External Conditions and Growth Performance

César Calderón
World Bank

Norman Loayza
World Bank

Klaus Schmidt-Hebbel
Central Bank of Chile

A central dimension of globalization is the world trend toward larger trade and financial openness, observed in most industrial and developing economies. Openness increases the integration of world goods and capital markets, contributing to potential gains in growth and welfare. However, increased integration may also lead to heightened vulnerability to external shocks. This vulnerability may be particularly important in developing countries, given their production specialization, nondiversified sources of income, unstable policies, incomplete financial markets, and weak institutions.

A growing empirical literature addresses the links between trade openness and growth, financial openness and growth, and external shocks and growth.[1] Earlier work on trade openness finds significant, positive, and often very large effects of trade openness on growth, income levels, or income convergence.[2] Much of the this research

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1. The different strands of work are based on one of two classes of openness measures. Policy or legal measures reflect policy and regulatory restrictions or barriers imposed domestically on international trade volumes and financial flows or holdings (or both). In contrast, outcome or de facto measures reflect actual trade volumes and financial flows or stocks between the domestic economy and the rest of the world.

2. See, among others, Dollar (1992); Ben-David (1993); Sachs and Warner (1995); Edwards (1998); Frankel and Romer (1999). Edwards (1993) reviews earlier work.

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has been criticized for possible bias stemming from the endogeneity of trade to income levels or gross domestic product (GDP) growth, a lack of robustness stemming from exclusion of relevant controls, and the use of inadequate data samples and estimation techniques. Rodrik and Rodríguez (2001) report that the trade openness effects on growth are not robust to the inclusion of the country's geographic latitude, and Rodrik, Subramanian, and Trebbi (2002) find that this effect is not robust to the inclusion of institutional quality. Rigobon and Rodrik (2004), based on a technique of simultaneous-equation identification through heteroskedasticity, report negative significant effects of trade openness on per capita income levels, controlling for institutions and geography.

On the other side of the distribution, some recent work reports significant and robust effects of trade openness on growth or income levels, even after controlling for the common criticisms of omitted variables and endogeneity (see, for instance, Wacziarg, 2001; Irwin and Terviö, 2002; Alcala and Ciccone, 2004; Kose, Prasad, and Terrones, 2004). Other recent work reports more qualified results: while trade openness effects are not robust in cross-section estimations, they are significant in panel studies and robust to the inclusion of institutional variables. This is the case, for instance, of Dollar and Kraay (2003) and Wacziarg and Welch (2003). The latter study, which focuses on country episodes of trade liberalization, shows that trade shares and growth increase significantly and substantially after trade is liberalized. Finally, two recent studies look at interaction effects between trade openness measures and other variables. Kose, Prasad, and Terrones (2004) report robust positive effects of trade openness on growth and find that trade openness turns the negative effect of volatility on growth into a positive one. Alesina, Spolaore, and Wacziarg (2005) study the interaction between trade openness and country size; they find that trade openness has large effects in small countries, but these effects become zero as country size tends to maximum values in their sample.

The shorter literature on links between financial openness and growth also shows mixed results. While Quinn (1997) and Edison and others (2002) report significant positive growth effects of international financial integration for the world at large, others do not find any evidence or reject robust evidence of such effects, including Grilli and Milesi-Ferretti (1995), Kraay (1998), Rodrik (1998), and O'Donnell (2001).[3] Some studies test for the interaction between financial openness

3. Edison and others (2002) provide a survey.

and other variables in order to consider nonlinearities and nonmonotonicities in the relation between financial openness and growth. The general finding is that financial openness and external financial liberalization tend to reduce growth in countries that are not industrialized (Klein and Olivei, 1999), feature ethnic heterogeneity (Chanda, 2005), have low income (Edwards, 2001), or exhibit high black-market premiums (Arteta, Eichengreen, and Wyplosz, 2001), while financial openness tends to raise growth in countries with the opposite features. Klein (2003) reports quadratic interaction terms of financial openness with government quality and with per capita GDP, concluding that financial openness only raises growth in middle-income countries. Finally Kose, Prasad, and Terrones (2004), complementing their work on links between trade openness and growth, do not find any robust growth effects of financial openness separately, but they show that sufficiently high international financial integration turns the negative effect of volatility on growth into a positive one.

External factors relevant to open economies comprise financial and real variables associated with capital flows and trade flows, respectively. They include price variables (in particular, international interest rates and terms of trade) and quantity variables (capital flows to emerging economies). For truly small countries facing infinite demand and supply elasticities for their exports and imports of capital and goods, only price variables matter for determining domestic performance, including growth. For countries with some monopoly or monopsony power in international markets—reflecting their size or their specialization in trading differentiated goods or services (or both)—quantities matter for domestic performance, too. However, examining the growth impact of external quantity variables requires isolating its exogenous component as the relevant predetermined variable. In this vein, the global or regional supply of capital could be an adequate proxy for the supply of capital to the domestic economy, while average growth of all trading partners could be an adequate proxy for the foreign demand of exports from the domestic economy.

Most empirical growth studies use one or two external variables as controls for foreign shocks.[4] The growth rate of the terms of trade is the most widely used measure of foreign shocks; representative studies include Easterly, Loayza, and Montiel (1997), Fernández-Arias

4. Foreign shocks are measured in two ways: the rate of growth or deviation of a foreign variable from its preceding level and the standard deviation of the variable in a given period. Most growth studies choose the first.

and Montiel (2001), Loayza, Fajnzylber, and Calderón (2005), and Barro and Sala-i-Martin (2004). In most studies, positive terms-of-trade shocks turn out to be significantly positive determinants of growth. Other studies consider the growth rate of trading partners as the relevant foreign shock. For instance, Arora and Vamvakidis (2004a) find that a 1 percentage point increase in economic growth of the country's trading partners leads to an increase in domestic growth of 0.8 percentage point. They argue that this result is consistent with the literature on the impact of cross-country spillovers (Arora and Vamvakidis, 2004b; Ahmed and Loungani, 1999).

