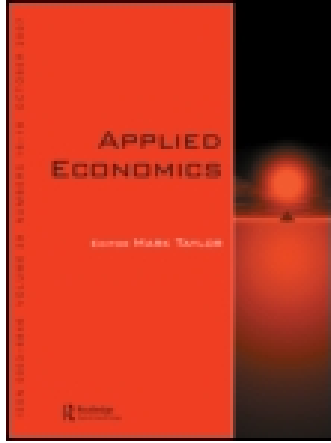


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Income inequality and financial reform in Asia: the role of human capital

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We investigate whether financial reform can reduce income inequality in Asia, with particular emphasis on the role of human capital. Extending Galor and Zeira (1993), we demonstrate that financial reform is effective in reducing income inequality, and the effect is more profound in a country with higher human capital. Using the data for 18 countries in Asia, the region with the most promising financial reform, we confirm our theoretical finding. In addition, among disaggregated financial reforms, lift of credit control, better banking supervision and security market development seem to be significantly associated with reduction of income inequality.

Keywords: financial reform; income inequality; human capital; Asia

JEL Classification: E44; O11; O15

I. Introduction

The effect of financial reform on economic growth is widely agreed.¹ Among many which are noteworthy, Hermes and Lensink (2005) and Levine (2005) suggest a strong positive linkage between financial development and economic growth. Quinn and Toyoda (2008), using data for 94 nations, demonstrate that capital account liberalization is associated positively with economic growth in both developed and emerging-market countries. Fase and Abma (2003) examine the issue for nine southeast countries and suggest that financial development promotes growth. Though Yu *et al.* (2012) argued that the linkage between financial development and economic growth could vary due to regional political or institutional differences, in most cases, evidence suggest significant positive relationship between financial reform and growth.

However, economic growth does not necessarily assure income equality. For instance, Janvry and Sadoulet (2000) find that income growth is effective in alleviating poverty and inequality only if the initial levels of inequality and poverty are not too high and if educational levels are sufficiently high. Galor and Zeira (1993) argue that initial level of wealth would influence the long-run wealth of an individual and his generations and further influence the economy. According to Greenwood and Jovanovic (1989), financial development indeed can improve allocation and benefit the poor, depending on the level of economic development.

On the theoretical link between financial development and inequality, some studies argue that financial development would reduce inequality by making it easier for the poor to get access to financial services and ameliorating the efficiency of capital allocation (Galor and Zeira, 1993;

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¹see King and Levine (1993), Demetriades and Hussein (1996), Bell and Rousseau (2001), Rousseau and Wachtel (2002), Rioja and Valev (2004) and Quinn and Toyoda (2008).

Aghion and Bolton, 1997; Mookherjee and Ray, 2003; Galor and Moav, 2004). Among empirical studies, Arestis and Caner (2004) examine the channels through which financial liberalization can influence income inequality. They suggest that, if macroeconomic stability and supporting institutions and policies are not in place, financial liberalization often exacerbates inequality. Abiad *et al.* (2008b) also find that financial liberalization can alleviate inequality through improving the allocative efficiency measured by dispersion in Tobin's Q across firms. However, when studying 17 Latin American countries over 1961–2005, Mandel (2010) shows that only with satisfactory redistributive institutions can a Latin American nation decrease inequality during the course of liberalization.

Instead of investigating the holistic effect of financial reform, some research focus on specific financial sectors. In a careful analysis, Das and Mohapatra (2003) find that, with liberalization in the equity market, people in the top quintile of the income distribution gain at the expense of 'middle class' defined as the three middle quintile of income distribution. But the lowest income share stays unchanged in the event of liberalization. Studying the link between financial intermediary development and Gini coefficient for 83 countries between 1960 and 1995, Clarke *et al.* (2006) show a negative relationship between financial deepening and income inequality in the long run.

Results of within-country studies are rather mixed. Studying the aggregate growth and the distributional effects in Thailand, Giné and Townsend (2004) find that financial liberalization affects different groups of population differently. Specifically, the primary beneficiaries were the 'talented would-be entrepreneurs' who could not run business because of the lack of credit. However, Crotty and Lee (2006) show that after the financial crisis in 1997, growth slowed, poverty and inequality rose, indicating that the financial reform experiment failed to benefit the majority of Korean. Agnello *et al.* (2012) used the same financial reform index as we do to study inequality issue. Our study, however, deviates from theirs in many aspects: first, we propose a theoretical model, specifying how human capital can improve the efficiency of financial reform on inequality; second, we focus on Asia, the region with most promising financial reform progress; third, in terms of econometric method, we also control endogeneity problem by using dynamic panel GMM approach, avoiding the concern that inequality may actually lead to financial reform.

The remainder of this article is structured as follows. Section II presents some stylized facts in Asia. In Section III, we extend Galor and Zeira (1993) to explain that financial reform can benefit the poor with

higher human capital. In Section IV, we show the general pattern of Gini coefficient in Asian countries, and Section V describes the empirical model. The empirical results are given in Section VI. Final section concludes the article.

II. Some Stylized Facts in Asia

Compared with other regions, financial sectors in Asian countries display its own characters. They were very small before financial reform was widely implemented starting from late 1970s. In the early 1980s, financial assets of nonbanking financial institutions took tiny weight in GDP, for example, 5% for Malaysia and 2% for India, much less than those of developed countries. In addition, the overwhelming power of government in financial system led to its ubiquitous intervention, making financial markets inefficient. Yet, from late 1970s, Asian countries started a series of financial reforms, huge in magnitude and extensive in categories. Singapore, Malaysia, India, Philippines and some other countries released the control over interest rates. Meanwhile, they adopted more flexible exchange rate policy. The size of financial system in most Asian countries expanded dramatically as well. The assets of deposit money banks took were 124% of GDP in Malaysia and 61.5% in India in 2010. In 1982, the share of private credit by deposit money banks and nonbanking financial institutions to GDP was about 9% for Indonesia and 8% for Nepal, while it reached 24% and 52%, respectively, in 2010.²

On the other hand, there is a general pattern of declining poverty in Asia. Figure 1 showed clearly that the global poverty had been declining since 1990. In 1990, 43.1% of the world's population lived at or below the poverty line of \$1.25 per day. In 2008, however, it dropped dramatically to about 22.4%, nearly half of that in 1990. In particular, the share in South Asia was at 48.6% in 1996, decreasing to 35.97% in 2008.

The area with the most dramatic decrease in this ratio was East Asia and Pacific. It dropped about a half, from 35.9% in 1996 to 14.34% in 2008. Europe and Central Asia, Latin America and Caribbean and Middle East and North Africa kept a low and declining poverty ratio in the decade. Especially for Europe and Central Asia and Middle East and North Africa, the ratio had always been under 10%, much lower than other areas in the world.

Although the situation of poverty declined in the past decades, inequality of the world increased slightly. The global Gini coefficient increased from 68.4 to 70.7 between 1988 and 2005. Nevertheless, Malaysia, Philippines and Thailand experienced significant

²The data is from Financial Structure Dataset, 2012.

