Costs and Benefits of the Financial Sector*

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Abstract
The financial sector allows a better allocation of capital compared to autarchy, increasing the aggregate technology and thus the income growth rate of the economy. At the same time, however, it also amplifies the business cycles through the financial accelerator which increases the volatility of income. In this paper we first present a general equilibrium model which captures both effects of the financial sector. We then parametrize the model to analyze the quantitative effects of policies aimed at reducing the income volatility caused by the financial system. Finally, we study whether limiting the size of the financial sector is welfare enhancing in the context of this model.

[PRELIMINARY AND INCOMPLETE: DO NOT QUOTE NOR CIRCULATE]

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“In the last 30 years, financial systems around the world have undergone revolutionary change. People can borrow greater amounts at cheaper rates than ever before, invest in a multitude of instruments catering to every possible profile of risk and return, and share risks with strangers from across the globe. Have these undoubted benefits come at a cost?”

Rajan (2005)

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1 Introduction

The financial crisis of 2007-2009 spurred a debate about the effects of the size of the financial sector and financial innovation on the stability of the economy and on the regulation to help prevent another crisis. One group in this debate claimed that overregulation of the financial sector would have a crippling effect on growth (Akerman, 2010). Another group focused on the large output loss that resulted from the financial crisis. This paper intends to shed light on the tradeoff between a higher growth rate and the increased volatility. In particular, we are interested in studying the effects on income growth and on income volatility of an expansion of the financial sector through a relaxation of borrowing constraints. The tradeoff arises naturally because in the short run, financial services allow a better allocation of capital, which increases the aggregate technology and the growth rate of the economy. At the same time, however, the financial sector can amplify the business cycle when a shock to productivity reduces asset prices in turn tightening borrowing constraints and further reducing output.

We first present a general equilibrium model which captures the tradeoff between income growth and income volatility caused by the financial sector. We then parametrize the model to analyze the quantitative effects on future income of financial regulations aimed at reducing the income volatility. Finally, we study the welfare effects of these policies to evaluate whether limiting the size of the financial sector might be welfare enhancing in the context of this model.

Our approach consist on developing a theoretical framework with elements from the economic development literature\(^1\) and elements from the financial sector and business cycle literature.\(^2\) In the model presented here, productivity is heterogeneous and financial markets help reallocate capital to the most productive agents in this economy, since the less productive agents lend their capital to more productive ones. If the capital markets are imperfect, on the other hand, credit constraints arise naturally because lenders cannot force borrowers to repay their debts unless the debts are secured and, as a result, the marginal product of capital in a hands of an entrepreneur exceeds the marginal product elsewhere. Because the durable assets of the economy serve as collateral for loans, borrowers’ credit limits are affected by the prices of the collateralized assets. At the same time, the prices of these assets are itself affected by the size of the credit limits. The dynamic interaction between credit limits and asset prices

\(^1\)See Banerjee and Duflo (2005), Buera and Shin (2008), Buera (2008), Matsuyama et al. (2007), and Moll (2010).

\(^2\)See Brunnermeier and Sannikov (2010), Gertler and Kiyotaki (2010), and Kiyotaki and Moore (1997) to mention a few.
amplifies and increases the persistence of productivity shocks thus raising the volatility of output.

The main point of the paper is to develop a framework to understand the interaction of the short- and long-run effects of the financial sector. This framework can be used to address positive questions like what is the net benefit of the financial sector for a given process of technological shocks. Other questions than can be address are for example the effect for growth and volatility from a policy directed to tighten or relax borrowing constraints in the economy. We are the first, to our knowledge, that make the connection between the short-run business cycle fluctuations and the long-run benefits in terms of growth in the context of the financial sector. Yet we are not alone in exploring the relationship between growth rates and the volatility of income nor the connection between the business cycle and the financial sector. In relating financial frictions and growth, probably our paper is closest to the work of Buera and Shin (2008).

The rest of the paper is organized as follows. Section 2 reviews the literature that relates the financial sector and the business cycle and discusses previous approaches to measuring the potential costs of financial crises. Section 3 describes our model of endogenous growth with a financial sector which builds upon the work of Kiyotaki (1999) and more generally on Kiyotaki and Moore (1997). Section 4 describes the parametrization and discusses the main results. Section 5 has some concluding remarks.