Blankenau, Kose, and Yi (2001) find that foreign real interest rate shocks explain almost one-third of output fluctuations in small open economies, as well as more than half of their fluctuations in net exports and net foreign assets. Other studies include the ratio of private capital inflows to GDP as a growth determinant and also evaluate the impact of different types of capital flows on growth (see Bosworth and Collins, 1999; Mody and Murshid, 2002; Calderón and Schmidt-Hebbel, 2003). Most of these studies find that private capital inflows have a positive impact on growth, with a stronger effect in the case of foreign direct investment.[5]

From our brief review, we conclude that the existing literature does not provide a systematic and symmetric empirical analysis of (i) the relationships between economic growth and both financial and trade openness, (ii) the role of external vulnerability reflected by foreign shocks (financial and real shocks that capture exogenous price and quantity shifts) and their influence on growth, and (iii) the interaction effects between openness measures and the corresponding foreign shocks on growth performance. This paper addresses some of these issues.

The remainder of the paper presents our empirical methodology, the data sample, and our panel data regression results on economic growth. Our empirical analysis focuses on the effects that openness and external shocks have on average economic growth. For this purpose, we study the simple linear effects of trade and financial openness, as well as various external shocks; we assess the dependence of the effect of trade and financial openness on the level of per capita income; and we examine the amplification or reduction of the effect of

5. Most of these studies instrumentalize capital inflows using lagged values, legal origin variables, or investor protection measures in order to avoid endogeneity bias from the response of capital flows to growth.

external shocks depending on the degree of trade and financial openness. A final section concludes briefly.

1. Methodology

We work with a pooled data set of cross-country and time-series observations (data details are given below). We use an estimation method that is suited to panel data, deals with static or dynamic regression specifications, controls for unobserved time- and country-specific effects, and accounts for some endogeneity in the explanatory variables. This is the generalized method of moments (GMM) for dynamic models of panel data developed by Arellano and Bond (1991) and Arellano and Bover (1995).

The general regression equation to be estimated is the following:

$$y_{i,t} = \beta' X_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} . \quad (1)$$

where y is the dependent variable of interest, that is, economic growth; the subscripts i and t represent country and period, respectively; X is a set of time- and country-varying explanatory variables, proxies of trade and financial openness, measures of various external shocks, interaction terms, and control variables; and β is the vector of coefficients to be estimated. Finally, μ_t is an unobserved time-specific effect, η_i is an unobserved country-specific effect, and ε is the error term.

The method deals with unobserved time effects through the inclusion of period-specific intercepts. Dealing with unobserved country effects is not as simple, given the possibility that the model is dynamic and contains endogenous explanatory variables. The method therefore uses differencing and instrumentation to control for unobserved country-effects. Likewise, the method relies on instrumentation to control for joint endogeneity. Specifically, it allows relaxing the assumption of strong exogeneity of the explanatory variables by allowing them to be correlated with current and previous realizations of the error term, ε.

Parameter identification is achieved by assuming that future realizations of the error term do not affect current values of the explanatory variables, that the error term is serially uncorrelated, and that changes in the explanatory variables are uncorrelated with the unobserved country-specific effect. As Arellano and Bond (1991) and Arellano and Bover (1995) show, this set of assumptions generates moment conditions that allow the estimation of the parameters of

interest. The instruments corresponding to these moment conditions are appropriately lagged values of both levels and differences of the explanatory and dependent variables (the latter if the model is dynamic). Since the moment conditions typically overidentify the regression model, the econometric technique also allows for specification testing through a Sargan-type test.

2. Sample and Results

We estimate economic growth regressions on a pooled (cross-country, time-series) data set consisting of seventy-six countries with at most six nonoverlapping five-year periods over 1970—2000 for each country. Appendix 1 lists the countries in the sample. Appendix 2 provides full definitions and sources of all variables used in the paper, and appendix 3 presents basic descriptive statistics for the data used in the regressions.

As is standard in the literature, the dependent variable is the average rate of real per capita GDP growth. The regression equation is dynamic in the sense that it includes the initial level of per capita GDP as an explanatory variable. As additional control variables, the regression includes the average rate of secondary school enrollment to account for human capital investment, the average ratio of private credit to GDP as a measure of financial depth, the average inflation rate to account for monetary discipline, and the average ratio of government consumption to GDP as a measure of the government burden. The regression equation also allows for both unobserved time- and country-specific effects.

The explanatory variables of interest are measures of trade and financial openness, measures of external shocks, and various interaction terms. Given that we want to evaluate the effect of actual exposure to international markets on economic growth, we work with outcome measures of trade and financial openness. These measures are related to policies, but they are also the result of structural characteristics of the economy, such as size, natural and social endowments, and public infrastructure. The outcome measures we use are the ratio of exports and imports to GDP in the case of trade and the ratio of portfolio and foreign direct investment (FDI) liabilities to GDP in the case of financial openness.

We consider four types of external shocks: the first two are primarily related to trade in goods, and the latter two are mainly related to financial transactions. All four are defined so that they can

be considered exogenous to the country in question. They are the average growth of the terms of trade, the average weighted output growth rate of trade partners, the average amount of capital flows to the region where the country is located, and the average change of the international interest rate. Whereas the first two variables vary by country and period, the third varies only by region and period and the fourth only by period. Because of its limited sample variation, the effect of the international interest rate shock cannot be distinguished from the unobserved time-specific effect; however, its interaction with the measures of trade and financial openness can be considered.

2.1 Linear Effects of Openness and External Shocks

In the basic case, the effects of openness and shocks on growth are independent from each other and independent from other characteristics of the economy. This corresponds to the most common treatment of growth determinants in the literature. We estimate the following regression equation in this case:

$$y_{i,t} = \beta_0' \mathrm{CV}_{i,t} + \beta_1' \mathrm{OPEN}_{i,t} + \beta_2' \mathrm{EXT}_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \,. \tag{2}$$

where CV is the set of control variables, OPEN is the set of openness variables, and EXT is the set of foreign-shock variables.

