

Sun, Puyang; Sen, Somnath; Jin, Shujing

**Working Paper**

## Equity market liberalization, credit constraints and income inequality

Economics Discussion Papers, No. 2012-22

**Provided in Cooperation with:**

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

*Suggested Citation:* Sun, Puyang; Sen, Somnath; Jin, Shujing (2012) : Equity market liberalization, credit constraints and income inequality, Economics Discussion Papers, No. 2012-22, Kiel Institute for the World Economy (IfW), Kiel

This Version is available at:

<https://hdl.handle.net/10419/57771>

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## Equity Market Liberalization, Credit Constraints and Income Inequality

*Puyang Sun*

*Nankai University and University of Nottingham*

*Somnath Sen*

*University of Birmingham*

*Shujing Jin*

*Nankai University*

**Abstract** This paper provides compelling evidence that equity market liberalization, the most efficient way to smooth financial market frictions such as credit constraints, can alleviate persistent cross-dynastic income inequality through increasing the accumulation of human capital. The authors examine the impact of equity market liberalization on inequality by using the data of 72 countries during 1980–2006. The effect is robust to alternative measurements of equity market liberalization. Furthermore, equity market liberalization is associated with the different effects of credit constraints on the persistence of cross-dynastic income inequality. Finally, it is proved that foreign equity flows benefit the initially less active stock markets more than the active ones, which is important evidence that foreign equity flows act as a substitute for the domestic financial market. This finding emphasizes the importance of equity market liberalization for the poor, which helps to reduce inequality.

**JEL** F36, F41, G0, O11, O15, O16

**Keywords** Income inequality; equity market liberalization; human capital; economic growth

**Correspondence** Puyang Sun, Department of International Economics & Trade, Nankai University, China, and GEP, University of Nottingham, UK: e-mail: [puyangsun@nankai.edu.cn](mailto:puyangsun@nankai.edu.cn)

*The authors appreciate the helpful comments from Dr. Zhihong Yu at the University of Nottingham, Professor Jiadong Tong and Professor Kunwang Li at Nankai University, Professor Liping He at Beijing Normal University, Dr. Ying Zhou at Aston University and others.*

## **1 Introduction**

The world witnessed the stunning cross-country differences in the income inequality and the persistent poverty, in particularly for some under-developed and developing countries. It is not difficult for us to find that the poverty in these countries seems to be stubborn for it transmits from one generation to the next. Discovering this feature of current income inequality and poverty, the principal object of this paper emphasizes on the persistence of cross-dynastic income inequality.

The income inequality is apparently associated with the level of human capital accumulation. Human capital is unique for it is embedded in the human, which is dominated by one's physical and intelligence factors. As such, human capital accumulation, which is the key to high income, is relevant to the education one attained. It is clear that with higher education level people tend to receive higher income than undereducated ones. Furthermore, education attained by individual is so various for different people that it is the substitute of endowment and intelligence for rich and complement of brilliance and talent for poor, which indicates that the lack of education investment makes the poor worse off much more than rich.

Now it is inevitable to consider the role of financial market. If there is a perfect financial market that nobody worries about insufficient financial support, the income depends solely on one's endowment. With the same education, superior endowment ones get higher income than inferior ones. Unfortunately, there is financial friction in real financial market, such as credit constraints which make economic opportunity varies with each other. These credit constraints operate on two dimensions. The first one is horizontal, which means that people cannot get sufficient financial support for themselves to develop their own capabilities. And the second one is vertical which concentrates on the effect of parents' financial restrictions on the children's income inequality. It implies that the reason of children's poverty is the lack of parents' education investment, which leads to the transmission of income inequality. For instance, poor family with tight credit constraint may have more difficulties in children's education investment, which hinders the children to go for advanced study and get high income. As is explained above, the credit constraints perpetuate the cross-dynastic income inequality and make the children lead a straitened life as their parents did.

In this paper, our research attempts to loosen the credit constraints through opening financial markets, and investigate various impacts of which on inequality.

Equity market liberalization gives foreign investors the opportunity to invest in domestic equity securities and domestic investors the right to transact in foreign equity securities, which is acknowledged to be the most direct and efficient mean to relax credit constraints (Harvey, 2005; Kalina, 2009). In fact, liberalizing equity market to receive more foreign equity flow can enrich the supply of domestic financial credit and therefore reduce the financing cost, which means that individuals who did not use those financial services may get the chance to be involved in. In this term, poor family expands their economic opportunities to invest in education for the next generation, which may diminish the persistence of cross-dynastic income inequality. People's total income is generally determined by two important aspects, the endowment of oneself and the education one attained in the whole life. The latter is theoretically associated with the ability of the access to acquire credit (Galor, 2004, 2009). For instance, children from poor family with superior endowment may meet much more credit constraints than one from rich family, which obstruct the poor children to attain enough education. As a result, poor can only get minimum wage from one generation to another. The tighter the credit constraints, the less the parental investment in children's education, which makes inequality perpetuate from generation to generation (Kunt & Levine 2007, 2009). On the contrary, children from rich family obtain enough education through their parental investment, which keeps them in the first rank of the whole society. It is a strong belief for us that the equity market liberalization can alleviate these kinds of restrictions, smooth the financial market frictions and expand the economic opportunity for poor. It enlarges the probability for poor to diminish the persistent income inequality.

A bulk of literatures has discussed the impact of financial development on income inequality; however, few consider the importance of opening financial markets, or even equity market liberalization. Besides, though many studies put emphasis on income inequality, few concentrate on its cross-dynastic persistence, which is especially significant for developing and under-developed countries. The main purpose of this paper is to show how the equity market liberalization could affect the persistence cross-dynastic income inequality through possible effects of credit constraints on the differences of acquiring human capital.

A growing body of the psychological and practical research provides conflicting predictions about the effect of financial market on poverty since we do admit that finance operates both extensive margin and intensive margin. Increasing access to credit expand the economic opportunity for poor, which means that it is easier for

poor family to get support on children's education investment. Thus, poor children may develop their own ability and get more return of human capital, which makes them reduce the intergenerational income inequality. This can explain how finance operates on extensive margin (Becker & Tomes 1979, 1986; Greenwood & Jovanovic 1990). In contrast, finance can also operate on intensive margin (Greenwood & Jovanovic 1990). The improvement of financial services may fall disproportionately on advantaged group, who had been involved in financial services. To this extent, the more perfect the financial market is, the more rich gain from it, which perpetuates the persistent cross-dynastic income inequality. Which effect that finance operates on income inequality, extensive margin or intensive margin, determines the impact of financial reform on poverty reducing.

