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The Effect of Financialization on Investment and Growth - Panel Cointegration Results using the OECD Data

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Abstract

This paper analyzes the long-term effect of financialization and financial development on investment and growth using data of Organization for Economic Cooperation and Development (OECD) member countries since the 1970s. We used various measures of financialization and financial development.
To investigate the long-run effect of these variables, we used panel cointegration approach. Results of estimation show evidence of cointegration between financial institutions, investment, and growth. Group mean fully modified ordinary least squares (FMOLS) results, which is robust of endogeneity problem, show that financial globalization is negatively correlated to private investment. Results of panel vector error-correction model (VECM) show the existence of unilateral Granger causality from financial globalization to private investment. No direct effect of financialization on growth is observed, but their indirect effect occurs via private investment.

Keywords : financialization, financial development, investment, growth, panel cointegration
JEL codes : O16, F65, G15

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1. Introduction

The financial system has been regarded as one of the most important factors in economic growth for a long time. Since Schumpeter (1912) emphasized the role of finance in innovation, many scholars have found a significant positive effect of financial development on economic growth (King and Levine, 1993; La Porta, Lopez-de-Silanes, and Shleifer, 2002). Financial development generally refers to the improvement of financial functions, which lead to the production of investment information, efficient allocation of capital, firm monitoring, risk management, savings mobilization, and ease of exchange of goods and services (Levine, 2005). These functions of the financial system are very important for investment and resource allocation; thus, the improvement of these functions is beneficial to economic growth.

Numerous papers have found a significant positive effect of financial development on economic growth using various data types such as cross-country, country panel, industry, and firm data and econometric methods such as OLS, fixed effect, and GMM (King and Levine 1993; Levine and Zervos, 1998; Beck and Levine, 2004; Rajan and Zingales, 1998; Beck et al., 2005).

However, the last global financial crisis casted doubt on the positive role of financial system on economy because economic crisis started from well-developed US financial system. Financialization is one of the critical ideas about financial system. It is a broadly defined observational concept and developed to depict the rapid development or expansion of the financial sector in the US since the 1980s. Financialization generally means a rising share of financial sector or increase of financial activities by non-financial sectors (Stockhammer, 2004; Tomaskovic-Devey et al., 2015; Kus, 2012). Some recent papers investigated the effect of financialization on investment or growth (Orhangazi, 2008; Davis, 2014; Stockhammer, 2004; Tomaskovic-Devey et al., 2015).

In this paper, we define "financialization" in terms of three factors: (1) expansion of financial sector in the economy, (2) increased share of financial sector or shareholders among profit or resources by non-financial sectors, and (3) increased overseas financial activities (financial globalization)[3]. Using this definitions, we investigate the effect of financialization on domestic investment and growth using panel cointegration methods. Review literature is in Section 2. Data and estimation method are in the Section 3 and 4. Estimation results are in the Section 5 and the conclusion is presented in Section 6.

2. Financialization and investment

Share of financial sector or shareholders among profit or resources by non-financial sectors, which is one of our definition of financialization, have increased in the developed countries such as the USA since 1980s. For example, share of shareholders and owners[4] among net value-added for non-financial corporations have increased 5.58% in 1998 to 7.82% in 2015 in the US. In particular, this share increased rapidly from 1.48% in 1988 to 21.8% in 2005 in Norway.

[3] They are similar to Shin and Lee (2019)'s definition.

[4] It is measured by net payments of distributed income of corporations, which consist of net payments of dividends plus withdrawals from the income of owners of quasi-corporations.

As a greater share of resources and profits of firms goes to shareholders and CEOs, the internal funds of firm for investment can be reduced. Furthermore, if the CEOs of firms are pressured to increase short-term profits for maximization of shareholder value, they might increase investment in financial assets and activities rather than in fixed capital because the latter generally takes a longer time to earn profit. Similarly, Lazonick (2014) showed that 54% and 37% of US companies' earning had been spent on stock buybacks and dividends in 449 firms among the S&P 500 firms from 2003 to 2012, respectively, using S&P Compustat data.[5]

Financial globalization, which is other one of our definition of financialization, can also affect investment. As restrictions on international capital transactions have been relaxed and financial globalization has deepened, a larger amount of capital can go overseas to earn higher expected returns rather than domestic investment for fixed capital.

Some studies argue that decrease of investment rate since 1980s is related to financialization, particularly in the US. Orhangazi (2008) argued that increased payment to financial markets measured by sum of interest, dividends, and stock buyback decreases the internal funds of firms and decreases the ratio of fixed capital investment to fixed capital stock of firms using US non-financial firm data from 1973 to 2003. Davis (2014) also found similar results using industry-level average of gross stock repurchases relative to the total equity in the same Compustat data from 1971 to 2011. Using country-level time-series regression from the 1960s to the 1990s for the US and France, Stockhammer (2004) argued that the share of interest and dividend in value-added in the nonfinancial firms decreases the growth rate of gross business capital stock, but no strong effect of financialization was observed in the UK and Germany.

If financialization affects the level or rate of fixed capital investment, then financialization might affect growth as well. However, studies that analyze this relationship are rare. Tomaskovic-Devey et al. (2015) found a significant negative effect of financialization measured by the ratio of financial assets to total assets on value-added using non-financial industry-level data from the US from 1970 to 2008.

