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External Crisis Vulnerability in Latin America and the Caribbean

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Abstract[1]

This paper assesses the vulnerability of Latin American and Caribbean (LAC) economies to external crises. It shows that while the average LAC economy has made significant strides to reduce vulnerability to crises to its historical minimum, there is still considerable room for improvement, compared to both advanced and non-advanced economies. When compared to other non-advanced economies, the average LAC economy displays a higher level of vulnerability, mainly due to slower improvements in portfolio composition and less accumulation of international reserves since 2000. Advanced economies have lower exposure to external risk factors and a structural resilience advantage to prevent exposure from leading to crises. This analysis highlights the need for LAC economies to focus more on enhancing their risk-mitigating strategies concerning the composition of their external portfolios and reserves accumulation, which will provide a stronger buffer against external shocks and promote overall economic resilience.

JEL classifications: F30, F34, G01, G15, H63
Key terms: External crisis, Financial crisis, External balance sheet, International reserves, Macroeconomic imbalances, External debt, Foreign direct investment, External Assets and Liabilities.

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The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-Ameri can Development Bank, its Board of Directors, or the countries they represent. This paper benefited from previous work with Juan Martín Rinaldi (University of British Columbia). Santiago Gómez-Malagón provided superb research assistance. All remaining errors are the responsibility of the authors.

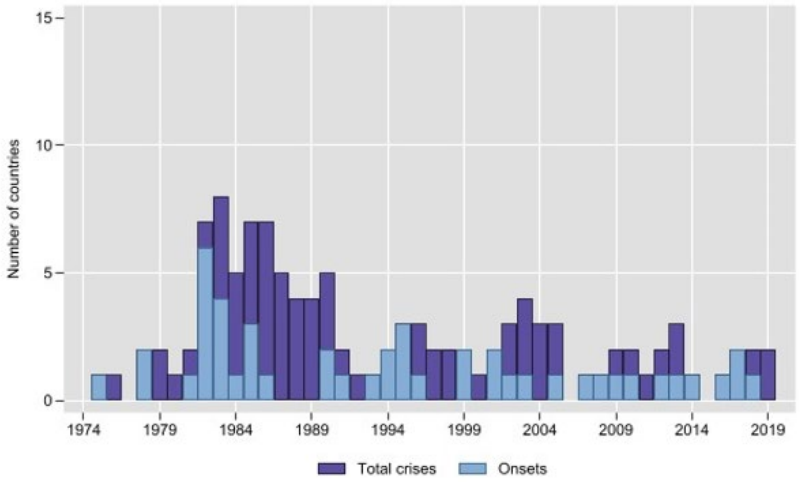
1. Introduction

The objective of this work is to gauge the risk of external crises in Latin America and the Caribbean (LAC) and identify its drivers. We look at the temporal evolution of LAC risk factors, both risk-creating and risk-mitigating, and the overall likelihood of crisis over 50 years. We conduct this study in absolute terms and relative to relevant comparators to detect anomalies that may be informative for policy analysis.

Following Catão and Milesi-Ferretti (2014), an external crisis is indicated by an external debt default or rescheduling event as well as events leading to large IMF support.[2] Figure 1 shows the incidence of external crises in LAC as measured by the number of countries in crisis (labeled total crisis) over the years. It was the highest in the 1980s following a significant number of crisis onsets—especially at the beginning of the decade. The crises extended for several years, resulting in a large number of countries in crisis during the decade. In the 1990s, crisis onsets declined but have remained a constant threat: there was, for example, a bunching of crises around the so-called Tequila crisis originating in Mexico in 1994, and a series of crises following the Asian and Russian financial crises of 1997 and 1998. There was the Brazilian crisis of 1999, and then the Argentine crisis in 2002. Since 2000, there have been crisis onsets concentrated around the global financial crisis of 2008/09 and the Euro crisis of 2013. The crises that originated starting in 1990 were of shorter duration (1.76 years instead of 3.8 years), which further contributed to the overall decline of crisis incidence after the 1980s.

[2] Large IMF support is defined as IMF loans exceeding twice the country's quota.

Figure 1. External Crises in Latin America and the Caribbean



Note: External crisis indicator is from Catão and Milesi-Ferretti (2014), updated by Cavallo, Fernández-Arias and Rinaldi (2022) up to 2019.
The LAC countries included in the sample are Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Jamaica, Mexico, Peru, Uruguay and Venezuela

What are the driving factors behind these crises, and what are the policy levers that may be used to make them less likely? One strand of the literature has emphasized the role of external factors, noting that the high number of bunching of crises around given years suggests that there are common external drivers leading to the "sudden stop" of foreign financing.[3] Still, the fact that some countries are hit while others are spared suggests that country idiosyncratic factors also matter.[4] We assess both types of risk factors of external crisis with the purpose of guiding prudential policy. This objective requires identifying causal factors amenable to policy intervention in a timely fashion. This approach differs from an *early-warning* analysis, in which the objective is to identify symptoms to predict or forecast the likelihood of crises.[5] While

[3] The idea that capital flows may be driven by "push" (external) rather "pull" (domestic) factors has a long tradition in the literature (see, Calvo, Leiderman, and Reinhart, 1996). The first analytic approach to the problem of sudden stops is Calvo (1998). To the best of our knowledge, the expression "sudden stops" to refer to external crises was first used by Dornbusch, Goldfajn, and Valdés (1995). For a survey of the literature, see Cavallo (2019).
[4] Reinhart and Rogoff (2009) provide a comprehensive historical overview of financial crises around the world, presenting evidence that excessive debt accumulation, whether by the government, households, or the private sector, often poses greater systemic risks than is apparent during a boom.
[5] An early warning approach (Kaminsky, Lizondo and Reinhart, 1998) would be concerned with symptoms that help predict crises, such as the emergence of capital flight, rather than their underlying causal drivers. For example, market indicators such as the sovereign risk spread may be a very useful component of an early warning model but would not be a policy-relevant risk factor.

symptoms can be informative of root causes, a causal model is needed to provide reliable guidance on the substance of healthy policy regimes and appropriate policy measures.

This paper contributes to a body of literature suggesting that external balance sheets are an important factor in the probability of financial crisis and should be carefully monitored and managed. Al-Saffar et al. (2013) argued that countries with significant leverage and rapid domestic credit growth, fueled by net capital inflows, may become over-leveraged, making them especially prone to crises. Joyce (2018) found that emerging markets with a "long debt, short equity" strategy, meaning they held debt assets and issued equity liabilities, were better able to mitigate the effects of the global financial crisis. Setser et al. (2002) lay out a framework for exploring crises in emerging markets based on the examination of stock variables in the aggregate balance sheet of a country and the balance sheets of its main sectors (assets and liabilities) but did not pursue an empirical investigation. Catão and Milesi-Ferretti (2014) examine the determinants of external crises, focusing on the role of net foreign liabilities and their composition by type of instrument (FDI, portfolio equity and debt).

The study builds on these papers to develop key risk indicators to assess the evolution of risk factors in LAC over time, and to compare the LAC economies with both advanced and non-advanced economies. The main objective of this comparison is to pinpoint areas where LAC economies can learn and adopt strategies to lower their susceptibility to crises.

This study finds that LAC economies have made considerable progress in managing their risks but there still exists a crisis vulnerability gap with respect to other non-advanced economies in the sample (the average probability of a crisis is about 1.4 times larger than other non-advanced) and a considerable disparity when compared to advanced economies (the probability is about 11 times larger than advanced economies). The paper concludes by suggesting that the LAC region needs to further improve its risk management, by enhancing the safety of its external portfolio composition, especially on the asset side, and increasing its international reserves. This would reduce financial risk exposure and provide stronger defenses against external shocks, lessening crisis vulnerability.

The plan of this paper is as follows. Section 2 describes the risk model used. The following sections apply the risk model to the LAC regional average. Section 3 analyzes the evolution of external portfolio risk, and Section 4 shows the evolution of three other risk factors: international reserves, macroeconomic imbalances, and global shocks. Section 5 puts together the risk analysis

in the preceding sections to explain the evolution of crisis vulnerability—the likelihood of external crisis—in LAC. Finally, Section 6 benchmarks LAC's risk profile against comparable economies to gain a better perspective on LAC's strengths and weaknesses. Section 7 summarizes the conclusions.

