Financial Deepening, Growth, and Inequality: A Structural Framework for Developing Countries

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Abstract

We develop a tractable micro-founded general equilibrium model with heterogeneous agents to analyze the economic implications of financial deepening in developing countries. We focus on three dimensions of financial deepening: reach (determined by the size of participation costs), depth (determined by the size of collateral constraints resulting from limited commitment), and efficiency (determined by the size of the interest spread due to default possibility and asymmetric information). We take the model to a micro-level data for six countries at varying degrees of economic development (Uganda, Kenya, Mozambique, Malaysia, Philippines, and Egypt). We show that different dimensions of financial deepening have a differential impact on growth and inequality. Moreover, country specific characteristics play a central role in how finance, growth, and inequality interact. Our framework provides a unified approach that allows for identifying key financial sector challenges and designing appropriate policy recommendations to address them.
1 Introduction

Financial deepening has accelerated sharply in developing countries over the past two decades, albeit from a low base. Better economic management and more effective macroeconomic and financial policies and reforms, coupled with a favorable external environment prior to the global crisis have fostered financial sector development. Since mid-1990s, developing countries experienced a rapid development of equity and bond markets, as well as banking sector with high private sector credit growth and lower interest margins and spreads (IMF, 2012). The inclusion of the financial markets has also broadened, with more people having an access for financial services. Nevertheless, financial systems in developing economies generally remain relatively shallow, suggesting considerable scope for further deepening. However, it is not clear \textit{a priori} what the implications of financial deepening on growth and inequality for those economies are.

Expanding the depth of financial markets holds the promise of increasing economic growth by providing access to capital to financially constrained economic agents. Given that the expansion of access favors the poor, financial development may improve income distribution by increasing the efficiency of capital allocation. Moreover, financial frictions, such as information and transactions costs, may disproportionately restrain the poor who lack collateral or credit history. In principle, by relaxing the credit constraints of this sort, financial deepening can help the poor and alleviate income inequality.

However, empirical evidence on the positive impact of financial deepening on growth and inequality remains controversial. Although there is a broad consensus that financial deepening is an integral part of the growth process following the work of Goldsmith (1969), McKinnon (1973), Shaw (1973), and more recently King and Levin (1993), it has not been established whether financial development brings growth.\footnote{In this line of research, financial deepening is often represented by aggregate macroeconomic variables, e.g. private credit, which are in turn affected by growth prospects. Thus, endogeneity arises.} The evidence is also not conclusive on the link between growth and income inequality. Kuznets (1955) suggested that higher growth would generate rising and eventual declining of inequality during a course of an economy’s lifetime. Paukert (1973), Lydall (1976) and Summers, Kravis and Heston (1984) provide supportive evidence to this hypothesis. However, when the possibility that growth and inequality may be jointly determined is taken into account, Barro (2000), Forbes (2000) and Lundberg and Squire (2003) find conflicting evidence to the Kuznets relation.

More generally, the empirical approaches based on regression analysis may not be entirely suitable to understand the impact of financial deepening in developing countries and to assess the effectiveness of policies in managing and promoting the process. The reason for this is
two-fold. First, a few implicit but important assumptions behind the regressions, such as linearity and stationarity, are often difficult to validate for developing economies which are naturally in transition. Moreover, data limitations (particularly at a micro-level) would perhaps not allow a purely empirical method. Second, regression analysis cannot provide much information on how financial deepening transmits to the economy and what feedback loops exist among finance, growth and inequality. As such, it is difficult if not impossible to conduct policy, counterfactual and scenario analysis using this type of work.

In this paper, we develop a tractable micro-founded general equilibrium model with several features specific to developing countries. Our model features heterogeneous agents—agents are distinguished from each other by wealth and talents, and they can choose their occupations between workers and entrepreneurs. Workers supply labor to entrepreneurs and are paid at the equilibrium wage. Entrepreneurs have access to a technology that uses capital and labor for production. In equilibrium, only talented individuals with a certain level of wealth choose to be entrepreneurs. Untalented individuals or those who are talented but wealth constrained may not be able to start a profitable business, hence they choose to be wage earners.

The model features an economy with two regimes: one with credit ("finance") and the other without ("savings only"). Individuals in savings regime cannot borrow but can make deposit in financial institutions to transfer wealth across generations (periods). We focus three dimensions of financial deepening: reach, depth and efficiency. First, individuals need to pay a financial participation cost in order to move from savings only regime to finance regime. The size of the participation cost would present the reach or inclusion of the financial markets. Second, individuals can sign financial contracts with institutions and get external credit once they are in the finance regime. However, borrowing is constrained by limited commitment, reflecting the poor contract enforceability. This imposes credit rationing where entrepreneurs have to post collateral in order to borrow. The size of collateral determines the depth of the financial market. Third, there is asymmetric information between banks and borrowers. To avoid mis-reporting, banks have to monitor which is costly. Taking the default possibility and monitoring costs into account, competitive banks charge a higher interest rate for highly leveraged firms. As more productive and poorer agents are more likely to leverage more, the higher cost of intermediation would be the source of financial market inefficiency and inequality in the model.

In our model, financial deepening impact growth and inequality through three channels:

\footnote{Increasing the breadth (range of markets and instruments) of financial systems is another dimension of financial deepening (Goyal et al., 2011). However, our model cannot capture this part of financial development. See Pesendorfer (1995) and Simsek (2013) for a discussion on the issue.}
(i) a more developed financial market allows to channel more funds to entrepreneurs and increases their output, (ii) more efficient financial contracts limits the resources wasted due to frictions and leads to growth, and (iii) more efficient allocation of funds in the financial system brings an increase in total factor productivity (TFP) because talented agents increase the scale of production which brings a higher equilibrium wage and interest rate, crowding inefficient or untalented agents out of the business. However, financial deepening could also allow relatively untalented agents to become entrepreneurs, decreasing TFP. For this reason, the impact of financial deepening on TFP and inequality are ambiguous.\(^3\)

We calibrate the model using firm-level data from 6 countries of varying degrees of economic development: 3 low-income countries (Uganda in 2005, Kenya in 2006, and Mozambique in 2006), and 3 emerging market economies (Malaysia in 2006, Philippines in 2007, and Egypt in 2007). We quantitatively explore the impact of various sources of financial deepening on income (measured by GDP) and income inequality (measured by Gini coefficient). In the model, financial deepening is considered as a decrease in financial participation cost, a relaxation of the borrowing constraint, or a decrease in the cost of intermediation to capture the increase in the reach, depth and efficiency of financial markets respectively.

