How Does Capital Control Spur Economic Growth?*

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Abstract

We provide a conceptual and empirical framework for evaluating the effect of capital controls on long-term economic growth. In a small open economy which relies on successful investment projects to provide capital goods, borrowing short-term loans has two contradictory impacts: it reduces the interest costs of financing investment projects, but leads to larger asset losses in the scenario of short-term debt run. We show that private financing decisions made by domestic investors are distorted towards excessive risk-taking, leading to ineffective capital formation. Thus, capital control policies, particularly, regulations on short-term loans, can be socially beneficial as they alter the debt composition, promote capital formation, and achieve a higher output level. Finally, using a panel dataset covering 80 countries from 1995 to 2009, we employ a system GMM estimator to sequentially test three hypotheses and find strong empirical evidence that supports our theory.

Keywords: Capital controls; Capital flow composition; Short-term debt run; Economic growth

JEL Classification: F43; O24; O16

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1 Introduction

The 2007-2009 global financial crisis has triggered a hot debate among economists on the use of capital controls as an important policy instrument to alleviate external shocks. For example, the IMF has evaluated its opinion on capital control policies. Dating back to the 1997-1998 East Asian financial crisis, the IMF offered bailout to Asian countries conditional on further capital account liberalization in the receiving country, because it believed that capital mobility could reduce economic distortions, strengthen economic fundamentals, and further promote economic growth. However, after the global financial crisis, the IMF no longer promotes free capital account convertibility for most countries, especially developing countries. Instead, the IMF suggests the use of capital control with caution, since it realizes that capital controls can limit the contagion of financial crisis from one country to another and mitigate potential large negative effects of financial crises on economic growth, such as financial amplification effects (IMF, 2011). [1]

Literature on either capital controls or economic growth is numerous, yet the impact of capital controls on economic growth is far from conclusive, as this linkage is rather complicated and is difficult to clearly identify.

On one side, several papers found a positive relation between capital controls and economic growth. For instance, Alesina et al. (1994) found that capital controls had positive but insignificant effects on economic growth in OECD countries, and Grilli and Milesi-Ferretti (1995) obtained a similar result for developing countries. Rodrik (1998) found that capital account openness generated no obvious benefit on long run growth, which attracted considerable attention among policy makers. Further, Rodrik and Velasco (1999) developed a two-lender three-period small open economy model to show that short-term debt exposure is associated with financial crises, which suggests that regulating short-term capital flows can be beneficial. Eichengreen and Leblang (2003) showed that capital controls serve to insulate economies from international crises and result in faster growth.

On the other side, some studies hold a more traditional view to argue that capital controls distort the economy and impede economic growth. Chanda (2005) argued that, for countries with relatively higher degrees of ethnic heterogeneity, the effects of capital controls are particularly adverse for economic growth, whereas for countries with high degrees of homogeneity, capital controls actually have a net positive effect on economic growth. Satyanath and Berger (2007) reported that capital controls negatively affect growth in authoritarian countries, while growth in democratic countries is insignificantly affected. A related strand of literature considers the opposite of capital controls – financial integration and investigates how financial integration affect growth. Many studies,

[1] See Krugman (1999) and Aghion et al. (2004) for more discussions on financial amplification.

including Kraay (1998), Reisen and Soto (2001), Edison et al. (2002), Ang and McKibbin (2007), Schularick and Steger (2010), and Bumann et al. (2013), found positive but insignificant impact of financial integration on economic growth. Naceur et al. (2008) find that stock market liberalization has no effect on economic and investment growth. Ranciere et al. (2006) decompose the effects of financial liberalization on economic growth and on the incidence of crises and show that financial liberalization's benefit on spurring growth outweighs its cost of triggering a crisis.[2]

A major limitation of existing studies is that this large body of empirical research with contradicting results can not clearly identify the specific channel from capital control policy to growth. Our model, following the framework of Rodrik and Velasco (1999), establishes and discusses the connections between capital controls, debt structure, capital formation and economic growth. It shows that assets with different maturities have different roles in determining economic growth. Short-term debt with lower interest cost can cause debt run when the performance of projects is unexpectedly poor. Since capital investment are rather illiquid in operation, short-term debt run can trigger large asset liquidation losses. Therefore, private financing decisions made by individual market participants are distorted towards excessive risk-taking, leading to greater financial instability. In this scenario, similar to to the argument of Korinek (2011), capital control policies can be socially beneficial as they increase macroeconomics stability. Particularly in our model, restrictions on short-term debt preserve assets in investment projects and promote capital formation, and ultimately spur economic growth. We demonstrate this growth promoting role of capital control with a numerical example.

To the best of our knowledge, our model is one of the few studies that theoretically establish a relationship between capital controls and economic growth.[3] Following our theoretical framework, we move on to conduct an empirical analysis to verify how capital controls affect economic growth. In existing empirical studies, the measure of capital controls is either too coarse or too broad. The primary data of capital controls, the IMF's Annual report on exchange arrangements and exchange restrictions (AREAER), only reported country's overall capital controls status using 0/1 dummies prior to 1995. Since 1995, the IMF breaks down the simple measure to several categories according to capital flows' asset type, ownership, and direction of flows. Based on this new reporting method, Schindler (2009) first codes capital controls into sub-categories. In the empirical part of this paper, we construct a dataset that covers 80 countries for the 1995-2009 period and measures capital flows and capital controls similar to Schindler (2009). This dataset allows

[2] These studies use de facto stock of capital flows as a proxy to the measure of capital controls, which is less meaningful to policy makers. Our study focus on de jure policies on capital flows, so we are not going to extend our discussion to this strand of literature.

[3] Chanda (2005) developed a theory to show that ethnic heterogeneity plays a significant role in determining the effects of capital controls on long run growth, while Jeanne and Korinek (2011) studied the linkage between capital controls and technology, investment, and growth.

us to investigate the effect of capital controls on economic growth by testing the following three hypotheses: capital controls, such as regulations on different types of assets, alter the composition of capital flows; capital controls influence investment by determining the debt structure; and, finally, capital control policies have significant impacts on economic growth. In particular, regulations on short-term debt like bonds spur economic growth, while restrictions on long-term capital flows such as equity and FDI impede growth. These growth effects go though the following channel,

$$\text{Capital control} \rightarrow \text{debt structure} \rightarrow \text{investment} \rightarrow \text{economic growth.}$$

The rest of this paper is constructed as follows. Section 2 presents a small open economy model in which the debt structure determines the outcome of investment projects and affects output level. Section 3 calibrates our model to provide a numerical example and illustrate the role of capital controls. Section 4 presents our empirical evidences. And Section 5 concludes.

2 The Model

In order to bridge the gap between capital controls and economic growth, we extend the framework of Rodrik and Velasco (1999) to develop a two-lender three-period small open economy model in which local investors are borrowing abroad to finance investment projects. And only successful projects provide assets to accumulate capital stock. We introduce capital control as regulations on debt structure, the composition of short-term loans and long-term loans, which can affect the outcome of investment projects, thus, influencing the potential level of output.

2.1 Economic Environment

There are four types of players in our model, local investors, short-term and long-term creditors, and a benevolent domestic government.

Investors

We assume that investment decisions are made by profit-seeking local investors, who randomly draw investment projects that last for three periods: 0 (the planning period), 1 (the short-term), and 2 (the long-term).

For a project i to be worth investing, the expected profit has to be positive,

$$E[\pi_i] - C \geqslant 0, \tag{1}$$

where $E[\pi_i]$ represents the expected profit, and $C \geqslant 0$ is an entry cost to access the international capital market. Any regulations in the finance market might cause this market entry cost to rise.

Investment Projects

Each project initially costs K units of capital in period 0 and yields return in period 2. Prior to period 2, assets of these projects are assumed to be illiquid. If an amount of L has to be "liquidated" in period 1, it only yields γL units, where $\gamma < 1$.

The amount of asset in project i that survives into period 2 is given by

$$I_i = K - L_i. \tag{2}$$

If $I_i > 0$, this project is considered to be successful, and yields return $r_i I_i$ to the local investor. This rate of return, r_i, is assumed to be uncertain in period 0, but can be revealed in period 1. We assume r_i satisfies

$$r_i = \mu_i + \epsilon_i, \tag{3}$$

where $\mu_i = E[r_i]$ is the expected return of this project, and ϵ_i represents a random disturbance which is determined by the secret power of nature that follows $N(0, \sigma_i)$. For the sake of simplicity, we assume μ_i is also drawn from a normal distribution $N(\mu, \sigma)$.

