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Can Reforms Promoting Growth Increase Financial Fragility? An Empirical Assessment

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ABSTRACT/RÉSUMÉ

Can Reforms Promoting Growth Increase Financial Fragility? An Empirical Assessment

Certain growth-promoting policies can have negative side-effects by increasing the vulnerability of economies to financial crises. Typical examples are greater openness to financial flows or more liberalised financial markets. This paper investigates whether the growth benefits of policy reforms in these growth-enhancing areas, and others such as trade openness, exceed the possible costs of occasional, albeit potentially severe, crises for a sample of 100 developed and emerging economies from 1970 to 2010. The results suggest that the pro-growth effects of greater capital account openness outweigh the negative effects of a higher propensity to twin crises. Greater domestic financial liberalisation is associated with faster growth, but also with a higher propensity to systemic banking and twin crises. A free floating exchange rate and greater openness to trade, by reducing the likelihood of currency crises, are associated with higher growth. While pro-competitive product market regulations and lower corporate taxes are associated with higher growth, they do not seem to influence financial fragility via higher probability of crises.

JEL classification codes: E32; E44; F3; F32; F33; F36; F43

Keywords: financial crises, growth, financial liberalisations, financial stability

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Les réformes visant à promouvoir la croissance augmentent-elles la fragilité financière? Un bilan empirique

Certaines politiques visant à favoriser la croissance peuvent avoir un impact négatif en augmentant la vulnérabilité des économies aux crises financières. Une plus grande ouverture aux flux financiers ou des marchés financiers plus libéralisés en sont des exemples types. Cet article examine si les avantages des réformes des politiques de croissance dans ces domaines, et d'autres tels que l'ouverture au commerce international, dépassent les coûts éventuels et potentiellement séveres des crises financières pour un échantillon de 100 pays développés et économies émergentes sur la période allant de 1970 à 2010. Les résultats suggèrent que les effets positifs sur la croissance d'une plus grande ouverture du compte de capital l'emportent sur les effets négatifs d'une plus forte propension des crises jumelles. La libéralisation financière est associée à une croissance plus rapide, mais aussi à une plus forte propension à des crises bancaires systémiques et aux crises jumelles. Un taux de change flottant et une plus grande ouverture au commerce stimulent la croissance en réduisant la probabilité des crises de change. Alors que la réglementation du marché des produits favorables à la concurrence et des impôts des sociétés plus faibles sont associés à une plus forte croissance, ils ne semblent pas influer sur la fragilité financière par l'intermédiaire d'une probabilité plus élevée aux crises.

Classification JEL: E32; E44; F3; F32; F33; F36; F43

Mots clefs: crises financières, croissance, libéralisation financière, stabilité financière

TABLE OF CONTENTS

Tables

Figures

CAN REFORMS PROMOTING GROWTH INCREASE FINANCIAL FRAGILITY? AN EMPIRICAL ASSESSMENT

By Aida Caldera Sánchez and Filippo Gori[1]

1. Introduction

Certain growth promoting policies can have negative side-effects by increasing the vulnerability of economies to financial crises. Typical examples are greater openness to financial flows or more liberalised financial markets. Greater openness to financial flows allows countries with limited savings to attract financing for productive investment projects, fosters diversification of investment risks and contributes to the development of financial markets promoting growth (e.g. Ostry et al. 2010). Financial liberalisation relaxes borrowing constraints and can lead to higher investment and higher average growth (e.g. Bekaert et al. 2005). However, the global financial crisis has forcefully reminded that there are also risks associated with greater financial liberalisation and that where financial markets are imperfect and regulatory and supervisory policies inadequate, capital inflows can fuel costly boms and bust cycles (e.g. Coeuré, 2016).

The purpose of this paper is to investigate whether policy settings that are in principle good for economic growth can increase financial fragility and whether the benefits of pro-growth reforms can exceed the possible costs of occasional, albeit potentially severe, financial crises. To that end we use the empirical methodology developed by Rancière et al. (2006) and Razin and Rubinstein (2006) to assess the dual effects of financial liberalisation on growth. They decompose the effect of financial liberalisation on growth into two channels. A growth channel that captures the positive effect that financial liberalisation has on growth via a relaxation of borrowing constraints, leading to higher investment and higher average growth, and a second crisis vulnerability channel that captures the negative effect that financial liberalisation has on growth by encouraging risk-taking, financial fragility and increasing the probability of financial crises. Besides assessing the dual effect of financial liberalisation on growth, as in Ranciere et al. (2006), we explore the dual effect of other policies, including openness to capital flows, trade openness, exchange rate flexibility, product market regulation and tax settings on growth and vulnerability to financial crises.

The main findings can be summarised as follows:

- Greater capital account openness is associated with faster growth, but also with higher propensity to twin crises. Considering the overall effect, the pro-growth effects of greater financial openness outweigh the detrimental effects of greater incidence of twin crises. The composition of capital inflows matters. Using dissagregated data on capital inflows we find that portfolio investments, notably debt flows, are more risky as they increase the likelihood of a twin crisis taking place whereas foreign directment (FDIs) flows do not. This suggests that reforms that reduce the share of debt in the composition of capital flows are likely to reduce vulnerabilities associated with the financial system.

1 . The authors are members of the Economics Department of the OECD. They would like to thank OECD colleagues: Boris Cournède, Alain de Serres, Peter Gal, Antoine Goujard, Catherine L. Mann, Oliver Roehn, Nicolas Ruiz and Jean-Luc Schneider (Economics Department); Pierre Poret (Directorate for Financial and Enterprise Affairs) and Romain Rancière (Paris School of Economics),, for helpful comments and discussions and Caroline Abettan for technical assistance.

- Greater domestic financial liberalisation is associated with faster growth, but also with a higher propensity to systemic banking and twin crises.

- A free floating exchange rate is associated with a lower probability of currency crises. However, we did not find any direct effect of the type of exchange rate policy on growth, beyond its indirect impact via a lower risk of currency crises.

- Greater trade openness, as measured by tariff barriers, is associated with a lower incidence of currency crises. However, no direct effect, beyond the one via a lower crisis risk, was found on growth.

- Pro-competitive product market regulations are associated with faster growth, but do not seem to influence financial fragility via a higher probability of crises.

The paper updates and extends earlier work by Rancière et al. (2006) and Razin and Rubinstein (2006) assessing the dual effect of financial liberalisation on growth and crises risks. First, it expands the analysis to a wider set of policies, including openness to international trade, tax settings and product market regulation. Second, it considers a wider set of countries and crises episodes. While the previous studies focused on emerging economies, our analysis is conducted for a larger example of 100 developed and emerging economies from 1970 to 2010. Moreover, in contrast to previous studies that have focused on twin crises (Rancière et al. 2006) or currency crises (Razin and Rubinstein, 2006), we extend the analysis to consider systemic banking crises as well. Insofar as the recent 2008-2009 crisis was a banking crisis, shedding light on the drivers of banking crises is relevant. In addition, there is often a strong interconnection between banking, crurrency and twin crises and the occurrence of one type of crisis may trigger the occurrence of other types of crises. For instance, banking crises can lead to large output contractions that are followed by large currency devaluations and a drop in capital inflows. Third, the empirical literature has mostly assessed the determinants of financial crises through cross-crountry time-series correlations, using probit or logit models (e.g. Demirgüç-Kunt and Detragiache 2005; Rancière et al., 2006). However, controlling for country-specific unobservable heterogeneity is important to disentangle the true sources of crises. We introduce country-fixed effects to control for country-specific heterogeneity that are likely to influence crises outcomes, as well as growth outcomes.

The remainder of the paper is organised as follows. The next section discusses the possible impact of policies on growth and vulnerability to crises on the basis of a selective literature review. Section 3 describes the empirical methodology used to decompose the effect of a given policy on growth into a growth channel and a crisis vulnerability channel. Section 4 describes the data and presents some descriptive statistics. Section 5 discusses the results. The final section summarises the main findings.

2. Related literature

This section selectively surveys the large theoretical and empirical literature assessing the impact of structural settings on growth as well as the literature on financial crises to identify the channels through which policies impact growth and financial instability. Structural factors are broadly defined to include international financial openness, the development of financial markets, trade openness, exchange rate flexibility, tax settings and product market regulations. We focus on areas for which sufficiently long time-series data is available, which is needed for the later empirical investigation. A synthesis of the channels through which policies affect growth and financial instability is provided in Table 1.

Table 1. Channels through which policies affect growth and financial instability

Policy area	Growth channel	Financial instability channel
Current account openness	Freer capital flows lead to better risk sharing and more efficient allocation of resources, reduce cost of capital, transfer of knowledge	Capital inflows can fuel costly boom-bust cycles
Trade openness	Economies of scale, competition, diffusion	Greater trade flows reduce volatility of international flows as international investors are less likely to pull out from a country with higher trade linkages with the rest of the world
Financial liberalisation	Reduction in cost of capital and firm financial constraints	Booms and busts in financial markets
Exchange rate regime		Countries with floating exchange rate regimes are expected to be less vulnerable to currency and banking crises than countries under less flexible exchange rate regimes
Tax bias towards corporate debt	Debt bias can harm growth by discriminating against innovative firms	Higher risk of financial crises because a tax bias biases capital inflows towards more volatile flows.
Product market regulation	Strict product market regulation can harm productivity performance	Barriers to foreign direct investment (FDI) and strict product market regulation can increase the likelihood of systemic banking crises by encouraging a higher share of bank debt in external liabilities

International financial openness confers benefits, but creates threats to financial stability

International financial openness is thought to be beneficial for growth through several channels. First, in the neoclassical model, liberalising the capital account facilitates a more efficient international allocation of resources from capital-abundant to capital-scarce countries, reducing the cost of capital and triggering a temporary rise in investment and output in recipient economies (Fischer, 1998; Summers, 2000). A second channel works by facilitating foreign direct investment which can boost innovation and productivity growth through the transfer of technological and business know-how to recipient firms (e.g. Romer, 1993) and to other local firms via spillover effects (Rappaport, 2000), thereby boosting productivity of the entire economy. Thirdly, capital inflows can promote the development of the domestic financial sector and ease liquidity constraints enabling firms to adopt technologies that they could not finance prior to the liberalisation. Finally, greater openness facilitates greater portfolio diversification and risk sharing opportunities, which might encourage investment in riskier, higher-growth technologies (Lane and Milesi-Ferreti, 2007). While there is a general agreement about the positive effects of greater financial openness on growth, there is a debate about the magnitude of these benefits (See Henry (2007) for a review of the literature).

At the same time greater capital account openness can represent a threat to countries financial stability by making countries more vulnerable to volatile capital flows (Rodrik, 1998; Bhagwati, 1998; Stiglitz, 2002; OECD, 2011). Episodes of large capital inflows may lead to a banking crisis as large inflows can make the financial system more fragile by fuelling domestic lending booms, including foreign-exchange-denominated credit, and bust cycles, as well as increasing the risk of abrupt reversals in capital inflows. The unwinding of excessive currency appreciation, triggered by large net inflows, may also result in a currency crisis.

The empirical literature is mixed regarding whether countries with a more liberalised capital account are more prone to crises. For instance, Furceri et al. (2011) find that episodes of large capital inflows increase the probability of banking, currency and balance of payment crises (sudden stops episodes). On the other hand, Glick and Hutchinson (2006) find for a sample of emerging economies that countries with more liberalised capital accounts experience a *lower* likelihood of currency crises, but fail to uncover similar evidence on vulnerabilities to banking crises. In the same vein, studies assessing the impact of capital controls underscore the difficulty in finding robust evidence on the effectiveness of such controls in reducing fragility to international financial shocks (See Ostry et. al., 2010; Blundell-Wignall and Roulet 2014 for a literature review).

The composition of capital flows plays an important role in determining vulnerabilities and the possibility of crises outcomes (OECD, 2011). Foreign direct investment is more stable and less prone to reversals (Wei, 2002; Albuquerque, 2003), while there is a general consensus that portfolio flows, including portfolio bond flows and commercial bank loans, generate the greatest risks from financial openness.[2] For instance, Furceri et al. (2011) find that large capital inflows that are debt driven significantly increase the probability of banking, currency, and balance of payments crises, whereas if inflows are driven by equity portfolio investments or FDI they have a negligible effect. Ahrend and Goujard (2012a; 2015) further find that a bias in external liabilities towards debt strongly increases the risk of a systemic banking crisis.

Domestic financial liberalisation can lead to boom and busts in financial markets

From a theoretical perspective, the nexus between domestic financial liberalisation and growth works essentially through the positive effect of a reduction in the cost of capital and of firms' financial constraints. A well-developed financial system increases the availability of funds, allows for better risk sharing that can support investment in higher return projects and thus growth. Additionally, equity market liberalisation, by giving foreign investors the opportunity to invest in domestic equity securities and domestic investors the right to transact in foreign equity assets, can also decrease the cost of capital. For instance, empirically, evidence suggests that stock market liberalisations lead to a surge in investment (e.g. Henry, 2000) and to higher annual real growth (e.g. Bekaert et al., 2005).

On the other hand, the crisis literature suggests that booms and busts in financial markets can be triggered by domestic financial deregulation. Indeed, during their financial liberalisation processes, some countries have experienced financial crises, characterised by various combinations of banking sector insolvency, reversal of foreign capital inflows, sharp currency depreciation and difficulty in financing government deficits (e.g. Kaminsky and Reinhart, 1999; Demirgüç-Kunt and Detragiache, 1998). Empirically, Demirgüç-Kunt and Detragiache (1998) find that domestic financial liberalization increases the probability of a banking crisis, considering a panel of 53 countries during 1980-95. Kaminsky and Schmukler (2003) exploring the link between the liberalisation of capital markets and boom-bust cycles in stock markets in emerging economies find that excessive financial cycles with larger booms and crashes occur in the aftermath of financial liberalisation. Similarly Glick and Hutchinson (2001) find that the propensity to banking and currency crises increases in the aftermath of financial liberalisation. Rancière et al. (2006) find that financial liberalisations have a positive effect both on growth and on the likelihood of twin crises (banking and currency crises).

2. The theoretical literature yields a pecking order of capital inflows, in decreasing order of riskiness, with short-term inflows more risky than long-term ones within each category (Ostry et al. 2010): foreign curreny debt, consumer-price-indexed local currency debt, local currency debt, portfolio equity investment and foreign direct investment.