2. The Determinants of Crisis Risk

The analysis in this paper uses the model and estimations in Cavallo, Fernández-Arias and Rinaldi (2022), which separates global exogenous factors driving the risk of external crisis, oftentimes in the form of financial contagion, from risk factors under the control of each country. In turn, among the latter, it distinguishes the risks associated with the external financial portfolio of the country from macroeconomic factors. The risk model explains the onset of an external crisis three years ahead with a Probit specification applied to a panel of 62 countries, indexed by *i*, over yearly data in the period 1970-2019, indexed by *t*:

$$Prob\ (Crisis_{it} = 1) =$$

$$\Phi(Constant + \alpha D_N + \beta G_{it} + \gamma(Portfolio)_{it-3} + \delta(Macrocontrols)_{it-3}), \qquad (1)$$

In this risk model, the stocks of external assets and liabilities accumulated through the financial account of the Balance of Payments (**Portfolio**) are key explanatory variables of interest. These variables are complemented by domestic explanatory variables (**Macrocontrols**), namely the stock of international reserves and a set of proxies for macroeconomic imbalances. Furthermore, there is a dummy indicator D_N to control for lower crisis resilience in non-advanced economies (**Structural Risk**) and a proxy for global factors G_{it} equal to the fraction of foreign countries that are in crisis in any given year to reflect global crisis propensity over time (**Global Risk)**.

Within **Portfolio***,* we consider a vector of six external portfolio variables according to Balance of Payments classification: *Foreign Debt (Assets and Liabilities), Foreign Portfolio Equity (Assets and Liabilities),* and *Foreign Direct Investment (Assets and Liabilities).* These variables represent all international financial claims, private and public, except for the country's international reserves. The **Macrocontrols** include *International Reserves* and a set of macroeconomic imbalances that may trigger external crises: the *Current Account Deficit*, the

Fiscal Deficit Gap, and the *Real Exchange Rate Overvaluation*. Portfolio and nominal macro controls are measured as a share of trend GDP.[6]

The following is a summary of the estimated coefficient parameters grouped in three categories: *structural* and *global factors*, *portfolio variables*, and *macrocontrols*.[7]

Table 1. The Determinants of External Crises
(Baseline estimation)

Category	Variable	Coefficient
Baseline	Constant	-2.88***
		(0.33)
Structural and Global	Non-Advanced Dummy	1.08***
		(0.26)
	Global Risk	1.65*
		(0.96)
Portfolio	Debt Assets	0.17
		(0.46)
	Debt Liabilities	1.13***
		(0.39)
	PE Assets	-2.23
		(2.01)
	PE Liabilities	0.90
		(1.10)
	FDI Assets	-4.98***
		(1.72)
	FDI Liabilities	0.64*
		(0.35)
Macrocontrols	FX Reserves	-4.30***
		(1.12)
	Current Account Deficit	1.22*
		(0.74)
	Fiscal Deficit Gap	2.76**
		(1.31)
	REER Overvaluation Gap	0.61**
		(0.27)
	Observations	1949
	AIC	475.2
	AUROC	0.85
	Pseudo R^2	0.21

Country clustered standard errors.
* p<0.1, ** p<0.05, *** p<0.01

Note: Probit estimation of equation (1) with clustered standard errors. Dependent variable: external crisis (0.1). External crisis indicator is from Catão and Milesi-Ferretti (2014), updated by Cavallo, Fernández-Arias and Rinaldi (2022) up to 2019.
Source: Cavallo, Fernández-Arias and Rinaldi (2022)

[6] Trend GDP is a computed using a standard Hodrick-Prescott filter to extract the smooth trend from the GDP time series with a 6.25 smoothing parameter, in line with Ravn and Uhlig (2002).
[7] Appendix A contains additional information on data sources and methods; for further details see Cavallo, Fernández-Arias and Rinaldi (2022).

The estimations show that the portfolio risk factors generally carry significantly different risk effects that merit analysis both in gross terms and broken down by financial type. All the statistically significant portfolio factors (both risk-creating liabilities and risk-mitigating assets) have the expected sign. Macroeconomic risk factors are statistically significant and are estimated with the expected sign. Since portfolio and macrocontrols variables are measured with the same metric (as percent of trend GDP), relative point estimates are comparable in dollar terms. For example, one dollar of reserves (point estimate -4.30) or one dollar of FDI assets (point estimate of -4.98) would offset the risk of approximately 4 dollars of external debt (=4*1.13=4.52).

The risk model shows that other factors also have a statistically significant effect. First, everything else equal, non-advanced countries are significantly riskier. This differential effect reflected in the group dummy (point estimate 1.08) can be interpreted as lower resilience to risk, or structural risk. Second, global factors (point estimate 1.65), reflected in the incidence of crisis outside any given country, significantly magnify the risk created by domestic factors when there are crises abroad. Finally, the estimated constant measures the baseline risk that any country would face even if all risk-relevant factors identified in the model are neutralized.

3. External Portfolio Risks in LAC

This section starts the analysis of risk of external crisis in LAC by analying the risk footprint of the external portfolio of the average LAC country. The estimation of the parameter vector γ for the group of external portfolio variables can be used to construct a portfolio risk indicator for each country at a 3-year horizon (PRI):

$$PRI_{it} = \gamma_1 DA_{it} + \gamma_2 DL_{it} + \gamma_3 PEA_{it} + \gamma_4 PEL_{it} + \gamma_5 FDIA_{it} + \gamma_6 FDIL_{it}, \qquad (2)$$

where:

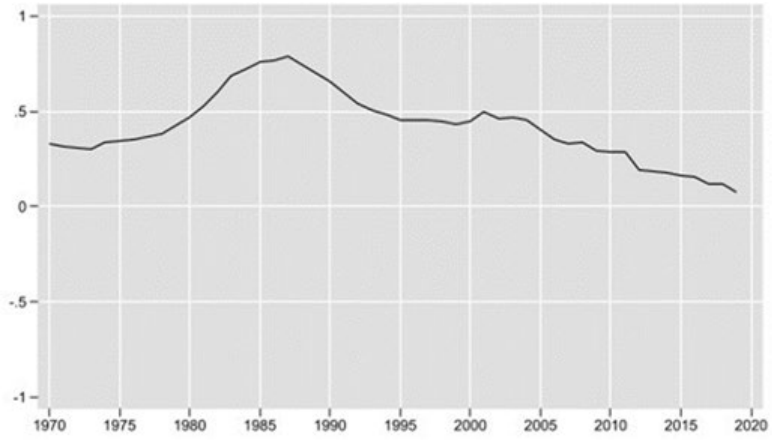
$DA: Debt\ Assets,$
$DL: Debt\ Liabilities,$
$PEA: Portfolio\ Equity\ Assets,$
$PEL: Portfolio\ Equity\ Liabilities,$
$FDIA: FDI\ Assets,$
$FDIL: FDI\ Liabilities.$

The PRI is a risk indicator, not a probability measure of risk. While the PRI is one factor relevant to the estimation of the probability of crisis in the Probit model, its mapping into probability space is mediated by a non-linear function that also depends on the rest of the risk

factors. Nevertheless, since that transformation is monotonic, it provides qualitative information about risk trends. Notice that the PRI of a country under financial portfolio autarky (an external financial portfolio with no assets or liabilities) would be zero. Therefore, the estimated PRI is an indicator of the risk created by the external portfolio relative to no external assets and liabilities. If portfolio risks are balanced, PRI is zero and the probability of external crisis would be the same as in financial autarky. A positive indicator implies that the external portfolio increases such probability of crisis, more so if the indicator is higher. The opposite is true for a negative indicator, in which case the external portfolio mitigates the risk that would obtain under financial portfolio autarky (created by other risk factors).

Figure 2 shows the evolution of the PRI in LAC, computed as the average PRI across countries.[8] We note that the PRI has been trending downwards since the mid-1980s, becoming virtually risk neutral by the end of the sample.