Creditors

In the international financial market, foreign creditors are willing to lend two types of loans with different maturities: short-term (S) loans that last one period, and long-term (L) loans that last two periods. This categorization of loans by maturity is somehow conceptual, as they correspond to several different types of assets in the financial market. The short-term assets should be liquid and bear very limited risk, such as treasury bills, short-term bank loan, and other money market securities. Many other types of assets, which are not subject to frequent rollover, and not sensitive to short-term risks, are considered to be long-term loans, including equity, foreign direct investment, long-term private bond, and some other long-term liabilities. Therefore, our long-term loans are relatively more flexible to investors.

We use R_L to represent the return to long-term loans over two periods, from period 0 to period 2, while R_S represents the return to short-term loans over only one period, from period 0 to 1 or from period 1 to 2, respectively.

The short-term loans are assumed to be risk free. In order to achieve this target, for each project i, the short-term lenders have to follow the investment project closely to observe the actual outcome r_i as soon as it is revealed in period 1. As a result, the short-term lenders can take this new information into account to decide whether they will issue new loans to the investors, or not. If the short-term creditors choose not to roll over the short-term loan in period 1, we say that a "run" on short-term debt has taken place.[4] As a result, the investor has to sell assets to repay the matured short-term loans.

The long-term creditors, on the contrary, have limited access to project-specific information, as they are only aware of some country-specific default risk $P_L > 0$.[5] Their expected return can be equal or greater than the world interest rate $R_L(1-P_L) \geqslant R_S^2$, thus,

$$R_L \geqslant \frac{R_S^2}{1-P_L} > R_S^2, \tag{4}$$

which is taken as exogenous.

Suppose that in period 0 the investor borrow a short-term loan D, $D \leqslant K$. Thus, the rest $K - D$ is borrowed in terms of long-term loan. If the observed investment return is less than the total debt payment, the short-term creditors will choose to take their money back and walk away in period 1, as they are afraid of any potential losses. Therefore, the return r_i that causes short-term debt run satisfies

$$r_i < R_L - \left(R_L - R_S^2\right)\frac{D}{K} \equiv \tau. \tag{5}$$

The probability of short-term debt run for project i satisfies $p_i = Prob(r_i < \tau)$.

Given K, equation (5) shows that as D increases, τ decreases, thus p_i decreases, meaning that borrowing short-term loans can be beneficial as it reduces the probability of short-term debt run. However, we should note that the higher the share of short-term loans, the less the assets that would be left in the scenario of short-term debt run, as shown by equation (2).

Because the assets of project i are illiquid in period 1, in order to get full insurance, payment on short-term loans has to satisfy $R_S D \leqslant \gamma K$, thus, the maximum amount of short-term loans issued in period 0 is given by

$$D_{max} = \frac{\gamma K}{R_S} < K. \tag{6}$$

[4] The short-term debt run, taken from Rodrik and Velasco (1999), refers to a crisis of short-term debt rollover in which all short-term creditors of an investment project decide to leave .

[5] The long-term creditors can be financial institutions, they don't care about the specific investment project, but the average risk of default in the market.

Production and Capital Stock

We consider a very simple production structure that primarily relies on capital inputs

$$Y = A \cdot Z, \tag{7}$$

where A is a technology index, and Z is the capital stock which is determined by the outcome of investment projects

$$Z = \sum_{0<i\leqslant N} I_i, \tag{8}$$

where I_i is the final capital formation from project i, $I_i \geqslant 0$.

Government

The benevolent domestic government intends to maximize the total output of this economy. According to the production function, it is equivalent to maximize expected capital stock.

For any project that does not suffer from short-term debt run, it contributes K units of capital goods to the capital stock. However, when the short-term debt run takes place, the short-term loan creditors claim $\frac{R_S D}{\gamma}$ from the project, thus only $K - \frac{R_S D}{\gamma}$ units of capital can survive and be successfully installed to the capital stock. Hence, the key to achieve a better outcome is to avoid the potential loss of early repayment caused by borrowing short-term loans.

There are several policy options for the government. For example, a simple suspension of payments that preserves these assets in the investment project makes the government better off. However, lenders are wary of such responses and they are likely to suspect the investment project attempts to default. An alternative policy response is to use capital control policies to regulate the access to different types of loans in the financial market which would influence the composition of loans that investors can borrow. If capital control policy intervene the financial market by restricting borrowing short-term loans, it will allow more assets to survive into the long-term, and encourage capital formation.

Capital control policy, however, also has disadvantages. Since short-term loans are usually cheaper than long-term loans, regulations on borrowing short-term loans cause interest payment to rise, leading to a higher probability of short-term debt run. In addition, capital controls induce market distortions, which create difficulties to local investors to borrow abroad. As a result, accessing the international financial market becomes more expensive, thus some investment projects become unprofitable to be carried out, which reduces the capital stock formation.

2.2 The Competitive Equilibrium

We start with a market with no capital control policy as a benchmark scenario. The local investors take interests as given, $R_L > R_S^2$, to maximize expected investment revenue

$$\max_{D_i} \pi_i = \int_{\tau}^{\infty} \left[r_i K - R_S^2 D_i - R_L \left(K - D_i \right) \right] f_i(r_i) dr_i.$$

The first-order condition is given by

$$\frac{\partial \pi_i}{\partial D_i} = (R_L - R_S^2) K > 0, \tag{9}$$

which implies that the optimal decision is to borrow short-term loans as much as possible, because borrowing short-term loans reduces interest costs. Therefore, we have $D_i = D_{max}$, and investor i will borrow $K - D_{max}$ in terms of long-term loans. One thing worth noting is that, with $D_i = D_{max}$, there is nothing left to the long-term creditors and to the accumulation of capital stock, if the short-term lenders choose to "run".

The threshold of short-term debt run in such a competitive equilibrium is given by

$$\tau^C = (R_S - \gamma) \frac{R_L}{R_S} + R_S \gamma. \tag{10}$$

If the realized return r_i is higher than τ^C, the investor can collect profit from this project. The expected profit is

$$E\left[\pi_i^C\right] - C = \int_{\tau^C}^{\infty} \left(r_i - \tau^C \right) K f_i(r_i) dr_i - C. \tag{11}$$

Let $p_i^C = Prob(r_i < \tau^C)$, the expected capital accumulation from project i is given by

$$E\left[I_i^C\right] = (1 - p_i^C) K. \tag{12}$$

This competitive equilibrium establishes a benchmark for the following evaluation of capital control policy.

2.3 Capital Controls

As we have shown that different economic agents have inconsistent incentives, the competitive equilibrium chosen by domestic investors might not be satisfactory to a benevolent government who intends to maximize the potential output in the home country. As we have shown that borrowing short-term debt makes domestic economy fragile to the short-term debt run, government can choose to adopt capital control policies in order to achieve a better outcome. For example, the government can simply impose a quota on borrowing short-term loans, $D^Q < D_{\max}$.[6]

We can define $d = 1 - \frac{D^Q}{D^C}$ to measure the strength of capital control, $d \in [0,\ 1]$. Thus, we have

$$D^Q = (1-d)D^C. \tag{13}$$

For $d = 0$, there is no capital control (0%), we have $D^Q = D^C$; For $d = 1$, there is complete capital control (100%) that no short-term debt borrowing is allowed, $D^Q = 0$.

In order to impose capital controls d, the government has to spend effort $e(d)$ on regulating the financial market, $e'(d) \geqslant 0$, $e(0) = 0$, and $e(1) = \infty$. These regulations distort the operation of the financial market, causing the entry cost of borrowing, C, to rise. Thus, we assume $C'(e) \geqslant 0$, $C(0) \geqslant 0$.

Because of this short-term debt quota, the local investors can only borrow D^Q as short-term debt, thus, $D_i = D^Q$. The new boundary return of short-term debt run is given by

$$\tau^Q = R_L - (R_L - R_S^2)\frac{D^Q}{K} > \tau^C. \tag{14}$$

Let $p_i^Q = Prob(r_i < \tau^Q)$. For any investment project i, it implies that $p_i^Q > p_i^C$. Thus, an immediate consequence of capital control using short-term debt quota is that the probability of short-term debt run is higher than the probability in the competitive equilibrium.

The expected capital accumulation from project i with capital control is given by

$$E\left[I_i^Q\right] = K - p_i^Q \frac{R_S D^Q}{\gamma}. \tag{15}$$

We have $E\left[I_i^Q\right] > E\left[I_i^C\right]$ if and only if $\frac{p_i^C}{p_i^Q} > \frac{R_S D^Q}{\gamma K}$, which provides a condition that capital control promotes capital formation.