3. Data

We will briefly discuss the data for the econometric analysis in this section. To measure investment and growth, we use log private gross fixed capital formation (log private GFCF) per capita and log GDP per capita, both of which are measured by using purchasing power parity (PPP). We collect private GFCF data from the IMF and GDP per capita data from the Penn World Table (PWT) 9.0. Investment and growth are usually measured based on the ratio of investment to GDP and GDP growth rate. However, panel unit root tests (PURT) show that both of these measures are stationary[6], so we do not use them in this paper. The panel cointegration approach adopted in this paper requires the dependent variable to be non-stationary because the linear combination of non-stationary dependent and independent variables is considered stationary. If all variables are stationary, then cointegration becomes trivial and meaningless.

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[5] This condition was called "profits without prosperity".

[6] The PURT results for these variables are presented in Appendix table 1.

Based on the definition presented in the previous section, we use three variables to measure financialization. There variables include the share of value-added in the finance and insurance sectors in the total value-added of all sectors (finance and insurance share), the share of net payments of the distributed income of corporations in the net value-added for non-financial corporations (distributed income of corporations), and the ratio of external financial asset plus liability to GDP (financial globalization).

Finance and insurance share is a basic indicator of the relative size of financial sectors in the economy and represents the first definition of financialization (expansion of the financial sector in the economy). Darcillon (2015) used a similar measure to estimate the effect of financialization on labor market institutions. We collect the finance and insurance share data from the OECD Structural Analysis Database (OECD STAN).

The distributed income of corporations measures how much of the value-added of firms goes to the shareholders and owners in non-financial corporations. This variable represents the second definition of financialization (increased share of the financial sector or shareholders in the total profit or resources of non-financial sectors).

Financial globalization measures the activeness of a country in the global financial market and represents the third definition of financialization (increased overseas financial activities). We collect financial globalization data from Lane and Milesi–Ferretti (2007). This variable does not include FDI stock and liabilities.

Apart from financialization, we also use three measures of financial development, namely, the domestic credit provided by financial sectors to the private sector as a percent of GDP (private credit), the market capitalization of listed domestic companies (market capitalization), and the domestic shares traded divided by market capitalization (turnover ratio).

Private credit is a widely used proxy for financial development (King and Levine 1993; Levine and Zervos, 1998) that measures how much capital the financial system provides to the private sector. Market capitalization measures the general development of the stock market. Turnover ratio determines how actively a stock is traded and measures the relative trading frictions in the stock market. Several studies show a significant correlation between growth and these variables, especially private credit and turnover ratio (King and Levine 1993; Levine and Zervos, 1998; Beck and Levine, 2004).

As mentioned earlier, when the linear combination of a set of non-stationary variables is stationary, then these variables are "cointegrated," that is, they are closely related and do not diverge from their equilibrium relationship in the long run.

The basic estimation equation is illustrated as follows:

$$y_{it} = \alpha_i + \delta_i t + \beta' x_{it} + \gamma' z_{it} + \varepsilon_{it} \quad \cdots \quad (1)$$

where y_{it} denotes the dependent variable, which can be log private GFCF per capita and log GDP per capita in country i and year t, and x_{it} denotes the financialization or financial development variables.

z_{it} denotes a set of control variables that differ according to the dependent variables. For the investment equation, the control variables include savings rate, central government debt, lending interest rate by banks, and trade openness. Except for lending interest, all of these variables are expressed as a percentage of GDP. These variables are traditional determinants of investment (Ndikumana, 2000) and are non-stationary as shown in the PURT results presented in the following section. The other determinants of investment, such as GDP

growth and inflation, are not included in the analysis because of their stationarity[7]. The panel cointegration approach is robust to this omission as will be discussed in the next section.

For the growth equation, the control variables include log private investment per capita, tertiary enrolment ratio, log triadic patent stock per million populations, and trade openness. These variables represent the traditional production factors of physical capital, human capital, technology, and external factors, respectively. We use tertiary enrolment ratio instead of primary or secondary enrolment ratio as a measure of human capital because most OECD countries are providing universal primary and secondary education since the 1980s.[8] Triadic patent refers to the patents filed at three major patent offices, namely, the European Patent Office, the Japan Patent Office, and the United States Patent and Trademark Office. Given that these patents have been filed since 1985, We use the cumulative triadic patent data from 1985 to generate a stock variable.

α_i is the country fixed effect, $\delta_i t$ is a country-specific linear trend, β is the effect of financialization or financial development on the dependent variable, and ε_{it} is an error term that is stationary if cointegration is present. If cointegration is present, then $(\beta', \gamma')'$ denotes the cointegrating vector. The following table presents the detailed definitions of these variables and the sources of data.

(Table 1 is here)

4. Estimation method

We use the panel cointegration approach to analyze the long-run effect of financialization and financial development on the investment and growth. Previous studies that use country- or industry-level data generally apply the panel fixed effect model, GMM, or time series model to estimate such effect. However, the fixed effect model is not robust to endogeneity problems, such as omitted variables or reverse causality, while the GMM estimator shows a poor small sample property (Bun and Windmeijer, 2010). Meanwhile, the time series model is suitable for analyzing one country but cannot sufficiently reveal the effect of financial institutions on several developed countries. By using the panel cointegration method, we can control endogeneity and estimate the long-run effect. We can also investigate the direction of Granger causality of the long- or short-run effect by using panel VECM.