We have two main results. First, we show that different dimensions of financial deepening have different implications for growth and inequality. For example, a decrease in participation cost lowers TFP and mitigates income inequality as entrepreneurs living in savings only regime get credit and workers obtain higher wages. However, relaxing collateral constraint or intermediation cost promotes TFP and increase inequality or generates Kuznets type responses. Second, the extent of which financial deepening has an impact on growth and inequality depends on the country specific characteristics. For example, Uganda’s GDP is most responsive to financial deepening along depth, rather than an increase in inclusion or intermediation—Uganda’s GDP would increase by 6% if 30% more credit are provided through a relaxation of the collateral constraint, while reducing the financial participation cost by 50% or decreasing intermediation cost to zero only marginally increases GDP by 2% and 0.8% respectively. This is because Uganda’s firms are severely constrained by collateral requirement, and hence reducing intermediation cost only benefit small number of highly leveraged firms, leaving financial sector virtually unchanged. For Malaysia, however, the major obstacle to financial development seems to be the high participation cost. Hence, in order to design effective policies, it is crucial for policymakers to identify main challenges of financial development.

\(^3\)The model focuses on growth during the transition as financial system develops. We do not intend to analyze the long-run balanced growth path or growth in the steady-state, which is mainly driven by technological progress.
This paper is closely connected to the various strands of development literature using occupation choice models. The theoretical framework is first introduced by Banerjee and Newman (1993) to capture the process of development. Lloyd-Ellis and Bernhardt (2000) extend the model to explain income inequality and the Kuznets curve. Gine and Townsend (2004) and Jeong and Townsend (2008) calibrate a variant of this structural framework to study the transition process in Thailand. Cagetti and De Nardi (2006, 2008) and DeNardi (2004) build on the framework and show that the introduction of a bequest motive generates lifetime savings profiles more consistent with data. Buera (2008), Buera, Kaboski, and Shin (2011), and Buera and Shin (2013) extend the model in several ways to study the effects of financial friction on economic development.

Our model builds on the occupation framework, but it has a couple of novel features. First, we focus on several dimensions of financial deepening. Although these dimensions are separately considered in the literature before, our paper is distinguished for providing a unified framework that can incorporate different forms of financial deepening. Second, the model features two types of financial frictions, limited commitment and asymmetric information. The effects of limited commitment are well addressed in Buera, Shin (2013) and Buera, Kaboski, Shin (2011). However, without asymmetric information, large interest rate spreads that we observe in many developing countries would not be possible to capture.

The modeling of information friction is inspired by Townsend (1979), that lenders cannot observe production results unless they do a costly state verification. This is similar to Greenwood, Sanchez, Wang (2010, 2013), where costly state verification framework is used to study the impact that financial intermediation has on economic development. However, in our model, firms are residual claimant and the credit market is perfectly competitive. Financial institutions provide a menu of contract, and each agent chooses the optimal one based on his own characteristic. In Greenwood et al. (2010, 2013), on the other hand, it is the financial institution who designs the contract for each firm to maximize its intermediation profits leaving the firms being indifferent with outside option. Also, state verification happens only for highly leveraged firms in our framework, hence firms are facing different cost of capital and might restrain themselves from borrowing more even though credit is available in the market. By contrast, in Greenwood, Sanchez, Wang (2010, 2013) verification occurs for all firms despite with different intensity.

The remainder of the paper is organized as follows. Section 2 sets out the structure of our model. Section 3 presents the data and the calibration of the model. Section 4 presents and discusses our quantitative results. Section 5 provides the concluding remarks.
2 The Model

The economy is populated by a continuum of agents of measure one. Agents are heterogeneous in terms of initial wealth $b$ and talent $z$.

We consider an overlapping generations framework. Each agent lives for two periods. In the first period, the agent makes financial participation, occupational choice, and investment decisions, taking the optimal decision in the second period as given. In the second period, the agent realizes income as wage or business profit depending on the occupation, and makes consumption and bequest decisions to maximize utility. Each agent has an offspring, whose wealth is equal to the bequest, and talent is drawn from a stochastic process. The time sub-script $t$ is omitted unless necessary.

2.1 Individuals

The agent generates utility only in the second period, through consumption and a bequest to her offspring. The utility function is Cobb-Douglas, given by

$$u(c, b') = c^{1-\omega}b'^\omega;$$

where $c$ is consumption, and $b'$ is bequest. The bequest motive transfers wealth across periods, which endogenously determines the economy’s wealth distribution. The assumption that utility is generated by bequest rather than the offspring’s utility, simplifies the analysis and captures the idea of a tradition for bequest-giving following Andreoni (1989).

In the second period, the agent maximizes (1) by choosing $c$ and $b'$ subject to the budget constraint $c + b' = W$, where $W$ denotes wealth in the second period, and depends on the initial wealth and realized first period income.

The Cobb-Douglas form implies that the optimal bequest rate is $\omega$. Hence, the utility function $u(c, b')$ is a linear function of end of period wealth $(W)$, i.e., the agent is risk neutral. This implies that maximizing expected utility is equivalent to maximizing the expected second-period wealth. Therefore, in the first period, the agent chooses financial participation, occupation and investment to maximize expected income.

In the first period, agents need to make an occupational choice decision between being a worker or an entrepreneur. Each worker supplies one unit of labor, and the income realized in the first period is equal to the equilibrium wage, $w$. The entrepreneur invests capital and labor, and obtains income through business profit.

Talent is drawn from a Pareto distribution $\mu(z)$. The offspring inherits the talent of her
parents with probability $\gamma$, otherwise, a new talent is drawn from $\mu(z)$.

The entrepreneur has access to a production technology, the productivity of which depends on the agent’s talent. The production function is,

$$f(k, l) = z(k^{\alpha}l^{1-\alpha})^{1-\nu}$$

where $1 - \nu$ is the Lucas span-of-control parameter, representing the share of output accruing to the variable factors. Out of this, a fraction $\alpha$ goes to capital, and $1 - \alpha$ goes to labor. Production exhibits diminishing returns to scale, with $\nu > 0$. Capital depreciates by $\delta$ after use.

Production fails with probability $p$, in which case output is zero and the agent is able to recover only a fraction $\eta < 1$ of installed capital, net of depreciation in the second period.

To simplify calculations, we assume workers get paid only when production is successful. Therefore, each worker earns a wage with probability $1 - p$.

All agents can make a deposit in a financial institution so as to transfer income and initial wealth to the second period for consumption and bequest. However, following Greenwood and Jovanovic (1990) and Townsend and Ueda (2006), agents need to pay a fixed cost, $\psi$, to obtain a borrowing contract from financial institutions. We assume that an agent lives in a finance regime, if the agent pays the cost $\psi$ and can thereby borrow; that an agent lives in a savings only regime, if the agent doesn’t pay $\psi$, and can thereby only save. This cost can be considered as a contractual fee, or a bargaining cost with financial institutions. Intuitively, since workers do not invest, they never demand external credit. Entrepreneurs may want to borrow in order to expand their firm scale and profits. In equilibrium, the fixed entry cost $\psi$ is more likely to exclude poor entrepreneurs from capital markets, because this amounts to a larger fraction of their initial wealth. We illustrate the structure of the borrowing contract in detail in the next section.