Proposition 1. *For any project i, there exists a set B_i. For $D^Q \in B_i$, $E\left[I_i^Q\right] > E\left[I_i^C\right]$.*

Proof. The necessary and sufficient condition for $E\left[I_i^Q\right] > E\left[I_i^C\right]$ is given by $\frac{p_i^C}{p_i^Q} > \frac{R_S D^Q}{\gamma K}$. Functions on both sides are continuous differentiable and monotonically decrease as D^Q decreases. Since $\frac{p_i^C}{p_i^Q} \in (\frac{p_C}{\int_{-\infty}^{R_L} f_i(r_i)dr_i}, 1]$, $\frac{R_S D^Q}{\gamma K} \in [0,1]$, there exists D^Q satisfies that $\frac{p_i^C}{p_i^Q} > \frac{R_S D^Q}{\gamma K}$. $\square$

Proposition 2. *B_i is not empty, $B_i \neq \emptyset$, because $0 \in B_i$.*

[6] A quota on capital flows is quantity-based capital controls, while imposing Tobin taxes on capital flows is price-based capital controls. Korinek (2011) argues that if the recipients of capital flows differ mostly in profitability, then price-based controls are desirable since they allow the market to allocate the most capital to the most profitable agents, while recipients differ mostly in riskiness, then quantity controls such as limits on leverage may be optimal since they prevent excessive risk-taking. We also impose Tobin tax on capital flows and calibrate the model. The result supports Korinek's (2011) argument.

Proof. If $D^Q = 0$, $\frac{p_i^C}{p_i^B} > p_i^C > 0$, $\frac{R_S D^Q}{\gamma K} = 0$, thus $\frac{p_i^C}{p_i^Q} > \frac{R_S D^Q}{\gamma K}$, and $E\left[I_i^Q\right] > E\left[I_i^C\right]$. Therefore, $0 \in B_i$. □

Propositions 1 and 2 show that imposing a quota on borrowing short-term debt as a capital control instrument can improve the capital formation in any operating investment projects. Then, we move on to evaluate the overall capital accumulation in the economy. We can show that if the entry cost is fixed at zero, complete capital control maximizes the aggregate capital formation to reach the maximum level of capital stock at K.

Proposition 3. *If the entry fee of borrowing is fixed at zero, $C = 0$, in order to maximize social benefit, the optimal borrowing quota on short-term debt is zero, $D^Q = 0$. Thus, the probability of short-term debt run is zero, and the level of capital stock is K.*

Proof. The expected profit of project i is given by

$$\int_{\tau^Q}^{\infty} \left[r_i K - R_S^2 D^Q - R_L \left(K - D^Q\right)\right] f_i(r_i) dr_i - C > 0,$$

which is always satisfied with $C = 0$. Therefore, all investment projects are profitable. According to equation (15), the maximum capital accumulation can be achieved if and only if $p_i^Q = 0$. Therefore, we should have $D^Q = 0$, meaning that investors can only borrow long-term loans. If $D^Q = 0$, borrowing short-term loans is banned, investors can only borrow from long-term lenders. Thus, the short-term debt run is impossible to happen. The capital formation from investment projects is given by

$$I_i^Q|_{D^Q=0} = K.$$

□

Unfortunately, the result of proposition 3 can be invalid with positive entry costs under capital control. If the borrowing cost from the financial market is positive for any given regulation effort, i.e. $C(e) > 0$ with $e > 0$, the return of a profitable project satisfies

$$\int_{\tau^Q}^{\infty} (r_i - \tau^Q) f_i(r_i) dr_i > C(e). \tag{16}$$

For a government that intends to increase capital control intensity and spends a higher effort e', $e' > e$. We have $\tau^Q(e') > \tau^Q(e)$, and $C(e') \geqslant C(e)$, thus less investment projects remain profitable. Therefore, there is a trade-off between the profitability of projects and the intensity of capital control. Since this cost function continues to rise, there might exist an optimal effort e^* that maximizes the total capital formation.

3 Quantitative Relevance

In order to fully understand the implications of our model, we numerically characterize its equilibrium and illustrate the impacts of capital control policy on capital formation and output growth.

3.1 Calibration

The calibration of our model requires parameter values for μ, σ, σ_i, γ, C, R_L, R_S, and K, which we assign based on the U.S. financial market data. Table 1 summarizes the parameter assumptions in this benchmark model. We use average return of long-term government bond to represent the return of long-term loans, and the average return of treasury bills to represent the return of short-term loans. Fernandez (2015) lists that the geometric average return was about 5.5% for long-term government bond and about 3.7% for short-term treasury bills over the period of 1926-2005. Thus, R_L is set at 1.055, and R_S is set at 1.018.[7] And we normalize the size of investment projects, K, to 1.

Moreover, we use equities in the stock market to represent these investment projects. The mean return of projects is measured by the average return on total assets, which is about 9.6% from 1985 to 2014 for companies included in the S&P 500 index with a standard deviation of 9.0%. We round parameter μ to be 1.10 and parameter σ to be 0.09. Similarly, the volatility of investment projects, σ_i, is estimated to be 0.06. Parameter γ is calibrated to match the average debt/asset ratio. Since the average solvency ratio[8] is about 36% for the S&P 500 companies, we set γ to be 0.65.

Table 1: Main Parameters

Parameter	μ	σ	σ_i	γ	R_L	R_S	K
Value	1.10	0.09	0.06	0.65	1.055	1.018	1

Finally, we consider the role of the entry cost, C, in our model. If borrowing from the international financial market is costless, $C = 0$, proposition 3 implies that complete capital control would maximize the potential output, which is our first scenario. Then, we turn to consider how a positive entry fee affect our results. In Case 2, we assume this entry fee is positive and constant, therefore, as we enforce more strict capital control, the number of profitable investment projects decreases. Finally, we allow this entry cost to increase along with capital control intensity, which is denoted by Case 3.

[7] It is worth noting that the annul return of short-term debt is given by R_S^2, which is around 1.037 for R_S=1.018.

[8] The solvency ratio is defined by the share of shareholders funds in total assets, according to the Bureau van Dijk (BvD) Osiris database.

Table 2: Three Cases

Case	Entry cost function
Case 1	$C(e) = 0$
Case 2	$C(e) > 0$, $C'(e) = 0$
Case 3	$C(e) \geqslant 0$, $C'(e) > 0$

3.2 Capital Controls and Capital Formation

Case 1: $C(e) = 0$

As we assume the fixed borrowing cost is zero, $C = 0$, the expected profits of investment projects would be positive for all projects. As a result, local investors will choose to borrow from the financial market to carry out all projects (propositions 1 and 3).

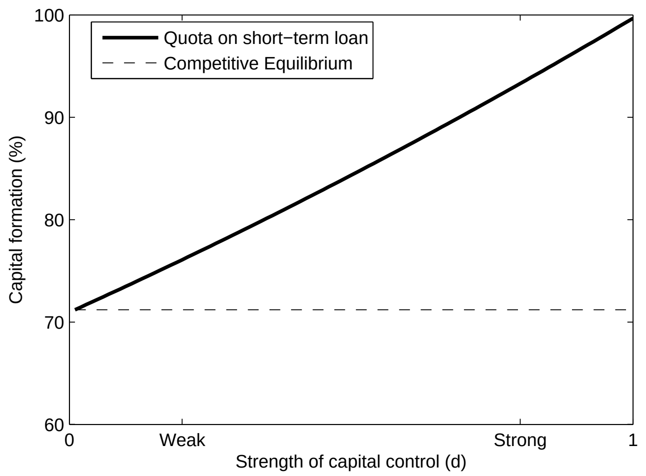


Figure 1: Capital controls and capital formation

Note: all parameter values are given by Table 1.

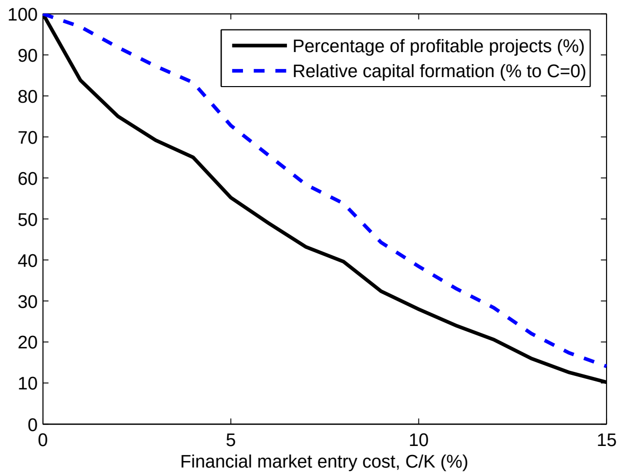
Figure 1 illustrates the main results using the parameter values from Table 1. The horizontal axis measures the strength of capital controls, $d = \frac{D_{\max} - D^Q}{D_{\max}}$, which ranges from no control (0%) to complete control (100%). The vertical axis is the level of capital formation. In the competitive equilibrium with no capital control, represented by the horizontal dash line, the expected capital formation is about 71% of potential capital stock, since the debt structure with a high level of short-term loans is associated with a large asset loss caused by early repayment in the scenario of short-term debt run. This level of capital formation is considered as a benchmark capital level.

