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The Current Account Income Balance: External Adjustment Channel or Vulnerability Amplifier?

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ABSTRACT: In terms of size, the net income balance (IB) is comparable to the trade balance (TB) for many countries. Yet the role of the IB in mitigating external vulnerabilities or complicating external adjustment remains underexplored. This paper studies the role of the IB in stabilizing or destabilizing the current account over the cycle and in crises. Our results show that, due to a negative correlation with the TB, the IB significantly dampens the time series volatility of the current account for most countries. However, the IB generally does not improve during crisis episodes, so current account adjustment occurs entirely through improvements in the TB. The paper also estimates IB semi-elasticities with respect to the exchange rate (ER). Semi-elasticities are small for most countries, so the IB is generally not a significant channel through which the ER stabilizes the current account, and trade-based semi-elasticities are, with some important exceptions, good proxies for current account semi-elasticities used in external sector assessments.

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WORKING PAPERS

The Current Account Income Balance:

External Adjustment Channel or Vulnerability Amphlifier?

Prepared by Alberto Behar, and Ramin Hassan[1]

[1] Work on this paper started when Ramin Hassan, who is currently at the University of Minnesota, was an intern at the IMF. Alberto Behar is at the IMF. We would like to thank Jorge Alvarez, Chris Christophedes, Mariana Colacelli, Peter Dohlman, Hamid Faruqee, Deepali Gautam, Russell Green, Geoffrey Heenan, Klaus Hellwig, Sandile Hlatshwayo, Christina Kolerus, Daniel Leigh, Nicolas Magud, Wojciech Maliszewski, Karmen Naidoo, Youssef Fareed Nazer, Cyril Rebillard, Chris Redl, Weining Xin, and Daria Zakharova. All errors are our own.

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I. Introduction

The income balance (IB) is an important component of the current account balance (CAB). Although gross trade flows dwarf gross income flows, the IB is at least half of the trade balance (TB) in half of the world's countries, and the IB exceeds the TB in 20 percent of countries. Within income flows, primary income (dominated by investment income) is four times larger than secondary income. Most emerging markets (EMs) and low-income countries (LICs) are net receivers of secondary income and net payers of primary income, while Advanced Economies (AEs) are on average net payers of both primary and secondary income.

Compared to trade, the potential contribution of income flows to current account stabilization or exchange rate misalignment has received little attention. Excessive large or persistent current account deficits typically precede many crises (Catão & Milesi-Ferretti, 2014) and often correct following crises (Lane & Milesi-Ferretti, 2011). However, studies are overwhelmingly of the aggregate current account, potentially with an accompanying discussion of trade channels, or explicitly focused on trade adjustment (Abiad et al., 2014). TBs can improve through a combination of demand compression and exchange rate depreciation, and the potential merit of preemptive exchange rate (ER) adjustment to contain current account deficits and reduce crisis risks has been discussed extensively (Chinn & Wei, 2013; Ghosh et al., 2015). Relatedly, external sector assessments, such as IMF (2020), typically map CAB misalignments to ER misalignments using (the inverse of) the semi-elasticity of the CAB to the ER; however, the semi-elasticity assumes adjustment occurs exclusively through trade (Cubeddu et al., 2019).

Over the long run, the IB may destabilize the current account through a liability trap. A country with a higher net external liability position will tend to have a more negative IB, a more negative CAB, and more net foreign borrowing needs, which in turn would decrease the IB. However, there may be stabilizing forces in the form of endogenous wealth effects and ER adjustment, which could reduce trade deficits in debtors and reduce surpluses in creditors. Alberola et al. (2020) find evidence consistent with some stabilization in debtors but not in creditors.

Over shorter horizons, the IB could potentially stabilize the CAB. For example, to the extent that inflows of remittances rise in bad times, these can substitute for other sources of foreign exchange (e.g., exports) that finance imports, while outflows of dividends could be lower to the extent that there is risk pooling between local and foreign claimants of profits. Consistent with this, the IB is negatively correlated with the TB in most countries (Colacelli et al., 2021). Such stabilization dynamics could, in principle, play out during crisis episodes, but the close links between investment income (e.g., interest) and stocks (e.g., debt) and the possibility that risk premia rise around crisis episodes may limit the potential for the IB to contribute meaningfully to current account adjustment.