Note that both the wage and deposit interest rate are time-varying and determined endogenously by the labor and capital market clearing conditions. Given equilibrium wage rate $w$, and deposit interest rate $r^d$, an agent of type $(b, z)$ makes financial participation and occupation choice decisions to maximize expected income.

We solve the problem in two steps: first, the agent chooses occupation conditional on the regime she is living in; second, the agent chooses the underlying regime by comparing the expected income she can obtain in each regime. The next section presents the occupational choice problem in the saving only and finance regimes, respectively.

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4The shock to talent is interpreted as changes in market conditions that affect the profitability of individual skills as in Buera, Kaboski, and Shin, (2011).
2.1.1 Savings Only Regime

Individuals living in savings only regimes cannot borrow from financial institutions—they have to finance the project exclusively with their own resources.

In the first period, the goal of the agent is to maximize expected income. Given a certain initial wealth, maximizing expected income is equivalent to maximizing expected end-of-period wealth, $W$. Let $\pi(b, z)$ be the expected end-of-period wealth function for an entrepreneur of type $(b, z)$. Denoting variables with superscript $S$ for the savings only regime, one can write:

$$W^S = \begin{cases} (1 + r^d)b + (1 - p)w & \text{for workers} \\ \pi^S(b, z) & \text{for entrepreneurs} \end{cases}$$

(3)

where workers are paid only if production is successful, with a probability $(1 - p)$. Since agents are risk-neutral, they choose to be workers if $b + (1 - p)w > \pi^S(b, z)$, and entrepreneurs otherwise. Therefore, end of period wealth for an agent can be simply written as $W^S = \max\{b + (1 - p)w, \pi^S(b, z)\}$.

The wealth function $\pi^S(b, z)$ for entrepreneurs is obtained from the following maximization problem,

$$\pi^S(b, z) = \max_{k, l} \{(1 - p)[z(k^{\alpha}l^{1-\alpha})^{1-\nu} - w - \delta k + k] + p\eta(1 - \delta)k + (1 + r^d)(b - k)\}$$

(4)

subject to

$$k \leq b$$

(5)

With probability $1-p$, production succeeds, and the entrepreneur gets revenue $z(k^{\alpha}l^{1-\alpha})^{1-\nu} - w - \delta k$ plus $k$ working capital. With probability $p$, production fails, and the entrepreneur can only get a fraction $\eta$ of working capital. The last term in the maximization problem accounts for wealth that is not used in production. The constraint reflects the fact that the entrepreneur needs to finance capital cost through her own initial wealth.\(^5\)

2.1.2 Finance Regime

Individuals living in the finance regime have access to external credit by paying an up-front cost $\psi$. As workers have no benefit from taking external credit, they do not demand capital. Therefore, we only consider the entrepreneur’s problem in the finance regime.

We assume that the financial sector is perfectly competitive, driving the profit of inter-\(^5\)Note that the diminishing returns to scale property implies that there exists an unconstrained level of capital $\tilde{k}^S(z)$. Entrepreneurs never want to operate their firms at a scale larger than this.
mediation to zero.\textsuperscript{6}

In order to borrow, individuals need to sign a contract with a financial institution. A financial contract is characterized by three variables, \((\Phi, \Delta, \Omega)\), where \(\Phi\) is the amount of borrowing, \(\Delta\) is the value of collateral, and \(\Omega\) is the value of principal. An individual comes to a financial institution (i.e. banks), posting collateral \(\Delta\) and asking to borrow \(\Phi\). Given the requested \(\Phi\) and \(\Delta\), the institution then assesses the credit risk and the principal value, \(\Omega\), is determined by the expected zero-profit condition. For simplicity, we assume that collateral is interest bearing. Notice that our model allows banks to provide all kinds of contracts, the optimal contract chosen by the agent depends on his type \((b, z)\).

If production fails, the entrepreneur may not be able to repay the debt principal \(\Omega\). In this case, the entrepreneur defaults and the financial institution seizes the collateral \(\Delta\) and the recovered value, \(\eta(1 - \delta)k\). In equilibrium, since highly leveraged entrepreneurs default in case of production failure, they are charged with a higher lending interest rate during good times to compensate for losses in bad times.

We consider two financial frictions in the financial sector: limited commitment and asymmetric information. The former imposes credit rationing on the entrepreneurs, since they have to post collateral in order to borrow. The latter increases the borrowing rate for entrepreneurs with default possibilities. Specifically, the constraints imply the following:

**Limited commitment** In order to borrow, an entrepreneur needs to post collateral in the financial institution. Suppose an entrepreneur can borrow \(\Phi\) if an amount of collateral \(\Delta\) is posted. Suppose further that the contract enforcement is imperfect, therefore, she can abscond with a fraction of \(1/\lambda\) of the rented capital. The only punishment is that she will lose her collateral \(\Delta\). In equilibrium, entrepreneurs do not abscond only if \(\Phi/\lambda < \Delta\). Therefore, the bank is only willing to lend \(\lambda \Delta\) to the entrepreneur if \(\lambda \Delta\) units of collateral are posted. This single parameter \(\lambda \geq 1\) parsimoniously captures the degree of financial friction caused by limited commitment. A special case of \(\lambda = 1\) implies that entrepreneurs cannot borrow.

**Asymmetric information** There is asymmetric information between entrepreneurs and banks (i.e. whether the production conducted by a particular entrepreneur fails or not is only known to the entrepreneur herself). Due to limited liability, entrepreneurs have a default option when production fails. This implies that they could pay less if a production failure is reported and not discovered by banks. Banks have a monitoring technology through which they get information on the success of the project at a cost proportional to the scale of the project (denoted by \(\chi\)). If entrepreneurs are caught cheating, then banks can legally enforce

\textsuperscript{6}This assumption can be easily relaxed by adding a profit margin for intermediation.
the full repayment of the loan principal. As banks are making zero profits in equilibrium, the monitoring cost is borne by entrepreneurs when the financial contract is designed.