Then, we introduce quota as a capital control instrument to limit borrowing short-term loans. As we have discussed in the theoretic model analysis, capital control limits the share of short-term debt in total debt, reducing the loss of asset in the case of debt crisis. As a result, the expected capital formation rises toward its potential level as the strength of capital control increases. With complete capital control, the capital formation explores its full potential, which generates about 41% more capital, comparing with capital stock in the competitive equilibrium. Therefore, our results establish a positive linkage between capital controls on debt structure and output.

Case 2: $C(e) > 0$**,** $C(e)' = 0$**.**

In Case 1, we assume the entry borrowing cost is fixed at zero. Under this specific condition, all investment projects are profitable, and capital control policy has only positive effects as it reduces the default rate for investment. In Case 2, we consider the scenario in which capital control policy causes a positive entry costs, thus some of the investment projects become unprofitable. As a result, the number of investment projects decreases.

Figure 2 describes the change of the competitive equilibrium with different entry costs. The solid line represents the share of projects that remains profitable that can be carried out by local investors, while the dash line represents the expected capital formation relative to the case with zero borrowing cost. Both the percentage of profitable projects and the relative capital formation decrease monotonically as borrowing from financial market becomes costlier. Under our parameter assumptions, when investors have to spend about 15% to make investment, the number of projects that are worth investing drops to merely 10%, and the expected capital formation is about only 14% of the benchmark.

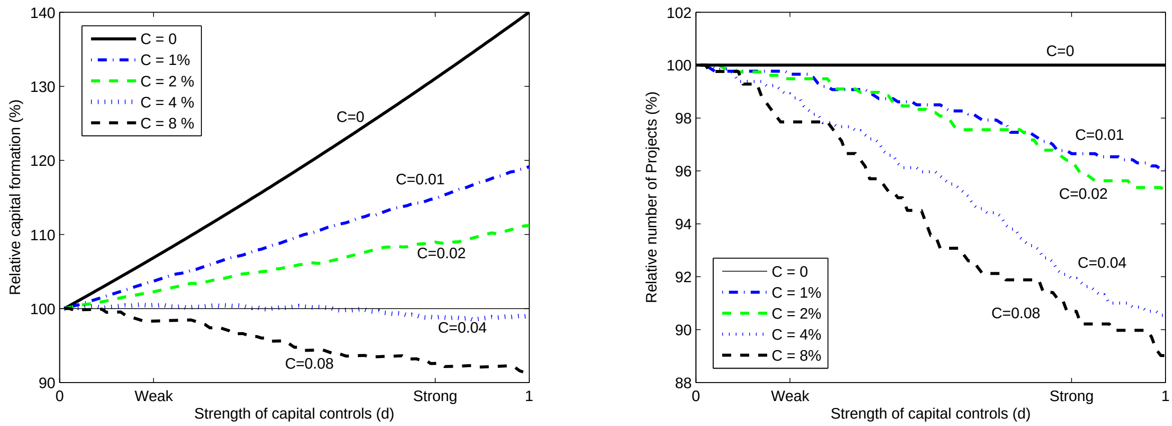


Note: all parameter values are given by Table 1, except that the fixed cost varies from 0% to 15%.

Figure 2: Percentage of projects and capital formation respect to different entry costs (with no capital controls)

Since the competitive equilibrium is also affected by rising entry fees, we can not compare the capital stock levels and investigate the impact of capital control at different entry costs as we have done in Figure 1. Instead, we will use the relative level of capital formation, the ratio of capital stock with capital control relative to competitive equilibrium capital stock.

In Figure 3, the diagram on the left measures the expected capital formation levels relative to the competitive equilibrium, and diagram on the right displays the number of profitable projects which is also relative to the case of competitive equilibrium. It shows that the efficiency of capital control policies decreases dramatically as the barrier to borrow rises. When this entry cost is relatively high ($C \geqslant 0.04$), the competitive equilibrium becomes superior to the outcome with capital control which might cause a significant loss of profitability for investment projects. Therefore, high entry cost can reverse our policy recommendation.



(a) Relative Capital Formation (b) Number of projects

Note: all parameter values are given by Table 1, except that the fixed costs take five different values between 0% and 8%.

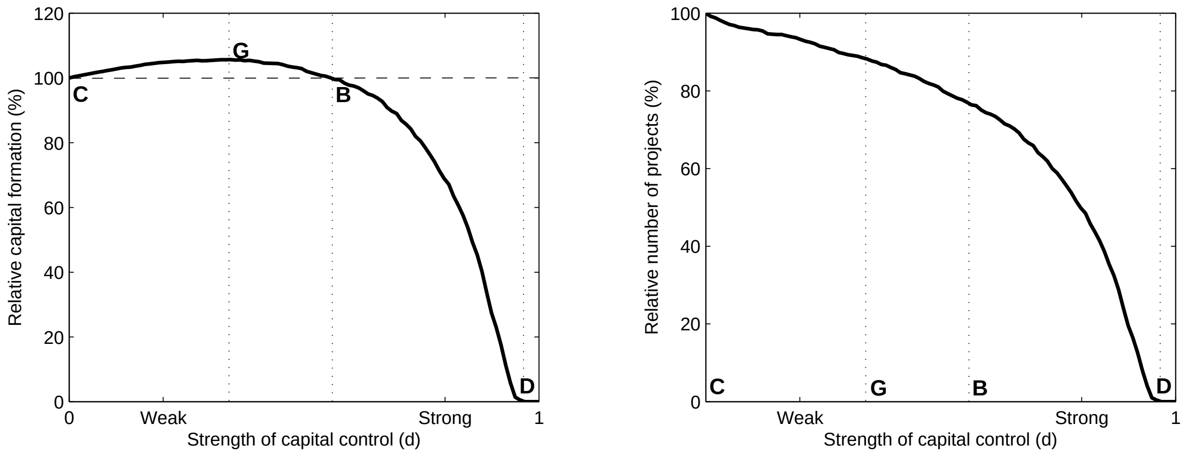
Figure 3: Capital controls with different borrowing costs

Case 3: $C(0) = 0$, and $C(e)' > 0$.

Finally, in a more general scenario, we allow the entry cost of borrowing to rise as government regulation effort increases, i.e. $C(e) \geqslant 0$, and $C(e)' > 0$. For the sake of simplicity, we assume the cost function is a linear function for e. For example, we consider the following cost function

$$C(e) = 0.15 \cdot e. \tag{17}$$

Figure 4 presents our result and demonstrate how capital control would affect total capital formation. There are three possible phases. As the strength of capital control increases from point C to G, the expected relative capital stock increases, meaning that capital regulations promote capital accumulation. However, as the government continue to enforce regulations, the negative impact of capital control starts to dominate. From point G to B, capital control policy can still provide higher level of capital formation relative to the competitive equilibrium, however, the benefits decreases. If the capital control intensity are stronger than point B, the high market entry costs hurt the profitability of investment projects. Regulating financial market can not generate benefit for the economy. Therefore, this simulated results imply that only appropriate capital control policy can be good for economic growth.



(a) Relative Capital Formation (b) Number of projects

Note: all parameter values are given by Table 1, and $C(e) = 0.15e$.

Figure 4: Capital controls policy with rising entry costs

We have to emphasize that this growth promoting capital control regime, from C to B in Figure 4 might not exist, when $C(0) > 0$. For example, in our Case 2, when $C(0) = 0.08$, capital control policies can not improve capital formation (panel (a) in Figure 3).

4 Empirical Analysis

This section empirically investigates the main theoretical predictions for the linkage between capital controls and economic growth. Our theoretic model indicates that capital controls influence economic growth through the following three steps (①+②+③), summarized by Figure 5. First, capital controls regulate debt structure to absorb a larger portion of long-term foreign liabilities. Second, investment projects with longer debt maturity structure can generate more capital for the economy. Third, high investment or capital formation eventually promote economic growth. One thing worth mentioning is that in the following empirical tests, we use capital controls on equity and FDI as controls on long-term liabilities, and controls on bond as short-term liabilities.

