Financial Openness and Output Fluctuations: Business Cycle Volatility or Disaster Risk?*

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Abstract

This paper analyses the effect of stock market liberalization on the *skewness* of output growth using a large cross-section of countries and industries. I find that both de jure and de facto openness increases substantially the negative skewness of the growth process, indicating a higher incidence of large, abrupt, and rare macroeconomic contractions. This effect comes mostly from a more negatively skewed distribution of capital investment. The costs of financial openness in terms of higher asymetric growth variability are augmented by trade openness and mitigated by strong institutions. At the same time, financial liberalization has no statistical effect on long-term output *volatility*.

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1 Introduction

One of the most robust observations in international macroeconomics is that emerging markets have considerably more volatile business cycles than developed economies (Aguiar and Gopinath, 2007). One of the most frequently cited factors behind this stylized fact has been the process of financial liberalization undertaken by emerging markets in the past several decades (Stiglitz, 2000; Agenor, 2003). This argument is well grounded in open economy real business cycle theory. Various such models have argued that opening the country's financial markets to foreign portfolio investment may lead to a crisis characterized by a sudden loss of access to international capital markets and by a collapse in domestic production (Mendoza, 1991; Calvo and Mendoza, 1996; Arellano and Mendoza, 2002).

A growing body of empirical work has taken this argument to the data by studying the link between financial liberalization and macroeconomic volatility.[1] However, a robust description of its impact on output *volatility* does not capture the full costs of financial openness associated with a more variable growth path because this approach ignores the *asymmetric* component of growth variability. It is entirely possible that financial liberalization has simultaneously reduced the amplitude of the business cycle and increased the probability of large but rare crises. If so, then the economy's overall long-term volatility may remain the same or even decline, leading the researcher to conclude that financial openness imposes no welfare costs on economic agents. However, while the welfare gains of lower business cycle volatility may be miniscule (Lucas, 1987), individuals may be willing to pay very high premia to eliminate the increase in the probability of a rare macroeconomic disaster (Barro, 2006, 2009; Gabaix, 2008; Gourio, 2008). To the degree that disaster risk may not be fully insurable, financial openness could paradoxically be welfare-decreasing

[1] The results are mixed. For example, Kose et al. (2003) and Levchenko et al. (2009) argue that foreign capital increases volatility both in the financial markets and in the real economy. However, Kaminsky and Schmukler (2008) find that financial openness is followed by large booms and busts only in the short run; still others find no effect of financial openness on macroeconomic volatility (Easterly et al., 2001), or even a negative effect when openness is proxied by stock market liberalization (Bekaert et al., 2002). For a comprehensive review of the literature on the volatility effects of financial liberalization, see Kose et al. (2006) and Obstfeld (2009), among others.

even if it resulted in lower business cycle volatility.

This point is illustrated in Table 1. The left panel reports average output volatility for financially open vs. financially closed economies, before and after stock market liberalization[2], using data on the 78 non-advanced economies from the Bekaert et al. (2005) sample, over the 1950-2009 period. The right panel does the same for the *skewness* of output growth. The table suggests that financial liberalization has resulted in lower long-term output volatility. However, this decline in volatility has been accompanied by a significant increase in the negative skewness of the distribution of output growth. Unlike the volatility, the skewness captures asymmetic and abnormal distributional patterns in output growth, or disaster risk.[3] Financial openness thus seems to be associated with a more stable business cycle, but also with a higher incidence of large, abrupt, and rare macroeconomic contractions.

The contribution of this paper is to draw attention to the negative effect of financial openness on output skewness, as well as to confirm the robustness of this relationship to a wide variety of empirical settings. In particular, I use both aggregate and sector-level data on value added growth for a wide cross section of countries to study the impact of equity market liberalization on output skewness. My main finding is that financial liberalization is followed by an increase in the negative skewness of the output growth process. At the same time, the data suggest no statistical effect of financial openness on output volatility. This effect holds both in aggregate and in industry-level data, implying that it is neither due to omitted variable bias in cross-country regressions, nor a feature of sectoral data which is averaged away through the correlation mechanism. This result is consistent with the view that financial openness raises the probability of a collapse in industrial output following a sudden stop in capital flows. I also find that the main effect is stronger in industries which are more externally dependent, face better growth opportunities, and have higher liquidity needs. I subject the main result of the paper to a wide variety of alternative experiments,

[2] For non-liberalized countries, the cut-off is the average liberalization year for the sample of liberalized countries.

[3] For example, Somalia had on average zero growth during the 1986-1993 and the 1995-2009 period, but its GDP declined by 22.7% in 1994. Consequently, the skewness of Somalia's GDP growth is the lowest of all countries in the sample, at -3.34.

including accounting for the endogeneity of liberalization, controlling for the channels through which concurrent policy reforms and macroeconomic developments affect the variability of the growth process, and alternating between *de jure* and *de facto* measures of financial openness. My results remain remarkably robust.

Second, the increase in negative skewness is primarily realized through a more negatively skewed distribution of investment. TFP, employment growth, and the rate of creative destruction seem to be relatively stable in the wake of financial market openness. Finally, the evidence suggests that the negative effect of financial openness on output skewness is relatively higher in countries open to trade and relatively lower in countries with better institutions. This implies that the effect of financial openness on asymmetric output risk is heterogeneous across countries.

This paper contributed to the debate on the costs and benefits of financial openness by demonstrating that financial liberalization can increase the asymmetric variability of output growth, both at the macro level and at the sector level. In contrast, earlier studies on the growth effect of stock market liberalization do not consider its effect on the variability of the growth process, and their evidence is derived from aggregate data only (Henry, 2000; Bekaert et al., 2005). More recent studies have addressed the question of the effect of financial openness on growth and volatility using industry-level data (Gupta and Yuan, 2009; Levchenko et al., 2009). I expand on this approach by looking at output skewness in addition to output volatility, in an attempt to capture better the asymmetric growth variability effect of financial openness. While testing for whether the same pattern holds for consumption (in addition to output) growth is beyond the scope of this paper, the evidence tentatively suggests that in a world where agents are willing to pay high premia to avoid rare disasters, financial openness may be associated with a welfare cost that has not been identified before.

My work is also related to a strand of theoretical literature which links financial openness to sudden stops, capital flights, and crises in general. One branch of this literature emphasizes the role of sovereign risk. In some of these models, strategic default - both on foreign debt or on both

foreign and domestic debt - can lead to large outflows of capital, and that effect depends on the level of development as well as on the degree of debt enforcement (e.g., Eaton and Gersowitz, 1981; Atkeson, 1991; Aguiar and Gopinath, 2006; Aguiar et al., 2009; Bai and Zhang, 2010; Broner and Ventura, 2010). Other work builds on financial accelerators-type mechanisms to model international financial contagion. In these models, credit constraints amplify the shocks that originate in one country and then spread to another country (e.g., Caballero and Krishnamurty, 2001; Paasche, 2001; Cook and Devereux, 2006; Mendoza and Smith, 2006; Gertler et al., 2007; Caballero et al., 2008; Mendoza et al., 2009; Mendoza and Quadrini, 2010). I evaluate the link between globalization and crisis broadly predicted by these models, taking output skewness as an empirical proxy for crisis incidence.

Finally, the empirical regularity investigated in this paper is perhaps most closely related to Ranciere et al. (2008) who study the link between financial liberalization, growth, and financial crises. In their model, in a financially liberalized economy with limited contract enforcement, systemic risk taking reduces the effective cost of capital and relaxes borrowing constraints. This allows greater investment and generates higher long-term growth, but it raises the probability of a sudden collapse in financial intermediation when a crash occurs. Systemic risk thus increases mean growth even if crises have arbitrarily large output and financial distress costs. While the authors test empirically the link between long-term growth and financial fragility, proxied by the skewness of domestic credit growth, my paper presents the first direct test of the link between financial openness and *output* skewness. This is a paper about the pattern of economic fluctuations, not about financial crises.

The paper proceeds as follows. Section 2 describes the data. Section 3 presents the empirical methodology. Section 4 reports the main results, alongside a battery of robustness tests. Section 5 concludes.

2 Data

I start by computing the volatility and the skewness of GDP growth for all countries in the Penn Tables for all the years before and after a liberalization event. The sample standard deviation of real output growth in country c during period t is defined as $\left(\frac{1}{T} \sum_{j=1}^{T} (g_{cj} - \overline{g}_c)^2 \right)^{\frac{1}{2}}$. The skewness of the distribution of growth rates in country c during period t is defined as $Skew_{ct} = \frac{\frac{1}{J} \sum_{j=1}^{J} (g_{cj} - \overline{g}_c)^3}{\left(\frac{1}{J} \sum_{j=1}^{J} (g_{cj} - \overline{g}_c)^2 \right)^{\frac{3}{2}}}$. In both cases, g_{cj} corresponds to the realization of real output growth in country c during year j of period t (variable GRGDPCH in the Penn Tables), and $\overline{g}_c$ is average real output growth in country c during period t. $t = 1$ denotes the post-liberalization period, and $t = 0$ the pre-liberalization period. For countries that did not liberalized their stock markets, $t = 1$ after the average liberalization year in the sample, 1986. Table 2 summarizes the data on GDP volatility and skewness for the countries in the sample. It also contains information on the dating of liberalization that is used in the empirical exercises.

