E C O N O M I C S B U L L E T I N

Does capital account liberalisation promote economic growth? Evidence from system estimation.

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Abstract

This paper proposes a three-equations empirical representation of the channels linking capital account liberalization (CAL) and economic growth. System estimates indicate that CAL determines growth through financial development and openness to trade. The residual effect of CAL on growth after accounting for these two channels is negligible. These results call for a reconsideration of the conclusions on the growth-effect of CAL drawn from single-equation empirical models.

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1. Introduction

The globalization of financial linkages has spurred a lively debate on the growth-effects of capital account liberalization. In the applied literature, this question is normally addressed within a standard single equation framework of the following type:

$$(1) \quad y_{it} = \alpha_0 + \alpha_1 x_{it} + \boldsymbol{\beta}\boldsymbol{\Omega}_{\mathbf{it}} + \varepsilon_{it}$$

where y is the growth rate of per-capita real GDP in generic country i, x is a measure of capital account liberalization (CAL), $\boldsymbol{\Omega}$ is a set of control variables, ε is a stochastic disturbance, αs and $\boldsymbol{\beta}$ are the parameters to be estimated, and t denotes time.

The specification of $\boldsymbol{\Omega}$, the empirical definition of x, the estimation methodology, and the composition of the sample differ across studies. It is therefore unsurprising that results also differ to some extent. However, the survey works of Eichengreen (2001), Lane (2004) and Edison *et al.* (2004) generally conclude that the literature has so far failed to provide robust and systematic evidence of a positive and significant effect of capital account liberalization on growth.

The purpose of this paper is to reconsider the above conclusion in light of new evidence stemming from the estimation of a system of equations. The rationale for using a system is to explicitly model the interactions between capital account liberalization and some of the other controls in equation (1). In fact, if x determines some of the variables in $\boldsymbol{\Omega}$, then the estimated coefficient on x will be imprecisely estimated, thus increasing the likelihood of not rejecting the null hypothesis in a standard t-test. The single equation framework (1) might therefore be inadequate to make correct inference on the significance of the relationship between x and y.

This paper estimates a system of three equations where growth, financial development (FINDEV) and trade openness (OPEN) are the dependant variables. Three main results are obtained. First, CAL is a significant determinant of both FINDEV and OPEN. Second, FINDEV and OPEN significantly determine growth. These first two results together imply that financial development and trade openness are the channels through which capital account liberalization affects growth. Third, the residual effect of CAL on growth after accounting for the financial development and trade openness channels is negligible.

2. Econometric model

The literature emphasizes two main macroeconomic effects of capital account liberalization. One is the strengthening of the domestic financial system: liberalizing restrictions on international portfolio flows tends to increase stock market liquidity, and allowing a greater presence of foreign banks fosters the efficiency of domestic financial intermediation[1]. The other effect is the specialization in production resulting from increased international risk sharing opportunities: by providing the necessary conditions for the integration of international financial markets, CAL facilitates the insurance of production risk via ownership diversification[2]. Production risk insurance then allows countries to exploit the

[1] See for instance Levine (2001) and Chinn and Ito (2002 and 2006).

[2] Several theoretical models incorporate this type of mechanism: see Obstfled (1994), Acemoglu and Zilibotti (1997), and Feeney (1998). The empirical evidence is less conclusive. Kamleli *et al.* (2003) show that international risk sharing increases specilization. Imbs (2004) reports a positive effect of international financial

gains from specialization through international trade, thus implying that trade openness is a function of CAL[3].

These theoretical considerations suggest that CAL is a determinant of both domestic financial development (FINDEV) and trade openness (OPEN). At the same time, there is now a vast literature indicating that FINDEV and OPEN are two key determinants of economic growth[4]. Financial development and trade openness are therefore two channels through which CAL can affect growth. A structural empirical representation of these links is as follows:

$$(2) \quad y_{it} = \alpha_0 + \alpha_1 x_{it} + \alpha_2 f_{it} + \alpha_3 s_{it} + \boldsymbol{\beta}_1 \mathbf{M_{it}} + \varepsilon_{it}$$

$$(3) \quad f_{it} = \gamma_0 + \gamma_1 x_{it} + \gamma_2 y_{it} + \gamma_3 s_{it} + \boldsymbol{\beta}_2 \boldsymbol{\Gamma}_{\mathbf{it}} + \upsilon_{it}$$