Moreover, some recent evidence sugests that the relationship between financial depth and economic growth might be non-linear and that the expansion of an already large financial sector can be harmful for economic growth (Rousseau and Wachtel, 2011; Cecchetti and Kharroubi, 2012; Beck, Georgiadis and Straub, 2014; Law and Singh, 2014; Arcand, Berkes and Panizza, 2015). For instance, recent OECD evidence suggests that above a certain point, further expansion in credit by banks and similar intermediaries is associated with slower growth in most OECD countries (Cournède and Denk, 2015).

One channel through which an excessive expansion in bank credit can harm growth is via credit booms. Credit booms have been shown to be associated with a higher likelihood of financial crises (e.g., Schularick and Taylor 2012, Jordà et al. 2013). Evidence by Jordà et al. (2015) further shows that when credit growth fuels bubbles in equity and housing markets the dangers for the financial sector and the real economy are much more substantial. These so-called "leveraged bubbles" are associated with noticeably worse recessions and recovery paths when they burst than credit bubbles. This is because in such leveraged bubbles, a positive feedback develops that involves credit growth, asset prices and increasing leverage. When the bubble bursts, the resulting deleverage depresses household and business spending, which weakens economic activity and increases macroeconomic risks in credit markets (Mishkin, 2009; Mian et al. 2015).

Trade openness boosts growth, but exposes countries to external shocks

Trade openness confers important benefits by promoting economic efficiency and risk sharing and there is a considerable body of evidence associating trade openness with growth (See OECD, 2010 for a review).[3] Trade promotes production efficiency via specialisation, exploitation of economies of scale, and technology transfer, as well as enhanced competition. Although research using firm-level data has produced mixed results, cross-country regressions generally find a positive correlation between greater openness on the one hand, and productivity and the growth rate of GDP per capita, on the other. However, the direction of causality is difficult to establish.

In principle, greater trade openness is thought to make countries less vulnerable to domestic shocks and to facilitate risk sharing by allowing the access to different export markets. However the empirical literature on the link between trade openness and macroeconomic volatility is rather mixed. Barrell and Gottschalk (2004) find trade openness to reduce output volatility in the US, while Karras and Song (1996) find the opposite effect. Kose et al. (2003) find that more open countries have higher output and consumption volatility, however, the ratio of consumption to output volatility is negatively correlated with trade openness, suggesting a role for risk sharing.

The literature is also mixed on the direction of the impact of trade openness on vulnerabilities to sudden stops. On the one hand, a country that is highly integrated into world markets is more exposed to external shocks (Calvo et al., 2004). On the other hand, if the export to GDP ratio is high so that export earnings are high, then it should be easier to cope with a sharp fall-off in international financing so that the country is less vulnerable to sudden stops (e.g. Cavallo and Frankel, 2008). Regarding the relationship between trade openness and the probability of a systemic banking crisis, Ahrend and Goujard (2012a; 2015) do not find a significant direct impact of trade openness on the probability of a systemic banking

3. Early cross-country analysis tended to find a positive relationship between growth and some measure of openness (Edwards, 1993; Baldwin, 2003). However, early cross-country regressions suffered from econometric shortcomings, most notably the direction of causality and measurement problems regarding the best proxy to measure trade openness. Sachs and Warner (1995) found that trade openness was strongly and positively correlated with the growth rate of GDP per capita using a measure of trade openness that encompasses a broad list of policy factors and has been subsequently used in many studies.

crisis. Conversely, Ahrend and Goujard (2012b; 2014) find that trade openness significantly reduces currency mismatch, which may indirectly reduce the probability of a banking crisis.

Countries with more rigid exchange rate regimes have a higher crisis risk

The link between different exchange rate regimes and growth is a debated topic in the literature and empirical evidence has failed to deliver a clear cut result. For instance, Baxter and Stockman (1988) find little evidence of systematic differences in the behaviour of macroeconomic aggregates (including output) under flexible or pegged nominal exchange-rate systems. Ghosh et al. (1997) find that growth varies only slightly across exchange rate regimes, although pegged regimes appear to be characterised by lower inflation but more pronounced output volatility. On the other hand, Husain et al. (2005) find that countries appear to benefit in terms of slightly higher growth by having increasingly flexible exchange rate systems as they become richer and more financially developed.

Countries with floating exchange rate regimes are expected to be less vulnerable to currency and banking crises than countries under less flexible exchange rate regimes, such a hard peg. A number of channels have been outlined in the literature (Ghosh et al., 2015). First, not having the exchange rate regime as an adjustment tool makes external imbalances, which are sometimes a source of financial crises, more difficult to correct. Second, regaining competitiveness without nominal exchange rate flexibility is more difficult putting deflationary pressures on the economy, which in turn can undermine growth. Third, the exchange rate guarantee implicit in a peg (or less flexible regimes in general) might encourage excessive foreign borrowing by the banking system, and, given open FX limits, may imply a corresponding increase in FX denominated lending to the private sector. Fourth, if a foreign exchange intervention is not sterilised, there may be excessive credit expansions, exacerbated by the exchange rate guarantee implicit in a peg that attracts non-resident deposits and expands bank balance sheets. Nonetheless, countries with floating regimes are not entirely immune, as evidence suggests that credit booms that end up in a crisis are as likely to occur under floating regimes as they are under pegged or intermediate regimes (Ghosh et al., 2015).

Tax bias towards corporate debt can reduce growth and increase crisis risks by inducing higher leverage

Most tax systems typically favour corporate debt over equity, especially because interest payments are deductible for corporate income tax purposes while equity returns are not (De Mooij, 2011) and OECD (2015). This leads to a tax induced bias towards debt finance, which creates complexities, economic distortions and inequities. While direct evidence on the link between tax bias towards corporate debt and growth does not exist, several authors have argued that such debt bias can harm growth by discriminating against innovative firms (See de Mooij, 2011 for a discussion, or Heckemeyer and de Mooij, 2013). Furthermore, recent OECD work suggests that too much debt generates instability, slows growth and undermines investments (OECD, 2015).

The global financial crisis spurred a debate on whether the tax bias towards corporate debt may have contributed indirectly to the crisis by encouraging excessive leverage and other financial market problems (e.g. IMF, 2009; Hemmelgarn and Nicodème, 2010). The basic mechanism is as follows. Because in most countries interest payments (the cost of debt) are deductible from the corporate income tax base, while returns on equity (such as dividends paid to shareholders or capital gains on shares) are not, corporate taxes typically create a bias towards debt financing among companies. High levels of leverage can make (financial and non-financial) companies more vulnerable to economic shocks and so increase the likelihood and intensity of financial crises (De Mooij et al., 2003). Debt financing also provides strong incentives for corporations to increase their risk profile enhancing the possibility of boom and bust periods (IMF, 2010; Claessens et al., 2010). In line with this, De Mooij et al (2013) assess empirically the link between a tax bias towards corporate debt and the probability of banking crises. They find that greater tax bias is

associated with significant aggregate bank leverage, and that this in turn is associated with a significantly greater chance of banking crisis.[4] Ahrend and Goujard (2012a; 2015) have also found that corporate tax systems favouring debt over equity are associated with a higher share of debt in external financing. Their finding suggests that tax codes that bias debt over equity finance would contribute to a higher risk of financial crises because they bias capital inflows towards more volatile flows.

Anti-competitive product market regulations can hurt growth and increase financial fragility

Arnold et al. (2008) survey the large literature on the effects of anticompetitive regulations on growth from the aggregate, industry and firm-level perspectives and discuss the different channels through which regulations that curb product market competition can harm the productivity performance of an economy. Anticompetitive regulations influence the productivity of existing firms by altering the incentives for technology adoption and investment in innovation among incumbents and by making the entry of new innovative firms difficult. Another conclusion of this review of the literature is that anti-competitive product market regulations can hamper productivity growth by impairing the ability of sectors and countries to allocate resources to the most efficient firms. Moreover, anticompetitive regulations may slow down the take-up of new general-purpose technologies such as ICT. Regulations can reduce competitive pressures and incentives to improve efficiency also in client ('downstream') sectors.

Barriers to foreign direct investment (FDI) and strict product market regulation can increase the likelihood of systemic banking crises by encouraging a higher share of bank debt in external liabilities. In particular, Ahrend and Goujard (2012b; 2014) find evidence that barriers to foreign direct investment (FDI) and strict product market regulations increase the likelihood of systemic banking crises by encouraging a higher share of debt in external liabilities. More precisely, they find that higher regulatory barriers to FDI and equity investment, as captured by the operational restrictions included in the OECD FDI Restrictiveness Index, have resulted in an increased bias of external liabilities towards debt, driven both by increases in external debt liabilities and decreases in equity and FDI liabilities. In particular, more stringent screening approvals for foreign investments, restrictions on employment of foreigners for key management and board positions, as well as operation restrictions on foreign investments (such as on branching or capital repatriation) are found to strongly increase the debt bias. Even though effects are less pronounced, stricter product market regulation, as measured by the OECD indicator of product market regulation in seven key non-manufacturing industries, also seems to bias external liabilities towards debt by diverting external financing away from equity.

3. Empirical approach

The objective of the empirical analysis is to explore jointly the impact of policy settings on growth and the financial fragility, proxied by the probability of financial crises. The empirical framework used to conduct this analysis is similar to the one in Rancière et al. (2006) and comprises a two-step estimation of a GDP growth model and a probability of crisis equation, along the lines of a treatment-effect model (Maddala, 1983). This framework allows to empirically decompose the effects of a given policy on growth and on the probability of crises and to assess whether the direct effect of a given policy on growth outweighs the indirect effect via a higher probability of crisis. In what follows the empirical approach is described in detail.

4. The economic literature provides ample evidence of a positive correlation between the level of corporate taxation and leverage (See De Mooij, 2011 for a review).

The growth equation

Consistent with research on economic growth within a panel framework, the baseline growth model takes the following form:

$$\Delta Y_{i,\tau} = \alpha Y_{i,t} + aX_{i,t} + bp_{i,t} + u_i + v_\tau + w_{i,\tau} \quad (1)$$

Where τ is a non-overlapping time spell defined by the set [t+1,t+5]; the dependent variable in Equation (1) is the five-year growth rate between t and t+5. The variable $Y_{i,t}$ is the log of real GDP per capita, $X_{i,t}$ is a vector of growth determinants standard in the literature and discussed in detail below, $p_{i,t}$ is a structural or policy variable and u_i and v_τ are country and time period-fixed effects respectively. The coefficient of interest b measures the marginal effect of a generic policy variable $p_{i,t}$ on growth. In all cases except one, policy variables are introduced in logarithmic form and b can be interpreted as the semi-elasticity of growth with respect to $p_{i,t}$.[5] The introduction of time period-fixed effects is expected to capture global shocks affecting all countries, while the use of country-fixed effects controls for unobserved, time-invariant country-specific characteristics that influence growth.

Controlling for country-fixed effects is a common practice in the literature on cross-country growth panel regressions. The reason is to avoid the bias originating from unobservable characteristics that influence growth and are also correlated with observed regressors or that affect a country's steady state, the most obvious of which is technology (Knight, et al., 1993; Caselli et al., 1996; and Acemoglu et al. , 2005; 2008).

There is some recent controversy in the literature regarding the use of country-fixed effects in this set-up, given that the usual approach to estimate a fixed-effects model might generate biased estimates (see Barro, 2015 for a discussion). This so-called Nickell bias results when panel data models with fixed effects and lagged dependent variables are estimated by the standard within estimator and the time dimension is finite (Nickell, 1981). In particular the bias would lead to a downward bias on the coefficient of the lagged dependent variable (i.e. the convergence parameter), overstating the convergence rate. The bias is of the order 1/T and thus disappears as T grows large. We estimate the growth model using the standard within estimator, as estimating Equation (1) using the system GMM estimator shows that in our case the bias is reasonably small, possibly because T is fairly large in our sample (about 40 years).[6]

For the identification of the growth determinants $X_{i,t}$, we follow the empirical literature assessing the cross-country drivers of growth and that naturally arise in a human-capital augmented Solow Model (Levine and Renelt, 1992; Barro and Lee, 1994; Caselli et al., 1996). Specifically the following variables are considered: the log of real GDP per capita, the population growth rate, the ratio of investment to GDP and the average years of schooling for individuals aged 25 or more. Within the neoclassical growth model, a negative coefficient on lagged real output is consistent with the prediction that a country relatively close to its steady state will experience slower economic growth (so-called conditional convergence).

All independent variables entering Equation (1) are considered at the beginning of the time spell over which average growth rates are computed, thus at time *t*. Avoiding the use of coincident averages reduces

5. The exception is the dichotomous indicator for the degree of exchange rate flexibility.

6. To test the magnitude of the Nickell bias in Model (1), the baseline equation was re-estimated using the system GMM estimator proposed by Arellano and Bond (1991) and Arellano and Bover (1995). The convergence parameter obtained using this method is very similar to the one obtained using the standard within estimator. The difference between both coefficients is not statistically significant.

the likelihood of simultaneity bias and is the typical approach used in the mainstream growth literature to deal with the endogeneity of regressors (Barro and Lee, 1994; Barro and Sala-i-Martin, 1992).

The growth and crisis model

Following Rancière et al. (2006), the growth model as given by Equation (1) is augmented with a dummy variable *crisis* which takes the value of 1 if country *i* experiences a financial crisis within the time period $\tau=[t+1:t+5]$ and zero otherwise.[7]

$$\Delta Y_{i,\tau} = \alpha_1 Y_{i,t} + a_1 X_{i,t} + b_1 p_{i,t} + c_1 Crisis_{i,\tau} + u_i + v_\tau + w_{i,\tau} \quad (2)$$

The *crisis* dummy is treated as an endogenous variable that depends on a number of variables including the policy variable. Three types of financial crisis episodes are considered: systemic banking crises, currency crises and twin crises (the simultaneous occurrence of banking and currency crises)[8]. More formally, the conditional likelihood of a crisis episode is modelled within a linear probability framework according to the following equation:

$$\Pr(Crisis_{i,\tau} = 1) = \alpha_2 Y_{i,t} + a_2 X_{i,t} + b_2 p_{i,t} + dZ_{i,t} + \mu_i + \vartheta_\tau + \varepsilon_{i,\tau} \quad (3)$$

where $\varepsilon_{i,\tau}$ and $w_{i,\tau}$ are assumed to be *i.i.d*.