Next, I use data used in the empirical analysis come from the 2010 UNIDO Industrial Statistics 2 Database. I use the version that reports data according to the 2-digit level of ISIC Revision 3 classification for the period 1963-2007. The data contain information on value added, capital, employment, and number of establishments for 21 manufacturing sectors in the best case, as well as for total manufacturing.[4] Similar to Levchenko et al. (2009) and following Heston et al. (2002), I use the data reported in current U.S. dollars and convert them into international dollars using the Penn World Tables.[5] I require that each sector contains data on at least 10 years before and at least 10 years after a liberalization event (for countries which experienced liberalization), and data on at least 10 years before and at least 10 years after the average liberalization year (for countries

[4] Data are not available for two additional industries, Motor vehicles, trailers, semi-trailers, and Recycling.

[5] The exact mechanism is as follows. Using the variable name conventions from the Penn World Tables, this deflation procedure involves multiplying the nominal U.S. dollar value by (100/P) *(RGDPL/CGDP) for output to obtain the deflated value. See Levchenko et al. (2009) for more details.

which did not), and that each country has at least 10 such sectors. The resulting dataset consists of 37 countries.

In the empirical tests using sectoral data, I focus only on the skewness of value added growth. I first calculate average real output growth in country c and industry s during period t, $\overline{g}_{cs}$, after taking differences in annual log output. Then, the sample skewness of output growth of industry s in country c during period t is calculated as $\frac{\frac{1}{T}\sum_{\tau=1}^{T}(g_{cs\tau}-\overline{g}_{cs})^3}{\left(\frac{1}{T}\sum_{\tau=1}^{T}(g_{cs\tau}-\overline{g}_{cs})^2\right)^{\frac{3}{2}}}$, where $\tau = 1, ..., T$ are all years with observations in period t.

The literature on financial liberalization uses various measures of *de jure* and *de facto* liberalization. Quinn (1997), Bekaert et al. (2005), Bekaert et al. (2007), and most recently Kaminsky and Schmukler (2008) have dated various liberalization events pertinent to capital accounts, credit markets, and equity markets. I use the Bekaert et al. (2005, 2007) classification, focusing on equity market liberalization. I later complement this normative index with *de facto* measures of financial globalization, namely foreign liabilities normalized by GDP from Lane and Milesi-Ferretti (2007).

While there are different types of financial market liberalization episodes, focusing on equity markets liberalization has good theoretical foundations in neoclassical theory. Improved risk sharing post-liberalization should decrease the cost of equity capital (see, for example, Bekaert and Harvey, 2000) and increase investment (see, for example, Bekaert et al., 2005), therefore affecting the distribution of growth rates. In the context of a more disaggregated analysis of the effect of stock market liberalization, Gupta and Yuan (2009) show that industries exhibit strictly higher growth rates in countries with liberalized equity markets. I extend their analysis to higher moments of growth.

Countries with liberalized financial markets are usually more developed in a host of other dimensions: they tend to have better institutions, more developed domestic financial markets, higher human capital, and be more open to trade. All of these parallel macroeconomic circumstances may be affecting both the rate (see Acemoglu et al., 2003) and the variability (see Raddatz, 2006)

of growth. Therefore, I collect data on institutional quality from Polity IV, on domestic credit to private institutions from Beck et al. (2010), on years of schooling from the Barro and Lee database, on life expectancy and school enrollment from the World Development Indicators, and on population and trade openness from the World Penn Tables, to control directly for these effects.

Identification in the paper rests on carrying out the analysis at the industry level, which allows to control for various channels through which other concurrent macroeconomic processes - like financial development, trade openness, etc. - may affect the variability of output growth. As argued by Rajan and Zingales (1998), the distribution of growth rates would be most sensitive to financial development in industries which are "naturally" dependent on external finance. Such "natural" dependence may arise due to variations in the scale of projects, gestation period, the ratio of hard vs. soft information, the ratio of tangible vs. intangible assets, follow-up investments, etc. I use the measure of external financial dependence originally proposed by Rajan and Zingales (1998) for SIC 3-digit industries and later adapted by Cetorelli and Strahan (2006) for SIC 2-digit industries. The benchmark is defined as the industry median value of the sum across years of total capital expenditures minus cash flow from operations, divided by capital expenditures, for mature Compustat firms.[6] Industry growth rates also tend to be affected by growth opportunities at the country level (Fisman and Love, 2007; Bekaert et al., 2007). Sectors which face higher global growth opportunities should grow faster post-liberalization. To address that point, I use data from Fisman and Love (2007) on industry sales growth in the US to account for this channel. Finally, the variability of growth is also negatively affected by financial development if industries exhibit naturally high liquidity needs (Raddatz, 2006), and so I use this measure aggregated at the SIC 2-digit level.[7] These three industry benchmarks are interacted with data on private credit to GDP from Beck et al. (2010). Finally, in order to account for the effect of international trade on output

[6] The exact procedure involves subtracting from the sum across years of total capital expenditures (Compustat item #128) the cash flow from operations, i.e., revenues minus nondepreciation costs (Compustat item #110) for each firm in Compustat, and then taking the median industry value as the benchmark.

[7] The exact procedure involves dividing the value of total inventories (Compustat item #3) by the value of total sales (Compustat item #12) for each firm in Compustat, and then taking the median industry value as the benchmark.

volatility and skewness, I re-weight the industry measures of the ratio of imports and exports to total output from Di Giovanni and Levchenko (2009) for the SIC 2-digit level, and interact with data on trade openness from the Penn Tables.

Table 3 lists the industries included in the dataset and summarizes all industry benchmarks. For definitions of all variables included in the paper, alongside variable sources, see Appendix.

3 Econometric framework

I start by estimating the following equation:

$$Output\ risk_{ct} = \quad \alpha Post_{ct} + \beta Lib_{ct} + \gamma X_{ct} + \delta \psi_{ct} + \varepsilon_{ct} \tag{1}$$

where the independent variable is, alternatively, GDP volatility and GDP skewness. $Post_t$ is a dummy variable equal to 1 after the liberalization event ($t = 1$), for countries which liberalized their financial markets, and after the average liberalization year for the sample, for countries which did not. It is equal to 0 for $t = 0$. Lib_{ct} is a dummy variable equal to 1 after the liberalization event, only for countries which liberalized their financial markets. X_{ct} is a vector of various controls which are predicted by theory to affect output growth risk. It includes proxies for economic development, human capital, macroeconomic stability, financial development, institutions, trade openness, etc. ψ_{ct} is a matrix of country and time fixed effects which control for a variety of omitted unobservable factors. Finally, ε_{ct} is the idiosyncratic error.

While investigating the effect of financial liberalization on GDP growth skewness provides valuable insights into how financial openness affects disaster risk, this approach is subject to both conceptual and econometric problems. Conceptually, incomplete risk-sharing may prevent the economy from behaving like a representative agent (Attanasio and Davis, 1996). Econometrically, both financial openness and disaster risk could be driven by any of a long list of common omitted variables that financial sector development could merely be a proxy of, or societies less averse

to risk-taking may be liberalizing financial markets earlier. As a consequence, recent studies have adopted the cross-country cross-industry methodology first suggested by Rajan and Zingales (1998) to evaluate the sectoral channels through which financial markets affect economic performance.

I proceed to investigate whether the effect of financial openness on skewness is robust to using sectoral-level data. To that end, I estimate the following equation:

$$Skewness_{cst} = \alpha Post_t + \beta Lib_{ct} + \gamma X_{ct} Z_s + \delta Share_{cst} + \eta \psi_{cst} + \varepsilon_{cst} \quad (2)$$

Here, $Share_{cst}$ is industry s's beginning-of-period share in total manufacturing value added in country c during period t. X_{ct} is a matrix of country variables. It includes proxies for financial development, trade openness, democracy, initial growth volatility, etc. Z_s is a matrix of industry benchmarks (external financial dependence, growth opportunities, liquidity needs, and export/import intensity), and it is interacted with the matrix of country variables. ψ_{cst} is a matrix of country, sector, and time fixed effects. Finally, ε_{cst} is the idiosyncratic error. Because financial liberalization is measured at the country $\times$ time level, I cluster the standard errors at the country $\times$ time level as well, in order to avoid biasing the standard errors downwards.

In both models, the coefficient of interest is β and it measures, in a difference-in-differences sense, the effect of financial liberalization on skewness during the post-liberalization period for countries which underwent liberalization *relative to* countries which did not. I choose two types of control groups for this exercise. In the main tests, I use all non-liberalized countries as a control group. This approach, however, does not account for the possible endogeneity of liberalization. Liberalization may be a strategic decision correlated with a variety of circumstances unobservable to the econometrician. For instance, it may be correlated with growth opportunities and thus made in anticipation of higher future growth (Bekaert et al., 2005). To control for that possibility, I borrow from the propensity score literature pioneered by Rosenbaum and Rubin (1983) and first run a first-stage logistic regression on a set of country level variables to determine what macro

variables were correlated with the decision to liberalize.[8] Based on the propensity score, I choose for each treated country a country that is most similar to it, and run the second-stage regression on this subset of control countries. The idea is to eliminate the potential selection bias arising from the fact that countries were not assigned the "treatment" randomly - that is, only systematically different countries liberalized their financial markets, and these systematic differences cannot be perfectly dealt with through the inclusion of covariates in the OLS regression because the distribution of the covariates does not overlap sufficiently across the two groups. This approach relates to earlier work by Persson (2001), Glick et al. (2006), and Levchenko et al. (2009).