The bank’s optimal verification strategy closely follows Townsend (1979), which occurs if and only if the entrepreneurs report a production failure and have an incentive to default \((\eta(1 - \delta)\Phi + (1 + r^d)\Delta < \Omega)\). Intuitively, since all the borrowed funds are invested in capital, when production fails, the entrepreneur is only left with the recovered capital, \(\eta(1 - \delta)\Phi + (1 + r^d)\Delta\). If this is large enough to repay the loan, \(\Omega\), then banks have no reason to verify whether the entrepreneur is truth-telling since this will not increase their revenues.\(^7\) On the other hand, if \(\eta(1 - \delta)\Phi + (1 + r^d)\Delta < \Omega\), then due to limited liability, the entrepreneur can repay at most \(\eta(1 - \delta)\Phi + (1 + r^d)\Delta\), which is insufficient to cover the principal of the loan. As a result, default happens. Note that, in this case, entrepreneurs have the incentive to lie when production is successful. Therefore, to motivate truth-telling, financial institutions verify all the results if a production failure is reported, although some of the entrepreneurs indeed fail.

Since production fails with probability \(p\), the verification frequency for troubled firms is equal to \(p\). A direct result of this verification is to increase the cost of external funds for risky entrepreneurs. It is also worth emphasizing that banks don’t need to observe output in order to conduct the optimal verification strategy. What they need to know are the parameters \(\Phi\), \(\Delta\), and \(\Omega\), which are specified in the contract.

Although the financial contract doesn’t specify the borrowing interest rate, we can define the implied interest rate in the following way

\[
r^d = \frac{\Omega}{\Phi} - 1
\]

(6)

\(r^d\) would be potentially different for different entrepreneurs, depending on the terms of the contract.

Similarly, the leverage ratio is defined as,

\[
\lambda = \frac{\Phi}{\Delta}
\]

(7)

Due to limited commitment, there is an upper bound to the leverage ratio, \(\lambda\), and \(\bar{\lambda} \leq \lambda\). In the finance regime, the end-of-period wealth is given by

\[
W^F = \pi^F(b, z)
\]

\(^7\)Entrepreneurs in this case have no incentive to lie, because they need to honor the repayment no matter if the production fails or not.
where the superscript $F$ denotes the finance regime. The agent chooses to pay the financial participation cost when $W^F > W^S$.

Note that entrepreneurs can earn interest on their collateral. Therefore, posting collateral is essentially the same as making a deposit, except that they are allowed to borrow more than the amount of collateral. Without loss of generality, we simply assume that entrepreneurs deposit all of their wealth at the bank as collateral, and the borrowed fund, $\Phi$ is fully used in production (i.e., to purchase capital, $k$). In the case $\Phi < \Delta$, entrepreneurs self finance production, and lend the rest of money to the bank.

As stated above, $\Omega$ in the financial contract is determined by the zero-profit condition, which, in general, is a function of $\Phi$ and $\Delta$; without loss of generality, $\Phi$ and $\Delta$ correspond to capital $k$ and wealth $b - \psi$, respectively. Therefore, given $b - \psi$, the entrepreneur chooses capital $k$ and labor $l$ subject to the borrowing constraint and zero-profit condition to maximize the firm’s profit. This uniquely determines the optimal financial contract, $(k, b - \psi, \Omega(k, b - \psi))$. The only difference with the savings only regime is that the entrepreneur now can borrow, and thereby faces an additional zero profit constraint.

Hence, the entrepreneur solves the following problem,

$$
\pi^F(b, z) = \max_{k, l} \{(1 - p)[z(k^\alpha l^{1-\alpha})^{1-\nu} - \omega l] + (1 - \delta)k - \Omega + (1 + r^d)(b - \psi)]
+ p \max(0, \eta(1 - \delta)k + b - \psi - \Omega) \}
$$

subject to

$$
k \leq \lambda(b - \psi) \quad \text{(9a)}$$

$$(1 - p)\Omega + p \min(\Omega, \eta(1 - \delta)k + (1 + r^d)(b - \psi)) = (1 + r^d)k + p\chi k \cdot 1_{\{\eta(1 - \delta)k + (1 + r^d)(b - \psi) < \Omega\}} \quad \text{(9b)}$$

The second constraint, (9b) is the zero-profit condition, which determines the value of $\Omega$. The term $p\chi k \cdot 1_{\{\eta(1 - \delta)k + (1 + r^d)(b - \psi) < \Omega\}}$ in (9b) captures the verification cost. $1_{\{\eta(1 - \delta)k + (1 + r^d)(b - \psi) < \Omega\}}$ is an indicator function, which takes value 1 if $\eta(1 - \delta)k + (1 + r^d)(b - \psi) < \Omega$, and 0 otherwise.

As mentioned above, banks verify only if default is possible, thereby the verification cost,

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8 We can make this assumption for two reasons: (i) even after adding asymmetric information, more collateral would result in less costly verification, and (ii) the cost of verification depends on the amount of capital invested, i.e. on the scale of project, but not on the amount of funds borrowed.

9 For a special case: if $k < b$, the zero profit condition suggests that $\Omega$ is $(1 + r^f)k$, so that the borrowing rate facing the entrepreneur on the loan $k$ is equal to $r^f$, i.e., there is no interest rate spread. When $k$ is smaller than $b$, the entrepreneur has sufficient wealth to self-finance the project, and there is no need to borrow. In our model, we require the entrepreneur to deposit all the wealth $b$ in the financial institution, and borrow $k < b$ at the same interest rate $r^d$. So the entrepreneur still needs to sign a contract. Although the interpretation is a bit different, the result is isomorphic.
which is \( p\chi k \) in expected value terms, is incurred only when \( \eta(1 - \delta)k + (1 + r^d)(b - \psi) < \Omega \). Production succeeds with probability \( p \), in which case the entrepreneur is able to repay the principal, \( \Omega \). Hence, wealth at the end of period is \( z(k^\alpha l^{1-\alpha})^{1-\nu} - wl + (1 - \delta)k - \Omega \), plus the collateral, \( (1 + r^d)(b - \psi) \). In case of production failure, the bank can only get \( \min(\Omega, \eta(1 - \delta)k + (1 + r^d)(b - \psi)) \) due to the firm’s limited liability. The entrepreneur’s end of period wealth is given by \( \max(0, \eta(1 - \delta)k + (1 + r^d)(b - \psi) - \Omega) \).

In a high interest rate case \( (r^d > \frac{\eta(1 - \delta)\lambda}{\chi - 1} - 1) \), default would happen for highly leveraged firms. This is an intuitive result, as higher leverage leads to higher losses when production fails. Moreover, for firms that are already facing the risk of default, higher leverage increases the implied borrowing interest rate.

Note that the implied borrowing interest rate is not treated as the cost of capital by firms. The lending interest rate is the interest rate firms need to pay when production is successful. But if production fails, firms have an option to default and pay less. The cost of capital values this default option. Therefore, it should be a weighted average of the lending interest rate and the repayment during default. Financial institutions do costly state verification for all firms with default possibility. Hence, despite leverage, the cost of capital is increased by \( p\chi \) as long as firms are facing a risk of default.