Equation (3) states that the conditional probability of the occurrence of a crisis within the five years following time *t* depends linearly on the same set of controls included in the growth equation, $X_{i,t}$, on the policy variable $p_{i,t}$ and on a number of additional variables grouped in a vector $Z_{i,t}$. The elements in $Z_{i,t}$ are assumed to affect the occurrence of a crisis in $[t+1:t+5]$, but not to drive growth computed over the same interval; μ_i and ϑ_τ are country and time period-fixed effects respectively. The expected value of the *crisis* variable corresponds to the probability of a crisis starting within the next 5 years. The choice of explanatory variables included in the crisis model reflects previous findings in the literature on the determinants of banking and currency crises.[9]

While it could be argued that financial cycles might span over longer than five years, there are two reasons why it is desirable to limit the analysis to five years windows. First, increasing the length of the time spell would compress the time dimension of the dataset and exponentially reduce the total number of

7. For crises lasting more than one year, given the difficulty to date when a crisis ends, only the year when the crisis starts has been coded as a crisis.

8. The reason of limiting the analysis to this set of crises lies in the fact that there are stablished datasets for banking, currency and twin crises, which is less the case for other type of crises. For instance, sovereign debt crises are normally protracted, with different intensity, over an extended period of time (like in the case of the Latin American debt crises of the 80s and 90s), which arguably makes sovereign debt crisis difficult to measure with a dichotomous indicator. The identification of other types of crises (e.g. housing market crises), is even more complex as no established data source exist for an international comparison.

9. The literature suggests that the determinants of banking crises often coincide with the determinants of currency crises (Kaminski and Reinhart, 2009). Indeed it is often the case that the occurrence of a banking crisis often precedes (or occurs simultaneously with) the onset of a currency crisis (Reinhart and Rogoff, 2010; Laeven and Valencia, 2012).

observations available for estimation.[10] Second, even if financial booms can develop over decades, their early detection can be difficult and the predictive ability of the crisis equation would be limited.

There is an argument for reverse causality from crisis episodes to some of the control variables described above. For example, after the occurrence of a banking crisis, the ratio of private credit to GDP and inflation are likely to fall. To address this issue, all the control variables are considered at the beginning of the time spell over which the probability of a crisis is considered. Similarly, we can imagine policy variables to be affected by crisis episodes, to the extent policy changes can originate as a response to economic downturns. In order to deal with this endogeniety issue, we measure policy stances with *de-jure* indicators, that can be considered as pre-determined to coincident economic conditions.

Considering both Equations (2) and (3), the overall effect of a policy variable $p_{i,t}$ on growth can be decomposed into two linear components: a *direct* effect on real GDP growth (captured by b_1) and an *indirect* effect due to a change in the probability of a crisis taking place captured by (b_2) times the marginal effect of the crisis itself on growth (c_1). Thus the total effect of a given policy variable on growth is given by:

$$total\ effect = b_1 + c_1 b_2 \qquad (4)$$

If equations (2) and (3) are correctly identified, the overall effect of a given policy variable on the five-year real GDP per capita growth rate between *t* and *t+5* is equal to $b_1 + c_1 b_2$.

The framework embodied in Equations (2) and (3) represents a modification of a treatment-effect model as described by Maddala (1983) and used in Rancière et al. (2006), Razin and Rubinstein (2006) and Edwards (2004).[11] As in Rancière et al. (2006), Razin and Rubinstein (2006) and Edwards (2004)) the objective is not to assess the effect of crisis episodes on growth but to identify the impact of a policy variable on growth, controlling for the likelihood of a crisis, and the impact of the same policy variable on the probability of the crisis itself.

There are some differences between the analytical framework used in this paper compared to the one used by Rancière et al. (2006), Razin and Rubinstein (2006) and Edwards (2004). In particular, in this paper the first stage regression is estimated using a linear probability model rather than non-linear models, such as Probit or Logit.[12] This difference does not alter the substance of the empirical approach, as it only concerns the estimation method for the crisis equation, yet it has some advantages. A first important advantage is the possibility of introducing country fixed-effects without incurring in the incidental parameter problem typical of non-linear models. In our panel set-up, using country fixed-effects is important to control for unobservable time-invariant, country-specific characteristics that can bias the estimates if correlated with the independent variables and are not adequatedly controlled for.[13] More

10. For example moving from five to ten years time spells would imply halving the number of observations available for estimation.

11. Edwards (2004) assesses the impact of a sudden stop on growth. Razin and Rubinstein (2006) study the growth effects of exchange rate regimes in the presence of a currency crisis. Rancière et al. (2006) assess the effects of financial liberalisation on growth and the incidence of twin crises.

12. In response to Oaxaca and Horrace (2009)'s criticism about the possible bias originating when using the linear probability model with fitted probabilities falling outside the [0, 1] range, the baseline crisis equations were estimated leaving out those observations for which the fitted probabilities are out of the [0, 1] range. The estimated average marginal effects do not differ significantly.

13. An alternative to the use of country-fixed effects is to estimate pooled regressions including a number of variables that aim at capturing country specific characteristics (e.g. Barro, 2015 for the growth equation). A

generally we can imagine that some of these characteristics can affect growth and the likelihood of a crisis, as for example the institutional capacity (institutional architecture, constitutional law, central banks reputation and independence, etc.), or policy makers preferences and commitment toward reforms. In the specific case of the growth equation time invariant, country specific characteristics can also include countries' technological paths or the aggregate production function (Caselli et al., 1996).

A second advantage of estimating the crisis equation via a linear probability model is that it delivers readily interpretable and linear coefficients for the marginal effect (or elasticity) of a given policy variable on the likelihood of the occurrence of a crisis. This is particularly helpful when policy variables are continuous given that non-linear models deliver non-liner coefficients whose magnitude depends on the level of the policy variable.

The use of a non-linear model, as a Probit or or Logit like in Rancière et al. (2006), Razin and Rubinstein (2006) and Edwards (2004), could in principle offer some advantages; the non-linearity of the specification would, in theoretically, be sufficient to acheive identification. However, Arellano (2006) shows that relying only on the non-linearity of the specification for identifying the model is likely to result in weak identification and is advisable to include in the crisis equation some excluded instruments. These excluded instruments need to be chosen among variables that have been found to be robust determinants of crises, but that are uncorrelated with growth. The correct identification of Equation (3) will be intrinsically related to the correct identification of these excluded instruments.[14]

The estimation and identification approach

Equations (2) and (3) are estimated in a two stage least squares (2SLS) framework. Standard errors are clustered at the country-level to account for heteroscedasticity and autocorrelation in the error term for observations from the same country in both equations.

As discussed above, the identification of the crisis model relies on the introduction of a set of excluded instruments which are correlated with the likelihood of crisis episodes but uncorrelated with economic growth. The identification of such excluded instruments is, however, not trivial to the extent that factors which typically have been found to determine the probability of a crisis taking place tend to directly affect growth.

The exclusion restrictions involving all the instruments are motivated on the basis of the existing literature or economic rationale. In addition, a number of statistical tests are performed and discussed in the results section in order to assess the relevance of the instruments used, notably the ability of the excluded instruments to predict the corresponding crisis episodes.

Firstly, we consider the ratio of domestic credit to GDP and the real effective exchange rate (REER), both as percentage deviations from their trend components (measured as log deviation from a trend identified using an HP filter), in line with existing literature on the determinants of crises (i.e. Milesi

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test of such approach using the same variables as Barro (2015) (democracy, democracy squared, changes in the terms of trade, trade openness, rule of law and government consumption) shows is less convenient for two reasons. First, the goodness of fit is significantly lower than when using country-fixed effects, which suggests that the addition of new variables does not fully capture the unobserved heterogeneity. Second, the introduction of five new variables significantly reduces the degrees of freedom, compromising the efficiency of the estimates.

14. To the extent that the modelling approach relies on identifying excluded instruments, later in the text the discussion will use terminology from instrumental variable models (IV), including applying the relevant tests to evaluate the adequacy of the instruments.

Ferretti and Razin, 1996, Sachs, Tornell, and Velasco, 1995 and Kaminsky, Lizondo and Reinhart, 1998). Consistently with the traditional separation between cyclical and trend economic outcomes, cyclical components of the real effective exchange rate (REER) and the credit ratio are assumed to not affect economic growth in the medium term.

A second set of instruments is considered on the basis of the concept of long-run neutrality of money. According to the quantity theory of money, following a change in the level of the money stock, prices should rise eventually in proportion to the increase in the money stock, and all real variables – after some transition – will return to their original value. This implies that a one-time change in the level of the money stock, will only affect real variables temporarily, and not in the long run. In monetary theory, nearly all models based on standard economic assumptions embody long-run monetary neutrality within time intervals of less than 5 years.[15] The instruments considered are: the log of the monetary base (M2) and CPI inflation. In this set-up, money neutrality requires orthogonality between the instruments and real output per capita five years ahead.[16]

As a final set of instruments we consider two additional indicators, namely a dummy variable indicating the presence of an explicit deposit insurance and the ratio of foreign reserves as a share of GDP. The relevance of the first variable is conjectured on the basis of a classical literature suggesting that explicit deposit insurance can affect the behaviour of depositors during times of financial distress (Diamond and Dybvig, 1983), while the second is suggested by extensive literature on the determinants of currency and twin crises starting from the work of Calvo and Mendoza (1996). The orthogonality of explicit deposit insurance and that of the ratio of reserves as a share of GDP with respect to real output per capita five years ahead is assumed.

The determination of the appropriate set of instruments, among the ones discussed above, for the identification of each type of crisis is made heuristically, on the basis of the correlation between each instrument and a specific crisis episode. Currency crises are correlated with the REER, explicit deposit insurance and reserves over GDP. Systemic banking crises are correlated with CPI inflation, the credit ratio, M2 and explicit deposit insurance, while twin crises are correlated with the credit ratio, reserves on GDP and explicit deposit insurance.

4. Data

The dataset consists of an unbalanced panel of 100 countries covering the period from 1970 to 2010 (for a complete list see the Annex). The use of a large sample of countries is necessary for having sufficient variability in the variables identifying crisis episodes. The time and country dimensions of the panel changes depending on the data available for each variable considered in the estimation. All data

15. Estimates of the degree of price rigidities vary from 2 to 6.5 quarters (Christiano et al., (2005); Altig et al. (2005); Smets and Wouters, (2007); Del Negro et al., (2007); Klenow and Kryvtsov, (2005)). This evidence is incorporated in virtually all theoretical models with nominal price rigidities that, as a consequence, foresee money neutrality within intervals of time smaller than 5 years.

16. Model (2) can be rewritten as

$$Y_{i,t+5} = (\alpha - 1)Y_{i,t} + a_1 X_{i,t} + b_1 p_{i,t} + c_1 Crisis_{i,\tau} + u_i + v_\tau + \omega_{i,t+5}$$

Where α is the so called convergence parameter. The identification of the Crisis effect requires a set of instruments $Z_{i,t}$ such that $E(\omega_{i,t+5} Z_{i,t}) = 0$.

series are yearly.[17] As in other similar exercises, there are limitations associated with cross-country regressions. In particular, there is a trade-off between sample size and the homogeneity of the countries covered. We aim at mitigating this problem by controlling for various country characteristics.

Crises episodes are taken from the widely used systemic banking crises database compiled by Laeven and Valencia (2008; 2012). The database covers 147 banking crises, 218 currency crises and 28 twin crises episodes in the period 1970-2011. Laeven and Valencia (2008; 2012) classify a systemic banking crisis as an episode displaying both significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and bank liquidations) and significant banking policy intervention measures in response to significant losses in the banking sector. They define currency crisis as a nominal depreciation of the currency vis-à-vis the U.S. dollar of at least 30 percent that is also at least 10 percentage points higher than the rate of depreciation in the year before. Twin crises are defined as the simultaneous occurrence of a banking and currency crisis.

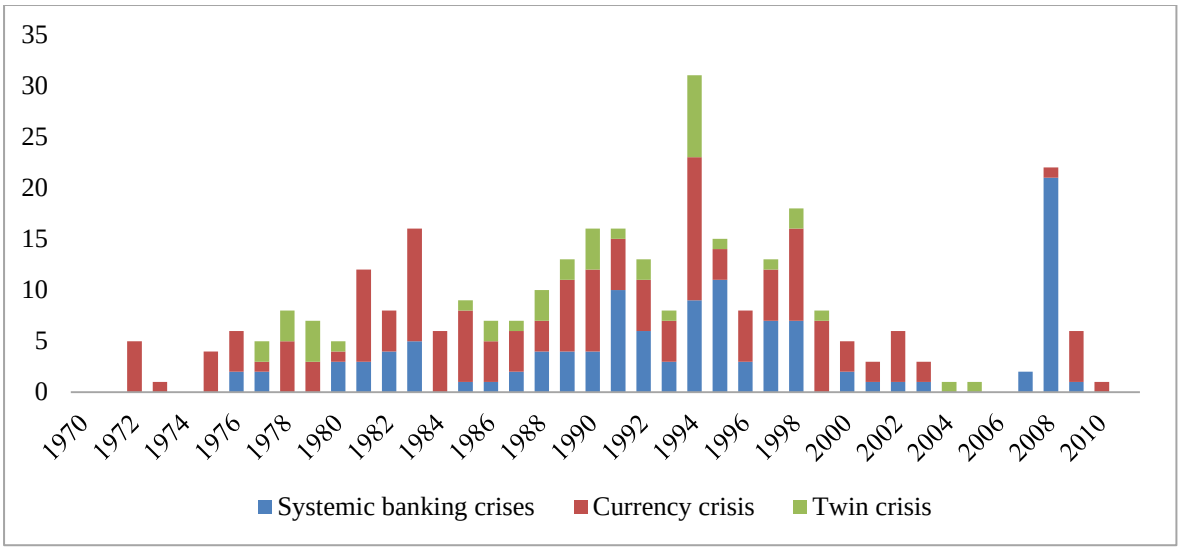
As a first step, it is interesting to overview the crises covered by the dataset. Figure 1 plots the number of countries during the period 1970-2011 having a given crisis in any given year for the whole sample of countries (Panel A) and for OECD countries alone (Panel B). As it has been noted in the literature (e.g., Reinhart and Rogoff, 2009; Laeven and Valencia, 2012), crises occur in waves and have affected both OECD and non-OECD countries. While some countries experienced difficulties in the 1970s, there was a more marked pick-up in crisis activity in the early eighties as a collapse in global commodity prices combined with high and volatile interest rates in the US contributed to a spate of crises in emerging economies, most famously in Latin America (e.g. Reinhart and Rogoff, 2008).