In addition, I perform a variety of alternative tests. First, I replace *de jure* liberalization with *de facto* liberalization to control for the possibility that *de jure* liberalization captures poorly the actual financial integration of the domestic economy in the world economy (Levchenko et al., 2009). To that end, I replace my primary measure of financial openness based on liberalization events with a quantitative measure derived from Lane and Milesi-Ferretti (2007)'s data on capital flows.

Second, because liberalization varies at the country $\times$ time level, I cannot include in the main tests country $\times$ time fixed effects that would capture other time-varying country characteristics that are not picked up by the controls. One solution to this problem is to identify the casual effect of openness on skewness through a particular industry channel. To that end, I estimate the following equation:

$$Skewness_{cst} = \alpha Post_t + \beta Lib_{ct} Z_s + \gamma X_{ct} Z_s + \delta Share_{cst} + \eta \psi_{cst} + \varepsilon_{cst} \tag{3}$$

In this modification, Lib_{ct} is, alternatively, the *de jure* index Lib_{ct} from models (1) and (2), or a *de facto* measure of financial globalization derived from Lane and Milesi-Ferretti (2007)'s data on capital flows. These variables are interacted with the industry benchmarks identified above. This robustness check allows me to establish whether the effect of liberalization on growth and

[8] The set includes pre-liberalization measures of economic development, financial development, institutional quality, human capital, and trade openness, among others.

risk is equally strong for various measures of liberalization, and more so for industries which are naturally more sensitive to financial market development while controlling for time-varying country characteristics.

Finally, I study which attributes of the macroeconomic environment tend to alleviate/exacerbate the positive/negative effects of financial liberalization in terms of extreme output risk. To that end, I estimate the following equation:

$$Skewness_{cst} = \alpha Post_t + \beta Lib_{ct} Z_{ct} + \gamma X_{ct} Z_s + \delta Share_{cst} + \eta\psi_{cst} + \varepsilon_{cst} \tag{4}$$

Here, Z_{ct} is a matrix of country level variables including measures of financial development, economic development, institutional quality, human capital, etc. This model is consistent with tests of the heterogeneous effects of financial liberalization in Bekaert et al. (2005) and Kose et al. (2006), among others.

4 Empirical results

This section discusses the results of estimating the above empirical models. I report the main results using data on GDP growth in Section 4.1. Section 4.2 reports the results from the industry-level analysis. Section 4.3 presents a battery of robustness tests. In Section 4.4 I study the channels through which liberalization affects the distribution of growth rates. Section 4.5 investigates the heterogeneous effect of liberalization across countries.

4.1 Financial openness and output risk: Aggregate data

4.1.1 Volatility vs. skewness

I begin by contrasting the effect of financial openness on GDP volatility and on GDP skewness. I use data on GDP growth from the Penn Tables over 1950-2009 to calculate the volatility and the skewness of GDP growth for the 78 non-advanced economies in the Bekaert et al. (2005) sample

before and after equity market liberalization. I then use these data to estimate model (1), and report the estimates in Table 4.

Overall, the evidence implies that financial openness has led to a decline in GDP volatility, but this result is not robust in the statistical sense. In column (1) where I do not control for any country-level characteristics, I find that in the post-liberalization period, GDP volatility in a financially open country is lower by 0.53 of a sample standard deviation relative to a non-open country. However, once I add standard controls for economic development, human capital, and macroeconomic stability (column (2)), the decline in GDP volatility in financially open countries post-liberalization becomes indistinguishable from the concurrent decline in GDP volatility in non-liberalized countries. Looked at from another angle, the evidence allows me to reject the hypothesis that financial openness increases the volatility of GDP growth.

At the same time, the evidence strongly implies that financial openness increases the negative skewness of GDP growth. This effect is significant at the 5% statistical level regardless of whether I do not control for standard determinants of output risk (column (3)) or whether I do (column (4)). Numerically, the estimates in column (4) imply that during the post-liberalization period, the skewness of the distribution of growth rates in a financially open country declines by 0.62 of a sample standard deviation relative to a non-open country. The combined evidence implies that the distribution of growth rates has become both more squeezed and more left-skewed as a result of financial openness. Alternatively put, a less volatile business cycle is complemented by a higher probability of large, abrupt, and rare macroeconomic contractions.

Figure 1 illustrates this result by comparing the output growth pattern of Argentina and Panama. These two countries are similar in terms of per capita wealth, are a part of the same economic area, and exhibit similar trade patterns. Argentina liberalized its stock market in 1989, while Panama did not. Figure 1 indicates that Argentina grew at a rate almost four times higher after 1989 (2.6% vs. 0.7%), while annual growth rates in Panama declined somewhat after 1991, from 3.8% to 2.9%. Aggregate volatility declined in Panama while it remained steady in Ar-

gentina. Finally, while the distribution of growth rates became more positively skewed in Panama, it went from symmetric to negatively skewed in Argentina (-0.666 post-liberalization vs. -0.118 pre-liberalization). Thus, relative to non-liberalized Panama, liberalized Argentina experienced higher growth, and its growth distribution became more negatively skewed indicating the incidence of a large and abrupt macroeconomic contraction.[9]

4.1.2 Financial openness and output skewness: Accounting for financial development, trade openness, and institutions

In Table 5, I test for whether the results so far are not driven by omitting some of the most important factors that are theoretically linked to output risk. In column (1), we add to the model the ratio of private credit to GDP (a proxy for financial development). In column (2), I add the sum of exports and imports normalized by GDP (a proxy for trade openness). In column (3), I add a variable capturing the degree to which the country's legal system has imposed constraints on the executive (a proxy for institutional quality). Finally, I perform a horse race in column (4). Domestic financial market development has been argued to affect both output growth and its variability (Acemoglu and Zilibotti, 1997; Aghion et al., 2010). The same applies to trade openness and institutional quality (Acemoglu et al., 2003; Bekaert et al., 2005; Kose et al., 2006). I find that only domestic financial development matters for rare output risk in that countries with a higher private credit-to-GDP ratio tend to have a more negatively skewed distribution of growth rates (columns (1) and (4)). Importantly, the main result remains little changed - both in terms of magnitude and in terms of statistical significance - throughout these empirical tests.

4.2 Financial openness and output skewness: Industry results

The negative effect of financial openness on skewness that has emerged from the aggregate data has important implications. For one, it links financial liberalization to the incidence of large, abrupt,

[9] Argentina's real GDP declined by 20% between 1998 and 2002.

and rare macroeconomic contractions. For two, to the extent that output risk cannot be fully insured away, it has potentially important welfare implications.

This approach, however, is subject to both conceptual and econometric problems. Conceptually, incomplete risk-sharing may prevent the economy from behaving like a representative agent (Attanasio and Davis (1996)). Econometrically, both financial openness and disaster risk could be driven by any of a long list of common omitted variables that financial sector development could merely be a proxy of, or societies less averse to risk-taking may be liberalizing financial markets earlier.

For all these reasons, industry-level data is better suited than country-level data for the purpose of identification. I therefore proceed with the estimation of Model (2), which replicates Model (1) with sectoral-level data in the case of the skewness of output growth. $X_{ct}Z_s$ contains a number of country variables and of country-industry interactions relevant to output risk. In particular, it contains country c's beginning-of-period log GDP per capita and ratio of private credit to GDP during period t; interactions of industry s's export and import intensity with beginning-of-period trade openness in country c during period t; interactions of industry s's dependence on external finance, growth opportunities, and liquidity needs with country c's beginning-of-period ratio of private credit to GDP during period t, and country c's beginning-of-period population during period t, as well as its interaction with industry s's liquidity needs. I expect economic development and country size to affect diversification (see Acemoglu and Zilibotti, 1997; Alesina and Wacziarg, 1998) and thus output risk. Finance also affects output risk, especially in industries with high liquidity needs (Raddatz, 2006).

The results from this test are reported in column (1) of Table 6. I apply a difference-in-differences approach where the control group consists of all countries that have not liberalized their equity markets during the sample period (see Table 2 for details). The evidence implies that financial openness increases the negative skewness of the distribution of growth rates. Numerically, a financial liberalization event, captured by moving the *Lib* variable from 0 to 1, is associated with

a sector-level negative skewness higher by 0.78 of a standard deviation of the average sector-level skewness observed in the sample.