$$(4) \quad s_{it} = \omega_0 + \omega_1 x_{it} + \omega_2 y_{it} + \omega_3 f_{it} + \boldsymbol{\beta}_3 \mathbf{K_{it}} + \zeta_{it}$$

where y, x, ε, i, t are the same as in equation (1); f and s respectively denote FINDEV and OPEN; **M, K** and **Γ** are sets of controls that might have some elements in common, υ ζ are stochastic disturbances and αs, γs, ω's, $\boldsymbol{\beta_1}$, $\boldsymbol{\beta_2}$, and $\boldsymbol{\beta_3}$ are the coefficients to be estimated. For estimation purposes, CAL will be measured by index of Chinn and Ito (2002 and 2006), FINDEV will be proxied by credit to the private sector in percent of GDP, and OPEN will be defined as the imports plus exports share of GDP.

Equation (2) is a restatement of the growth model (1). CAL appears on the r.h.s. together with FINDEV and OPEN, so that α_1 effectively represents the residual effect of capital account liberalization on growth after controlling for its indirect effect through financial development and trade openness. Drawing on Edison *et al.* (2002) and Schularik and Stegel (2006), **M** includes lagged per-capita GDP (in logs), government consumption expenditure in percent of GDP, the number of school years attended by the average individual in the population, and the population growth rate. The model thus allows for the impact of relative convergence, factors accumulation, and government size in what can be seen as a combination of neo-classical and endogenous growth theories[5].

Equation (3) models financial development. The effect of CAL is captured by γ_1, while γ_2 represents the possible feedback effect of growth onto the domestic financial system and γ_3 allows for endogeneity between FINDEV and OPEN. The other controls are the log-level of per-capita income, a dummy taking value 1 if country's legal system originates from the

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integration on specialization. However, Kose *et al.* (2007) report that the empirical effect of financial globalization on risk sharing is significantly less strong than what the theory predicts.

[3] If international trade increases aggregate risks (as in Rodrik, 1998), then risk cannot be diversified in purely domestic financial markets and therefore greater international financial integration increases openness to trade. See also Svaleryd and Vlachos (2002). In addition, Feeney and Hillman (2001) note that the political-economic opposition to trade liberalization is weaker when financial systems are more interntionally open, so that CAL leads to greater trade openness.

[4] For an overview of this literature see Aghion and Durlauf (2005, Chapters 12 and 23 in particular).

[5] The inclusion of the GDP share of gross capital formation on the r.h.s. of equation (2) does not qualitatively affect the estimates of α_1 , α_2 , α_3 , and $\boldsymbol{\beta_1}$. Robustness checks on system estimates were also conducted by enriching the basic specification of equation (2) with other popular variables in the growth literature (see Durlauf et al. 2005). Results are available upon request and do not substantially differ from those reported in the paper.

French common law, the inflation rate and the government debt to GDP ratio. This specification therefore accounts for structural, institutional and policy determinants of FINDEV (see Rajan and Zingales, 2003 and Balatagi *et al.* 2007). In particular, the legal origin dummy accounts for the political and adaptability channels used by a growing body of literature to explain cross-country differences in financial development (see Beck *et al.* 2003 and Acemoglu *et al.* 2004).

Equation (4) refers to the determinants of trade openness. The specification allows for a direct effect of CAL (captured by ω_1), for the feedback effect of growth on openness (captured by ω_2) and for joint endogeneity of OPEN and FINDEV (captured by ω_3). In addition, the specification also controls for a size effect, through the inclusion of the log of total population and log country's area, and for a demand effect, through the inclusion of log per-capita income (see Alesina and Waiczarg, 1998).

The choice of the estimator must be driven by the assumptions concerning the structure of the variance-covariance matrix of residuals. The most general structure allows for heteroskedasticity, contemporaneous correlation of the residuals across equations and non-zero correlation between some of the regressors and the error term in each equation. In this case, the GMM-system estimator proposed by Wooldridge (2002) with White's heteroskedasticity correction is a suitable estimator. However, the problem with the system estimator is that if one of the equations is misspecified, then estimates of all parameters in the system will be affected. Therefore, system estimates should be complemented by a set of equation-by-equation estimates obtained from a standard 2 stages-least-squares instrumental variables estimator.