During the late 1980s and early 1990s, the Nordic countries experienced some of the worst banking crises high income economies had experienced (Sweden and Finland 1991-1995; Norway 1991-93) since World War II. In the second half of the 1990s, emerging markets were affected by banking and currency crises, including Mexico (1994-1996) the Asian crisis (circa 1997-1998), and the troubles in Russia (1998). The early 2000s was a relatively calm period, with the exceptions of a few banking crises, for instance in Argentina (2001-2003) and other Latin American countries (e.g. Uruguay, 2002-2005). This tranquil period ended in 2007, when the subprime crisis began in the United States and then became a global financial crisis, affecting a large number of countries.

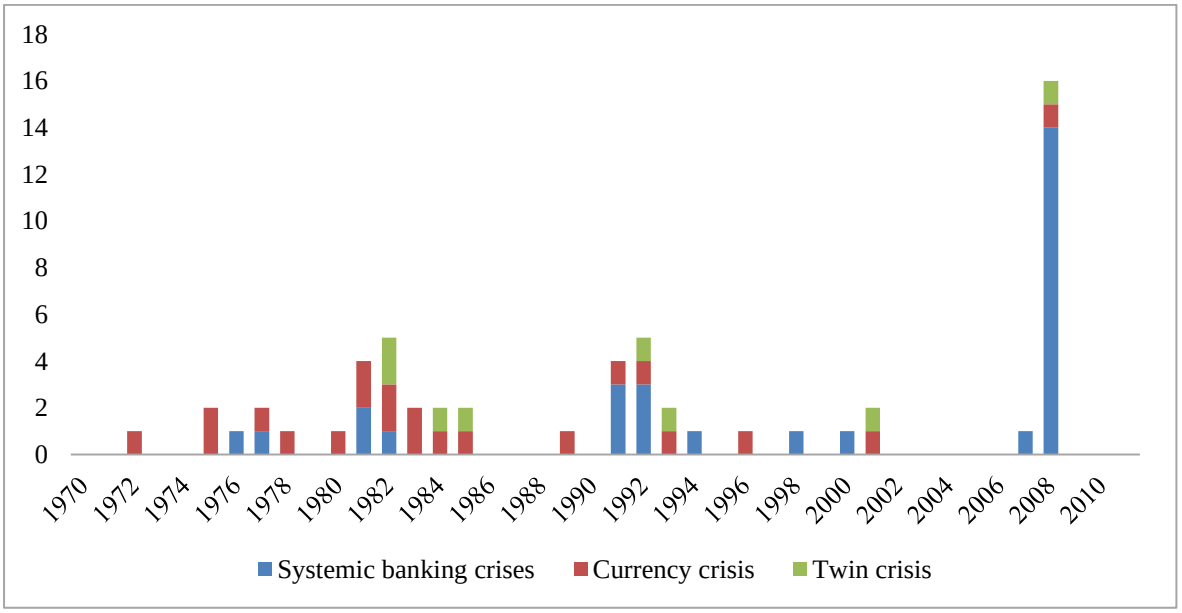
17. Using yearly data, five years non-overlapping time spells are computed starting from 1970 to 2010, that is 1970-1974; 1975-1979 etc.

Figure 1. Number of countries experiencing a crisis in a given year, 1970-2011

Panel A. All countries



Panel B. OECD countries



Source: OECD based on Laeven and Valencia (2012).

4.1 Variables definition

Capital account openness:

The level of a country international financial openness is measured by the (log of) the index by Chinn and Ito (2008) measuring a country's degree of capital account openness that is commonly used in the literature. The index has a higher value for countries that are more open to cross-border financial transactions. International financial openness, as measured by the Chinn and Ito index, is high in OECD

countries, with most countries having the highest possible level of openness, with the exception of Slovenia, Australia, Iceland, Mexico, Slovakia, Turkey, Poland and Korea (Figure A1.1).

By the nature of its construction, the Chinn Ito index is a *de jure* measure of financial openness because it attempts to measure regulatory restrictions on capital account transactions. It is therefore limited in its ability to measure the extent to which restrictions are applied and enforced. In contrast, *de facto* measures of capital account openness − such as the ratio of international assets and liabilities over GDP or measures based on deviations from covered interest rate parity (as the one proposed by Blundell −Wignall and Roulet, 2016) −are likely to be a better metrix of the actual stance of international financial openness. However, some important advantages of the Chinn-Ito index are that it is available for a large set of countries over a long time period and that it is less obviously endogenous to economic shocks.

Domestic financial liberalisation:

The extent of a country degree of financial liberalisation is measured with the log of the financial reform index computed by Abiad et al. (2010). The index considers seven dimensions of financial sector policy: i) credit controls and reserve requirements, ii) interest rate controls, iii) barriers to entry, iv) public ownership in the banking sector, v) policies on security markets, vi) prudential regulations and supervision of the banking sector, and iiv) restrictions on the financial account. Scores for each category are then combined in a graded index that is normalised between zero and one, with zero corresponding to the highest degree of repression and one indicating full liberalisation. According to this indicator, financial liberalisation was fairly high across OECD countries in 2005, with the lowest values corresponding to Korea and Turkey (Figure A1.2).

While a drawback of this indicator is that it is only available until 2005, it should be noted that this limitation does not impede to capture the effects of financial liberalisations prior to 2005 on the 2007 financial crisis. Indeed, the 2005 observation of the financial liberalisation index is used to predict financial crises in the period 2006-2010.

Trade openness:

To measure the degree of trade openness, we employ a proxy for trade barriers: the simple mean import applied tariff, that is the unweighted average of effectively applied rates for all products subject to tariffs calculated for all traded goods. This is preferred to a more classical measure of trade openness, the ratio of total trade over GDP, because by being a *de jure* measure the trade barriers proxy is less likely to be endogenous to other macroeconomic indicators.[18] On the basis of this measure, OECD countries are fairly open. With the exception Korea, OECD countries have a tariff rate below the overall sample mean of 8.65% (Figure A1.3).

Exchange rate flexibility:

The degree of exchange rate flexibility is measured with a dichotomous variable taking value one when there is a free floating exchange rate regime and zero otherwise. This measure is based on the coarse exchange rate regime *de jure* classification by Ilzetzki, Reinhart and Rogoff (2008).

18. Nonetheless, as discussed in the results section, the results do not change substantially when using the ratio of total trade (imports and exports) over GDP trade openness as an alternative measure of trade openness.

Bias towards corporate debt:

Consistently with the mainstream literature on the effect of taxes on corporate funding structure (Ahrend and Goujard, 2012b, de Mooij, 2013, Altshuler, R. and H. Grubert, 2003, Ramb and Weichenrieder, 2005, Huizinga et. Al., 2008), and in the absence of a more precise measure for the bias towards corporate debt financing, we proxy the degree to which tax systems favour debt over equity finance by he (log) of the statutory corporate income tax rate (see Figure A1.7). The necessary assumption for using this proxy is that differences in tax treatment should have a larger impact on corporate financing when corporate tax rates are higher.

Product market regulation:

The product market regulatory stance is proxied by different indicators available from the OECD Product Market Regulation (PMR) Database. These include the aggregate indicator of regulation in energy, transport and communications (ETCR) (Figure A1.4), the overall PMR indicator (Figure A1.5) and the barriers to entrepreneurship component of PMR (Figure A1.6).

Other control variables:

As regards the source of the control variables in the growth equation that is, the population growth rate, measured in log differences, the real GDP per capita in PPP terms and the investment ratio, measured as gross capital formation over GDP, are from the Penn World Table (PWT). All other series used are from the IMF International Financial Statistics, the OECD or the World Bank database. Additional details about the variables and the data sources are in the Appendix (Table A1.1).

5. Empirical results

Results from the growth equation

As a starting point the growth equation as given by Equation (1) is estimated to see whether the results are consistent with existing analysis on the drivers of growth. The first column of Table A2.1 shows the results, without considering any policy variable. As the dependant variable is the 5-year growth rate, to obtain an annualised effect the coefficients should be divided by five.

The coefficient on the (log) lagged real GDP per capita measuring conditional convergence is negative and significant across all specifications. The estimated parameter of about -0.075 (Table A2.1, first column, dividing the coefficient by five (-0.351/5=-0.075) to obtain an annual effect) is within a reasonable range from what is found in the literature when using panel data sets with country fixed effects.[19] For instance, Caselli et al. (1996) find that per capita incomes converge to their steady state levels at a rate of approximately 10 percent per year. The investment rate has a positive and significant effect on growth as predicted by theory. Years of schooling and population growth are generally not significant. These results are roughly in line with comparable evidence in Barro and Lee (1994), Caselli et al. (1996), Barro (2015) which consistently fail to find a significant positive effect from human capital on growth,

19. Estimates of the speed of convergence from panel data with fixed effects tend to be much larger than the 2-percent-per-year number estimated from cross sections or panels without fixed effects. Speeds of convergence in the range of 12 to 20 percent per year are not uncommon in the literature (Barro and Sala-i-Martin, 2003). A speed of convergence of about 10 percent per year implies that the average time an economy spends to cover half of the distance between its initial position and its steady state is about seven years. This implies that most economies will be usually very near to their steady state.

despite strong theoretical priors.[20] As discussed by Turner et al. (2015), the reasons for this are unclear but may be related to measurement issues, including the difficulty of properly assessing the quality and the quantity of schooling.

Results from the combined growth and crisis equations

Table A2.1 further reports the results for the 2SLS estimation of Models (2) and (3) considering the three types of crises: currency crisis, systemic banking crisis and twin crisis. The regression output is organised in three pairs of columns starting from the second column; the first column of each pair shows estimates for the growth equation, the second for the crisis equation.[21] No policy variables are considered at this stage.

We start by briefly discussing the identification of the first stage probability of crises regressions and the suitability of the instruments, as on the basis of this we are able to assess the reliability of the point estimates for the policy variables. A number of statistical tests are performed to assess the relevance of the instruments used, notably the ability of the excluded instruments contained in $Z_{i,t}$ to predict the corresponding crisis episodes. The tests are reported at the bottom of the table. In all three models the chosen set of instruments performs quite well. The Kleibergen-Paap (K-P) rk LM under-identification test rejects the null of limited canonical correlation between instruments and instrumented variables at 10 percent significance level, while the K-P rk Wald F statistic is large enough to rule out the possibility that the estimated coefficient could be biased toward the corresponding OLS value due to weak identification. [22]

The main results can be summarised as follows. All crisis episodes have a negative and significant effect on growth; the most detrimental impacts are associated with twin crisis (column 6, point estimate of -0.59, corresponding to an impact on annual growth of -0.12 percent) and currency crises (column 2, point estimate of -0.54 percent). The point estimate measuring the reduction in growth between crises and normal times in the five years following the crisis is in the range of (-0.117, -0.060) percent annually. Regarding the other control variables in the growth equation, population growth is not significant except in one specification (column 4), where it is positive contrary to what one would expect. The coefficient on the (log) lagged real GDP per capita is negative and significant in all specifications while the investment over GDP is positive and significant in one specification (column 6). The other controls in the growth equation are not statistically significant.

Turning to the crisis equations, an overvalued exchange rate has a significant and positive effect on the probability of currency crisis, while an explicit deposit insurance reduces the likelihood of systemic banking and currency crisis (7.1 and 13.6 percent, respectively). A higher monetary base (M2) is negatively associated with systemic banking crises (column 5). Inflation and deviations in the credit to GDP ratio from trend are positively associated with a higher probability of banking, and banking and twin crises respectively. The ratio of reserves to GDP has a significant and negative effect on the probability of twin crises (column 7), in line with the results of Obstfeld et al. (2010) that discuss the rationale for holding reserves as a crisis prevention device against sudden stops.

20. All these papers introduce two variables measuring separately female and male years of schooling. In all cases the corresponding coefficients are significant, but opposite in sign for the two groups.

21. The number of countries and thus observations included in the sample changes for the three models due to the use of instruments that are available unevenly across countries and time.

22. Called weak identification test in Table A2.1. These statistics are fairly high in all IV models with the exception of the currency crisis results. The weak identification test statistic significantly increases when policy variables are included in the model (see Table A2.5 and A2.6), yet the low value in Table A2.1 might suggest a bias associated with the coefficient of currency crisis of up to 30 percent.

Results from the combined growth and crisis equations: assessing the role of policies

The next subsection discusses the results assessing different policy trade-offs. We only discuss the size of the coefficients and significance of the policy variables, given that the results on the other controls are overall consistent with those discussed in previous subsections. In interpreting the results it is important to bear in mind that the sample size (shown at the bottom of each result table) varies, sometimes considerably, between estimations depending on the country coverage for key indicators. In particular, the set of countries for which product market regulation information is available greatly reduces the sample size.

In all models presented in the following sub-sections, the instruments perform fairly well; the under-identification test rejects the null of limited canonical correlation between instruments and instrumented variables at 10 percent significance level, while the weak identification test delivers reasonably high statistics. These statistics suggest that the identification of the first step equation (crisis equation) is achieved and thus that corresponding estimates for both first and second stage should be considered as fairly reliable. A final consideration concerns the variability of both the under-identification and weak identification statistics across models; this is due to both the introduction of a different policy variable, possibly having different correlation with crisis episodes, across models, and to the variation in time and country samples across different equations. This latter effect is due to the use of different policy variables, which are available for different country sets and with different time length.

The following sections are devoted to discussing results in different policy areas. In addition to the results presented below, other policy areas were explored, including the role of the quality of institutions (measured using the World Bank Good Governance Indicators) and the role of alternative sources of capital funding (e.g. share of venture capital financing) in a country financial system, but the results were non-significant and therefore are not reported. We also considered a number of non-linearities, such as interacting the size of capital inflows with the type of exchange rate regime. The results were non-significant, possibly because of the significant multicollinearity that originates from interacting variables that are quite persistent over time.

Capital account openness

The results presented in Table A2.2 show the regression results for the two-step estimation of models (2) and (3) where the effect of capital account openness on growth is assessed via its direct effect on growth and its indirect impact on the likelihood of a twin crisis. The focus on twin crises is consistent with existing literature (Rancière et al., 2006) and is in line with the fact that capital account openness affects domestic financial markets via shocks propagating via currency markets.