It is also informative to note the effect of the industry and country covariates on asymmetric output variability. Larger sectors tend to have a more negatively skewed distribution of growth rates, but not significantly so. Sectors in countries with a higher degree of economic development and with less developed financial markets tend to have more negatively skewed industry growth. The growth pattern of sectors which face higher growth opportunities is more left-skewed in countries with more developed domestic financial markets. Finally, diversification opportunities, proxied by population size, are associated with lower risk, especially for industries with high liquidity needs, which is consistent with Mobarak (2005) and Raddatz (2006). However, the effect is not significant in the statistical sense.

This test is subject to selection bias. Countries which liberalized their financial markets may have been systematically different, implying that liberalization may have been a strategic choice (Bekaert et al., 2005). To address this concern, in column (2) of Table 6 I report estimates from regressions where each liberalized country is first matched with a similar non-liberalized country based on a propensity score derived from a logistic regression. The variables used in the first stage to estimate the propensity score include pre-liberalization economic development (proxied by GDP per capita and GDP growth volatility), trade openness, institutional quality (proxied by creditors rights), human capital (proxied by secondary school enrollment), and financial development (proxied by the ratio of private credit to GDP). This procedure accounts for the possibility that, for example, countries liberalize in order to take advantage of a large pool of specialized human capital, and so the measured post-liberalization increase in output risk is partly due to the independent effect of specialization.

The estimates from the propensity-score matching procedure are not weakened in a statistical sense when I restrict the control sample to the group of countries that are pair-wise most similar to the liberalized countries. A financial liberalization event, captured by moving the *Lib* variable

from 0 to 1, is associated with a sector-level skewness lower by 0.39 standard deviations, and the effect is significant at the 5% level. I conclude that the estimated effects of financial liberalization are not due to liberalizing countries being systematically different from non-liberalizing ones over a range of observable macroeconomic characteristics.

In unreported regression, I find that in both cases financial liberalization is not associated with a significant effect on volatility, confirming the finding based on aggregate data that a higher incidence of rare but large macroeconomic contractions does not necessarily imply higher long-term volatility if the business cycle has become less volatile over time.

4.3 Robustness

4.3.1 Financial openness and output skewness: Accounting for sectoral characteristics

While the empirical approach in the previous subsection should alleviate concerns about estimation bias caused by selection on observables, concerns about selection on unobservables still linger. Because in the empirical model financial openness varies at the country $\times$ time level, I cannot include country $\times$ time fixed effects that would capture any other time-varying characteristics not picked up by the controls. Recall, for example, the model in Ranciere et al. (2008) which implies that systemic risk taking increases the correlation between growth and crises. If countries liberalize when risk taking opportunities are abundant, regressions of future growth skewness on a liberalization indicator will yield upward biased estimates. To that end, in this subsection I proceed to check whether the estimates so far are not driven by the fact that financial liberalization events may be correlated with other unobservable developments at the country level.

My approach to dealing with this potentially confounding problem is to employ a cross-country cross-industry methodology in the spirit of Rajan and Zingales (1998). In particular, I interact the main liberalization variable with industry benchmarks for external financial dependence, growth opportunities, and liquidity needs (Model (3)). The extant literature suggests that the following

three hypotheses can be formulated:

1) By lowering the cost of external capital (Henry, 2000; Bekaert and Harvey, 2000), financial liberalization will lead to higher growth in industries that are more dependent on external finance. If growth and disaster risk are positively correlated as in Ranciere et al. (2008), financial openness will lead to a more negatively skewed distribution of output growth in financially dependent industries.

2) By improving the alignment between capital and growth opportunities (Fisman and Love, 2007; Bekaert et al., 2007), financial liberalization will lead to higher growth in industries that face better growth opportunities. If growth and disaster risk are positively correlated, financial openness will lead to a more negatively skewed distribution of output growth in industries that face higher growth opportunities.

3) By reducing information asymmetries and alleviating firms' temporary cash flows and/or net worth problems (Caballero and Krishnamurty, 2001), financial liberalization will lead to lower output risk in industries that have higher liquidity needs.

The first two hypothesis are identical to Gupta and Yuan (2009). In addition, Love (2003) shows that investment is less sensitive to internal funds at the firm level in financially developed countries. The third is consistent with the theory outlined and the evidence presented in Raddatz (2006).

The results from the estimation of Model (3) are reported in the first three columns of Table 7. Consistent with hypothesis 1 and 2, I find that industries that are more dependent on external finance (column (1)) and/or face higher growth opportunities (column (2)) exhibit a more negatively skewed distribution of growth rates following liberalization. In the second case, this effect is statistically significant as well. Numerically, a financial liberalization event is associated with a growth skewness lower by 0.3 standard deviations if the industry is at the 75th rather than the 25th percentile of growth opportunities. In addition to that, financial liberalization turns out to be associated with lower skewness in industries with high liquidity needs (Column (3)). A financial liberalization event is associated with a skewness lower by 0.15 standard deviations if the industry

is at the 75th rather than the 25th percentile of liquidity needs.

4.3.2 De jure vs. de facto liberalization

It has been argued that *de jure* measures of liberalization capture poorly the actual degree of financial market integration (e.g., Lane and Milesi-Ferretti, 2007). While conducive to the increase in foreign investment in domestic securities, liberalization may result in different magnitudes of actual integration of the domestic market with the world's financial markets (Levchenko et al., 2009), and some non-liberalized countries could in reality be more integrated than some liberalized ones. I aim to partially counter this problem by replacing the de jure indicator of liberalization with a *de facto* measure of financial globalization based on foreign liabilities-to-GDP data from Lane and Milesi-Ferretti (2007). Essentially, this variable estimates the actual exposure of a country's economy to foreign investors. The advantage of this method is that it captures better the degree to which various degrees of financial globalization within the set of financially liberalized countries map into differences in growth and risk.

The results of this version of Model (3) are reported in the last three columns of Table 7. Again, I account for the natural characteristics of the sector, in particular for dependence on external finance, for growth opportunities, and for liquidity needs. I find that higher foreign liabilities are uniformly associated with a more negatively skewed distribution of growth rates, with this effect being significant at the 5% in two cases (columns (5) and (6)). I conclude that main results of the paper are broadly consistent across alternative definitions of financial markets liberalization.

4.4 Capital accumulation, productivity, new business creation, and employment

I next turn to some of the channels through which financial liberalization affects the distribution of growth rates. Previous studies using disaggregated data have found that at the sector level, financial liberalization tends to promote output growth through the growth of existing establishments and through higher capital accumulation (Levchenko et al., 2009; Gupta and Yuan, 2009), and it also

stimulates new business creation if adopted by countries with lower barriers to entry (Gupta and Yuan, 2009). I wish to know how these results extend into the higher moments of the distribution of growth rates.

The 2010 UNIDO Industrial Statistics 2 Database contains industry data on investment, number of establishments, and employment. I need to construct the capital series from the investment data, and the productivity measure from the capital and employment series.

In order to construct the capital series from the investment data in the dataset, I apply the perpetual inventory method proposed by Hall and Jones (1999) and followed by Bonfiglioli (2008) and Levchenko et al. (2009), among others. The initial stock of capital in country c in industry s is estimated as $\frac{I_{cst_0}}{g_{cs}+\delta}$, where g_{cs} is the average geometric growth rate of total investment between t_0 and t_0+10. A depreciation rate of $\delta = 0.06$ is assumed. t_0 is the first year for which investment data is available in the dataset, for each country-sector pair. Finally, the stock of capital in country c in industry s at time t is computed as $K_{cst} = (1-\delta)K_{cst-1} + I_{cst}$. Next, the TFP data series is constructed by assuming for each industry s in country c a production function $Y_{cst} = K_{cst}^{\alpha}(A_{cst}H_{ct}L_{cst})^{1-\alpha}$, where Y_{cst} is total output in country c in industry s at time t, K_{cst} is the stock of physical capital in country c in industry s at time t, A_{cst} is labour-augmenting productivity in country c in industry s at time t, L_{cst} is total employment in country c in industry s at time t, and H_{ct} is a measure of the average human capital of workers in country c at time t. $H_{ct}L_{cst}$ is therefore the human capital-augmented labour in country c in industry s at time t. Following Psacharopulos (1994), I define labour-augmenting human capital as a function of years of schooling ($educ_{ct}$) as $H_{ct} = e^{\phi(educ_{ct})}$, where $\phi(educ_{ct})$ is a piecewise linear function with coefficients 0.134 for the first four years of education, 0.101 for the next four years, and 0.068 for all years thereafter. Finally, using data on capital constructed as above, on employment, and on output from the 2010 UNIDO Industrial Statistics 2 Database, as well as data on years of schooling from the Barro and Lee Database, TFP for each industry-country pair is calculated as $A_{cst} = \frac{Y_{cst}}{H_{ct}L_{cst}}\left(\frac{K_{cst}}{Y_{cst}}\right)^{\frac{\alpha}{1-\alpha}}$, where the factor share is assumed to be constant in each industry and

across countries, and is given the value of one third, which adequately represents national account data for developed countries.