The ER could help or hinder external adjustment through the IB channel. The currency denomination of foreign assets and foreign liabilities has mechanical effects on the investment income balance (IIB) (Bénétrix et al., 2019). For example, a depreciation would increase both inflows and outflows as a share of GDP, but the net effect depends on the relative sizes of investment income receipts and payments as well as their currency denomination (Colacelli et al., 2021). However, the ER could also affect income flows through other channels, such as profitability (and hence investment income) or remittances. Alberola et al. (2020) regress the IIB on the exchange rate and find no significant effects. Separating out (total) income debits and credits, Colacelli et al., (2021) find that depreciations increase both inflows and outflows and that mechanical effects dominate. As a

result, they conclude that IB responses to the ER may amplify the TB response in large net creditor countries and dampen it in large debtors.

We contribute to this literature by answering three questions: (i) is the stabilizing role of the IB in the current account quantitatively important over the course of the cycle?, (ii) how does the IB evolve during crisis episodes?, and (iii) what does the semi-elasticity of the IB to the ER imply for CAB semi-elasticities, current account stabilization, and estimates of ER misalignments?

First, we find that the IB has an important stabilizing role over the cycle. For a broader sample than Colacelli et al. (2021) that includes low-income countries, we find that within-country correlations between the TB and IB are large and negative. However, the quantitative significance would be minor if the IB itself exhibits limited variation. We, therefore, calculate a covariance share of volatility and find that the mean value is -98 percent. This value means that, relative to a counterfactual of zero correlation between the IB and TB, the IB dampens the variance of the CAB by half. The median country's covariance share is -37 percent. This dampening effect is more substantial in EMs and LICs, where a positive covariance between imports and income credits (including remittances) is particularly pronounced. The dampening effect is absent in a significant minority of countries, including some with sizeable current account gaps.

Second, exploiting a dataset compiled for the IMF's Vulnerability Exercise (IMF, 2021), we analyze the behavior of the IB before, during, and after fiscal, financial, external, and real (growth) crisis episodes. We use an event-study approach in the tradition of Catão & Milesi-Ferretti (2014), Gourinchas & Obstfeld (2012), and Kolerus, (2021) to estimate conditional means during a crisis window benchmarked against tranquil times.

The use of "traditional" two-way fixed effects (TWFE) for estimating treatment effects has attracted considerable attention (Abadie, 2021; de Chaisemartin & d'Haultfoeuille, 2020; Jardim et al., 2020). For example, an estimated coefficient showing how the IB behaves during a crisis on average can be severely biased if there is heterogeneity in effects. Moreover, identifying a causal treatment effect, such as natural disasters (Cavallo et al., 2013) or German reunification (Abadie et al., 2015) on growth relies on assumptions that have been hard to verify. Taking advantage of recent advances in this field, we employ a two-way fixed effects counterfactual estimator (FEct) (Liu et al., 2021). FEct has two features that are relevant for our purposes. One is an ability to account for heterogeneity in IB crisis behavior. Another is the ability to test the hypothesis that countries experiencing a crisis have the same trend in IB, compared to non-crisis countries, in the years leading up to a crisis—the parallel trends assumption. Testing this hypothesis would add statistical rigor to our analysis of pre-crisis dynamics. However, rejecting it would invalidate the assumption needed to identify a causal effect of a crisis relative to an unobserved counterfactual of no crisis. We use the diagnostics to formulate a factor-augmented FEct to overcome this issue and provide complementary results on causal effects.

Our findings are that the IB generally does not show any correction during crises. Before a crisis, the IB is lower than in tranquil times. However, in contrast to the TB, the IB, if anything, worsens during the crisis. In the crisis aftermath, it is still no better than in tranquil times. This suggests a destabilizing role for the IB. The lack of a statistically significant improvement in the IB is robust across crisis types and income groups, but the destabilizing behavior is especially strong for financial crises and more robust among AEs and EMs than among LICs. However, delving into components of the IB, we find that FDI and other equity income start to improve on the eve of the crisis. Our estimates of the causal effects suggest that crises worsen the IB relative to an unobserved counterfactual of no crisis among AEs and EMs, but there is some evidence that crises improve the IB for LICs.