The estimation results are presented in table 1. We find that both trade and financial openness are positively related to economic growth. As mentioned in the introduction, the effect of openness on growth is found to be ambiguous in the literature. However, ambiguity gives way to positive effects when the time-series dimension is taken into account: the beneficial impact of openness is most clearly seen in the experience of countries before and after liberalization (see, for instance, Wacziarg and Welch, 2003). Our panel data results confirm this finding, as they are based not only on cross-country comparisons, but also on changes over time for individual countries. Furthermore, since our methodology controls for country-specific effects and the joint endogeneity of openness, our results are not subject to the criticism that the positive growth effect of openness is not robust to the inclusion of variables such as geographical location (see Rodrik and Rodríguez, 2001, for the case of trade) or is due to reverse causation.

The growth effects of external shocks are all significant and carry the expected signs. That is, increases in favorable terms of trade, in the growth rate of trade partners, and in capital flows to the region

Table 1. Economic Growth, Trade Openness, Financial Openness and Foreign Shocks[a]

Explanatory variable	*Baseline regression*
Constant	7.142 **
	(2.25)
Control variables	
Initial GDP per capita (in logs)	–0.177 **
	(0.09)
Education (secondary enrollment, in logs)	1.058 **
	(0.16)
Financial depth (private domestic credit to GDP, in logs)	0.631 **
	(0.10)
Lack of price stability (inflation rate, in log[100 + inf. rate])	–2.275 **
	(0.37)
Government burden (government consumption to GDP, in logs)	–1.488 **
	(0.22)
Openness	
Trade openness (real exports and imports to GDP, in logs)	0.403 **
	(0.13)
Financial openness (stock of equity-related foreign liabilities, in logs)	0.051**
	(0.01)
Foreign shocks	
Terms-of-trade shocks (growth rate of terms of trade)	0.038 **
	(0.01)
Foreign growth (growth rate of the country's trading partners)	1.536 **
	(0.17)
Regional capital inflows (private capital inflows to country's region)	0.098 **
	(0.02)
Period shifts	
1976–80 period	–1.119 **
1981–85 period	–1.284 **
1986–90 period	–1.865 **
1991–95 period	–0.517 *
1996–2000 period	–1.843 **
Summary statistic	
Specification tests (*p* values)	
Sargan test	(0.41)
Second-order correlation	(0.90)
No. countries / No. Observations	76 / 438

Source: Authors' calculations.
* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
a. The dependent variable is growth in real per capita GDP. The estimation method is the general method of moment instrumental variables (GMM-IV) system developed by Arellano and Bover (1995) and Blundell and Bond (1998). Our sample covers seventy-six countries over the period 1970–2000 (in five-year-period observations). Robust standard errors are in parentheses.

produce a rise in average economic growth. These results, together with the estimated size and significance of the period shifts, confirm the substantial importance of external conditions as growth determinants.

All control variables carry significant coefficients with the expected signs. The Sargan and serial-correlation specification tests do not reject the null hypothesis of correct specification, lending support to our estimation results. This is the case in all exercises presented below, and to avoid redundancy we only mention it here.

2.2 The Effect of Openness Depending on the Level of Income

It is increasingly held that the growth effect of openness may not be homogeneous across countries. Some researchers, in part motivated by the work of Klein and Olivei (1999) in the case of financial openness, consider the possibility that the growth effect of openness may depend on country characteristics such as income and institutional quality (see Edwards, 2001; Klein, 2003). In the framework of our panel data methodology, we now reassess this possibility by allowing the effect of each measure of openness to vary with the level of real per capita GDP, which serves as a proxy for overall development. We do this by interacting each openness measure with linear and quadratic per capita GDP (INC) in each country at the start of the corresponding period. The regression equation we estimate in this case is the following:

$$y_{i,t} = \beta_0' \mathrm{CV}_{i,t} + \beta_1' \mathrm{OPEN}_{i,t} + \beta_2' \mathrm{EXT}_{i,t} + \beta_3' \mathrm{OPEN}_{i,t} * \mathrm{INC}_{i,t} + \beta_4' \mathrm{OPEN}_{i,t} * \mathrm{INC}_{i,t}^2 + \mu_t + \eta_i + \varepsilon_{i,t}. \quad (3)$$

Table 2 presents the estimation results. We consider the interaction between per capita GDP and the openness variables one at a time; this simplifies the interpretation of the results without overextending the parameter requirements on the data. Thus, column 1 shows the results when financial openness is interacted with income, and column 2, when trade openness is interacted with income. The regression results are qualitatively similar whether we deal with financial or trade openness and can be summarized as follows. The coefficient on the openness indicator by itself is negative and significant, and the coefficients on the linear and quadratic interaction terms are significantly positive and negative, respectively. The growth effect of openness then depends on per capita income or,

taking a broader interpretation, on the overall level of development. A corollary is that the net growth effect could, in theory, be positive or negative, and we should examine which is the case for the actual levels of per capita GDP found in our sample.

Figure 1 illustrates what the estimated pattern of coefficients implies for the change in growth produced by an increase in each openness measure. Specifically, the figure uses the regression point estimates to plot the growth effect of a one-standard-deviation increase in openness as a function of per capita GDP for the full range of the sample. For both financial and trade openness, the growth effect is nearly zero for low levels of per capita GDP, it increases at a decreasing rate as income rises, and it reaches a maximum at high levels of income (higher in the case of trade openness). The growth effect of openness appears to be economically significant for middle- and high-income countries. In relation to the previous literature, we also find nonlinear growth effects of openness, but the precise nature of the nonlinearity differs. For instance, we do not find negative effects of financial openness for low-income countries (in contrast with Edwards, 2001), and we find that the growth effects of financial openness remain positive even for high-income countries (unlike Klein, 2003). However, we agree with these papers that middle-income countries can expect to improve their growth performance as they become more integrated with the rest of the world.