2 Literature

Our paper touches upon three strands of literature. The following section reviews each one. First the literature on financial intermediation and growth, second the literature on the negative spillovers of the financial sector to the economy, and third the literature on the relationship between the rate of growth and its volatility.

2.1 Financial intermediation and growth

The theoretical linkages between financial intermediation and economic growth have been explored by Townsend (1978, 1983b), Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), among others. In general the positive effect of financial intermediation on growth has to do with at least one of the following: a) providing valuable aggregation of information; b) easing borrowing constraints; c) reducing moral hazard and other informational problems by
scrutinizing investment projects; d) helping capital reallocation from low return liquid assets to high return ones; e) improving risk taking and risk sharing; or f) boosting technological innovation by identifying investment opportunities.

Evidently, the growth rate of an economy and the development of the financial sector are endogenous. One mechanism is that the financial services are costly to provide and develop only over time. Thus, a low income economy cannot afford to provide these services at the scale that a high income country can. This is the point of Townsend (1983b). In this vain, Greenwood and Jovanovic (1990) develops a model where financial development promotes growth because it allows a higher rate of return on capital while growth allows the investment in financial development.

Bencivenga and Smith (1991) considers an endogenous growth model in which the introduction of a financial sector shifts the composition of savings towards capital accumulation which, under some general conditions, leads to a higher growth rate. This result is valid even in the special case of a model without externalities in which the steady state growth rate is larger when financial intermediation is present.

Empirically, the causal relationship between the growth rate of an economy and the level of financial development is hard to test because of the endogeneity problem. Still, Kuznets (1955) noticed that the size of the financial sector (defined as banking, insurance and real estate) as a share of GDP grows steeply with per capita income. Beyond the mere correlation, several studies have tried to identify the direction of causality. Rajan and Zingales (1998) explain this correlation by arguing that a more developed financial system provides lower costs of capital to firms. Therefore, in their view, there is a causal effect from financial development to the growth rate. Using within country industry variations they identify that financial development affects growth more than the average in industries that technologically are more dependent on external financing.

2.2 Financial intermediation and the business cycle

The idea that the financial sector can be a source of economic fluctuations is not new but has been reexamined recently in light of the last global financial crisis and the recession that ensued. Keynes (1936) and Minsky are early examples of this idea.

Important examples of a more formal treatment of this idea are Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). These two papers started a long literature on the “financial accelerator” by which a fundamental shock can be amplified by the financial sector.
These papers are theories of endogenously determined credit supply in an economy and are useful to understand the mechanisms of the business cycle and how the financial system can amplify and make small technological shocks to become large and persistent. In these models, credit constraints arise because creditors cannot force debtors to repay debts unless they are secured by collateral. The first paper focuses on the costly state verification problem between creditors and debtors which gives rise to the external financing premium, i.e. the difference between the costs of internal funding via retained dividends and the costs of external funding. The second paper focuses on the level of credit in the economy is constrained by its value of the collateral which in turn depends on asset prices.

Christiano et al. (2009) study quantitatively the importance of the financial sector in explaining business cycle fluctuations by augmenting a standard monetary DSGE model to include a detailed banking sector. Their estimations suggest that financial shocks are the main determinants of economic fluctuations explaining close to half of the volatility of GDP in the US between 1981 and 2008. Their model suggest that financial intermediation turns diversifiable sources of idiosyncratic risk, into an aggregate systematic source or risk.

The recent financial crisis also spurred interest in examining the possibility of new linkages between the financial sector and the real economy. One of the new channels being explored in the literature is the informational channel through dispersed, private or heterogeneous information. In a model with heterogeneous information, La’O (2010) shows how financial frictions in the form of collateral constraints can drive business cycle fluctuations even when fundamentals remain constant in a standard real business cycle model. Another novel channel of amplification is the one explored by Brunnermeier and Sannikov (2010). In their model, amplification of shocks occurs not only through the fall in the value of collateral, but also through the increased volatility in asset prices which in turn provides incentives for households to hold precautionary cash balances and fire sales. Gertler and Kiyotaki (2010) is another recent example of a model that attempts to connect financial frictions with business cycle fluctuations. They calibrate their model and then generate a crisis experiment to show the effects on asset prices and output of an exogenous change to capital quality.