As a result, in the fourth section we attempt to check the relationship between financial market liberalization and income inequality by connecting the latter with domestic financial market activity. And we try to answer the controversial question that whether domestic financial markets act as substitutes or complements of foreign equity flow. First of all, it is significant that countries with less active domestic financial market tend to suffer from serious income inequality. So it is rational to find the relationship between domestic stock market and the foreign equity flow. If foreign equity flow benefits more for developed domestic stock market, it will make the financial market allocate resource disproportionately to rich, who had gain from the better financial infrastructure. If it is so, equity foreign flow deteriorate domestic income inequality, which implies that foreign equity flow act as a complement of domestic stock market (Kalina, 2009). On the contrary, equity market liberalization may be a blessing not a curse for under-developed domestic stock market, for the diminishing return of capital foreign equity flow benefits more to imperfect financial market. Foreign equity flow increases the activity of domestic stock market through the way of enriching the fund, spreading the risk and so on. To this extent, we may conclude that foreign equity flow act as a substitute of domestic stock market (Kalina, 2009). According to this idea, we collect some comprehensive indicators of stock market activity and testify the function of equity market liberalization, finding the compelling evidence that foreign equity flow act as a substitute of domestic stock market in section four.

We organized the rest of the paper as follows. The second section provides an estimation framework, which investigates the relationship among credit constraints, human capital accumulation and the income, and describes the data and estimation

models. In the third section we analysis the empirical results, finding that equity market liberalization help to reduce the income inequality though alleviating the persistent cross-dynastic income inequality. The last section is a summary.

## **2. Data and preliminary analysis**

### **2.1 The theoretical background**

In this section, we emphasize the role that financial market exerts on inequality. Some pronounced literatures have discussed the interrelationships between finance and inequality such as Claessens & Perotti (2007), Kunt & Levine (2009). In contrast, our preoccupation is the impact of equity market liberalization on persistence of cross-dynastic income inequality. We do significant attempts in two dimensions. Firstly, we explore the effect of equity market liberalization that is the most direct and efficient way to relax the credit constraints. Secondly, the principal object of this study is the persistence of cross-dynastic income inequality rather than the poverty itself, which makes it clear to find the transmission mechanism from one generation to the next. As no one can ignore the financial market frictions, people have different economic opportunity in participating economic activities. Considering the credit constraints, poor parents may give up investing in children's education, which hinder children receive advanced education and lose the opportunity to get high income. To this extent, children's income inequality originates in parents' poverty and their credit constraints, which shapes the persistence of cross-dynastic income inequality. Poverty transmits from one generation to the next because of the lack of education investment for children and it makes the income inequality difficult to change. In contrast, rich family provides sufficient investment to their children and ensures them to develop the human capital and get high pay. Prosperity transmits in the rich family, which makes the income inequality stubborn in some countries. Foreign equity flow may be an efficient way to smooth that friction by facilitating the investments especially for education. After liberalizing the foreign equity market, capital becomes abundant in financial market, which makes it easier to financing for all people. Poor parents have a new channel to get financial support and pay for children's education. Thus, children in poor families with superior endowment expand their economic opportunity, and may get the opportunity to end the dynastic transmission of low income distribution.

In terms of theoretical mechanism by Kunt & Levine (2009), the equation of total

income  $y_{i,t}$  can be expressed like this:

$$y_{i,t} = h_{i,t}w_{i,t} + a_{i,t}r_{i,t}$$

where  $h_{i,t}w_{i,t}$  is the return on human capital and  $a_{i,t}r_{i,t}$  is the return on physical capital(assets),  $h_{i,t}$  is the level of human capital in dynasty i in generation t,  $w_{i,t}$  is the wage rate per unit of human capital,  $a_{i,t}$  is the wealth and  $r_{i,t}$  is the return on asset. Human capital is associated with the endowment of generation t, denoted by  $e_{i,t}$  and investment of generation t-1, denoted by  $s_{i,t-1}$ . So we rewrite  $h_{i,t}$  like this :

$$h_{i,t} = h(e_{i,t}, s_{i,t-1}).$$

If there is a perfect financial market everyone has an equal opportunity to get the investment,  $y_{i,t}$  tends to be the same across dynasties. Unfortunately, there is financial market friction and we cannot eliminate it for a long time, which means  $s_{i,t-1}$  is a function of  $p_{i,t-1}$  and

$$h_{i,t} = h[e_{i,t}, f(p_{i,t-1})],$$

Here  $p_{i,t-1}$  is the credit constraint, one of the presentations of domestic financial friction, which hinder the poor's accumulation of human capital through borrowing from financial sectors. As a result, without considering the asset return, one's income is associated with his own endowment as well as the education investment that his parents could afford. Since  $\frac{\partial h_{i,t}}{\partial p_{i,t-1}} > 0$ , parents' education investment has a positive effect on children's human capital accumulation and thus total income. Namely the lack of education investment in poor family may lead to a low income for children and shape the distribution gap between poor and rich, which will finally form the persistence cross-dynastic income inequality.

We want to prove that equity market liberalization, as an external shock, can smooth the financial market frictions by relaxing credit constraints and expand the economic opportunity for the poor.

## 2.2 Data:

To measure the inequality on income distribution, the annual growth rate of the *gini* coefficient is employed in this paper, which is computed over the period 1980–2006 including 72 economies. We choose the growth rate of *gini* rather than the level value because of the importance of the persistence of cross-dynastic differences in income and wealth. The growth value implies the change of inequality better than the level value of *gini* (Kunt and Levine 2009). Considering the transmission of income inequality, it is necessary to use the growth of *gini* coefficient since it is a dynamic indicator that expresses the change of inequality from one generation to another.

Private credit is a comparatively comprehensive measure of the credit constraints, which will be a lower value if the credit constraint is tight, otherwise it will be a higher value. We use private credit to distinguish the differences among economies, which is presented by the logarithm value of domestic private credit by deposit money banks and other financial institutions over GDP. Data on private credit are from updated version of the Financial Structure Database, which is collected from International Financial Statistics. Furthermore, to testify the persistence of cross-dynastic differences in income, we use the lagged private credit, which indicates the credit constraints of last period. We want to make sure whether the credit constraints that parents faced up affect the opportunity of their children to acquire the wealth through the channel of education investment.

Data on equity market liberalization are available for 72 countries between 1980 and 2004 from Bekaert, Harvey and Lundblad (2005). It includes both the official year of equity market liberalization and the “first sign” of liberalization, which is the same presentation as in Kalina (2008). The first sign measurement is the earliest of three probabilities: an official liberalization, first launching of a country fund and the first American Depositary Receipt (ADR) announcement. So it is clear to see that the first sign year of liberalization is earlier than the official liberalization year, which implies that the impact of equity market liberalization on income inequality may be shown before official liberalization announcement. In these 72 countries, there are 16 countries opened to foreign equity flows before 1980, while 21 countries liberalized after 2000 and the rest 35 countries removed the stock market constraint during the period of 1980 to 2004. In Table 1 panel B, there are some significant variables in our analysis which indicate the impact of equity market liberalization on them. The pre and post liberalization variables show the change in 35 countries that remove the



restrictions during the sample period. Never liberalized countries are the ones that get rid of foreign equity flow until 2000, while fully liberalized are the ones that opened their equity market before 1980. To imply the effect of external shock in equity market, we construct post-liberalization dummies which equal 1 in the year of and all years after an official or first-sign liberalization. And before that year, all dummies equal 0. As a result, in the sample the liberalization dummies of some developed countries like United States, United Kingdom, Switzerland and so on equal one during the whole sample period, which implies that these countries opened their equity market before 1980 and even earlier. Although the equity market of these developed countries didn't experience financial reform, we still involve them into the whole sample to keep the sample integrity. Besides, other countries' opening equity market brings these financial developed countries new access to invest, which will probably affect the financial market and thus income inequality of both sides. Furthermore, these well-functioned financial markets are always attractive to under-developed countries for its variety and safety of financial assets. After equity market opening, investors and borrowers can enter the developed financial markets more freely and conveniently than before. For all the above reasons, the unchanged financial markets are necessary to be considered in the analysis.