Our coefficient estimates suggest significant economic effects. For instance, a one-standard-deviation increase in the degree of financial openness would lead to higher per capita growth rates by 0.70 percentage point for countries in the twenty-fifth percentile of the world distribution of output per capita for the 1996–2000 period (Honduras and Zimbabwe); by 0.85 percentage point for countries in the seventy-fifth percentile (Spain and Israel); and by 0.76 percentage point for countries in the ninety-fifth percentile (Japan). The highest growth effect of international financial integration (0.90 percentage point) is achieved by middle-income countries in the sixty-seventh percentile (namely, Chile, Mexico, and South Africa). Similarly, an analogous increase in the degree of trade openness will generate an increase in the per capita GDP growth rate of 0.40 percentage point for countries in the twenty-fifth percentile, 0.57 percentage point for median countries (such as Paraguay and Tunisia), 0.70 percentage point for countries in the seventy-fifth percentile, and 0.75 percentage point for countries in the ninety-fifth percentile of the world distribution of output per capita.

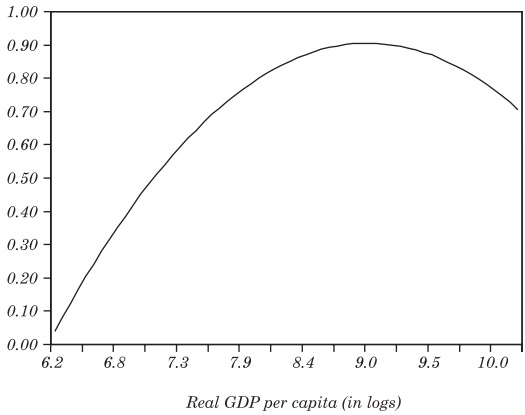
Table 2. Economic Growth and the Interaction between Openness and Real GDP per Capita[a]

	Outcome measures of openness	
Explanatory variable	*Financial (1)*	*Trade (2)*
Constant	2.105	23.419**
	(2.57)	(2.37)
Control variables		
Initial GDP per capita (in logs)	–0.704**	–2.883**
	(0.24)	(0.27)
Education (secondary enrollment, in logs)	2.443**	2.062**
	(0.24)	(0.15)
Financial depth (private domestic credit to GDP, in logs)	0.354**	0.402**
	(0.15)	(0.13)
Lack of price stability (inflation rate, in log[100 + inf. rate])	–1.434**	–1.605**
	(0.43)	(0.34)
Government burden (government consumption to GDP, in logs)	–1.184**	–1.460**
	(0.24)	(0.32)
Openness		
Trade openness (real exports and imports to GDP, in logs)	0.449**	–8.214**
	(0.10)	(0.77)
Financial openness (stock of equity-related foreign liabilities, in logs)	–2.274**	–0.050**
	(0.35)	(0.01)
Openness * Initial GDP per capita	0.562**	1.832**
	(0.10)	(0.19)
Openness * Initial GDP per capita squared	–0.031**	–0.089**
	(0.01)	(0.01)
Foreign shocks		
Terms-of-trade shocks (growth rate of terms of trade)	0.041**	0.055**
	(0.01)	(0.01)
Foreign growth (growth rate of the country's trading partners)	1.749**	1.666**
	(0.12)	(0.11)
Regional capital inflows (private capital inflows to country's region)	0.115**	0.115**
	(0.03)	(0.03)
Period shifts		
1976–80 period	–1.359**	–1.110**
1981–85 period	–1.627**	–1.099**
1986–90 period	–2.322**	–1.873**
1991–95 period	–0.832**	–0.260
1996–2000 period	–2.610**	–1.609**
Summary statistic		
Specification tests (*p* values)		
Sargan test	(0.18)	(0.45)
Second-order correlation	(0.94)	(0.79)
No. countries / No. Observations	76 / 438	76 / 438

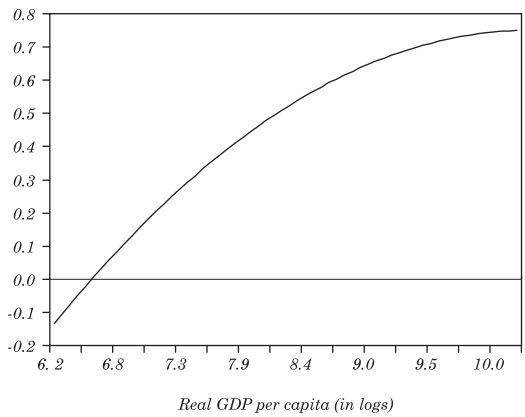
Source: Authors' calculations.
* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
a. The dependent variable is growth in real per capita GDP. The estimation method is the GMM-IV system developed by Arellano and Bover (1995) and Blundell and Bond (1998). Our sample covers seventy-six countries over the period 1970–2000 (in five-year-period observations). Robust standard errors are in parentheses.

Figure 1. Growth Effect of Openness as a Function of GDP per Capita

A. Growth effect of outcome financial openness as a function of GDP per capita



B. Growth effect of outcome trade openness as a function of GDP per capita



Source: Authors' calculations.

2.3 The Interaction between Openness and External Shocks

The previous exercises focus on the potential effect that openness can have on economic growth, controlling for various external shocks. An additional issue is whether openness makes the economy more or less responsive to external shocks. Ideally, openness should amplify the growth effect of positive shocks and dampen the effect of negative ones. However, we find no evidence of asymmetric interaction effects (in results not presented here) and limit ourselves to the issue of whether the growth effect of shocks depends on the economy's openness. We address this question by considering interaction terms between each of the shocks and the openness variables. The regression equation we estimate in this case is the following:

$$y_{i,t} = \beta_0' \mathrm{CV}_{i,t} + \beta_1' \mathrm{OPEN}_{i,t} + \beta_2' \mathrm{EXT}_{i,t} + \beta_3' \mathrm{OPEN}_{i,t} * \mathrm{EXT}_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}. \quad (4)$$

These interactions present a large number of possibilities, but we consider the interactions between financial and trade openness indicators with the external shocks one shock at a time to avoid overextending the parameter requirements on the data. This also allows us to simulate the effect of each shock independently. The results are presented in table 3, with each column devoted to the interactions with each of the four external shocks. An interesting pattern emerges. Larger trade openness decreases the growth effect of trade-related shocks (the growth of terms of trade and the GDP growth of trade partners) while increasing the growth effect of financial market shocks (international interest rate changes and regional capital inflows). Conversely, greater financial openness increases the growth effect of trade-related shocks while reducing the impact of regional capital inflows, one of the financial market shocks. The exception to this pattern is that financial openness seems to increase the growth effect of international interest rate changes. Except for the latter case, the results challenge the conventional wisdom that trade openness increases vulnerability to trade-related shocks and that financial openness does likewise with financial-related shocks. The channels of transmission seem to be more complex.

