

Acknowledgements

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Abbreviations

CEPAL	Comisión Económica para América Latina y el Caribe, the United Nations Economic Commission for Latin America and the Caribbean (ECLAC)
GDF	Global Development Finance database
GDP	Gross Domestic Product
GLS	Generalised Least Squares
GNI	Gross National Income
IADB	Inter-American Development Bank
IMF	International Monetary Fund
ISI	Import Substitution Industrialisation
Latin America	The 15 countries that are included in the empirical research (Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Mexico, Paraguay, Peru, El Salvador, Uruguay and Venezuela)
MERCOSUR	Mercado Común del Sur
NAFTA	North American Free Trade Agreement
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
SITC	Standard International Trade Classification
SUR	Seemingly Unrelated Regression
UN COMTRADE	United Nations Commodity Trade Database
UNCTAD	United Nations Conference on Trade and Development
US	United States of America
WDI	World Bank's World Development Indicators database

1. Introduction

The ongoing globalisation has posed new challenges to Latin America. While at first, integration with the world trade markets went hand in hand with a surge in economic growth, it is also believed to expose the region to greater economic risk. Latin America is plagued by macroeconomic volatility. Recent economic crises fuel the heated debate about the ambiguous benefits of trade liberalisation.

Latin America has a long history of reforms and its liberalisation policies came to the close scrutiny of economists and international institutions. In the 1970s and 1980s Latin American countries were closed economies and the region's foreign trade was among the most distorted in the world (Edwards 1993). The economies were characterised by a high degree of state intervention. After years of disappointing economic performance Latin America embarked upon an ambitious liberalisation process. One after the other Latin American countries transformed their trade policies from strong protectionism towards a more outward oriented market economy. Encouraged by the IMF and the World Bank¹ they had opened up their markets to international trade and foreign investors and at the same time privatised their prime industries. This reform agenda – or Washington Consensus, as it was labelled by John Williamson (1990) – was centred around three policy goals: stabilisation, liberalisation and privatisation. There were high hopes for a more stable and prosperous future.

While the liberalisation process initially led to great successes, faith vanished in the 1990s when Mexico and Argentina were hit by severe economic crises, which rapidly spread throughout the continent. The Washington Consensus came under pressure. Even though reforms were aimed at growth and stability, numerous Latin American countries have been plagued by economic volatility and instability (e.g. Venezuela in the early 1990s, Mexico in 1994/95 and Argentina and Brazil in the end of the 1990s). This raises the question whether the reforms had reduced volatility at all. The liberalisation programme is alleged to expose Latin American economies to greater risk and it is claimed to be the cause of severe economic shocks in the region. Economist Dani Rodrik has even dubbed it the 'Washington Confusion' (2006). Stiglitz (2003) argued that the Washington Consensus treated the reforms as ends in themselves, not as means to achieving greater welfare and stability. The question is whether the reforms have made Latin American economies better equipped to weather the storm or have made them suffer from increased vulnerability.

In this thesis I investigate the determinants of macroeconomic volatility in Latin America. My main research question is:

What is the impact of trade liberalisation on macroeconomic volatility in Latin America?

¹ These institutions provided loans to Latin American countries under the condition of adhering to the Structural Adjustment Programmes, which included structural reforms.

In a quantitative research I analyse the determinants of volatility in Latin America over a period of 31 years (1970-2000). The time frame is dictated by data availability and it covers several years before, during and after the reforms were introduced in the various countries. From economic theory I derive various likely sources of growth volatility. In a pooled regression those variables are tested on their correlation with growth volatility. My focus is on the impact of the reform policies on macroeconomic stability. In addition, I examine how the size of the government might change the relationship between openness and volatility. If government expenditure is found to significantly mitigate any destabilising effect of openness, governments are given the ultimate instrument to enhance stability.

Latin America is an interesting case not only because it is notorious for its frequent booms and busts, but also because of its distinctive history of reform programmes. In the 1980s and 1990s all countries in the region liberalised their trade regimes to some extent. Some did it faster and more thorough than others, and with varying success rates. The economic crises that followed, worked as a pressure test for the sustainability of the trade reforms. In the light of recent crises the benefit of integration with the world markets has openly been questioned. My research contributes to the debate by providing insight in the mechanisms behind macroeconomic volatility in Latin America. I directly test the effects of trade liberalisation on volatility. If openness leads to macroeconomic instability I expect to find a positive effect of the openness variables on volatility. My research has important policy implications. By giving insight in the impact of government policies on macroeconomic volatility, it provides the authorities with tools to promote greater stability.

There is little consensus among economists about the effect of trade liberalisation on volatility. Unlike the relationship between trade openness and growth, the impact of openness on volatility has not been studied extensively. Neither theory nor empirics has been able to unambiguously establish the relationship between the two. A higher degree of trade openness may expose a country to more external shocks and thereby increase growth volatility. However, it may also cushion the effects of idiosyncratic shocks (Bejan 2006).

The number of studies that researched the impact of liberalisation policies on macroeconomic volatility is limited. Moreover, the studies that are available demonstrate conflicting results. It appears that the research sample is crucial for the results. Most researchers use a worldwide sample of countries. When the sample is split into more homogenous groups of developing and developed countries, the nature of the relationship changes radically (see e.g. Bejan 2006). Coefficients change sign or lose significance. Hence, one has to be careful when making policy recommendations based on results of a global cross-country study. Nevertheless, only few studies work with a regional sample. Ahmed and Suardi (2009) focus on Sub-Saharan Africa. Their findings are at odds with several studies that used a global sample. It demonstrates that what holds for a worldwide sample does not necessarily hold for a regional sample. By focusing on Latin America my sample consists of a more homogenous group of countries and my results are more tailored to the local situation.

Even though numerous papers have been written about the liberalisation policies in Latin America, to my knowledge there has not been a formal, empirical analysis of the impact of the reforms on

macroeconomic volatility. This is surprising, since the welfare costs of volatility are large. Volatility has important implications for economic growth. Hausmann and Gavin (1995) have attempted to quantify the impact on growth and find that volatility accounts for almost a third of the growth gap. Had Latin America experienced the same level of macroeconomic volatility as industrial economies, its annual economic growth would have been 1 percentage point higher than it actually was.

My methodology facilitates the exploration of the time dimension of the data. Most researchers use variables that have been averaged over multiple years, leaving only few observations in the time dimension. Their focus is on cross-country differences, rather than on changes within a country over time. Valuable information may get lost when multiple-year averages are used. Unlike the cross-country studies, my study has an important time dimension. Using a rolling window to calculate the volatility measure I maintain yearly observations for all variables. With a time span of 31 years, that enables me to include the effects of gradual changes over time.

My main results show that the structural reforms have impacted growth volatility significantly. Trade liberalisation has decreased volatility, whereas privatisation has increased it. The effect of financial liberalisation cannot be determined due to a lack of consistency and significance. My results show that it is essential to distinguish between the policy aspect of trade liberalisation and the factual level of trade openness. *De facto* trade openness did not significantly impact volatility. Hence, liberalising trade by lowering import tariffs was successful in reducing volatility whereas the resulting trade openness had no significant effect. Financial openness is found to be associated with increased volatility, but this effect can be mitigated by increasing the size of the government.

My thesis is structured as follows. In the next section I describe the reform process in Latin America. I analyse the background of the structural reforms and their (socio-)economic effects. In chapter 3 I build the theoretical framework that underpins my empirical research and I discuss the relevant literature. In chapter 4 I describe the data and set out the methodology for my data analysis. I explain my econometric approach. The results are presented in chapter 5. I start with a preliminary investigation and then interpret the results of my formal analysis. I finish off with my conclusion in which I summarise the results and make some suggestions for further research.

2. Three decades of reforms

For Latin American countries the period 1970-2000 is marked by a dramatic shift in economic policy. Despite their differences in culture, history, size, population and level of development, the Latin American countries followed a similar development in trade policy. Over the course of three decades they moved away from protectionism towards a market oriented economy. After a series of crises in the 1980s, the authorities adopted reform measures aimed at macroeconomic stabilisation and the reduction of structural imbalances. Latin American governments liberalised their trade regimes and capital markets. The reforms were accompanied by large-scale privatisation of state-owned enterprises.

The same three decades are known for their macroeconomic volatility. Despite the reforms many of the Latin American countries encountered recurring inflation surges, debt crises and balance-of-payment difficulties. Economic performance was disappointing: GDP growth was low and volatile. Between 1970 and 2000 GDP per capita grew annually just above 1 percent, whereas East Asian countries achieved an annual per capita growth of almost 6 percent in the same period (author's calculations, based on WDI data). In the 1990s Latin American countries became more integrated into the world economy, thereby increasing their exposure to international fluctuations.

This chapter provides an analysis of the Latin American evolution of economic policy and performance in the 20th century, with a special focus on the last three decades. It highlights the effects of the policy changes on the macroeconomic conditions and social indicators.

2.1 Import substitution industrialisation

For a good understanding of Latin American economic policy in the 1970s we have to go back a few more decades. In the first decades of the 20th century Latin American economies achieved relative high levels of income per capita by their export led growth. During the *belle époque*² the share of exports in GDP increased from 10 percent to 25 percent (Bértola and Williamson 2003). Compared to the periphery Latin America was relatively rich. Income per capita levels were at 50 percent of European levels (Bértola and Williamson 2003).

The Great Depression of the 1930s marks a turning point in Latin American economic policy. The sudden worldwide economic downturn severely affected Latin American economies. Large external shocks in the trade and capital markets shattered the authorities' believe in free trade. Prices of primary products – Latin America's main export product – collapsed. With import prices falling less steeply, Latin America's terms-of-trade deteriorated dramatically. Capital inflows plummeted and, together with the fall in export revenue, that led to great balance-of-payments problems (Diaz Alejandro 1982). GDP per capital fell to nearly 30 percent of its pre-depression value (Meller 2000).

² From the late 19th century until 1914.

The depression revealed the vulnerability of the Latin American economies. Many, including CEPAL, thought Latin American countries were better off in autarky (Taylor 1998).

Import substitution industrialisation policy (ISI) became the prevailing development paradigm in Latin America until the end of the 1980s. The core idea of ISI was that industrialisation is the key to economic progress. Latin American countries had to undergo an industrial revolution similar to the one that had brought prosperity to Europe and the US in the 19th century. Latin America had to build a large, modern manufacturing industry in order to develop. Industrialisation was alleged to increase technology transfer and thereby raise productivity, ultimately leading to income per capita growth (Love 2005).

Not only would ISI enable Latin American countries to develop and protect their industries and move away from poverty, it would also shelter their economies from external shocks. Latin America was hard hit by the external shocks of the Great Depression. ISI was promising in making the economies less vulnerable and reducing economic volatility. The IADB and even the World Bank acknowledged the advantages of the domestic focus of ISI (Love 2005).

The main tools to promote ISI were state-led industrialisation and trade protection. Not market forces, but large-scale planning was the instrument to achieve industrialisation. Moreover, the domestic rather than the international market was believed to be the engine of economic growth. Imports from rich countries were to be replaced by domestic substitutes. There was an active role for governments in achieving this. The state had to initialise development of manufacturing industries. In addition, it had to protect infant industries in order to allow them some start-up time before entering into competition with foreign firms (Meller 2000).

In order to implement the ISI strategy, Latin American governments introduced large-scale protection programmes. The authorities raised import tariffs and quotas. Governments set up state-intervention programmes to protect upcoming industries. Import for tens of thousands of goods were subjected to extensive regulation, quotas, restrictions and exemptions. Latin American import tariffs were among the highest of the developing world (Table 1).

Table 1. Import protection worldwide, 1985

	Total tariff protection* (%)
Central America	66
South America	51
Caribbean	17
North Africa	39
Other Africa	36
West Asia	5
Other Asia	25

*weighted average
 Source: Edwards (1993)

Economic growth picked up in many Latin American countries. In the ISI period annual GDP growth in the 6 largest economies was twice as great as in the export era (1900-1940) and it was more than four times larger than in the neoliberal time (1980-2000) (Love 2005). Moreover, growth rates were significantly less volatile than in earlier decades (Astorga et al. 2005). ISI policy turned out to be successful in increasing the share of manufacturing in the national product.

Despite these achievements ISI was not quite a success story. What started as an industrialisation programme aimed at decreasing Latin America's vulnerability and promoting independent development turned out to bring forth severe distortions that had been unaccounted for. The ISI growth strategy was unsustainable. By the end of the 1980s the economic state-of-affairs in most Latin American countries was deplorable. Increasing trade deficits, sky rocketing inflation, growing public deficit, recurring debt crises and growing income inequality were prevalent problems in all Latin American countries.

2.2 Amassment of problems

The high degree of protection under ISI created an inefficient manufacturing sector. High tariffs, quotas and other policies provided a permanent shelter for certain manufacturing industries. The protectionist system led to rent-seeking behaviour: an influential lobby for a preference treatment became more profitable than investing in efficiency improvements (Jenkins 1997). A constant group of stakeholders effectively lobbied for their extreme benefits to be continued. Protective measures were rarely reduced. It resulted into a very low productivity growth in most Latin American countries. Moreover, labour and resources were withdrawn from productive sectors and employment creation was slow. Paradoxically, the import substitution policy that was aimed at the development of a productive industrial sector resulted into the creation of a non-productive sector with very productive lobbyists.

