Credit market imperfection, labor supply complementarity, and output volatility ☆

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ABSTRACT

This paper argues that output volatility depends on the degree of credit market imperfection. In the early stages of financial development, agents are constrained in their borrowing ability. As a result, the individual savings, affected by the labor supply, play a dual role in the economy, having repercussions on the interest rate. On the one hand, high savings imply high investment, low marginal product of capital and thus low interest rate. On the other hand, high savings affect the agents' ability to run highly productive investment projects, which increases the interest rate. When the former effect is dominant, a dynamic complementarity between individual and aggregate labor supply arises. This leads to a local and global indeterminacy of equilibrium paths. If the borrowing constraint is relaxed, the complementarity between individual and aggregate labor supply decisions weakens, equilibrium becomes globally unique and the possibility of having aggregate fluctuations in output disappears.

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1. Introduction

Why does per capita output fluctuate more in some countries than in others? Lucas (1988) argued that the output growth rate is very stable within advanced economies but fluctuates widely in less developed countries. For example, the estimated standard deviation of the annualized growth rate of per capita real gross domestic product (GDP) between 1960 and 2011 is 2.94%, 6.56%, 8.42%, 10.55% and 21.28% for the United States, Canada, India, China, and Russia, respectively. What explains this variation? And why are early stages of development subject to greater randomness? At an accounting level, variation of per capita output can be due to variations in productivity and factor endowments. But why do productivity and factor endowment fluctuations differ so much across countries?

The central hypothesis of this paper is that imperfection in the credit market can cause individual labor supply decisions to complement each other and fluctuations of factor endowments can take place endogenously. Unlike the view of real business cycle theory, the model presented in this paper offers a mechanism through which endogenous, rather than exogenous, fluctuations of productivity determine excessive volatility of factor supplies and cause excessive output volatility.

Agents in less developed countries have less capital to invest and rely more on external funding. This along with the minimum size requirements of investment projects creates a positive feedback between aggregate savings and return on capital. In fact, as savings increase, agents become able to invest in more productive activities. High returns on savings create an incentive for agents to supply more labor and to substitute current leisure for future consumption. As a result, individual and aggregate labor supply decisions complement each other and endogenous fluctuations become possible. If the borrowing constraint is relaxed, the positive relationship between aggregate savings and return on capital diminishes gradually. As a result, the complementarity between individual and aggregate labor supply decisions weakens and endogenous fluctuations in output disappear.

1.1. Motivation and historical evidence

Several authors emphasize the high variability of output growth at early stages of development. For example, Acemoglu and Zilibotti (1997), Neumeyer and Perri (2005), Aguiar and Gopinath (2007), Garia-Cicco et al. (2010), and Koren and Tenreyro (2013) among others,

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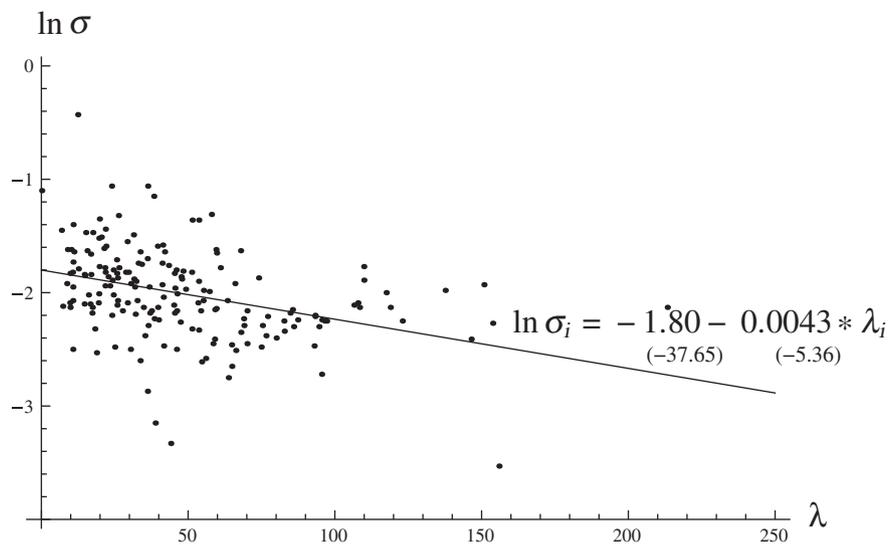$$\ln \sigma_i = -1.80 - 0.0043 * \lambda_i$$
$$(-37.65) \qquad (-5.36)$$

Fig. 1. Standard deviation of the annualized growth rate of income versus the average level of credit market imperfection. Sample consists of 179 countries.

document high macroeconomic volatility for developing and emerging economies.