Third, to attain IB semi-elasticities with respect to the ER, we follow the approach used for TB semi-elasticities in external sector assessments (Cubeddu and others, 2019). We estimate elasticities for income receipts and payments separately using panel data and combine those panel-wide estimates with country-specific shares of income receipts and payments as a share of GDP to derive country-specific semi-elasticities. The approach is similar to Colacelli et al. (2021) but for a broader country sample that breaks down estimates by country income-per-capita grouping and by IB component. Moreover, we combine IB semi-elasticities with TB semi-elasticities to refine estimates of CAB semi-elasticities and assess their importance for ER misalignment estimates.

We find that, although TB semi-elasticities offer good approximations to CAB semi-elasticities in many countries, ER misalignment estimates can be severely biased in important cases. IB semi-elasticities are broadly symmetric around zero, which means the IB is as likely to act against TB adjustment as support it. Estimates are between -0.1 and +0.1 in about 90 percent of countries. Part of the reason is that income debits and credits act against one another in response to ER changes. The distribution suggests that the IB is generally not an essential channel through which the ER can stabilize the current account and that omitting the IB channel does not seriously bias CAB semi-elasticities. However, TB semi-elasticities have a median of only -0.3 and can also be very small. Because it is the inverse of the CAB semi-elasticity that determines ER misalignment, omitting the IB can be arithmetically important. We present examples where ER misalignments are underestimated in countries with sizeable CAB gaps though we caution that such gaps can be liable to large statistical uncertainty.

The rest of the paper is organized as follows. Section II describes stylized facts highlighting the dynamics and importance of the IB, and the subsequent three sections focus on the three questions addressed in this paper: section III discusses the covariance of the IB and TB over the cycle, section IV uncovers the behavior of the IB in economic crises, and section V assesses the response of the IB to the ER. Section VI concludes.

II. Stylized facts

In what follows, we present stylized facts on the importance of the income balance, the relative significance of income balance components, and the relationship between investment income and the international investment position.

A. The Importance of the Income Balance and its Components

The current account consists of goods and services trade and income flows.[1] The income balance (IB) is the net of receipts/credits and payments/debits. Together with the trade balance (TB), the IB contributes to the current account balance (CAB): CAB=TB+IB. In turn, the IB is the sum of the primary income balance (PIB) and secondary income balance (SIB). Primary income receipts represent the return that residents receive from non-residents from financial assets (Investment Income), labor provision to production (Employee Compensation), and renting natural resources and returns. Analogously, primary income payments are made by residents to non-residents. The investment income balance (IIB) includes dividends, earning reinvestments or withdrawals, and interest on debt, and it is the principal component of PIB for most countries. Secondary income consists of current transfers (i.e., no quid pro quo) between residents and non-residents. Examples include workers' remittances and inter-government official transfers.

[1] For more details, see the IMF's Balance of Payments and International Investment Position Manual (BPM6).

While income flows are smaller than trade flows, the IB is an important component of the CA for many countries (Table 1, Figure II-1). In gross terms, trade flows (the sum of imports and exports) exceed income flows (the sum of receipts and payments). During the 2017 to 2019 period, the median value for gross trade was 79 percent of GDP, and the median for income flows was 16 percent of GDP.[2] In net terms, the TB has a median of -3 percent, and the IB has a median of +0.5 percent of GDP. The size of the IB relative to the TB varies considerably across countries.[3] In 37 countries, the absolute value of the IB was larger than the absolute value of the TB; that is $\frac{|IB|}{|TB|} > 1$.[4] In another 57 countries, $1 > \frac{|IB|}{|TB|} > 0.5$. Therefore, for many countries, income flows are too large to ignore when analyzing the drivers of the current account and formulating policies.