The import tariffs and other restrictive policies had made Latin American economies inward looking. Openness, in terms of both trade and capital, was low. Their retreat from the global market was rapid and long lasting (Taylor 1998). As a result of the tariffs the domestic prices of many imported products were a manifold of the prices on the international market. Shelter from foreign competition had allowed domestic manufacturers to charge monopoly prices for their products. With price levels that were 20, 50 or even 300 percent higher than international price levels many products were out of reach for the average household. Moreover, the locally produced substitutes were often of much lower quality (Edwards and Lederman 2009).

In capital-intensive industries such as mining, energy, steel and telecommunication large state-owned companies had been set up. The creation of a solid manufacturing industry was considered to be too important to be left to foreign investors. The state-owned manufacturing firms paid high salaries and offered generous health and retirement benefits. Workers who were not that fortunate to be employed in one of the protected companies frequently worked in the informal sector at a much lower wage.

Amounting 12 percent of the total labour force, informality was widespread in Latin America in 1970 (Edwards and Lederman 2009).

ISI was disastrous for the export sector. Import barriers increased the cost of inputs that were needed for the production of export goods. Many Latin American governments kept their exchange rate overvalued in order to subsidise capital formation and keep inflation under control. However, exporters suffered from the overvalued exchange rate that made their products uncompetitive in the global market. Edwards and Lederman (2009) calculated that by the end of the 1960s the overvaluation of the Chilean peso was equivalent to an export tax of approximately 30 percent. Due to the anti-export bias the relative importance of exports remained low, as can be judged from its share in GDP (Table 2). Except for Chile, which reformed its trade policy in the 1970s, the ratio of exports over GDP barely increased between 1960 and 1980. Growth of the exports share in GDP lagged behind in comparison with other parts of the world. Additionally, the level of export diversification remained low. Natural resources continued to provide the largest share of export revenue (Love 2005). The low export diversification increased the economies' vulnerability. One year of bad harvest could curtail the import capacity, causing an industrial recession (Mahon 1992).

Table 2. Share of exports in GDP in selected countries and continents (%), 1960-2000

	1960	1970	1980	1990	2000
Brazil	7.1	7.0	9.1	8.2	10.0
Chile	13.5	14.6	22.8	34.0	31.6
Mexico	8.5	7.7	10.7	18.6	30.9
Venezuela	27.1	20.9	28.8	39.5	29.7
Latin America (simple average)	11.7	10.9	14.6	17.3	21.4
East Asia & Pacific	13.1	13.3	19.1	18.8	23.4
Sub-Saharan Africa	12.1	13.6	18.7	18.9	24.4
Middle East & North Africa	... ³	32.9	46.1	34.9	39.2
OECD members	11.2	12.9	17.5	17.3	22.2

Data source: World Development Indicators

Despite high import tariffs the region remained dependent on the imports of capital goods and intermediate inputs. Since the share of imports in GDP remained high and the export sector was neglected, Latin American countries were running large trade deficits. The disparity caused recurring balance-of-payment pressures. These were usually solved with adding new layers of regulation to tighten imports further. The underperforming export sector did not generate enough foreign exchange to pay for the imports. These deficits were initially financed by foreign borrowing, but when credits dried up governments spent the international reserves held by the central banks (Edwards and Lederman 2009).

Macroeconomic conditions deteriorated in the 1970s and 1980s. In the 1970s the world was hit by the oil crisis. Oil prices tripled in 1973 and peaked again in 1979 (Edwards and Lederman 2009). Oil importing countries suffered from terms-of-trade deterioration (since the prices of imports relative to

³ Data for the Middle East & North Africa are not available until 1968.

those of exports had increased). The global recession curtailed export revenues and foreign investment in Latin America even further. In an attempt to cushion the effects, governments borrowed heavily from the rest of the world. In Latin America the ratio of debt over GNI rose from its pre-crisis level of 26 percent in 1973, to 41 percent in 1980 and 82 percent in 1985 (Figure 1). Debt service payments were so high that net financial flows turned negative.

Fig. 1. External debt stock as % of GNI

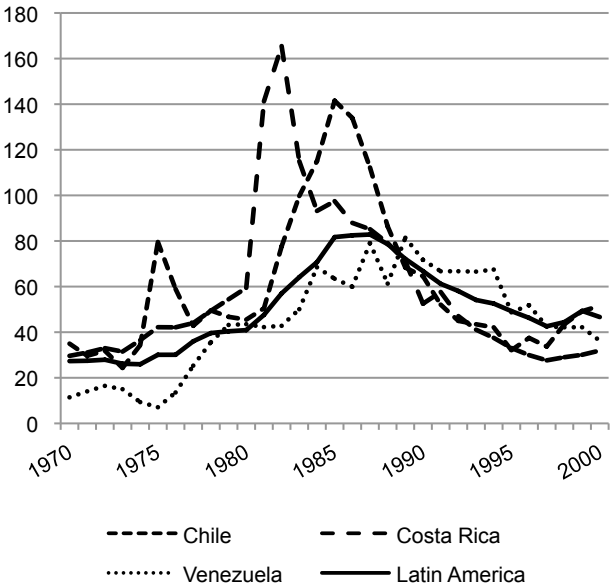
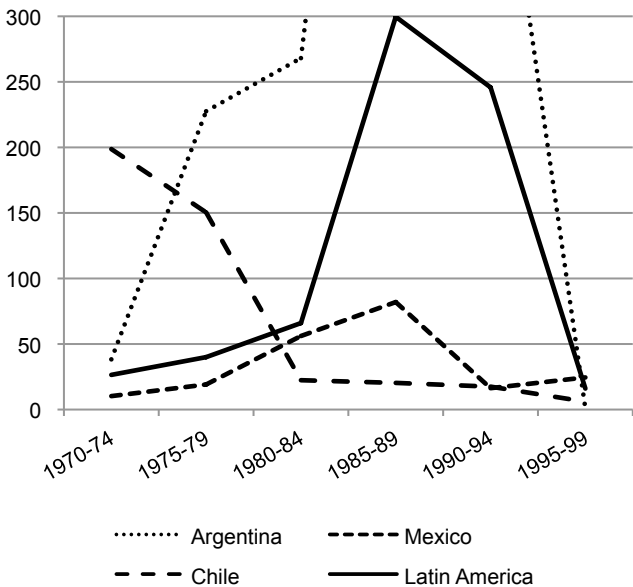


Fig. 2. Inflation, consumer prices, 5-year average



Data source: World Bank Global Development Finance.

Especially in the 1980s, in the aftermath of the oil shock, the public deficit rose rapidly. Central banks were pressured by the authorities to grant extensive loans. Some of them simply turned to the money printing machines. Inflation was a major problem throughout Latin America. In the late 1980s the average rate of inflation was a striking 300 percent (Figure 2). The consequences were severe: credit supply dried up rapidly, investments plummeted and the purchasing power of savings, pensions and wages eroded quickly.

In 1982 Mexico was unable to fulfil its financial liabilities – in spite of its considerable oil revenues – and defaulted on its debt. The crisis was the result of a long chain of policy failures and economic malperformance. The Mexican peso lost 75 percent of its value and the government could not repay its loans since those were denoted in foreign currencies, mostly US dollars. The Mexican crisis was only the beginning of the so called ‘decada perdida’, Latin America’s lost decade of the 1980s. A severe economic crisis unfolded throughout the continent. Country after country faced financial difficulties. Real GDP per capita in 1990 was almost 7 percent lower than in 1980 (author’s calculation based on WDI data).

It became clear that the strategy of industrialisation through import substitution was incapable of providing sustainable economic growth. ISI policy was being criticised for creating price distortions that

harmful economic growth. Furthermore, it had failed to make the economies less dependent on the international markets. There was a growing consensus that reforms were needed to bring stability and economic growth to Latin America. The debt shock of the 1980s forced the Latin American countries to turn to the IMF and World Bank for support. The international financial institutions encouraged the adoption of a market-based reform strategy. The success of early reformer Chile and the rapid export-led growth of the East Asian economies paved the way for outward oriented reforms.

2.3 Early reformers

As early as the 1970s the economic performance of several East Asian countries attracted the attention of development economists. Until the late 1950s Korea and Taiwan had adopted an import substitution development model similar to that of most Latin American countries. In the 1960s they embarked on a reform programme in order to reduce distortions and promote export. Export incentives were established and at the same time the multiple (overvalued) exchange rates, high import tariffs, quotas, foreign exchange restrictions and other controls were dismantled. The achievements were remarkable. With double-digits Korea's and Taiwan's GDP growth rates were much larger than in any other country at the time. What is more, unemployment and poverty were reduced significantly (Bruton 1998).

The comparison between East Asia and Latin America was often drawn and it was not difficult to conclude that the latter's economic performance lagged behind (Loayza and Palacios 1997). The East Asian success encouraged Latin American policymakers to adopt a market oriented development strategy. Chile was Latin America's pioneer of trade liberalisation. Under the military Pinochet regime Chile adopted the recommendations of a group of Chilean economists educated in Chicago who were advocates of the neoclassical free trade model (Teichman 2004). The Chilean liberalisation period started with the Minister of Finance's statement that:

"Chile's best prospects for growth are in opening to international competition."

(quotation from Edwards 1993)

The government embarked upon a unilateral liberalisation process and drastically reduced tariff rates. Between 1973 and 1976 the average applied tariff was lowered from 100 percent to 33 percent, before it was set to a uniform level of 10 percent in 1979 (Edwards and Lederman 2009). At the same time, the share of trade in GDP grew from less than 30 percent in 1973 to more than 50 percent in 1976 (WDI data). Alongside the tariff reductions the government stimulated the export sector, especially non-traditional exports.

The economic restructuring has not been smooth. Critics pointed at the harmful effects of the reforms on employment and social conditions, but resistance was suppressed by the authoritarian regime. In the first years of the transition Chile was struck by double-digit unemployment rates, but after 1986 unemployment was the lowest in the region (Edwards and Lederman 2009). Moreover, as a consequence of the new exchange rate policy the peso appreciated unsustainably, causing severe balance-of-payments difficulties. Chile ran out of reserves, had to devalue its currency significantly

and the economy entered into a deep recession. Despite the major economic crash in 1982-85, a shift in power in 1989 (from military regime to democratic government) and harsh criticism Chile continued its liberalisation process (Edwards and Lederman 2009).

Since the reforms, Chile's economic performance is unlike that of the other Latin American countries. Chile rapidly achieved the highest level of trade openness in the region (according to the trade openness index of Escaith and Paunovic 2004). Since the early 1980s the share of exports in GDP has increased continuously. Chilean income per capita rapidly caught up with the Latin American average and since the 1990s Chile has one of the highest income per capita levels in the region. Poverty rates are the lowest of the continent.

2.4 Liberalisation policy

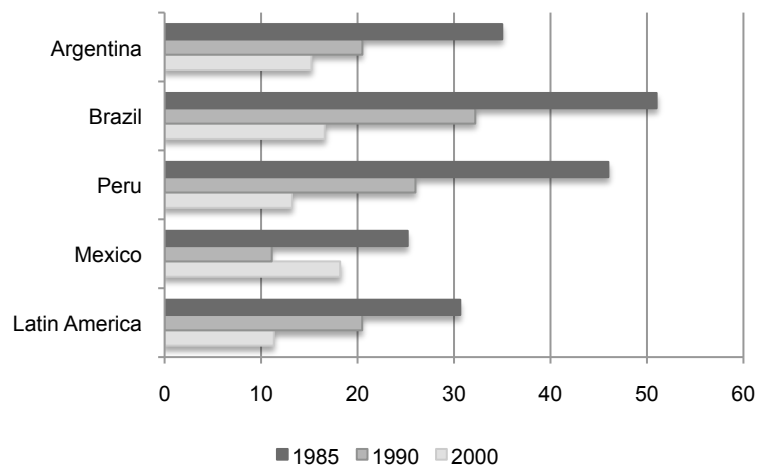
In the late 1980s and early 1990s more Latin American countries followed Chile's example. One by one they embarked on some kind of reform programme. Liberalise, stabilise and privatise, was the development mantra (Rodrik 2006). In an influential article John Williamson (1990) summarised the ongoing reform process in Latin America. He listed the core of policy advice addressed by the IMF and World Bank in 10 policies⁴. Williamson's contribution became known as the Washington Consensus. Hopes were high that this neoliberal wind could bring stability and economic growth to the crisis-plagued continent.