?? argue that the fragility of the financial system, and in particular of banks, is a necessary implication of the very purpose of banks of creating liquidity. Therefore, given that the banking system is necessarily fragile, then from time to time, shocks to the system will end up spilling over to the real economy. However, their mechanism of fragility is the likelihood of bank runs as proposed by Diamond and Dybvig (1983). Some authors contend that this
can’t be the mechanism of fragility (and thus of spillover) since the bank run equilibrium can be ruled out by simple government policies like deposit insurance.

In sum, several strands of literature agree on the fact that the financial system can, at times, generate and amplify business cycle fluctuations. However, there is less agreement if this source or risk and amplification is a necessary condition of the financial system. In a review article, Matsuyama et al. (2007) point to the fact that models that study financial market imperfections still have no agreed upon implications in areas like growth and development. For example, do financial market frictions create recessions or boom-and-bust cycles? Our paper examines the case where the financial system is potentially a source of risk and amplification and asks what are the costs in terms of growth of avoiding the fluctuations induced by it.

2.3 Growth and Volatility

Finally our paper touches also upon the relationship between the mean rate and the volatility of growth. The negative correlation between mean growth and the volatility of growth has been documented by Ramey and Ramey (1995). One explanation for this correlation is that it may be driven by the weight of countries that are in the early stages of development. This was shown by Acemoglu and Zilibotti and Aghion et al. (2010). Thus if we believe that volatility of output is explained to large by financial shocks, then the correlation of growth and volatility may be best explained by the stage of development of the financial sector. In other words, the relationship between financial development, growth, the volatility of growth and development need not be constant over time. In fact it is likely that in the early stages of development financial markets development will play a lesser role in development because of indivisibility of investment projects. In this stage of development, the growth and its positive correlation with its volatility are given by the riskiness of the capital accumulation process. As development progresses and financial markets deepen, the financial accelerator mechanism may play a role as seen in the Great Depression and the Great Recession.

3 The Model

We consider a endogenous growth model with the addition of the Kiyotaki and Moore (1997) model for the financial sector. We consider two types of agents, households and entrepreneurs and one source of aggregate risk from technology shocks. Both types of agents are risk averse and derive utility from consumption. To generate a wedge between households and
entrepreneurs we assume that the latter are less productive then in equilibrium they lend to entrepreneurs. The financial sector has a friction in the form of imperfect enforcement which generates a collateral constraint faced by the entrepreneurs. The consumption good is perishable and cannot be stored and the evolution of productivity follows a stochastic process which differs between households and entrepreneurs. Time is infinite and discrete.

3.1 Households

Households maximize their expected discounted utility:

$$E_0 \sum_{t=0}^{\infty} \beta^t U(C_t)$$

where $C_t$ is consumption at time $t > 0$ and $0 < \beta < 1$ is the time discount factor. Households choose their consumption as well as their physical capital holdings, $K_t$, and the lending to the entrepreneurial sector, $B_t$, which is a claim to a unit of consumption in every period in the future. The value of the lending to the entrepreneurial sector is state-dependent because it depends on the state of the economy.

Let $q_t$ be the price of a unit of effective physical capital and $q_t^b$ the price of the long term claim to consumption from the lending to the entrepreneurial sector. The representative household chooses consumption and capital subject to the following sequence of budget constraints:

$$C_t + q_t K_{t+1} + q_t^B B_{t+1} = A_t F^H(K_t) + q_t K_t + (1 + q_t^B) B_t,$$

for $t > 0$. The capital stock of households evolves according to the following law of motion:

$$K_{t+1} = (1 - \delta) K_t + I_{t+1}$$

where $\delta$ is the depreciation rate of capital.

3.2 Entrepreneurs

We assume that entrepreneurs have access to better technology than households. This reflects the idea that the financial sector, among other things, can reallocate capital to the best available projects that entrepreneurs can sample. We simplify the process of sampling projects by assuming the production function of entrepreneurs has increasing returns to scale.