Since the growth effect of a shock now depends on three coefficients plus the levels of trade and financial openness, the net effect is not immediately clear. Figure 2 helps to make this assessment by

Table 3. Economic Growth and the Interaction between Openness and Foreign Shocks[a]

Explanatory variable	Terms-of-trade changes *(1)*	Foreign growth *(2)*	World interest rate changes *(3)*	Regional capital inflows *(4)*
Constant	5.242**	12.005**	9.444**	10.804**
	(2.41)	(2.94)	(2.44)	(3.06)
Control variables				
Initial GDP per capita (in logs)	–0.138*	–0.280**	–0.176*	–0.152*
	(0.09)	(0.13)	(0.11)	(0.09)
Education	1.284**	1.419**	1.110**	0.977**
(secondary enrollment, in logs)	(0.19)	(0.19)	(0.17)	(0.16)
Financial depth	0.592**	0.669**	0.578**	0.628**
(private domestic credit to GDP, in logs)	(0.07)	(0.14)	(0.11)	(0.10)
Lack of price stability	–1.786**	–3.936**	–2.400**	–2.733**
(inflation rate, in log[100 + inf. rate])	(0.39)	(0.33)	(0.42)	(0.49)
Government burden	–1.597**	–1.523**	–1.547**	–1.384**
(government consumption to GDP, in logs)	(0.24)	(0.28)	(0.26)	(0.23)
Openness				
Trade openness (stock of equity-related	0.133*	1.227**	0.404**	–0.190
foreign liabilities, in logs)	(0.08)	(0.46)	(0.12)	(0.15)
Financial openness	0.080**	–0.159**	0.071**	0.146**
	(0.01)	(0.04)	(0.01)	(0.02)
Foreign shocks:				
Terms-of-trade shocks	1.175**	0.033**	0.050**	0.039**
(growth rate of terms of trade)	(0.12)	(0.01)	(0.01)	(0.01)
Foreign growth (growth rate	1.703**	2.756**	1.499**	1.618**
of the country's trading partners)	(0.17)	(0.75)	(0.16)	(0.19)
Regional capital inflows (private	0.025	0.057**	0.086**	–0.374**
capital inflows to country's region)	(0.02)	(0.01)	(0.02)	(0.12)
Interaction: openness and foreign shock				
Trade openness * foreign shock	–0.276**	–0.361*	0.397**	0.151**
	(0.03)	(0.19)	(0.11)	(0.03)
Financial openness * foreign shock	0.010**	0.067**	0.118**	–0.043**
	(0.00)	(0.02)	(0.02)	(0.01)
Period shifts				
1976–80 period	–1.239**	–1.087**	–5.122**	–0.993**
1981–85 period	–1.413**	–1.290**	–2.605**	–1.099**
1986–90 period	–2.495**	–1.807**	–3.443**	–1.638**
1991–95 period	–0.564**	–0.545*	–1.359**	–0.169
1996–2000 period	–1.900**	–1.911**	–3.075**	–1.604**
Summary statistic				
Specification tests (*p* values)				
Sargan test	(0.22)	(0.38)	(0.37)	(0.38)
Second-order correlation	(0.81)	(0.59)	(0.96)	(0.67)
No. countries / No. observations	76 / 438	76 / 438	76 / 438	76 / 438

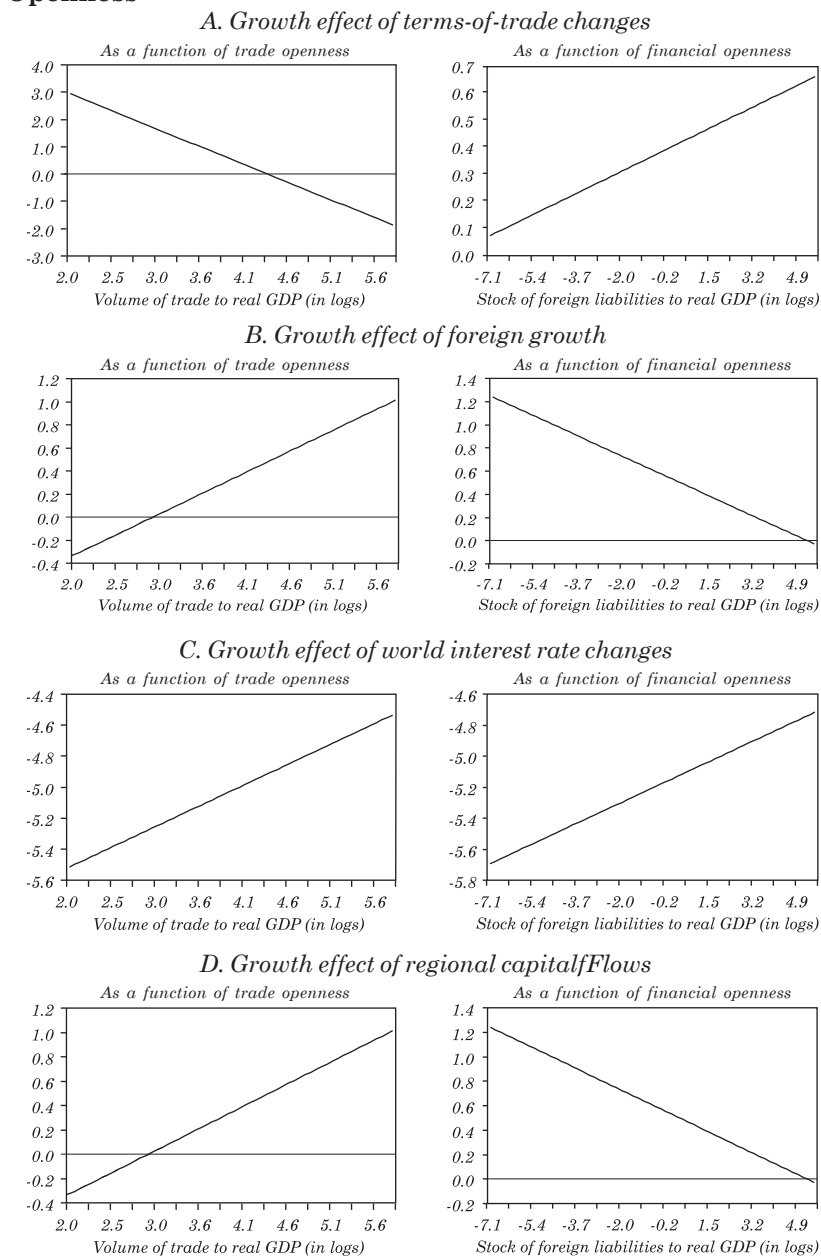
Source: Authors' calculations.
* Statistically significant at the 10 percent level.
** Statistically significant at the 5 percent level.
a. The dependent variable is growth in real per capita GDP. The estimation method is the GMM-IV system developed by Arellano and Bover (1995) and Blundell and Bond (1998). Our sample covers seventy-six countries over the period 1970–2000 (in five-year-period observations). Robust standard errors are in parentheses.