The restructuring was not a uniform process; the pace, scope and degree of the reforms differed significantly from country to country. There was a wide variety in modernisation policies. Certain countries – Chile, Argentina, Bolivia and Peru – were considered to be aggressive reformers (Ocampo 2004). These countries implemented far-reaching reforms in a short period of time. In addition, the scope of their reform packages was wide: it was not limited to the trade and capital markets, but it also covered the privatisation of state-owned companies and it usually included a stabilisation programme. Others restructured their economy more gradually. Brazil, Colombia, Costa Rica and Mexico were more cautious reformers.

Despite these differences, some generalisations can be made. The reforms were aimed at stability and economic growth. Throughout Latin America fiscal deficits were reduced, progress was made on the reduction of capital controls, tariffs were lowered and taxes reformed. On average tariffs were reduced from 30 percent in 1985 to just over 10 percent fifteen years later (Fig. 3). Latin American governments implemented mass privatisation programmes. Revenues from privatisation amounted to over 10 percent of GDP in Argentina, Bolivia, Paraguay and Peru (Chong and López-de-Silanes 2003). Between 1988-93 more than half of worldwide divestitures occurred in Latin America (Birdsall et al. 1998).

⁴ The Washington Consensus list: 1. Achieve fiscal balance. 2. Target public expenditures at reducing poverty and improving social conditions of the poor. 3. Reform taxes in order to reduce evasion and increase revenues. 4. Liberalise the capital account. 5. Avoid an overvalued exchange rate. 6. Reduce trade protection. 7. Encourage FDI. 8. Privatise state-owned companies. 9. Deregulate business transactions. 10. Improve legal protection of property rights. (Williamson 1990).

Fig. 3. Tariff rates (%), selected countries.

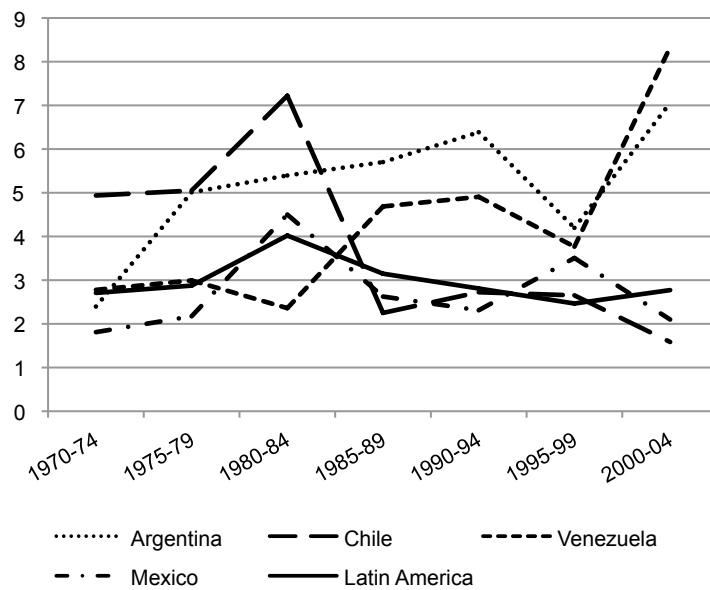


Data source: World Bank, Ng (2010)

The initial results of the modernisations were impressive. The new growth strategy was successful in attracting foreign investment, fostering export and increasing productivity (Ocampo 2004). Latin America became more integrated in the world economy. The export sector recovered from being neglected in the ISI period. The 1990s witnessed a real surge in the number of trade agreements in Latin America. No fewer than 26 free trade agreements were signed between 1990-94 (Meller 2000). In 1991 Argentina, Brazil, Paraguay and Uruguay signed the treaty for the foundation of MERCOSUR. This regional trade agreement turned out to be a powerful stimulus to intraregional trade: trade between the four countries increased from \$ 4 billion in 1990 to \$ 20 billion in 1998 (Cardoso 2009). Foreign investors returned to the Latin American market. The net outflow of capital of the 1980s was reversed. In the end of the 1990s foreign direct investment became the main source of capital influx in Latin America (Ocampo 2004).

By the end of the 1990s inflation was under control in most Latin American countries and reached single digits early 2000s. Economic growth returned to the continent in the 1990s, but it did not reach the same levels as before the lost decade of the 1980s. Despite the substantial decrease in volatility rates since the mid 1980s volatility was on the rise again towards the end of the millennium. Chile, a country that suffered from particularly high volatility in the early 1980s, achieved consistently low volatility rates after its reform process (Figure 4). In other countries, however, volatility remained high (Argentina) or even increased considerably (Venezuela). The initial economic boom could not be sustained and in the late 1990s growth stagnated and another period of depressions was imminent.

Fig. 4. Growth volatility, 5-year averages, selected countries.



Source: author's calculations, based on WDI data

The reforms increased Latin America's exposure to external risk (Stiglitz 2003). The Mexican Tequila crisis demonstrated the effects of a sudden withdrawal of foreign capital. In the late 1980s Mexico had liberalised the interest rates and deregulated the banking system. As a result, it experienced a financial boom. Capital inflow to Mexico increased annually by 8 percent and credit supply to the private sector quadrupled over 5 years (Birdsall et al. 1998). However, when domestic disturbances caused the peso to devalue by the end of 1994, panic spread across the financial market. Banks were suddenly confronted with major capital reversal. Mexico had already spent most of its reserves in an attempt to prevent devaluation, and now it was forced to bail out the financial sector. Once more Mexico was in danger of default. The US stepped in by issuing a \$ 50 billion rescue package. The Mexican authorities cut public expenditure, raised taxes, and let interest rate float to peak levels in order to control inflation. 1.2 million jobs were lost (Green 1996). The negative effect of the Tequila crisis was far-reaching. It caused severe regional contagion, dragging Argentina and Brazil into crisis.

The Mexican crisis was not the only shock that affected Latin American economies. Also the 1997-98 Asian crisis and the sudden increase in US interest rate in 1994 left their marks. These shocks lay bare the fundamental vulnerabilities. Since Chile had reduced its debt stock considerably it had created a fiscal buffer and was able to weather the external shocks. Others countries that did not have the same strong policy fundamentals turned out to be more vulnerable (Singh et al. 2005). Most countries lacked the resilience of Chile and a series of crises struck Latin America.

The effects of the reforms in Latin America had not lived up to the expectations. Had hopes been too high? Was the liberalisation policy incapable of reducing growth volatility? Or was volatility caused by other variables that were unrelated to the reforms? The next chapter provides a theoretical basis for the impact of trade liberalisation on growth volatility and gives an overview of the main findings of previous studies.

3. Theoretical framework

In this chapter I construct the theoretical foundation for my empirical research. I review the theory behind the relationship between trade and growth volatility and discuss the relevant literature. Previous research reveals several economic and non-economic variables that are crucial determinants of volatility. This chapter provides the rationale for the inclusion of the independent variables in my empirical model. I start off with an explanation of the theoretical gains of trade.

3.1 Gains of trade liberalisation

Classical economists Adam Smith and David Ricardo laid down the foundation for international trade theory. Smith emphasised the importance of opportunity costs in trade regulation. When each individual or entity specialises in the production of those goods in which he has some advantage, it generates the largest benefit for the economy as a whole. Regulation draws resources away from industries where they might have been allocated more profitably. Steering the employment of production factors artificially reduces production efficiency and increases opportunity costs. In absence of regulation production factors are employed at the lowest opportunity costs. The same applies to international trade regulation. If a commodity can be produced cheaper elsewhere it will be imported. In a free trade world goods are produced where production can take place with the greatest advantage (Van Marrewijk et al. 2007).

The theory of comparative advantage was introduced by David Ricardo. Even if a country has no *absolute* advantage in the production of any good, it can still benefit from specialising in the production of goods in which it has a *comparative* advantage. A country has a comparative advantage if it can produce at lower relative opportunity costs⁵. If in a 2 x 2 x 1 model⁶ both countries allocate their resources at the production according to their comparative advantage and trade their surpluses, their total production increases. This way they mutually gain from trade (Van Marrewijk et al. 2007).

The idea of international specialisation is further developed in the neoclassical Heckscher-Ohlin-Samuelson (HOS) model⁷. In this model the driving forces behind international trade flows are countries' differences in factor endowment. Each country specialises in the industry that requires relatively more of the abundant production factor. If in one country labour is relatively abundant, it will specialise in the labour-intensive industry and export the produce.

Trade barriers interfere with the price mechanisms and lead to trade and production levels that are distorted from the free trade optimum. The removal of trade barriers then results into trade creation. Misallocation of resources is corrected and production takes place according to the marginal costs and

⁵ In other words: country *X* has a comparative advantage in the production of good *A* when it has to give up fewer units of good *B* for the production of one unit of good *A*, compared to country *Y*.

⁶ Two countries, producing two goods, with labour as the only production factor.

⁷ A 2 x 2 x 2 model: two countries, producing two goods, with labour and capital as production factors.

benefits. This is called the static gains of trade, and it is of a once and for all nature. Welfare improves and consumers benefit from an increase in income and lower prices (Dornbusch 1992). Empirical evidence shows that the static gains of trade liberalisation are generally low (Baldwin 1992).

The new trade theory altered the emphasis from static gains to dynamic gains of trade. Dynamic gains result from an outward shift of the production possibilities frontier, implying that they yield long-run growth effects. Foreign direct investments and trade enhance competition and create incentives to innovate. The dynamics of competition promotes the development of improved production technologies. Trade facilitates the transfer of technology that is embodied in capital and intermediate goods (Nordås et al. 2006). Access to better technologies, knowledge spillover and investments in research & development (R&D) all lead to improvements in total factor productivity. In addition, a higher degree of trade openness increases the market size and hence allows firms to better exploit the benefits of increasing returns to scale (Wacziarg 2001).

It is not difficult to see that the potential gains from trade were large for Latin America in the 1970s. Latin America embarked upon a trade reform process inspired by the potential benefits of trade liberalisation: more efficient resource allocation, production growth, closing the technology gap and a larger variety of products available at lower prices. But most importantly, trade liberalisation was believed to bring more stability to the region. After years of skyrocketing inflation and recurring currency crises, people longed for more stability. However, the link between trade openness and volatility has been established neither in theory, nor in practice.

3.2 Trade openness and volatility

The relationship between trade openness and macroeconomic volatility is ambiguous and not well understood. There is no consensus in economic theory about the sign and significance of the relationship. Even empirical research does not provide conclusive evidence. A liberalisation process that increases the level of trade openness may cause a range of offsetting effects. In this section I analyse the two main channels that may lie behind the relationship between growth volatility and trade openness: external risk and export diversification.

Trade openness may increase macroeconomic volatility by exposing the economy to greater external risk (Rodrik 1997). Increased openness makes the domestic economy more vulnerable to world supply and demand shocks (Newbery and Stiglitz 1984). Sudden fluctuations in the international markets are more easily transmitted into countries that are more tightly integrated into the world markets. Moreover, in countries with a higher trade share in GDP these fluctuations will have a bigger impact. As a result, a higher degree of trade openness is likely to increase growth volatility. On the other hand, more trade openness may lower growth volatility by reducing a country's exposure to domestic risk. Access to international markets enables producers to smooth output when domestic demand is sluggish (Kim 2007). If an economy is well integrated with the international markets idiosyncratic shocks may have a lesser impact. Also, trade openness expands the market and since larger markets are less volatile an open economy may be less volatile (Kim 2007).

Empirical research demonstrates mixed results. Most researchers include both trade openness and a measure of external risk in their empirical model to test their individual effects on growth volatility. The standard deviation of terms-of-trade is often used as a measure of exposure to external risk. Rodrik (1997) uses the product of trade openness and terms-of-trade volatility as a proxy for external risk. He finds a positive relationship between external risk and real macroeconomic volatility. His results suggest that countries that are more exposed to trade openness and terms-of-trade fluctuations demonstrate higher GDP growth volatility. Cavallo (2007) argues that the destabilising effect of trade liberalisation arises from terms-of-trade risk. He shows that once accounted for terms-of-trade volatility, openness has a stabilising effect on growth volatility. A 25 percent increase in the trade/GDP ratio leads to a decline in volatility of more than 40 percent. Bejan (2006) establishes a positive correlation between trade openness and volatility, but when controlling for terms-of-trade volatility the correlation turns negative. It implies that macroeconomic volatility stems from terms-of-trade fluctuations, not from trade openness. On the contrary, Easterly et al. (2000) and Kose et al. (2003) find that both terms-of-trade volatility and openness to trade increase growth volatility. Kim (2007) finds that once controlled for terms-of-trade volatility, trade openness does not significantly impact volatility.

While most evidence stems from panel research that includes a large number of countries worldwide, regional research can show distinct results. Ahmed and Suardi (2009) investigate the sources of macroeconomic volatility in Sub-Saharan Africa (SSA). This region is comparable to Latin America in the sense that it is highly dependant on export of primary products. Controlling for a range of economic, socioeconomic and structural characteristics Ahmed and Suardi find that trade openness has a destabilising impact on macroeconomic volatility. In SSA increased trade openness invokes higher volatility. Financial openness, however, has a negative - thus stabilising - effect on volatility.