Figure 2. Portfolio Risk Indicator (PRI)
(Cross-country average)



Note: The PRI is calculated as specified in equation (2), using the coefficient estimates from Table 1, and the observed portfolio values for country *i* at time *t*. The cross-country average is the simple average of the PRI by country. To avoid country compositional changes in the PRI time series we included the missing portfolio observations omitted from the estimation sample due to crisis continuation and recovery years after each crisis onset. The remaining missing values at the beginning of the sample period for countries whose data starts later were filled by extrapolating their first sample observation. In this way, we obtain a complete panel of portfolio observations of 62 countries from 1970 to 2019.

[8] To avoid country compositional changes in the PRI time series we included the missing portfolio observations omitted from the estimation sample due to crisis continuation and recovery years after each crisis onset (see Cavallo, Fernández-Arias and Rinaldi (2022) for estimation details). The remaining missing values at the beginning of the sample period for countries whose data starts later were filled by extrapolating their first sample observation. In this way, we obtain a complete panel of portfolio observations of 62 countries from 1970 to 2019.

Panels A and B in Figure 3 explore the portfolio components that account for this evolution. Panel A decomposes the PRI into gross asset and liability positions, where each subcomponent indicates the risk relative to autarky, that is, zero assets and liabilities, respectively (time subindexes dropped for clarity):

$$PRI = PRI_A + PRI_L, \tag{3}$$

where:

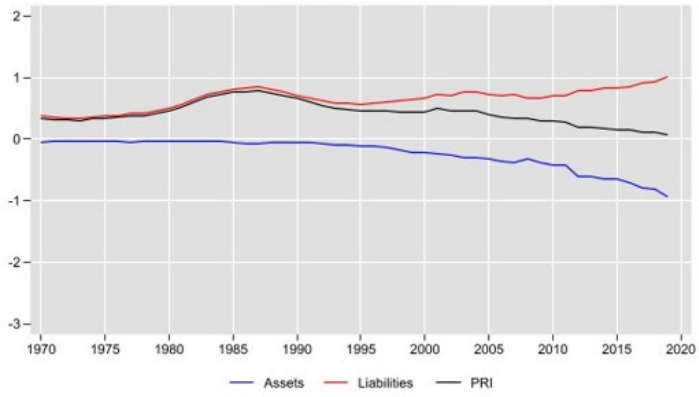
$$PRI_A = \gamma_1 D_A + \gamma_3 PE_A + \gamma_5 FDI_A$$
$$PRI_L = \gamma_2 D_L + \gamma_4 PE_L + \gamma_6 FDI_L$$

Panel B decomposes the PRI in terms of the positions in each financial type (again relative to portfolios that do not include each one of the types):

$$PRI = (\gamma_1 D_A + \gamma_2 D_L) + (\gamma_3 PE_A + \gamma_4 PE_L) + (\gamma_5 FDI_A + \gamma_6 FDI_L) \tag{4}$$

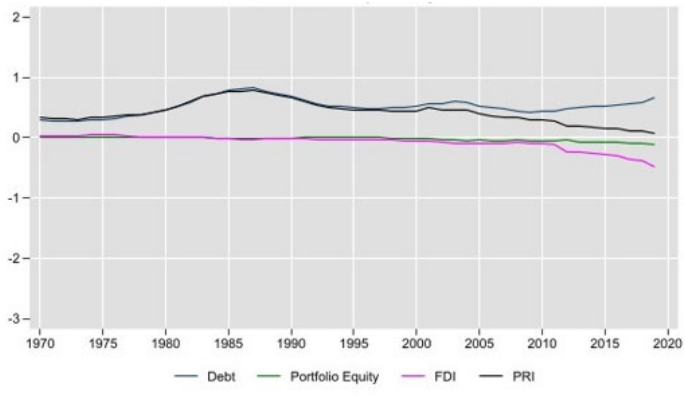
Figure 3. PRI: Breakdowns by Contributing Factors
(LAC regional average)

PANEL A: By Assets & Liabilities



Note: The PRI is calculated as specified in equation (3), using the coefficient estimates from Table 1, and the observed portfolio values for country *i* at time *t*. The regional average is the simple average of the index by country.

PANEL B: By Financial Type



Note: The PRI is calculated as specified in equation (4), using the coefficient estimates from Table 1, and the observed portfolio values for country *i* at time *t*. The regional average is the simple average of the index by country.

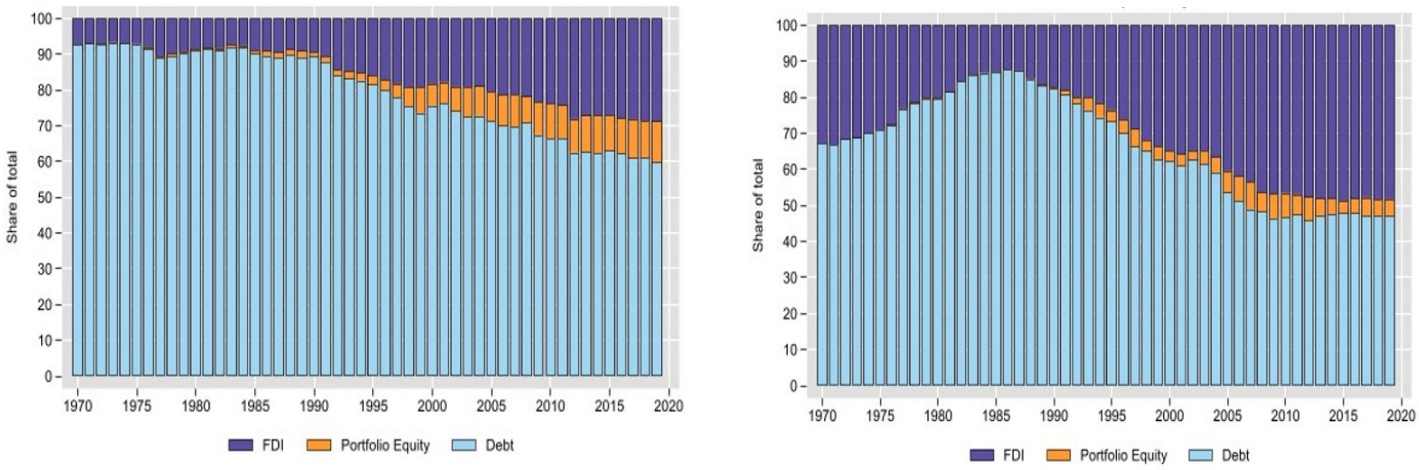
Panel A shows that the risk indicator for foreign liabilities has not declined and is currently above its historical maximum level in the mid-1980s. Nevertheless, despite increasingly risky liabilities, the PRI had an overall downward trend over the past three decades because of the

increase in risk mitigation afforded by foreign assets. Panel B reveals that the main driver of the declining PRI is the impact of net FDI positions since 2010. In contrast, net debt positions have become increasingly risky in the same period.

In order to analytically disentangle the drivers of the PRI, we distinguish two main sources of changes : changes in the composition of the portfolio (moving assets or liabilities from one type to another type leads to changes in the PRI because γ's are different across types) and changes in the aggregate level of assets and liabilities, an extensive margin that would leverage the risk profile of any given portfolio composition.

The underlying changes in portfolio composition can be summarized as a more intensive use of equity instruments (especially FDI), which are less risky as liabilities (i.e., point estimate of Debt Liabilities=1.13 vs. 0.64 for FDI Liabilities in Table 1) and much more protective as assets (i.e., point estimate of Debt Assets =0.17 vs. -4.98 for FDI Assets in Table 1). Figure 4 portrays the consistent increase of the share of equity positions (portfolio and especially FDI) in overall foreign assets. The equity share in liabilities has also grown since the debt crisis of the 1980s, although it appears to have stalled since 2010.

Figure 4. External Portfolio Composition in Latin America and the Caribbean



Note: The figure shows the share of external portfolio assets (panel A) and liabilities (panel B) by instrument: Foreign Direct Investment (FDI), Portfolio Equity, and Debt. The share of each instrument is over the total assets and liabilities, respectively. Figures show simple averages by country in LAC. Data on external portfolios are from Lane and Milesi-Ferretti (2018), updated to 2019 by Milesi-Ferretti (Brookings Website).