graphing the growth effect of one-standard-deviation increase in each shock as a function of, first, trade openness and, second, financial openness (in the former case, we use the sample average of financial openness in the calculation of the partial effects; in the latter, the sample average of trade openness).[6] For the terms-of-trade shock, the growth effect is positive for low and medium levels of trade openness, but the growth effect changes signs and becomes negative as trade openness increases further. The growth effect of the terms-of-trade shock increases with financial openness and is positive throughout the relevant range. Regarding the trade partners' growth shock, as noted above, the effect decreases with trade openness and increases with financial openness, but it is always positive in both cases. In the case of the international interest rate shock, the direct impact on growth cannot be separated from the time effects. We estimate that the direct impact is negative, however, based on an exercise in which we compare the period shifts with and without the interest rate shock interactions. Once we take into account the interactions, the total growth effect of interest shocks continues to be negative, but it approaches zero as either type of openness rises. Finally, the direct impact of the capital flow shock is negative, although the total effect on growth is positive once the openness interactions are taken into account, with larger trade openness increasing its growth effect and financial openness reducing it.

We can use the numbers to draw several quantitative implications. First, given an average level of financial openness, a one-standard-deviation decline in the terms of trade would lead to a fall in real per capita GDP growth of 0.55 percentage point for countries in the twenty-fifth percentile of the distribution of trade openness across the world in the 1996–2000 period (namely, Greece, with exports and imports representing almost 50 percent of GDP). For median countries—such as Venezuela and Portugal—the growth decline stemming from a deterioration in the terms of trade is smaller (0.13 percentage point) thanks to their higher trade openness. The growth effect of declining terms of trade would be null for countries in the ninetieth percentile (like Australia). Second, given an average level of financial openness, a one-standard-deviation decline in the growth rate of a country's trading partners would lead to a reduction in the growth rate of 0.90 percentage point for countries in the twenty-fifth percentile of the distribution of

6. For these simulations, we restrict the range of the financial openness indicator to values at which the stock of foreign liabilities is positive.

Figure 2. Growth Effect of External Shocks as a Function of Openness



Source: Authors' calculations.

trade openness. The reduction of the growth rate would be smaller, at approximately 0.75 percentage point, for countries in the seventy-fifth percentile (Israel). Third, given an average level of trade openness, a one-standard-deviation decline in the capital flows to the country's region would generate a reduction in the country's growth rate of 0.23 percentage point for countries in the twenty-fifth percentile of the distribution of financial openness across the world for the 1996–2000 period (Greece), 0.17 percentage point for median countries in the distribution (South Africa), and 0.12 percentage point for countries in the seventy-fifth percentile (Chile and Spain).

Finally, openness and external shocks may have a significant effect on macroeconomic volatility, and this, in turn, has been found to have a harmful influence on economic growth (see Fatás, 2002; Hnatkovska and Loayza, 2004). Therefore, the growth effects of openness and external shocks that we just described might occur through their impact on macroeconomic volatility.[7] To consider this possibility, we add the standard deviation of economic growth as an additional explanatory variable. The results are presented in table 4. Growth volatility carries the expected negative and significant coefficient, but the coefficients on all other relevant variables retain their sign, significance, and, to a large extent, size. The growth effects of openness, external shocks, and their interactions can thus be considered independently of their volatility effects.

3. Conclusions

The goal of this paper was to provide a systematic empirical assessment of the impact of openness and external shocks—as well as their interactions—on economic growth. To accomplish this task, we ran linear and nonlinear growth regressions on a cross-country panel data set spanning seventy-six countries for the 1970–2000 period. We considered outcome (or de facto) measures of both trade and financial openness and used four types of external shocks. Trade openness was proxied by the ratio of the volume of imports plus exports to GDP, and financial openness by the ratio of foreign liabilities to GDP. Under the assumption that no country faces a perfectly elastic demand for its products or has unobstructed access to financial markets, we considered not only price, but also quantity proxies for external shocks. Two of

7. According to the estimates presented in table 4, a one-unit reduction in the standard deviation of real GDP growth would lead to an increase in economic growth between 0.35 and 0.40 percentage point.