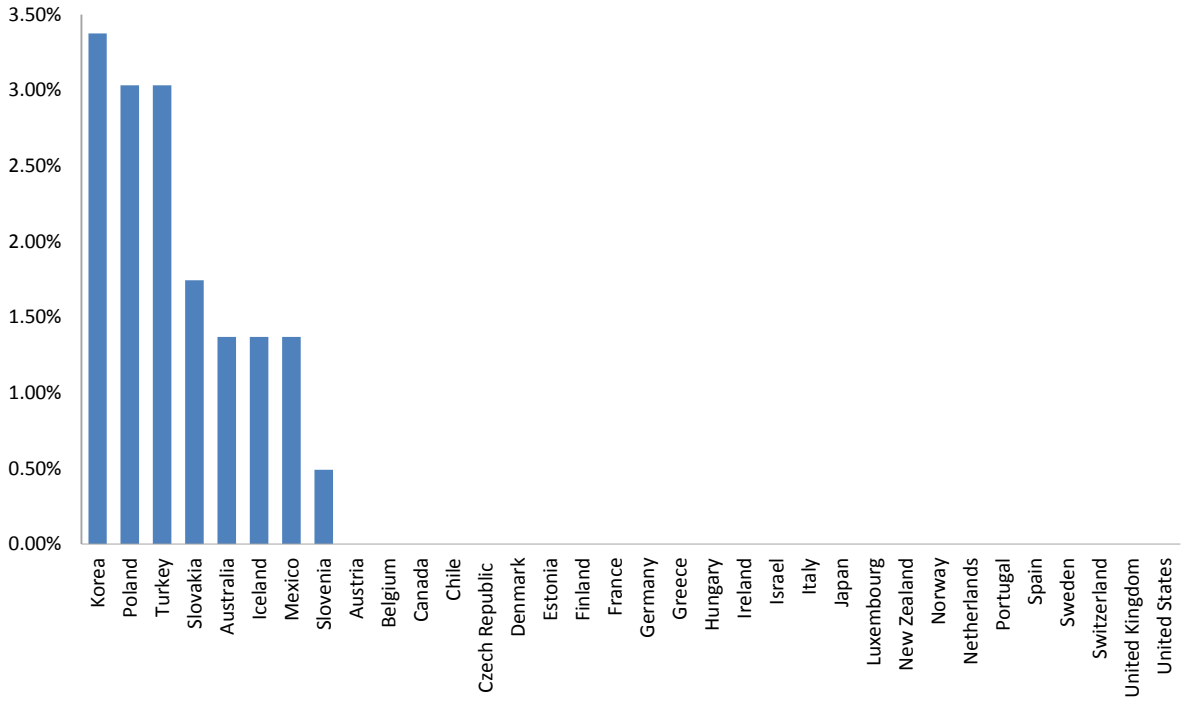
Capital account openness has a positive and significant effect on per capita GDP growth (column 1). The effect is significant at the 10% confidence level with a point estimate of 0.154. The incidence of a twin crisis has a negative and significant effect on growth, implying that the reduction in growth in the subsequent 5 years conditional on experiencing a twin crisis is 0.53 percent. Greater capital account openness has a positive, however only weakly significant at the 14% level, effect on the probability of twin crises: the crisis effect associated with a one percent increase for the Chinn Ito index of capital account openness is 0.067 percent. Being mindful of the weak significance of the crisis effect, one can compute the total effect of capital account openness on growth in the next five years as described by Equation (4). This is given by: (0.154) + (-0.534)* 0.067=0.12, or 0.024 percentage point of annual GDP growth. The total effect is statistically different from zero at the 11% level.[23] This would suggest that the positive direct effect of capital account openness on growth outweighs the indirect negative effect via a higher propensity

23. The statistical test is performed using delta methods.

to crises. This result confirms the findings by Rancière et al. (2006), who find that the direct effect of financial liberalisation on growth by far outweights the indirect effect via a higher propensity to crisis for a narrower set of countries than in our analysis and for time period ending in the early 2000s.

In order to illustrate the possible growth gains of greater capital account openness for OECD countries, we conduct a simulation exercise. Figure 2 shows that Korea, Poland and Turkey would benefit the most if they were to reach the maximum level of capital account openness observed in the OECD, by gaining about 3.5 percentage points higher growth in the next five years. For countries at the right end of the figure, there would be no gains of greater capital account openness, given that they have achieved the highest degree of openness, according to the measure used in this paper.

Figure 2. Growth effects of greater capital account openness



Note: Gains from reaching the maximum level of capital account openness observed in the OECD, based on estimates of column 1 and 2 in Table A2.2. Data for Luxembourg not available. Countries for which the value is zero are at the maximum level of the financial liberalisation indicator in 2010.

Capital flow composition: which flows are more risky?

The composition of capital flows might have a significant effect on the impact of capital account openness on the likelihood of twin crises. Among others Ahrend, Goujard and Schwellnus (2012) find that the structure of a country's external liabilities is a key determinant of the vulnerability to financial crises. Portfolio flows are typically considered less stable and more prone to reversal than FDIs flows, possibly exacerbating the destabilising effect of international sources of financing on recipient economies. Table A2.3 tests this hypothesis by assessing the effect of different types of net capital flows on the likelihood of a twin crisis. To do so instead of using the *de jure* index of international financial openness proposed by Chinn and Ito as in the previous sub-section, we use actual net inflows as a percentage of GDP. This is a necessary step to the extent the Chinn-Ito's index does not permit a selective focus on the type of the financial flows.

Table A2.3 presents results from the estimation of Model (2). Column 1 shows regression results for the second step equation (the growth equation), while column 2 shows the estimation of the conditional probability of the occurrence of a twin crisis within the next five years (first step, crisis equation). In both cases we distinguish between net FDIs, portfolio equity, portfolio debt and other flows. Results in column 1 show that all types of capital flows (with exception of other flows) are associated with a direct growth effect. However, results in column 2 suggest that the impact of capital flows on the likelihood of a twin crisis originates from portfolio debt flows, while FDIs and portfolio equity flows do not appear to affect the probability of a twin crisis taking place. This evidence is consistent with Furceri et al. (2011), Ahrend, Goujard and Schwellnus (2012) and Ahrend and Goujard (2012a,b; 2014; 2015) who find that portfolio, and more specifically portfolio debt flows, have a strong positive impact on the likelihood of financial crises.

In the light of these results, the risk channel associated with higher capital account openness reported in the previous subsection is likely to work via portfolio debt flows. To this extent, countries willing to optimise the benefits of international financial openness would need to focus on opening domestic markets to longer term flows (FDI) and shifting the exposure away from debt assets to non-debt related flows. This could be done, for example, by improving the quality of their institutions and trade openness (Faria et al., 2007), rather than making use of capital account restrictions, which might hamper the development of beneficial flows (as FDIs) and represent only temporary and second best solutions to cope with international financial fragility.

Domestic financial liberalisation

Table A2.4 assesses the impact of the degree of domestic financial liberalisation on growth and the probability of systemic banking crises (columns 1 and 2) and twin crises (columns 3 and 4). While a significant literature has focused on the role of financial liberalisations and banking crises (see Rancière et al., 2006 for a discussion), the choice of investigating as well the relationship with twin crises is justified by the fact that banking and currency crises frequently occur together. In the data sample, out of 120 banking crises, 42 of them coincided with a currency crisis.

Focusing first on the results reported in columns 1 and 2, greater financial market openness has a positive and significant effect on per capita GDP growth. The effect is significant at the 5% confidence level with a point estimate of 0.159. The incidence of a systemic banking crisis has a negative and significant effect on growth. Greater financial market openness has a positive and significant effect on the probability of a systemic banking crisis: the crisis effect associated with a one percent increase in financial market openness is: 0.829 percent. Following Equation (4), the total effect of a one percent increase in domestic financial liberalisation on growth in the next 5 years is: (0.159) + (-0.182)*0.829= 0.0098, however, the effect is not statistically different from zero at the 10%.

Turning next to the results reported in columns 3 and 4, as before, greater financial market openness has a positive and significant effect on per capita GDP growth. The incidence of a twin crisis has a negative and significant effect on growth. Greater financial market openness has a positive, although weakly significant effect on the probability of twin crises: the crisis effect associated with a one percent increase in financial market openness is 0.186, although only significant at the 13% significance level. Following Equation (4), the total effect, taking into consideration the direct growth and the indirect crisis effect, of a one percent increase in domestic financial liberalisation on five-year growth is: (0.152) + (-0.441)*0.186=0.014 percentage points, however the effect is not statistically different from zero at the 10%.

Trade openness

Table A2.5 assesses the effect of trade openness on both GDP per capita growth (column 1) and the likelihood of a currency crisis (column 2). The focus on currency crises is in line with a literature which has showed that openness to trade is an important factor in determining whether a country is prone to sudden stops in capital inflows (see Cavallo and Frankel (2008) for a discussion).

A higher applied tariff rate on imports has a positive and significant effect on the probability of currency crisis: a 1 percent increase in the applied tariff rate on imports increases the likelihood of a currency crisis taking place within the next five years by 0.53 percent. This result appears to be consistent with a line of research suggesting that economies that trade less with other countries, in other words, countries that have stricter trade barriers, are more prone to sudden stops and currency crises (Rose, 2005; Cavallo and Frankel, 2008). The idea is that greater trade flows reduce the volatility of international flows as international investors are less likely to pull out from a country with higher trade linkages with the rest of the world, because they know that the country is less likely to default. The implication is that greater trade openness reduces vulnerability to currency crises.

The trade openness variable does not have a significant effect on per capita GDP growth, when crisis risk is controlled for. This result may seem surprising, given the large literature that posits a positive relationship between trade openness and growth (e.g. OECD, 2010).[24] This, however, does not mean that trade restrictions are harmless for growth. Note that the analysis tries to disentangle the relationship between trade and growth through two channels: a risk sharing and stability channel (lower probability of crisis) versus a more traditional efficiency channel (economies of scale, competition, diffusion). Taken at face value, what the results suggest is that, when considering both channels simultaneously, it is the risk-sharing channel that comes out more strongly. Within this setting, higher trade barriers have a negative growth effect via a higher exposure to the risk of a currency crisis.

Exchange rate flexibility

Table A2.6 shows results on the effect of greater exchange rate flexibility on both GDP per capita growth (column 1) and the likelihood of a currency crisis (column 2). The exchange rate dummy – which takes value one when there is a free floating exchange rate regime and zero otherwise – does not have a significant effect on per capita GDP growth. On the other hand, a free floating exchange rate has a negative and significant negative effect on the probability of currency crises, suggesting that countries with a more flexible exchange rate are less susceptible to currency crises. This is in line with evidence from a number of studies that have documented that countries with less flexible exchange rate regimes have higher frequency of currency crisis (Bubula and Ötker, 2003; Ghosh et al., 2003; Rogoff et al., 2004). According to Equation (4), the total effect of a flexible exchange rate on growth, working through a lower probability of currency crisis, is therefore positive and about 0.11=((-0.237)*(-0.481)), suggesting that it increases annual GDP growth by 0.023, that is 0.11/5=0.023.

Product market regulation and barriers to entrepreneurship

As a starting point, the effect of product market regulation and barriers to entrepreneurship on growth is assessed on the basis of the simple growth model (Table A2.7, columns 1a, 2a and 3a). All policy variables appear to have a negative and significant effect on growth, suggesting that higher regulation in

24. A possible reason for the non-significant effect of trade openness on growth could be the proxy used to measure trade openness, however, results are similar when trade openness is measured instead by the ratio of total trade (imports and exports) over GDP.

non-manufacturing sectors (ETCR indicator) and product markets (PMR indicator), and higher barriers to entry are associated with lower growth.[25]

On the other hand, there is no conclusive evidence on the effect of product market regulations and barriers to entrepreneurship on growth and the probability of crises from the joint growth-crises models (columns b and c in Table 2.7). A possible reason for this result is the limited country and time sample for which the product market regulation indicators, notably PMR and its subcomponent, are available. The loss in statistical significance of the policy variables in the joint growth-crisis models compared to the growth model might be explained by the additional noise brought about by introducing a poorly identified instrumented crisis variable.[26]

Tax bias

There is no conclusive evidence on the effect of a tax bias on growth and the probability of crises from the joint growth-crises models. In the growth equation, the effect of an increase in the corporate tax rate is negative but not significant (Table A2.7, column 4a). In the crisis equation, the corresponding coefficient on the tax variable is positive but not significant (Table A2.7, column 4b), suggesting that the corporate tax rate, does not have a significant effect on the likelihood of a crisis. On the other hand, the results from the simple growth model show that a higher corporate tax rate is associated with lower growth; however, the impact is only mildly significant at the 15% level.

6. Concluding remarks

This paper has discussed the role of a number of growth-promoting policies in shaping the vulnerability of an economy to financial crises and has assessed empirically possible growth-crisis trade-offs policymakers could face when choosing policies to boost growth.

Figure 3 shows the main results and illustrates possible trade-offs in a growth-crisis map.

- **High growth-low crisis risk**: In the top left-quadrant fall policies in the best of worlds, those that are characterised by achieving higher growth, while also being associated with a lower risk of crises. Among the policies studied, none achieve this twin objective. Yet, more pro-competitive product market regulations, either through lower regulation in network industries, lower product market regulation, or reforms in product markets that lower barriers to entry, are associated with higher growth, without leading to higher crisis risk. While we find some evidence that lower corporate taxation is associated with higher growth without affecting crisis risk, the evidence is only weakly significant.

- **Low growth-low crisis risk**: In the bottom left quadrant fall policies characterised by lower growth, but with the benefit of reducing the risk of crises. A free floating exchange rate and higher openness to trade are associated with a lower risk of a currency crisis. At the same time

25. Additional PMR components tested include administrative barriers to entrepreneurship, competition barriers to entrepreneurship, barriers to trade and investment, other barriers to trade, opacity barriers to entrepreneurship, explicit barriers to trade, public involvement, public ownership and state controls. No significant results were found for these variables and therefore are not reported.