Table 8 reports the estimates from the modified Model (2). I use all non-liberalized countries as a control group in the tests (the results are robust to a propensity score matching procedure). The evidence is somewhat mixed. In column (1), I find that financial openness increases the negative skewness of capital investment. The increase in negative skewness relates to the argument in Eichengreen and Lebland (2003) about the link between financial liberalization and banking crises, if liberalizing countries tend to be dominated by industries dependent on external finance. In that sense, my finding somewhat qualifies the result in Galindo et al. (2007) who find that liberalization has a beneficial long-term effect on economic performance by increasing the efficiency with which investment funds are allocated. Alternatively, it could be driven by sudden stops, which, as Rothenberg and Warnock (2011) show, tend to lead to more pronounced slowdowns in GDP than sudden flights.

The negative skewness of TFP growth also increases following liberalization (column (2)). However, the effect I register is not significant in the statistical sense. This result complements the results in Levchenko et al. (2009) and Gupta and Yuan (2009), who find no robust effect of liberalization on TFP growth at the sector level. In columns (3) and (4), I look at the effect of liberalization on the rate of creation of new establishments and on employment growth. I find that financial openness has a significant effect on the skewness of neither of them. Consequently, the main channel through which financial liberalization manifests itself into higher skewness of value added growth seems to be the channel of capital investment.

4.5 Financial openness and output skewness: Country heterogeneity

There is a growing body of work arguing that various economic developments and institutions should interact with financial liberalization in affecting the distribution of growth rates. For example, democracy and institutions tend to raise economic growth by offering stronger protection

of investment, thus both increasing the return to and lowering the cost of entrepreneurship. In general, however, the direct effect on growth may differ from the indirect effect. Mobarak (2005) estimates jointly the effect of democracy on growth and volatility and finds that through the direct channel, democracy lowers the rate of economic growth, but through the channel of lowering volatility it increases it. Following Acemoglu et al. (2003), I use constraints on the executive as a proxy for the country's level of institutional development.

Domestic financial market development and trade openness have also been argued by the literature to affect output growth and variability (Acemoglu and Zilibotti, 1997; Bekaert et al., 2005; Kose et al., 2006) and so I interact my liberalization variable with empirical proxies for these. Human capital has a positive effect on growth (e.g., Barro, 1991), and so I include a proxy for years of schooling in the interactions. Finally, it is possible that for reasons of unobservable institutional quality, distance to trade centers, and social cohesion, among others, different regions will experience different responses, in terms of disaster risk, to the same event (liberalization). To that end, I include dummies for various regions of the world interacted with the dummy for financial liberalization. I also instrument private credit and institutions using data on legal origin in the spirit of La Porta et al. (1998), who argue that the predetermined component of the country's legal system is a good instrument for concurrent financial and legal development.[10]

The estimates of Model (4) are reported in Table 9. The evidence suggests that in countries open to trade the distribution of sectoral growth rates becomes more negatively skewed following financial liberalization (columns (1) and (2)), suggesting that there are asymmetric risk complementarities between financial and trade openness. For example, Paasche (2001) shows that if financial frictions are present, a temporary terms of trade shock an trigger capital outflows and a decline in output. This result also relates to recent evidence on the positive effect of trade openness on aggregate volatility (Di Giovanni and Levchenko, 2009). At the same time, financial liberalization is associated

[10] Data on settlers mortality is missing for 31 of the 53 countries in the sample, and so while in robustness exercises the main message of Table 10 is not altered by using settlers mortality to instrument for institutions, as in Acemoglu et al. (2003), I do not report these results here.

with a less negatively skewed distribution of sectoral growth in countries with strong institutions, proxied by constraints on the executive (column (2)). To the extent that constraints on the executive are correlated with democracy, the evidence relates to the finding in Acemoglu et al. (2003) and Rodrik and Wacziarg (2005) that strong institutions and democratic transitions are associated with a decline in the volatility of output growth.

5 Conclusion

In this paper, I examine the effect of financial openness on the asymmetric variability of output growth over the business cycle. The literature has so far focused on output growth and volatility, pointing to mixed effects of financial liberalization in the dimension of volatility (see Kose et al., 2006, for a survey) and to a mostly positive effect in the dimension of growth, especially in the case of stock market liberalization (Bekaert et al., 2005; Gupta and Yuan, 2009). However, the first two moments of growth do not exhaust the welfare implications of financial openness. In particular, the same increase in volatility could be driven by one large macroeconomic contraction, or by a series of small symmetric deviations from a relatively stable growth path. In the latter case, a larger government would insure the additional output volatility away (Rodrik, 1998), and even with no insurance the welfare cost of higher volatility would be small (Lucas, 1987). In the former case, however, the government sector could be unable to provide adequate insurance, and so a large and rare macroeconomic contraction could impose non-negligible welfare costs on economic agents as in Barro (2006, 2009).

I use output data on 78 countries over 60 years to study the impact of financial liberalization on output *skewness*. The skewness of the distribution of output growth captures the asymmetric variability of the growth process and is thus more closely related to the concept of disaster risk than the volatility of growth. The data strongly suggests that while financial openness has no effect on volatility, it is associated with a more negatively skewed distribution of output growth. The latter result holds in both aggregate and in sectoral data. It also appears to be remarkably robust to a

wide variety of alternative tests, including accounting for the strategic choice associated with liberalization, controlling for the channels through which concurrent policy reforms and macroeconomic developments affect the rate and the variability of the growth process, and alternating between *de jure* and *de facto* measures of openness. Regarding the specific channels, the increase in negative skewness appears to be driven by a more left-skewed distribution of growth rates of capital investment. I also find that the negative effect of financial openness on output skewness is relatively higher in countries open to trade and relatively lower in countries with better institutions.

The fact that I record the same effect of financial openness on skewness in aggregate and in sectoral data is the centerpiece of the paper. For example in the case of the volatility of growth, Imbs (2007) shows that while high-growth sectors tend to be more volatile, in the aggregate data a component of aggregate volatility dominates which correlates negatively with growth, and hence an increase in sectoral volatility is not inconsistent with a decrease in aggregate volatility. I show that the negative effect of financial openness on sectoral output skewness is a phenomenon that is not averaged away in aggregate data. Combining this evidence with prior results on the positive effect of financial openness on growth implies that financial openness increases simultaneously growth and disaster risk. What are the combined welfare implications of these two effects would, of course, require a fully specified growth model, as well as a robust empirical test of the role of the government sector in insuring away not just excess volatility, but also excess negative skewness. While such an investigation is beyond the scope of this paper, it is certainly an exciting venue of future research.

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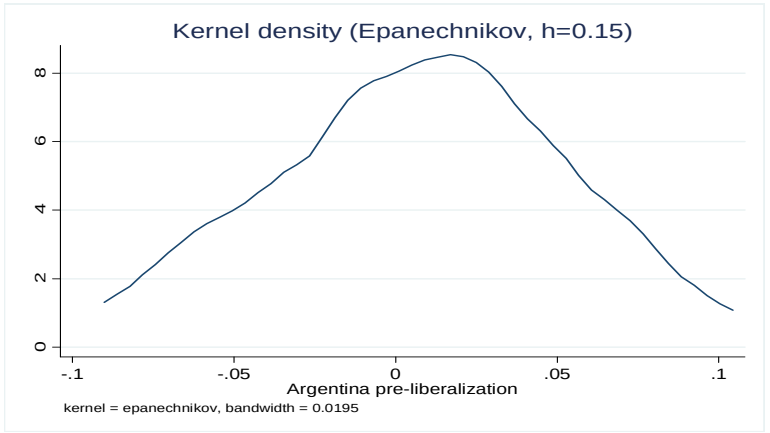
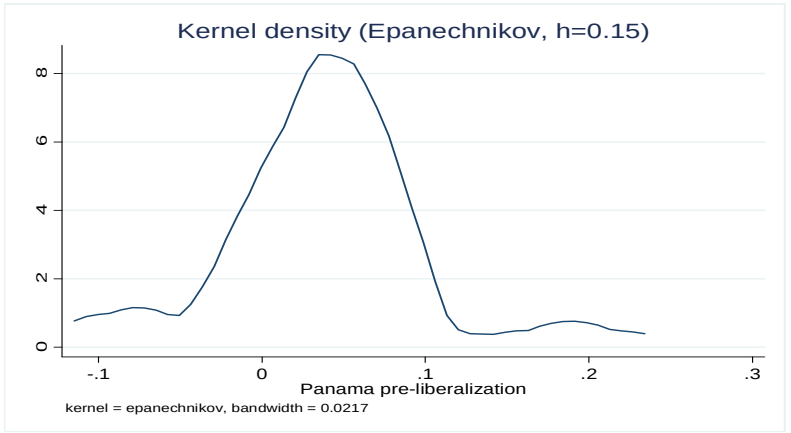
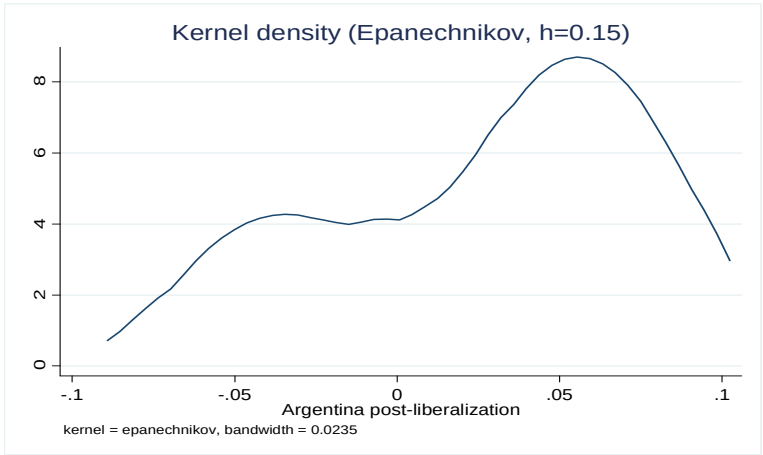
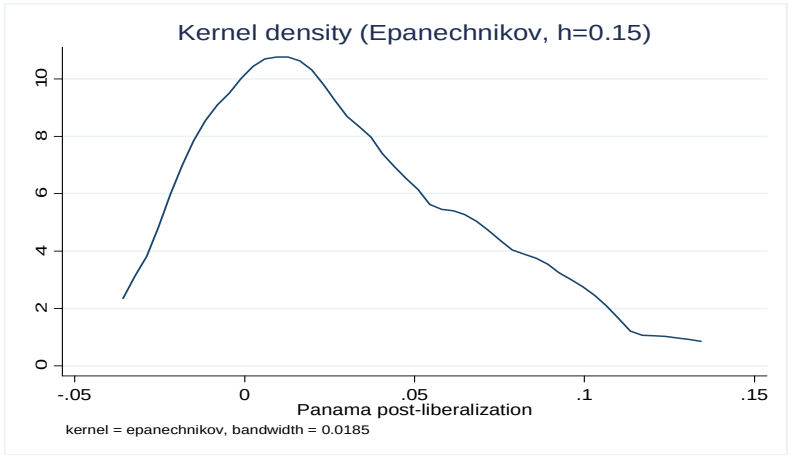
Figure 1.Kernel distribution of real GDP growth, pre- and post- liberalization: Argentina vs. Panama