To measure the portfolio composition effect, we consider a core portfolio normalized by the level of aggregate portfolio assets (A) and liabilities (L) in country *i* at time *t*:

$$(Asset\ Portfolio\ Item)'_{it} = \frac{(Asset\ Portfolio\ Item)_{it}}{A_{it}}, \tag{5}$$

$$(Liability\ Portfolio\ Item)'_{it} = \frac{(Liability\ Portfolio\ Item)_{it}}{L_{it}}, \tag{6}$$

The normalized portfolio items are the shares of each financial type for both assets and liabilities as shown in Figure 4. We capture the portfolio composition source by looking at the evolution of the risk indicator of these normalized portfolios (PRI'), whose variations are not due to changes in aggregate assets or liabilities but to changes in composition (changes in the share allocation of assets and liabilities across types). This leads to the following analytical decomposition:

$$PRI_{A,it} = \left(PRI'_{A_{it}}\right) A_{it}, \tag{7}$$

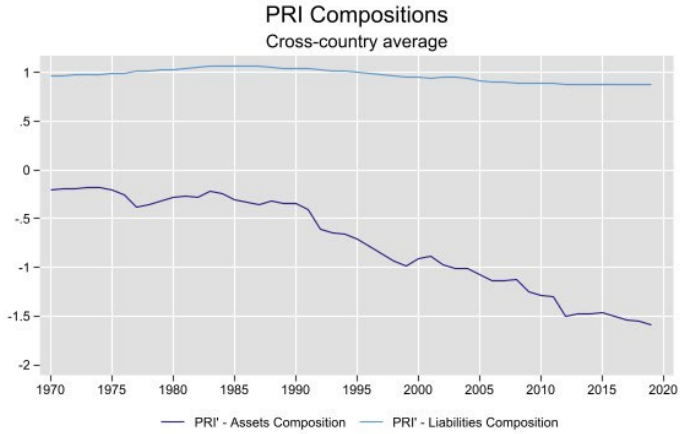
$$PRI_{L,it} = \left(PRI'_{L_{it}}\right) L_{it}, \tag{8}$$

Figure 5 sheds light on the evolution of PRI_A and PRI_L depicted in Figure 3 by showing the evolution of their two analytical components: the risk associated with normalized portfolios over time (PRI'_A and PRI'_L) in panel A, and the evolution of the asset and liability levels (A and L) in panel B.

Panel A shows that the risk associated with liability composition has been relatively constant throughout the period. However, asset composition has become increasingly risk-mitigating since the mid-1980s, fully offsetting the liability risk of the normalized portfolio by 2000. In other words, if aggregate assets and liabilities had remained constant, the observed changes in their composition would have reduced overall portfolio risk. If they were equal, so that the net financial account is zero, the overall portfolio risk would have turned around by 2000. At the same time, Panel B shows a consistent upward trend of both gross assets and liabilities over time, which magnifies the risk implications of the portfolio composition effects. This implies that, by and large, higher gross positions have amplified the risk gains of safer composition.

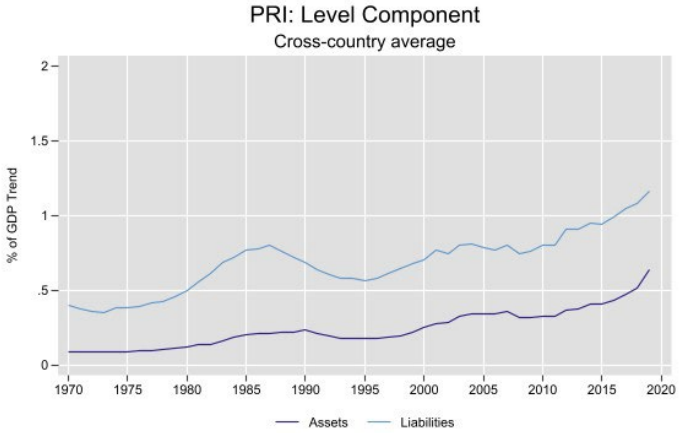
Figure 5. PRI Analytical Components

PANEL A: Normalized PRI'$_A$ and PRI'$_L$



Note: The PRI'$_A$ and PRI'$_L$ are calculated as specified in equations (7) and (8) respectively, using the coefficient estimates from Table 1, and the observed portfolio values for country *i* at time *t*. The regional averages are the simple average by country.

PANEL B: Asset and Liabilities (% of GDP)



Note: The A and L are the simple average across countries of observed portfolio values for External Assets (A) and External Liabilities (L) in country *i* at time *t*. The regional averages are the simple average by country.

The conclusion is that, for the average LAC country, changes in portfolio asset composition, especially towards FDI, have been responsible for driving the overall improvement in the risk indicator PRI. Changes in liability composition away from risky debt have made a relatively smaller contribution to improving the risk indicator. A substantial increase in financial integration has leveraged the impact of portfolio composition, further contributing to an increasingly safer external portfolio.

4. Non-Portfolio Risk Drivers of External Crisis in LAC

The other drivers of external crisis in the average LAC country are derived from the Structural Risk, Global Risk and Macrocontrols in the baseline specification. In Table 1, the low resilience or "structural risk" of a non-advanced economy is captured in the country group dummy. Furthermore, the global risk that every country faces in turbulent times is captured by the proportion of other countries that are in crisis at time *t*. The evolution of global risk encompasses changes in global fundamentals (e.g., a world recession or global financial turbulence not fully captured in countries' fundamentals) or crisis contagion (e.g., an increase in the risk assessment of

all countries due to the onset of crisis in some of them without a change in fundamentals).[9] Correspondingly, the structural risk indicator SRI_i and the global risk indicator GRI_{it} are:

$$SRI_i = \alpha D_N \qquad (10)$$

$$GRI_{it} = \beta G_{it+3} \qquad (11)$$

The estimation of the parameter vector δ can be used to assess the risk mitigation of international reserves (reserves risk indicator, RRI) and to construct a macroeconomic imbalance risk indicator (MIRI) similar to the PRI, which indicates the additional risk relative to a neutral situation of no overall macroeconomic imbalance:

$$RRI_{it} = \delta_1 R_{it} \quad (12)$$

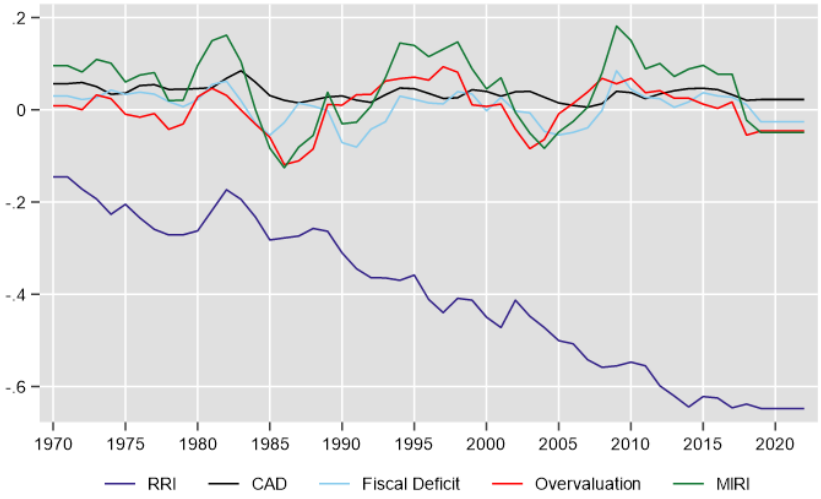
$$MIRI_{it} = \delta_2 CAD_{it} + \delta_3 Fiscal\ Deficit_{it} + \delta_4 Overvaluation_{it}, \qquad (13)$$

Figure 6 shows the evolution of the RRI and MIRI for the average LAC country using the coefficient estimates from Table 1. The MIRI in turn is decomposed in its three components. Macroeconomic imbalances per se appear to have a small impact on risk creation or risk mitigation (notwithstanding that sustained imbalances may lead over time to risky external liabilities, both public and private, accounted in the PRI). On the contrary, international reserves are a dominant driver, whose risk mitigation has consistently increased over time until, it appears, stalling since 2013.[10]

[9] As a risk indicator of external crisis three years ahead, the corresponding expected global risk needs to be estimated. For simplicity, we assume perfect foresight. That is why three-year leads are used in equation (11). See Cavallo, Fernández-Arias and Rinaldi (2022).