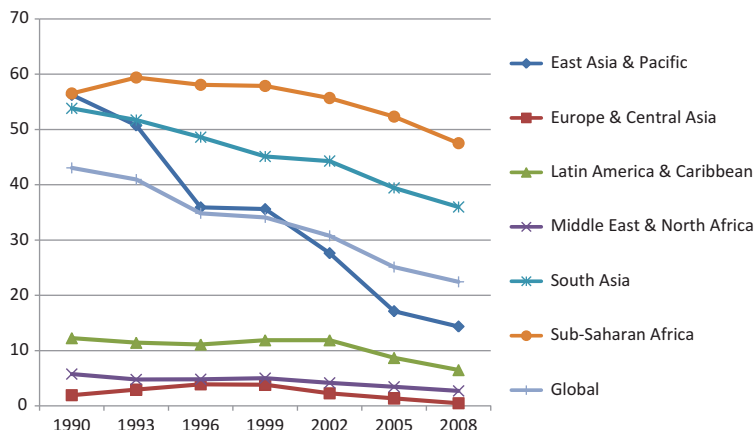


Fig. 1. Poverty in the world

Notes: The vertical axis is the percentile of people in the area who live under the \$1.25 living expenses per day poverty line. The horizontal axis is the year. Data source: World Bank.

reduction in Gini coefficient for about 7.55%, 15.08% and 6.46%, respectively.

Figure 2 presents the histograms of financial reform index and inequality in selected Asian countries. The pattern was not clear enough, except for Malaysia and Philippines, whose Gini coefficient dropped significantly during the sample time period with a relatively high value of financial reform index.

III. The Analytical Model

Much importance of human capital has been attached to helping economic growth and total factor of productivity promotion. The positive growth effect is widely agreed (Fleisher *et al.* (2010); Crespo Cuaresma and Mishra (2011)). We extend the analytical framework in Galor and Zeira (1993) assuming that there is no adjustment cost and depreciation of capital. There are two kinds of workers in the economy, skilled and unskilled workers. A worker will live for two periods and can choose to invest in education in the first period in order to work as skilled worker in the second period, or he can choose to be an unskilled worker in both two periods. For unskilled workers, the production function is given by

$$Y_t^U = W^U L_t^U \tag{1}$$

where Y_t^U , L_t^U and W^U are output of unskilled workers, the number of unskilled worker in the economy in period t and the wage of unskilled worker, respectively.

We use Cobb–Douglas production function to describe the output of skilled labour at period t .

$$Y_t^S = AF(K_t, L_t^S) \equiv A(L_t^S)^\alpha (K_t)^{1-\alpha} \tag{2}$$

where K_t and L_t^S are physical capital and skilled labour employed at period t . Along with Lucas (1988), we further postulate that technology is the side product of education. So, we let A be the level of technology in the economy, and it is the function of stock value of human capital investment in the economy $A = H^\theta$, where H is human capital investment level in the economy, and $\theta \geq 1$. Hence, the wage of skilled worker at t equals the marginal product of skilled worker, i.e.

$$W_t^S = Y_L(K_t, L_t^S) = H^\theta \alpha \left(\frac{K}{L}\right)^{1-\alpha} \tag{3}$$

In the economy, each worker is the same except for the amount of inheritance, M , received from his ancestor. Consumption can only happen in the second period. A worker i 's utility is derived from his consumption and the bequest he leaves for his child.

$$U_{i,t} = \beta \log c + (1 - \beta) \log b \\ = \beta \log \beta k + (1 - \beta) \log(1 - \beta)k \tag{4}$$

where k is the total wealth of an individual in his life time. If a worker chooses not to take education and works as an unskilled one, his utility should be

$$U^U(M) \log = [(M + W^U)(1 + r) + W^U] + \mu \tag{5}$$

where μ is defined as $\beta \log \beta + (1 - \beta) \log(1 - \beta)$.

The unskilled worker leaves his offspring a bequest at the amount of

$$b^U(M) \equiv (1 - \beta)k = (1 - \beta)[(1 + r)(M + W^U) + W^U] \tag{6}$$

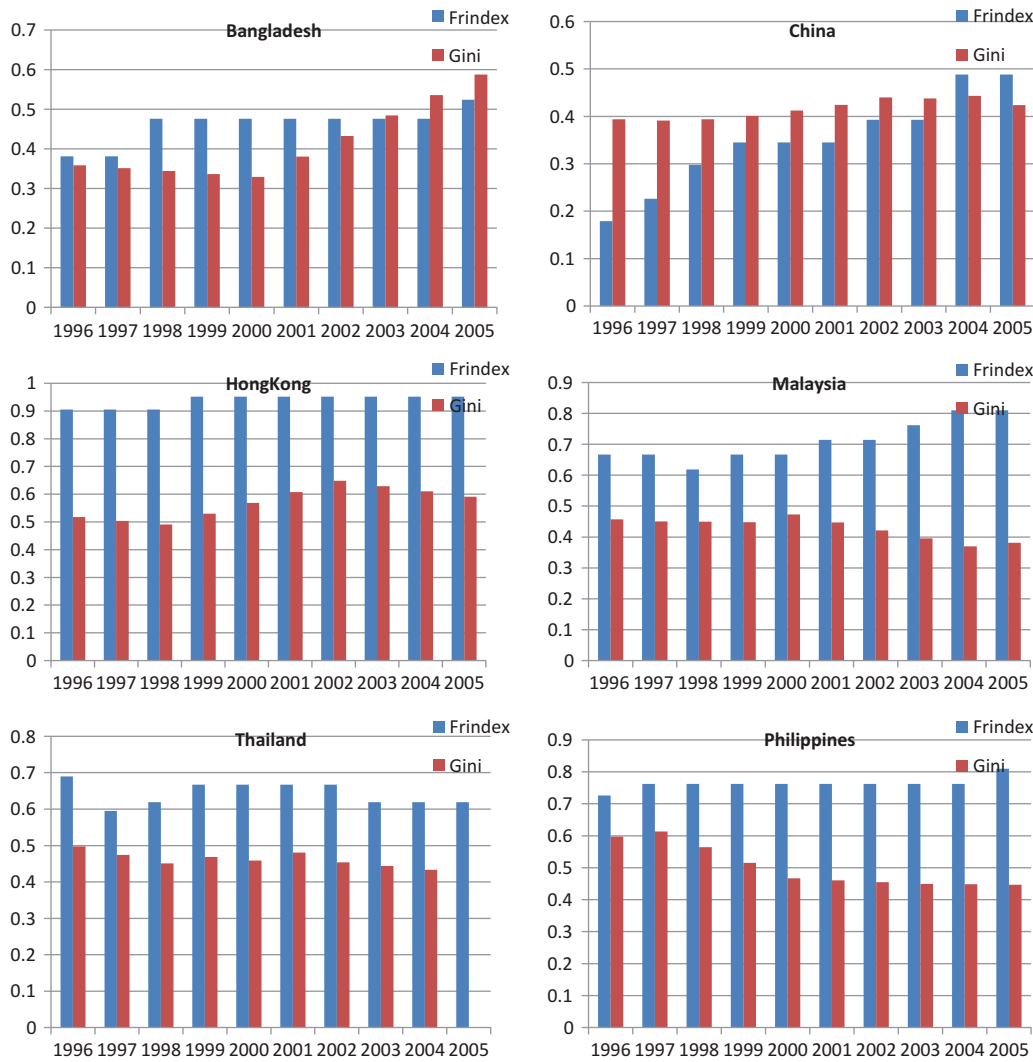


Fig. 2. Gini coefficient and financial reform in Bangladesh, China, Hong Kong, Malaysia, Thailand and Philippines
 Note: The vertical line is the Gini coefficient. Since Gini coefficient ranges from 0 to 1, the numbers on the axis suggest the percentile. The horizontal axis is the year. Data source: Financial Reform Database.