However, there are several alternative channels that bypass some stages. For example, capital controls might affect debt structure which determines economic growth (①+④); or capital controls can directly influence capital formation to affect economic growth (⑤+③);

or, finally, capital controls only have direct impacts on economic growth, without going through any of these stages (⑥).

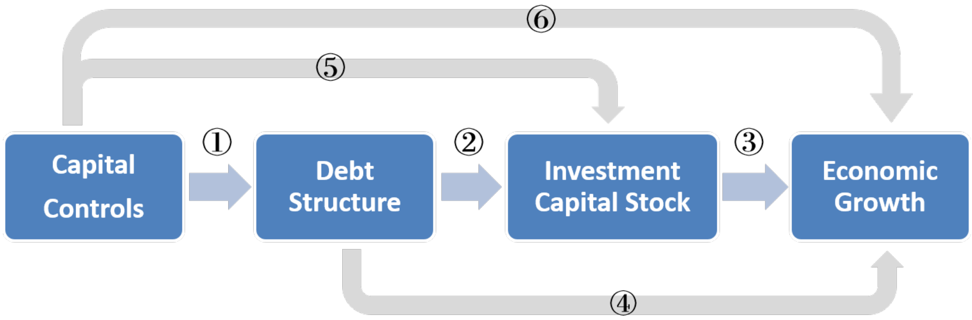


Figure 5: Linkages from capital controls to economic growth

In order to identify how capital control policy promotes economic growth with these channels, we seek to test the following three hypotheses: (i) Capital controls affect the debt structure by reducing the share of short-term liabilities (①); (ii) Capital controls influence investment through the channel of debt structure (①+②); (iii) Capital controls affect economic growth, however, this growth effect of capital controls influenced by debt composition goes through the channel of investment or capital accumulation (①+②+③).

4.1 Model Specification

To address the first hypothesis, we consider the following empirical specification to evaluate the impact of capital control policies on debt structure,

$$S_{i,t} = \alpha_S + \beta_i^S CC_{i,t} + \psi_S X_{i,t} + \epsilon_{i,t}, \tag{18}$$

where i and t denote country and year, $S_{i,t}$ represents the share of various of assets in total capital flows, such as bond, equity, and direct investment. $CC_{i,t}$ is a vector of capital control variables, such as restrictions across three broad asset categories: bond, equity, and direct investment. And $X_{i,t}$ is a group of control variables, including income level, openness, financial market development, and institution quality. In this equation, β_i^S is the key coefficient of interest. For example, if $S_{i,t}$ represents the share of bonds in total capital flows and $CC_{i,t}$ represents capital controls on bonds, then a negative and significant β_i^S means that capital controls on bonds successfully reduce the share of bonds. In other words, we do not reject the first hypothesis in this example.

To investigate our second hypothesis, the effectiveness of capital control on capital formation, we consider the following regression equation

$$I_{i,t} = \alpha_I + \beta_i^I CC_{i,t} + \gamma_I S_{i,t} + \psi_I Y_{i,t} + e_{i,t}, \tag{19}$$

where $I_{i,t}$ is investment rate, measuring the level of capital formation in country i, $CC_{i,t}$ measures capital controls, $S_{i,t}$ captures the debt structure, and $Y_{i,t}$ is a group of control variables, including trade openness, financial development, inflation rate, life expectancy, and schooling. Most of these variables are commonly used in growth literature. In this model, we also include financial development and trade openness, because these variables are closely linked to capital flows and capital account convertibility. In this equation, β_i^I and γ_I are of interest. For example, suppose $S_{i,t}$ represents the share of bonds in total capital flows and $CC_{i,t}$ represents capital controls on bonds. We first run regression using Equation 19 without $S_{i,t}$. If β_i^I is significant, then capital controls on bonds can affect capital formation. Next, we run regression using Equation 19 with $S_{i,t}$. If γ_I is significant but β_i^I is no longer significant, then we can conclude that capital controls can only affect capital formation through changing the share of bonds, which is the second hypothesis.

Finally, we consider the following empirical specification to test the third hypothesis, how capital controls influence economic growth,

$$g_{i,t} = \alpha_G + \beta_i^G CC_{i,t} + \gamma_G S_{i,t} + \phi_G I_{i,t} + \psi_G Z_{i,t} + u_{i,t}, \tag{20}$$

where $g_{i,t}$ measures the growth rate of per capital income, and $Z_{i,t}$ is a group of control variables which are potential determinants of economic growth. We sequentially add debt structure, $S_{i,t}$, investment rate, $I_{i,t}$, into the regression to identify the correct channel of capital control on growth. For example, suppose $S_{i,t}$ represents the share of bond in total capital flows and $CC_{i,t}$ represents capital controls on bonds. Step one, we run regression using Equation 20 without $S_{i,t}$ and $I_{i,t}$. A significant β_i^G suggests that capital controls on bond affect growth. Step two, we add $S_{i,t}$ into the equation in Step one and run regression again. If γ_G is significant but β_i^G is no longer significant, then we say capital controls can only affect growth through changing the share of bonds. Step three, we further add $I_{i,t}$ into the equation in Step two and run regression again. If ϕ_G is the only significant coefficient among β_i^G, γ_G, and ϕ_G, then we can conclude that the growth effect of capital controls influenced by debt composition goes through the channel of investment or capital accumulation, which is the third hypothesis.

We adopt the dynamic panel data system generalized method of moments (GMM) estimation, pioneered by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998), to estimate these equations. System GMM is a popular econometric method extensively used in growth literature. Levine et al. (2000), Hasan et al. (2009), Schularick and Steger (2010), Mattana and Panetti (2014) and many other studies use this method to test the effects of financial liberalization or financial development on economic growth. [9] This system GMM estimation is developed to address a general model

[9] We also use IV fixed effect model to reproduce our empirical results in Table 3 - 11. Results using this model is consistent with system GMM estimation in terms of signs and significance. These results

as follows:

$$\begin{aligned} y_{i,t} - y_{i,t-1} &= (\alpha - 1)y_{i,t-1} + \beta x_{i,t} + \xi_{i,t} \\ \xi_{i,t} &= \eta_i + v_{i,t} \\ E(\eta_i) &= E(v_{i,t}) = E(\eta_i v_{i,t}) = 0 \end{aligned}$$

where the disturbance term has two orthogonal components: the fixed effects, η_i, and the idiosyncratic shocks, $v_{i,t}$.

System GMM is popularly used in growth literature because of its advantages over other estimations such as OLS or fixed effect models. In our study, its advantages can be specified as follows. First, system GMM estimation addresses omitted variable bias by construction. Our study has a large panel data including both developing countries and developed countries. Country heterogeneity is a central issue in our empirical framework. Many country specific time-invariant factors, including country risk premium, institutional quality, development stage and so on, can have significant impacts on our interested variables but are poorly captured by our data. However, system GMM can use data transformations such as first-difference or "orthogonal deviations" for each individual to remove these country fixed effects. For instance, using first-difference, $\Delta y_{i,t} = (\alpha-1)y_{i,t-1}+\beta\Delta x_{i,t}+v_{i,t}$. The individual fixed effect, μ_i, is removed from the model.

Second, system GMM accounts for endogeneity issues. In our study, growth rate can have two-way causality with capital controls and many control variables, such as trade openness, financial development, and inflation rate. In cross-sectional growth literature, a common way to address such endogeneity problems is to regress growth rate on lagged values of these variables. Taking financial development as an example, a reasonable argument is that financial development level two or three years ago can affect growth rate today but can hardly be the case the other way. System GMM can handle this endogeneity issue in a similar way. It uses lagged values of the explanatory variables as instruments of their own and does a 2-stage GMM estimation. In this way, potential endogeneity problems can be largely mitigated. One thing worth mention is that in addition to this regular treatment to endogeneity, we also use external instrument variable to check the robustness of the relation between capital controls and economic growth.

Third, system GMM can deal with several econometric issues which might bias our estimation results. 1) It addresses the dynamics of a dependent variable. A stylized factor on growth literature is that a country's growth rate is dependent on initial income, which is can be seen as a proxy to capture a country's development stage. However, such dynamics of a dependent variable would make regular OLS estimation biased.System GMM can correct such biasness and yield a consistent estimation. 2) It avoids Hurwicz

can be obtained from the authors upon request.

bias which would bias the estimator downward when the time dimension of the panel is short in a dynamic model. 3) Windmeijer (2005) develops a small-sample correction to improve the accuracy of standard errors provided by the estimation, which makes the estimation more practical.