The opportunity of person's wealth acquiring is associated with his or her education career, which is another crucial variable in our empirical models. To stand in the top rank of income distribution, one needs the opportunity to attain sufficient education even for the ones with superior endowment. As a result, it is inevitable to involve an education indicator in our analysis. We use the secondary school gross enrollment ratio to measure the effect of education career for it aims at laying the foundations for lifelong learning and human development, by offering more subject or skill-oriented instruction using more specialized teachers. It determines the human capital development, which is the key to get high wage. In this term, obtaining sufficient education helps poor children to get rid of poverty and may diminish the cross-dynasty persistence of relative income.

To show the impact of equity market liberalization on income inequality through the transmission channel of human capital, we choose some countries to draw graphs. In the Figure 1, the vertical lines indicate the official or "first sign" year of liberalizing, the other lines are the *gini* coefficient and the average years of secondary schooling. As the graphs illustrate, after liberalizing the equity market, the average years of secondary schooling increase for education investment is sufficient, and

what's more, income inequality decreases since the accumulation of human capital. So we can clearly see the impact of external shock in financial market on human capital accumulation and income inequality.

The Table 1 shows the principal descriptive statistics for the sample of 72 countries from 1980 to 2004. Panel A is summary statistics and panel B presents the different situation before and after the equity market liberalization. We divided the sample countries into three groups according to the liberalization years. The first group is the ones experience the financial reform during sample period, while the rest groups are respectively the ones that didn't liberalized the equity market until 2000 and the ones that opened their equity market before 1980. From panel B, it is clear to find that after liberalizing equity market the private credit, education level and the economic growth increase significantly for countries in group one, while the change of both dynamic and level value of income inequality is vague. The similar situation is observed between never liberalized and fully liberalized countries. However, we can easily discover that the education one attained in fully liberalized countries is much more than in never liberalized countries.

Table 1: Summary statistics

Panel A:

Variable	Obs	Mean	Std. Dev.	Min	Max
Growth in Gini	1599	0.000977	0.029174	-0.12885	0.266944
Initial Gini	1674	0.460325	0.075961	0.287459	0.772764
Education	931	0.712277	0.332808	0.04	1.6178
Credit constraints	1775	-1.01927	0.88984	-4.1719	0.837602

Panel B:

	Pre-Liberalization	Post-Liberalization	Never Liberalized	Fully Liberalized
Gini growth rate (%)	-0.46606	0.356416	0.1487	0.2035
Gini coefficient	0.451017989	0.4510695	0.460963	0.486817
Private credit	0.464385571	0.54282834	0.552327	0.464066
Education	0.544961827	0.69858176	0.408171	1.090826
GDP growth rate (%)	3.155237354	3.93592246	2.517136	2.5422

### 2.3 Empirical model

Although most previous studies mentioned the roles of local financial markets on economic growth, our paper emphasize financial liberalization on the transmission from credit constraint to persistent cross-dynastic income inequality; furthermore, we use the difference in difference dummy variable to measure the global financial liberalization in each nation, whereas the common methods of traditional panel estimation have a serious weakness in the sense that they do not account for a consideration of external shocks from opening the financial markets. We use a generalized difference-in-difference (DiD) approach to test for the differential effect of equity market liberalization on persistent cross-dynastic income inequality across countries. As the panel dataset in our paper has a larger country dimension and a short time dimension, and the endogenous characteristic of the financial variable has a serious negative impact on empirical research on economic development and theoretical studies (Levine 2005 , Kunt and Levine 2009, Leaven and Levine 2009, Claessens and Perotti 2007). We use a system generalized method of moments (GMM)

estimator approach developed by Blundell and Bond (1998) to overcome the endogenous factors and make the results of panel data more effective. Arellano and Bond (1991) develop the generalized method of moments (GMM) estimator approach, which is specifically designed for situations where there are a large number of cross sections and a short time periods. Unfortunately, the Arellano and Bond (1991) approach can, in some instances, perform poorly if the autoregressive parameters are too large or the ratio of the variance of the panel-level effect to the variance of the idiosyncratic error is too large. Blundell and Bond (1998), building on the work of Arellano and Bover (1995), develop the system GMM estimator which addresses these problems by expanding the instrument list to include instruments for the level equation. In this paper, logarithmic credit constraint is treated as an endogenous variable. The ordinary least squares regressions (OLS) results are supplied as comparisons.

We use a difference-in-difference (DiD) approach to analysis the impact of equity market liberalization on income inequality, using the following estimate function:

$$\begin{aligned}
Inequl_{i,t} = & \lambda_{igini} Igin_{i,t} + \lambda_{crd} FinCrd_{i,t} + \lambda_{libedu} EquLib_{i,t} \times Edu_{i,t} \\
& + \lambda_{libcrd1} EquLib_{i,t} \times FinCrd_{i,t-1} + \lambda_{crd1edu} FinCrd_{i,t-1} \times Edu_{i,t} \\
& + \eta_{cv} Contl_{i,t} + \theta_i + v_t + e_{it}
\end{aligned} \tag{1}$$

The term of  $Inequl_{i,t}$  measures the persistent cross-dynastic income inequality, which is defined as the growth of gini coefficients in dynasty i generation t across different countries. The notion of  $Igin_{i,t}$  equals the value of the gini coefficient at the beginning of the sample period. Financial market frictions are presented as the notion of domestic credit market constraints, which are denoted as the term of  $FinCrd_{i,t}$  in our above model. The external financial shocks, specifically as equity market liberalization, are presented as the term of  $EquLib_{i,t}$ , which are shown as either the official liberalization dummy or the first-sign dummy in our model.  $EquLib_{i,t}$  is a binary variable either equals to 1 in the year of and all tears after an equity market liberalization or 0 otherwise. The ability of acquiring human capital is presented as the level of taking education, and we use the gross enrollment of secondary school

and finally, denoted as  $Edu_{i,t}$  in the above equation. The term of  $FinCrd_{i,t-1}$  is employed to indicate the credit constraints that was in last generation, which is an important determinate for persistence of cross-dynastic income inequality. Poor family with serious credit constraints has difficulty in sending their children to go for advanced study, which reduces the human capital accumulation and make the children be stuck in poverty.