In order to take education, the worker should pay the amount of h . If a worker who has the amount of inheritance $M \geq h$ chooses to take education and work as a skilled one in the second period, his utility is

$$U^S(M) = \log[W^S + (M - h)(1 + r)] + \mu \tag{7}$$

His offspring gets a bequest of

$$b_t^S(M) \equiv (1 - \beta)k = (1 - \beta)[W_t^S + (M - h)(1 + r)] \tag{8}$$

At last, if an individual, with the amount of inheritance $M < h$, intends to be a skilled worker, he has to borrow money to invest in education; thus, his utility is

$$U_t^S(M) = \log[W_t^S + (M - h)(1 + i)] + \mu \tag{9}$$

and he leaves a bequest of

$$b_t^S(M) \equiv (1 - \beta)k = (1 - \beta)[W_t^S + (M - h)(1 + i)] \tag{10}$$

Obviously, an individual with inheritance $M \geq h$ will take education only if (7) \geq (5). Specifically,

$$W_t^S \geq h(1 + r) + (2 + r)W^U \tag{11}$$

For the workers who have to borrow to invest in education, they will make the investment only if (9) \geq (5).

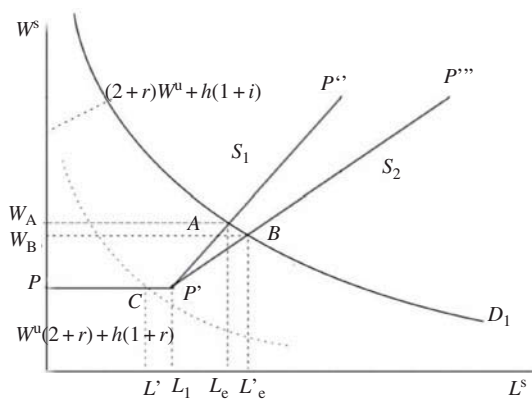


Fig. 3. Wage and skilled labour in the economy

$$W_t^S \geq (h - M)(1 + i) + M(1 + r) + (2 + r)W^U \quad (12)$$

Clearly, if Equation 12 holds, Equation 11 holds automatically, since $h > M$ for borrowers.

$$(h - M)(1 + i) + M(1 + r) + (2 + r)W^U \geq h(1 + r) + (2 + r)W_t^U$$

Figure 3 depicts the supply and demand curve of a skilled worker. There is no skilled labour in the market until W_t^S reaches the value of $W^U(2 + r) + h(1 + r)$. At this wage level, people with inheritance $M \geq h$ are indifferent between investing in human capital and working as an unskilled. Therefore, the maximum of skilled worker supply is the number of people who have an inheritance higher than h . We denote this amount of labour supply as L_1 . Similarly, if W_t^S reaches the value of $W^U(2 + r) + h(1 + i)$, all people in the economy are indifferent between working as a skilled and an unskilled.

From Equation 12 we know that for any borrower j , he will choose to work as a skilled if

$$W_t^S \geq (h - M_j)(1 + i) + M_j(1 + r) + (2 + r)W^U$$

The supply curve for borrowers is upward-sloping since higher W^S makes more borrowers satisfy this condition.

Due to financial reform, the interest rate at which an individual can borrow (i) drops. Then, $P'P''$ along supply curve S_1 shifts to $P'P'''$ on S_2 . S_1 and S_2 intersect with demand curve at A and B , respectively. It is clear that at point B , the market clearing wage is lower than that at point A . In the meantime, more borrowers are able to take education and become skilled labours.

We use $IE = \frac{W^S}{W^U}$ to represent income inequality between the rich and the poor.

By plugging Equation 3 into W_t^S at point A , IE is

$$IE = \frac{H^\theta \alpha \left(\frac{K}{L_e}\right)^{1-\alpha}}{W^U} \quad (14)$$

After i drops at point B , IE becomes

$$IE = \frac{H^\theta \alpha \left(\frac{K}{L_e}\right)^{1-\alpha}}{W^U} \quad (15)$$

The decrease of income inequality (DIE) is therefore

$$DIE = \frac{H^\theta \alpha \left(\frac{K}{L_e}\right)^{1-\alpha}}{W^U} - \frac{H^\theta \alpha \left(\frac{K}{L_e}\right)^{1-\alpha}}{W^U} \quad (16)$$

$$= \frac{H^\theta \alpha K^{1-\alpha} [(L_e')^{1-\alpha} - (L_e)^{1-\alpha}]}{W^U (L_e L_e')^{1-\alpha}}$$

It is obvious that $DIE > 0$, which means financial reform can reduce income inequality.

By taking the derivative of DIE with respect to H , we have

$$DIE_H = \frac{\partial DIE}{\partial H} = \frac{H^{\theta-1} \alpha \theta K^{1-\alpha} [(L_e')^{1-\alpha} - (L_e)^{1-\alpha}]}{W^U (L_e L_e')^{1-\alpha}} \quad (17)$$

Since $\theta \geq 1$, we know that DIE is an increasing function of H . It implies that, with higher level of human capital in the economy, financial reform has a larger impact on reducing income inequality, given everything else constant.

In the following sections, we carry out the empirical study, investigating: (1) whether financial reform is effective in reducing inequality; (2) whether financial reform is more effective when it is interacted with higher human capital.

IV. The Empirical Model

We estimate the following model:

$$Gini_{i,t} = \beta_0 + \beta_1 Frindex_{i,t} + \beta_2 LowEduDummy * Frindex_{i,t} + \beta_3 X_{i,t} + \epsilon_{i,t} \quad (17)$$

$Gini_{i,t}$ is the Gini index of inequality. $Frindex_{i,t}$ represents aggregated score of financial reform index, standardized between 0 and 1. $LowEduDummy * Frindex_{i,t}$ is an interaction term of human capital and financial reform index. $X_{i,t}$ refers to standard control variables.

More specifically, $Gini_{i,t}$ is the Gini index of inequality in equalized household gross (pre-tax, pre-transfer) income, using Luxembourg Income Study data as the standard. Among differently measured Gini coefficients, Bergh and Nilsson (2010) show that the Standardized

World Income Inequality Database (SWIID) created by Solt (2009) is better for comparison across countries. We use the SWIID Version 3.1.

