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A simple endogenous growth model of financial intermediation with multiplicity and indeterminacy☆

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ABSTRACT

This paper analyzes the role of financial intermediation in a simple endogenous growth model. The results suggest that multiple endogenous growth paths can exist in connection with various levels of financial development, due to the reciprocal externality between financial and real sectors. According to multiplicity, the growth effects of shocks on the technology of intermediation are opposite, depending on the balanced growth path. Furthermore, transitional dynamics is examined, and reveals that the high equilibrium is a saddle path, while the low-growth is locally stable. Therefore, the model presents local and global indeterminacy. These theoretical results support the large empirical literature on the relationship between financial development and growth which depicts conflicting impacts.

1. Introduction

Financial intermediation is seen as an important determinant of economic growth in a large number of studies in economic development. Higher financial development improves the collect of savings and the efficiency of capital allocation (Pagano, 1993) and ensures a better management of risk.[1] Since the works of McKinnon (1973) and Shaw (1973), which show that financial liberalization is a key factor of economic growth in developing countries, many theoretical and empirical contributions have shown that financial development may foster growth.[2] Accounting for financial factors in endogenous growth models highlights the importance of financial development as a potential source of long-run economic growth. Several papers in the literature identify different channels of transmission between financial development and economic growth. Greenwood and Jovanovic (1990), for example, show that financial institutions produce better information on firms and thus induce a more efficient allocation of capital investment which can foster economic growth. According to Bencivenga and Smith (1991), emerging financial intermediaries shift the composition of savings towards productive investments and improve the management of liquidity risks. By doing so, banks enhance the efficiency of capital allocation, which in turn increases the equilibrium growth path. Moreover, portfolio diversification and risk sharing provided by the financial intermediaries induce faster long-term growth in King and Levine (1993a) and Acemoglu and Zilibotti (1997). Finally, Pagano (1993) suggests, in a basic endogenous growth model, that the development of the financial sector may affect economic growth by three channels because: i) it can raise the proportion of funneled savings to investment; ii) it may increase the social marginal productivity of capital; and iii) it can influence the private saving rate.

Although the nexus between financial development and economic growth is well established theoretically, empirical evidences are less conclusive, and depend notably on the current level of financial or economic development. The empirical literature on the role of financial development on growth can be stratified in two main points: first, the traditional analyses in cross-section and on panel data, and second, causality studies.

The traditional approach has stressed the key importance of financial factors in economic development and growth, and generally showed that the financial sector may be a leading indicator of growth.[3] However, some authors, like Ram (1999), De Gregorio and Guidotti

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[1] Another role of financial development in economic growth process is to reduce asymmetric information, moral hazard and credit rationing problems between borrowers and lenders. See e.g., de la Fuente and Marin (1996), and Blackburn and Hung (1998).

[2] Levine (2005) surveys this literature.

[3] See King and Levine (1993b), Levine et al. (2000), Beck et al. (2000) and Rioja and Valev (2004).

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(1995) or Benhabib and Spiegel (2000) have provided opposite results and suggested a weak or negative relationship between financial development and economic growth.

As regards causality issues, since the work of Patrick (1966), highlighting two kinds of causality ("*supply-lending*" and "*demand-following*") between finance and growth, numerous studies[4] have been conducted using different methodologies, with no consensus. These studies suggest either unidirectional, bidirectional or no causality between these variables. The outcomes strongly depend on the selected countries, the period under examination and the financial development indicators used for the analysis.

These controversial results may rely on the existence of threshold effects between finance and growth, which involves a nonlinear relationship between both variables. Shen and Lee (2006) confirm this nonlinearity, using different indicators to measure banking as well as stock market development, and find that the relationship between banking development and economic growth exhibits an inverse U-shaped curve. More recently, Huang and Lin (2009) detect overwhelming evidence in support of this nonlinearity, using the dataset of Levine et al. (2000), and show that the positive effect of financial development on growth is larger in the low-income countries than in the high-income ones. Aghion et al. (2005) find that all countries should converge in growth above some critical level of financial development, and that in such countries, financial development has a positive but eventually vanishing effect on steady-state GDP. The vanishing effect of financial development is also highlighted by Arcand et al. (2012), and they suggest that there can indeed be "too much" finance in some countries. In the same vein, Cecchetti and Kharroubi (2012) conclude that there comes a point one that many developed countries passed long ago — where more credit is associated with lower economic growth.