The Hausman test of endogeneity shows that (i) CAL, government expenditure, average years of schooling, and population growth are potentially endogenous to the GDP growth rate, (ii) CAL, inflation and government debt are potentially endogenous to FINDEV, (iii) CAL is potentially endogenous to OPEN. These potentially endogenous regressors are then instrumented by legal origin dummies, geographical latitude, the percentage of Muslims in the population and the percentage of Catholics in the population, an index of democracy, a trichotomous variable capturing the type of political system, and three indicators of quality of the polity (see the appendix for details). Following Baum *et al.* (2003), the validity of this choice of instruments is tested in two ways: (i) in the regression of each potentially endogenous variable on the set of instruments (first stage regression), the null hypothesis that instruments are jointly insignificant is always rejected, (ii) the null hypothesis of the Sargan test of overidentfying restrictions is never rejected[6].

The model is estimated on a sample of 79 countries over the period 1970-2000. To focus on long-term effects, data are averaged over five years spell. See the appendix for data definition and sources and for the full list of countries.

3. Results

To start with, Column 1 of Table 1 reports the estimated coefficient of a single equation growth model. The estimator is Caselli *et al.*'s (1996) version of Arellano and Bond (1991) GMM single equation estimator. It can be seen that both FINDEV and OPEN increase

[6] The full set of results concerning these tests is available from the author upon request. The statistics of the Sargan test are reported at the bottom of Table 1.

growth and that the coefficient on CAL is not statistically significant. In this respect, the equation reproduces the overall conclusion drawn from the existing literature: CAL fails to affect growth significantly[7]. Column 2 shows the same equation without FINDEV and OPEN on the r.h.s. CAL has now a positive and significant coefficient, but the equation is clearly misspecified since some relevant variables (FINDEV and OPEN) are omitted.

Table 1: Estimation results

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Equation (2): dependent variable is growth						
Constant	…		0.104**	0.096**	0.089**	0.121***
Schooling	-0.096	0.067**	-0.005*	-0.004	-0.005*	-0.003
Capital account liberalization (CAL)	0.055	0.080***	-0.014	-0.013	-0.015	-0.007
Credit to private sector (FINDEV)	0.422**	..	0.176***	0.174***	0.168***	0.144***
Trade openness (OPEN)	1.404**	..	0.057**	0.052*	0.057*	0.038
Per-capita income	0.076***	0.303***	-0.011*	-0.011*	0.008	-0.014**
Pop. Growth	-13.471***	-7.611***	-2.053***	-1.813***	-1.954***	-1.886***
Gov. expenditure	-0.641	-0.893	-0.115*	-0.092	-0.114	-0.057
Equation (3): dependent variable is credit to private sector (FINDEV)						
Constant	..	..	-0.004	-0.025	0.074	-0.008
Per-capita income	..	..	0.039*	0.043**	0.042	0.041
Capital account liberalization (CAL)	..	..	0.153***	0.125***	0.121**	0.143***
Trade openness (OPEN)	..	..	-0.267*	-0.204*	-0.262*	-0.273*
Inflation	..	..	0.230	0.247	-0.108	-0.032
Government debt	..	..	0.300	0.161	0.085	0.298
French legal origin	..	..	-0.057*	-0.045	-0.041	-0.030
Growth	..	..	..	2.392***	2.350	1.629
Equation (4): dependent variable is trade openness (OPEN)						
Constant	..	..	2.363***	2.542***	2.457***	2.562***
Per-capita income	..	..	-0.087**	-0.075**	-0.070	-0.077**
Population	..	..	-0.325***	-0.433***	-0.408***	-0.442***
Area	..	..	-0.048***	-0.042***	-0.042***	-0.043***
Capital account liberalization (CAL)	..	..	0.135***	0.163***	0.162**	0.139**
Credit to private sector (FINDEV)	..	..	0.342	0.086	0.043	0.210
Growth	..	..		2.601	2.727	2.424
Sargan test statistic	2.105	4.718	0.049	0.040	0.025	..
p-value	0.74	0.69	0.295	0.42	0.964	..
Included observations	197	211	487	487	487	..
Total system observations	..	..	1130	1130	1130	..