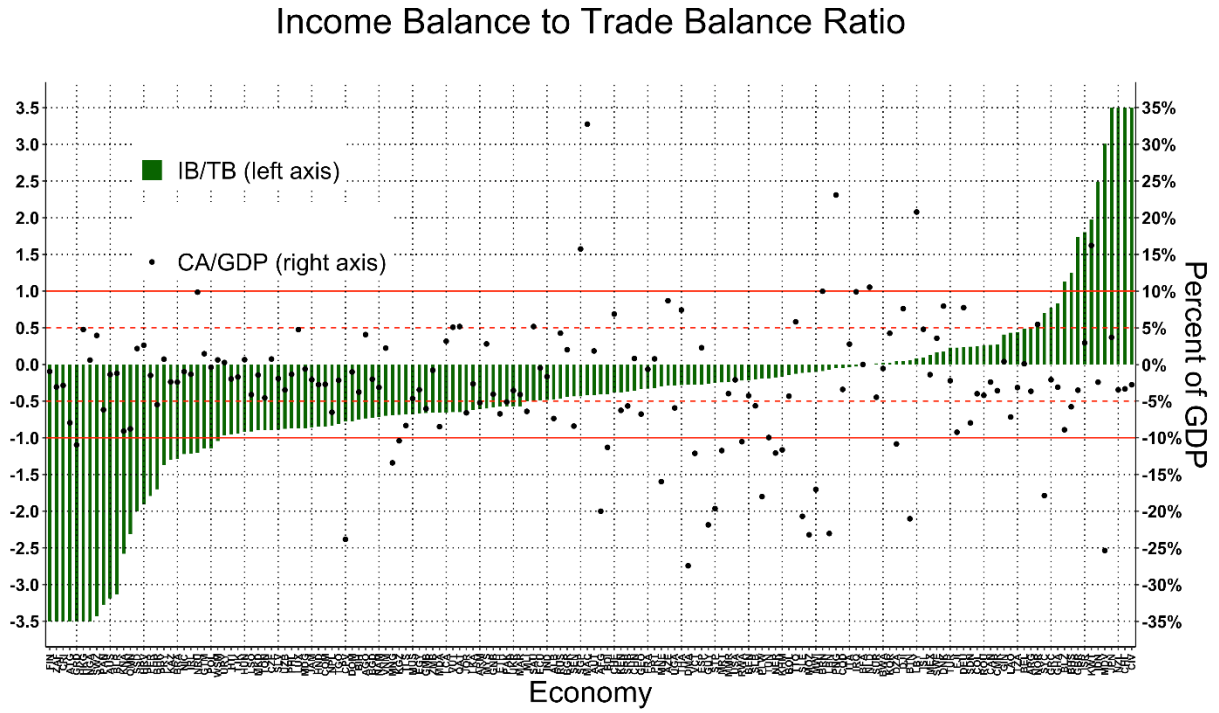


Figure I-1: The ratio of IB to TB, the average of the 2017 to 2019 period. The solid red lines show +/- 1.0 ratios, and the dashed red lines are +/- 0.5 ratios. We have winsorized values at +/- 3.5.

[2] On average, between 2017 and 2019, the global annual income credits were $5.7 trillion for the 168 countries in the sample. During the same period, this value for exports (of goods and services) was $23.3 trillion.

[3] The majority of countries are net recipients of income flows. However, while most emerging and low-income are net receivers, nearly 70% of advanced countries are net income payers.

[4] The income surplus exceeded the trade surplus in 5 cases (e.g., Japan). The income deficit exceeded the trade deficit in 7 cases (e.g., the UK). The income surplus exceeded the trade deficit in 7 cases (e.g., Nigeria). The income deficit exceeded the trade surplus in 18 cases (e.g., in Brazil, Ireland, Australia).

Table 1: Summary statistics of the variables. All variables are average of 2017 to 2019.