The main explanatory variable, $Frindex_{i,t}$, is the financial reform index constructed by Abiad *et al.* (2008a). The index has seven dimensions: credit controls and reserve requirements, interest rate controls, entry barriers, state ownership, policies on securities market, banking regulations and restrictions on the capital account. Each dimension has its raw scores between 0 and 3. The score of 0 to 3 stands for the fully repressed to the fully liberalized. Each country has an aggregate score of the seven dimensions, thus scaled from 0 to 21, then further standardized between 0 and 1.

We introduce an interaction term of human capital, proxied by secondary school enrolment as in Barro (1991), and financial reform, $LowEduDummy * frindex_{i,t}$. $LowEduDummy$ is a dummy which takes 1 when secondary school enrolment is below 60% and 0 otherwise. Thus, the coefficient for $Frindex$, β_1 , the main coefficient of our interest, represents the impact of financial reform on inequality when human capital is high.

X is a vector of the following control variables:

- (1) *Secondary School Enrolment* $_{i,t}$ is the ratio of total secondary school enrolment to the population. More participation in education implies more investment in human capital which may increase the productivity of people, particularly the poor, and enable them with better-paid jobs. Besides, Galor and Zeira (1993) show that the poor who invests in education may leave more to his descendants. After generations, his offspring may become rich, which reduces income inequality.
- (2) *Life Expectancy* $_{i,t}$ is the average life expectancy of a country i at year t . Life expectancy could influence inequality directly, since the old tends to be relatively poor. Hence, higher life expectancy may increase the inequality of a country.
- (3) $Gov/GDP_{i,t}$ represents the ratio of general government final consumption expenditure to GDP, where the government expenditure includes all current expenditure for purchases of goods and services, but excludes government military expenditures. Government spending is usually invested on public facilities that benefit private investment, enriching those private investors, usually the rich. In the meantime, government expenditure includes transfer payment, which tends to reduce inequality instead.
- (4) *Institutional Quality* $_{i,t}$ is the perception of the ability of a government to formulate and implement sound policies and regulations that promote private sector development.³ Better institutional quality may help implement those policies targeting poor reduction, which tends to reduce income inequality.
- (5) *Inflation* $_{i,t}$ is the growth rate of inflation. Empirical evidence shows that inflation and inequality have a positive correlation (Beetsma and Van Der Ploeg, 1996; Al-Marhubi, 2000).
- (6) *Turnover* $_{i,t}$ is the total value of shares traded in year t for country i divided by the average market capitalization for that year. We use turnover of the domestic security market to measure the development of the security market of the country. The more developed security market means more opportunity for poor people to participate and make profits, which leads to less inequality.
- (7) *GDP Growth Rate* $pc_{i,t}$ is the growth rate of real GDP per capita. Janvry and Sadoulet (2000) demonstrate that inequality can be reduced when real GDP per capita rises. Yet, they believe that the effect of changes in real GDP per capita on inequality is more complicated, due to the existence of asymmetry in the relationship.
- (8) In addition, we also control for *Crisis Dummy* $_{i,t}$, *Population Growth* $_{i,t}$, *terms of trade* $_{i,t}$, *Private Credit/GDP* $_{i,t}$ and *Openness* $_{i,t}$.

Our annual data sample covers the time period of 1996–2005⁴ for 18 countries and areas in Asia: Bangladesh, China, Hong Kong, India, Indonesia, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Thailand, Japan, Korea, Pakistan, Turkey, Israel, Jordan and Kazakhstan. Table 1 provides data definitions and sources while Table 2 summarizes the statistics of all variables.

V. The Empirical Results

Benchmark estimations

We use Gini coefficient as dependent variable in benchmark estimations. Table 3 summarizes the results of the panel data regressions with fixed effect.⁵ Model 1 includes only basic control variables, while Model 2 appends it with macroeconomic variables, Model 3 with financial variables, Model 4 with crisis dummy and Model 5 with all controls. The main variable of our

³ Mandel (2010).

⁴ This time span is constrained by the availability of the main explanatory variable, $Frindex$.

⁵ Hausman test favours fixed effect models over random effect ones.

Table 1. Data definition and source

Notation	Definition	Data source
Gini	(Gini coefficient)/100	SWIID
Gini growth	Gini growth rate	SWIID
Frindex	Financial reform index	Financial Reform Database (FRD)
Edu	Low education dummy: secondary school enrolment is lower than 60%, 70% or 80%	WDI
Life expectancy	Average life expectancy	WDI
Pop growth	Population growth	WDI
Gov/GDP	Government expenditure to GDP ratio	WDI
Institution quality	Higher value refers to better quality	WGI
Sec school enrol	Second school enrolment	WDI
ToT growth	Ln(terms of trade index)/100	WDI
Inflation	Ln(100 + CPI annual growth rate%*100)	WDI
Initial Gini	(Gini coefficient for each country in 1996)/100	SWIID
Openness	Trade to GDP ratio	WDI
GDP growth per capita	Real GDP per-capita growth rate	WDI
Privatecred/GDP	Domestic credit to private sector (% of GDP)	WDI
Turnover	Turnover ratio	WDI
Crisis dummy	Dummy variable for banking crisis	Laeven and Valencia (2008)
Credit control	Credit controls and reserve requirements	FRD
Interestcontrol	Interest rate controls	FRD
Entry barrier	Entry barrier	FRD
Banking superv	Banking supervision	FRD
Privatization	Privatization	FRD
Intl capital	Openness of international capital account	FRD
Security market	security market development	FRD

interest, financial reform index (*Frindex*), seems to be negatively associated with income inequality, significantly in Models 3 and 5. In other specifications of the model, it still shows negative sign, but not statistically significant. Thus, we see weak evidence that the poor in Asia might benefit relatively more from financial reform in this area, reducing income inequality. Among other control variables, there is also weak evidence that *Life Expectancy* might be positively associated with income inequality (Models 2 and 4). Consistent with the prediction, longer life expectancy indicates the larger share of senior people with relatively lower income, which leads to more income

Table 2. Summary statistics of variables

Variable	Obs.	Mean	SD	Min	Max
Gini	175	0.420	0.0735	0.306	0.649
Gini growth	175	0.00230	0.0435	-0.100	0.234
Frindex	180	0.668	0.186	0.179	0.952
Life expectancy	180	70.81	6.314	58.27	82.03
Pop growth	180	0.0144	0.00972	-0.0173	0.0444
Gov/GDP	180	0.126	0.0530	0.0436	0.286
Institution quality	180	0.227	0.803	-1.104	2.226
Sec school enrol	125	0.719	0.201	0.277	1.069
ToT growth	166	0.0460	0.00101	0.0419	0.0499
Initial Gini	180	0.424	0.0716	0.327	0.598
Inflation	180	4.671	0.107	4.564	5.224
Private cred/GDP	180	0.723	0.549	0.0517	2.311
Openness	180	1.022	0.936	0.190	4.306
Turnover	178	0.836	0.941	0.00936	4.974
GDP growth percapita	180	0.0307	0.0389	-0.143	0.137
Crisis dummy	180	0.0944	0.293	0	1
Credit control	180	0.106	0.0357	0	0.143
Interestcontrol	180	0.121	0.0378	0	0.143
Entry barrier	180	0.0984	0.0468	0	0.143
Banking superv	180	0.0685	0.0311	0	0.0952
Privatization	180	0.0630	0.0566	0	0.143
Intl capital	180	0.104	0.0397	0.0476	0.143
Security market	180	0.106	0.0321	0.0476	0.143