The empirical estimation can be divided into four steps, namely, PURT, panel cointegration test, group-mean fully modified OLS (group-mean FMOLS), and panel VECM.

In the first step, we check whether the variables are stationary or non-stationary for the panel cointegration approach. We conduct two widely used PURTs, namely, the Im, Pesaran, and Shin (2003) test (IPS) and the Pesaran (2007) test.

The IPS test uses the augmented Dicky–Fuller (ADF) test in the panel setting with heterogeneous AR(1) coefficient. The corresponding estimation equation is as follows:

[7] The PURT results for these variables are presented in Appendix table 1.

[8] The secondary enrolment ratio at 1980 was over 90% in 9 countries and over 80% in 21 countries among the 28 OECD countries with available data.

$$\Delta y_{it} = \delta_i y_{it-1} + \sum_{L=1}^{P_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \quad \cdots \quad (2)$$

where y_{it} is the tested variable, Δ is the first difference operator, and d_{mt} is the vector of deterministic variables, such as constant or time. δ_i can vary with *i* in the IPS test. The null hypothesis of the IPS test is $\delta_i = 0$ for all *i*, and the alternative hypothesis is $\delta_i < 0$ for at least one *i*. Therefore, the rejection of the IPS test means that the time series are stationary in at least one country.

However, IPS tests assume the cross-sectional independence of error term ε_{it}. To check whether a variable has cross-sectional dependence, we perform the cross-section dependence (CD) test of Pesaran (2004), which is estimation equation is expressed as follows:

$$\text{CD} = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \quad \cdots \quad (3)$$

where $\hat{\rho}_{ij}$ is the pair-wise cross-section correlation coefficients between countries *i* and *j* of the residuals from individual ADF regressions. Rejection of the CD test indicates the existence of cross-sectional dependence in a variable. In this case, we perform Pesaran (2007) test, which allows the cross-sectional dependence of the error term.

The Pesaran (2007) test adds the cross-sectional averages of lagged levels and first differences to the ADF regression to control the common effect in the error term. It is estimated as follows:

$$\Delta y_{it} = a_i + b_i y_{it-1} + c_i \bar{y}_{t-1} + \sum_{j=0}^{p} d_{ij} \Delta \bar{y}_{t-j} + \sum_{j=1}^{p} \delta_{ij} \Delta y_{it-j} + \varepsilon_{it} \quad \cdots \quad (4)$$

where $\bar{y}_{t-1}$ and $\Delta \bar{y}_{t-j}$ are the cross-sectional averages of lagged level and first difference that are used to control for the single unobserved factor. The rejection of the Pesaran (2007) test means that the time series are stationary in at least one country.

In the second step, if the non-stationarity of variables is confirmed, then we conduct a panel cointegration test to see whether a cointegration relationship exists between variables in the long run. We perform the Pedroni (1995, 1997) cointegration test, which uses the individual ADF regression for the residuals of each country data. The residual can be obtained by the following simple individual OLS regression:

$$y_{it} = \alpha_i + \delta_i t + \beta_i' x_{it} + e_{it} \quad \cdots \quad (5)$$

where $\delta_i t$ is a country-specific linear trend, x_{it} is a vector of variables (including finance variables), β_i is a cointegrating vector that can vary across each country if cointegration exists, α_i is a country fixed effect, and e_{it} is an error term. After estimating the residual $\hat{e}_{it}$ from equation (5), the Pedroni cointegration test checks whether this residual is stationary. The null hypothesis is cointegration does not exist, while alternative hypothesis is cointegration exists for all countries.

In the third step, if the existence of cointegration is confirmed, then we can apply group-mean FMOLS to estimate the long-run coefficients. Developed by Pedroni (2001a, b), this approach has two advantages. First, its convergence rate is $T\sqrt{N}$, which is faster than the conventional $\sqrt{N}$ convergence rate. Therefore, group-mean FMOLS has a better small sample property compared with traditional approaches. Second, group-mean FMOLS is robust to the omission of variables that are not included in the cointegrating relationship (Pedroni, 2007). Thus, omitting those stationary variables that can affect the dependent variable and be correlated to finance variables will not present an issue if these variables are not part of the cointegrating relationship.

Group-mean FMOLS is a panel extension of the time series FMOLS developed by Phillips and Hansen (1990), who applied semi-parametric correction to eliminate the bias from the long-run correlation between the error term ε_{it} and the innovation of regressors (first differnce of regressors).

In the last step, we apply panel VECM (Pesaran et al., 1999; Apergis and Payne, 2009) to conduct Granger causality tests. The estimation equation is presented as follows:

$$\Delta \boldsymbol{z_{it}} = \boldsymbol{\delta_i}\hat{\varepsilon}_{it-1} + \sum_{j=1}^{p} \boldsymbol{\Theta_{ij}}\Delta \boldsymbol{z_{it-j}} + \boldsymbol{\alpha_i} + \boldsymbol{\xi_{it}} \quad \cdots \quad (6)$$

If number of independent variables is *k*, equation (6) is simple type of error-correction model where $\boldsymbol{z_{it}}$ is the $((\mathrm{k}+1)\times 1)$ vector of all variables (including the dependent variable as first element and the finance variables), $\hat{\varepsilon}_{it-1}$ is the estimated error correction term, and $\boldsymbol{\delta_i}$ is the $((\mathrm{k}+1)\times 1)$ speed of adjustment vector of country *i*. The error correction term comes from the residual of group-mean FMOLS in equation (5). $\boldsymbol{\Theta_{ij}}$ is the $((\mathrm{k}+1)\times(\mathrm{k}+1))$ matrix of short-run effect coefficients in country *i* and year *t-j*, while $\boldsymbol{\alpha_i}$ is the $((\mathrm{k}+1)\times 1)$ vector of the country fixed effect. $\boldsymbol{\xi_{it}}$ is the $((\mathrm{k}+1)\times 1)$ vector of the error term.