Another ambiguous feature of trade openness is its specialisation versus diversification effect. According to the neoclassical trade theory trade liberalisation drives countries to specialising according to their comparative advantage. When trade barriers are removed this specialisation effect will lead to more concentrated production structures. If trade integration leads to inter-industry specialisation across countries and industry-specific shocks are important driver of business cycles, increased openness may lead to greater output volatility (Krugman 1993). On the contrary, a higher degree of trade openness may enable a country to expand and diversify its export sector. By varying its export industry a country reduces its dependency on a small number of products or trading partners. A more varied production structure provides a buffer against country-specific shocks (Calderón and Schmidt-Hebbel 2008). This may have a stabilising effect that reduces growth volatility.

While the specialisation effect may seem straightforward at first sight, its effect on output volatility may be a little more complicated than presented above. The pattern of trade specialisation and the nature of shocks are important factors in the determination of the impact of trade openness on volatility (Kose et al. 2003). When trade integration leads to intra-industry specialisation instead of inter-industry specialisation output volatility may decline (Razin and Rose 1994). Intra-industry specialisation fuels the trade in intermediate inputs. Idiosyncratic shocks will then have a lesser impact and output

volatility is declined (Kose et al. 2003). Even in the case of inter-industry specialisation a more concentrated export sector does not necessarily increase output volatility. When specialisation enables a firm to obtain market power, pricing-to-market may reduce its vulnerability and hence its output volatility (Buch 2002). This occurs when a firm gains a monopolistic position through specialising in a niche market. Then increased specialisation may be negatively related to output volatility.

In the ISI era most Latin American export sectors were highly concentrated on a few primary goods. The high degree of specialisation made them vulnerable to terms-of-trade shocks, which occurred frequently since world prices of primary commodities are known for their volatility (Fiaschi and Lavezzi 2003). Advocates of liberalisation argued that trade liberalisation offered opportunities for Latin American countries to expand their export base and develop new export industries. Moving away from their specialised position in highly volatile industries would reduce their dependency and stabilise their economies.

Several economists researched the relationship between trade integration and specialisation. Calderón and Schmidt-Hebbel (2008) find that export diversification plays an important role in protecting the economy to adverse effects of global shocks. Their results show that trade openness decreases growth volatility when countries are well diversified and trade openness has a destabilising effect in countries with a specialised export sector. Haddad et al. (2010) performed a similar research. Their results suggest that the degree of export diversification determines the sign of the link between openness and growth volatility. Trade openness reduces growth volatility when exports are well diversified. However, this effect only holds for lower and middle-income countries. In the sample of higher income countries the effect disappears. It is likely that high-income countries have access to other kinds of insurance to shield them from the impact of global shocks, Haddad and her colleagues argue.

Di Giovanni and Levchenko (2009) investigate the specialisation-versus-diversification effect on industry level. They prove that higher trade openness increases production specialisation. Moreover, they find that sectors more open to trade demonstrate a higher volatility level. It would be too simple, however, to jump to the conclusion that trade openness increases volatility through the specialisation effect. Sector-volatility does not necessarily increase aggregate volatility. This is because an increase in trade openness may cause a change in co-movement between sectors within the economy. A sector that is relatively open to international trade may depend more on global rather than domestic fluctuations. Internationalisation allows sectors to delink themselves from the rest of the economy. When trade openness reduces the correlation between an individual sector and the rest of the economy, aggregate volatility is decreased. Di Giovanni's and Levchenko's results demonstrate that growth in open sectors shows a lower correlation with aggregate growth (and thus contributes to lower aggregate volatility). It turns out that this co-movement effect is weaker than the specialisation and sector-volatility effects and that the net result of increased openness is an increase in aggregate volatility. The aggregate effect shows that a 60 percent increase in trade openness results into a 17 percent increase in volatility.

3.3 Other determinants of volatility

Trade liberalisation is often part of a wider reform package. Liberalisation policies in other fields may impact growth volatility as well (Cavallo 2007). A great amount of research has been devoted to the link between financial liberalisation and macroeconomic volatility. Theory does not provide a clear guide to the nature of this link. Financial liberalisation is often mentioned as an important source of macroeconomic volatility in Latin America (see e.g. Stiglitz 2003). When capital market liberalisation brings about procyclical surges in capital it creates instability in the real economy. Investors pull out their capital when market conditions turn for the worse, thereby exacerbating a downturn. Especially when financial institutions are weak and the financial sector is poorly regulated capital markets have a tendency to create bubbles, which cause the countries to enter into deep recessions when they collapse.

On the other hand, financial markets can act as insurance providers. Increased financial openness may lower volatility by offering international risk sharing opportunities (Kose et al. 2003). A purely domestic investment portfolio has limited risk diversification possibilities. Due to more financial openness consumers, producers and investors are offered a wider range of financial instruments. That offers new opportunities in terms of portfolio diversification, which they can use to reduce risk (Kim 2007). Moreover, sound financial markets can act as shock absorbers since they enable economic entities to smooth output in times of an economic downturn (Hausmann and Gavin 1995). Financially integrated markets provide access to foreign credit, which consumers and producer may use to finance their needs when domestic credit supply is limited. On the aggregate it allows a country to preserve demand during a negative output shock (Aizenman and Pinto 2005).

Empirical results are mixed. Bekaert et al. (2006) test the impact of financial liberalisation on consumption volatility in a worldwide sample of countries over the period 1980-2000. Using different liberalisation indicators, they find all of them to be negatively associated with volatility. However, they also report that the effect of capital account liberalisation depends on certain country characteristics. They find that financial liberalisation increases volatility in countries with underdeveloped domestic financial sectors. While on average there is a negative relationship between financial liberalisation and volatility, this relationship is found to be diametrically different in less developed countries. This seems to support the results of O'Donnell (2001) who concludes that a higher level of financial integration is associated with less volatility in OECD countries, whereas associated with more volatility in non-OECD countries.

In an attempt to establish the effect of improved international risk sharing Kose et al. (2003) investigate the effects of financial openness (measured as gross capital flows) on the ratio of consumption volatility to income volatility. Their findings show that financial openness is associated with an increase in this ratio, contrary to the believes of better risk sharing opportunities through financial integration. The relation is, however, nonlinear. Beyond a certain threshold capital flows do offer better risk sharing opportunities. Kose et al. conclude that developing countries need to be more, not less, integrated with the international financial markets. This conclusion is somewhat remarkable, since their results show that financial openness significantly impacts neither output volatility, nor

income volatility, nor consumption volatility. Financial openness was found to be significantly associated only with the ratio of consumption volatility to income volatility and this association was positive. Only when gross capital flows exceed a threshold of 49 percent (ratio to GDP) would financial openness decrease volatility. Only a handful of developing countries manage to achieve such a high financial openness level. Instead, one could draw the conclusion that Kose et al. found no evidence for a significant impact of financial openness on macroeconomic volatility and that benefits from risk sharing opportunities accrue for only a few countries with exceptionally high financial openness.

Easterly et al. (2000) find that financial development (measured as credit to the private sector as share of GDP) is associated with lower volatility. They discover that a deep financial system reduces volatility only up to a limit. Very large financial sectors can create instability, since a high debt-equity ratio implies a higher leverage and hence more risk (but also here this threshold is very high).

Stiglitz (2003) argues that the privatisation of important utilities and infrastructure in Latin America has not produced stability. The extraordinary scale and speed at which privatisation took place may have caused shocks into the economies. While privatisation was usually successful in terms of efficiency gains (Estache and Trujillo 2008), it came at large adjustment costs. Often privatisation went hand in hand with extensive layoffs, sudden price surges and discontinuity of utilities. Insufficient competitive forces and absence of proper regulation for the privatised industries added to the problems.

Another important determinant of macroeconomic volatility is the size of the government. Government intervention helps to stabilise growth (Stiglitz 2003). According to the compensation theory open countries have a bigger government in order to compensate for their greater exposure to external risk (Rodrik 1997). By providing social security and intervention upon economic fluctuations, governments can mitigate the adverse effects of high exposure to international risk. Rodrik finds that countries that are more open to trade have larger governments. However, he does not include government spending as a variable in his research for the determinants of output volatility. This gap is filled by Bejan (2006). In a large panel study she firstly studies the effect of trade openness on volatility, which tends to be positive. When dividing the sample into developed and developing countries, the pattern changes. Trade openness increases growth volatility in developing countries, whereas in developed countries the effect is the contrary. Consequently, greater trade openness smoothes output volatility only in the developed world. In addition, Bejan investigates Rodrik's compensation theory in the two sub samples of developed and developing countries. Her findings show that government spending mitigates output volatility only in developed countries. In developing countries government spending has no significant effect on growth volatility. Bejan's findings show that developed countries are able to mitigate the risks stemming from trade openness by means of a larger government, thereby reducing output volatility. Developing countries, however, do not benefit from more government spending and exhibit greater output volatility when trade openness increases.

Hausmann and Gavin (1995) emphasise the importance of institutional quality. High quality institutions may promote macroeconomic stability. They argue that Latin American countries can improve their institutional framework to cope with macroeconomic shocks and help to absorb instead of amplify

shocks. Institutions can reduce volatility by adapting monetary and fiscal policy to the economic situation and by designing a policy framework that is tailored to improve the functioning of the market under economic insecurity.

High inflation levels often reflect domestic macroeconomic imbalances. Unsustainable macroeconomic policy and exchange rate shocks are important drivers of inflation in Latin America. High inflation levels can destabilise an economy by increasing uncertainty. It distorts the price mechanism that steers efficient resource allocation, hence causing negative output effects and volatility accordingly. Moreover, sudden surges in inflation may induce erratic monetary policy responses, thereby creating uncertainty in the market (Ahmed and Suardi 2009).

Throughout the economic literature the level of development – usually measured as (initial) income per capita – is found to be negatively associated with volatility. More developed countries experience less macroeconomic volatility. See e.g. Ahmed and Suardi (2009), Caldéron and Schmidt-Hebbel (2008) and Kim (2007).

A factor that is often overlooked – but potentially very relevant for Latin America – is the impact of natural disasters (Auffret 2003). The Caribbean region is often hit by tropical storms, which can cause severe damage to buildings, infrastructure and agricultural land and affect a large part of the population. Also droughts, floods and earthquakes can have a serious impact on the economy. In addition, conflicts such as coups, revolutions and (civil) wars can drive a country into serious economic crisis (Ahmed and Suardi 2009).

3.4 Adverse effects of growth volatility

Why should we care about macroeconomic volatility? Because the welfare costs of volatility are large. Economic insecurity is a major concern in Latin America. Reducing volatility can result into substantial welfare gains. Ferranti et al. (2000) estimated potential welfare gains expressed as the permanent percentage increase in expected consumption. They calculate that if Latin American countries had optimally diversified their idiosyncratic risks – and thereby minimised volatility – in the 1990s, their consumption growth would have increased on average by more than 7 percent per year. In the industrialised countries these gains are on average 1 percent.

Volatility has a direct welfare cost, notably for risk-averse individuals. Economic volatility implies risk since the adjustment costs after a disruption are usually highly concentrated on a specific group of individuals (Hausmann and Gavin 1995). Whether these are employees who lose their jobs, investors whose industry goes bankrupt or creditors whose outstanding loan is not repaid, it implies uncertainty. An extensive survey in 14 Latin American countries revealed that the sense of economic insecurity in the region is high (Rodrik 1999). It is thus not surprising that the respondents ventilated a strong demand for social insurance. Almost 80 percent of the respondents expressed their wish for more spending on pensions and unemployment insurance; a number that is significantly higher than in industrialised countries, where volatility levels are much lower.

Macroeconomic volatility exerts a negative effect on long-run economic growth, especially in poor countries. In an influential article Ramey and Ramey (1995) provided evidence for this negative relationship. Their article gave rise to a wave of empirical research, most of which confirmed these results. Since then, there is a general consensus that macroeconomic volatility is an impediment for long run growth. The negative correlation between volatility and growth is found to be robust to alternative samples and estimation methods (Cavallo 2007).

In an attempt to quantify the impact of macroeconomic volatility on long-run growth Hnatkovska and Loayza (2003) estimated that a one standard deviation increase in volatility (measured as the standard deviation of output growth) leads to a growth reduction of almost 1.3 percentage point. This is the average impact for a sample of 79 countries over a period of 1960-2000. Others found similar effects: Ramey and Ramey (1995) estimated the impact at 0.5 percentage point and Mendoza (1994) at 1 percentage point. Hausmann and Gavin (1995) investigated the welfare costs of volatility in Latin America during the 1970-1992 period. Their results imply that had Latin America experienced the same level of macroeconomic volatility as industrial economies, its annual economic growth would have been 1 percentage point higher than it actually was. Macroeconomic fluctuations account for almost a third of the growth gap⁸. The estimated foregone income growth of 1 percentage point in Latin America is in line with the findings in worldwide samples of countries.