Last, we strictly follow the instructions in Roodman (2006) when applying system GMM. In addition, to minimize potential mis-specification issues of the model, all empirical results in the following sections have passed the Arellano–Bond test of no second order autocorrelation and the Hansen test of the joint validity of the instruments at conventional levels.

4.2 Description of the Data

Our empirical analysis uses a panel dataset covering 80 countries – developed and developing – during 1995-2009.

Indicators of capital controls, $CC_{i,t}$, are the most important variables, which measure the intended level of capital flows from policy makers. Following the methodology proposed by Schindler (2009), we construct a dataset based on the IMF's Annual report on exchange arrangements and exchange restrictions (AREAER). Prior to 1995, AREAER reported country's overall capital controls status using 0/1 dummies; since 1995, the IMF breaks down the simple measure to several categories according to capital flows' asset type, ownership, and direction of flows. Based on this new coding system, Schindler (2009) first coded the restrictiveness of controls at the level of individual transactions, and then took average of these sub-indices to obtain more finely gradated asset- or inflow/outflow-specific indices. We update this data to cover the period from 1995 to 2010.[10] In this dataset, restrictions on capital controls can be identified according to flows' asset type or direction of flows, and the intensity of capital control policies is also considered because of the coding method.

We estimate the stocks of foreign assets and liabilities to GDP ratio to measure the actual level of capital flows which has been treated as de facto measure of capital control, such as Edison et al. (2002). The data source is the IMF's international financial statistics (IFS) .

The choice of control variables follows previous studies quite closely. The growth rate of a country is calculated using real GDP per capita. Control variables include inflation rate, schooling, life expectancy, initial income (initial per capital GDP), population growth rate, financial development (private credit to GDP ratio), trade openness (trade volume to GDP ratio), and domestic institution. The data source of real GDP per capita, investment, inflation rate, initial income, population growth rate, and trade openness is Penn World

[10] The data coverage of Schindler (2009) is from 1995 to 2005.

Table 7.0. The source of schooling (secondary school enrollment), life expectancy, and financial development is from World Bank's world development indicators (WDI).

4.3 Empirical Results

Table 3 presents the estimation results of equation (18). Column (1) shows that the share of short-term loans (bond) is negatively correlated with the policy restrictions on short-term loans, but is positively correlated with the capital control on FDI, which are statistically significant at the 5% level and 10% level, respectively. Capital controls on equity indicate some degree of a positive association with the share of short-term loans, but it is not statistically significant.

Table 3: Capital controls and debt structure

	(1)	(2)	(3)	(4)
	Bond share	Equity share	FDI share	Equity&FDI
Bond control	-4.999**	5.875*	5.627	15.03**
	(1.963)	(3.512)	(4.653)	(7.163)
Equity control	2.772	-2.068	3.257	-3.689
	(2.512)	(2.857)	(4.519)	(8.184)
FDI control	2.516*	-2.459*	-6.154*	-8.309**
	(1.287)	(1.461)	(3.595)	(3.992)
Log income	-0.306	7.650**	21.51***	23.64***
	(2.332)	(2.332)	(6.568)	(8.612)
Openness	-0.130**	0.0206	0.164	0.188
	(0.0501)	(0.0338)	(0.109)	(0.153)
Financial development	0.0362	-0.0198	-0.109	-0.109
	(0.0347)	(0.0337)	(0.106)	(0.0800)
Institution	7.530**	-0.519	-15.55	-10.98
	(3.430)	(3.197)	(10.76)	(9.965)
Constant	20.72	-62.92*	-173.6***	-189.1**
	(23.49)	(35.17)	(62.13)	(82.03)
Countries	80	80	80	80

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses.

Columns (2) to (4) in Table 3 present the role of capital controls on the shares of other assets with longer maturity including equity and FDI. The results show that bond controls raise the share of equity and equity&FDI, while FDI controls reduce all the shares. All these coefficients are statistically significant with correct signs as expected. The estimated coefficients for equity control have the correct signs but are not significant statistically. Overall, our estimation results indicate that capital control policies can effectively alter the debt structure as intended (link ① in Figure 5). This result is consistent with the findings in the literature such as Montiel and Reinhart (1999) and Gregorio et al. (2000).

Table 4: Investment and capital controls

	Dependent variable: investment rate		
	(1)	(2)	(3)
Bond control	4.78*	3.33	2.71
	(2.84)	(2.42)	(2.71)
Equity control	-4.41*	-3.29	-4.57
	(2.64)	(3.48)	(3.01)
FDI control	-0.536	0.752	0.183
	(1.47)	(1.63)	(1.78)
Capital flow	-0.475	-0.511	-0.283
	(0.348)	(0.460)	(0.331)
Debt structure (bond share)		-40.8***	
		(10.4)	
Debt structure (equity&FDI)			16.8**
			(7.19)
Openness	0.019	-0.001	-0.0199
	(0.0277)	(0.0334)	(0.0275)
Financial development	0.0253	0.0545**	0.0284
	(0.0288)	(0.0244)	(0.0296)
Inflation	-0.0529	-0.0886	-0.0614
	(0.0457)	(0.0599)	(0.0405)
Life expectancy	0.119	0.352	-0.0417
	(0.289)	(0.333)	(0.497)
Secondary enrollment	-0.0171	0.0303	0.007
	(0.0772)	(0.0618)	(0.0667)
Year dummies	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Countries	77	77	77

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses.

Based on this result, we will further explore the linkage among debt structure, investment, and economic growth.

We estimate equation (19) to verify our second hypothesis. Our results are summarized in Table 4. Column (1) shows that regulations on bond encourage capital formation, whereas controls on equity are associated with lower investment rates. The estimated coefficients of both capital control measures are significant at 10% level. One would wonder whether this impact is caused by the debt structure channel. Columns (2) and (3) of Table 4 add two indicators for the composition of capital flows: the bond share in total capital flows has a strong negative relationship with investment rate, and the equity and

FDI share in total capital flows exhibit a strong and positive effect on investment. Both coefficients are significant at 1% level, while the coefficients of capital control indicators become insignificant. This result rules out the possibility of a direct channel from capital controls to capital formation (link ⑤ in Figure 5). Therefore, we find strong support for our second hypothesis that capital controls affect capital formation and investment by changing the debt structure, i.e. the composition of capital flows (link ①+② in Figure 5).

Lastly, Table 5 presents our main empirical results between capital controls and economic growth. Our estimation results of equation (20), presented by Column (1), find that regulations on different types of asset have distinct impacts on economic growth. As predicted by our model, restrictions on short-term loans (bond) can promote economic growth, however, restrictions on equity can dampen economic growth,[11] and we find no significant results for FDI. This result implies capital control regulations on different assets might have different, even opposite, impacts on economic growth. Therefore, policymakers should be cautious on any one-size-fit-all kind of policy strategies.

In order to identify the channel through which capital controls can affect economic growth, we introduce variables that measures debt structure into our regressions. Column (2) of Table 5 shows that capital controls on assets are no longer significant, while the newly added variable, the share of bond in total capital flows, has a significant and negative correlation with economic growth. As we replace this indicator of short-term flows by an indicator of long-term flows (equity plus FDI) in Column (3), this correlation becomes positive and is also statistically significant. Therefore, we rule out the direct channel for capital controls on growth (link ⑥ in Figure 5).

According to our theoretic framework, capital controls increase the portion of long-term liability, encourage capital formation, and ultimately promote economic growth. In Column (4) and (5), we add investment rates into our regressions. Once we add investment rates, the growth effect of debt structure disappears, only investment rates have strong correlation with growth rates, neither capital control variables nor debt structure variables is still significant. Therefore, we have no evidence that debt structure can directly affect economic growth which bypasses capital formation. This result eliminates channel ④ in Figure 5.

As mentioned in the Model Specification section, we use system GMM to estimate our results. As suggested by Roodman (2006), we treat all explanatory variables, except year dummies, as endogenous variables and use their own lagged values as instruments to do the estimation. To check the validity of our instruments, we perform two tests — the Hansen test of over-identifying restrictions and the Arellano-Bond test for autocorrelation. The Hansen test tests the joint validity of the instruments, while the Arellano-Bond test

[11] This result is consistent with the finding that stock market liberalization promotes economic growth (Bekaert et al., 2004).