If the null hypothesis $H_0 : \delta_{1i} = 0, \forall i$ is rejected, then the dependent variable responds to the deviation from the long-run relationship of the previous year. In this case, the other variables are the Granger cause of dependent variable in the long run. Similarly, we can identify the direction of the long-run Granger causality between variables by testing $H_0 : \delta_{1i} = 0, \forall i, H_0 : \delta_{2i} = 0, \forall i, \cdots$.

A short-run Granger causality test can be conducted by estimating $\boldsymbol{\Theta_{ij}} = \begin{pmatrix} \theta_{11ij} & \cdots & \theta_{1(k+1)ij} \\ \vdots & \ddots & \vdots \\ \theta_{(k+1)1ij} & \cdots & \theta_{(k+1)(k+1)ij} \end{pmatrix}$. If the null hypothesis $H_0 : \theta_{12ij} = 0, \forall i, j$ is rejected, then the first independent variable is the Granger cause of the dependent variable in the short run because the first differences of the first independent variable in the previous years will affect the first difference of dependent variable in the current year. The existence of other short-run effects can be also checked by testing the null hypothesis of each element of matrix $\boldsymbol{\Theta_{ij}}$. Thus, we test the existence and direction of long- and short-run Granger causality by using panel VECM.

5. Estimation results

The PURT results are presented in the appendix. The data coverage of each variable is the widest coverage that is used in the following analysis. For example, given that trade openness is used in the investment and growth equations, any countries which used in the investment or growth equation are included in the PURT of trade openness. If the IPS or Pesaran (2007) tests do not reject the null hypothesis of non-stationarity and if one variable is confirmed as non-stationary, then the smaller data coverage of the variable is also non-stationary because both of these tests posit in their null hypothesis that each time series of this variable is non-stationary. It reduces the burden on PURT because we use various specifications in the following analysis.

Appendix table 2 shows that the CD test reveals a cross-sectional dependence in all variables. The CD statistics are significant at the 1% level in all variables. Thus, we perform the Pesaran (2007) test instead of the IPS test for these variables.

In the Pesaran (2007) test, we use three lag structures of residual serial correlation from no serial correlation to AR(2) ("p" in equation (4)). The Pesaran (2007) test results show that financial globalization, private credit, tertiary enrolment ratio, log private GFCF per capita, savings rate, and central government debt are all non-stationary regardless of the lag structure or the existence of a linear trend. Thus, we can conclude that these variables are non-stationary. However, Pesaran (2007) test generates mixed results for the remaining eight variables depending on the lag structure or the existence of linear trend. To investigate these results in detail, we conduct the Pesaran (2007) test for these variables up to five lags[9].

The appendix table 3 shows that both the Pesaran (2007) statistic and its p-value increase along with lag length for most variables, which indicates that the test statistics cannot reject the null hypothesis of non-stationarity when enough lags of the residual are considered. These findings also imply that the significant statistics in lag 0 or 1 are most likely caused by the inappropriately short lag structure. When two or more lags of the residual are considered, then the Pesaran (2007) statistics are insignificant for distributed income of corporations, finance and insurance share, and market capitalization regardless of the existence of a linear trend. Thus, these variables tend to be non-stationary. The Pesaran (2007) statistics are also insignificant for the other variables if the linear time trends and enough number of lags are controlled. Thus, these variables seem to be non-stationary data with a linear trend. Given that we use the country-specific linear time trend as a default control variable, these variables can be considered non-stationary in the following analysis.

The following tables show the cointegration test results for the variables in the investment and growth equations.

(Table 2, 3 are here)

We include one finance variable with control variables, fixed effect, and linear trend for one specificaion and change finance variable across specifications because of restiction for

[9] Lag structure is determined by the order of the serial correlation of residuals. A method to determine the order of serial correlation in advance is not found. Thus, we assume that a maximum fifth order of serial correlation of residuals exists. Allowing high order requires a long time series, which is not satisfied for most tested variables.

number of independent variables in the Pedroni cointegration test. When log private GFCF per capita is the dependent variable, the cointegration test results are relatively strong in the specification that includes financial globalization. Panel v and ADF, group PP, and ADF statistics are significant at the 1% or 5% level in this specification. Meanwhile, weak cointegration test results are obtained in the specification that includes other finance variables. Therefore, we focus on the relationship between financial globalization and investment in the following group-mean FMOLS and panel VECM.

When log GDP per capita is the dependent variable, the cointegration test results are generally weak in all specifications that include finance variables. The 1~3 statistics are significant in these specifications. Meanwhile, these results become stronger if no finance variable is included. As shown in the last column of Table 3, panel v, PP, ADF, and group PP statistics are significant at the 1% or 5% level, thereby suggesting that financial institution variables are not cointegrated with log GDP per capita because the cointegration test results become weak when these variables are added.

The following table shows the group-mean FMOLS results for the variables in the investment equation.