inequality. In the meantime, government expenditure, *Gov/GDP*, is strongly associated positively with income inequality. This implies that the investment on public facilities may reduce the transaction cost of private investment, benefiting the rich investors more. Another explanation is that corruption and rent-seeking behaviour may benefit a handful of rich people who have access to government-spending related projects. Regarding financial variables, the expansion of private credit, *Private Cred/GDP*, who has more power in 'evaluating managers, selecting investment projects and pooling risks', can be used as an indicator as financial development (Akinboade and Kinfaek, 2013), and our empirical result suggests that it increases income inequality. People who can get access to private credit may be the ones with much more power and wealth. In addition, it seems that the rich can better utilize expanding private credit than the poor. When it comes to the banking crisis impact (*Crisis Dummy*), the poor appears to get hit more, which leads to higher income inequality.

Table 4 presents the main result of the theoretical model prediction. We interact *Frindex* with low education dummy *LowEduDummy*. *LowEduDummy* is a

Table 3. Fixed effect models

Variables	(1) Gini	(2) Gini	(3) Gini	(4) Gini	(5) Gini
Frindex	-0.129 (0.0831)	-0.131 (0.0855)	-0.133* (0.0767)	-0.122 (0.0810)	-0.139* (0.0769)
Life expectancy	0.0103* (0.00617)	0.0102 (0.00649)	0.00727 (0.00581)	0.0144** (0.00625)	0.0102 (0.00630)
Pop growth	-1.268 (0.928)	-1.268 (1.013)	-1.331 (0.860)	-1.098 (0.907)	-0.884 (0.922)
Gov/GDP	0.886** (0.379)	0.900** (0.404)	1.184*** (0.359)	0.828** (0.370)	1.373*** (0.384)
Institution quality	-0.0268 (0.0229)	-0.0272 (0.0237)	-0.0267 (0.0220)	-0.0288 (0.0223)	-0.0361 (0.0222)
Sec school enrol	-0.164 (0.112)	-0.164 (0.120)	-0.0766 (0.108)	-0.180 (0.109)	-0.112 (0.116)
ToT growth	-3.275 (5.054)	-3.172 (5.236)	-6.557 (4.728)	-3.061 (4.928)	-4.382 (4.780)
Inflation		-0.00145 (0.0940)			0.0257 (0.0865)
Openness		-0.00189 (0.0308)			0.00368 (0.0282)
GDPgrowth percapita		0.0219 (0.126)			0.277** (0.132)
Private cred/GDP			0.103*** (0.0273)		0.101*** (0.0308)
Turnover			-0.00794 (0.00757)		-0.00836 (0.00760)
Crisis dummy				0.0312** (0.0130)	0.0259* (0.0154)
Constant	-0.0477 (0.556)	-0.0386 (0.816)	0.146 (0.516)	-0.339 (0.556)	-0.290 (0.747)
Observations	115	115	115	115	115
R ²	0.200	0.200	0.334	0.248	0.376

Note: Dependent variable is Gini coefficient, and it has been normalized to 0–1 scale. *: significant at 10%; **: significant at 5%; ***: significant at 1%.

dummy which takes 1 when secondary school enrolment is below 60% and 0 otherwise. The coefficient of *Frindex*, β_1 , the one of our main interest, represents the impact of financial reform on income inequality when secondary school enrolment ratio is above 60%. The first row of the table shows that financial reform with higher human capital can significantly reduce income inequality across all five specifications of the model. This piece of evidence confirms our main prediction of the theoretical model: with higher human capital, the poor can better utilize the funding made available to them by financial reform, which leads to lower inequality. Similar to the previous models, *Gov/GDP* and *Private Cred/GDP* remain significant.

In the following exercises, we use disaggregated financial reform index rather than the general one, shedding light on which dimension of financial reform matters more in terms of reducing income inequality. There are seven

dimensions of the general financial reform index. Each one has a raw score which is normalized to 0–3 scale. A score of 3 indicates that that country is fully liberalized in that dimension. A score of 2 in any dimension means that the country is partially liberalized. A score of 1 and 0 indicate a partially repressed and fully repressed financial sector, respectively.

The first dimension is credit controls and reserve requirements (*Credit Control*). Some countries had or still have directed credit to some priority sectors controlled by the government. In the meantime, government may set credit ceilings or a high reserve requirement. For instance, China has long been criticized for supporting its state-owned enterprises with cheap credits and currently China's required reserve rate is 21.5%.

The second dimension is interest rate controls. Some countries including some developed countries, set ceilings or floors of interest rate for lending or deposits or both.

Table 4. Fixed effect models with interaction terms

Variables	(1) Gini	(2) Gini	(3) Gini	(4) Gini	(5) Gini
Frindex	-0.152* (0.0849)	-0.152* (0.0869)	-0.143* (0.0790)	-0.139* (0.0832)	-0.146* (0.0788)
LowEduDummy*Frindex	0.0406 (0.0330)	0.0424 (0.0343)	0.0180 (0.0311)	0.0310 (0.0325)	0.0147 (0.0317)
Life expectancy	0.00991 (0.00616)	0.00971 (0.00648)	0.00720 (0.00583)	0.0139** (0.00627)	0.00993 (0.00634)
Pop growth	-1.247 (0.925)	-1.147 (1.015)	-1.320 (0.864)	-1.090 (0.908)	-0.850 (0.929)
Gov/GDP	1.010** (0.391)	1.053** (0.422)	1.231*** (0.370)	0.926** (0.384)	1.419*** (0.399)
Institution quality	-0.0301 (0.0230)	-0.0316 (0.0239)	-0.0281 (0.0222)	-0.0313 (0.0225)	-0.0374 (0.0225)
Sec school enrol	-0.118 (0.118)	-0.124 (0.124)	-0.0588 (0.113)	-0.145 (0.116)	-0.0981 (0.120)
ToT growth	-4.249 (5.102)	-4.033 (5.267)	-6.906 (4.784)	-3.818 (4.994)	-4.680 (4.845)
Inflation		-0.00137 (0.0937)			0.0254 (0.0869)
Openness		0.00637 (0.0314)			0.00659 (0.0290)
GDPGrowth percapita		0.0218 (0.126)			0.271** (0.133)
Private cred/GDP			0.100*** (0.0278)		0.0994*** (0.0311)
Turnover			-0.00780 (0.00761)		-0.00825 (0.00764)
Crisis dummy				0.0296** (0.0131)	0.0251 (0.0156)
Constant	-0.0175 (0.555)	-0.0158 (0.814)	0.154 (0.518)	-0.301 (0.557)	-0.274 (0.751)
Observations	115	115	115	115	115
R ²	0.213	0.214	0.337	0.256	0.378

Note: Dependent variable is Gini coefficient, and it has been normalized to 0–1 scale. *Low EduDummy* is a dummy which takes 1 when secondary school enrolment is below 60%, otherwise 0. *: significant at 10%; **: significant at 5%; ***: significant at 1%.