Table 5: Growth and capital controls

	Dependent variable: growth rate				
	(1)	(2)	(3)	(4)	(5)
Bond control	4.22**	2.48	2.34	1.40	1.06
	(1.81)	(2.398)	(1.85)	(1.55)	(1.81)
Equity control	-6.97***	-2.47	-3.12*	-1.43	-1.99
	(2.23)	(2.10)	(1.69)	(2.72)	(2.21)
FDI control	1.85	1.27	0.60	1.57	1.79
	(1.66)	(1.58)	(1.46)	(1.33)	(1.25)
Capital flow	-0.063	-0.12	0.13	0.19	0.21
	(0.11)	(0.14)	(0.14)	(0.22)	(0.19)
Debt structure (bond share)		-19.01*		2.57	
		(10.41)		(8.12)	
Debt structure (equity&FDI)			10.04**		5.84
			(4.572)		(5.56)
Investment				40.44***	40.05***
				(8.69)	(8.86)
Log income	0.98***	0.99***	0.98***	0.99***	0.98***
	(0.018)	(0.019)	(0.018)	(0.021)	(0.0183)
Openness	0.48	-0.54	0.68	0.75	-0.33
	(1.53)	(1.53)	(2.21)	(2.36)	(1.70)
Financial development	-3.61*	-2.36	-4.00***	-5.86***	-4.81**
	(1.94)	(1.90)	(2.07)	(2.39)	(2.19)
Inflation	-8.95***	-7.15	-18.50**	-16.10**	-18.30**
	(4.25)	(5.99)	(8.53)	(6.51)	(7.70)
Life expectancy	-4.11	4.64	9.59	-11.7	-7.31
	(17.80)	(15.20)	(25.00)	(21.20)	(19.80)
Secondary enrollment	11.2**	17.1***	7.75	11.4*	8.58*
	(4.53)	(5.40)	(5.21)	(6.34)	(5.11)
Year dummies	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Countries	78	78	78	78	78
P-value of AR(1) test	0	0	0	0	0
P-value of AR(2) test	0.279	0.359	0.421	0.318	0.319
P-value of Hansen test	0.458	0.999	0.437	0.684	0.393

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses. AR(1) and AR(2) tests are the Arellano-Bond test for autocorrelation. Hansen test is the test of over-identifying restrictions.

tests the hypothesis that the residual is not serially correlated. By construction, the differenced error term is allowed to be first-order serially correlated, but the second-order autocorrelation of error term will violate the assumption of GMM procedure. In Table 5, the AR(1) test is rejected but the AR(2) test is not. In addition, the Hansen test does not reject the null of joint validity of our instruments. Thus, we can savely conclude that our instruments are valid and our GMM estimation is reliable.

This set of results verify our last hypothesis that capital controls can determine the rate of economic growth through a three-step process, first altering the composition of capital flows, then influencing the level of capital formation, and finally determining economic growth (link ①+②+③ in Figure 5).

As part of our robustness check, in addition to using GMM estimation, we also use the instrument variable fixed effect model to test equation 18, 19, and 20 . In particular, we use lagged values as instruments to capital controls and run a fixed effect model to check the robustness of our main results. Results from IV fixed effect models are not reported here due to limited space, but can be obtained upon request. These results also support our hypotheses. Hence, our conclusion regarding capital controls and growth is relatively robust among different empirical methods.

4.4 Discussions

Our empirical results have verified the channel we proposed in our theoretic framework. However, two further questions arise. The first one is that whether this mechanism exists in developing countries, since these economies are more vulnerable to debt crisis and are more likely to consider capital control policies as an option. And the second question is that if our results are robust to an alternative measure of capital flows. In order to address these issues, this section will replicate our empirical tests in a sub-sample of developing countries, and using capital inflows as the dependent variable to verify our results.

Results for Developing Countries

Developing countries are more vulnerable to pro-cyclical international capital flows than advanced countries due to their financial fragility. The destabilized international capital flows in the developing economies that have liberalized their capital markets have imposed severe welfare costs, slowed down the economy, and even led to severe financial crisis. Hence, there are great concerns among policymakers and society. Many emerging economies including Brazil, Chile, Malaysia, Russia, Thailand, and many others have recently responded to these concerns by imposing prudential controls on international capital flows. To evaluate the overall validation of capital controls in developing countries, this section replicates the empirical tests in previous section.

Tables 6, 7, and 8 report regression results of equations (18), (19), and (20) in developing countries. Unsurprisingly, compared with results for all countries, these results are highly consistent in terms of both signs and significance level, and even more significant in some cases. That is, capital controls in developing countries are more effective and important.

Table 6: Capital controls and debt structure in developing economies

	(1)	(2)	(3)	(4)
	Bond share	Equity share	FDI share	Equity&FDI
Bond control	-2.162*	-0.498	5.630***	4.547**
	(1.174)	(0.838)	(2.108)	(2.206)
Equity control	1.356	0.651	-1.093	-0.865
	(1.295)	(0.924)	(2.351)	(2.434)
FDI control	-0.0809	-0.601	-2.761*	-3.052**
	(0.824)	(0.588)	(1.480)	(1.548)
Log income	-1.609	3.505***	6.796**	12.87***
	(1.865)	(1.332)	(3.252)	(3.506)
Openness	-0.0363***	-0.0276***	0.218***	0.170***
	(0.0133)	(0.00949)	(0.0237)	(0.0250)
Financial development	-0.120***	0.00165	-0.0483*	-0.0393
	(0.0163)	(0.0117)	(0.0274)	(0.0307)
Institution	7.156***	0.00326	6.015***	5.241***
	(1.078)	(0.769)	(1.902)	(2.026)
Constant	29.94*	-23.93**	-55.50**	-99.20***
	(15.33)	(10.94)	(26.78)	(28.81)
Countries	49	49	49	49

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses.

Why capital controls are of great interests and importance in developing countries? On one side, when emerging economies experience negative aggregate demand shocks, their exchange rates depreciate and asset prices fall. This results in a declining value of collateral and net worth for domestic borrowers, which is known as balance sheet effects on the macroeconomic level. In the presence of financial market imperfections, such balance sheet effects constrain the access of domestic agents to external finance, which in turn forces them to cut back on their spending and contract aggregate demand further. As a result of this feedback loop, economic shocks may have amplified effects on macroeconomic aggregates and eventually lead to financial crisis. However, on the other side, individual private market participants cannot perceive the potential overall balance sheet effect, but take exchange rates and asset prices as given, and make distorted financial decisions accordingly. The forms of distortions include overborrowing, excessive

Table 7: Investment and capital controls in developing economies

	Dependent variable: investment rate		
	(1)	(2)	(3)
Bond control	-3.474***	-0.379	1.107
	(1.171)	(1.775)	(2.326)
Equity control	4.446*	-1.582	-0.903
	(2.616)	(3.395)	(2.275)
FDI control	0.514	0.837	-0.641
	(1.130)	(0.952)	(1.429)
Capital flow	-4.236***	-6.647***	-4.644**
	(1.287)	(2.371)	(2.086)
Debt structure (bond share)		-54.3***	
		(7.14)	
Debt structure (equity&FDI)			9.77**
			(3.11)
Openness	-0.0350	-0.00934	-0.0198
	(0.0407)	(0.0302)	(0.0496)
Financial development	0.184***	0.0981	0.108*
	(0.0496)	(0.0617)	(0.0595)
Inflation	-0.0587*	-0.0659*	-0.0473
	(0.0320)	(0.0369)	(0.0284)
Life expectancy	0.397**	0.402*	0.234
	(0.166)	(0.231)	(0.165)
Secondary enrollment	0.143*	0.0428	0.00171
	(0.0770)	(0.0989)	(0.0901)
Year dummies	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Countries	47	47	47

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses.

risk-taking, and excessive short-term debt Korinek (2011). Capital controls are suitable policy tools to correct or mitigate such distortions. For instance, imposing Tobin taxes on capital flows can limit overborrowing while a quota on short-term debt borrowing can address the issues of excessive risk-taking and excessive short-term debt. Our theoretical model in particular describes how capital controls can limit excessive risk-taking and excessive short-term debt, further increase investment, and eventually spur growth in the long term. The empirical results from developing countries provide strong support to our theoretical implications.