(Table 4 is here)

We also control for linear country-specific trends and fixed effects in the regression. The estimation results in the above table show that financial globalization is negatively correlated to log private GFCF per capita in the long run. Financial globalization is significant and negative at the 1% significance level. A 1% points increase in financial globalization corresponds to a 0.15% decrease in private GFCF per capita in the long run. The share of central government debt in GDP is negative and significant, savings rate is positive and significant, and both trade openness and lending interest rate are not significant.

The following table shows the group-mean FMOLS results for the variables in the growth equation.

(Table 5 is here)

Log private investment per capita is positively and significantly correlated with log GDP per capita in the long run. A 1% increase in private investment per capita corresponds to a 0.24% increase in GDP per capita in the long run. The other variables show the expected positive coefficient even though only trade openness is significant.

The estimation results in Tables 4 and 5 imply that financial globalization has an indirect effect on GDP per capita because the former is negatively correlated with private investment per capita, which in turn is positively correlated with GDP per capita. If we multiply the two coefficients in Tables 4 and 5, then a 1% points increase in financial globalization corresponds to a 0.036% decrease in GDP per capita in the long run.

The panel VECM results for log private GFCF per capita are presented as follows.

(Table 6 is here)

Estimation results suggest that the null hypothesis $H_0 : \delta_{1i} = 0, \forall i$ is rejected at the 1% significance level (F stat.=2.58), which indicates that log private GFCF per capita responds to the deviation from the long-run relationship of the previous year, thereby supporting the results of the panel cointegration test and group-mean FMOLS. The null hypothesis H_0 :

$\delta_{2i} = 0, \forall i$ cannot be rejected even at the 10% significance level (F stat.=0.41), which means that financial globalization does not respond to the deviation from the long-run relationship of the previous year. These results suggest a unilateral Granger causality from financial globalization to private investment in the long run.

In terms of short-run effect, the null hypothesis $H_0 : \theta_{12i} = 0, \forall i$ is rejected at the 1% level (F stat.=4.29), while the null hypothesis $H_0 : \theta_{21} = 0, \forall i$ cannot be rejected even at the 10% significance level (F stat.=0.63). These findings also suggest a unilateral short-run Granger causality from financial globalization to log private GFCF per capita.

6. Conclusion

This paper investigated the long-run relationship between financialization, financial development, investment, and growth by using the panel cointegration approach.

The estimation results reveal a negative significant correlation between financial globalization and investment in the long run. A unilateral Granger causality is also observed from financial globalization to investment, thereby suggesting that increasing international financial investment might crowd out domestic investment in the long-run in developed countries.

However, this paper uses OECD country data beginning from the 1970s, but more countries or time series data need to be considered in future studies to conduct a more powerful panel cointegration analysis. If enough time series data are available, then the country-specific effects on various outcomes can be investigated in future research. Firm-level analyses, such as Alvarez (2015) and Orhangazi (2008), can be conducted to understand the effect of financial institutions at the micro level in the future research.

Table 1. Definitions of variables and sources of data

Variable	Definition	Source
Log private GFCF per capita	Log of private gross fixed capital formation per capita (PPP, 2005 US$)	IMF
Log GDP per capita	Log of expenditure-side real GDP at chained PPPs per capita (2011 US$)	Penn World Table 9.0
Finance and insurance share	Share of value-added in the finance and insurance sectors among all sectors (%)	OECD Structural Analysis Databases (OECD STAN) (ISIC Rev. 3)
Financial globalization	Ratio of external financial asset plus liability to GDP (%)	Lane and Milesi-Ferretti (2007)
Distributed income of corporations	Share of net payments of distributed income of corporations among net value-added for non-financial corporations (%)	OECD National Accounts
Private credit	Domestic credit provided by financial sectors to private sector as percent of GDP (%)	Worldbank
Market capitalization	Market capitalization of listed domestic companies (% of GDP)	Worldbank
Turnover ratio	Domestic shares traded divided by market capitalization (%)	Worldbank
Trade openness	Export+import/GDP (%)	Worldbank
Tertiary enrolment ratio	Gross enrolment ratio, tertiary, both sexes (%)	Worldbank
Saving rate	Gross saving as percent of GDP (%)	Worldbank
Lending interest rate	Lending interest rate by banks to the private sectors (%)	Worldbank
Central government debt	Central government debt as percent of GDP (%)	OECD Stat.
Log triadic patent stock per million population	Log triadic patent stock per million populations	OECD Stat.

Table 2. Pedroni panel cointegration test for log private GFCF per capita

	Distributed income of corporations	Financial globalization	Finance and insurance share	Private credit	Market capitalization	Turnover ratio
Panel v-Statistic	0.25	3.03**	3.64**	0.57	2.75**	2.51**
	(0.403)	(0.001)	(0.000)	(0.286)	(0.003)	(0.006)
Panel rho-Statistic	4.22	4.13	4.16	4.35	4.86	5.21
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)
Panel PP-Statistic	-3.46**	-0.20	0.50	0.28	0.98	2.07
	(0.000)	(0.423)	(0.690)	(0.610)	(0.837)	(0.981)
Panel ADF-Statistic	-1.12	-1.73*	0.39	0.54	0.44	1.95
	(0.132)	(0.041)	(0.652)	(0.706)	(0.668)	(0.975)
Group rho-Statistic	6.71	6.70	6.43	6.25	6.92	7.45
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)
Group PP-Statistic	-9.50**	-3.20**	-6.15**	-9.83**	-7.20**	-6.72**
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Group ADF-Statistic	-2.04*	-2.43**	-1.46	-1.66*	-1.98*	-1.89*
	(0.021)	(0.008)	(0.072)	(0.048)	(0.024)	(0.030)
number of countries	20	27	24	27	25	25
number of obs. per country	13.70	21.30	20.25	20.33	19.08	18.92
Period	1983-2010	1981-2010	1981-2009	1981-2010	1981-2010	1981-2010