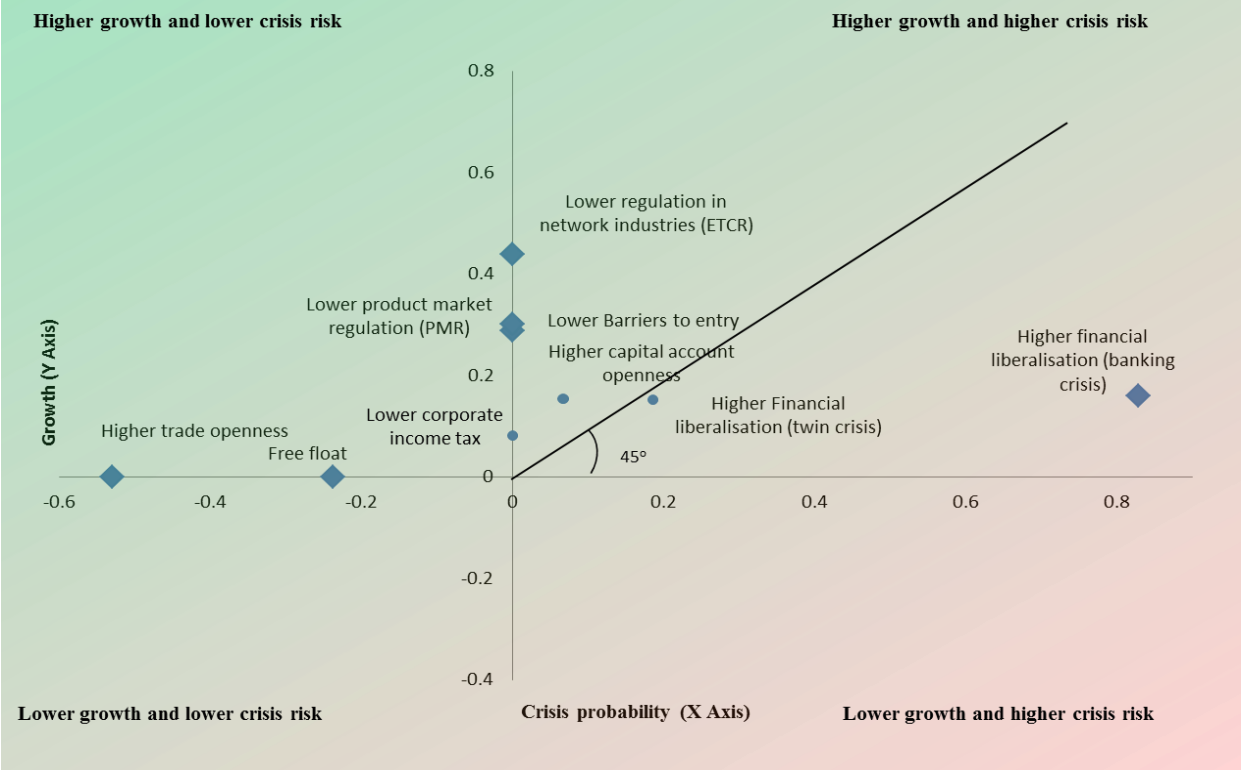
26. Note that the under-identification test fails to reject the null hypothesis of limited correlation between the instruments and the endogenous variable with by a large margin. In the case of the PMR variable and its subcomponent, the reason of this poor performance is related to the limited country and time sample for which PMR data are available. The limited time dimension is particularly important as the PMR series start in 1998; the crisis equation virtually identifies only the 2007-08 financial crisis.

the type of exchange rate regime does not seem to affect growth, and neither does greater trade openness, other than by reducing crises risks.

- **Low growth-high crisis risk**: In the bottom right quadrant fall policies to avoid: those characterised by low growth and high crisis risk. Among the policies studied, none fall there.

- **High growth-high crisis risk**: In the top right quadrant fall policies facing a trade-off between higher growth and higher crisis risk. In this regard, greater capital account openness is associated with higher growth, but there is some weak evidence that this comes at the expense of a higher risk of twin crises. Similarly, greater liberalisation of the financial market is associated with higher growth, but is also associated with a higher risk of banking crises. There is also some weak evidence that greater financial liberalisation leads to higher risk of twin crises. A key issue for policies facing a growth-crisis trade-off is the net effect of the two. Indeed, higher crisis risk could be compensated by higher overall growth. As it has been shown in the paper, this is the case for capital account openness: the positive growth effect of greater capital account openness outweighs the indirect negative effect via a higher propensity to crises. In the case of financial liberalisation the evidence is too weak to really tell.

Figure 3. Policy effects on growth and crisis risk



Note: The x axis plots the estimated coefficient of a given policy variable on the probability of crises ($\widehat{b_2}$ in equation 3); the y axis plots the estimated coefficient of a given policy variable on real GDP per capita growth in the subsequent 5 years ($\widehat{b_1}$ in Equation 2). It can thus be read as follows, an increase by one percentage point in a given policy indicator leads to y percent change in the subsequent five years growth, and to a x percent change in the subsequent five years probability of crisis. Coefficients are elasticities with the exception of the free floating exchange rate dummy variable ("free float"), which is the marginal effect from switiching from 0 to 1. A diamond signifies results for which results are significant at the 10,5, or 1% level. A circle signifies results for which results are significant at the 14% level and at the 15% level (corporate taxation).

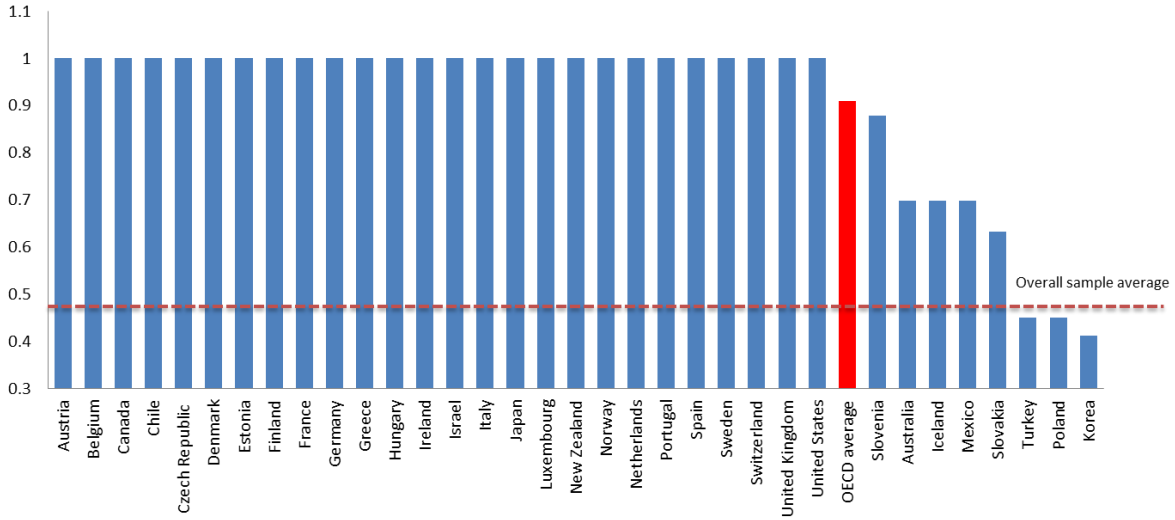
APPENDIX I: DATA

Table A1.1. Data description and sources

Variable name	Description	Source
Population growth	Population growth	Penn World Table - National accounts
log real GDP per capita	GDP constant prices per capita	Penn World Table - National accounts
Investment on GDP	Gross capital formation as a share of GDP	Penn World Table - National accounts
Years of schooling	Average years of schooling, population aged 25 years and over	Barro and Lee (2013)
Current account openness	The KAOPEN index is based on the first principal component of four categories of binary variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Rate Arrangements and Exchange Restrictions (AREAER).	Chinn and Ito (2008).
Financial markets openness	Financial reform index	Abiad et al. (2010)
Trade openness	Simple mean applied tariff is the unweighted average of effectively applied rates for all products subject to tariffs calculated for all traded goods. Data are classified using the Harmonized System of trade at the six- or eight-digit level.	World Bank, World Development Indicators
Free floating	The degree of exchange rate flexibility is measured with a dichotomous variable taking one when there is a free floating exchange rate regime and zero otherwise based on the coarse exchange rate regime classification following Ilzetzki, Reinhart and Rogoff (2008).	Ilzetzki, Reinhart and Rogoff (2004).
Currency crisis	Dummy for currency crisis	Laeven and Valencia (2012)
Systemic banking crisis	Dummy for systemic banking crisis	Laeven and Valencia (2012)
Twin crisis	Dummy for twin crisis	Laeven and Valencia (2012)
REER	Real effective exchange rate, trade weighted	IMF, International Financial Statistics
Explicit deposit insurance	Dummy identifying an explicit deposit insurance	Demirgüç-Kunt et al. (2013)
Monetary base growth	Growth in monetary base	IMF, International Financial Statistics
CPI inflation	Consumer price index	IMF, International Financial Statistics
M2 on GDP	Broad money (M2) to GDP	IMF, International Financial Statistics
Monetary base on broad money	Ratio of monetary base to broad money	IMF, International Financial Statistics
Reserves on GDP	Non gold reserves on GDP	IMF, International Financial Statistics
Real lending rate	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator	IMF, International Financial Statistics
Public debt to GDP	General government debt to GDP	Reinhart and Rogoff (2009)
Credit to GDP	Banks credit to the private sector divided by GDP	IMF, International Financial Statistics
Reg. in 7 non-manufacturing network-industries	The ETCR indicator measured as a simple average of regulation in 7 non-manufacturing sectors: Rail, road, airlines, gas, electricity, telecom and post.	OECD – Product Market Regulation Database
Product market regulation (PMR)	Overall PMR indicator. The OECD Indicators of Product Market Regulation (PMR) are a comprehensive and internationally-comparable set of indicators that measure the degree to which policies promote or inhibit competition in areas of the product market where competition is viable. They measure the economy-wide regulatory and market environments in 34 OECD countries in (or around) 1998, 2003, 2008 and 2013, and in another set of non-OECD countries in 2013. They are consistent across time and countries. Users of the data must be aware that they may no longer fully reflect the current situation in fast reforming countries. The indicators cover formal regulations in the following areas: state control of business enterprises; legal and administrative barriers to entrepreneurship; barriers to international trade and investment. Not all data are available for all countries for all years.	OECD - Product Market Regulation Database
Barriers to entrepreneurship (PMR)	Barriers to entrepreneurship, component of PMR	OECD - Product Market Regulation Database
Adjusted statutory corporate income tax rate	Basic central government statutory corporate income tax rate (inclusive of surtax (if any)), adjusted (if applicable) to show the net rate where the central government provides a deduction in respect of sub-central income tax.	OECD Tax Database

Figure A1.1 Capital account openness index

2010

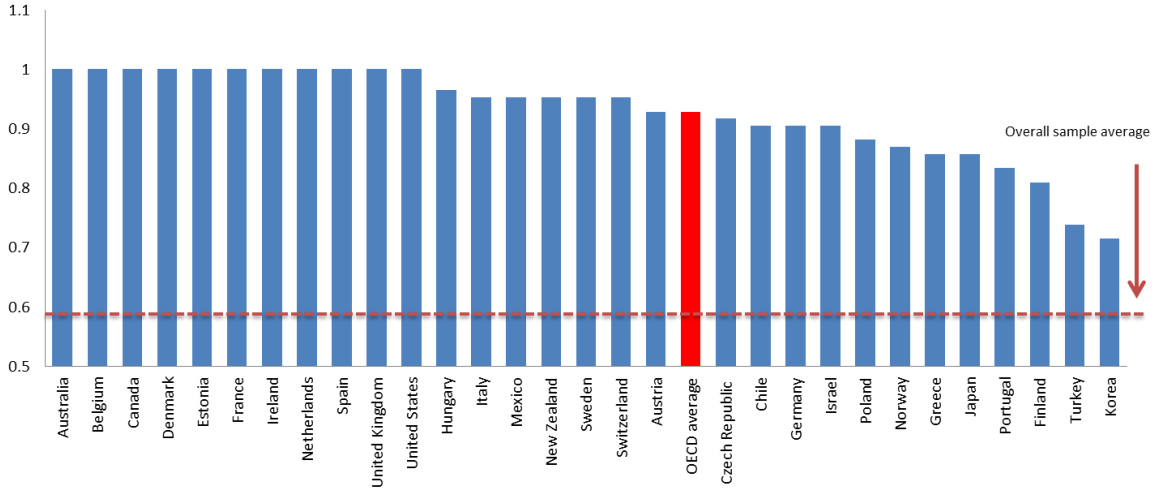


Note: The index ranges from 0 to 1, with higher values corresponding to greater capital account openness.

Source: Chinn-Ito (2008)

Figure A1.2 Financial liberalisation index

2005

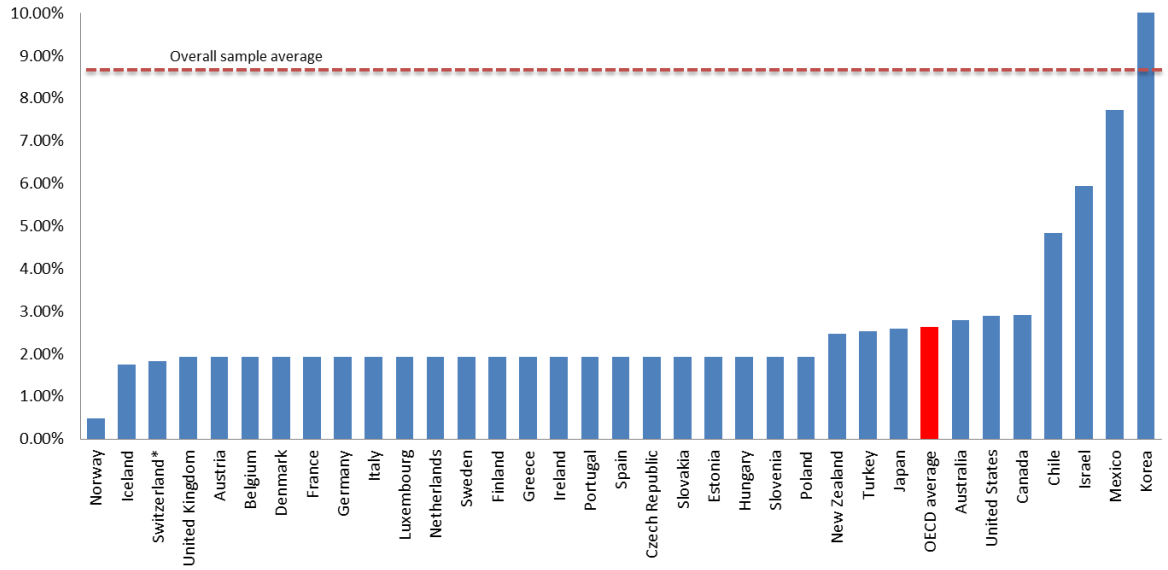


Note: Data for Iceland, Luxembourg, Slovakia and Slovenia are not available.

Source: Abiad et al. (2010).

Figure A1.3 Tariff Rate - Tariff rate, applied simple mean.