The coefficients of initial income inequality, denoted as  $\beta_{igini}$ , are expected to be positive in the estimation model, since countries with low initial income inequality tends to experience slower reductions in the levels of the income inequality. It is obvious that the improvement in countries with severe income inequality will meet more obstacles than relatively equal countries. The coefficient of  $\beta_{crd}$  presents the level of credit constraints: the lower level of  $FinCrd_{i,t}$  means more serious credit constraint since we use private credit to indicate the level of credit constraints. Thereby,  $\beta_{crd}$  is expected to be negative. We expect  $\beta_{libedu} < 0$ , which means after experiencing the liberalization shocks in equity market, those obtaining more education will probably acquire more social wealth. In this term, equity market liberalization alleviate the cross-dynastic persistent income inequality though the effects of developing human capital.  $\beta_{libcrd1} < 0$  since equity market liberalization, acting as an external shock to domestic market, can relieve the credit constraints and reduce the persistence of intergeneration income inequality. For instance, it is difficult for poor parents with serious credit constraint to invest in their children's education, which definitely affects the human capital accumulation for children and makes the next generation keep on leading a straitened life.

### 3. Empirical results

To confirm the necessity of choosing dynamic income inequality, it is meaningful to find the impact of equity market liberalization on level value of income inequality. In Table 2 and Table 3, the dependant variable is the level value of gini coefficient itself, which makes the effect of equity market liberalization vague and ambiguous. So it is reasonable to choose the dynamic variables and analyze the persistent of cross-dynastic income inequality.

Table 2: Different dependent variable (the gini coefficient) in OLS regression

	A	B	C	D1	D2
Education	0.1313*** (7.04)	0.1373*** (7.43)	0.1305*** (7.51)	0.0963*** (5.29)	0.1020*** (5.57)
Credit constraints		0.0455*** (5.43)	0.0258* (1.81)		
Lagged Credit constraints			0.0248* (1.78)		
EquLib				0.0055 (0.78)	-0.0030 (-0.41)
EquLib*L.FinCrd				-0.0061 (-0.73)	-0.0018 (-0.21)
L.EquLib*Edu				0.0764*** (5.17)	0.0709*** (4.8)
Capital inflow	-0.0369*** (-5.47)	-0.0333*** (-4.97)	-0.0350*** (-5.4)	-0.0378*** (-5.86)	-0.0364*** (-5.65)
GDP per capita	0.0337** (2.01)	0.0379** (2.29)	0.0784*** (4.36)	0.0778*** (4.35)	0.0793*** (4.44)
Openness in constant price	-0.0135 (-1.56)	-0.0143* (-1.68)	-0.0112 (-1.3)	-0.0107 (-1.25)	-0.0126 (-1.46)
Investment Share of Real GDP per capita	0.0074 (1.1)	0.0099 (1.49)	0.0118* (1.79)	0.0110* (1.68)	0.0112* (1.72)
Government consumption	-0.0209** (-2.31)	-0.0200** (-2.24)	-0.0279*** (-2.82)	-0.0278*** (-2.84)	-0.0278*** (-2.84)
Population	-0.0030 (-0.13)	-0.0066 (-0.29)	0.0385 (1.51)	0.0495* (1.78)	0.0592** (2.15)

Table 3: Different dependent variable (the gini coefficient) in GMM regression

	A	B	C	D1	D2
Education	0.0151*** (12.02)	0.0128*** (10.8)	0.0116*** (8.17)	-0.0015 (-1.39)	-0.0011 (-0.84)
Credit constraints		0.0148*** (11.11)	0.0058*** (4.17)		
Lagged Credit constraints			0.0150*** (9.08)		
EquLib				0.0077*** (5.61)	0.0070*** (10.99)
EquLib*L.FinCrd				-0.0055*** (-5.15)	-0.0044*** (-7.22)
L.EquLib*Edu				0.0283*** (12.68)	0.0277*** (11.6)
Capital inflow	-0.0026*** (-4.18)	0.0004 (0.48)	0.0019*** (4.06)	0.0005 (0.44)	0.0012 (1.24)
GDP per capita	0.0085*** (4.99)	0.0081*** (3.53)	0.0078*** (4.32)	0.0063*** (3.33)	0.0075*** (3.3)
Openness in constant price	0.0067*** (8.4)	0.0015* (1.82)	0.0011 (1.4)	-0.0001 (-0.05)	-0.0006 (-0.47)
Investment Share of Real GDP per capita	-0.0060*** (-8.37)	-0.0036*** (-4.94)	-0.0019*** (-2.61)	-0.0012* (-1.66)	-0.0017** (-2.22)
Government consumption	-0.0092*** (-6.41)	-0.0086*** (-5.36)	-0.0079*** (-3.86)	-0.0084*** (-4.46)	-0.0079*** (-3.58)
Population	0.0019 (1.01)	0.0023** (2.05)	-0.0001 (-0.03)	0.0023 (0.47)	0.0008 (0.34)

In empirical research, we firstly testify the relationship between credit constraints and inequality. As shown in column A and B of Table 4, without considering credit restrictions, we can clearly find that initial income inequality and education enter as the same as our expectations. Education is the key to human capital accumulation, which reduce the inequality. Getting knowledge is proved to be the shortcut to equal income distribution. And initial income inequality indicates the value of *gini* coefficient in the beginning of sample period, which is the initial income condition of the country, so initial income inequality has a positive impact on inequality. In Table 4, there are the regression results using the econometric methods of GMM. Before

considering the impact of equity market liberalization on income inequality, the results in this table assesses the impact of non-liberalization determinants. Both Initial inequality and credit constraints play the role in above equation as the same as our expectation. Considering the effects of credit constraint in column C, as expected it enters negatively and significantly. Credit constraint, one of the main presentations of financial market frictions, hinders the poor to get sufficient education investment, which perpetuate the persistent cross-dynastic income inequality. In this empirical research, we use private credit to indicate credit constraints, which means that the higher private credit, the less credit constraint. On the contrary, in column D the lagged credit constraints, which indicates the private credit that parents got, enters positively. This is the same as our hypothesis, that credit constraints in generation  $t-1$  determine the parental investment in children's education, which has the intergenerational impact on income inequality. Poor parents with superior endowment children saw the dawn to reduce the poverty but the lack of education investment stops the children to go for advantage study, which makes them fail in competing with inferior endowment children from rich family. To this extent, it is the credit constraint that perpetuates the cross-dynastic income inequality. The notion of education is negatively associated with growth of inequality, which is the same as our ideas that more education helps developing human capital and increasing one's probability to get high income.