note: .01 - **; .05 - *, p-value is in parenthesis

* Null hypothesis : No cointegration

* Four variables (saving rate, lending interest rate, central government debt, and trade openness), linear country-specific trends and fixed effects are controlled.

* Use d.f. corrected Dickey-Fuller residual variances

* Automatic lag length selection based on SIC with lags from 0 to observation-based maximum lag length

* Newey-West automatic bandwidth selection and Bartlett kernel

Table 3. Pedroni panel cointegration test for log GDP per capita

	Distributed income of corporations	Financial globalization	Finance and insurance share	Private credit	Market capitalization	Turnover ratio	None
Panel v-Statistic	4.69**	3.86**	2.89**	4.07**	0.02	0.09	5.75**
	(0.000)	(0.000)	(0.002)	(0.000)	(0.491)	(0.463)	(0.000)
Panel rho-Statistic	5.00	4.16	4.73	4.01	4.09	4.05	2.40
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(0.992)
Panel PP-Statistic	0.01	-1.20	1.83	0.24	-0.26	-1.06	-2.03*
	(0.503)	(0.114)	(0.967)	(0.593)	(0.398)	(0.145)	(0.021)
Panel ADF-Statistic	-0.94	-1.00	0.47	0.23	-0.17	-0.97	-2.03*
	(0.172)	(0.159)	(0.682)	(0.589)	(0.434)	(0.166)	(0.021)
Group rho-Statistic	6.95	5.78	6.87	5.98	6.51	6.46	4.71
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)
Group PP-Statistic	-5.15**	-3.31**	-3.28**	-1.61	-6.75**	-5.33**	-2.14*
	(0.000)	(0.001)	(0.001)	(0.053)	(0.000)	(0.000)	(0.016)
Group ADF-Statistic	-1.94*	-1.95*	-1.40	-0.71	-1.77*	-2.61**	-1.02
	(0.026)	(0.025)	(0.081)	(0.238)	(0.038)	(0.005)	(0.155)
number of countries	24	30	28	30	28	28	30
number of obs.per country	16.92	24.30	19.64	22.87	21.04	20.82	24.47
Period	1986-2013	1986-2013	1986-2009	1986-2013	1986-2013	1986-2013	1986-2013

note: .01 - **; .05 - *

* p-value is in parenthesis

* Null hypothesis : No cointegration

* Four variables (log private GFCF per capita, tertiary enrolment, log triadic patent stock per million populations, and trade openness), linear country-specific trends and fixed effects are controlled.

* Use d.f. corrected Dickey-Fuller residual variances

* Automatic lag length selection based on SIC with lags from 0 to observation-based maximum lag length

* Newey-West automatic bandwidth selection and Bartlett kernel

Table 4. Pedroni group-mean FMOLS results for the investment equation

Variable	Coef.	p-value
Financial globalization	-0.0015**	0.000
Trade openness	0.001	0.174
Saving rate	0.021**	0.000
Lending interest rate	-0.001	0.578
Central government debt	-0.021**	0.000
Number of countries	27	
Number of observation per country	21.3	
Number of observation	575	
Period	1981-2010	

note: .01 - **; .05 - *

* Linear country-specific trends and fixed effects are controlled

* Long-run covariance estimates : Bartlett kernel, Newey-West fixed bandwidth, d.f. adjustment

Table 5. Pedroni group-mean FMOLS results for the growth equation

Variable	Coef.	p-value
Log private GFCF per capita	0.243**	0.000
Tertiary enrolment ratio	0.000	0.851
Log triadic patent stock per million populations	0.022	0.188
Trade openness	0.001**	0.000
Number of countries	30	
Number of observation per country	24.5	
Number of observation	734	
Period	1986-2013	

note: .01 - **; .05 - *

* Linear country-specific trends and fixed effects are controlled

* Long-run covariance estimates : Bartlett kernel, Newey-West fixed bandwidth, d.f. adjustment

Table 6. Panel VECM results for log private GFCF per capita

Dependent variable	Source of causation(independent variables)						
	Long-run	Short-run					
	L.ECT	L.ΔLog private GFCF per capita	L.ΔFinancial globalization	L.ΔSaving rate	L.ΔLending interest	L.ΔCentral government debt	L.ΔTrade openness
ΔLog private GFCF per capita	2.58**	2.85**	4.29**	2.09**	3.04**	1.43	2.02**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.078)	(0.002)
ΔFinancial globalization	0.41	0.63	1.42	2.34**	0.38	0.64	0.30
	(0.996)	(0.928)	(0.084)	(0.000)	(0.998)	(0.922)	(1.000)
ΔSaving rate	0.90	1.12	2.62**	1.32	1.98**	1.47	1.81**
	(0.613)	(0.314)	(0.000)	(0.137)	(0.003)	(0.063)	(0.009)
ΔLending interest	2.71**	5.36**	1.01	0.67	3.19**	11.32**	3.04**
	(0.000)	(0.000)	(0.457)	(0.893)	(0.000)	(0.000)	(0.000)
ΔCentral government debt	5.54**	1.62*	3.66**	0.85	2.97**	3.91**	1.50
	(0.000)	(0.028)	(0.000)	(0.677)	(0.000)	(0.000)	(0.055)
ΔTrade openness	1.51	1.68*	3.55**	1.69*	1.88**	1.83**	0.81
	(0.053)	(0.019)	(0.000)	(0.019)	(0.006)	(0.008)	(0.744)