[10] Even if increased reserves *lead* to increased external liabilities, either directly or indirectly, its risk mitigation effect appears to be extremely powerful and would yield substantial net risk mitigation, as noted by Cavallo, Fernández-Arias and Rinaldi (2022).

Figure 6. Macroeconomic Risk Indicators
(LAC regional average)



Note: The RRI and the components of the MIRI are calculated as specified in equation (13), using the coefficient estimates from Table 1, and each of the observed variables for country *i* at time *t*. The regional average is the simple average of each index by country.

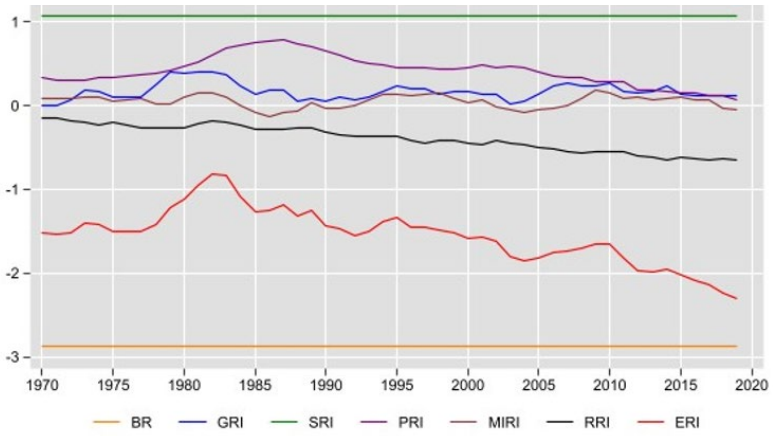
To put together all risk sources analyzed in this and the previous section, we define the overall External Risk Indicator (ERI) as the sum of the five risk indicators plus the estimated constant -2.88 representing background risk (BR):[11]

$$ERI_{it} = -2.88 + SRI_i + GRI_{it} + PRI_{it} + RRI_{it} + MIRI_{it} \qquad (14)$$

Figure 7 accounts for the sources of the evolution of the average ERI over the period. The figure shows a large decline in average overall risk after the debt crisis of the 1980s. ERI by the end of the sample was at its historical low. This overall risk reduction over time has been supported mainly by a reduction in external portfolio risk (PRI) after the mid-1980s, and an equally substantial risk mitigation improvement due to increasing international reserves (RRI). We note, however, that the increase in protection afforded by international reserves appears to have slowed down after the global financial crisis of 2008/09.

[11] While the constant in the risk model would not add any information as a risk indicator because it is time invariant, we incorporate it in the overall risk indicator for convenience and completeness.

Figure 7. External Risk Indicator (ERI)
(LAC regional average)



Note: The ERI and its components are calculated as specified in equation (14), using the PRI, MIRI, RRI, SRI, and GRI previously described. The regional average is the simple average of the corresponding index by country.

5. LAC External Vulnerability Assessment (EVA)

Going beyond risk indicators, the estimating equation of the probability of external crisis three years ahead is an assessment of external vulnerability in probability space, or EVA. This formulation makes the EVA a useful policy tool because it assesses overall risk with enough time to implement prudential policies on variables amenable to policy intervention, namely Macrocontrols and Portfolio variables, when vulnerability is at critical levels.

The external vulnerability of country *i* at time *t* is:

$$EVA_{it} = \Phi(ERI_{it}) = \Phi(-2.88 + SRI_i + GRI_{it} + PRI_{it} + RRI_{it} + MIRI_{it}) \qquad (15)$$

where $\Phi(.)$is the probit (normal density) function, and ERI, SRI, GRI, PRI, RRI and MIRI are the risk indicators defined in previous sections. This assessment of crisis probability can be used to trace the level of vulnerability over time as well as to compare vulnerability across countries. In the remainder of the section, we analyze the evolution and drivers of the average EVA across LAC countries.

Baseline risk (BR) is captured by the constant in Table 1 and is estimated as BR = Φ(-2.88) = 0.19%. The identified risk factors would add or subtract risk relative to the baseline depending on the sign of their risk indicators in equation (15). Their risk contributions would fill the gap between the observed crisis probability and baseline risk.

How important are the contributions of the five risk factors on top of baseline risk to country vulnerability? To answer this question, we need to decompose the EVA. Since the estimating equation of the probability of crisis in this Probit formulation is not linear, risk-augmenting and risk-mitigating sources interact to produce substantial joint effects whose attribution is ambiguous. In this section we derive a decomposition that utilizes the linear risk indicators SRI, GRI, PRI, RRI and MIRI as building blocks.

We express the EVA shown in equation (15) using the mean value theorem around the constant -2.88 for each (i,t):

$$EVA_{it} = \Phi(ERI_{it}) = \Phi(-2.88) + \lambda_{it}\,(ERI_{it} + 2.88) \tag{16}$$

$$= BR + \lambda_{it}\,(SRI_i + GRI_{it} + PRI_{it} + RRI_{it} + MIRI_{it})$$

(where $\lambda_{it} > 0$ is the normal density Φ evaluated at some point between -2.88 and ERI_{it}.) In what follows, equation (16) is used to obtain the risk contributions on top of baseline risk and decompose EVA into its six components:

$$EVA_{it} = 0.19 + SR_i + GR_{it} + PR_{it} + RR_{it} + MIR_{it} \tag{17}$$

where the contributions of the identified risk sources are given by

$$SR_{it} = \lambda_{it}\,SRI_i \tag{18}$$
$$GR_{it} = \lambda_{it}\,GRI_{it} \tag{19}$$
$$PR_{it} = \lambda_{it}\,PRI_{it} \tag{20}$$
$$RR_{it} = \lambda_{it}\,RRI_{it} \tag{21}$$
$$MIR_{it} = \lambda_{it}\,MIRI_{it} \tag{22}$$

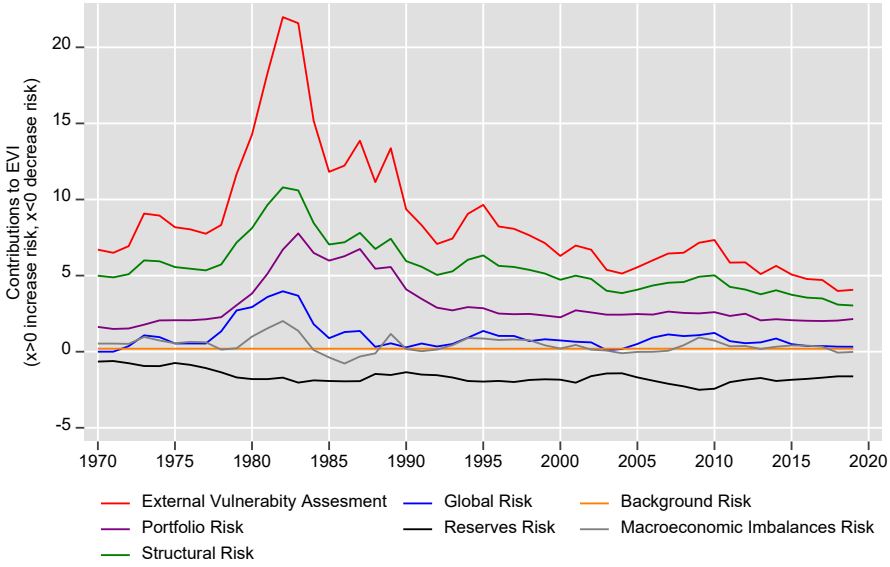
$$\lambda_{it} = \frac{EVA_{it} - 0.19}{SRI_i + GRI_{it} + PRI_{it} + RRI_{it} + MIRI_{it}} \tag{23}$$

Note that this decomposition ensures that the signs of risk contributions and risk indicators coincide (because the scaling variable $\lambda_{it} > 0$) and also preserves the shares of these four sources within ERI (because the scalar is λ_{it} is common across equations (18-22), and therefore the relative risk conclusions discussed previously using linear risk indicators are preserved.[12] This decomposition separates the effect of baseline risk as defined and then derives a decomposition of the risk effects of the explanatory variables to fill the remaining risk gap that is fully consistent with the previous relative risk analysis based on risk indicators.