Table 4: Credit constraints and inequality (dependent variable is gini growth rate)

	A	B	C	D
Initial gini	0.0584*** (2.79)	0.1269*** (3.64)	0.1486*** (4.18)	0.1409*** (3.98)
Education		-0.0851*** (-5.09)	-0.0938*** (-5.54)	-0.0924*** (-5.47)
Credit constraints			-0.0241*** (-3.02)	-0.0473*** (-3.56)
Lagged Credit constraints				0.0286** (2.2)
Capital inflow	-0.0122*** (-3)	-0.0102* (-1.67)	0.0140 (0.82)	0.0185 (1.09)
GDP per capita	0.0264*** (3.05)	0.0189 (1.12)	-0.0112* (-1.82)	-0.0119* (-1.94)
Openness in constant price	-0.0069 (-1.43)	-0.0212*** (-2.66)	-0.0196** (-2.46)	-0.0202** (-2.53)
Investment Share of Real GDP per capita	0.0011 (0.31)	-0.0031 (-0.5)	-0.0046 (-0.74)	-0.0039 (-0.64)
Government consumption	0.0003 (0.06)	0.0044 (0.48)	0.0050 (0.54)	0.0037 (0.4)
Population	0.0335*** (2.64)	0.0692*** (2.89)	0.0678*** (2.83)	0.0676*** (2.83)

After the preliminary analysis, we involve the equity market liberalization to investigate the effect of itself on persistent cross-dynastic income inequality. The results are robust in Table 5 to using the fixed effect estimation method, while in Table 6 these results remain robust to the consideration of endogeneity and using the method of GMM. The regressions reported in column A1, A2 and A3 are the standard determinants, which exclude the impact of equity market liberalization on income inequality. It is clear to find that the initial income inequality and credit constraints in last generation enter positively and significantly, which are exactly the same as our expectation. Also, credit constraints, denoted by private credit, and second school enrollment are negatively related to inequality, which indicates that the increasing of human capital accumulation through loosening the credit constraints slow down the persistent intergenerational income inequality as same as our hypothesis. Results in column B and column C consider the various measurement of liberalization, which

are respectively the official equity market liberalization and first-sigh liberalization while both of which present the information of equity market liberalization. The initial inequality, credit constraints and gross enrollment of secondary school remain significant. However, in column B3 and C3, the cross term of equity market liberalization and credit constraints in the last generation, denoted as the time of  $t-1$ , enters negatively, which shows that when we consider the effect of liberalization the financial market friction in generation  $t-1$  can be smoothed by foreign equity flow. The severe credit constraint makes parents keep from investing in their children's education, which hinders them to accumulate human capital that is the key to high income. However, when we consider the equity market liberalization, parents have a brand new way to financing and may expand their investment opportunity. To this extent, parents have much more opportunity to obtain financial support and invest in their children's education, which will definitely reduce the persistence of cross-dynastic income inequality.

Table 5: Results with fixed effect

	A1	A2	A3	B1	B2	B3	C1	C2	C3
	Standard determinates			Official liberalization dummy			Fist sign liberalization dummy		
InitialGini	0.1269*** (3.64)	0.1486*** (4.18)	0.1409*** (3.98)	0.1265*** (3.63)	0.1335*** (3.8)	0.1205*** (3.37)	0.1281*** (3.67)	0.1262*** (3.6)	0.1249*** (3.49)
Education	-0.0851*** (-5.09)	-0.0938*** (-5.54)	-0.0924*** (-5.47)	-0.0887*** (-5.26)	-0.0923*** (-5.45)	-0.1012*** (-5.76)	-0.0889*** (-5.23)	-0.0851*** (-5.08)	-0.1001*** (-5.65)
Credit constraint		-0.0241*** (-3.02)	-0.0473*** (-3.56)						
L. FinCrd			0.0286** (2.2)						
EquLib				0.0071 (1.57)	0.0139** (2.44)	0.0205*** (3.07)	0.0058 (1.24)		0.0183*** (2.6)
EquLib*L.FinCrd					-0.0105* (-1.86)	-0.0207*** (-2.64)		-0.0022 (-0.48)	-0.0186** (-2.32)
L.EquLib*Edu						0.0265* (1.88)			0.0225 (1.59)
Capital inflow	-0.0102* (-1.67)	-0.0112* (-1.82)	-0.0119* (-1.94)	-0.0114* (-1.85)	-0.0124** (-2)	-0.0135** (-2.18)	-0.0110* (-1.79)	-0.0102* (-1.66)	-0.0129** (-2.08)
GDP per capita	0.0189 (1.12)	0.0140 (0.82)	0.0185 (1.09)	0.0163 (0.96)	0.0189 (1.11)	0.0223 (1.31)	0.0172 (1.02)	0.0230 (1.36)	0.0222 (1.3)
Openness in constant price	-0.0212*** (-2.66)	-0.0196** (-2.46)	-0.0202** (-2.53)	-0.0192** (-2.39)	-0.0194** (-2.41)	-0.0200** (-2.49)	-0.0191** (-2.35)	-0.0220*** (-2.75)	-0.0189** (-2.33)
Investment Share of Real GDP per capita	-0.0031 (-0.5)	-0.0046 (-0.74)	-0.0039 (-0.64)	-0.0035 (-0.56)	-0.0038 (-0.62)	-0.0033 (-0.53)	-0.0036 (-0.58)	-0.0031 (-0.51)	-0.0036 (-0.59)
Gov consumption expenditure	0.0044 (0.48)	0.0050 (0.54)	0.0037 (0.4)	0.0047 (0.5)	0.0038 (0.41)	0.0033 (0.36)	0.0046 (0.5)	0.0034 (0.37)	0.0034 (0.37)
Population	0.0692*** (2.89)	0.0678*** (2.83)	0.0676*** (2.83)	0.0537** (2.07)	0.0575** (2.22)	0.0657** (2.5)	0.0576** (2.24)	0.0742*** (2.97)	0.0676*** (2.59)