What are the channels through which volatility affects growth? When macroeconomic volatility is associated with economic uncertainty⁹, it deters investors (Hnatkovska and Loayza 2003). The risk that macroeconomic fluctuations bring along, exerts a downward pressure on investment profitability. Investments are irreversible when sunk costs are sizable. Once such an irreversible investment project is started the investor cannot divest and investment costs cannot be recovered. This makes the investment highly sensitive to various kinds of risks (Pindyck 1991). Uncertainty over future returns creates an opportunity cost for these irreversible investments (Pindyck 1991). Especially when investments induce high start-up costs, investors may stay away from economies that suffer from high volatility or they may postpone their investment decision. Investors can reduce risk by investing in low-volatility countries. Macroeconomic volatility may then reduce investment, which ultimately hampers economic growth. Even though this relation is difficult to translate into an empirical model, Aizenman and Marion (1999) find a negative correlation between volatility and private investments in developing countries.

Moreover, macroeconomic volatility increases income inequality, which also exerts an adverse effect on growth. Hausmann and Gavin (1995) prove that real GDP volatility increases income inequality significantly. If volatility rates in Latin America equalled those of developed countries, 7 percent of the

⁸ Hausmann and Gavin (1995) define the growth gap as the difference between the actual per capita GDP growth and the predicted growth under convergence assumptions. In Latin America per capita GDP growth was about 1 percentage point lower than in industrial countries. Since neoclassical theories predict convergence - implying that lower income countries demonstrate a faster economic growth in their process of catching up with higher income countries - Latin America's growth should have been nearly 2 percentage points higher than the industrial economies. That suggests a growth gap of almost 3 percentage points.

⁹ Strictly speaking, volatility is distinct from uncertainty. Volatility refers to the fluctuations of a variable, whereas uncertainty refers to the unpredictability of these movements (Aizenman and Marion 1999). In reality however, volatile variables are often unpredictable.

Latin American people would have escaped poverty. When it is considered that volatility affects economic growth and education attainment, the observed impact on poverty reduction would be even larger. Income inequality affects economic growth by reducing investment in human capital, the cost of which is biased to the poor population. Poor households face more credit constraints, which limit their opportunities to invest in education. Due to limited access to credit future earnings cannot be used to finance educational attainment. Hence, education (and other investments) can only be financed out of household wealth, which poor households lack. This way volatility reduces human capital accumulation and thereby growth (Aizenman and Pinto 2005).

3.5 My contribution to the existing research

My research is a modest contribution to the existing literature in several ways. I concentrate on the effects of trade liberalisation in Latin America whereas most researchers use a large panel with a worldwide sample of countries. It has been demonstrated that the sample is crucial for the determinants of volatility. Researchers found the nature of the relationship between trade openness and volatility to change diametrically when a different sample was chosen. Bejan (2006) discovers that trade openness increases growth volatility in developing countries, whereas in developed countries the effect is the contrary. The few researchers that do limit their sample to a more homogenous group of countries come to findings that are at odds with those found in the large panel studies¹⁰. Quite often the results are the exact opposite. It is hard to comprehend why so little regional research is done while the values of the relevant coefficients vary to such an extent according to the sample chosen. Policy makers in Latin America may not be interested in averages when the effects vary per region.

Moreover, most studies are cross-country investigations with a short time dimension. Their focus is on the determinants of cross-country differences in macroeconomic volatility. Volatility is measured as the standard deviation of output, consumption or income growth over a window of five or ten years. The vast majority of papers use a non-overlapping window. That leaves them with few observations in the time-dimension. All independent variables have to be averaged over the same time window in order to match the frequency of the volatility measure. Valuable information may get lost in this process of averaging. My study, on the contrary, has a substantial time dimension. Using a rolling window I maintain yearly observations for all variables. With a time span of 31 years, that enables me to include the effects of gradual changes over time.

The fact that the trade reforms were part of a larger reform package adds an extra complexity to my empirical investigation. Trade liberalisation coincided with financial liberalisation and privatisation. It is well known that these may impact volatility as well (Cavallo and Frankel 2008). Failing to distillate the effect of trade reforms from other reforms may give spurious results. To disentangle the effects of trade and financial reforms and privatisation, I use a unique set of policy reform indices as constructed by Escaith and Paunovic (2004). These indices provide measures of the structural reforms in the above mentioned policy fields. To my knowledge these indices have not been used in empirical

¹⁰ See for example Ahmed and Suardi (2009), who find a positive relationship between trade openness and growth volatility in their sample of Sub-Sahara African countries, while this relation is negative in Cavallo's (2007) worldwide sample of countries.

volatility assessment before. It enables me to study the effects of the reforms in the different fields individually and single out the impact of trade liberalisation. For reasons of intercorrelation I replace the financial liberalisation index by a similar index constructed by Chinn and Ito (2008).

Measuring trade openness can be challenging. Most economists only use the share of trade in GDP as an estimate for trade openness. I utilise two different estimates in my research in response to the findings of Prasad et al. (2004) and Pritchett (1996). Prasad et al. have emphasised the difference between *de jure* and *de facto* openness in the field of finance. They argue that *de jure* measures can fail to accurately reflect the degree of financial openness, as capital restrictions can be ineffective. In other words, there is a difference between the policy factor and the markets' behaviour. A similar argument can be made for trade policy. Trade liberalisation does not necessarily lead to greater trade openness. Pritchett (1996) has shown that there can be surprisingly little correlation between trade policy measures and trade flows. Therefore, I distinguish between a *de jure* and a *de facto* measure of trade openness in my research. Likewise, I include a *de jure* and a *de facto* measure of financial openness.

In the next chapter my econometric approach and data are explained in greater detail.

4. Methodology

In this chapter I set out my empirical strategy. I describe my dataset, the empirical model and the estimation technique that I use. In the previous chapter I derived the relevant variables that may have an impact on growth volatility. I include these variables in my model to test their association with the volatility measures. Furthermore, I discuss the econometrical challenges that are implied in my research.

4.1 The data

My data file compiles annual data of 15 Latin American countries¹¹ over the period 1970-2000. The sample and time period are dictated by the availability of data. The most important restriction is the limited availability of reform measures. Escaith and Paunovic (2004) have constructed reform indices for 17 Latin American countries over 31 years (1970-2000). The number of cross-sections is further reduced to 15, due to incomplete data for Jamaica and Guatemala. Hence, these two countries are excluded from my research. Appendix 1 provides a detailed description of the definitions and data sources of all the variables used. Summary statistics are provided in Appendix 2. All variables and their expected impact on macroeconomic volatility are explained below.

Volatility

Macroeconomic volatility is the dependent variable in my research. It is a well-established convention in the economic literature to measure macroeconomic volatility as the standard deviation of the growth rate of the relevant variable over five or ten years. Following Bekaert et al. (2006) I use a rolling standard deviation over a five-year window to measure volatility. Whereas using a rolling standard deviation offers great advantages in terms of efficient data usage it also generates statistical challenges. The overlapping nature of the data results into the presence of autocorrelation. This implies that the error terms in the model are no longer independently and identically distributed, which violates the OLS assumptions (Verbeek 2008). When ignored, the model estimates may be inefficient and the standard tests invalid. Indeed, when the autocorrelation is uncorrected for, a low Durbin Watson statistic indicates that autocorrelation is present. One solution would be to use non-overlapping data. However, this reduces the number of observations drastically and throws out valuable information, since five-year averages of all other variables have to be used. It would smooth out subtle changes in the variables over time that can be important in explaining the impact of e.g. policy reforms. Since my main interest is in the effect of policy reforms in Latin America averaging the data would be inappropriate. Using overlapping data facilitates the maximum exploitation of the time-dimension. A better solution is therefore to account for the autocorrelation in the empirical model. I

¹¹ Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Honduras, Mexico, Paraguay, Peru, Uruguay and Venezuela.

correct for autocorrelation by including a lagged dependent variable as an explanatory variable (an AR(1) term).

For robustness reasons the model is tested for three volatility measures: volatility of GDP growth (VOL_g), volatility of Gross National Income growth (VOL_y) and volatility of consumption growth (VOL_c). Fluctuations in output do not necessarily imply fluctuations in consumption levels, due to the possibility of consumption smoothing. When risk-sharing opportunities are well developed trade openness may have a lesser effect on consumption volatility. The difference between GDP and GNI is found in international net factor income flows. Especially when multinational companies have a sizeable share in the economy the repatriation of their profits and interest can cause the GDP and GNI to diverge. Taking into account net factor payments, GNI captures the effects of international risk sharing.

Trade Openness

As was mentioned in section 3.5, I include both a *de jure* and a *de facto* measure of trade openness. *De jure* indicates a policy measure of trade openness, whereas *de facto* is the factual level of trade openness. Following the tradition, *de facto* openness is measured as the sum of exports and imports of goods and services as share of GDP. The *de jure* measure is the trade liberalisation index of Escaith and Paunovic (2004), as set out below.

The two measures are different. It could be argued that since we are interested in the effect of liberalisation policy on volatility a *de jure* measure of trade openness is preferred over a *de facto* measure. The *de jure* measure highlights the importance of trade policy. The *de facto* openness is the outcome of a range of underlying factors that are beyond the control of policy makers. Geography and history are important determinants of trade openness, but they cannot be changed. This reduces the usefulness of the *de facto* trade openness when one is interested in the results' policy implications. The *de jure* measure may be more useful, since it reflects government policy, which can be deployed in order to reduce volatility (Baltagi et al. 2008). However, the *de jure* measure does not reflect the actual level of openness. Liberalisation policy may be ineffective in promoting trade openness. In that case trade reforms fail to increase trade openness.

Reform indices

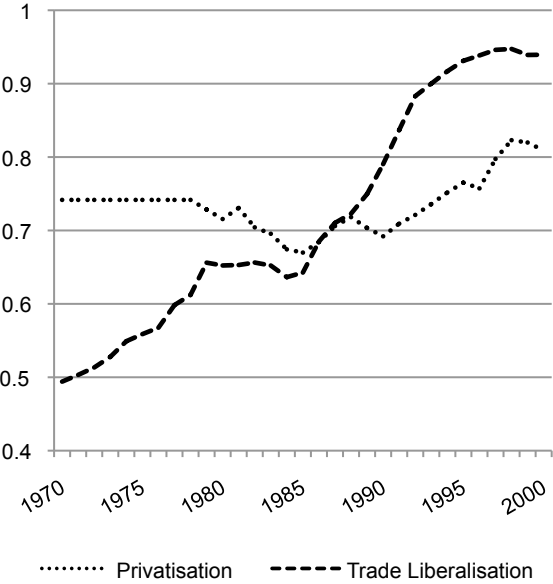
Data on macroeconomic variables - inter alia inflation, economic growth and international trade - are collected worldwide and are generally available for research. Unlike the macroeconomic variables it is exceptionally difficult to collect reliable and comparable data about policy indicators. The lack of policy data is an impediment to economic research, since the macroeconomic variables – including volatility – are to a certain extent the result of economic policy. Lora (1997) attempted to fill this gap by providing indices that quantify the magnitude of the policy reforms in Latin America. His indices are available for most Latin American countries over a period of 10 years (1985-1995). They have been updated and extended by Morley and al. (1999) and later also by Escaith and Paunovic (2004), so the reform indices are now available for 17 countries over a period from 1970 to 2000. I include the trade liberalisation index and the privatisation index as have been published by Escaith and Paunovic (2004). Even though they offer more reform indices I deliberately choose not to include them, since

these are highly correlated with the trade liberalisation index (correlations values exceeding 0.50). A high degree of correlation among the explanatory variables may result in multicollinearity problems. The regression estimates may then become unreliable with high standard errors (Verbeek 2008). With a value of -0.15 the correlation between the trade liberalisation index and privatisation index is acceptable.

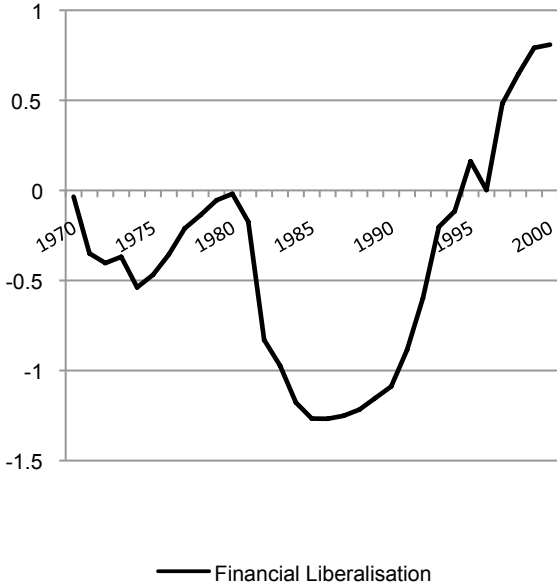
The trade liberalisation index is constructed as a simple average of two elements: the average tariff rate and the dispersion of the tariff rate. Inclusion of non-tariff data could have been a valuable contribution to the index. However, consistent and continuous non-tariff data are not available (Escaith and Paunovic 2004). The index is normalised in order for the values to range within the [0,1] interval. The index takes on higher values the more liberalised the trade regime is. The privatisation index is measured as 1 minus the ratio of added value of state owned enterprises over non-agriculture GDP. The underlying idea is that privatisation decreases the total value added of the public enterprises.

