_h - \lambda_l|$ is higher.

Propositions 1 and 2 identify the growth-enhancing role of asymmetric information in the credit market. This results from the stylized fact that the asymmetry hampers the formation of borrower-specific borrowing constraints, which are set for heterogeneous borrowers (who differ in productivity and creditworthiness). The present study reveals, after all, the two forces determining the direction of role of asymmetric information:

1. The balancing effect: there will be an increase in efficiency of capital good production through balancing the distribution of the credit between the hi-techs and the low-techs, owing to the natural convexity assumption of production technologies.

2. The productivity gap effect: more investment by the hi-techs leads to more production of the capital good due to their productivity advantage for the low-techs.

Notice that the balancing effect is always positive for economic development, whereas the productivity gap effect is ambiguous depending on the trade-off between productivity and pledgeability. If the trade-off exists ($a\lambda_h < \lambda_l$), the productivity gap effect is positive, associated with a credit switch to the more productive hi-techs. There exist two positive forces in this case, so that the economy grows more and more with asymmetric information (cf. Proposition 1).

In the case without the trade-off ($a\lambda_h > \lambda_l$), conversely, the productivity gap effect is negative. This is because, in this case, a credit switch, associated with asymmetric information, increases investment by the low-techs. In this case, asymmetric information encourages economic development when the balancing effect is strong and/or when the productivity gap effect is weak, and then the degrees of creditworthiness and productivity heterogeneity, which are the key of this note, determine the magnitude of the balancing effect and of the productivity gap effect respectively. I therefore conclude that in economies with a lower (higher) degree of productivity (creditworthiness) heterogeneity, asymmetric information in credit markets is more likely to promote economic development.

4 Conclusion

This paper allows for the heterogeneity of imperfect creditworthiness of borrowers in a overlapping generations model with credit market asymmetric information. Borrowers differ in the crucial two aspects determining the quality of borrowers in credit markets, namely productivity and creditworthiness. This paper finds the importance of creditworthiness heterogeneity in the process of economic development with asymmetric information. It shows that the asymmetry of information normally decreases capital accumulation, short-run growth, and the long-run national income; a natural speculation basically goes far. However, when the degree of heterogeneity of borrowers' creditworthiness is sufficiently high, the current study offers a counterintuitive result: asymmetric information might *enhance* short-run growth and the long-run national income. This paper emphasizes the crucial role of heterogeneous creditworthiness in economic development with asymmetric information.,

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