In our model, asymmetric information imposes a higher cost of capital only for highly leveraged firms, which are more likely to be operated by the poor but talented entrepreneurs. This slows down the catch-up of these talented but wealth-constrained entrepreneurs as well as the growth of the economy.

### 2.1.3 Occupational Choice

The occupation map (Figure 1) is plotted according to the choice of occupation and whether this choice is constrained by wealth. We identify four categories of agents, separated by the blue solid line in the figure: unconstrained workers (region I), constrained workers (region II), constrained entrepreneurs (region III), and unconstrained entrepreneurs (region IV).

For illustration, we only focus here on the impact of reducing the participation cost, by comparing the occupation choice map in the savings only regime and the finance regime. In the model, growth occurs as the economy gradually transits to a new steady-state with larger output reflecting financial deepening.

As shown in Figure 1, there is a certain threshold level of talent (1.05), below which agents always find that working for a wage is better than operating a firm. These people are identified as unconstrained workers, meaning that their talent is so low that they never find it is optimal to become an entrepreneur. Above this talent level, the figure is further segmented into three parts. The left part refers to constrained workers. These people
could be talented, but they do not have enough wealth, so they cannot operate a firm at a profitable scale. Hence, to gain a higher income, they choose to be workers. The middle part represents entrepreneurs with sufficient wealth to operate a profitable firm but its scale is still constrained by wealth. The right part represents unconstrained entrepreneurs that, as the name implies, are not constrained by wealth, and they operate their firms at the unconstrained scale.\footnote{We could make a further distinction within the constrained entrepreneurs according to whether they default or not.}

When an agent obtains external credit, the occupation choice map is changed to the red dotted line. Clearly, the area of constrained workers shrinks, and that of unconstrained entrepreneurs increases. This implies that the agent is more likely to become an entrepreneur and operate her business at a larger scale by borrowing from the financial institution. In an extreme case, when there is no limited commitment, region II and III would disappear and all agents are either unconstrained workers or unconstrained entrepreneurs.\footnote{We use the same wage and interest rate while plotting the occupation choice map. This is to highlight the partial equilibrium result of moving an agent from autarky to a finance regime. When financial deepening allows more agents to get credit, the wage and interest rate would also change.}

Consider an economy with a highly inefficient initial distribution of wealth, where talented agents are poor but untalented agents are wealthy. As talented poor agents accumulate wealth overtime by producing and saving more\footnote{In our model, the savings rate is constant across agents because of the Cobb-Douglas form. In a model with forward looking agents, Banerjee and Moll (2010) show that talented agents save more as the marginal return on wealth is higher. A related issue is that talented agents might fall into poverty traps, a topic well addressed by Buera (2008).}, they move across regions, from being constrained workers (region II) to constrained entrepreneurs (region III), and eventually become
unconstrained (region IV). This generates growth at the aggregate level, since talented agents are more productive and, thereby, employ more capital and labor.\footnote{Financial deepening promotes growth because it accelerates this transition process. As shown in Figure I, the two red lines are on the left of two blue lines that separate region II, III, and IV. Endowing agents with external funds, allows the talented to move across regions and increases firm scale at a faster pace. Therefore, a higher output growth rate is realized in the short run. This channel is explored theoretically by Banerjee, Newman (1993) and Lloyd-Ellis, Bernhardt (2000), but with no consideration of financial deepening. Gine, Townsend (2004) and Jeong, Townsend (2008) evaluate the importance of financial deepening in terms of promoting this transition using household data from Thailand. We do not consider such an evaluation as it would require detailed household level data which is not available for a large sample of developing countries.}

Notice that our model is focused on developing economies, which are by definition in transition. The model is not useful for explaining the linkage between financial deepening and growth if the economy is already in the steady-state.\footnote{A model with external increasing returns to scale technology can shed light on this issue. See Bencivenga and Smith (1991).}

\subsection{2.2 Competitive Equilibrium}

Given an initial joint probability density distribution of wealth and talent $H_0(b, z)$, a competitive equilibrium consists of allocations $\{c_t(b, z), k_t(b, z), l_t(b, z)\}_{t=0}^{\infty}$, sequences of joint distributions of wealth and talent $\{H_t(b, z)\}_{t=1}^{\infty}$ and prices $\{r^d(t), w(t)\}_t$, such that

1). Agent of type $(b, z)$ optimally chooses the underlying regime, occupation, $c_t(b, z)$, $k_t(b, z)$, $l_t(b, z)$ to maximize utility at $t \geq 0$.

2). Capital market clears at all $t \geq 0$

$$\int \int_{(b, z) \in E(t)} k_t(b, z) H_t(b, z) db dz = \int \int_{(b, z) \in \text{Fin}(t)} b H_t(b, z) db dz - \psi \int \int_{(b, z) \in E(t)} H_t(b, z) db dz$$

where $E(t)$ is the set for all type $(b, z)$, who choose to be entrepreneurs at time $t$; $\text{Fin}(t)$ is the set for all type $(b, z)$, who are in the finance regime.

3). Labor market clears at all $t \geq 0$

$$\int \int_{(b, z) \in E(t)} l_t(b, z) H_t(b, z) db dz = \int \int_{(b, z) \in E(t)} H_t(b, z) db dz$$

4). $\{H_t(b, z)\}_{t=1}^{\infty}$ evolves according to the equilibrium mapping.

$$H_{t+1}(\tilde{b}, z) = \gamma \mu(z) db \int_z 1_{\{\nu' = \tilde{b}\}} H_t(b, z) dz + (1 - \gamma) 1_{\{\nu' = \tilde{b}\}} H_t(b, z) db dz$$

where $b'$ is the bequest for agent of type $(b, z)$.\footnote{A model with external increasing returns to scale technology can shed light on this issue. See Bencivenga and Smith (1991).}
The steady-state of the economy is defined as the invariant joint distribution of wealth and talent \( H(b, z) \),
\[
H(b, z) = \lim_{t \to \infty} H_t(b, z)
\]

3 Data and Calibration

We calibrate the model for 6 countries at various stages of economic development: 3 low-income countries (Uganda in 2005, Kenya in 2006, and Mozambique in 2006), and 3 emerging market economies (Malaysia in 2007, Philippines in 2008 and Egypt in 2007). We use two data sets from World Bank, the Enterprise Surveys which provides firm-level cross-section data and World Development Indicators (WDI) from which we obtain data on gross savings, non-performing loans, and the interest rate spread.\(^{15}\)

In general, financial deepening in low-income countries is relatively low compared to emerging economies across all dimensions—the depth, reach and efficiency of financial markets are lower as indicated by high collateral values, low share of firms with credits, and high borrowing costs. In particular, interest rate spreads are almost twice as high in emerging market economies. However, there is a significant heterogeneity among the country groups. For example, the reach of the financial system is lower in Mozambique than in Uganda and Kenya, despite a relatively low collateral and interest rate spread. In the Philippines, collateral is very high, while interest rate spreads are comparable to other emerging economies in the sample.