As a financial liberalisation index I utilise the Chinn and Ito (2007) *KAOPEN* index. The index is constructed out of four categories of financial liberalisation reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. It is based on information about the presence of multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions and the requirements of the surrender of export proceeds. It measures the extensity of capital controls and its values range between -1.9 and 2.6. A higher index value indicates a more liberalised financial system.

Fig. 5 Reform indices – Latin American average.



Data source: Escaith and Paunovic (2004)



Data source: Chinn and Ito (2007)

The course of the three reform indices is depicted in Figure 5. It shows that over the course of 30 years trade reform increased spectacularly. The value of the index rose from just under 0.5 in 1970 to

almost complete liberalisation in 2000. Privatisation demonstrates a very gradual course. It remained at constant level in the 1970s, dipped in the 1980s and recovered in 1990s. Financial liberalisation follows a bumpier course. It decreased in the early 1970s, recovered in the late 1970s, then plunged in the early 1980s, before starting off a steep growth as from 1985. In the 'lost decade' of the 1980s reform measures were (temporarily) revoked in several countries. In several countries the state intervened by re-imposing capital account controls, increasing tariffs and undo privatisation. These policy changes are reflected in the downward bend of the indices. When positive results failed to materialise and economic conditions worsened even more, the liberalisation process was put in motion. That is the time of the Washington Consensus. The period between 1985-1995 shows the steepest increase in the reform indices.

If the economic policy reforms have exacerbated volatility in Latin America, the liberalisation indices are expected to be positively correlated with the volatility measures. If the reforms have been successful in reducing volatility, the coefficients of the reform indices are negatively associated with volatility.

Financial openness

I already explained why I include both a *de facto* and a *de jure* measure of trade openness. For the same reasons I include a *de facto* measure of financial openness in addition to the *de jure* financial liberalisation measure. Inflow of FDI as percentage of GDP is the *de facto* measure of financial openness¹². The effect of financial openness on macroeconomic volatility is not clear beforehand. The coefficient can either be positive or negative.

Export concentration

Following Haddad et al. (2010) I include a measures of export concentration to test the effect of the level of export concentration on output volatility. As explained in section 3.2 a more concentrated export sector is likely to be associated with increased volatility. The most widely used concentration measure is the Herfindahl Hirschman Index (HHI), defined as the sum of squared market shares of export sector j in country i at time t . It is denoted by:

$$HHI_{i,t} = \sum_{j=1}^m s_{j,i,t}^2 \quad (2)$$

where s is the export value of the j^{th} commodity as share in the total export value. It is calculated using UN COMTRADE data reported at the 2-digit level of the SITC classification. The HHI values range within the $[0,1]$ interval where a higher (lower) value indicates a more (less) concentrated export sector. HHI is expected to be positively associated with volatility.

Other control variables

Financial development is a measure of depth of the domestic financial markets. It is measured as the domestic credit to the private sector as percentage of GDP. Well-developed national financial systems

¹² Even though it could be argued that the sum of FDI inflow and outflow as percentage of GDP would be a more appropriate measure of financial openness, incomplete data series prevent me from doing so.

can act as shock absorbers by enabling economic entities to smooth their consumption and production patterns in case of a crisis. It is expected to be negatively associated with volatility.

Following the convention in economic literature, terms-of-trade volatility is included as a measure of external risk. It is expected that volatility of prices in the global markets disseminates into the Latin American economies. Hence, I expect to find a positive relationship between terms-of-trade volatility and the dependent variable.

Government expenditure is measured as general government final consumption expenditure as percentage of GDP. It can be either positively or negatively associated with volatility. By providing social security and anticyclical policy intervention, governments can mitigate the fluctuations in growth. The larger the government, the larger is the effect of automatic stabilisers in a downturn. On the other hand, if government spending is procyclical, it may exacerbate volatility.

Institutional quality is proxied by the democratic indicator from the Polity IV Project (Marshall and Jaggers 2009). It provides a measure of the level of democratic development of a country's institutions. An autocratic political system with few constraints on the executive power tends to create macroeconomic problems. Tension between the various groups to take control may cause economic disruptions and hence countries with less developed democratic institutions are expected to experience more volatility (Acemoglu et al. 2003). Democracies where the executive power is regulated, constrained and open to participation are likely to produce a more sustainable economic policy. Hence, I expect to find a negative relationship between institutional quality and volatility.

Inflation is expected to be an important source of macroeconomic volatility in Latin America. High inflation levels have always been an issue in Latin America. It is likely to be positively associated with volatility, just as armed conflict intensity and the occurrence of natural disasters.

Initial income is measured as a country's income level in 1970. More developed countries are likely to experience less volatility and hence, initial income is expected to be negatively associated with volatility. US real interest rate is included as a measure of cost of foreign borrowing. The strong economic ties between Latin American and the United States imply that an increase in US interest rate restrains Latin America's debt position and hence restricts its smoothing possibilities. US real interest rate is also assumed to reflect global market conditions and its inclusion in the regression serves to control for external shocks. It is expected to be positively associated with macroeconomic volatility.

4.2 Empirical model

The baseline regression model for growth volatility is given by:

$$VOL_{i,t} = \alpha + \beta TO_{i,t} + \gamma X_{i,t} + \delta Z_t + \varepsilon_{i,t} \quad (1)$$

where VOL is macroeconomic volatility for country i in year t , α is a constant, TO is trade openness (either *de jure* or *de facto*), X is a vector of the control variables, Z is the time-specific variable (US real

interest rate) and ε is the disturbance term. I have included a rich set of control variables to prevent the problem of omitting variables. As control variables I include: privatisation index, either *de jure* financial liberalisation or *de facto* financial openness, financial development, terms-of-trade volatility, government expenditure, inflation, export concentration, institutional quality, armed conflict intensity, natural disaster impact and initial income level. All variables and their expected influence on the dependent variables have been explained in the previous section. All control variables have been tested for correlation with each other and no high levels were found.

Equation (1) is estimated in a pooled estimation, using the cross-section seemingly unrelated regression (SUR) weighted least squares technique. This is a feasible Generalised Least Squares (GLS) estimator that allows for both cross-sectional heteroskedasticity and correlation between the error terms. I use GLS because the presence of heteroskedasticity and contemporaneous correlation impairs the Gauss-Markov assumptions. Hence, an OLS estimation is not efficient. GLS produces a transformed model¹³ that corrects for heteroskedasticity and satisfies the Gauss-Markov conditions (Verbeek 2008). The SUR weighted least squares technique is a special GLS application that also corrects for correlation among the equation disturbances. Despite the inclusion of an AR(1) term there may still be contemporaneous correlation (correlation between the error terms across the equations), stemming from omitted variables that in fact impact volatility throughout Latin America. By treating the regressions as separate equations in a system it permits nonzero covariance across the error terms, while increasing efficiency of the estimator (Vogelvang 2005).

A common issue in time-series analysis is non-stationarity of the data. It implies that the distribution of a variable is time-dependent (Verbeek 2008). Non-stationarity has important implications: a regression with non-stationary variables generally results in a non-stationary error term, which violates the basic assumption of OLS. The regression model will give spurious results with misleadingly high R-squares and t-ratios. Hence, with non-stationary data the traditional estimation techniques cannot be used. A special case of non-stationarity occurs when series contain a unit root. These series are also referred to as random walks. Many economic time-series are random walks. Unlike stationary data, series that contains a unit root are not mean-reverting. This implies that shocks have a persistent effect that continues forever (Verbeek 2008). I have tested all my variables for the presence of a unit root, using the Fisher Augmented Dickey-Fuller test, which is designed for panel data. When a unit root was found, I took the natural logarithm of the series to transform them into a stationary process. I tested the logarithmic series again for the presence of a unit root and no unit roots were found.

4.3 Endogeneity

I am aware of the potential problem of endogeneity (or reverse causality) of the trade openness variable. There might be a circular relationship between output volatility and trade openness, the presence of which violates the assumption of strictly exogenous variables on the right side of the equation. If any of the independent variables is endogenous it causes the standard errors to be

¹³ By weighting the observations by the inverse of the error variance.

biased. The liberalisation process as described by the Washington Consensus was a policy response to the high volatility levels of the 'lost decade'. It was aimed at reducing volatility. Since the *de jure* measure is a policy variable it may be endogenous.

One could solve the problem by using instrumental variables in General Method of Moments (GMM) estimation. This, however, is a rather advanced procedure, which is beyond the scope of this thesis. Another solution is to use gravity estimates in order to construct instrumental variables. This method – as developed by Frankel and Romer (1999) – predicts a country's bilateral trade level with each of its partner countries by means of exogenous geographical variables. However, the gravity approach is a particularly cumbersome process that requires an extensive data set, which is not freely accessible. Moreover, these geographical instruments do not change over time and therefore fail to measure the effect of trade liberalisation. The gravity approach would be more appropriate for a cross-country research rather than for a panel research with an important time-dimension. Since I am particularly interested the effect of policy changes over time, my research has an important emphasis on the time-dimension and the gravity approach is not appropriate for my study.

It is questionable whether endogeneity is that much of a problem in my research. As Haddad et al. (2010) argued endogeneity is more likely to be a concern when regressing growth rates rather than growth volatility on trade openness. Moreover, the *de facto* measure of trade openness is less likely to be endogenous since this variable is not a policy measure but it is at most influenced by economic policy. In a probit analysis Bekaert et al. (2006) tested whether past volatility had an effect on the probability of liberalisation and they found no significant effect.

4.4 Non-linearities and interaction

Kose et al. (2003) have found the relationship between financial openness and volatility to be nonlinear. While positively associated with volatility, the effect diminished after a certain degree of openness was achieved. It is not unlikely that the same may hold for the measures of openness in my research. The occurrence of nonlinearity may not be limited to financial openness. Trade openness and financial development might demonstrate a similar relationship. I verify this by including the quadratic terms of these variables (the squares of the gross flow measures) in the regressions.

According to Rodrik's (1997) compensation theory more open economies have larger governments in order to compensate for their greater exposure to external risk. This implies an interaction effect between openness and government expenditure. I investigate whether this theory holds in my sample by including an interaction term of government expenditure with the proxies for both trade and financial openness. If the compensation theory holds I expect to find the coefficient of the interaction term to be negative and significant.

5. Results

In this chapter I estimate the empirical model defined in (1) as discussed in chapter 4. I discuss the results for the main regressions, examine potential nonlinearities and verify whether the compensation theory holds for Latin America.

5.1 Preliminary analysis

To obtain a first impression of the effect of trade liberalisation on output volatility I compare the average output growth volatility of the five years before and after the liberalisation date. I utilise the countries' liberalisation dates as estimated by Wacziarg and Welch (2008). They base the year of liberalisation on data about tariff rates, nontariff barriers and the black market premium on the exchange rate. The results are reported in Table 3 below.

Table 3. Pre- and post-liberalisation volatility rates compared.

	Year of trade liberalisation ¹	Pre-liberalisation output growth volatility	Post-liberalisation output growth volatility
Argentina	1991	6.33	4.65
Bolivia	1985	1.79	1.92
Brazil	1991	3.12	2.17
Chile	1976	4.94	5.13
Colombia	1986	1.39	1.25
Costa Rica	1986	4.12	1.85
Dominican Republic	1992	4.93	2.19
Ecuador	1991	3.32	1.59
El Salvador	1989	1.40	1.97
Honduras	1991	1.94	2.61
Mexico	1986	4.38	1.92
Paraguay	1989	2.50	1.16
Peru	1991	7.30	4.70
Uruguay	1990	4.16	3.08
Venezuela	1996	4.25	4.41
Latin American simple average		3.73	2.71

¹ Source: Wacziarg Welch (2008)

On average volatility is reduced by 25 percent after trade has been liberalised. In Costa Rica, Dominican Republic, Ecuador, Mexico and Paraguay volatility levels were halved. Post-liberalisation volatility was higher in only 5 of the 15 Latin American countries. At first sight trade liberalisation policy seems to be successful in reducing output volatility. These rough data are of course only suggestive. The regression results of model (1) will provide information for a more formal analysis.

5.2 Main regression results

In the remainder of this chapter I estimate the empirical model (1). Results for growth volatility of output (VOL_q), income (VOL_y) and consumption (VOL_c) are reported in Tables 4, 5 and 6 respectively. In regressions (1), (2), (5), (6), (9) and (10) the *de jure* measure of trade openness is included in the regression (indicated as 'Trade liberalisation'), while the regressions (3), (4), (7), (8), (11) and (12) contain the *de facto* measure of openness ('Trade openness'). Similarly, the *de jure* measure of financial openness ('Financial liberalisation') is included in the regressions with odd numbers and the *de facto* measure ('Financial openness') in the regressions with even numbers.

The R^2 ranges between 0.7 - 0.8, indicating a good fit of the regressions.