Table 4. Economic Growth and the Interaction between Openness and Foreign Shocks: Controlling for Macroeconomic Volatility[a]

Explanatory variable	Terms-of-trade changes *(1)*	Foreign growth *(2)*	World interest rate changes *(3)*	Regional capital inflows *(4)*
Constant	0.139	1.107	2.011	4.385**
	(1.85)	(1.81)	(2.08)	(1.91)
Control variables				
Initial GDP per capita (in logs)	–0.284*	–0.226*	–0.342*	–0.351**
	(0.16)	(0.13)	(0.18)	(0.13)
Education (secondary enrollment, in logs)	1.233**	0.861**	0.821**	0.836**
	(0.20)	(0.12)	(0.19)	(0.12)
Financial depth	0.670**		0.826**	
(private domestic credit to GDP, in logs)	1.080**		0.972**	
	(0.18)	(0.15)	(0.18)	(0.16)
Lack of price stability	–0.390	–1.138**	–0.522*	–0.999**
(inflation rate, in log[100 + inf. rate])	(0.32)	(0.17)	(0.35)	(0.23)
Government burden	–1.622**	–1.583**	–1.660**	–1.345**
(government consumption to GDP, in logs)	(0.26)	(0.22)	(0.30)	(0.22)
Openness				
Trade openness (real exports and	0.573**	1.380**	0.616**	0.118
imports to GDP, in logs)	(0.13)	(0.33)	(0.13)	(0.15)
Financial openness (stock of equity-	0.029**	–0.203**	0.034**	0.111**
related foreign liabilities, in logs)	(0.01)	(0.03)	(0.01)	(0.01)
Foreign shocks				
Terms-of-trade shocks	0.917**	0.038**	0.042**	0.036**
(growth rate of terms of trade)	(0.15)	(0.01)	(0.01)	(0.01)
Foreign growth (growth rate of the	1.457**	2.573**	1.457**	1.477**
country's trading partners)	(0.17)	(0.50)	(0.16)	(0.16)
Regional capital inflows (private	0.029	0.049**	0.063**	–0.233*
capital inflows to country's region)	(0.03)	(0.02)	(0.03)	(0.14)

these are related to international trade (changes in the terms of trade and the growth rate of country trading partners), and two are related to financial markets (changes in international real interest rates and regional capital inflows).

We conducted three types of exercises. The first follows the most common growth regression specification and consists of estimating the linear effects of trade and financial openness, as well as external shocks. The second assesses whether the effect of trade and financial openness depends on the country's level of per capita income. Finally, the third exercise examines whether trade and financial openness amplifies or dampens the growth effects of external shocks.

Table 4. (continued)

Explanatory variable	Terms-of-trade changes *(1)*	Foreign growth *(2)*	World interest rate changes *(3)*	Regional capital inflows *(4)*
Interaction: openness and foreign shock				
Trade openness * Foreign Shock	–0.215**	–0.346**	0.311**	0.105**
	(0.04)	(0.12)	(0.13)	(0.04)
Financial openness * Foreign Shock	0.004**	0.089**	0.101**	–0.039**
	(0.00)	(0.01)	(0.02)	(0.01)
Macroeconomic volatility				
Standard Deviation of the Growth	–0.380**	–0.401**	–0.354**	–0.395**
Rate of Real GDP per capita	(0.02)	(0.02)	(0.02)	(0.02)
Period shifts				
1976–80 period	–1.324**	–1.187**	–4.458**	–1.252**
1981–85 period	–1.704**	–1.491**	–2.587**	–1.486**
1986–90 period	–2.624**	–2.099**	–3.512**	–2.043**
1991–95 period	–0.974**	–0.629*	–1.306**	–0.497
1996–2000 period	–2.457**	–2.173**	–3.200**	–2.093**
Summary statistic				
Specification tests (*p* values)				
Sargan test	(0.22)	(0.27)	(0.24)	(0.46)
Second-order correlation	(0.94)	(0.62)	(0.78)	(0.74)
No. countries / No. observations	76 / 438	76 / 438	76 / 438	76 / 438

Source: Authors' calculations.

* Statistically significant at the 10 percent level.

** Statistically significant at the 5 percent level.

a. The dependent variable is growth in real per capita GDP. The estimation method is the GMM-IV system developed by Arellano and Bover (1995) and Blundell and Bond (1998). Our sample covers seventy-six countries over the period 1970–2000 (in five-year-period observations). Robust standard errors are in parentheses.

When we considered the simple linear specification we found that both trade and financial openness are positively related to economic growth. Our panel data results confirm the finding that when evidence over time is jointly considered with cross-country comparisons, openness emerges as an engine for growth. Given our econometric methodology, these results are not subject to the criticism that the positive growth effect of openness is not robust to the inclusion of variables such as geographical location or is due to reverse causation. Regarding the growth effects of external shocks, we find that increases in favorable terms of trade, in the growth rate of trade partners, and in capital flows to the region produce a rise in economic growth. These results corroborate the substantial importance of external conditions as growth determinants.

When we expanded our regression specification to consider the interaction between openness and the level of income, we found

interesting nonlinearities. The regression results are qualitatively similar for financial or trade openness: in both cases, the growth effect is nearly zero for low levels of per capita GDP, it increases at a decreasing rate as income rises, and it reaches a maximum at high levels of income (higher in the case of trade openness). The growth effect of trade and financial openness appears to be economically significant for middle- and high-income countries.

Finally, on the question of the amplification of external shocks through openness, we uncovered an interesting and rather unexpected pattern: larger trade openness dampens the growth effect of trade-related shocks while amplifying the effect of financial market shocks. Conversely, larger financial openness increases the growth effect of trade-related shocks while attenuating the impact of regional capital inflows (one of the financial market shocks). These results challenge the conventional wisdom that trade openness increases the vulnerability to trade-related shocks and that financial openness does likewise with financial-related shocks.

All in all, our assessment of the growth effects of external conditions is quite positive regarding the beneficial impact of trade and financial openness. However, the fact that these effects change with the level of development presents an interesting avenue for future research: finding precisely under what conditions of macroeconomic stability, public infrastructure, market flexibility, and human capital does integration to international markets offer the greatest promise for growth.

Appendix A
Sample of Countries

Our sample of seventy-six countries breaks down as follows.

— Industrial economies (twenty-two countries): Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

— Latin America and the Caribbean (twenty-one countries): Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

— East Asia and the Pacific (eight countries): China, Indonesia, Korea, Malaysia, Papua New Guinea, the Philippines, Singapore, and Thailand.

— Middle East and North Africa (seven countries): Algeria, Egypt, Israel, Jordan, Morocco, Tunisia, and Turkey.