Table 8: Growth and capital controls in developing economies

	Dependent variable: growth rate				
	(1)	(2)	(3)	(4)	(5)
Bond control	5.390**	2.020	2.466	0.780	2.832
	(2.092)	(1.866)	(2.125)	(2.495)	(2.632)
Equity control	-5.908***	-0.0236	-2.149	-4.610	-3.801
	(2.115)	(2.678)	(2.512)	(3.269)	(2.475)
FDI control	2.984**	1.285	1.967	3.044	-0.0374
	(1.275)	(1.415)	(1.203)	(1.860)	(2.142)
Capital flow	-1.738***	-2.677***	-1.810***	-1.978*	-2.122**
	(0.559)	(0.785)	(0.523)	(1.130)	(0.993)
Debt structure (bond share)		-17.22**		8.682	
		(7.992)		(9.343)	
Debt structure (equity&FDI)			8.633**		2.114
			(3.787)		(4.117)
Investment				25.50***	22.55***
				(6.390)	(7.229)
Log income	1.013***	1.004***	1.005***	1.023***	1.019***
	(0.0165)	(0.0212)	(0.0202)	(0.0192)	(0.0163)
Openness	0.00373	0.00617	-0.0146	-0.0240	-0.0140
	(0.0145)	(0.0193)	(0.0211)	(0.0238)	(0.0183)
Financial development	-4.82***	-3.05	-4.91**	-1.86	-4.46*
	(1.65)	(2.97)	(1.93)	(2.94)	(2.58)
Inflation	-8.95***	-4.16	-8.75**	-6.11**	-5.69**
	(2.51)	(3.75)	(3.16)	(3.12)	(3.15)
Life expectancy	-2.32	7.08	5.57	-6.86	-15.9
	(9.14)	(8.61)	(9.18)	(17.2)	(13.2)
Secondary enrollment	7.57	11.9**	8.12	6.68	4.65
	(4.64)	(5.19)	(4.38)	(4.78)	(3.79)
Year dummies	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Countries	47	47	47	47	47

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses.

Results for Capital Inflows

Our theoretical framework has established a channel through which capital controls can affect economic growth. Be more specific, this channel aims at the the inflow side of capital flows. However, our main empirical analysis uses total capital flows rather than capital inflows. To further fill in the gap between the empirical evidence and the theoretical illustration, we replace total capital flows with capital inflows in this section to verify the robustness of our results.

In Table 9, we re-estimate equation (18) using capital inflows as dependent variables. Our results are highly consistent with Table 3 in terms of signs and significance level. It suggests that capital control policies can successfully change the debt structure of capital inflows, which provides a strong support to the first hypothesis with a more specific case — capital inflows.

Table 9: Capital controls and composition of capital inflows

	(1)	(2)	(3)	(4)
	Bond share in inflows	Equity share in inflows	FDI share in inflows	Equity&FDI share in inflows
Bond control	-4.542*	7.662*	9.761*	24.71***
	(2.675)	(4.589)	(5.307)	(8.628)
Equity control	2.804	-3.561	-1.087	-9.059
	(2.824)	(4.813)	(6.217)	(9.710)
FDI control	2.236	-2.706*	-8.801**	-10.48**
	(1.692)	(1.465)	(3.886)	(4.506)
Log income	0.501	8.102**	29.04***	33.46***
	(3.460)	(4.029)	(7.809)	(11.31)
Openness	-0.105*	0.00823	0.211*	0.249*
	(0.0549)	(0.0309)	(0.113)	(0.144)
Financial development	0.0681*	-0.0169	-0.194**	-0.215**
	(0.0365)	(0.0384)	(0.0920)	(0.0899)
Institution	6.024*	-2.547	-23.45**	-18.72
	(3.218)	(3.210)	(11.28)	(12.66)
Constant	8.507	-66.35*	-229.7***	-266.1**
	(31.58)	(36.06)	(71.86)	(105.3)
Countries	80	80	80	80

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses.

Table 10 estimates equation (19) to verify our second hypothesis. Similar to results in Table 4, results in Table 10 show that capital controls indirectly affect capital formation and investment by changing the composition of capital inflows. Therefore, the second hypothesis is confirmed at the level of capital inflows.

Table 10: Investment and capital controls on capital inflows

	Dependent variable: investment rate		
	(1)	(2)	(3)
Bond control	5.192**	2.912	2.059
	(2.527)	(2.915)	(2.627)
Equity control	-4.541	-2.902	-3.130
	(2.910)	(3.280)	(3.496)
FDI control	-0.690	0.743	-0.188
	(1.429)	(2.119)	(1.797)
Capital inflow	-0.742	-0.881	-0.525
	(0.557)	(0.668)	(0.642)
Debt structure		-35.56***	
(bond share of inflows)		(8.289)	
Debt structure			15.99**
(equity&FDI of inflows)			(6.119)
Openness	0.0169	-0.00148	-0.0168
	(0.0273)	(0.0364)	(0.0302)
Financial development	0.0192	0.0506*	0.0380
	(0.0257)	(0.0295)	(0.0280)
Inflation	-0.0496	-0.0800	-0.0628
	(0.0444)	(0.0603)	(0.0465)
Life expectancy	0.115	0.317	0.235
	(0.300)	(0.349)	(0.384)
Secondary enrollment	-0.0150	0.0668	-0.0301
	(0.0793)	(0.0903)	(0.0775)
Year dummies	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Countries	77	77	77

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses.

Finally, similar to Table 5, Table 11 presents our empirical results among capital controls, capital inflows, and economic growth. Again, given almost identical estimation results in the two tables, we verify the third hypothesis, at the level of capital inflows, that capital controls first alter the composition of capital inflows, then influence the level of capital formation, and finally affect economic growth.

5 Conclusion

The role of capital controls or capital mobility on growth has been debated for decades, yet the empirical evidence is still far from conclusive. This paper revisits this long-lasting topic and argues that capital controls on assets with different maturity and risk-bearing

Table 11: Economic growth and capital controls on capital inflows

	Dependent variable: growth rate				
	(1)	(2)	(3)	(4)	(5)
Bond control	4.279**	2.472	1.906	1.287	1.348
	(1.839)	(2.255)	(1.702)	(1.584)	(1.679)
Equity control	-6.974***	-3.041	-2.226	-1.024	-1.916
	(2.245)	(2.377)	(1.569)	(2.793)	(2.195)
FDI control	1.901	1.730	0.339	1.443	1.167
	(1.656)	(1.683)	(1.415)	(1.295)	(1.200)
Capital inflows	-0.130	-0.391	0.368	0.537	0.543
	(0.235)	(0.249)	(0.277)	(0.403)	(0.390)
Debt structure		-17.17**		3.320	
(bond share of inflows)		(7.677)		(6.376)	
Debt structure			9.682***		4.207
(equity&FDI of inflows)			(2.986)		(4.410)
Investment				43.91***	41.40***
				(10.45)	(10.17)
Log income	0.988***	1.005***	0.987***	0.992***	0.994***
	(0.018)	(0.019)	(0.018)	(0.021)	(0.0183)
Openness	0.484	1.120	1.151	0.466	-1.130
	(1.510)	(1.490)	(2.560)	(2.150)	(2.340)
Financial development	-3.620*	-2.910	-4.180**	-6.740***	-5.710***
	(2.070)	(2.330)	(2.100)	(2.220)	(2.160)
Inflation	-0.0917**	-0.0439	-0.191**	-0.164**	-0.173**
	(0.0457)	(0.0541)	(0.0841)	(0.0676)	(0.0754)
Life expectancy	-0.0401	0.0475	0.121	-0.179	-0.116
	(0.179)	(0.160)	(0.197)	(0.214)	(0.229)
Secondary enrollment	0.113**	0.150**	0.0727	0.126*	0.101*
	(0.0440)	(0.0652)	(0.0485)	(0.0635)	(0.0563)
Year dummies	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Countries	78	78	78	78	78

* Significant at 10%, ** significant at 5%, *** significant at 1%. Robust standard errors are in the parentheses.

properties can have different impacts on economic performance, thus affecting economic growth.

We develop a simple model in which output is related to the debt structure of financing investment projects. We show that short-term debt run can cause major losses of capital as illiquid asset has to be cashed out before they generate return. As a result, capital control policies can be socially beneficial, as they can reduce the composition of short-term loans to prevent large asset loss during crisis. We calibrate our model based on data from the U.S. financial markets, and discuss the effectiveness of a capital control policy (quota).

Finally, we conduct an empirical study to investigate three hypotheses that can be derived directly from our model. We find our the following results. (a) Restrictions on different types of assets can influence the composition of total liability. Controls on bond reduce the share of short-term loans, whereas controls on FDI reduce the share of long-term loans. (b) By altering the composition of capital flows, capital controls affect the capital formation process which can be captured by investment. (c) We find that both capital control policies and the structure of capital flows have significant impacts on economic growth respectively. However, as we control for capital formation (investment), these growth effects disappear.

Our results indicate that the linkage between capital control policies and economic growth is rather complex. Different types of capital flows have distinctive impacts, thus, the composition of capital flows plays an important factor to achieve growth. Capital controls can promote economic growth by influencing the structure of assets. Therefore, instead of looking for a one-size-fit-all policy, policymakers should be more discretionary when interacting with international financial market.

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