Like households, entrepreneurs maximize their expected discounted utility
\[ E_0 \sum_{t=0}^{\infty} \beta^t U(C^i_t) \]

where \( C^i_t \) is the consumption of entrepreneurs and \( i \) is used to distinguish them from consumers. The period budget constraint of the entrepreneurs is the following:

\[ C^i_t + q_t K^i_{t+1} + q_t^B B^i_{t+1} = A_t F^E(K^i_t) + q_t K^i_t + (1 + q_t^B) B^i_t. \]

Like in Kiyotaki and Moore (1997), entrepreneurs face a series of collateral constraints:

\[ -q_t^B B^i_{t+1} < \iota q_t K^i_{t+1}, \]

which imply that entrepreneurs can only borrow fraction \( \iota \) of the current period value of their stock of capital. This is the mechanism by which a shock to either prices or capital stock of entrepreneurs can have effects on their borrowing capacity. In our paper we will explore the policy channel of changes in \( \iota \). This constraint arises from the monitoring problem as in Townsend (1983b) -costly state verification- but other authors have provided other microeconomic foundations.

The capital stock of entrepreneurs evolves according to the following law of motion:

\[ K^i_{t+1} = (1 - \delta) K^i_t + I^i_{t+1}, \]

where \( \delta \) is the depreciation rate of capital.

### 3.3 TFP growth, endogenous growth

We assume the evolution of technology to be an AR(1) process:

\[ \log A_{t+1} = \rho \log A_t + \varepsilon^A_{t+1} \]

with \( \varepsilon \sim N(0, \sigma^2_A) \) and i.i.d. An endogenous version of the model can be obtained by modifying the evolution of TFP to depend on the capital stock. Notice that TFP is an aggregate quantity for both entrepreneurs and households yet their productivity depends on their specific function \( F(\cdot) \).
3.4 Equilibrium

An equilibrium is defined in the standard way. An equilibrium is the sequences of state-contingent allocations \( \{C_t, C^i_t, K_t, K^i_t, B_t, B^i_t\}_{t=0}^{\infty} \) and prices \( \{q_t, q^B_t\}_{t=0}^{\infty} \) such that i) households maximize lifetime expected utility subject to their period budget constraints, ii) entrepreneurs maximize lifetime expected utility subject to their budget and collateral constraints, and iii) asset and capital markets clear:

\[
K_t + K^i_t = K^T_t,
q_t^B B_{t+1} + q^B_t B^i_{t+1} = 0,
q_t K_{t+1} + q^i_t K^i_{t+1} = 0,
\]

where \( K^T_t \) is the total capital stock at time \( t \).

The first order conditions for the households are:

\[
q_t U'(C_t) = \beta E_t \left[ (A_t + F^H(K_{t+1}) + q_{t+1}) U''(C_{t+1}) \right]
\]

\[
U'(C_t) = \beta E_t \left[ \left( \frac{1 + q^B_{t+1} - \theta}{q^B_t} \right) U'(C_{t+1}) \right]
\]

and for the entrepreneurs:

\[
q_t U'(C^i_t) = \beta E_t \left[ (A_t + F^E(K^i_{t+1}) + q_{t+1}) U''(C^i_{t+1}) \right]
\]

\[
U'(C^i_t) = \beta E_t \left[ \left( \frac{1 + q^B_{t+1} - \theta}{q^B_t} \right) U'(C^i_{t+1}) \right]
\]

3.5 Deterministic Steady State

The financial sector gives households access to the technology of the entrepreneurs with the corresponding risk of partial default. In equilibrium households lend a fraction of their capital to the entrepreneurs and the growth rate is determined by TFP in the economy.

3.6 Stochastic Steady State

[To be completed]

3.7 Comparative Statics and Dynamic

[To be completed]
4 Calibration

[To be completed: a simple simulation of the model to see graphically when a fundamental shock, i.e. a technology shock can be amplified by the financial accelerator, and the have permanent effects on the BGP after the transition period.]

4.1 Policy Experiment: Variation of $\iota$

[To be completed]

4.2 Welfare Costs

[To be completed]

5 Concluding remarks

This paper aims to shed light to the relationship between the financial sector, the volatility of output and the growth rate of the economy. We first present a general equilibrium model which captures the tradeoff between income growth and income volatility caused by the financial sector. We then parametrize the model to analyze the quantitative effects on future income of financial regulations aimed at reducing the income volatility. Finally, we study the welfare effects of these policies to evaluate whether limiting the size of the financial sector might be welfare enhancing in the context of this model.

The main point of the paper is to develop a framework to understand the interaction of the short- and long-run effects of the financial sector. Future work could hinge on computing optimal time consistent policies.

References