Table 6: Results with GMM

	A1	A2	A3	B1	B2	B3	C1	C2	C3
	Standard determinates			Official liberalization dummy			Fist sign liberalization dummy		
Initial Gini	0.2344*** (21.27)	0.2107*** (27.11)	0.2269*** (11.61)	0.2297*** (14.76)	0.2214*** (22.92)	0.2275*** (10.53)	0.2424*** (24.72)	0.2215*** (22.89)	0.2118*** (15.12)
Education	-0.0385*** (-22.4)	-0.0365*** (-14.92)	-0.0415*** (-27.64)	-0.0431*** (-18.48)	-0.0460*** (-18.68)	-0.0922*** (-18.32)	-0.0417*** (-29.96)	-0.0466*** (-19.59)	-0.0902*** (-24.96)
Credit constraint		-0.0154*** (-4.81)	-0.0605*** (-14.27)						
L. FinCrd			0.0637*** (13.85)						
EquLib				0.0024*** (2.71)		0.0167*** (8.7)	0.0051*** (5.23)		0.0159*** (6.63)
EquLib*L.Fin Crd					0.0040*** (3.7)	-0.0240*** (-12.13)		0.0058*** (5.2)	-0.0229*** (-11.15)
L.EquLib*Ed u						0.0904*** (12.46)			0.0878*** (13.55)
Capital inflow	-0.0032* (-1.71)	-0.0073*** (-4.68)	-0.0054*** (-2.84)	-0.0079*** (-2.99)	-0.0042** (-2.03)	-0.0057*** (-3.25)	-0.0075*** (-6)	-0.0049** (-2.2)	-0.0052** (-2.12)
GDP per capita	-0.0099*** (-12.59)	-0.0120*** (-9.31)	-0.0104*** (-8.75)	-0.0095*** (-6.45)	-0.0092*** (-8.98)	-0.0054*** (-2.75)	-0.0099*** (-11.93)	-0.0093*** (-9.69)	-0.0074*** (-4.13)
Openness in constant price	-0.0107*** (-6.02)	-0.0032 (-1.43)	-0.0023 (-0.78)	-0.0064* (-1.88)	-0.0107*** (-4.06)	-0.0130*** (-3.65)	-0.0076*** (-2.84)	-0.0118*** (-4.4)	-0.0144*** (-4.98)
Investment Share of Real GDP per capita	-0.0042 (-1.51)	-0.0047*** (-2.78)	0.0000 (0.01)	-0.0022 (-1.38)	0.0005 (0.29)	0.0039 (1.25)	-0.0048** (-2.18)	0.0008 (0.44)	0.0023 (0.84)
Gov consumption expenditure	0.0043*** (3.88)	0.0066*** (5.23)	0.0062*** (5.93)	0.0039*** (3.21)	0.0032*** (4.23)	0.0009 (0.58)	0.0039*** (4.25)	0.0030*** (3.87)	0.0019 (1.41)
Population	-0.0007 (-0.87)	-0.0037*** (-3.07)	-0.0019 (-1.23)	-0.0008 (-0.66)	0.0013 (1.13)	0.0061*** (3.96)	0.0000 (0.01)	0.0015 (1.22)	0.0058*** (4.56)

## **4. The effect of foreign equity flow in different domestic stock market**

### **4.1 Theoretical background of the effect**

In the first stage of estimating the model, it is certified that equity market liberalization, acting as an external shocks on domestic credit constraints, exerting an roles in alleviating or diminishing credit constraints, and therefore to affect the income inequality through loosening the credit constraints on accumulating human capital. Considering the income inequality is significant in under-developed and developing countries, whose activity of domestic stock market is relatively low, we raise another question hereby: which kind of domestic equity market benefit more from the diminishing credit constraints? It means that it is important for us to investigate how the effects of foreign equity inflow vary with the activity of domestic stock market. If the less active domestic stock market, which more likely leads to insufficient financial support and then income inequality, benefits more from equity market liberalization, it is convincing to conclude that equity market liberalization could help to reduce the world persistent income inequality. However, if the more active domestic stock market prior to equity market reform gains more the conclusion may be very different.

So firstly, in Table 7 there are the summary statistics in different domestic stock market. It is clear to find the distinct effect of equity market liberalization on countries with different activity of domestic stock market. Countries with less active domestic stock market show significantly decrease in income inequality after opening equity markets, while the ones with active domestic stock market display vaguely. Similarly, the private credit increase after opening equity market, while the education rise as well. Statistically, it is obvious that the impact of equity market liberalization on different domestic stock market is significant especially on the less active ones.

In the empirical research, we must firstly investigate the relationship between domestic stock market activity and intergenerational income inequality and make sure whether the less active stock market leads to serious income inequality. If so, the way to compensate domestic stock market can definitely diminish cross-dynastic income inequality.

Furthermore, we must make sure how finance operates on income inequality. Finance can operate on intensive margin, enhancing the access to financial services for well-developed stock markets prior to the equity market liberalization

(Greenwood & Jovanovich 1990). It is reasonable to believe that the initially active domestic stock market leads a relatively equal income distribution since it allocates resource among people efficiently. Before liberalizing, people can get support from domestic stock market, which makes it much more probable for poor to invest in education and get high income. As a result, foreign equity flow, a complement of domestic stock market, may help more for countries with better financial infrastructure, which may not have so significant impact on world inequality. To this extent, we may say domestic stock market and foreign equity flow act as complements.

However, at the same time, less-developed equity market may gain more for the finance also operate on extensive margin? Initially less active domestic stock market leads to a serious inequality for it is hard to provide sufficient investment for poor, which definitely widen the inequality of the income distribution. After financial reform, under-developed stock market can provide the poor and former disadvantaged groups much more fund support than before. People may expand their economic opportunity through parental investment in education or self-investment in increasing the ability to acquire more income or wealth, which can reduce the intergenerational persistence of relative incomes. To this extent, we may say, domestic stock market and foreign equity flow act as substitutes. So it is crucial to find that whether the activity of domestic stock market exerts a complement or substitute role on foreign equity flow. Knowing this, it is probable to conclude the impact of equity market liberalization on intergenerational income inequality.

Table 7: Summary statistics in different domestic stock market

variables	Pre-Liberalization		Post-Liberalization		Without-Liberalization	Fully-Liberalization
	active stock market	less Active stock market	active stock market	less Active stock market		
Gini growth rate(%)	-0.673603	0.01129	0.553021	-0.1350975	0.1487	0.2035
Gini coefficient	0.454092949	0.44394558	0.45724183	0.435638674	0.460963	0.486817
Private credit	0.420929823	0.573024941	0.43073891	0.823051901	0.552327	0.464066
Education	0.568774357	0.4854305	0.74736883	0.576614085	0.408171	1.090826
GDP growth rate(%)	3.494466775	2.307163802	4.01619571	3.735239351	2.517136	2.5422

## 4.2 Empirical framework of the effect

To measure the stock market activity, we choose stock market value traded divided by GDP (stvt) and stock market turnover ratio (stto) following the ideas by Kalina (2008). We examine whether domestic stock market and foreign equity flow act as substitutes or complements by extending equation (1) and adding interactions of domestic stock market activity with equity market liberalization.

$$\begin{aligned}
 Inequl_{i,t} = & \beta_{igini} Igin_{i,t} + \beta_{crd} FinCrd_{i,t} + \beta_{mktlib} MktAct_{i,t} \times EquLib_{i,t} \\
 & + \beta_{mktedu} MktAct_{i,t} \times Edu_{i,t} + \beta_{mktlib1} MktAct_{i,t-1} \times EquLib_{i,t-1} \\
 & + \beta_{mktlibedu} MktAct_{i,t} \times EquLib_{i,t} \times Edu_{i,t} + \beta_{crd1edu} FinCrd_{i,t-1} \times Edu_{i,t} \\
 & + \eta_{cv} Contl_{i,t} + \theta_i + v_t + e_{it}
 \end{aligned} \tag{Equation 2}$$

If countries with lower level of initial income inequality (low Initial gini) tend to experience slower reductions in that inequality, we expect  $\beta_{igini} > 0$  as before.  $\beta_{crd} < 0$ , since the less credit constraints (higher private credit), the slower inequality growth. Similarly,  $\beta_{mktedu} < 0$  if active domestic stock market stimulates investment in education, simultaneously increases enrollment in secondary school and reduce the income inequality. And if active domestic stock market can alleviate the credit constraints laid in the last period, it may facilitates the education investments to children for parents and the  $\beta_{mktlib1} < 0$ . Finally, if domestic stock market and foreign equity flow act as substitutes, which means after equity market liberalization, less developed domestic stock market gains more and the extensive margin effect of finance operates, the income inequality will reduce and  $\beta_{mktlib} > 0$ ,  $\beta_{mktlibedu} < 0$ .