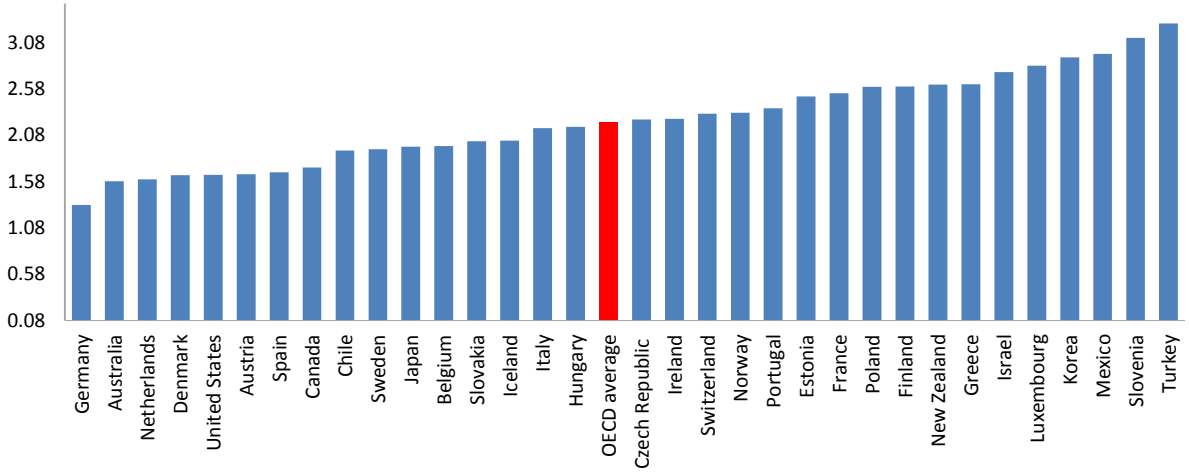
2010



Source: World Bank, World Development Indicators Database. *2009 data.

Figure A1.4 Indicator of regulation in energy, transport and communications (ETCR), 2010

Index scale of 0-6 from least to most restrictive

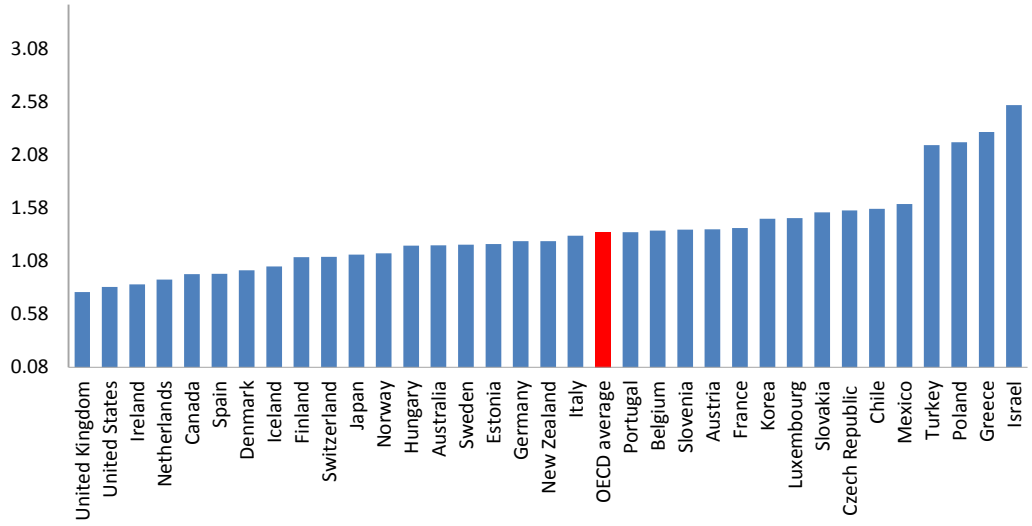


Note: For the United States the value reported is 2008.

Source: OECD, Product Market Regulation Database.

Figure A1.5 Economy-wide product market regulation (PMR) score

Index scale of 0-6 from least to most restrictive

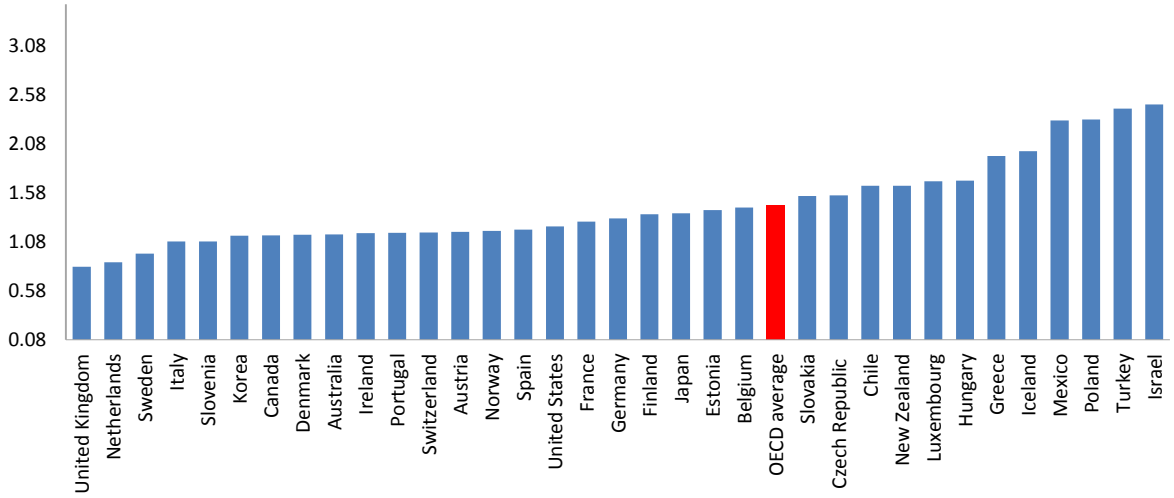


Note: Overall PMR indicator.

Source: OECD, Product Market Regulation Database.

Figure A1.6 Barriers to entrepreneurship

Index scale of 0-6 from least to most restrictive

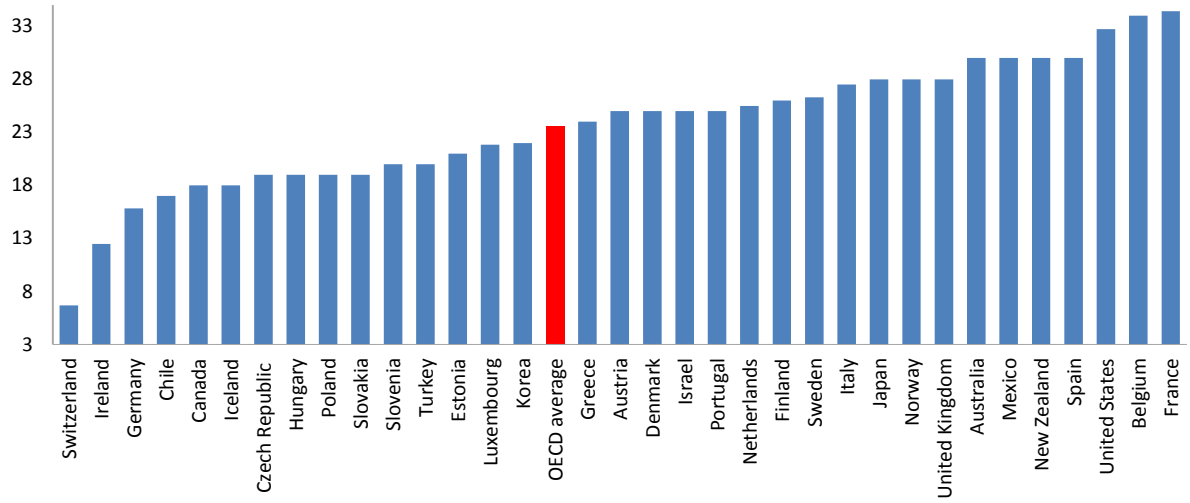


Note: PMR, barriers to entrepreneurship.

Source: OECD, Product Market Regulation Database.

Figure A1.7 Adjusted statutory corporate income tax rate

2010



Note: Adjusted statutory corporate income tax rate. Y axis is values are in percentage points.

Source: OECD, Tax Database.

APPENDIX II:ESTIMATION RESULTS

Table A2.1 Growth and crisis probability

VARIABLES (t)	(1) OLS Real growth per capita (t+1:5)	(2) Second stage Real growth per capita (t+1:5)	(3) First stage Currency crisis (t+1:5)	(4) Second stage Real growth per capita (t+1:5)	(5) First stage S. Banking crisis (t+1:5)	(6) Second stage Real growth per capita (t+1:5)	(7) First stage Twin crisis (t+1:5)
Population growth	-2.107	1.722	2.930	7.401	13.070*	-1.817	0.310
	(1.341)	(3.033)	(3.085)	(4.678)	(4.218)	(1.450)	(0.891)
log real GDP per capita	-0.351**	-0.330**	0.134	-0.206**	0.375**	-0.277**	0.0064
	(0.0565)	(0.111)	(0.084)	(0.0862)	(0.121)	(0.0758)	(0.037)
Investment on GDP	0.358**	0.188	-0.206	-0.0067	-0.444	0.417**	0.003
	(0.145)	(0.256)	(0.285)	(0.229)	(0.571)	(0.195)	(0.222)
Years of schooling	-0.00604	-0.00874	-0.009	0.00313	-0.059	-0.0141	-0.013
	(0.0153)	(0.0240)	(0.028)	(0.0221)	(0.047)	(0.0173)	(0.011)
Currency crisis		-0.543**					
		(0.193)					
Systemic banking crisis				-0.298**			
				(0.101)			
Twin crisis						-0.587**	
						(0.261)	
REER trend deviations			0.369**				
			(0.186)				
Explicit deposit insurance			-0.136**		-0.153		'-0.071**
			(0.049)		(0.104)		(0.029)
CPI inflation					0.001**		
					(0.0001)		
M2					-0.022**		
					(0.012)		
Credit to GDP trend deviations					0.459**		0.207**
					(0.180)		(0.089)
Reserves on GDP			0.001				-0.001**
			(0.0001)				(0.0001)
Underidentification test P-val			0.0441		0.0278		0.0457
Weak identification test stat.[1]			5.023		31.007		19.481
Observations	707	415	415	298	298	622	622
Number of countries	100	66	66	70	70	97	97
Country fixed-effects	YES	YES	YES	YES	YES	YES	YES
Time fixed-effects	YES	YES	YES	YES	YES	YES	YES

Note: The dependent variable is the 5-years growth rate between time t and time t+5, all coefficients in the growth regression should be divided by 5 for the annualised effect. Robust-clustered standard errors in parentheses. The time sample is 1970-2010 for all regressions [1] Kleibergen-Paap rk Wald F statistic (Stock-Yogo weak ID test critical values - 20% maximal IV relative bias - is 6.46). *, **, *** denote significance at the 10, 5, and 1% level respectively.

Table A2.2 Capital account openness, growth and twin crisis probability

VARIABLES (t)	(1) Second stage Real growth per capita (t+1:5)	(2) First stage Twin crisis (t+1:5)
Twin crisis	-0.534**	
	(0.229)	
Population growth	-2.100	-0.221
	(1.339)	(0.944)
log real GDP per capita	-0.304**	0.0606
	(0.0796)	(0.046)
Investment on GDP	0.408**	0.035
	(0.207)	(0.239)
Years of schooling	-0.0213	-0.016
	(0.0202)	(0.013)
Capital account openness	0.154**	0.067+
	(0.0660)	(0.046)
Explicit deposit insurance		-0.092**
		(0.033)
Credit to GDP trend deviations		0.248**
		(0.096)
Reserves on GDP		-0.001**
		(0.0001)
Underidentification test P-val		0.0248
Weak identification test stat.[1]		19.043
Observations	588	588
Number of countries	95	95
Country fixed-effects	YES	YES
Time fixed-effects	YES	YES

Note: The dependent variable is the 5-years growth rate between time t and time t+5, all coefficients in the growth regression should be divided by 5 for the annualised effect. Robust-clustered standard errors in parentheses. Time sample 1970-2010. 1 Kleibergen-Paap rk Wald F statistic (Stock-Yogo weak ID test critical values - 20% maximal IV relative bias - is 6.46). *, **, *** denote significance at the 10, 5, and 1% level respectively, while + denotes significance at the 14% level.

Table A2.3 Capital inflow composition and twin crisis probability

	(1)	(2)
	Second stage	First stage
VARIABLES (t)	Real growth per capita (t+1:5)	Twin crisis (t+1:5)
Twin crisis	-0.671**	
	(0.273)	
Population growth	-1.600	-0.991
	(1.600)	(0.721)
log real GDP per capita	-0.258**	0.056*
	(0.043)	(0.031)
Investment on GDP	0.339*	0.011
	(0.183)	(0.252)
Years of schooling	-0.015	-0.008
	(0.017)	(0.014)
FDI	0.342*	0.140
	(0.197)	(0.243)
Portfolio equity	0.319+	0.046
	(0.211)	(0.259)
Portfolio debt	0.544**	0.566**
	(0.277)	(0.271)
Other flows	0.353	0.348
	(0.269)	(0.531)
Explicit deposit insurance		-0.061**
		(0.033)
Credit to GDP trend deviations		0.152**
		(0.081)
Reserves on GDP		-0.001**
		(0.0001)
Underidentification test P-val		0.0986
Weak identification test stat.[1]		16.175
Observations	636	636
Number of countries	114	114
Country fixed-effects	YES	YES
Time fixed-effects	YES	YES

The dependent variable is the 5-years growth rate between time t and time t+5, all coefficients in the growth regression should be divided by 5 for the annualised effect. Time sample 1970-2010. Robust-clsutered standard errors in parentheses. [1] Kleibergen-Paap rk Wald F statistic (Stock-Yogo weak ID test critical values - 20% maximal IV relative bias - is 6.71). *, **, *** denote significance at the 10, 5, and 1% level respectively, while + denotes significance at the 14% level.