Sometimes the interest rate is only allowed to fluctuate between a narrow band. It is a common form of financial repression.

The third dimension is entry barriers. Some countries restrict the entry of foreign banks, new domestic banks or some other financial intermediaries in order to be easier allocating credit. There are four sub-dimensions: the extent to which foreign banks and new domestic banks are allowed to enter domestic market, the restriction on branching and how widely the businesses of the banks can be.

Dimension four is openness of international capital account. Capital account restrictions limit capital flow across borders and manipulate exchange rate. The dimension is scored on the unification of exchange rates, restrictions on capital inflows and outflows.

Dimension five is privatization. It describes the proportion of banking assets controlled by state-owned

banks. If there is no state-owned bank or public bank assets take less than 10%, it is defined as fully liberalized. If most of domestic banks are owned by the state or public bank assets take more than 50%, it is defined as fully repressed.

The last two dimensions are banking supervision and security market development. As for banking supervision, there are four aspects to be considered: (1) whether to adopt a capital adequacy ratio based on the Basle standard; (2) whether the banking supervisory agency is independent from executives influence; (3) whether a banking supervisory agency conducts effective supervision through on-site and off-site examinations; (4) whether a country's banking supervisory agency cover all financial institutions without exception. As for security market development, whether a country intends to develop its security market and whether its security market is open to foreign investors are taken into account.

Table 5. Fixed effect models with credit control

	(1)	(2)	(3)	(4)	(5)
Variables	Gini	Gini	Gini	Gini	Gini
Credit control	-0.552** (0.226)	-0.588** (0.235)	-0.553*** (0.208)	-0.556** (0.219)	-0.563*** (0.212)
Life expectancy	0.00690 (0.00575)	0.00623 (0.00604)	0.00383 (0.00539)	0.0113* (0.00585)	0.00589 (0.00590)
Pop growth	-1.135 (0.905)	-0.938 (0.983)	-1.197 (0.837)	-0.970 (0.882)	-0.555 (0.896)
Gov/GDP	0.865** (0.371)	0.896** (0.395)	1.163*** (0.351)	0.808** (0.361)	1.358*** (0.376)
Institution quality	-0.0220 (0.0223)	-0.0236 (0.0230)	-0.0218 (0.0214)	-0.0244 (0.0217)	-0.0315 (0.0217)
Sec school enrol	-0.130 (0.111)	-0.148 (0.117)	-0.0432 (0.107)	-0.144 (0.108)	-0.101 (0.113)
ToT growth	-5.361 (5.051)	-5.570 (5.231)	-8.633* (4.707)	-5.174 (4.908)	-6.695 (4.777)
Inflation		-0.0426 (0.0928)			-0.0152 (0.0856)
Openness		0.0184 (0.0303)			0.0242 (0.0279)
GDPGrowth Percapita		-0.0396 (0.124)			0.206 (0.130)
Private cred/GDP			0.103*** (0.0268)		0.0995*** (0.0301)
Turnover			-0.00776 (0.00740)		-0.00871 (0.00745)
Crisis dummy				0.0322** (0.0127)	0.0241 (0.0151)
Constant	0.232 (0.541)	0.483 (0.801)	0.430 (0.500)	-0.0766 (0.540)	0.249 (0.735)
Observations	115	115	115	115	115
R ²	0.229	0.234	0.363	0.281	0.402

Note: Dependent variable is Gini coefficient, and it has been normalized to 0–1 scale. In this table, we use the disaggregate item of financial reform index (Credit Control) rather than the index its self as the main explanatory variable. *: significant at 10%; **: significant at 5%; ***: significant at 1%.

In Table 5, we find that credit control liberalization seems to reduce income inequality significantly. The result is stable and significant at 1% level across all five specifications of the model. It strongly supports the fact that the lack of openness of domestic credit market retards efficiency of the market, which in turn, was harmful to equality. In Asia, credit control has always been a serious problem. For example, in China, the big state-owned banks charges interest rate well below the market level to subsidize those state-owned enterprises, and these bank loans were considered to be policy loans (Fung *et al.*, 2000). Besides, lack of financial access has long been recognized as a leading cause of persisting inequality, especially in Asia. Subsidized credits are given to those politically connected parties, usually the rich in the area. Therefore, a more open and competitive domestic credit market might better allocate credits, benefiting the poor more.

Regarding other control variables, *Gov/GDP* remain significantly positive as before, but *Life expectancy*

loses its significance. *Pop Growth* is negatively associated with inequality, but insignificant across all model specifications. The sign of institution quality is also negative, but insignificant. It appears that there is a limited role for better institutions to play in reducing inequality. The negative relationship between secondary school enrolment and inequality conforms to expectation, implying the importance of education level. Investment in education gives an individual higher productivity and more chances to get better paid jobs. The growth of terms of trade, *ToT Growth*, seems to be associated with less inequality, but not significant, as in Mandel (2010).

When controlling for macroeconomic, financial and crisis variables, the previous conclusions do not change much. Among these newly added variables, macroeconomic controls like *Inflation* and *Openness* are not significant. The growth rate of GDP per capita is weakly significant. Among financial variables, *Private Cred/GDP* is stably associated significantly with more inequality, but not

Table 6. Fixed effect models with disaggregated financial reform index

Variables	(1) Gini	(2) Gini	(3) Gini	(4) Gini	(5) Gini
Interest control	-0.222 (0.200)	-0.226 (0.205)	-0.141 (0.187)	-0.258 (0.195)	-0.217 (0.188)
Entry barrier	0.143 (0.337)	0.149 (0.351)	0.0333 (0.313)	0.128 (0.328)	0.114 (0.320)
Banking superv	-1.013*** (0.291)	-1.022*** (0.298)	-0.823*** (0.278)	-1.005*** (0.282)	-0.784*** (0.282)
Privatization	0.370* (0.208)	0.461* (0.234)	0.315 (0.197)	0.490** (0.204)	0.318 (0.222)
Intl capital	0.317 (0.222)	0.338 (0.230)	0.252 (0.207)	0.300 (0.216)	0.261 (0.210)
Security market	-0.635** (0.276)	-0.653** (0.286)	-0.773*** (0.262)	-0.619** (0.268)	-0.735*** (0.271)

Note: Dependent variable is Gini coefficient, and it has been normalized to 0–1 scale. This table presents the results of using the other six disaggregated items of financial reform as the main explanatory variables. The coefficients of control variables are not reported in this table. *: significant at 10%; **: significant at 5%; ***: significant at 1%.