Table 4. Regression results of output growth volatility

	Dependent variable: VOL_q			
	(1)	(2)	(3)	(4)
Trade liberalisation	-0.460 ** (0.204)	-0.412 ** (0.196)		
Trade openness			-0.012 (0.071)	-0.024 (0.070)
Financial liberalisation	0.025 * (0.014)		0.007 (0.013)	
Financial openness		0.014 *** (0.005)		0.013 ** (0.005)
Financial development	-0.005 *** (0.001)	-0.005 *** (0.001)	-0.004 *** (0.001)	-0.005 *** (0.001)
Privatisation	0.371 *** (0.127)	0.378 *** (0.123)	0.459 *** (0.118)	0.452 *** (0.115)
Export concentration (HHI)	-0.125 *** (0.042)	-0.120 *** (0.041)	-0.110 ** (0.050)	-0.104 ** (0.049)
Armed conflict	0.033 *** (0.009)	0.033 *** (0.010)	0.028 *** (0.010)	0.031 *** (0.011)
Disaster	0.004 *** (0.001)	0.005 *** (0.001)	0.004 ** (0.002)	0.004 ** (0.001)
Government spending	0.056 (0.073)	0.055 (0.074)	0.040 (0.075)	0.033 (0.075)
Initial income	0.611 *** (0.085)	0.617 *** (0.089)	0.621 *** (0.102)	0.618 *** (0.103)
Inflation	3.4E-05 *** (1.1E-05)	3.3E-05 *** (1.1E-05)	3.2E-05 *** (1.0E-05)	3.2E-05 *** (10.0E-06)
Institutional quality	-0.003 (0.004)	-0.003 (0.004)	-0.003 (0.004)	-0.003 (0.004)
Terms-of-trade volatility	0.044 *** (0.014)	0.045 *** (0.013)	0.051 *** (0.016)	0.053 *** (0.015)
US real interest rate	3.9E-06 0.027	0.002 (0.028)	-0.007 (0.027)	-0.006 (0.028)
AR(1)	0.760 *** (0.028)	0.765 *** (0.030)	0.775 *** (0.026)	0.778 *** (0.027)
R-squared (adjusted)	0.806	0.803	0.814	0.810
Observations	408	408	408	408

Heteroskedasticity corrected standard errors in parentheses. A constant was included in the regression, but is not reported here. AR(1) is the autoregressive term that is included to correct for first order autocorrelation. The sample consists of data for 15 Latin American countries between 1970-2000.

* denotes significance at 10 percent level, ** at 5 percent level, *** at 1 percent level.

Table 5. Regression results of income growth volatility

	Dependent variable: VOL _y			
	(5)	(6)	(7)	(8)
Trade liberalisation	-6.286 *** (2.047)	-6.913 *** (2.002)		
Trade openness			1.236 (0.843)	1.056 (0.817)
Financial liberalisation	-0.171 (0.209)		-0.363 * (0.207)	
Financial openness		0.042 (0.045)		0.014 (0.045)
Financial development	-0.026 ** (0.010)	-0.026 *** (0.010)	-0.025 ** (0.011)	-0.023 ** (0.010)
Privatisation	1.204 (1.275)	1.095 (1.317)	2.054 (1.276)	1.903 (1.297)
Export concentration (HHI)	-0.236 (0.311)	-0.285 (0.296)	-0.168 (0.352)	-0.204 (0.350)
Armed conflict	0.033 (0.159)	0.072 (0.145)	0.040 (0.171)	0.095 (0.167)
Disaster	0.041 *** (0.015)	0.040 *** (0.015)	0.039 ** (0.016)	0.037 ** (0.016)
Government spending	0.446 (0.836)	0.368 (0.817)	0.485 (0.863)	0.363 (0.844)
Initial income	3.265 *** (0.762)	3.300 *** (0.740)	3.839 *** (0.967)	3.913 *** (0.903)
Inflation	1.7E-05 (6.6E-05)	2.7E-05 (6.2E-05)	1.4E-06 (7.3E-05)	1.2E-05 (6.6E-05)
Institutional quality	-0.020 (0.035)	-0.021 (0.035)	-0.002 (0.033)	-0.003 (0.032)
Terms-of-trade volatility	-0.350 (0.246)	-0.332 (0.251)	-0.228 (0.237)	-0.192 (0.249)
US real interest rate	0.687 *** (0.183)	0.697 *** (0.183)	0.565 *** (0.190)	0.552 *** (0.193)
AR(1)	0.774 *** (0.027)	0.772 *** (0.026)	0.817 *** (0.025)	0.818 *** (0.024)
R-squared (adjusted)	0.718	0.715	0.712	0.700
Observations	407	407	407	407

Heteroskedasticity corrected standard errors in parentheses. A constant was included in the regression, but is not reported here. AR(1) is the autoregressive term that is included to correct for first order autocorrelation. The sample consists of data for 15 Latin American countries between 1970-2000.

* denotes significance at 10 percent level, ** at 5 percent level, *** at 1 percent level.

Table 6. Regression results of consumption growth volatility

	Dependent variable: VOL _c			
	(9)	(10)	(11)	(12)
Trade liberalisation	-0.338 ** (0.161)	-0.255 * (0.144)		
Trade openness			0.092 (0.074)	0.092 (0.074)
Financial liberalisation	0.039 ** (0.019)		0.024 (0.018)	
Financial openness		0.009 (0.007)		0.004 (0.010)
Financial development	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)
Privatisation	0.293 * (0.166)	0.300 * (0.168)	0.336 * (0.176)	0.320 * (0.176)
Export concentration (HHI)	-0.073 (0.046)	-0.076 (0.046)	-0.089 * (0.051)	-0.096 * (0.050)
Armed conflict	0.097 *** (0.016)	0.096 *** (0.017)	0.092 *** (0.022)	0.091 *** (0.022)
Disaster	0.010 *** (0.002)	0.010 *** (0.002)	0.010 *** (0.002)	0.010 *** (0.002)
Government spending	-0.227 *** (0.078)	-0.210 *** (0.075)	-0.235 *** (0.087)	-0.219 ** (0.085)
Initial income	0.657 *** (0.164)	0.679 *** (0.172)	0.657 *** (0.162)	0.680 *** (0.163)
Inflation	-6.9E-06 (1.4E-04)	-8.3E-06 (1.5E-05)	-9.8E-06 (1.5E-05)	-1.1E-05 (1.5E-05)
Institutional quality	0.003 (0.003)	0.003 (0.003)	0.006 * (0.003)	0.006 * (0.003)
Terms-of-trade volatility	0.046 ** (0.021)	0.044 ** (0.021)	0.049 * (0.025)	0.049 * (0.025)
US real interest rate	0.039 ** (0.018)	0.043 *** (0.016)	0.044 * (0.026)	0.048 * (0.026)
AR(1)	0.817 *** (0.023)	0.818 *** (0.023)	0.830 *** (0.030)	0.830 *** (0.030)
R-squared (adjusted)	0.766	0.760	0.769	0.766
Observations	404	404	404	404

Heteroskedasticity corrected standard errors in parentheses. A constant was included in the regression, but is not reported here. AR(1) is the autoregressive term that is included to correct for first order autocorrelation. The sample consists of data for 15 Latin American countries between 1970-2000.

* denotes significance at 10 percent level, ** at 5 percent level, *** at 1 percent level.

I start with analysing the effects of the main variables of interest: the measures of trade openness. *De facto* trade openness is significant in none of the regressions. Hence, there is no evidence that the relative size of the trade sector affects growth volatility. Trade liberalisation is significantly negatively associated with all volatility measures. It indicates that the trade policy reforms were successful in reducing growth fluctuations. A one standard deviation increase in the trade liberalisation index results into an increase in VOL_q of almost 0.1, *ceteris paribus*¹⁴. Given the mean of VOL_q (0.97) this impact is modest. The effect on consumption growth volatility is even slightly lower. The impact of trade

¹⁴ Calculated as the standard deviation of the trade liberalisation index times its coefficient (0.218 * -0.460 = 0.1).

liberalisation on income growth volatility is, however, more significant both statistically and in magnitude. A one standard deviation increase in the trade liberalisation index causes VOL_y to increase with 1.4, *ceteris paribus*. This magnitude is considerable when compared with its mean value of 7.5.

It is not unusual that one of the trade openness measures is significant while the other is not (see Kose et al. (2003) for similar results). The correlation between trade liberalisation and trade openness is only 0.18. It stresses the importance of the difference between trade policy and the consequential increase in trade openness. Lowering tariffs in order to reduce trade distortions has proved to be effective in stabilising macroeconomic growth. The increased trade openness that resulted from the trade reforms, however, did not have a significant impact on volatility.

The effect of financial liberalisation is somewhat inconclusive. Although positively associated with output and consumption growth volatility, it is negatively associated with income growth volatility (borderline significant). In three of the regressions its effect is not even significant. Financial openness – measured as FDI inflow as percentage of GDP – is associated with greater volatility, but the effect is only significant for VOL_q . Even though the results should be interpreted with appropriate caution due to the lack of significance, they seem to point towards a positive rather than a negative association. The results seem to confirm the notion that international investment flows are pro-cyclical, thereby exacerbating fluctuations. Investigation of the interaction effects in section 5.3 confirms that.

At the same time financial development – measured as domestic credit supply as percentage of GDP – does mitigate volatility. That result is in line with previous studies of Easterly et al. (2000) and Ahmed and Suardi (2009). The negative coefficient shows that well developed financial home markets act as shock absorbers. The variable is strongly significant for VOL_q and VOL_y . Hence, by expanding credit facilities the state can dampen growth fluctuations. From these various financial indicators it can be concluded that greater stability is not achieved by attracting foreign investors, but by expanding the domestic financial sector.

Privatisation is found to be positively associated with output and consumption growth volatility. Since the relationship between privatisation and growth volatility has not been studied extensively, the effect is not obvious beforehand. The positive relationship might be explained by the massive scale and the exceptional speed at which privatisation took place in Latin America. The privatisation and deregulation programmes caused substantial alteration of the entire industrial structure, and came with extensive layoffs (Stiglitz 2003). The resulting variability may have harmed macroeconomic stability.

Many of the control variables display a significant impact on the volatility measures. Terms-of-trade volatility turns out to be an important determinant of output and consumption growth volatility. As mentioned in section 3.2, terms-of-trade volatility is interpreted as a measure of exposure to external risk. In line with general findings in literature (e.g. Kose et al. (2003), Ahmed and Suardi (2009)) my findings show a positive relationship between terms-of-trade volatility and growth volatility. The result is not surprising, since many Latin American economies are highly dependent on the export of primary

products, the prices of which are known to be volatile. Commodity price shocks have a disruptive effect on the rest of the economy.

Government spending is negatively related to consumption growth volatility. This result emphasises the role of governments in mitigating risk and is in line with Rodrik's (1997) compensation theory. In section 5.3 I investigate the validity of the compensation theory in Latin America by testing the interaction between government spending and the proxies for openness.

Initial income is strongly significant in all regressions. Unexpectedly, it is positively associated with growth volatility, indicating that Latin American countries with a higher welfare level in 1970 experienced higher growth fluctuations later on. That is at odds with the consensus in the literature. The vast majority of researchers found income to be negatively associated with volatility. This outcome is a result of the chosen sample. In my research the result may be driven by countries as Argentina, Chile, Uruguay and Venezuela, which experienced high levels of volatility and were relatively rich in 1970. In worldwide samples the group of countries is more heterogeneous. Industrialised countries generally are less volatile than developing countries, hence, the negative association with volatility.

The occurrence of natural disasters has a destabilising impact. Its effect is consistently significant across most of the regressions. Armed conflict also enters the regression with a positive coefficient, even though it is significant only for consumption and output growth volatility. Somewhat surprisingly, institutional quality does not significantly impact volatility. Furthermore, there is significant evidence to suggest that inflation increases volatility, albeit only output growth volatility. The coefficient seems to indicate a trivial impact. However, with Latin American inflation rates averaging at 132 percent the ultimate impact of inflation is in line with the other variables.

The sign of export specialisation indicates that a more concentrated export structure is associated with lower growth volatility. This outcome is hard to reconcile with the predictions from theory and with previous findings (e.g. Haddad et al. (2010) and Hou (2010)). Latin American exports have become more diversified over time and one would expect this to reduce volatility. A more specialised export structure is usually associated with higher volatility. My results could be explained by Razin and Rose's (1994) theory. They state that when specialisation is of an intra-industry nature it leads to larger trade volumes of intermediate inputs, which reduce the co-movement of business cycles. This way output volatility is decreased. Unavailability of industry-level data prevents me from verifying this hypothesis quantitatively.

Finally, US real interest rate was included to control for external shocks. It is found to be a significantly determinant of income and consumption growth volatility. The positive coefficient indicates that growth stability in Latin America is sensitive to global market conditions.