Statistic	Unit	Obs	Mean	Std	25% Prct.	Median	75% Prct.
Income Balance (IB)	% of GDP	169	3.54	13.63	-2.22	0.54	6.42
IB Debit	% of GDP	169	15.78	64.58	4.02	6.94	10.54
IB Credit	% of GDP	168	20.25	71.57	4.54	8.03	15.06
PIB	% of GDP	169	-2.99	20.94	-4.34	-2.32	0.1
Investment PIB (IIB)	% of GDP	166	-4.52	24.33	-5.00	-2.71	-0.7
non-FDI IIB	% of GDP	153	-1.01	6.81	-1.39	-0.62	-0.07
FDI IIB	% of GDP	153	-2.49	4.04	-3.91	-1.74	-0.43
Portfolio IIB	% of GDP	141	-0.17	1.66	-0.79	-0.24	0.03
SIB	% of GDP	169	6.53	22.15	-0.39	2.37	7.57
Trade Balance (TB)	% of GDP	169	-8.38	28.97	-13.94	-3.1	1.98
CA	% of GDP	169	-5.38	35.64	-6.4	-2.65	1.17
IB/TB	ratio	169	-0.57	5.06	-0.86	-0.42	-0.02
|IB/TB|	ratio	169	1.49	4.87	0.26	0.59	0.91
Gross Income (debit + credit)	% of GDP	168	36	135.44	9.97	16.48	22.74
Gross Trade (Export + Import)	% of GDP	169	139.19	614.05	57.03	78.59	107
Gross Income / Gross Trade	ratio	168	0.3	0.49	0.14	0.21	0.3

Primary income flows are four times larger than secondary income flows in global dollar terms, but the median PIB (-2.3 percent of GDP) is offset by the median SIB (+2.4 percent of GDP). AEs are on average net payers of both primary and secondary income, though Japan and some other G7 countries have positive PIBs. In gross terms, AEs are much more financially integrated. In 2017-9, the average developed country had gross investment income equivalent to 14.7 percent of GDP, whereas EMs had 5.5 and LICs had 4.3 percent of GDP.

Among the countries in the sample, only 25 percent are net receivers of primary income, while about 70 percent of countries are net receivers of secondary income. Within the PIB, the Investment Income Balance (IIB) is the predominant component for most countries (Figure I-2), of which FDI income is the biggest component. AEs have higher gross flows than EMDEs in all components of investment income, but the difference is particularly pronounced for portfolio equity income. Secondary income is important in many small or low-income countries (Giuliano & Ruiz-Arranz, (2009); Jidoud, (2015); Atoyan et al., (2016). Remittances are the dominant component of the secondary income, making up 80% of secondary income inflows in the median country. Most emerging and low-income countries are net receivers of secondary income and net payers of primary income.