Table A2.4 Domestic financial markets openness, growth and crisis probability

VARIABLES (t)	(1) Second stage Real growth per capita (t+1:5)	(2) First stage S.Banking crisis (t+1:5)	(3) Second stage Real growth per capita (t+1:5)	(4) First stage Twin crisis (t+1:5)
Systemic banking crisis	-0.182**			
	(0.0855)			
Twin crisis			-0.441**	
			(0.177)	
Population growth	-5.903	8.205	0.992	-1.361
	(4.104)	(6.630)	(4.013)	(3.366)
log real GDP per capita	-0.326**	0.632**	-0.344**	0.174**
	(0.0979)	(0.178)	(0.121)	(0.081)
Investment on GDP	-0.105	-0.304	-0.181	0.21
	(0.398)	(1.364)	(0.359)	(0.616)
Years of schooling	0.00907	-0.181	-0.0224	-0.028
	(0.0315)	(0.116)	(0.0293)	(0.025)
Financial markets openness	0.159*	0.829**	0.152*	0.186+
	(0.0991)	(0.396)	(0.0812)	(0.124)
CPI inflation		0.001**		
		(0.0001)		
Credit to GDP trend deviations		0.55**		0.229**
		(0.296)		(0.120)
M2		-0.012		
		(0.016)		
Explicit deposit insurance		-0.244**		-0.101*
		(0.110)		(0.048)
Reserves on GDP				-0.001*
				(0.0001)
Underidentification test P-val		0.0301		0.1048
Weak identification test stat.[1]		20.314		10.883
Observations	144	144	355	355
Number of countries	36	36	63	63
Country fixed-effects	YES	YES	YES	YES
Time fixed-effects	YES	YES	YES	YES

Note: The dependent variable is the 5-years growth rate between time t and time t+5, all coefficients in the growth regression should be divided by 5 for the annualised effect. Robust-clustered standard errors in parentheses. Time sample 1970-2010.[1] Kleibergen-Paap rk Wald F statistic (Stock-Yogo weak ID test critical values - 20% maximal IV relative bias is - 6.46). *, **, *** denote significance at the 10, 5, and 1% level respectively, while + denotes significance at the 14% level.

Table A2. 5 Trade openness, growth and currency crisis probability

	(1)	(2)
	Second stage	First stage
VARIABLES (t)	Real growth per capita (t+1:5)	Currency crisis (t+1:5)
Currency crisis	-0.344**	
	(0.115)	
Pop. growth	1.952	0.584
	(3.344)	(3.986)
log real GDP per capita	-0.556**	-0.035
	(0.108)	(0.101)
Investment on GDP	0.706**	1.366**
	(0.348)	(0.687)
Years of schooling	-0.0502	-0.009
	(0.0307)	(0.031)
Tariff rate	0.12	0.530*
	(0.196)	(0.296)
REER trend deviations		0.595**
		(0.205)
Explicit deposit insurance		-0.165**
		(0.062)
Reserves on GDP		-0.001**
		(0.001)
Underidentification test P-val		0.0359
Weak identification test stat.[1]		18.391
Observations	240	240
Number of Countries	49	49
Country FE	YES	YES
Time FE	YES	YES

Note: The dependent variable is the 5-years growth rate between time t and time t+5, all coefficients in the growth regression should be divided by 5 for the annualised effect. Robust-clustered standard errors in parentheses. Time sample 1970-2010 [1] Kleibergen-Paap rk Wald F statistic (Stock-Yogo weak ID test critical values - 20% maximal IV relative bias - is 6.46). *, **, *** denote significance at the 10, 5, and 1% level respectively.

Table A2.6 Exchange rate flexibility, growth and currency crisis probability

	(1)	(2)
	Second stage	First stage
VARIABLES (t)	Real growth per capita (t+1:5)	Currency crisis (t+1:5)
Currency crisis	-0.481**	
	(0.144)	
Population growth	0.573	4.191
	(2.974)	(3.499)
log real GDP per capita	-0.372**	0.108
	(0.130)	(0.120)
Investment on GDP	0.288	0.201
	(0.347)	(0.494)
Years of schooling	-0.0147	-0.0186
	(0.0295)	(0.029)
Free floating exchange rate (=1, 0 otherwise)	-0.0852	-0.237**
	(0.0711)	(0.107)
REER trend deviations		0.588**
		(0.198)
Explicit deposit insurance		-0.166**
		(0.055)
Reserves on GDP		-0.001**
		(0.0001)
Underidentification test P-val		0.0257
Weak identification test stat.[1]		8.087
Observations	342	342
Number of countries	52	52
Country fixed-effects	YES	YES
Time fixed-effects	YES	YES

Note: The dependent variable is the 5-years growth rate between time t and time t+5, all coefficients in the growth regression should be divided by 5 for the annualised effect. Robust-clustered standard errors in parentheses. Time sample 1970-2010. [1] Kleibergen-Paap rk Wald F statistic (Stock-Yogo weak ID test critical values - 20% maximal IV relative bias - is 6.46). *, **, *** denote significance at the 10, 5, and 1% level respectively.

Table A2.7 Growth and crisis probability, other structural indicators

VARIABLES (t)	(1a) OLS Real growth per capita (t+1:5)	(1b) II stage Real growth per capita (t+1:5)	(1c) I stage S.Banking crisis (t+1:5)	(2a) OLS Real growth per capita (t+1:5)	(2b) II stage Real growth per capita (t+1:5)	(2c) I stage S.Banking crisis (t+1:5)	(3a) OLS Real growth per capita (t+1:5)	(3b) II stage Real growth per capita (t+1:5)	(3c) I stage S.Banking crisis (t+1:5)	(4a) OLS Real growth per capita (t+1:5)	(4b) II stage Real growth per capita (t+1:5)	(4c) I stage S.Banking crisis (t+1:5)
Systemic banking crisis		0.183			-0.138**			-0.158**			-0.0890	
		(0.156)			(0.0476)			(0.0352)			(0.0728)	
Population growth	-5.062*	-8.467*	-17.27*	-17.27**	-12.91	3.334	-13.92*	-9.974	-6.504	-7.697*	-4.301	4.254
	(2.686)	(5.124)	(9.668)	(8.544)	(10.07)	(38.194)	(7.400)	(9.301)	(35.865)	(4.297)	(4.325)	(19.780)
log real GDP per capita	-0.253**	-0.261**	0.252	-0.0680	-0.248	-0.055	-0.136	-0.225	-0.239	-0.255**	-0.263**	0.081
	(0.0509)	(0.0943)	(0.262)	(0.252)	(0.221)	(0.980)	(0.271)	(0.201)	(0.916)	(0.0862)	(0.0979)	(0.528)
Investment on GDP	-0.232	0.208	-1.601	0.622	0.957**	-2.298	0.324	0.520	-1.406	0.0551	0.179	-1.87
	(0.303)	(0.436)	(1.254)	(0.651)	(0.487)	(2.080)	(0.699)	(0.635)	(2.649)	(0.411)	(0.430)	(1.398)
Years of schooling	0.0107	0.0441	-0.115	-0.0457	-0.0442	-0.142	-0.110	-0.0466	-0.1381	-0.00741	0.00111	-0.006
	(0.0118)	(0.0316)	(0.083)	(0.0463)	(0.0502)	(0.177)	(0.540)	(0.0525)	(0.179)	(0.0124)	(0.0195)	(0.077)
Reg. in 7 non-manufacturing network-industries (ETCR)	-0.438*	-0.282	0.0301									
	(0.239)	(0.360)	(1.068)									
Product market regulation (PMR)				-0.288*	-0.220	1.028						
				(0.194)	(0.274)	(1.109)						
Barriers to entrepreneurship (PMR)							-0.302**	-0.233	0.451			
							(0.0940)	(0.184)	(0.938)			
Adjusted statutory corporate income tax rate										-0.0813+	-0.0567	-0.039
										(0.0594)	(0.0587)	(0.319)
CPI inflation			0.002**			0.034**			0.0359**			0.021**
			(0.001)			(0.006)			(0.0049)			(0.007)
Credit to GDP trend deviations			0.371**			0.0768			0.119			0.500*
			(0.241)			(0.341)			(0.374)			(0.259)
Explicit deposit insurance			-0.0273			-0.422			-0.348*			0.232
			(0.108)			(0.246)			(0.176)			(0.149)
Underidentification test P-val			0.1265			0.4589			0.4588			0.1343
Weak identification test stat.[1]			3.452			21.026			23.616			5.436
Observations	236	211	211	88	79	79	88	79	79	168	153	153
Number of countries	36	34	34	30	27	27	30	27	27	34	32	32
Time sample	1975-2010	1975-2010	1975-2010	2000-2010	2000-2010	2000-2010	2000-2010	2000-2010	2000-2010	1980-2010	1980-2010	1980-2010
Time and country fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: The dependent variable is the 5-years growth rate between time t and time t+5, all coefficients in the growth regression should be divided by 5 for the annualised effect. Robust-clustered standard errors in parentheses. [1] Kleibergen-Paap rk Wald F statistic (Stock-Yogo weak ID test critical values - 20% maximal IV relative bias - is 6.46). *, **, *** denote significance at the 10, 5, and 1% level respectively, while + denotes significance at the 15% level.

APPENDIX III: SAMPLE OF COUNTRIES USED IN REGRESSIONS

Table A3.1 List of countries in the analysis

Antigua and Barbuda	Greece	Panama
Argentina	Grenada	Paraguay
Australia	Guatemala	Peru
Austria	Honduras	Philippines
Belgium	Hungary	Poland
Barbados	Iceland	Portugal
Bolivia	India	Romania
Botswana	Indonesia	Saint Kitts and Nevis
Brazil	Ireland	Saint Lucia
Cameroon	Israel	Saint Vincent and the Grenadines
Canada	Italy	Saudi Arabia
Chile	Jamaica	Senegal
China, P.R.: Mainland	Japan	Singapore
Congo, Republic of	Jordan	Slovakia
Costa Rica	Korea, Republic of	Slovenia
Croatia	Kuwait	South Africa
Cyprus[2728]	Laos	Spain
Czech Republic	Latvia	Sri Lanka
Côte d'Ivoire	Lithuania	Suriname
Dominican Republic	Luxembourg	Swaziland
Denmark	Malaysia	Sweden
Dominica	Maldives	Switzerland
Ecuador	Malta	Syria
Egypt	Mexico	Thailand
El Salvador	Mongolia	Trinidad and Tobago
Estonia	Morocco	Tunisia
Fiji	Netherlands	Turkey
Finland	New Zealand	United Kingdom
France	Nigeria	United States
Gabon	Norway	Uruguay
Germany	Oman	Venezuela
Ghana	Pakistan	Zambia

[27] *Footnote by Turkey*
The information in the documents with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

[28] *Footnote by all the European Union Member States of the OECD and the European Union*
The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in the documents relates to the area under the effective control of the Government of the Republic of Cyprus.

APPENDIX IV: CRISES IN THE SAMPLE OF COUNTRIES

Table A4.1 Sample countries and systemic banking crises dates

Argentina	1980-1982,1989-1991,2001-2003	Jordan	1989, 1990-1991
Austria	2008	Korea	1997-1998
Belgium	2008-2011	Latvia	1995-1996
Bolivia	1994	Lithuania	1995-1996
Brazil	1990-1998	Luxembourg	2008-2011
Cameroon	1987-1988,1990-1992,1995-1997	Malaysia	1997-1999
Chile	1976,1981-1985	Mexico	1994-1996
China, PR	1998	Mongolia	2008-2011
Colombia	1982,1998-2000	Netherlands	2008-2011
Congo	1992-1993	Nicaragua	1990,2000-2001
Costa Rica	1987-1989,1990-1991,1994-1995	Nigeria	1991-1995,2009
Croatia	1998-1999	Norway	1991-1993
Czech Republic	1996-2000	Paraguay	1995
Denmark	1998-2011	Philippines	1997-2001
Dominican Republic	2003-2004	Poland	1992-1994
Ecuador	1982-1986,1998-2002	Portugal	2008-2011
Egypt	1980	Romania	1990-1992
El Salvador	1989-1990	Russian Federation	1998,2008-2011
Estonia	1992-1994	Senegal	1990-1991
Finland	1991-1995	Slovakia	1998-2002
France	2008-2011	Slovenia	1992,2008-2011
Germany	2008-2011	Sri Lanka	1990-1991,2008
Ghana	1982-1983	Swaziland	1995-1999
Greece	2008-2011	Sweden	1991-1995,2008-2011
Grenada	1985	Switzerland	2008-2011
Hungary	1991-1992,1994-1995,2008-2011	Thailand	1997-2000
Iceland	2008-2011	Tunisia	1991
India	1993	Turkey	2000-2001
Indonesia	1997-2001	Ukraine	1998-1999,2008-2011
Ireland	2008-2011	United Kingdom	2007
Israel	1977	United States	1988, 2007
Italy	2008-2011	Uruguay	1981-1985, 2002-2005
Jamaica	1996-1998	Venezuela	1994-1998
Japan	1997-2001	Zambia	1995-1998

Source: Laeven and Valencia (2012).

Table A4.2 Sample countries and currency crises dates

Argentina	1975, 1981, 1987, 2000	Malaysia	1998
Bangladesh	1976	Maldives	1975
Bolivia	1973, 1981	Mexico	1977, 1982, 1995
Brazil	1999	Mongolia	1990, 1997
Cameroon	1994	Morocco	1981
Chile	1972, 1982	Namibia	1984
Colombia	1985	New Zealand	1984
Congo, Republic of	1994	Nicaragua	1979, 1985, 1990
Costa Rica	1981, 1991	Nigeria	1983, 1989, 1997
Dominican Republic	1985, 1990, 2003	Pakistan	1972
Ecuador	1982, 1999	Paraguay	1984, 1989, 2002
Egypt	1978, 1990	Peru	1976, 1981, 1988
El Salvador	1986	Philippines	1983, 1998
Estonia	1992	Portugal	1983
Fiji	1998	Romania	1996
Finland	1993	Russian	1998
Gabon	1994	Senegal	1994
Ghana	1978, 1983, 1993, 2000	South Africa	1984
Greece	1983	Spain	1983
Guatemala	1986	Sri Lanka	1978
Honduras	1990	Sudan	1981, 1988, 1994
Iceland	1975, 1981, 1989	Suriname	1990, 1994, 2001
Indonesia	1979, 1998	Swaziland	1985
Israel	1975, 1980, 1985	Sweden	1993
Italy	1981	Thailand	1998
Jamaica	1978, 1983, 1991	Trinidad	1986
Jordan	1989	Turkey	2001
Korea	1998	Ukraine	1998
Laos	1972, 1978, 1986, 1997	Uruguay	1972, 1983, 1990, 2002
Latvia	1992	Venezuela	1984, 1989, 1994, 2002
Lesotho	1985	Zambia	1985, 1995
Lithuania	1992	Zimbabwe	1983, 1991, 1998, 2003

Source: Laeven and Valencia (2012).

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