In this paper, we try to build a theoretical model that is able to capture this nonlinear relationship and to replicate the different results obtained in the literature. We construct a simple endogenous growth model of financial intermediation to show the existence of multiple balanced growth paths (hereafter BGPs).[5] Our model is built on the fundamental assumption that households' savings must be intermediated by banks before being usable as investment by firms. As in Pagano (1993) and Roubini and Sala-I-Martin (1995), financial intermediation is described as a process which transforms one dollar of savings into $\phi < 1$ dollar available for investment. Towards the intermediation process, banks transform the flow of anonymous savings into specific loans that firms can use for financing their investment decisions. This mechanism takes account of the specificity of banks in the intermediation process: banks are able to supervise investment projects and provide "intermediation services" to firms. The assumption $\phi < 1$ represent the fact that intermediation is costly. We suppose that coefficient ϕ positively depends on the workforce employed in the financial sector.[6] The more people are employed in the financial sector, the more efficient the intermediation will be. In the final goods sector, technology is described by a constant return-to-scale production function with an aggregate capital externality, as in Romer (1986), which allows obtaining an endogenous growth path in the long-run. We assume competitive behavior in the final goods sector. In contrast, we model the financial sector as monopolistic competition between banks. Thus, each bank can profit from its market power to benefit from a margin of intermediation. Labor is competitively allocated between final goods and financial sectors, and the long-run equilibrium is simply described by the Keynes–Ramsey rule and the IS equilibrium. These two relations provide reciprocal interactions between the rate of economic growth and the workforce employed in the financial sector.

This interaction generates the possibility of two balanced growth paths in the long-run, in which the economy grows at positive rates: a high-growth BGP and a low-growth BGP. Furthermore, transitional dynamics shows that the high-growth BGP is a stable saddle path, while the low-growth BGP is locally stable. Therefore, our model presents local and global indeterminacy.[7] Local indeterminacy is associated with the existence of a continuum of equilibrium paths, which, starting from different initial conditions converges towards a given stationary BGP. This is the case of the high-growth BGP. Global indeterminacy is defined by the existence of multiple equilibrium paths starting from a given initial condition and converging towards different stationary balanced BGPs. In our model, since there is a multiplicity of BGP in the long-run, global indeterminacy arises because the high-growth BGP is locally determinate and the low-growth BGP is locally indeterminate. Thus, we cannot exclude any of them on the grounds of stability. Starting from the same initial conditions, transitional dynamics is fundamentally indeterminate: the economy can go towards the high or the low BGP, by a continuum of equilibrium paths.

The remainder of the paper is organized as follows: Section 2 presents agents' behavior and symmetric equilibrium. Section 3 describes the multiplicity of BGPs in the long-run, while Section 4 analyzes the transitional dynamic, and highlights the case for local and global indeterminacy. Section 5 concludes the paper.

2. The model

We consider a closed economy populated by three types of agents: households, firms (the productive sector) and financial intermediaries represented by banks. We assume a very stylized framework in which firms can finance investment only through bank loans and households cannot keep their savings elsewhere than in banks.

2.1. Households

In our model, households have perfect foresight and maximize the following intertemporal utility function:

$$U = \int_0^{+\infty} \exp(-\rho t) u(c_t) dt, \tag{1}$$

where $c_t > 0$ designs consumption per capita ($c_t \equiv C_t/N$, C_t is total consumption and N corresponds to population, which we suppose to be constant) and $\rho > 0$ is the subjective discount rate. In order to obtain

[4] See e.g. Demetriades and Hussein (1996) and Christopoulos and Tsionas (2004).

[5] Examples of endogenous growth models in which the financial sector generates multiple equilibria include Saint-Paul (1992), Zilibotti (1994) and Berthélemy and Varoudakis (1996). More recently, Hung (2009) also exhibits multiplicity in an overlapping generation model.

[6] Our model is close to the framework of Berthélemy and Varoudakis (1996), hereafter BV, but departs from them in following ways. First, BV model the banking sector as a static optimization problem at each period while our model assumes a complete dynamic solution, in which the intertemporal behavior of banks is considered in a monopolistic competition set-up. Second, in BV banks do not provide specific services to firms and are in Cournot–Nash equilibrium. In our model on the contrary, we adopt a standard monopolistic competition "à la Chamberlin", since each bank has a monopoly power on a market segment, according to the specificity of its relation with firms. Third, our model gives rise to two steady-states with positive economic growth on the BGP, while BV obtain one steady-state with positive growth, and two equilibria that are not economically acceptable (one BGP is unstable and is not reachable by any adjustment path, and another BGP conducts to a poverty trap in which the financial sector disappears and economic growth becomes negative in the long-run). Owing to the "replication" principle, one can exclude the negative BGP, so that their model does not exhibit multiplicity. On the contrary, in our model, multiplicity cannot be excluded on the basis of this principle. Finally, we are able to explicitly discuss transitional dynamics, while BV do not, and this transitional dynamics exhibits a great variety of paths, with a possible indeterminacy.

[7] The possibility of indeterminacy in dynamic equilibrium models has been largely explored in the literature (for a survey see, e.g. Benhabib and Farmer, 1999). The endogenous growth literature has isolated three mechanisms that can give rise to indeterminacy (Benhabib and Farmer, 1999): increasing social returns (for example, Benhabib and Farmer (1994)), monopolistic competition (e.g., Farmer and Guo, 1994), and external effects that lead to constant social returns of capital (Park and Philippopoulos, 2003; Schmitt-Grohe and Uribe, 1997). Since there are externalities that give rise to constant returns to capital in equilibrium, the present model belongs to the third strand of literature.