— South Asia (three countries): India, Pakistan, and Sri Lanka.

— Sub-Saharan Africa (fifteen countries): Botswana, Cote d'Ivoire, the Gambia, Ghana, Kenya, Madagascar, Malawi, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Togo, Zambia, and Zimbabwe.

APPENDIX B
Definitions and Sources of Variables Used in Regression Analysis

Table B1

Variable	*Definition and construction*	*Source*
GDP per capita	Ratio of total GDP to total population. GDP is in 1985 PPP-adjusted US$.	Authors' construction using Summers and Heston (1991) and World Bank (2002).
GDP per capita growth	Log difference of real GDP per capita.	Authors' construction using Summers and Heston (1991) and World Bank (2002).
Initial GDP per capita	Initial value of ratio of total GDP to total population. GDP is in 1985 PPP-adjusted US$.	Authors' construction using Summers and Heston (1991) and World Bank (2002).
Education	Ratio of total secondary enrollment, regardless of age, to the population of the age group that officially corresponds to that level of education.	World Bank (2004).
Financial depth	Ratio of domestic credit claims on private sector to GDP.	Author's calculations using data from IFS, central bank publications, and Penn World data. The calculation method is based on Beck, Demirgüç-Kunt, and Levine (1999).
Trade openness	Log of the ratio of exports and imports (in 1995 US$) to GDP (in 1995 US$).	World Bank (2004).
Financial openness	Log of the stock of equity-based foreign liabilities to GDP (both expressed in 1995 US$). Following Eichengreen and Irwin (1998), we add the value of one to the stock to include cases in which the stock of foreign liabilities is zero.	Lane and Milesi-Ferretti (2001, 2003), and the IMF's Balance-of-Payments Statistics
Government burden	Log of the ratio of government consumption to GDP.	World Bank (2002).
CPI	Consumer price index (1995 = 100) at the end of the year.	Author's calculations with data from IFS.

Table B1 (continued)

Variable	*Definition and construction*	*Source*
Inflation rate	Annual percent change in CPI.	Author's calculations with data from IFS.
Terms of trade	Net barter terms of trade index (1995=100).	World Bank (2004).
Terms-of-trade changes	Log differences of the terms of trade index.	Authors' construction using World Bank (2002).
Foreign growth	Growth in main trading partners calculated as the trade-weighted growth for the main trading partners of the corresponding country.	Authors' construction using Summers and Heston (1991), World Bank (2002), and the IMF's Direction of Trade Statistics.
World nominal interest rate	G-3 (United States, Germany, and Japan) money market rate (period average).	Author's calculations with data from IFS.
World inflation	G-3 (United States, Germany, and Japan) consumer price index (CPI) inflation rate.	Author's calculations with data from IFS.
World real interest rate	World nominal interest rate minus world inflation.	Author's calculations with data from IFS.
Regional capital inflows	(Gross) capital inflows (FDI, portfolio-equity, loans) to the region of the corresponding country.	Author's calculations with data from the IMF's Balance-of-Payments Statistics.
Macroeconomic volatility	Standard deviation of the growth rate of real GDP.	Authors' construction using Summers and Heston (1991) and World Bank (2002).
Period-specific shifts	Time dummy variables.	Authors' construction.

Appendix C
Descriptive Statistics for Growth Regressions

This section reports descriptive statistics for univariate and bivariate growth regressions. Data are five-year-period averages over 1970–2000 for seventy-six countries, resulting in 438 observations.

Table C1. Univariate Regressions

Variable	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
Growth rate of GDP per capita	1.422	2.642	–7.944	10.128
Initial GDP per capita (in logs)	8.522	0.989	6.243	10.240
Secondary enrollment (in logs)	3.739	0.788	0.113	4.923
Private domestic credit/GDP (in logs)	3.485	0.844	0.568	5.435
Inflation (in log [100+inf. rate])	4.743	0.175	4.585	6.135
Government consumption /GDP (in logs)	2.680	0.371	1.475	3.637
Trade openness	3.948	0.594	2.024	5.787
Financial openness	1.689	3.779	–21.044	5.536
Terms-of-trade changes	–0.424	4.644	–18.859	21.415
Foreign growth	2.244	0.606	0.834	3.833
World interest rate changes	–0.017	0.658	–0.975	1.505
Regional capital flows	3.419	2.359	–1.635	10.336

Source: Author's calculations.

Table C2. Bivariate Correlations between Growth and Determinants

Variable	*Growth rate of GDP per capita*	*Initial GDP per capita (in logs)*	*Secondary enrollment (in logs)*	*Private domestic credit/GDP (in logs)*	*Inflation (in log [100+inf. rate])*	*Government consumption /GDP (in logs)*	*Trade openness*	*Financial openness*	*Terms-of-trade changes*	*Foreign growth*	*World interest rate changes*	*Regional capital inflows*
Growth rate of GDP per capita	1.00											
Initial GDP per capita (in logs)	0.19	1.00										
Secondary enrollment (in logs)	0.22	0.80	1.00									
Private domestic credit/GDP (in logs)	0.25	0.71	0.61	1.00								
Inflation (in log [100+inf. rate])	–0.29	–0.10	0.00	–0.35	1.00							
Government consumption/GDP (in logs)	–0.03	0.36	0.29	0.35	–0.10	1.00						
Trade openness	–0.04	–0.14	–0.13	0.01	–0.30	0.27	1.00					
Financial openness	0.15	0.34	0.44	0.28	0.04	0.03	–0.11	1.00				
Terms-of-trade changes	0.10	0.07	0.03	0.04	–0.12	–0.04	0.08	0.06	1.00			
Foreign growth	0.28	–0.14	–0.24	–0.12	–0.17	–0.15	–0.12	–0.23	0.08	1.00		
World interest rate changes	0.04	–0.01	–0.02	0.00	0.03	0.05	–0.01	0.03	0.20	0.29	1.00	
Regional capital flows	0.19	0.44	0.34	0.41	–0.29	0.18	0.12	0.17	0.11	–0.14	0.06	1.00

Source: Authors' calculations.

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