Moments of real growth, pre- vs. post- liberalization event

	Argentina		Panama	
	Pre-	Post-	Pre-	Post
Mean	0.007	0.026	0.038	0.029
Standard deviation	0.042	0.043	0.059	0.034
Skewness	-0.118	-0.666	0.365	0.863

Table 1.
Volatility and skewness, pre- vs. post- liberalization event

Panel A. Output volatility			
	Liberalized	Non-liberalized	Difference
Pre-liberalization	0.046	0.054	0.008*
Post-liberalization	0.036	0.052	0.016***
Difference	-0.010***	-0.002	0.008**

Panel B. Output skewness			
	Liberalized	Non-liberalized	Difference
Pre-liberalization	-0.134	-0.067	0.067
Post-liberalization	-0.524	-0.133	0.391**
Difference	-0.390***	-0.066	0.324**

Note: The table reports difference-in-differences estimate from a Mann-Whitney two-sided test. 'Liberalized' are countries which have opened their equity markets to foreign portfolio investment. Output volatility and output skewness are averaged calculated over both the pre-liberalization and the post-liberalization period, for 1960-2009. For non-liberalized countries, the cut-off is at the average liberalization year for the sample, 1986. The statistical significance of the difference-in-differences estimate can be found next to the difference, where *** indicates significance at the 1% level. Sources: Penn Tables (2010) and Bekaert et al. (2005).

Table 2
Volatility, skewness, and liberalization

Country	GDP output volatility		GDP output skewness		Liberalization year
	Pre-liberalization	Post-liberalization	Pre-liberalization	Post-liberalization	
Algeria	0.092	0.025	-1.566	0.019	
Argentina	0.044	0.051	-0.375	-0.694	1989
Bangladesh	0.037	0.023	-1.118	-0.206	1991
Barbados	0.044	0.046	-0.308	-0.763	
Benin	0.055	0.044	1.242	-0.881	
Botswana	0.092	0.080	0.593	-0.153	1990
Brazil	0.044	0.020	-0.383	0.045	1991
Burkina Faso	0.063	0.029	1.533	0.152	
Cameroon	0.050	0.040	-0.097	-1.058	
Central African Republic	0.034	0.045	-0.690	0.052	
Chad	0.069	0.090	-0.192	2.151	
Chile	0.059	0.035	-1.442	-0.337	1992
Colombia	0.024	0.044	-0.306	1.330	1991
Congo, Republic of	0.070	0.056	-0.004	-0.074	
Costa Rica	0.043	0.025	-0.531	0.093	
Cote d`Ivoire	0.048	0.028	0.071	0.175	1995
Dominican Republic	0.051	0.038	-0.275	-0.295	
Ecuador	0.043	0.037	0.322	-1.655	1994
Egypt	0.050	0.016	0.686	1.009	1992
El Salvador	0.035	0.024	-1.022	-0.480	
Fiji	0.048	0.058	0.295	1.801	
Gabon	0.084	0.068	0.638	-0.347	
Gambia	0.053	0.076	0.647	2.511	
Ghana	0.126	0.043	0.298	-1.122	1993
Greece	0.041	0.024	-0.536	-0.872	1987
Guatemala	0.030	0.015	-0.101	-0.742	
Guyana	0.066	0.100	0.555	1.174	
Haiti	0.037	0.042	0.370	-0.154	
Honduras	0.052	0.033	0.058	-0.891	
Iceland	0.053	0.047	0.425	-1.234	1991
India	0.029	0.036	-0.295	0.794	1992
Indonesia	0.036	0.049	-0.410	-2.929	1989
Iran	0.100	0.046	-1.302	-1.604	
Israel	0.050	0.026	-0.027	-0.238	1993
Jamaica	0.046	0.033	0.224	1.931	1991
Japan	0.035	0.025	-0.271	-0.597	1983
Jordan	0.104	0.032	0.355	0.310	1995
Kenya	0.047	0.021	0.253	-0.521	1995
Korea	0.041	0.047	-0.773	-1.518	1992
Lesotho	0.078	0.040	0.279	-0.078	
Madagascar	0.033	0.063	-0.364	0.421	
Malawi	0.130	0.063	0.254	-0.479	
Malaysia	0.043	0.048	0.882	-1.651	1988
Mali	0.059	0.052	-0.402	0.135	
Malta	0.031	0.024	1.452	-1.288	1992
Mauritius	0.069	0.022	-0.188	0.670	1994
Mexico	0.038	0.044	-0.619	-0.713	1989

Morocco	0.073	0.047	0.437	-0.493	1988
Nepal	0.027	0.026	-0.164	-1.642	
New Zealand	0.039	0.019	0.719	-0.212	1987
Nicaragua	0.103	0.056	-1.157	-2.087	
Niger	0.059	0.071	-1.156	0.247	
Nigeria	0.078	0.089	0.404	0.140	1995
Norway	0.016	0.019	-0.017	-0.080	
Oman	0.080	0.056	0.474	-0.505	1999
Pakistan	0.032	0.035	0.623	-2.021	1991
Paraguay	0.040	0.030	0.680	0.183	
Peru	0.063	0.041	-0.635	0.165	1992
Philippines	0.037	0.049	-0.778	0.438	1991
Portugal	0.044	0.029	-1.279	-0.005	1986
Rwanda	0.077	0.172	0.594	1.114	
Saudi Arabia	0.029	0.051	0.447	0.073	1999
Senegal	0.046	0.035	0.688	0.826	
Sierra Leone	0.043	0.078	-0.262	-1.221	
South Africa	0.030	0.023	-0.347	-0.580	1994
Spain	0.045	0.022	0.403	-1.158	1985
Sri Lanka	0.039	0.019	-2.177	-1.572	1991
Swaziland	0.087	0.025	2.312	0.742	
Syria	0.094	0.059	0.692	-1.244	
Thailand	0.053	0.047	-1.287	-1.286	1987
Togo	0.061	0.057	-0.679	-0.221	
Trinidad and Tobago	0.060	0.073	-0.335	0.211	1997
Tunisia	0.050	0.017	0.552	-0.628	1995
Turkey	0.057	0.048	0.693	-0.670	1989
Uruguay	0.050	0.060	-0.013	-0.921	
Venezuela	0.053	0.064	-0.561	0.009	1990
Zambia	0.067	0.119	-0.185	3.026	
Zimbabwe	0.088	0.095	-0.116	-0.710	1993

Note: Output volatility and output skewness are averaged calculated over both the pre-liberalization and the post-liberalization period, for 1960-2009. For non-liberalized countries, the cut-off is at the average liberalization year for the sample, 1986. Sources: Penn Tables (2010) Bekaert, Harvey, and Lundblad (2005).