[12] If the denominator is zero, the decomposition would utilize the limiting value $\lambda_{it} = \phi(-2.88)$ to ensure continuity.

The mapping between risk indicators and crisis probabilities is complicated because risk sources in this model are synergistic (the marginal risk contribution of any risk factor is higher if other risks factors are at a high level). For this reason, the multiplier λ_{it}, which reflects the circumstances in country *i* at time *t*, is not constant. An important corollary is that the average EVA across countries depicted in Figure 8 is not the EVA of the average country. Likewise, its decomposition into the five vulnerability sources (on top of baseline risk), depicted in Figure 8, cannot be derived from the risk indicators of the average country shown before.

Figure 8. Decomposition of External Vulnerability Assessment
(Regional LAC average)



Note: The EVA results from applying the probit (normal density) function to ERI as defined in previous sections. The components of the EVA in this figure are computed following the decomposition described in equations (18) through (23). The figure shows the average EVA and its components across countries in the region.

Average country vulnerability to external crisis, measured as the estimated probability of falling into external crisis three years down the road, started in the 1970s at a low level of about 7 percent, dramatically increased in the 1980s, exceeding a 20 percent crisis probability at its peak, and declined below initial levels to reach less than 5 percent by the end of the sample. To have a sense of magnitudes, a 10 percent probability of having a crisis in three years is equivalent to a 65 percent probability of falling into a crisis in a 10-year period. A 4 percent risk, lower than the one

observed in recent years, is equivalent to a 34 percent crisis probability over a 10-year period. Odds of one in three would be a significant threat for any given country.

Figure 8 shows that structural risk in non-advanced economies, that is their resiliency handicap relative to advanced economies to manage risk factors, is clearly a substantial drag for LAC economies. Its role in leveraging risks appears to be on average the single most important source of vulnerability, contributing by itself half of the crisis probability observed in the peak of the 1980s. Beyond structural risk, external portfolio risk is the main underlying factor, making a substantial contribution to crisis probability in the 1980s and remaining relevant by the end of the sample after it stabilized around 1995. Despite portfolio risk being currently very low for the average country, high portfolio risks in some countries lead to substantial regional vulnerability as measured by average risk across LAC countries. Macroeconomic imbalances appear to be a smaller contributor to crisis risk compared to structural and external portfolio risks. Of course, the findings about macroeconomic imbalances apply on average, and they may certainly differ substantially across countries. Global risk appears to have made a substantial contribution only during the 1980s. On the flip side, international reserves have been consistently risk-mitigating throughout the period. The relative importance of international reserves has been increasing, and they are currently a substantial offset to risk sources, fully mitigating portfolio risks.

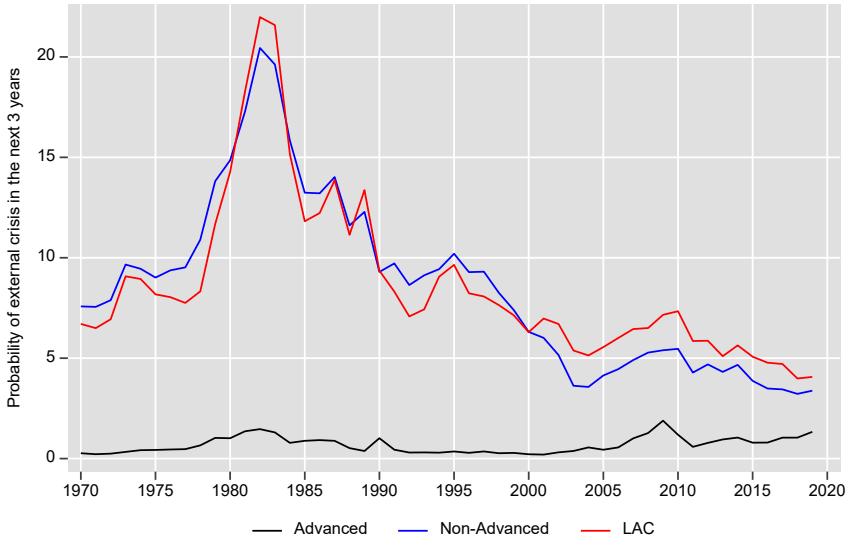
This analysis leads to two important findings concerning LAC countries. First, macroeconomic imbalances have not been a substantial risk contributor on average, not even in the 1980s. By and large, the crisis period of the 1980s was not prompted by macroeconomic imbalances or by low reserves, but rather unsafe accumulated portfolios (and lack of resilience to control their risks).[13] Second, international reserves have played an important mitigating role, becoming increasingly protective during the 1980s and fully offsetting portfolio risk in recent years.

Figure 9 puts the evolution of external vulnerability in LAC in context. It shows that LAC's experience in this regard was comparable to that in non-advanced economies in general but substantially different from that of advanced economies. Advanced economies risk remains a fraction of that of non-advanced economies despite non-advanced economies' very substantial

[13] The insignificance of the effect of macroeconomic imbalances is of course ceteris paribus, given portfolio and reserves stocks. Sustained macroeconomic imbalances would lead to the accumulation of risky financial positions over time.

reduction in the likelihood of crisis. While average LAC vulnerability has consistently improved since the 1980s to reach its lowest level, it remains high by world standards relative to both sets of economies. The next section explores the differences in the key underlying risk creation and risk mitigation factors behind the vulnerability gaps between LAC and world comparators.

Figure 9. External Vulnerability Assessment (EVA)
(Cross-country averages by group)



Note: The EVA results from applying the probit (normal density) function to the ERI defined in previous sections. The figure shows the average EVA across countries in each region or group.

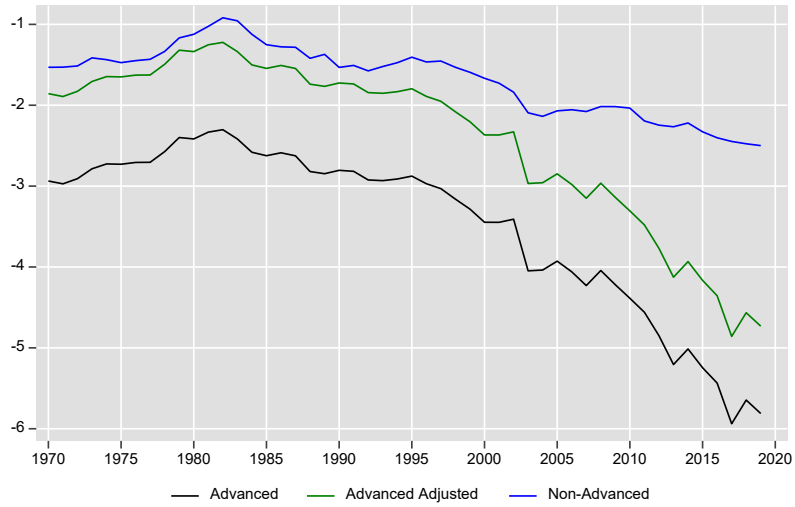
6. LAC Crisis Risk in the World Context

Comparative analysis relative to extra-regional economies may provide clues about the LAC experience useful for risk diagnostics and prudential policy. This section first analyzes the differences between advanced and non-advanced economies (which includes LAC economies). Once such divide is established, it focusses on benchmarking LAC risks against other non-regional economies, which is a natural comparator to contextualize the analysis of the previous sections and discover useful contrasts.

6.1 The Advanced and Non-advanced Divide

Figure 10 shows this divide, illustrating the considerable gap between the External Risk Indicators (ERIs) of advanced and non-advanced economies. Advanced economies are substantially safer.

Figure 10. External Risk Indicator (ERI)
(Cross-country averages by group)



Note: The ERI is calculated as specified in equation (14). The adjusted ERI for advanced economies is equal to the original ERI plus the coefficient estimate for structural risk (advanced country dummy) in Table 1. The group averages are the simple average of the ERI by country in each group.