note: .01 - **; .05 - *

* Wald statistics are presented, p-value is in parenthesis

* Error correction term (ECT) comes from residual of group-mean FMOLS with country-specific linear trend in the table 4.

* 27 countries from 1982 to 2011

Appendix

Appendix table 1. Panel unit root test (PURT) for growth rate of GDP per capita, gross capital formation (GCF, % of GDP), and inflation

Test / Variables	IPS	Pesaran (2007)			IPS	Pesaran (2007)			Pesaran (2004) CD test
		lags=0	lags=1	lags=2		lags=0	lags=1	lags=2	
	With intercept				With intercept and trend				
GDP growth	-19** (0.000)	-15.4** (0.000)	-9.6** (0.000)	-4.5** (0.000)	-16.2** (0.000)	-13.6** (0.000)	-8.2** (0.000)	-2.8** (0.000)	32.28** (0.000)
GCF	-4.9** (0.000)	-2.81** (0.002)	-3.98** (0.000)	-1.34 (0.091)	-4.8** (0.000)	-1.79* (0.037)	-2.9** (0.002)	-0.3 (0.381)	29.5** (0.000)
Inflation	-7.6** (0.000)	-6.19** (0.000)	-4.67** (0.000)	-3.03** (0.001)	-7.6** (0.000)	-4.78** (0.000)	-2.89** (0.002)	-1.27 (0.102)	57.93** (0.000)

note: .01 - **; .05 - *

* data : GDP growth, GCF : 34 countries, 1970-2007, inflation : 27 countries, 1975-2010

* p-value is in the parenthesis

* null hypothesis : variable is non-stationary

* IPS : lag length selection based on SIC, maximum lag length is observation-based, Newey-West automatic bandwidth selection and Bartlett kernel

* Data : Growth rate of GDP per capita : Penn World Table 9.0, GCF, Inflation : Worldbank

Appendix table 2. PURT results

Test \ Variable			Finance and insurance share	Financial globalization	Distributed income of corporations	Private credit	Market capitalization	Turnover ratio	Trade openness
IPS		With intercept	-0.94 (0.174)	8.89 (1.000)	-3.29** (0.001)	2.87 (0.998)	-4.32** (0.000)	-7.23** (0.000)	3.7 (0.999)
Pesaran (2007)	lags=0	With intercept	-1.76* (0.04)	-0.74 (0.229)	-4.7** (0.000)	2.6 (0.995)	-3.32** (0.000)	-4.9** (0.000)	-1.5 (0.066)
Pesaran (2007)	lags=1	With intercept	-1.34 (0.09)	-1.03 (0.152)	-1.72* (0.043)	0.73 (0.767)	-0.96 (0.168)	-3.69** (0.000)	-2.88** (0.002)
Pesaran (2007)	lags=2	With intercept	0.36 (0.642)	-1.06 (0.144)	-0.16 (0.436)	1.43 (0.924)	-0.2 (0.421)	-2.28* (0.011)	-1.81* (0.035)
IPS		With intercept and trend	-2.23* (0.013)	-0.12 (0.452)	-3.48** (0.000)	1.94 (0.974)	-6.12** (0.000)	-7.12** (0.000)	-3.67** (0.000)
Pesaran (2007)	lags=0	With intercept and trend	-2.14* (0.016)	1.55 (0.94)	-3.58** (0.000)	4.62 (1.000)	-2.68** (0.004)	-4.5** (0.000)	-0.41 (0.339)
Pesaran (2007)	lags=1	With intercept and trend	-2.49** (0.006)	1.34 (0.91)	-0.09 (0.463)	3.17 (0.999)	0.97 (0.834)	-1.68* (0.046)	-2.76** (0.003)
Pesaran (2007)	lags=2	With intercept and trend	1.57 (0.942)	1.56 (0.94)	0.82 (0.795)	4.57 (1.000)	1.74 (0.959)	0.42 (0.663)	-1.58 (0.057)
Pesaran (2004) CD test			18.47** (0.000)	98.42** (0.000)	4.01** (0.000)	72.32** (0.000)	51.36** (0.000)	29.1** (0.000)	89.62** (0.000)
Number of countries			28	30	25	34	32	32	34
Period			1972-2009	1971-2013	1979-2013	1971-2014	1976-2014	1976-2014	1971-2014