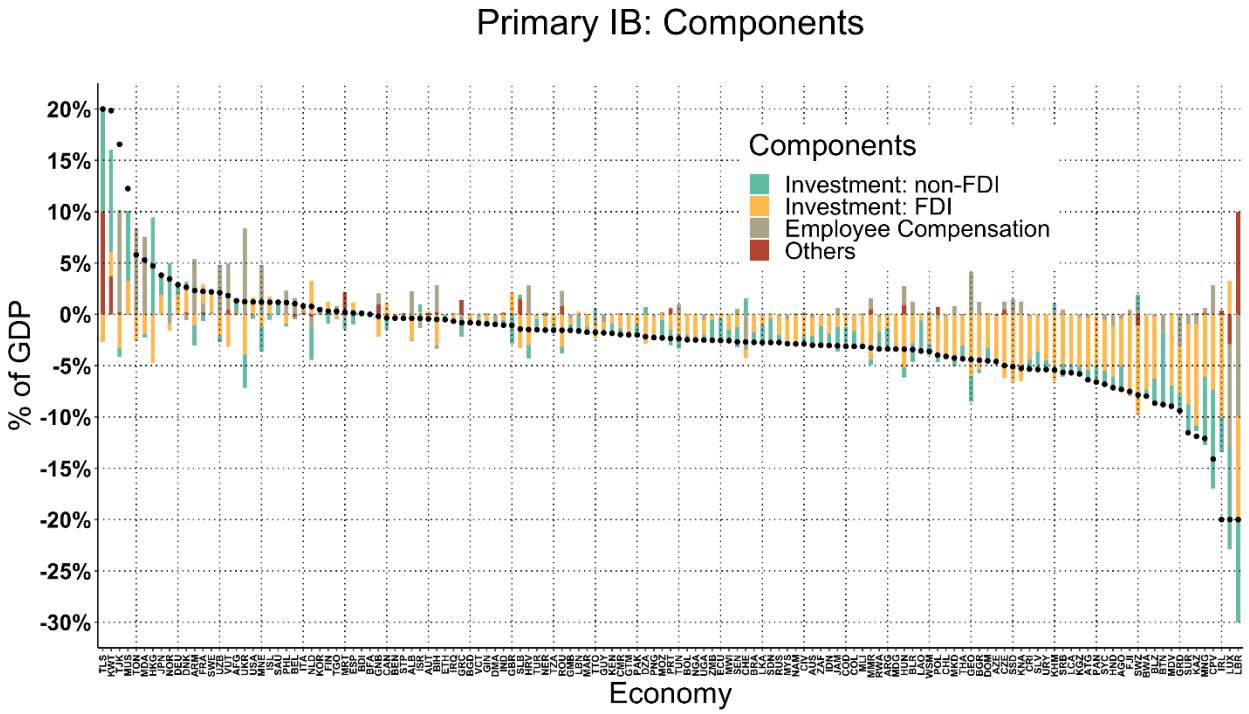


Figure I-2: Primary Income Balance (PIB) and its components, as % of GDP. The black circles show PIB, and each column shows the elements of PIB for that economy. Economies are sorted on their PIB values. We winsorized the values to make the figure presentable; therefore, the component's columns do not add up to the PIB for a handful of countries (at the two extremes). Investment income is further divided into FDI and non-FDI categories.

Figure I-3 shows 25 countries with the most positive and 25 with the most negative IB/GDP values. Countries with the highest IB/GDP ratios are all EMs or LICs, and many are close to a balanced CA, which implies income surpluses are financing trade deficits. Many of these countries rely on remittances to finance imports. However, countries with the lowest IB/GDP ratios are all AEs or EMs. Many AEs, including financial centers, have large negative primary income outflows (investment income and employee compensation). Some Gulf Cooperation Council countries have sizeable remittances outflows. While EMs in the group rely on financial inflows to finance sizeable current account deficits, the AEs in this group tend to have current account surpluses.