The paper's model shows differences in structural crisis resilience between advanced and non-advanced countries. For example, comparing the estimated coefficients in Table 1, the additional resilience of advanced economies of 1.08 would amount to 25 percentage points of added reserves (= 1.08/-4.30, based on coefficient estimates) or the ability to carry 96 percentage points of external debt at no extra risk (=1.08/1.13, based on coefficient estimates). This resilience gap applies to all non-advanced economies, including LAC countries, and is one factor for the divide in two regimes. But even if the structural resilience gap ignored by adjusting upwards the ERI of advanced economies (i.e., adding to the Advanced economies' ERI the value of the estimated non-advanced coefficient, 1.08), advanced economies retain a risk advantage that grows over time (see the risk gap relative to adjusted ERI in Figure 10).

The gap between the adjusted External Risk Indicator (ERI) for advanced economies and the ERI of non-advanced economies is due to differences in identified risk factors. In particular,

advanced economies have a considerable advantage in their portfolio risks. In turn, portfolios are safer (in fact risk mitigating) because asset composition is substantially safer due to the high participation of FDI and equity in general. The risk advantage in the overall portfolio composition is leveraged by a very substantial financial integration, which is a multiple of that of non-advanced economies. The increasing trend towards more financial integration in non-advanced economies over time has been dwarfed by that of advanced economies. This advantage in portfolio risk that advanced countries enjoy more than offsets lower reserves.

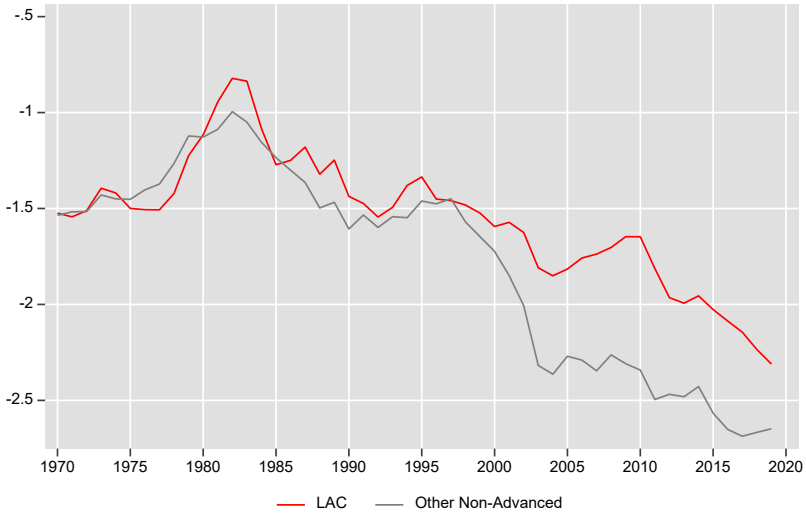
The divide between advanced and non-advanced economies highlights the relevance of underlying structural factors associated with the stage of development and suggests that comparisons between groups may not be useful to detect informative deviations. In other words, LAC's heightened vulnerability to risk is the natural result of being a region composed of non-advanced economies. In contrast, the comparison of LAC economies with a group of peers within the group of non-advanced economies is an appropriate benchmark to conduct comparative analysis to shed light on risk gaps that may be fruitful for policy action. The remainder of this section undertakes a comparative analysis of LAC vis-à-vis other non-advanced economies.

6.2 LAC Risk Profile Compared to Other Non-Advanced Economies

LAC and non-advanced economies show a roughly similar reduction in risk vulnerability in terms of their average probability of crisis (Figure 9). This implies that the substantial improvements made in the LAC region concerning its risk profile that were noted in previous sections were also experienced in other non-advanced countries. As a result, on average, LAC has remained more vulnerable than other non-advanced economies since 2000.

Figure 11 shows the overall external risk for LAC and other non-advanced economies using the ERI, indicating that other non-advanced economies have seen larger improvements in their risk profiles than LAC. In fact, other non-advanced economies have outstripped LAC reduction in the risk indicators that were noted in Sections 2 and 3 as important elements in LAC's progress. In the remainder of this section, we highlight two key factors behind the gap in the ERI of LAC and other non-advanced economies: the composition of the foreign assets portfolio (PRI) and international reserves (RRI).

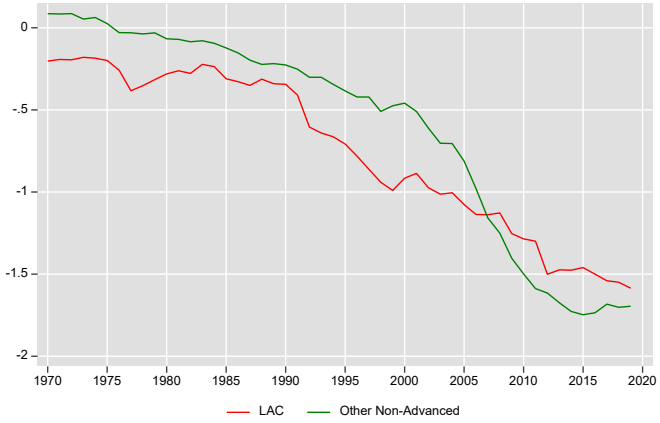
Figure 11. External Risk Indicator (ERI)
(LAC vs. Other non-advanced average)



Note: The ERI is calculated as specified in equation (14). The group averages are the simple average of the ERI by country in each group.

The first element concerns portfolio risk. After 2005, the rest of the non-advanced economies outstripped the improvement in asset composition that was central to the LAC experience. (Figure 12). Over the last decade, asset composition in other non-advanced economies is more risk-mitigating than in LAC.

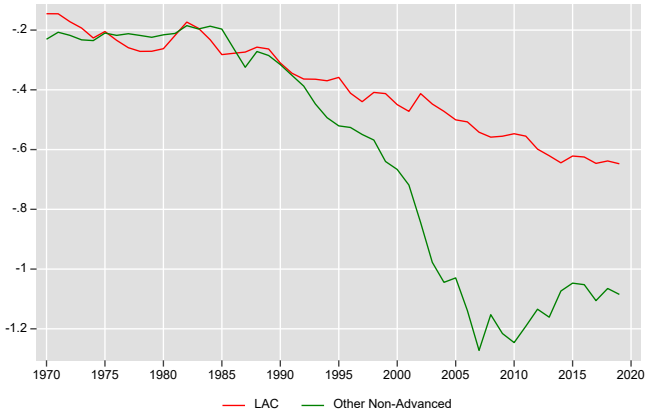
Figure 12. PRI: Asset Composition (PRI'$_A$)
(LAC vs. Other non-advanced average)



Note: The PRI'$_A$ is calculated as specified in equation (7), using the coefficient estimates from Table 1, and the observed values for country *i* at time *t*. The group averages are the simple average of the index by country in each group.

In terms of the Reserves Risk Indicator (RRI), LAC shows a key relative disadvantage with respect to other non-advanced economies. There is a wider separation concerning comparative risk mitigation of international reserves starting around 1990 (Figure 13). Since then, the rest of the non-advanced economies have substantially outstripped the increase in international reserves in LAC, a strength identified in Section 4. This is the main reason why relative LAC risk worsened after about 2000, as LAC reserves stabilized at a lower level than in other non-advanced economies.

Figure 13. Reserves Risk Indicator (RRI)
(LAC vs. Other non-advanced average)



Note: The RRI is calculated as specified in equation (12), using the coefficient estimates from table 1, and the observed macroeconomic imbalances for country *i* at time *t*. The group averages are the simple average of the index by country in each group.

The identified gaps indicate that improvements in LAC in these dimensions over the sample period were smaller in size than in the rest of the non-advanced economies. This in turn suggests that the LAC region has still room to catch up to its peers in these dimensions and thus reduce crisis risk by more than it has already done since the 1970s and 1980s.

7. Conclusions

The comprehensive analysis of this study shows the evolution of the sources of external risk in the average Latin American and Caribbean (LAC) economy and assesses LAC's vulnerability to external crises. For the average LAC country, changes in portfolio asset composition, especially towards FDI, have been responsible for driving the overall improvement in risk indicators.