Appendix table 2. PURT results *(continued)*

Test \ Variable			Tertiary enrolment ratio	Log private GFCF per capita	Log GDP per capita	Saving rate	Lending interest rate	Central government debt	Log triadic patent stock per million populations
IPS		With intercept	11.05 (1.000)	-0.41 (0.34)	-1.7* (0.045)	-2.94** (0.002)	-0.98 (0.164)	-0.35 (0.362)	-23.18** (0.000)
Pesaran (2007)	lags=0	With intercept	4.13 (1.000)	0.79 (0.784)	0.15 (0.56)	-0.47 (0.318)	-3.88** (0.000)	5.76 (1.000)	-16.4** (0.000)
Pesaran (2007)	lags=1	With intercept	2.64 (0.996)	-1.15 (0.126)	-2.17* (0.015)	-0.24 (0.406)	-4.21** (0.000)	3.21 (0.999)	-1.18 (0.12)
Pesaran (2007)	lags=2	With intercept	2.52 (0.994)	0.37 (0.643)	-0.9 (0.183)	n.a.	0.65 (0.743)	2.45 (0.993)	2.81 (0.998)
IPS		With intercept and trend	3.12 (0.999)	-1.62 (0.053)	-1.28 (0.1)	-2.32* (0.01)	-3.6** (0.000)	-0.05 (0.481)	-12.66** (0.000)
Pesaran (2007)	lags=0	With intercept and trend	6.34 (1.000)	2.72 (0.997)	1.56 (0.941)	-0.78 (0.217)	-3.16** (0.001)	2.09 (0.982)	-15.15** (0.000)
Pesaran (2007)	lags=1	With intercept and trend	5.9 (1.000)	1.67 (0.953)	0.52 (0.698)	1.19 (0.884)	-5.3** (0.000)	2.45 (0.993)	-1.54 (0.062)
Pesaran (2007)	lags=2	With intercept and trend	4.8 (1.000)	3.24 (0.999)	2.1 (0.982)	n.a.	1.04 (0.85)	4.36 (1.000)	2.77 (0.997)
Pesaran (2004) CD test			110.61** (0.000)	87.52** (0.000)	99.92** (0.000)	12.09** (0.000)	57.83** (0.000)	13.37** (0.000)	106.97** (0.000)
Number of countries			30	30	30	29	27	29	30
Period			1971-2013	1981-2013	1986-2013	1981-2010	1981-2010	1981-2010	1986-2013

note: .01 - **; .05 - *

* p-value is in the parenthesis

* null hypothesis : variable is non-stationary

* IPS : lag length selection based on SIC, maximum lag length is observation-based, Newey-West automatic bandwidth selection and Bartlett kernel

Appendix table 3. Pesaran (2007) test results for the selected variables

Variable		Distributed income of corporations	Finance and insurance share	Market capitalization	Turnover ratio	Trade openness	Log GDP per capita	Lending interest rate	Log triadic patent stock per million populations
With intercept	lags=0	-4.7** (0.000)	-1.76* (0.04)	-3.32** (0.000)	-4.9** (0.000)	-1.5 (0.066)	0.15 (0.56)	-3.88** (0.000)	-16.4** (0.000)
	lags=1	-1.72* (0.043)	-1.34 (0.09)	-0.96 (0.168)	-3.69** (0.000)	-2.88** (0.002)	-2.17* (0.015)	-4.21** (0.000)	-1.18 (0.12)
	lags=2	-0.16 (0.436)	0.36 (0.642)	-0.2 (0.421)	-2.28* (0.011)	-1.81* (0.035)	-0.9 (0.183)	0.65 (0.743)	2.81 (0.998)
	lags=3	1.34 (0.91)	-1.1 (0.135)	1.72 (0.957)	1.67 (0.952)	-1.26 (0.103)	-3.3** (0.000)	n.a.	0.7 (0.757)
	lags=4	5.75 (1.000)	5.9 (1.000)	n.a.	n.a.	0.62 (0.733)	-2.09* (0.018)	n.a.	-2.82** (0.002)
	lags=5	n.a.	n.a.	n.a.	n.a.	1.28 (0.9)	-1.8* (0.036)	n.a.	-0.82 (0.207)
With intercept and trend	lags=0	-3.58** (0.000)	-2.14* (0.016)	-2.68** (0.004)	-4.5** (0.000)	-0.41 (0.339)	1.56 (0.941)	-3.16** (0.001)	-15.15** (0.000)
	lags=1	-0.09 (0.463)	-2.49** (0.006)	0.97 (0.834)	-1.68* (0.046)	-2.76** (0.003)	0.52 (0.698)	-5.3** (0.000)	-1.54 (0.062)
	lags=2	0.82 (0.795)	1.57 (0.942)	1.74 (0.959)	0.42 (0.663)	-1.58 (0.057)	2.1 (0.982)	1.04 (0.85)	2.77 (0.997)
	lags=3	5.09 (1.000)	2.05 (0.98)	3.6 (1.000)	4.92 (1.000)	-1.48 (0.069)	0.6 (0.725)	n.a.	0.59 (0.722)
	lags=4	6.61 (1.000)	5.16 (1.000)	n.a.	n.a.	0.53 (0.703)	3.2 (0.999)	n.a.	-2.52** (0.006)
	lags=5	n.a.	n.a.	n.a.	n.a.	1.27 (0.898)	5.11 (1.000)	n.a.	-0.66 (0.255)
Number of countries		25	28	32	32	34	30	27	30
Period		1979-2013	1972-2009	1976-2014	1976-2014	1971-2014	1986-2013	1981-2010	1986-2013

note: .01 - **; .05 - *

* p-value is in the parenthesis

* null hypothesis : variable is non-stationary

* n.a. : not available due to limit of observations

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