We use standard values from the literature for some of the parameters. The one-year depreciation is set at 0.06. Following Buera and Shin (2013), we choose the share of output going to the variable factors in the production function, \( \nu \), to be 0.21, of which the share of capital, \( \alpha \), is 0.33. The probability that the offspring inherits the talent of his parents, \( \gamma \), is assumed to be 0.106. The other parameters are estimated by matching the simulated moments to real data.

\(^{15}\)The selection of the countries is mainly driven by data availability. First and foremost, we need sufficient cross-section units to run our framework. The numbers of cross section firms in our sample are 563 for Uganda, 781 for Kenya, 599 for Mozambique, 1115 for Malaysia, 1326 for Philippines, and 996 for Egypt. Second, we consider relatively recent cases, but exclude countries with financial turbulence around the year of the survey.
Table 1. Calibration: Data, Model, and Estimated Parameters

<table>
<thead>
<tr>
<th></th>
<th>Uganda</th>
<th></th>
<th>Kenya</th>
<th></th>
<th>Mozambique</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data</td>
<td>Model</td>
<td>Parameter</td>
<td>Data</td>
<td>Model</td>
<td>Parameter</td>
</tr>
<tr>
<td>Savings (% of GDP)</td>
<td>8</td>
<td>8</td>
<td>$\omega = 0.08$</td>
<td>15.4</td>
<td>15.4</td>
<td>$\omega = 0.15$</td>
</tr>
<tr>
<td>Collateral (% of loan)</td>
<td>173</td>
<td>173</td>
<td>$\lambda = 1.58$</td>
<td>120.8</td>
<td>120.8</td>
<td>$\lambda = 1.83$</td>
</tr>
<tr>
<td>Firms with credit (%)</td>
<td>17.2</td>
<td>17.3</td>
<td>25.4</td>
<td>25.6</td>
<td>14.2</td>
<td>13.8</td>
</tr>
<tr>
<td>Non-perfor. loan (%)</td>
<td>2.3</td>
<td>2.9</td>
<td>$\psi = 0.03$</td>
<td>10.6</td>
<td>11</td>
<td>$\psi = 0.08$</td>
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<tr>
<td>Top 5% emp. share</td>
<td>53.8</td>
<td>52.9</td>
<td>$\chi = 0.85$</td>
<td>54.1</td>
<td>57</td>
<td>$\chi = 0.30$</td>
</tr>
<tr>
<td>Top 10% emp. share</td>
<td>64.2</td>
<td>64.5</td>
<td>$\eta = 0.37$</td>
<td>66.9</td>
<td>69.5</td>
<td>$\eta = 0.37$</td>
</tr>
<tr>
<td>Top 20% emp. share</td>
<td>74.6</td>
<td>74.7</td>
<td>$\rho = 0.15$</td>
<td>81</td>
<td>80.3</td>
<td>$\rho = 0.18$</td>
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<tr>
<td>Top 40% emp. share</td>
<td>86.4</td>
<td>84.7</td>
<td>$\rho = 4.8$</td>
<td>93.2</td>
<td>88.7</td>
<td>$\rho = 4.4$</td>
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<tr>
<td>Interest rate spread</td>
<td>10.9</td>
<td>10.05</td>
<td>8.5</td>
<td>8.7</td>
<td>8.2</td>
<td>8.3</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Malaysia</th>
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<th>Egypt</th>
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<tr>
<td></td>
<td>Data</td>
<td>Model</td>
<td>Parameter</td>
<td>Data</td>
<td>Model</td>
<td>Parameter</td>
</tr>
<tr>
<td>Savings (% of GDP)</td>
<td>39</td>
<td>39</td>
<td>$\omega = 0.39$</td>
<td>25.7</td>
<td>25.7</td>
<td>$\omega = 0.26$</td>
</tr>
<tr>
<td>Collateral (% of loan)</td>
<td>64.6</td>
<td>64.6</td>
<td>$\lambda = 2.56$</td>
<td>238.4</td>
<td>238.4</td>
<td>$\lambda = 1.42$</td>
</tr>
<tr>
<td>Firms with credit (%)</td>
<td>60.4</td>
<td>60.5</td>
<td>33.2</td>
<td>33.2</td>
<td>17.4</td>
<td>17.5</td>
</tr>
<tr>
<td>Non-perfor. loan (%)</td>
<td>8.5</td>
<td>7.6</td>
<td>$\psi = 0.13$</td>
<td>4.5</td>
<td>5.3</td>
<td>$\psi = 0.07$</td>
</tr>
<tr>
<td>Top 5% emp. share</td>
<td>29.5</td>
<td>34.7</td>
<td>$\chi = 0.11$</td>
<td>52.7</td>
<td>54.7</td>
<td>$\chi = 0.35$</td>
</tr>
<tr>
<td>Top 10% emp. share</td>
<td>46.3</td>
<td>47.1</td>
<td>$\eta = 0.37$</td>
<td>65.7</td>
<td>66.3</td>
<td>$\eta = 0.29$</td>
</tr>
<tr>
<td>Top 20% emp. share</td>
<td>63.5</td>
<td>61.7</td>
<td>$\rho = 0.12$</td>
<td>79</td>
<td>77.3</td>
<td>$\rho = 0.11$</td>
</tr>
<tr>
<td>Top 40% emp. share</td>
<td>84.1</td>
<td>78.6</td>
<td>$\rho = 6.8$</td>
<td>90.8</td>
<td>87.2</td>
<td>$\rho = 4.3$</td>
</tr>
<tr>
<td>Interest rate spread</td>
<td>3.3</td>
<td>5.1</td>
<td>4.3</td>
<td>4.1</td>
<td>6.1</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Each generation is interpreted as one year. We match the gross savings rate in the data and the model to estimate the optimal bequest rate, $\omega$. We use the average value of collateral as a percentage of loan to calibrate the parameter $\lambda$, which captures the degree of financial friction caused by limited commitment. Financial participation cost, $\psi$, intermediation cost, $\chi$, recovery rate, $\eta$, the probability of failure, $\rho$ and the parameter governing talent distribution, $\rho$ are jointly estimated to match the moments of the percent of firms with a line of credit, non-performing loans as a percentage of total loans, interest rate spreads, and the employment share distribution (using four brackets of employment share—top 5% / 10% / 20% / 40%).\(^{16}\)

\(^{16}\)The model performs well in terms of capturing the movements in macroeconomic variables. There are
The linkages between different characteristics of an economy and financial development are complex. For example, it might seem surprising at first that the calibrated financial participation cost, $\psi$, in general, is lower in low-income countries despite the lower financial inclusion ratio. However, both $\lambda$ and $\chi$ affect the financial inclusion ratio in the model—a higher $\lambda$ and lower $\chi$ increases the participation cost in emerging market countries. Moreover, these countries have higher saving rates (higher $\omega$), which implies that agents transfer more wealth to the next generation. In this case, the financial participation cost is a relatively smaller proportion of the agents’ wealth in emerging market countries, and, therefore, less binding, as is reflected in the high financial inclusion ratio. In the next section, we analyze the implications of financial development on the economy and identify the role that country characteristics play in the process.