Changes in liability composition away from risky debt further contributed to improving the risk indicators. International reserves have played an important mitigating role, becoming increasingly protective during the 1980s and fully offsetting portfolio risk in recent years. Instead, macroeconomic imbalances have not been an additional substantial risk contributor on average, not even in the 1980s.

The results indicate that despite notable improvements in the average LAC economy in key factors such as external portfolio composition and international reserves over the last few decades, which has led to its lowest historical vulnerability, LAC economies remain more susceptible to external crises in comparison to both advanced and other non-advanced economies.

We found that advanced economies benefit from a considerably safer portfolio composition due to the high presence of foreign direct investment (FDI) and equity. This safety advantage is further amplified by substantial financial integration, which far surpasses that of non-advanced economies, including the LAC region. Furthermore, advanced economies have a structural resilience advantage in preventing the degree of exposure that leads to crises, which in turn allows them to safely manage high-risk factors.

Other non-advanced economies are a more relevant benchmark to illuminate LAC's weaknesses that may merit policy action. When benchmarked against this comparator, the study highlights that LAC's substantial risk reduction progress has been outpaced by its peers, particularly after the year 2000. Two primary factors contributed to this outcome: first, the rest of the non-advanced economies have experienced greater improvements in the composition of their foreign asset portfolios, making them more risk-mitigating. Second, their increase in international reserves has significantly surpassed that of LAC, providing a stronger buffer against external economic shocks.

Thus, this paper underscores the continuing need for strategic risk management in the LAC region. While the region's progress since the economic challenges of the 1970s and 1980s has been significant, there remains ample room for improvement. Enhanced focus on risk-mitigating asset compositions and increased reserve accumulation could further lower the LAC region's external crisis exposure and help align its risk profile to that of other non-advanced regions, thereby reducing its overall vulnerability.

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Appendix A.

Data Sources and Methods

External Crisis

The definition of external crisis follows Catão and Milesi-Ferretti (2014). There is a crisis when there is an external debt default or rescheduling event as well as events leading to large IMF support (IMF loans in excess of twice the country's quota). The debt default and rescheduling events are based on Beim and Calomiris (2001) and S&P Global Ratings Research and S&P Global Market Intelligence's CreditPro® (ex-Standard and Poor's) and Internal Financial Statistics (2020). IMF loans at least twice as large as the respective country's quota in the IMF come from McFadden et al. (1985); and Kraay and Nehru (2006). To account for the duration of each crisis episode, we use as a reference the episodes flagged as pertaining to a debt crisis or restructuring event in Laeven and Valencia (2020).

External Portfolio Variables
Lane and Maria Milesi-Ferretti (2018), updated to 2019 by Milesi-Ferretti (Brookings Website)

International Reserves
IMF: World Economic Outlook (WEO) Database, October 2020.

Fiscal Deficit
Raw data are from Kaminsky, Reinhart, and Végh (2004), and Mauro et al. (2013). Data are updated through 2019 using: IMF: World Economic Outlook (WEO) Database, October 2020.

Real Effective Exchange Rate (REER)
Darvas (2021)

Relative Per Capita Income
Feenstra, Inklaar, and Timmer (2015). Data are updated through 2019 using: IMF: World Economic Outlook (WEO) Database, October 2020.

Current Account Deficit
IMF: World Economic Outlook (WEO) Database, October 2020.

GDP
IMF: World Economic Outlook (WEO) Database, October 2020. We use an HP filter to extract the smooth trend from the GDP time series with a 6.25 smoothing parameter, in line with Ravn and Uhlig (2002).

Sample Characteristics

Table A.1. Summary Statistics

Variable	Description	Obs	Mean	Std. dev.	Min	Max
Debt Assets	Debt assets/GDP trend (%)	2,066	39.4	49.2	0.4	344.0
Debt Liabilities	Debt liabilities/GDP trend (%)	2,066	62.5	53.4	2.8	389.6
PE Assets	Portfolio equity assets/GDP trend (%)	2,066	9.5	19.5	0.0	234.0
PE Liabilities	Portfolio equity liabilities/GDP trend (%)	2,066	9.6	15.5	0.0	168.8
FDI Assets	FDI assets/GDP trend (%)	2,066	20.6	57.5	0.0	806.4
FDI Liabilities	FDI liabilities/GDP trend (%)	2,066	31.1	49.9	0.0	671.9
FX Reserves	Reserves/GDP trend (%)	2,066	11.4	11.7	0.1	85.4
Current Account Deficit	Two year moving average of CA deficit/GDP trend (%)	2,066	1.3	6.2	-18.1	111.0
Fiscal Deficit Gap	Observed fiscal deficit/GDP trend relative to its previous five-year average (%)	2,066	-0.01	3.7	-81.8	26.7
Overvaluation Gap	Real exchange rate overvaluation gap relative to its previous five-year average (%)	2,066	2.3	32.4	-63.6	1237.4
Global Risk	Fraction of foreign countries that are in crisis in a given year (%)	2,066	10.5	5.7	0.0	25.4
Income - Per Capita	Per-capita income relative to the US (%)	1,880	42.2	37.6	1.1	201.1

Table A.2. Summary Statistics: LAC

Variable	Description	Obs	Mean	Std. dev.	Min	Max
Debt Assets	Debt assets/GDP trend (%)	490	19.3	14.8	1.3	108.8
Debt Liabilities	Debt liabilities/GDP trend (%)	490	42.8	21.3	7.0	132.0
PE Assets	Portfolio equity assets/GDP trend (%)	490	2.6	7.5	0.0	52.8
PE Liabilities	Portfolio equity liabilities/GDP trend (%)	490	2.7	4.7	0.0	26.3
FDI Assets	FDI assets/GDP trend (%)	490	5.6	8.6	0.0	48.1
FDI Liabilities	FDI liabilities/GDP trend (%)	490	27.1	24.8	0.9	109.3
FX Reserves	Reserves/GDP trend (%)	490	10.5	6.7	0.3	34.3
Current Account Deficit	Two year moving average of CA deficit/GDP trend (%)	490	2.6	4.2	-15.1	19.7
Fiscal Deficit Gap	Observed fiscal deficit/GDP trend relative to its previous five-year average (%)	490	0.3	2.8	-12.9	12.1
Overvaluation Gap	Real exchange rate overvaluation gap relative to its previous five-year average (%)	490	6.9	63.0	-49.8	1237.4
Global Risk	Fraction of foreign countries that are in crisis in a given year (%)	490	10.2	5.5	0.0	25.5
Income - Per Capita	Per-capita income relative to the US (%)	443	12.9	7.8	2.4	66.6

Table A.3. Country Groups

Country Group	Countries
Advanced	Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Netherlands, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States.
Non Advanced	Argentina, Belize, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Guatemala, Jamaica, Jordan, India, Indonesia, Malaysia, Mexico, Morocco, Pakistan, Peru, Poland, Romania, Russia, Serbia, Taiwan, Thailand Turkey, Ukraine, Uruguay, Venezuela.
LAC	Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Jamaica, Mexico, Peru, Uruguay, Venezuela
Other Non-Advanced	Bulgaria, China, Croatia, Egypt, Jordan, India, Indonesia, Malaysia, Morocco, Pakistan, Poland, Romania, Russia, Serbia, Taiwan, Thailand Turkey, Ukraine.

Table A.4. Crisis Incidence by Country in LAC

Country	Crisis Incidence	Crisis Onsets Years
Argentina	38.0%	1982,1986,1993,1995,2001,2014,2016,2018
Jamaica	30.0%	1978,2010,2013
Mexico	28.0%	1982,1984,1995
Dominican Republic	26.0%	1982,1994,2003,2005,2009
Brazil	20.0%	1983,1994,1999,2001
Chile	18.0%	1975,1983,1985
Ecuador	18.0%	1982,1985,1995,1999,2008
Peru	12.0%	1978,1982,1996
Uruguay	12.0%	1983,1991,2002
Venezuela, Rep. Bol.	12.0%	1982,1990,2017
Belize	8.0%	2007,2012,2017
Costa Rica	8.0%	1981,1983,1985,1990

Note: Table A.4 shows only countries with crisis episodes. Crisis incidence: Years in crisis over total years in the sample for each country.