See the appendix for variables definition and sources. *,**,*** denote statistical significance at 10%,5% and 1% confidence level respectively. Estimators are as follows: Caselli *et al.* (1996)'s GMM in columns 1 and 2; System-GMM with White's correction for heteroskedasticity in columns 3 and 4; system-GMM with heterosckedasticity and autocorrelation consistent variance-covariance matrix in column 5, and equation-by-equation 2SLS in column 6. The Sargan test statistic is the statistic of the test of overidentifying restrictions in GMM estimation.

[7] The growth equation has been re-estimated using both OLS and standard single equation 2SLS IV and results are not qualitatively different from those reported in the table.

These first two columns provide an example of the potential fallacy in estimating the growth-CAL nexus within the single equation framework. Column (3) therefore reports the GMM estimates of the system of three equations presented in Section 2. The feedback effect of growth on FINDEV and OPEN is for now restricted to be zero (i.e. $\gamma_2 = \omega_2 = 0$). The estimated α_2, α_3, ω_1, and γ_1 are all positive and statistically significant. This means that: (i) FINDEV and OPEN promote growth and (ii) CAL increases both FINDEV and OPEN. Therefore, financial development and trade openness are two channels through which capital account liberalization stimulates growth. The estimated coefficients mean that an increase in CAL by 0.5 points (which would be empirically equivalent to reducing capitol controls in China to the average level observed in Chile in 1996-2000) would increase domestic credit to the private sector by about 6 points of GDP and trade openness by about 6.5 points of GDP. These effects would in turn raise per capita growth by roughly 1.3 points per year. The coefficient α_1 is instead not significant, meaning that after accounting for the indirect effects of CAL through FINDEV and OPEN, the residual direct effect of capital account liberalization on growth is negligible.

The results on the other controls are worth a mention. There is mild evidence of a relative converge effect in growth, as suggested by the neo-classical theory. Schooling instead appears to hurt growth, even though the coefficient is only marginally significant and it will become insignificant in the subsequent specifications of the system. This might be due to the fact that male schooling and female schooling tend to have effects of opposite sign on growth, and therefore in aggregate they cancel each other out (see Barro and Sala-i-Martin, 1995). The French legal origin, reflecting an overall worse quality of institutions, negatively affects financial development, a result that is consistent with Beck et al (2003) and Acemoglu *et al.* (2004). However, it will turn out that this finding is not robust to the inclusion of growth as an explanatory variable in the FINDEV equation. There is also strong evidence of a size effect in trade openness as proposed by Alesina and Waiczarg (1998). Finally, there is evidence of a marginally significant effect of OPEN on FINDEV, while the opposite is not true. The negative sign estimated for γ_3 is in fact consistent with the findings reported by Baltagi *et al.* (2007) and suggests that a combination of trade and financial liberalization does not necessarily lead to deeper financial development.

In column 4, the restriction $\gamma_2 = \omega_2 = 0$ is lifted. It turns out that faster growth increases financial development, in spite of possible multicollinearity with the legal origin dummy, while the effect on trade openness is negligible. With respect to the effect of CAL on growth nothing changes substantially relative to column 3. In column 5, the variance-covariance matrix is not only heterosckedasticity consistent, but also autocorrelation consistent. Once again the bulk of the results from column 3 are confirmed. Finally, column 6 reports equation-by-equation estimates. The most important change relative to GMM-estimates is that OPEN becomes marginally insignificant (p-value is 0.12) in the growth equation. This means that while CAL still increases openness to trade, this latter no longer determines growth. Consequently, the only transmission channel of CAL to growth is through financial development. According to these latter estimates, a 0.5 points increase in the index of CAL generates an increase of 0.75 percentage points in the growth rate.

4. Conclusions

The estimation of a system of three equations indicates that CAL has a rather strong positive impact on growth. However, this impact occurs through financial development and trade openness. It is therefore difficult to estimate it correctly within a single equation model that

includes both financial development and trade openness as control variables. After accounting for the transmission through financial development and trade openness, the residual impact of capital account liberalization is not statistically significant.