Fig. 1 shows a simple scatter plot of the natural logarithm of the standard deviation of a country's real GDP per capita growth rate over the period 1960–2011 versus the average domestic credit provided by the banking sector as a percentage of GDP. We consider 179 countries for which data is available.[2] The regression line (in solid) is downward sloping, with a highly significant slope, t-statistic = −5.36 and $R^2 = 0.14$.

The relationship presented in Fig. 1 remains robust for different samples. For instance, Table 1 reports the estimation results of the same equation for G8, G20, OECD, Richest 50, and Richest 100 countries. As the table indicates, the slope is always negative and highly significant.

1.2. Literature review

Several authors have investigated how imperfections in credit market may lead to endogenous, expectations-driven business cycles. This idea was first suggested by Woodford (1986) and then further investigated by Grandmont et al. (1998), Cazzavillan et al. (1998), Barinci and Chéron (2001), Zhao (2013), and others. A distinctive feature of these models is that the economy is populated by two classes of agents: workers and capitalists. Workers work in each period; capitalists do not work at all. Workers face a binding cash-in-advance constraint that reflects the difficulty they have in borrowing against labor income. Capitalists do not face any borrowing constraint, because capital is accepted as collateral to secure a loan. The assumption that capitalists discount the future less than workers implies that capitalists will end up owning the entire capital stock and they will never become credit constrained. Conversely, workers save only in the form of money balances and are never able to borrow against future labor income. As a result, there is no reallocation effect of the credit constraint, a central point for generating indeterminacy in our model as we show below.

Another body of literature investigates how indeterminacy can arise from imperfections in the credit market. This idea was first suggested by Azariadis and Smith (1996, 1998). Changes in beliefs about the credit market conditions can influence agents' current choices in such a way that the fluctuations in beliefs become self-fulfilling. If lenders are "optimistic" about credit market conditions then there is an extensive lending, a low cost of inter-mediation, and a large volume of investment. Moreover, in equilibrium, the low cost of inter-mediation

justifies the initial optimism. The exact opposite happens in the case of initial "pessimism". As a result, imperfections in the credit market create credit cycles associated with an indeterminacy of equilibrium.

A different channel through which imperfections in the credit market can create credit cycles through self-fulfilling beliefs is proposed in Kikuchi and Vachadze (2012). When the credit market is imperfect and savings are endogenous, the aggregate savings can play a dual role. On the one hand high aggregate savings imply a low marginal product of capital which negatively affects the interest rate; on the other hand they imply more investment in highly productive entrepreneurial activity which positively affects the interest rate. If the former effect is dominant, then the individual and aggregate savings complement each other.[3] Complementarity may lead to multiple equilibria and multiple steady states. The existence of multiple steady states entails global indeterminacy and endogenous fluctuations can emerge, if beliefs switch indefinitely because of waves of optimistic and pessimistic self-fulfilling expectations.

In this paper we show that, in the presence of credit market imperfection, the long run behavior of the economy can become highly sensitive to initial conditions and endogenous fluctuations may arise even without fluctuations of self-fulfilling expectations. For this purpose we consider a model closely related to the one considered in Kikuchi and Vachadze (2012). As in Kikuchi and Vachadze (2012) we assume that young agents have to make a decision on their first period savings. This assumption implies that the borrowing constraint may induce instability into the dynamics, even in the absence of increasing returns to scale in financial inter-mediation and without any cost of state verification. High savings (i.e., low first period consumption/low leisure) is individually detrimental, but contributes to the improvement of net worth of other borrowers. Under a binding borrowing constraint this means high net worth, more productive investment and higher returns on individual savings. Higher returns on savings reinforce the initial high saving (low first period consumption/low leisure) activity by individual workers. Precisely the opposite is true under initial pessimism. This is why credit reversals can take place through self-fulfilling expectations in both papers.[4]

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[2] A detailed description of the data is provided in the Appendix A.

[3] The standard definition of complementarity is that the optimal strategy of one decision-maker is increasing in the strategies of other similar decision-makers.

[4] It is clear that individual saving decisions will not generate any aggregate demand spillovers in the absence of credit market imperfection. This is so because the borrowing constraint will never bind in the absence of credit market imperfection and the interest rate would always coincide with the marginal product of capital. As a result, high aggregate saving will always create a downward pressure on the interest rate and thus discourages individual saving.