Table 8: Foreign equity flow and domestic stock market

	A1	A2	B1	(MktAct=stock market traded value)					D1	(MktAct=stock market turnover ratio)				
				B2 (official)	B3	C1	C2 (first sigh)	C3		D2 (official)	D3	E1	E2 (first sigh)	E3
Initial Gini	0.1460* **	0.1623* **	0.1396* **	0.1593* **	0.0935* **	0.1452* **	0.1645* **	0.1012* **	0.1332* **	0.1484* **	0.1038* **	0.1018* **	0.0969* **	0.1348* **
	(7.79)	(6.87)	(7.51)	(6.09)	(5.16)	(7.68)	(7.12)	(5.8)	(4.32)	(4.53)	(3.06)	(6.78)	(6.38)	(4.37)
FinCrd	0.0068* **	0.0067* **	0.0022	0.0033	-0.0094 *	0.0021	0.0015	-0.0002	0.0025	0.0030	-0.0036	-0.0028	-0.0025	-0.0042
	(3.14)	(3.7)	(0.73)	(1.12)	(-1.88)	(0.58)	(0.4)	(-0.03)	(0.84)	(0.99)	(-0.76)	(-0.93)	(-0.87)	(-0.93)
Education	-0.0601 ***	-0.0646 ***												
	(-13.42)	(-13.42)												
MktAct1 <sup>1</sup>	-0.0069 ***													
	(-5.38)													
MktAct2 <sup>2</sup>		-0.0040 ***												
		(-8.01)												
MktAct*EquLib			0.0631* **	0.0711* **	0.0641* **	0.0738* **	0.0743* **	0.0806* **	0.0064* *	0.0098* **	0.0118* **	0.0046	0.0044	0.0082* *
			(8.13)	(8)	(5.28)	(9.51)	(6.41)	(11.68)	(2.41)	(3.81)	(3.06)	(1.16)	(0.98)	(2.4)
MktAct*Edu			-0.0741 ***	-0.0348 ***	-0.0314 ***	-0.0854 ***	-0.0401 *	-0.0378 ***	-0.0135 ***	-0.0027	-0.0098 ***	-0.0101 **	0.0000	-0.0127 ***
			(-7.72)	(-7.35)	(-5.95)	(-8.79)	(-1.68)	(-4.55)	(-3.51)	(-0.22)	(-3.51)	(-2.04)	(0)	(-4.42)
MktAct*EquLib *Edu				-0.0495 ***	-0.0478 ***		-0.0478 *	-0.0538 ***		-0.0144	-0.0118 ***		-0.0091	-0.0060
				(-6.1)	(-4.86)		(-1.87)	(-5.26)		(-1.23)	(-3.01)		(-0.76)	(-1.59)

<sup>1</sup> MktAct1 indicates the stock market value traded.<sup>2</sup> MktAct2 indicates the stock market turnover ratio.

L.MktAct*	0.0104							0.0005	-0.0006				-0.0012	
L.FinCrd	(1.07)							(0.06)	(-0.16)				(-0.4)	
L.FinCrd*Edu	0.0058							-0.0006	0.0041				0.0000	
	(0.98)							(-0.08)	(0.8)				(0)	
Capital inflow	-0.0083 **	-0.0096 ***	-0.0125 ***	-0.0111 ***	-0.0110 ***	-0.0119 ***	-0.0087 **	-0.0093 **	-0.0103 **	-0.0102 **	-0.0134 ***	-0.0200 ***	-0.0195 ***	-0.0141 ***
	(-2.39)	(-2.64)	(-3.48)	(-3.42)	(-2.83)	(-3.37)	(-2.1)	(-2.26)	(-2.23)	(-2.19)	(-3.21)	(-5.83)	(-5.57)	(-3.31)
GDP per capita	-0.0081 *	-0.0112 ***	-0.0176 ***	-0.0123 ***	-0.0030 ***	-0.0173 ***	-0.0150 ***	-0.0095 ***	-0.0127 ***	-0.0153 ***	-0.0070 ***	-0.0152 ***	-0.0137 ***	-0.0101 *
	(-1.92)	(-2.63)	(-7.04)	(-4.74)	(-0.63)	(-6.04)	(-3.34)	(-3.64)	(-3.94)	(-4.09)	(-1.58)	(-4.86)	(-3.56)	(-1.78)
Openness in	-0.0080 **	-0.0079 **	-0.0051 **	-0.0106 **	-0.0115 **	-0.0053 **	-0.0094 **	-0.0127 ***	-0.0100 **	-0.0083 *	-0.0070 *	-0.0048 *	-0.0064 *	-0.0064 *
constant price	(-1.96)	(-1.36)	(-1.17)	(-2.14)	(-2.26)	(-1.22)	(-2)	(-3.07)	(-2.39)	(-1.71)	(-1.61)	(-0.84)	(-1.06)	(-1.42)
Investment	-0.0090 ***	-0.0081 *	-0.0188 ***	-0.0168 ***	-0.0036 ***	-0.0174 ***	-0.0160 **	-0.0066 *	-0.0217 ***	-0.0254 ***	-0.0041 ***	-0.0174 ***	-0.0164 ***	-0.0090 **
Share of RGDP	(-2.64)	(-1.91)	(-3.67)	(-4.52)	(-0.93)	(-3.37)	(-2.46)	(-1.67)	(-5.07)	(-4.81)	(-1.12)	(-5.37)	(-4.87)	(-2.09)
Government	0.0049	0.0076	0.0144* **	0.0110* **	0.0023	0.0138* **	0.0105* *	0.0058* *	0.0095* **	0.0124* **	0.0023	0.0107* **	0.0087* **	0.0040
consumption	(1.11)	(1.6)	(4.76)	(2.91)	(0.53)	(4.3)	(2.11)	(1.81)	(2.74)	(3.01)	(0.37)	(3.14)	(1.96)	(0.69)
Population	-0.0089 **	-0.0104 **	-0.0159 ***	-0.0114 ***	-0.0052 ***	-0.0147 ***	-0.0105 *	-0.0097 ***	-0.0099 ***	-0.0136 ***	-0.0078 ***	-0.0069 **	-0.0049 **	-0.0016 **
	(-2.39)	(-2.28)	(-4)	(-5.86)	(-1.27)	(-3.59)	(-1.86)	(-2.87)	(-2.86)	(-3.41)	(-1.49)	(-2.23)	(-1.07)	(-0.29)

### 4.3 Empirical result analysis

Before analyzing the impact of foreign equity flow on different domestic stock market, it is necessary to ensure the relationship between domestic stock market activity and persistent cross-dynastic income inequality. In Table 5 column A1 and A2, we testify this kind of relationship and, as same as our hypothesis, find that domestic stock market activity is negatively associated with income inequality, suggesting that countries with less active stock market tend to experience skewed income distribution.