4 Evaluation of Financial Deepening

As mentioned before, financial deepening is reflected by three parameters in our model. The financial participation cost, $\psi$, directly measures the difficulty of getting credit; thereby an increase in the ratio reflects a broadening of financial inclusion. The parameter $\lambda$ in the borrowing constraint coincides directly with the maximum leverage ratio, an increase in which reflects an increase in financial depth. Finally, a decrease in the cost of state verification, $\chi$, indicates an increase in the "efficiency" of financial intermediation.

This section analyzes the economic implications of financial deepening across all these three dimensions for the countries in our sample. Specifically, we focus on the changes in the steady states of the economy when these financial factors change. Figures 2-7 present the simulation results when each of the three financial factor changes (on the horizontal axis). For all the following experiments, GDP is calculated by summing up the income of all individuals; TFP is defined as the average entrepreneurs’ talent weighted by their respective output. We use circles to point out the position of countries in the survey dates.

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17 In our model, the percent of firms with credit is endogenous and is affected by the three parameters above.
18 See Appendix for the transitional dynamics.
4.1 Increase in financial inclusion

Figures 2-3 present the impact of a decline in the financial participation cost $\psi$ from 0.15 to 0. Following this, GDP increases for two reasons. First, a lower financial participation cost enables more firms to have access to credit, leading to more capital invested in production. This is the capital deepening story. Second, less funds are wasted in unproductive contract negotiation and, hence, firms can invest more capital in production. However, aggregate TFP declines, implying efficiency losses in the allocation of capital.

The interest rate spread is very stable when $\psi$ is high, but eventually decreases in some countries (Uganda, Mozambique, and Philippines) and increases slightly in others (e.g. in Kenya and Malaysia). This is because a decrease in $\psi$ has two countervailing effects on interest rates in the model. On the one hand, it has a wealth effect which makes all entrepreneurs richer, since they need to pay less to get credit. Entrepreneurs tend to deleverage when they become wealthy, which results in a lower average interest rate spread. On the other hand, a smaller $\psi$ enables some of the constrained workers to become entrepreneurs. These entrepreneurs are severely wealth constrained and therefore choose a very high leverage ratio, which drives up the average interest rate spread. Nevertheless, these two effects are significant only when $\psi$ is small enough. The first effect dominates the second effect if there exist tight borrowing constraints which discourage constrained workers from becoming highly leveraged entrepreneurs—the share of non-performing loans declines.

As financial market develops, income inequality (Gini coefficient in our calibration) first increases and then decreases in low-income countries, consistent with the Kuznets’ hypothesis. When $\psi$ decreases from a particularly high value, it only enables a very small number of constrained workers to become entrepreneurs. In fact, Figure 2 shows that percent of firms with credit are almost unchanged for high values of $\psi$. However, the effect on the incumbent entrepreneurs is large since it reduces their contracting cost, allowing them to invest more capital in production. These entrepreneurs make more profits, which leads to higher income inequality. If $\psi$ decreases further (all the way to zero), it becomes beneficial for constrained workers and entrepreneurs without credit to obtain credit. This enables the relatively poorer agents to earn more income, driving down the Gini coefficient.

By contrast, in emerging markets, the Kuznets’ pattern is not observed. The reason for this is that at $\psi = 0.15$, financial markets in these economies are already highly developed compared to the low-income cases; in other words, emerging market economies are already in the second stage of development. A decrease in $\psi$ unambiguously leads to a lower Gini

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\[\text{As reflected in Figures 2-3 , at } \psi = 0.15, \text{ the percent of firms with credit is about 50\% in Malaysia while it is close to zero in Uganda, for example. The position of Uganda (identified by the blue solid line in Figure 2) indicates that in 2006, Uganda was about to move from the initial stage of development (in Kuznets' stage).}\]
coefficient in emerging market economies—since $\psi$ is a fixed cost; a decrease in $\psi$ obviously benefits poor entrepreneurs disproportionately as this constitutes a larger proportion of their wealth.

4.2 Increase in financial depth

In Figures 4-5, we vary the credit constraint parameter $\lambda$ from 1 to 3 to reflect an increase in financial depth. Following the relaxation of the borrowing constraint, aggregate GDP increases in all countries. However, the responsiveness of output in this case is highly dependent on the saving rates. In low-income countries, GDP is typically more responsive as agents’ production relies heavily on external financing due to small transfers across periods (low savings rates). This seems to suggest that credit constraints are one of the major obstacles to economic development for low-income countries in our sample. Philippines’ GDP also responds well to the increase in financial depth, however, the reason for this is different than in the low-income cases. In the Philippines, financial reach is moderate, but interest spreads are low and saving rates are high. Therefore, the decline in the collateral requirement unlocks financial resources, leading to a significant increase in GDP.
As $\lambda$ declines, TFP increases, implying a more efficient resource allocation across firms. A relaxation of the borrowing constraint benefits talented entrepreneurs more as they often desire to operate firms at a larger scale than untalented entrepreneurs. Relaxing the borrowing constraint allows all entrepreneurs to borrow more, but, on average, untalented ones do not borrow as much because their small maximum business scale may have already been achieved. As a result, more talented entrepreneurs expand business scales, driving up TFP in the finance regime.\textsuperscript{20}

The interest rate spread starts at zero when $\lambda$ is low, because firms’ leverage is low — no default happens even when production fails. As $\lambda$ increases above a threshold, agents leverage more, the share of non-performing loans increases, and the interest rate spread starts increasing in both low-income and emerging market countries. Note that, in general, low-income countries have higher interest rate spreads at the start than emerging market countries due to high intermediation costs.

In the case of an expansion in financial depth, we observe the Kuznets pattern for low-income countries. As $\lambda$ increases, talented entrepreneurs can leverage more and increase their profits, which drives up the Gini coefficient. In low-income countries, the savings rate

\textsuperscript{20}There is a general equilibrium effect on TFP as higher interest rates and wages resulting from credit expansion crowds out marginal entrepreneurs. But this effect is of second-order.
is small, therefore external credit is limited and the interest rate is more responsive to the easier borrowing constraints. When $\lambda$ becomes larger, the sharp increase in the interest rate shrinks entrepreneurs’ profits, leading to a lower Gini coefficient.