Table 7. Arellano-bond GMM estimation with dynamic panel data

Variables	(1) Gini	(2) Gini	(3) Gini	(4) Gini	(5) Gini
L.Gini	0.940*** (0.0425)	0.922*** (0.0431)	0.888*** (0.0464)	0.936*** (0.0429)	0.879*** (0.0476)
Frindex	-0.111*** (0.0407)	-0.0731* (0.0421)	-0.134*** (0.0419)	-0.111*** (0.0412)	-0.0863* (0.0447)
Life expectancy	0.00685*** (0.00117)	0.00650*** (0.00136)	0.0119*** (0.00205)	0.00686*** (0.00118)	0.0112*** (0.00228)
Pop growth	0.831 (0.784)	0.317 (0.809)	1.576* (0.835)	0.836 (0.789)	1.011 (0.869)
Gov/GDP	-0.293*** (0.113)	-0.483*** (0.129)	-0.209* (0.119)	-0.297*** (0.114)	-0.415*** (0.135)
Institution quality	-0.0346*** (0.00799)	-0.0117 (0.0107)	-0.0340*** (0.00813)	-0.0347*** (0.00810)	-0.0119 (0.0111)
Sec school enrol	0.00720 (0.0412)	0.00588 (0.0423)	-0.0346 (0.0443)	0.00775 (0.0415)	-0.0351 (0.0462)
ToT growth	-3.685 (2.330)	-2.504 (2.420)	-1.832 (2.430)	-3.888* (2.335)	-0.708 (2.558)
Inflation		-0.0469 (0.0448)			-0.0579 (0.0464)
Openness		-0.0287*** (0.00935)			-0.0293*** (0.00972)
GPGDP		0.0214 (0.0478)			0.0209 (0.0530)
Private cred/GDP			-0.0390*** (0.0131)		-0.0361*** (0.0138)
Turnover			-3.54e-05 (0.00424)		-0.000237 (0.00441)
Crisis dummy				-0.00193 (0.00682)	0.0101 (0.00799)
Constant	-0.190 (0.127)	0.0350 (0.297)	-0.556*** (0.178)	-0.179 (0.129)	-0.267 (0.332)
Observations	106	106	106	106	106

Note: Dependent variable is Gini coefficient, and it has been normalized to 0–1 scale. *: significant at 10%; ***: significant at 1%.

Table 8. Fixed effect models with Gini growth as the dependent variable

Variables	(1) Gini	(2) Gini	(3) Gini	(4) Gini	(5) Gini
Frindex	-0.135 (0.0815)	-0.154* (0.0822)	-0.138* (0.0822)	-0.137* (0.0820)	-0.156* (0.0834)
Life expectancy	0.0122** (0.00605)	0.0120* (0.00624)	0.0119* (0.00622)	0.0115* (0.00632)	0.0110 (0.00683)
Pop growth	0.550 (0.910)	-0.0286 (0.974)	0.568 (0.921)	0.521 (0.918)	0.00678 (0.999)
Gov/GDP	-0.452 (0.372)	-0.578 (0.388)	-0.407 (0.385)	-0.442 (0.374)	-0.520 (0.417)
Institution quality	-0.0461** (0.0225)	-0.0417* (0.0228)	-0.0439* (0.0235)	-0.0457** (0.0226)	-0.0390 (0.0241)
Sec school enrol	0.0714 (0.110)	0.0998 (0.116)	0.0806 (0.116)	0.0743 (0.111)	0.107 (0.125)
ToT growth	-4.503 (4.961)	-5.481 (5.033)	-5.128 (5.065)	-4.540 (4.984)	-6.054 (5.182)
Inflation		-0.0430 (0.0904)			-0.0426 (0.0938)
Openness		-0.0524* (0.0296)			-0.0484 (0.0306)
GPGDP		0.0228 (0.121)			0.0191 (0.143)
Private cred/GDP			0.0167 (0.0293)		0.0148 (0.0334)
Turnover			-0.00427 (0.00811)		-0.00471 (0.00824)
Crisis dummy				-0.00530 (0.0132)	-0.00601 (0.0167)
Constant	-0.560 (0.546)	-0.240 (0.785)	-0.532 (0.553)	-0.511 (0.562)	-0.166 (0.809)
Observations	115	115	115	115	115
R ²	0.148	0.183	0.156	0.150	0.190

Note: Dependent variable is Gini growth rate. *: significant at 10%; **: significant at 5%.

Turnover: Finally, the banking crisis dummy seems to worsen inequality.

We repeat the same regressions in Table 5, but replace *Credit Control* with other disaggregate financial reform index: interest rate control, bank supervision, privatization, capital mobility and security market development. Table 6 summarizes only the results of our interest. The performances of other control variables are very similar to Table 5 and not reported here.

The first row of Table 6 shows that the release of interest rate controls might be negatively associated with income inequality, but not statistically significant.

The second row reveals the fact that the lift of financial market entry barrier does not significantly decrease inequality; in addition, *Entry Barrier* even carries the wrong sign. The new entry of financial institutions may make competition more fierce, causing the instability of financial system (Allen and Gale, 2004). This instability may lead to widening inequality.

The third row indicates the strong negative correlation between independent banking supervision and inequality.

More independent banking supervision can effectively reduce the related lending which mainly goes to the parties connected with political power. Common in Asia, the lack of independence in banking supervision agency implies the executive's intervention or say, political interference, which enriches those rich. Financial reform in this aspect, however, can significantly lower related lending, helping ameliorate inequality.

Interestingly, *Privatization*, in the fourth row, seems to be statistically significant and positive in association with inequality. The less state-owned banks exist in the economy, the higher the privatization. A possible reason to explain the positive coefficient of privatization is that those nonstate-owned banks may be small in size compared with state-owned banks. To stay in business, these small banks tend to lend more to rich clients, rather than the poor (Rajan, 2006; Cull et al., 2007). In addition, the high transaction costs of building new branches make it harder for these small banks to cater to poor clients. Besides, those state-owned banks may have to carry some social responsibility set by governments to lend to

Table 9. Fixed effect models with interaction terms

Variables	(1)	(2)	(3)	(4)	(5)
	Gini	Gini	Gini	Gini	Gini
Frindex	-0.145*	-0.152*	-0.143*	-0.138*	-0.158**
	(0.0836)	(0.0865)	(0.0775)	(0.0815)	(0.0777)
LowEduDummy*Frindex	0.0377	0.0409	0.0280	0.0394	0.0392
	(0.0293)	(0.0306)	(0.0276)	(0.0285)	(0.0282)
Life expectancy	0.0101	0.00993	0.00709	0.0143**	0.0103
	(0.00615)	(0.00646)	(0.00581)	(0.00622)	(0.00626)
Pop growth	-1.249	-1.315	-1.330	-1.075	-0.933
	(0.925)	(1.009)	(0.860)	(0.903)	(0.918)
Gov/GDP	0.909**	0.920**	1.202***	0.851**	1.384***
	(0.378)	(0.402)	(0.359)	(0.368)	(0.382)
Institution quality	-0.0172	-0.0167	-0.0205	-0.0188	-0.0274
	(0.0240)	(0.0249)	(0.0228)	(0.0234)	(0.0230)
Sec school enrol	-0.0797	-0.0705	-0.0122	-0.0929	-0.0227
	(0.129)	(0.139)	(0.125)	(0.126)	(0.132)
ToT growth	-2.791	-2.679	-6.147	-2.553	-3.704
	(5.050)	(5.225)	(4.745)	(4.917)	(4.779)
Inflation		-0.00770			0.0207
		(0.0937)			(0.0861)
Openness		-0.00957			-0.00522
		(0.0312)			(0.0288)
GPGDP		0.0425			0.306**
		(0.127)			(0.133)
Private cred/GDP			0.103***		0.0979***
			(0.0273)		(0.0307)
Turnover			-0.00657		-0.00653
			(0.00769)		(0.00768)
Crisis dummy				0.0316**	0.0293*
				(0.0129)	(0.0155)
Constant	-0.124	-0.0764	0.0903	-0.423	-0.367
	(0.557)	(0.813)	(0.519)	(0.556)	(0.745)
Observations	115	115	115	115	115
R ²	0.214	0.217	0.342	0.264	0.390