Column B, C, D and E in Table 5 show the results of testing whether the domestic stock market and foreign equity flow substitutes or complements. The results reported in column B, C and column D, E consider a variety of stock market activity measurement which are respectively stock market value traded and stock market turnover ratio. With the same consideration of stock market activity measurement, column B and C vary in different equity market liberalization dummy and so it does in column D and E. Results in column B and C focus on the measurement of stock market value traded and our findings are robust to using both official liberalization dummy and first sigh dummy. We find that the initial gini and credit constraints are associated with the growth of income inequality in the way we expected. The positive relationship between the interaction of domestic stock market activity and foreign equity flow with the growth of income inequality in column B and C prove that equity market liberalization benefits the less-developed domestic stock market more than the developed ones, slowing down the growth of income inequality. What's more, the negative relationship between interaction of market activity and education indicates that similar with foreign equity flow, domestic stock market stimulates investment in human capital, which absolutely alleviates the transmission of inequality. The triple interaction terms is negatively associated with gini growth, as we expected, which indicates that foreign equity flow stimulates the less-developed domestic stock market, increase the human capital accumulation, thus equalize the income distribution. From this analysis, there are compelling evidences that foreign equity flow and domestic stock market act as substitutes. When we consider the stock market turnover ratio as the indicator of domestic stock market activity, the results remain significant when using the official liberalization dummy. The main results are similar as in column B and C and the same as we expected. This can be the third evidence that equity market liberalization compensates for under-developed stock market.

At the beginning of analysis in this section, we have already testify the relationship between domestic stock market and income inequality, which implies that less active stock market is associated with severe cross-dynastic income inequality. As a result, based on the above analysis, foreign equity flow compensates the less active domestic stock market, which indicates that income unequal country resulted from less active domestic stock market gains more from equity market liberalization. It is no doubt that though providing sufficient financial support, equity market

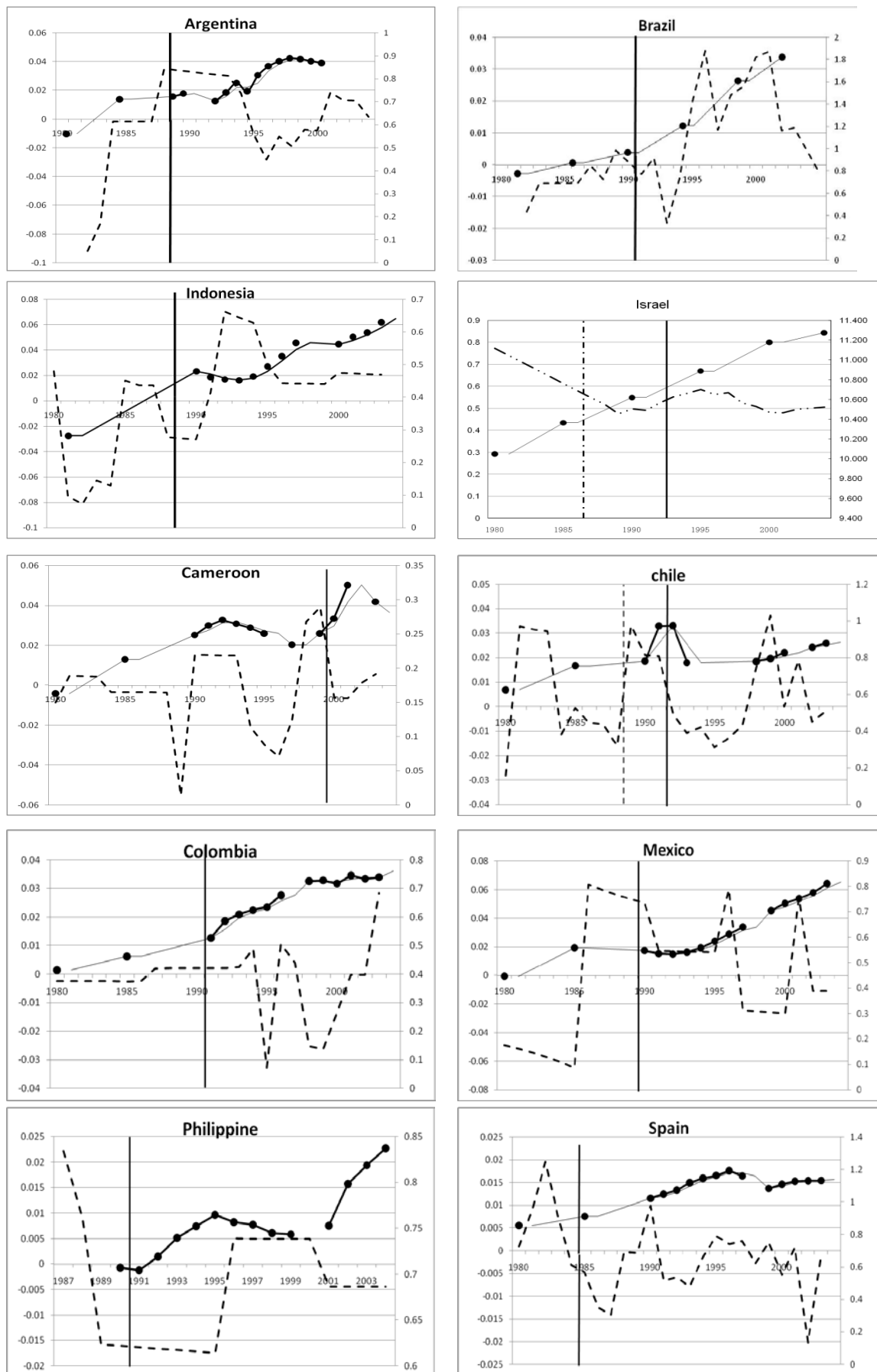
liberalization reduces the persistent cross-dynastic income inequality.

## **5 Conclusions**

This paper illustrates that equity market liberalization, an external shock of the financial market, can smooth the financial market frictions such as credit constraints and expand the economic opportunities especially in under-developed domestic stock market for poor. Without consideration of equity market liberalization, the lack of parental education investment hinders human capital development and accumulation, which is the main reason of persistent cross-dynastic income inequality. On the contrary, after liberalizing the equity market, foreign equity flow supports poor family to invest in superior endowment children, which makes it easier for poor children to develop their ability and get high income to diminish the intergenerational inequality.

Besides, we testify the relationship between domestic stock market activity and intergenerational income inequality and find that less active stock market leads to severe cross-dynastic income inequality. Furthermore, we prove that finance operate extensive margin more than intensive margin on inequality through empirical research. In particular, we test that the foreign equity flow act as a substitute of domestic stock market, which means that initially less active domestic equity market benefits more from foreign equity flow. Considering income inequality is serious in countries with less active stock market, opening equity market benefits more to this kind of countries and consequently reduces persistent cross-dynastic income inequality.

Figure 1: Liberalization and inequality in typical economies



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