Table 3
Industry characteristics

Two-Digit ISIC Sector	External dependence	Growth opportunities	Liquidity needs	Exports/ Output	Imports/ Output
15. Food and beverages	-0.118	0.056	0.10	0.168	0.239
16. Tobacco manufacturing	-0.459	0.045	0.24	0.158	0.591
17. Textile mills products	-0.067	0.072	0.16	0.209	1.127
18. Wearing apparel and fur	-0.489	0.062	0.20	1.047	0.797
19. Leather and leather products	-0.996	0.027	0.245	0.654	2.057
20. Wood products	0.058	0.079	0.15	1.499	8.130
21. Paper and allied products	-0.052	0.074	0.11	0.184	0.729
22. Printing and publishing	-0.120	0.089	0.08	0.065	0.173
23. Petroleum and coal products	-0.065	0.009	0.105	0.201	1.037
24. Chemicals and allied products	0.306	0.031	0.14	0.413	1.417
25. Rubber and plastic products	-0.031	0.052	0.14	0.276	1.073
26. Stone, clay, glass and concrete	0.083	0.040	0.16	0.420	1.486
27. Primary metals	0.083	0.040	0.155	0.861	1.624
28. Fabricated metal products	-0.067	0.043	0.18	0.183	0.577
29. Industrial machinery and equipment	0.058	0.030	0.21	3.878	12.188
30. Office, accounting, and computing	0.058	0.030	0.21	0.484	2.205
31. Electrical and electronic equipment	0.441	0.044	0.21	0.484	2.205
32. Radio, television, and communications	0.244	0.044	0.21	0.484	2.205
33. Medical, precision, and optical instruments	0.473	0.026	0.21	0.484	2.205
34. Other transportation equipment	0.129	0.056	0.15	1.499	8.130
35. Furniture; miscellaneous manufacturing	0.031	0.049	0.21	1.035	4.941

Note: The table reports summary statistics from industry-specific control variables. 'External dependence' is the sector's median value of capital expenditures minus cash flows divided by capital expenditures for 1980-1990, for mature Compustat firms. 'Growth opportunities' is the sector's average median sales growth for 1980-1990, for mature Compustat firms. 'Liquidity needs' is the sector's median value of total inventories divided by total sales for 1980-1990, for mature Compustat firms. 'Exports/Output' is average exports in a particular sector divided by output in a particular sector. 'Imports/Output' is average imports in a particular sector divided by output in a particular sector. Sources: Compustat and di Giovanni and Levchenko (2009).

Table 4
Financial openness and the volatility and skewness of aggregate output growth

	(1)	(2)	(4)	(5)
	Output volatility		Output skewness	
Liberalized	-0.0133	-0.0029	-0.4972	-0.5639
	(0.0055)***	(0.0059)	(0.2036)**	(0.2326)**
Post	-0.0023	-0.0008	0.0653	0.1140
	(0.0048)	(0.0048)	(0.1793)	(0.1894)
Log GDP per capita		-0.0007		0.0296
		(0.0031)		(0.1204)
Government spending / GDP		0.0005		0.0083
		(0.0003)*		(0.0111)
Secondary school enrollment		0.0002		0.0135
		(0.0002)		(0.0060)**
Log life expectancy		-0.0625		-2.5095
		(0.0202)***		(0.7977)***
Population growth		0.0041		0.1320
		(0.0028)		(0.1084)
Log inflation		0.0051		-0.0447
		(0.0025)**		(0.1002)
Observations	156	150	156	150
R-squared	0.06	0.20	0.04	0.09

Note: The table reports estimates from fixed effects regressions where the dependent variable is the standard deviation (Columns labeled 'Output volatility') or the skewness (Columns labeled 'Output skewness') of the distribution of the growth rates of output during the years before or after an episode of financial liberalization. 'Liberalized' is a dummy variable equal to 1 if a country is liberalized in a given period. Liberalization dates come from Bekaert et al. (2005). 'Post' is a dummy variable equal to 1 after a liberalization event for all countries, irrespective of whether they liberalized or not. For non-liberalized countries, the dummy takes a value of 1 after the mean liberalization year for the sample, 1986. 'Log GDP per capita' is the natural logarithm of the beginning-of-period GDP per capita. 'Government spending/GDP' is the average ratio of government spending to GDP over the period. 'Secondary school enrollment' is the ratio of secondary school enrollment to total enrollment. 'Log life expectancy' is the natural logarithm of average life expectancy over the period. 'Population growth' is average growth rate of the population over the period. 'Log inflation' is the natural logairthm of average inflation over the period. Standard errors appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. All data definitions and sources in Appendix.

Table 5
Financial openness and the skewness of aggregate output growth: Accounting for financial development, trade openness, and institutions

	(1)	(2)	(3)	(4)
	Output skewness			
Liberalized	-0.6364	-0.5284	-0.5943	-0.4426
	(0.2361)*	(0.2331)***	(0.2331)**	(0.2360)*
Post	0.0874	(0.1012)	0.1126	0.0327
	(0.1878)	(0.1900)	(0.1895)	(0.1885)
Log GDP per capita	0.0749	0.0233	0.0440	0.0827
	(0.1203)	(0.1200)	(0.1205)	(0.1200)
Government spending / GDP	0.0095	0.0089	0.0076	0.0092
	(0.0109)	(0.0111)	(0.0111)	(0.0109)
Secondary school enrollment	0.0171	0.0122	0.0131	0.0152
	(0.0061)***	(0.0060)**	(0.0059)**	(0.0061)**
Log (life expectancy)	-2.5483	-2.3476	-2.7431	-2.6525
	(0.7865)***	(0.8026)***	(0.8137)***	(0.8041)***
Population growth	0.1164	0.1311	0.1555	0.1431
	(0.1071)	(0.1080)	(0.1095)	(0.1077)
Log (inflation)	-0.1593	-0.0108	-0.0498	-0.1254
	(0.1110)	(0.1025)	(0.0999)	(0.1136)
Private credit / GDP	-0.0089			-0.0085
	(0.0039)**			(0.0039)**
Trade openness		0.0029		0.0029
		(0.0020)		(0.0020)
Constraints on executive			0.0907	0.1037
			(0.0667)	(0.0659)*
Observations	150	150	150	150
R-squared	0.12	0.10	0.10	0.13

Note: The table reports estimates from fixed effects regressions where the dependent variable is the skewness of the distribution of the growth rates of output during the years before or after an episode of financial liberalization. 'Liberalized' is a dummy variable equal to 1 if a country is liberalized in a given period. Liberalization dates come from Bekaert et al. (2005). 'Post' is a dummy variable equal to 1 after a liberalization event for all countries, irrespective of whether they liberalized or not. For non-liberalized countries, the dummy takes a value of 1 after the mean liberalization year for the sample, 1986. 'Log GDP per capita' is the natural logarithm of the beginning-of-period GDP per capita. 'Government spending/GDP' is the average ratio of government spending to GDP over the period. 'Secondary school enrollment' is the ratio of secondary school enrollment to total enrollment. 'Log life expectancy' is the natural logarithm of average life expectancy over the period. 'Population growth' is average growth rate of the population over the period. 'Log inflation' is the natural logairthm of average inflation over the period. 'Private credit/GDP' is the ratio of credit to the private sector to GDP. 'Trade openness' is the average degree of openness to trade. 'Constraints on executive' is an index of executive checks and balances in the country. Standard errors appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. All data definitions and sources in Appendix.

Table 6
Financial liberalization and the skewness of industry-level output growth:
OLS and Propensity score matching results

	(1)		(2)
	Output skewness		
	OLS		PSM
Liberalized	-0.8745		-0.4348
	(0.3481)**		(0.1106)***
Post	0.2576		0.2212
	(0.2013)		(0.1873)
Initial share	-0.8365		-0.5056
	(0.8621)		(0.8825)
Exports/Output × Trade openness	-0.1160		0.0982
	(0.1940)		(0.3367)
Imports/Output × Trade openness	0.0248		-0.0512
	(0.0650)		(0.0948)
Log GDP per capita	-1.0614		-0.5170
	(0.4608)**		(0.1332)***
Private credit/GDP	1.7668		3.2212
	(0.6134)***		(1.2105)***
Private credit/GDP × External dependence	0.0908		0.1845
	(0.4873)		(0.8239)
Private credit/GDP × Growth opportunities	-0.1014		0.0739
	(0.0566)*		(0.0985)
Private credit/GDP × Liquidity needs	-0.0335		0.0264
	(0.0234)		(0.0575)
Log population	0.2827		0.3914
	(0.4194)		(0.0719)
Log population × Liquidity needs	0.0057		-0.0002
	(0.0043)		(0.0027)
Fixed effects		Country	
		Industry	
Observations	1052		526
R-squared	0.14		0.34

Note: The table reports estimates from fixed effects regressions where the dependent variable is the skewness of the distribution of the growth rates of output during the years immediately before or immediately after an episode of financial liberalization. 'Liberalized' is a dummy variable equal to 1 if a country is liberalized in a given period. Liberalization dates come from Bekaert et al. (2005). 'Post' is a dummy variable equal to 1 after a liberalization event for all countries, irrespective of whether they liberalized or not. For non-liberalized countries, the dummy takes a value of 1 after the mean liberalization year for the sample, 1986. 'Initial share' is the beginning-of-period share of output in a sector in total manufacturing output. 'Exports/Output' are exports in a particular sector divided by output in a particular sector. 'Imports/Output' are imports in a particular sector divided by output in a particular sector. 'Trade openness' is average degree of openness to trade. 'Log GDP per capita' is the logarithm of average GDP per capita in the period before and after a liberalization event. 'Private credit/GDP' is the ratio of credit to the private sector to GDP. 'External dependence' is the sector's median capital expenditures minus cash flows divided by capital expenditures. 'Growth opportunities' is the sector's median sales growth. 'Liquidity needs' is the sector's median inventories over sales. 'Log population' is the logarithm of total population. Estimates from OLS regressions (Columns labeled "OLS") and from propensity score matching regressions (Columns labeled "PSM"). Standard errors clustered at the country × time level appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. All variable definitions and sources in Appendix.