5.3 Non-linearities and interaction

In this section I verify whether the effects of financial development and financial and trade openness are nonlinear by including quadratic terms (the squares of the gross flow measures). Only two cases of nonlinearity are found to be significant. There are nonlinearities in the relationship between financial openness and VOL_y , and between financial development and VOL_c . The results can be found in Appendix 3 (only the significant results are reported). It appears that financial openness may increase income growth volatility, but up to a limit. The squared term is significant and enters the regression with a negative sign. As the economy becomes more integrated with the international financial markets, growth stabilises. It indicates that Latin American economies need not to be less integrated with worldwide financial markets, but more. After the threshold value of 5.7 percent of GDP¹⁵, FDI inflow decreases volatility. Even though this threshold value is more than two standard deviations higher than the mean value, these values were not unusual in the end of the 1990s when financial markets were booming.

However, the nonlinear relationship is found to be only significant for one of the volatility measures and its significance is weak. The evidence is not strong enough to draw a firm conclusion. Evidence for nonlinearity in financial development shows a stronger significance, but again the result is found to be significant for only one of the volatility measures. Financial development was not significant without the inclusion of its square, implying that its effect on consumption volatility cannot be proxied by a linear line. The significance of the nonlinearity indicates that increasing credit supply is associated with more consumption growth volatility, but up to a limit. After its threshold of 73 percent of GDP¹⁶, credit supply has a stabilising effect. It takes a very large domestic financial sector for it to pass the threshold.

Additionally, I investigated whether Rodrik's (1997) compensation theory holds for my sample. As explained in section 3.3 the compensation theory claims that more open economies have larger governments in order to compensate for their greater exposure to external risk. Governments mitigate the fluctuations that result from a higher degree of integration with international markets. This would suggest an interaction effect between government spending and openness. I test this hypothesis by including an interaction term of government spending with the proxies for both trade and financial openness. If the compensation theory holds I expect to find the coefficient of the interaction term to be negative and significant.

¹⁵ The threshold value is calculated from the coefficients of financial openness and its squared term: $0.215 / (2 \cdot 0.019) = 5.7$

¹⁶ The threshold value is calculated from the coefficients of financial development and its squared term: $0.011 / (2 \cdot 7.5E-05) = 73$.

Table 7. Regression results for interaction

	VOL _q	VOL _y	VOL _c
Financial openness	0.128 ** (0.058)	1.686 *** (0.631)	0.200 *** (0.072)
Government spending	0.130 (0.093)	1.862 * (1.009)	-0.093 (0.097)
Interaction	-0.046 ** (0.023)	-0.668 *** (0.257)	-0.077 *** (0.028)
R-squared (adjusted)	0.806	0.702	0.761
Observations	408	407	404

	VOL _q	VOL _y	VOL _c
Trade openness	-0.308 (0.293)	-3.710 (4.595)	-0.319 (0.301)
Government spending	-0.391 (0.390)	-7.225 (7.201)	-0.849 * (0.438)
Interaction	0.120 (0.111)	1.997 (1.875)	0.174 (0.127)
R-squared (adjusted)	0.806	0.705	0.771
Observations	408	407	404

Heteroskedasticity corrected standard errors in parentheses. The same control variables as in the main regression (model (1)) were included in the regression, but are not reported here. AR(1) is the autoregressive term that is included to correct for first order autocorrelation.

* denotes significance at 10 percent level, ** at 5 percent level, *** at 1 percent level.

The coefficient of financial openness is now strongly significant in all three regressions. It indicates that in absence of government expenditure financial openness increases growth volatility. The negative coefficient of the interaction term demonstrates the mitigating effect of government expenditure. Financial openness is negatively associated with volatility once governments are sizeable. Hence, financially integrated countries need a larger government to mitigate the destabilising effect of financial openness.

The results as reported in the lower half of the table demonstrate that there is no evidence for the compensation theory when it comes to trade openness. This is not surprising, since trade openness did not have a significant effect on volatility in the first place (see Tables 4-6).

6. Conclusion

The Washington Consensus has often been blamed for doing more harm than good. Its reform agenda has been perceived as market fundamentalism (Rodrik 2006, Stiglitz 2003) and its liberalisation schemes became unpopular among Latin Americans when the region's performance was disappointing. In this thesis I examined the effects of several market reforms on growth stability. I have investigated the determinants of growth volatility in Latin American countries, with a special focus on trade reforms, financial liberalisation and privatisation. My research outcomes have apparent policy implications. By giving insight in the variables that impact volatility, my analysis could provide governments with instruments to promote greater stability.

The structural reforms that were implemented throughout Latin America in the 1980s and 1990s have impacted growth stability. My research demonstrates that one has to distinguish between the different reform policies. Trade liberalisation, financial liberalisation and privatisation each have a distinct effect on growth volatility. Furthermore, there is an important difference between the *de jure* reform policies and the *de facto* effects. They do not necessarily have the same impact on volatility.

The regression results demonstrate a crucial difference between the effects of trade liberalisation, trade openness and external risk. Trade liberalisation is found to reduce growth fluctuations in Latin America. By lowering tariff rates governments can lessen price distortions and achieve greater stability. At the same time, greater trade openness has no impact on volatility. It is not the size of the trade sector that affects growth volatility, but rather the exposure to external risk. Fluctuations in prices on the international markets are found to be an important determinant of growth volatility.

My results show that it is essential to distinguish between the different financial sector variables. The claim that financial reforms – in terms of capital account liberalisation – promote stability does not hold in Latin America. The effect on growth volatility lacks robustness. Instead, international investment flows are found to exacerbate fluctuations. Analysis of interaction effects reveals that the destabilising effect of international investment flows can be mitigated by increasing the size of governments. I also find that development of the domestic financial sector reduces growth volatility. Hence, governments can enhance stability by expanding credit facilities.

The results are robust for the inclusion of a large set of control variables, ranging from inflation and institutional quality to the occurrence of armed conflicts and the cost of foreign borrowing. Little evidence of nonlinearities was found.

When comparing my results with previous findings it becomes clear that the chosen sample is crucial. The conclusions drawn from worldwide samples do not necessarily match those of a regional sample. Especially when there is little consensus about the nature of the relationship one should be cautious. What holds on average for a worldwide sample does not necessarily hold for a specific region. Even

though a number of studies found trade liberalisation to be positively associated with growth volatility on a global average, the opposite is true for Latin America. Similarly, suggesting Latin American economies to open up to foreign investments because global studies have proved that this stabilises growth, may turn out disappointingly. A general claim that liberalisation mitigates volatility is equally misleading. Trade liberalisation has proved to reduce volatility in Latin America, but the opposite is true for privatisation. Hence, a general claim that the reform agenda of the Washington Consensus caused greater growth volatility in Latin America does not hold.

As a suggestion for further research, it would be interesting to extend the time dimension of the sample in order to include the impact of the most recent global financial crisis (that started in 2007). Being the most severe economic downturn since decades, it is the ultimate test for Latin America's exposure to risk. It would be interesting to compare the effect with the impact of the Oil Crisis in the 1970s, when Latin American economies were still closed. It may answer the question how the impact of a major global shock resonates in Latin America now it has become more integrated with the world markets. In order to do so the policy reform indices have to be updated.

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Appendix 1. Variables

Variable	Expected sign	Definition	Data source
Output volatility (VOL _q)		Real GDP growth volatility (in logs).	World Bank Development Indicators
Income volatility (VOL _y)		Real GNI growth volatility.	World Bank Development Indicators
Consumption volatility (VOL _c)		Private consumption growth volatility (in logs).	World Bank Development Indicators
Trade liberalisation	+/-	The trade liberalisation index is constructed as the simple average of the average tariff rate and the dispersion of tariff rates. It is normalised and ranges from its minimum observed value 0 to the maximum observed value 1.	Escaith and Paunovic (2004)
Trade openness	+/-	The sum of exports and imports of goods and services as percentage of GDP (in logs).	World Bank Development Indicators
Financial liberalisation	+/-	Chinn and Ito's $KAOPEN_t$ index. The index is constructed out of binary dummy variables reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. These variables include: the presence of multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions and requirement of the surrender of export proceeds. $KAOPEN_t$ is constructed by standardising the reverse of these binary variables.	Chinn and Ito (2007)
Financial openness	+/-	Foreign direct investment inflow as percentage of GDP.	UNCTAD
Privatisation	+/-	Privatisation index, computed as: $1 - \frac{\text{value added by state companies}}{\text{non agricultural GDP}}$ <p>The index ranges from its minimum observed value 0 to the maximum observed value 1.</p>	Escaith and Paunovic (2004)
Armed conflict	+	Intensity level of armed conflict. Categorized as: 0 (peace), 1 (minor), 2 (intermediate), 3 (war).	Nils Petter Gleditsch, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg & Håvard Strand, 2002. 'Armed Conflict 1946–2001: A New Dataset', <i>Journal of</i>

			<i>Peace Research</i> 39(5) pp. 615–637.
Financial development	-	Domestic credit to private sector as percentage of GDP.	World Bank Development Indicators
Disaster	+	Number of people affected by a disaster, as percentage of total population. Number of people affected is defined as the total number of deaths, homeless or injured people caused by a natural, biological, climatological, geophysical, hydrological meteorological or complex disaster.	EM-DAT International Disaster database developed by the Center for the Epidemiological Study of Disasters (CRED) of the Catholic University of Louvain, Belgium.
Government expenditure	+/-	General government final consumption expenditure as percentage of GDP (in logs).	World Bank Development Indicators
Herfindahl Hirschman Index of export concentration	+	Sum of squared market shares of the commodities export sectors at SITC level 2 (in logs).	COMTRADE
Initial income	-	GDP per capita level in 1970 (in logs).	World Bank Development Indicators
Inflation	+	Annual percentage change in consumer price index.	World Bank Development Indicators
Institutional quality	-	POLITY2 variable (from the Polity IV Project). This variable is a measure of the institutionalised political organisation and ranges from -10 (strongly autocratic) to 10 (strongly democratic). Its components are: Competitiveness of executive recruitment, openness of executive recruitment, constraints on chief executive, regulation of participation, and competitiveness of political participation. For the exact computation of the index, I refer to the User's Manual of the Polity IV Project Dataset, by Marshall and Jaggers (2009).	Polity IV
Terms of trade volatility	+	Rolling standard deviation of the terms-of-trade using a 5-year window (in logs).	Oxford Latin America Economic History Database
US real interest rate	+	United States real interest rate (in logs).	World Bank Development Indicators

Appendix 2. Summary statistics

	Mean	St dev
VOL _q	0.969	0.597
VOL _y	7.460	5.060
VOL _c	1.138	0.728
Trade openness	3.707	0.509
Trade liberalisation	0.729	0.218
Financial openness	1.489	1.815
Financial liberalisation	-0.395	1.392
Financial development	29.723	15.381
Privatisation	0.746	0.178
Export concentration (HHI)	-1.706	0.650
Armed conflict intensity	0.366	0.866
Natural disaster	1.201	4.557
Government expenditure	2.399	0.284
Initial income	6.169	0.564
Inflation	131.7	741.61
Institutional quality	3.306	6.427
Terms-of-trade volatility	2.16	0.941
US real interest rate	1.374	0.780

Appendix 3. Nonlinearities

Dependent variable:	VOL _y	Dependent variable:	VOL _c
Financial openness	0.215 *	Financial development	0.011 ***
	(0.120)		(0.003)
Financial openness squared	-0.019 *	Financial development squared	-7.5E-05 ***
	(0.010)		(1.8E-05)
Trade liberalisation	-7.157 ***	Trade liberalisation	-0.323 *
	(1.986)		(0.185)
Financial development	-0.025 **	Financial liberalisation	0.042 **
	(0.010)		(0.019)
Privatisation	1.271	Privatisation	0.306 *
	(1.326)		(0.177)
Export concentration (HHI)	-0.208	Export concentration (HHI)	-0.077
	(0.294)		(0.049)
Armed conflict	0.045	Armed conflict	0.087 ***
	(0.144)		(0.020)
Disaster	0.058 **	Disaster	0.010 ***
	(0.015)		(0.002)
Government spending	0.418	Government spending	-0.284 ***
	(0.782)		(0.090)
Initial income	3.263 ***	Initial income	0.660 ***
	(0.750)		(0.163)
Inflation	2.7E-05	Inflation	-9.2E-06
	(6.3E-05)		(1.4E-05)
Institutional quality	-0.015	Institutional quality	0.003
	(0.035)		(0.003)
Terms-of-trade volatility	-0.336	Terms-of-trade volatility	0.056 **
	(0.251)		(0.026)
US real interest rate	0.738 ***	US real interest rate	0.035
	(0.181)		(0.026)
AR(1)	0.770 ***	AR(1)	0.825 ***
	(0.026)		(0.029)
R-squared (adjusted)	0.713	R-squared (adjusted)	0.765
Observations	407	Observations	404

Heteroskedasticity corrected standard errors in parentheses. A constant was included in the regression, but is not reported here. AR(1) is the autoregressive term that is included to correct for first order autocorrelation. The sample consists of data for 15 Latin American countries between 1970 - 2000.

* denotes significance at 10 percent level, ** at 5 percent level, *** at 1 percent level.