More work has to be done in the future on the theoretical foundations of the three equations empirical representation used in this paper. It will be also interesting to test empirically whether the transmission channels linking CAL and growth differ between developing and industrial countries. Finally, as more data on international financial flows become available for a broader group of countries, it will be important to use *de facto* measures of financial openness in addition to the *de jure* index of Chinn and Ito (2002 and 2006).

Appendix: List of countries, variables description and data sources

Countries in the sample

Algeria	Estonia	Korea	Romania
Argentina	Finland	Kyrgyz Rep.	Russia
Armenia	France	Latvia	Slovak Republic
Australia	Gambia	Lesotho	Slovenia
Austria	Ghana	Libya	South Africa
Azerbaijan	Greece	Lithuania	Spain
Belarus	Guatemala	Malawi	Sri Lanka
Belgium	Haiti	Malaysia	Swaziland
Bolivia	Honduras	Mauritius	Syria
Brazil	Hungary	Mexico	Tanzania
Chile	Iceland	Moldova	Thailand
China	Indonesia	Morocco	Turkey
Colombia	Iran	Nepal	Uganda
Costa Rica	Ireland	Netherlands	United Kingdom
Cyprus	Israel	New Zealand	United States
Czech Republic	Italy	Nigeria	Uruguay
Denmark	Jamaica	Pakistan	Venezuela
Dominican Rep.	Jordan	Peru	Zambia
Ecuador	Kazakhstan	Philippines	Zimbabwe
Egypt	Kenya	Portugal	

Variables definition and sources

Variables	*Description*	*Sources*
Model variables		
Schooling	Average number of school years in adult population	Barro and Lee (2000)
CAL	First standardized principal component of R_1, R_2, $SHARE_3$ and R_4, where: (i) R_1 takes value 1 in the absence of multiple exchange rates, (ii) R_2 takes value 1 if current account transactions are not restricted, (iii) R_3 takes value 1 if capital account transactions are not restricted, (iv) R_4 takes value 1 in the absence of a requirement to surrender export proceeds. $SHARE_4$ is then constructed in each year as the average of R_3 in that year and in the four preceding years	Chinn and Ito (2002)
FINDEV	Domestic credit to private sector in percent of GDP	WDI
OPEN	Exports plus imports in percent of GDP	WDI
Per-capita income	Log of per-capita real GDP	WDI
Growth	Annual percent change in per-capita income	WDI
Population	Log of total population	WDI
Population growth	Annual percent change in population	WDI
Government expenditure	Total government expenditure in percent of GDP	WDI
Inflation	Annual percent change in consumer price index	WDI
Government debt	Total government debt in percent of GDP	WDI
Area	Log of country's total surface area	WDI
French legal origin	Dummy variable taking value 1 if country's commercial/company law is based on the French civil law	La Porta *et al.* (1999)
Instrumental variables		
Democracy	Index of democracy	Polity IV

Autocracy	Index of autocracy	Polity IV
Polity	Difference between Democracy and Autocracy	Polity IV
Catholic	Population of Catholic religion in percent of total population	Gradstein *et al.* (2003)
Muslim	Population of Islamic religion in percent of total population	Gradstein *et al.* (2003)
Latitude	Latitude of a nation's capital	CIA World Factbook
System	Type of political system: taking values 1 (presidential), 2 (aseembly elected) and 3 (parliamentary) depending on the constitutional arrangement disciplining the exercise of power	DPI
Regulation of participation	Extent and intensity of binding rules on when, whether and how political preferences are expressed	Polity IV
Competitiveness of recruitment	Extent to which prevailing modes of advancement give subordinates equal opportunities to become superordinates	Polity IV
Regulation of chief executive	Extent to which a polity has institutionalized procedures for transferring executive power	Polity IV
Legal origin (Socialist)	Dummy variable taking value 1 if country's commercial/company low is based on the socialist legal tradition	La Porta *et al.* (1999)
Legal original (Scandinavian)	Dummy variable taking value 1 if country's commercial/company low is based on the Scandinavian legal tradition	La Porta *et al.* (1999)

Detail of data sources:

WDI: World Development Indicator 2006, The World Bank, Washington D.C.

Chinn and Ito (2002): Chinn M., H. and Ito "Capital Account Liberalization, Institutions and Financial Development: Cross-Country Evidence", NBER Working Paper 8967 http://www.ssc.wisc.edu/~mchinn/research.html

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