The financial inclusion ratio increases as relaxing the borrowing constraint provides more external credit to entrepreneurs once they pay the participation cost. This induces more entrepreneurs to join the financial regime. The fraction of entrepreneurs falls because the increase in the interest rate and wages forces marginal entrepreneurs out of businesses, making the firm size distribution more skewed.

### 4.3 Increase in intermediation efficiency

In Figures 6-7, we vary the financial intermediation cost $\chi$ from 1.2 to 0 to reflect deepening from an intermediation efficiency angle.$^{21}$ When $\chi$ decreases, the response of GDP varies across countries. In some countries (Uganda, Mozambique and Egypt), GDP is not responsive as lower intermediation costs only benefit the highly leveraged firms which are few (due to the low financial inclusion ratio and tight borrowing constraints).

$^{21}$The actual intermediation cost is $p\chi$ as stated in Equation 9b.
Figure 5: Comparative Statics: Collateral Constraint—Emerging Market Countries

TPF increases (but only slightly) as the lower intermediation cost facilitates the allocation of capital to efficient entrepreneurs. The interest rate monotonically decreases in Kenya and Malaysia, but displays an inverted V-curve in other countries. Two opposing forces are in effect here: first, the decline in the cost of borrowing induces entrepreneurs to leverage more because it reduces the cost of capital for risky firms, and the share of non-performing loans increase. This tends to increase the endogenous interest rate spread. Second, it decreases the interest spread which is a direct function of the intermediation cost. Whether the interest rate spread increases or decreases depends on which effect dominates.

The Gini coefficient increases as efficient intermediation disproportionately benefits highly leveraged firms (who are already making more income than workers). The general equilibrium effects on wages and the interest rate also force some marginal entrepreneurs out of business, resulting in a decrease in the fraction of entrepreneurs. Similarly, lower intermediation cost induces more agents to borrow, hence increasing the percent of firms with credit.

4.4 Impact on Growth and Inequality: A numerical comparison

Figures 2-7 show that the economic implications of financial deepening depend on its source. In this section, we zoom in on the numerical comparison of the responses of GDP, TFP
Figure 6: Comparative Statics: Intermediation Cost—Low-income Countries

Figure 7: Comparative Statics: Intermediation Cost—Emerging Market Countries
and inequality to different sources of financial deepening. The numbers in the Table 2-3 are calculated as differences between the current state of the country (shown with a circle in the graphs) and the eventual steady-state values.

Interestingly, although financial deepening brings about growth in all cases, its impact on TFP and inequality varies. For example, easing the borrowing constraint has a substantial positive impact on Uganda’s GDP and TFP, yet income inequality increases after deepening as explained in Section 4. This may shed some light on the conflicting empirical findings on the growth and inequality nexus.

Moreover, in line with the discussion above, the numbers highlight that the form of financial development and country characteristics matters in how economies respond to financial deepening. For example, a lower financial participation cost (intermediation cost) leads to lower (higher) TFP and inequality in all countries in our sample, while a relaxation of the borrowing constraint has sometimes a positive (Uganda, Mozambique, Malaysia) and sometimes a negative effect on inequality.

Table 2. The Impact of Financial Deepening on Income and TFP (in percent)

<table>
<thead>
<tr>
<th>Participation cost $\psi$</th>
<th>Borrowing constraint $\lambda$</th>
<th>Intermediation cost $\chi$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GDP</td>
<td>TFP</td>
</tr>
<tr>
<td>Uganda</td>
<td>5.83</td>
<td>-8.77</td>
</tr>
<tr>
<td>Kenya</td>
<td>5.05</td>
<td>-12.80</td>
</tr>
<tr>
<td>Mozambique</td>
<td>13.14</td>
<td>-10.66</td>
</tr>
<tr>
<td>Malaysia</td>
<td>8.74</td>
<td>3.07</td>
</tr>
<tr>
<td>Philippines</td>
<td>2.23</td>
<td>-6.94</td>
</tr>
<tr>
<td>Egypt</td>
<td>7.91</td>
<td>-12.42</td>
</tr>
</tbody>
</table>

Table 3. The Impact of Financial Deepening on Inequality (in percent)

<table>
<thead>
<tr>
<th></th>
<th>decrease $\psi$ to 0</th>
<th>increase $\lambda$ to 3</th>
<th>decrease $\chi$ to 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uganda</td>
<td>-8.24</td>
<td>0.27</td>
<td>0.53</td>
</tr>
<tr>
<td>Kenya</td>
<td>-10.25</td>
<td>-5.12</td>
<td>2.05</td>
</tr>
<tr>
<td>Mozambique</td>
<td>-13.4</td>
<td>4.95</td>
<td>0.58</td>
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<td>Malaysia</td>
<td>-23.73</td>
<td>5.08</td>
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<td>Philippines</td>
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<td>0.79</td>
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<tr>
<td>Egypt</td>
<td>-5.27</td>
<td>-7.89</td>
<td>1.05</td>
</tr>
</tbody>
</table>
5 Conclusion

We develop a tractable micro-founded general equilibrium model with heterogeneous agents to analyze the economic implications of financial deepening in developing countries. We focus on three dimensions of financial deepening: reach (measured by the size of participation costs), depth (measured by the size of collateral constraints resulting from limited commitment), and efficiency (measured by the size of the interest spread reflecting default possibility and asymmetric information).

With analytical and numerical methods, we calibrate the model for six countries at varying degrees of economic development (Uganda, Kenya, Mozambique, Malaysia, Philippines, Egypt). We show that different dimensions of financial deepening have a differential impact on GDP growth and inequality. Moreover, country specific characteristics play a central role in how finance, growth, and inequality interact.

Our framework allows us to identify the major factors that limit financial deepening and growth in a particular country, and to run policy scenarios to assess the implications of financial development. The framework, therefore, could suggest directions for policy action and provide a tool for informed policy-making in terms of both the design and implementation of financial sector policies.
A Financial Deepening and Economic Transition

In this appendix we show the transitional dynamics after a deepening of financial systems. Starting at year 0, we linearly decrease $\psi$ and $\chi$ by 50%, and increase $\lambda$ by 30% linearly over 10 years in Figure 8-13. The figures have the same interpretation as presented in Section 4. However, they also provide some information on the time dimension of financial deepening.

Figure 8: Transitional Dynamics: Participation Cost—Low-income Countries
Figure 9: Transitional Dynamics: Participation Cost—Emerging Market Countries

Figure 10: Transitional dynamics: Collateral constraint—Low-income countries
Figure 11: Transitional dynamics: Collateral constraint—Emerging market countries

Figure 12: Transitional Dynamics: Intermediation Cost—Low-income Countries
References