Note: Dependent variable is Gini coefficient, and it has been normalized to 0–1 scale. LowEduDummy*Frindex stands for the obs with education level under 70%, otherwise 0. *: significant at 10%; **: significant at 5%; ***: significant at 1%.

the poor. Therefore, higher privatization leads to higher inequality.

In the fifth row, we find that international capital mobility does not seem to affect inequality significantly. The positive sign of *Intl Capital* implies that the rich may be able to reach international capital with more of cross-border capital flows, worsening inequality.

Security market development, in the sixth row, is very effective in reducing income inequality. The sign of *Security Market* is negative and significant at 1% level in all the regressions. It confirms our prediction that domestic security market development may render more chances for the poor to make money.

Robustness tests

It is widely believed that not only inequality can be influenced by financial development, but in turn, inequality has

effect on financial development too, i.e. there could be a problem of endogeneity. Perotti and Volpin (2007) model how rich incumbents lobby harder to block access to finance to entrants. So, we use the Arellano–Bond GMM estimation to control the possibility of endogeneity. The results in Table 7 suggest a strongly significant and negative connection between financial reform (*Frindex*) and inequality, in all five regressions. It reflects the fact that financial reform is quite effective in alleviating inequality in the economies in Asia, controlling for endogeneity issue. Regarding other control variables, the signs of government spending and private credit turn negative significantly. Moreover, openness firstly becomes significant in reducing inequality.

As a comparison, we also use the growth rate of Gini coefficient as the dependent variable. Demirgüç-Kunt and Levine (2009) believe that Gini growth rate is an important variable that reflects the transmission

Table 10. Fixed effect models with interaction terms

Variables	(1) Gini	(2) Gini	(3) Gini	(4) Gini	(5) Gini
Frindex	-0.182** (0.0899)	-0.182* (0.0920)	-0.180** (0.0830)	-0.166* (0.0882)	-0.175** (0.0834)
LowEduDummy*Frindex	0.0364 (0.0248)	0.0368 (0.0255)	0.0340 (0.0234)	0.0306 (0.0244)	0.0268 (0.0242)
Life expectancy	0.0102* (0.00613)	0.0103 (0.00645)	0.00698 (0.00578)	0.0141** (0.00624)	0.00955 (0.00631)
Pop growth	-1.463 (0.931)	-1.428 (1.013)	-1.538* (0.867)	-1.271 (0.915)	-1.051 (0.933)
Gov/GDP	0.682* (0.401)	0.696 (0.426)	1.003*** (0.378)	0.660* (0.392)	1.238*** (0.403)
Institution quality	-0.0258 (0.0228)	-0.0262 (0.0235)	-0.0275 (0.0218)	-0.0279 (0.0223)	-0.0364 (0.0222)
Sec school enrol	-0.0507 (0.135)	-0.0503 (0.143)	0.0347 (0.132)	-0.0846 (0.133)	-0.0169 (0.144)
ToT growth	-4.018 (5.048)	-3.879 (5.227)	-7.245 (4.723)	-3.697 (4.939)	-5.047 (4.812)
Inflation		0.00818 (0.0937)			0.0379 (0.0871)
Openness		0.00265 (0.0308)			0.00788 (0.0284)
GPGDP		0.0108 (0.126)			0.256* (0.133)
Private cred/GDP			0.105*** (0.0272)		0.105*** (0.0310)
Turnover			-0.00567 (0.00769)		-0.00637 (0.00780)
Crisis dummy				0.0294** (0.0130)	0.0221 (0.0157)
Constant	-0.0394 (0.553)	-0.0941 (0.812)	0.161 (0.513)	-0.316 (0.554)	-0.316 (0.746)
Observations	115	115	115	115	115
R ²	0.219	0.219	0.350	0.261	0.385

Note: Dependent variable is Gini coefficient and it has been normalized to 0–1 scale. LowE-duDummy*Frindex stands for the obs. with education level under 80%, otherwise 0. *: significant at 10%; **: significant at 5%; ***: significant at 1%.

of income inequality from generation to another. In Table 8, four out of five regressions show that financial reform is negatively correlated with income inequality, confirming, again, our main conclusion. Interestingly, institutional quality seems to be important in reducing inequality, significant at 5% to 10% level, consistent with Das and Mohapatra (2003) and Mandel (2010).

In Tables 9 and 10, we try different thresholds for defining low education dummy (*LowEduDummy*) which is defined to be 1 if secondary school enrolment is below 70% and 80%, respectively, rather than 60% in Table 2. The change of cut-off points do not change the results. Financial reform with high human capital (*Frindex*) is still significant in reducing income inequality across all models.⁶

VI. Concluding Remarks and Policy Implications

We contribute to the literature by investigating whether financial reform can reduce income inequality in Asia, with particular emphasis on the role of human capital. Extending Galor and Zeira (1993), we demonstrate that a well-educated poor can better utilize the funding, made available by financial reform, increase his/her marginal productivity, and thus, reduce his/her income gap with the rich. Therefore, financial reform is effective in reducing income inequality, and the effect is more profound in a country with higher human capital. Using the data for 18 countries in Asia, the region with the most promising financial reform, we confirm that financial reform in general can lead to lower income inequality. This effect

⁶ We also try GMM estimation for these tests. But considering for the length of the article, we do not report them here. The main conclusions do not change.

becomes more evident when financial reform is interacted with higher human capital. In addition, among seven disaggregated financial reforms, lift of credit control, better banking supervision and security market development are significantly associated with reduction of income inequality. Meanwhile, we find no strong evidence that relax of interest rate control, removal of entry barrier, privatization, as well as more international capital mobility contribute to income inequality reduction.

We also find that government expenditure is associated with more income inequality. This implies that the investment on public facilities may reduce the transaction cost of private investment, benefiting the rich investors more. Another explanation is that corruption and rent-seeking behaviour, resulting from more government expenditure, may benefit a handful of rich people who have access to government-spending related projects. This raises an alarming flag of the effectiveness of using expansionary fiscal policy to reduce poverty in Asia. Also alarmingly, the expansion of private credit is related to more of income inequality. It may suggest that those with access to private credit may be the ones with much more wealth. Meanwhile, it seems that the rich can better utilize expanding private credit than the poor. In another word, neither expansionary fiscal policy nor monetary policy help reduce income inequality in Asia.

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