Table 7
Financial openness and the skewness of industry-level output growth: Industry characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Output skewness					
Liberalized × External dependence	-0.1385					
	(0.3405)					
Liberalized × Growth opportunities		-0.1012				
		(0.0458)**				
Liberalized × Liquidity needs			-0.0366			
			(0.0163)**			
(Foreign liabilities/GDP) × External dependence				-0.3691		
				(0.5101)		
(Foreign liabilities/GDP) × Growth opportunities					-0.0680	
					(0.0370)**	
(Foreign liabilities/GDP) × Liquidity needs						-0.0372
						(0.0159)**
Post	0.0393	0.1701	0.1857	-0.8980	-0.9234	-0.8645
	(0.1811)	(0.1789)	(0.1896)	(0.8789)	(0.8780)	(0.8821)
Fixed effects			Country × Time			
			Industry			
Observations	1052	1052	1052	1032	1032	1032
R-squared	0.12	0.13	0.13	0.12	0.12	0.13

Note: The table reports estimates from fixed effects regressions where the dependent variable is the skewness of the distribution of the growth rates of output during the years before and after an episode of financial liberalization. 'Liberalized' is a dummy variable equal to 1 if a country is liberalized in a given period. Liberalization dates come from Bekaert et al. (2005). 'Post' is a dummy variable equal to 1 after a liberalization event for all countries, irrespective of whether they liberalized or not. For non-liberalized countries, the dummy takes a value of 1 after the mean liberalization year for the sample, 1986. 'Foreign liabilities/GDP' is the country's capital liabilities divided by GDP. 'External dependence' is the sector's median value of capital expenditures minus cash flows divided by capital expenditures. 'Growth opportunities' is the sector's median sales growth. 'Liquidity needs' is the sector's median value of inventories over sales. The regressions include all other covariates from Table 6 (coefficients not reported for brevity). Standard errors clustered at the country × time level appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. All data sources in Appendix.

Table 8
Financial openness and the skewness of industry-level output growth: Empirical channels

	(1)	(2)	(3)	(4)
	Skewness of:			
	Capital	TFP	Establishments	Employment
Liberalized	-0.4653	-0.1668	0.0819	-0.1505
	(0.2262)**	(0.2420)	(0.2750)	(0.2038)
Post	-0.1172	0.4479	0.8606	0.4112
	(0.2155)	(0.2414)*	(0.2638)***	(0.1820)**
Fixed effects	Country			
	Industry			
Observations	665	619	911	1050
R-squared	0.19	0.22	0.28	0.11

Note: The table reports estimates from fixed effects regressions where the dependent variable is the skewness of the distribution of growth rates of capital, TFP, establishments, and employment. 'Liberalized' is a dummy variable equal to 1 if a country is liberalized in a given period. Liberalization dates come from Bekaert et al. (2005). 'Post' is a dummy variable equal to 1 after a liberalization event for all countries, irrespective of whether they liberalized or not. For non-liberalized countries, the dummy takes a value of 1 after the mean liberalization year for the sample, 1986. The regressions include all other covariates from Table 6 (coefficients not reported for brevity). Standard errors clustered at the country×time level appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. All data sources in Appendix.

Table 9
Financial openness and the skewness of industry-level output growth: Heterogeneity

	(1)	(2)
	Skewness	
	OLS	2SLS
Liberalized × Constraints on executive	0.1055	0.3721
	(0.0855)	(0.2430)*
Liberalized × Private credit/GDP	-0.5200	0.2272
	(0.3693)	(2.2453)
Liberalized × Trade openness	-0.7788	-0.6927
	(0.1502)***	(0.2617)***
Liberalized × Secondary school enrollment	-0.0057	-0.0198
	(0.0055)	(0.0215)
Liberalized × Latin America dummy	-0.3581	-0.4303
	(0.2990)	(0.5775)
Liberalized × Asia dummy	-0.2920	-0.3494
	(0.2458)	(0.2954)
Fixed effects	Country	
	Industry	
Observations	898	876
R-squared	0.15	0.15

Note: The table reports estimates from fixed effects regressions where the dependent variable is the skewness of the distribution of the growth rates of output during the years immediately before or immediately after an episode of financial liberalization. 'Liberalized' is a dummy variable equal to 1 if a country is liberalized in a given period. Liberalization dates come from Bekaert et al. (2005). 'Post' is a dummy variable equal to 1 after a liberalization event for all countries, irrespective of whether they liberalized or not. For non-liberalized countries, the dummy takes a value of 1 after the mean liberalization year for the sample, 1986. 'Constraints on executive' is an index of executive checks and balances in the country. 'Private credit/GDP' is the ratio of credit to the private sector to GDP. 'Trade openness' is the average degree of openness to trade. 'Secondary school enrollment' is the ratio of secondary school enrollment to total enrollment. 'Latin America dummy' is an indicator variable equal to 1 if the country is in Latin America. 'Asia dummy' is an indicator variable equal to 1 if the country is in Asia. The regressions include all other covariates from Table 6 (coefficients not reported for brevity). Estimates from OLS regressions (column (1)) and from 2SLS regressions (column (2)) where the private credit to GDP ratio and constraints on the executive have been instrumented using dummies for legal origin, from La Porta et al. (1998). Standard errors clustered at the country × time level appear below each coefficient in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Appendix. Variables and sources

Output	Total output in a particular industry in a particular country in a particular year, in constant US dollars. Source: Penn Tables and INDSTAT 2010 Rev. 3.
Liberalized	Dummy variable equal to 1 following the year in which the country liberalizes its stock market. Source: Bekaert et al. (2005).
Post	Dummy variable equal to 1 following the year in which the country liberalizes its stock market. For countries which did not, it equals 1 after the mean liberalization year in the sample. Source: Bekaert et al. (2005).
Initial share	The industry's share of output out of total manufacturing output in this country for a particular year. Source: INDSTAT 2010 Rev. 3.
Minimum growth	Difference between minimum growth experienced during the pre- or post-liberalization period and the average growth experience during that period, for each industry. Source: INDSTAT 2010 Rev. 3.
Population	Total population in the respective country. Source: Penn Tables.
Population growth	Average growth in the total population over the previous year. Source: Penn Tables and author's calculations.
GDP per capita	Average of total GDP divided by the population. Source: Penn Tables.
GDP growth	Average growth in GDP per capita over the previous year. Source: Penn Tables.
Trade openness	Exports and imports divided by GDP. Source: Penn Tables.
Secondary school enrollment	Average ratio of secondary school enrollment to total enrollment. Source: World Bank Development Indicators.
Years of schooling	Average years of schooling per person (male and female) in the country. Source: Barro and Lee Database.
Life expectancy	Average life expectancy at birth. Source: WB Development Indicators.
Inflation	Average inflation in the respective country over the previous year. Source: WB Development Indicators.
Constraints on executive	Average index of executive checks and balances on the executive branch of government. Source: Polity IV.
Private credit/GDP	Average value of total credits by financial intermediaries to the private sector in each country, available with annual frequency. Excludes credit by central banks. Calculated using the following deflation method: {(0.5)*[Ft/P_et + Ft-1/P_et-1]}/[GDP_t/P_at] where F is credit to the private sector, P_e is end-of period CPI, and P_a is average annual CPI. Source: Beck et al. (2010).
Foreign liabilities/GDP	Average total foreign liabilities over GDP. Source: Lane and Milesi-Ferretti (2007).
Government spending/ GDP	Average government spending as a share of total GDP. Source: Penn Tables.

Legal origin	A matrix of dummies for the origin of the country's legal system. Dummies take on the value of 1 if the respective country has English, French, German, or Nordic legal origin. Source: La Porta et al. (1998)
Exports/Output	Average exports in a particular sector divided by output in a particular sector. Adapted for ISIC Rev. 3 from Di Giovanni and Levchenko (2007).
Imports/Output	Average imports in a particular sector divided by output in a particular sector. Adapted for ISIC Rev. 3 from Di Giovanni and Levchenko (2007).
External dependence	The sector's median value of capital expenditures minus cash flows divided by capital expenditures, for mature Compustat firms. Adapted for ISIC Rev. 3 from Cetorelli and Strahan (2006).
Growth opportunities	The sector's median value of capital expenditures minus cash flows divided by capital expenditures, for mature Compustat firms. Adapted for ISIC Rev. 3 from Fisman and Love (2006).
Liquidity needs	The sector's median value of total inventories divided by total sales, for mature Compustat firms. Adapted for ISIC Rev. 3 from Raddatz (2006).