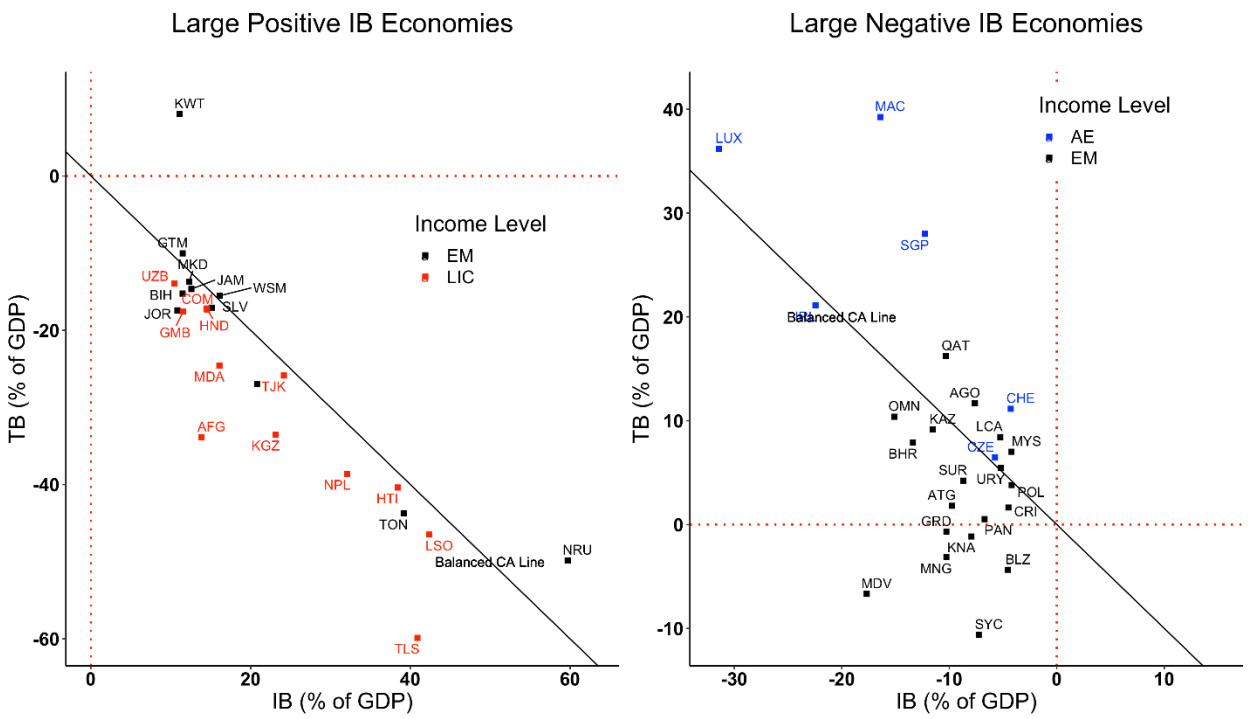


Figure I-3: Countries with highest and lowest IB/GDP ratios. The X-axis shows IB/GDP, and the Y-axis shows TB/GDP. Solid black lines show the balanced current account positions (IB+TB = 0). The left panel shows 25 countries with the most positive IB ratios from 2017 to 2019. The right panel shows 25 countries with the most negative IB ratios, similarly. Blue, black, and red squares show Advanced, Emerging, and Low-income countries, respectively.

B. NIIP and Income Balance

Income flows are closely related to the international investment position. We noted that the lion's share of gross income flows is from investment income. Investment income is closely linked to the international investment position, which describes the stock of assets and liabilities a country holds abroad. Colacelli et al. (2021) estimate that a 10 percentage-point rise in net foreign assets as a share of GDP is associated with a rise in the income balance of 0.2 percent of GDP. The estimates imply that a country with a neutral IIP is predicted to have a negative IIB, which is consistent with most countries paying a higher return on liabilities than the return on their assets.

There is a potentially destabilizing longer-term feedback loop between higher current account deficits and a more negative international investment position (IIP). Other things equal, larger primary/investment income outflows imply larger deficits that need financing, which leads to a more negative IIP and larger income outflows. Moreover, many countries have been relying on foreign funds to mitigate the adverse effects of the COVID-19 pandemic and have experienced a large weakening in their IIPs. For a debtor country, a lower GDP growth rate or higher interest rate would lead to a faster deterioration in its net foreign assets as a share of GDP (Cubeddu et al., 2019). However, there may be offsetting stabilization from wealth effects and exchange rate adjustment. Countries with higher IIPs could experience positive wealth effects and therefore consume/import more. Similarly, creditor countries could have currency appreciation over the long run, which would tend to increase net imports. For lower IIP / debtor countries, negative wealth effects and currency depreciation could act to increase net exports. Empirically, however, there appears to be an asymmetry between creditors and debtors. In particular,

creditors appear to exhibit destabilizing dynamics despite some mitigating effects from currency appreciation, while debtors appear to have stabilizing dynamics that operate mainly through wealth effects (Alberola et al., 2020).

AEs on average have positive NFA positions, and EMs on average have negative NFAs (Table 2). In a sample of 50 AEs and EMs compiled by Bénétrix et al., (2019), the median country has an NFA of –21 percent while the mean is –4 percent. This asymmetry is driven by AEs, who have a much higher mean positive NFA than median positive NFA. For EMs, liabilities exceed assets by about one-third. In gross terms (assets + liabilities), AEs are much more globally financially integrated than EMs.

The IIP composition is important for crisis risk. Higher net foreign liabilities increase the probability of an external crisis, especially beyond high thresholds and if liabilities are tilted towards net debt. Net foreign portfolio equity liabilities have weaker estimated effects on external crisis probabilities, while FDI liabilities, if anything, tend to reduce risk (Catão and Milesi Ferreti, 2014).

The IIP composition potentially matters for the stabilization properties of the IIB over the cycle. Empirical analysis suggests that foreign-currency debt liabilities increase the likelihood of a stress episode while equity liabilities do not (Cubeddu, Hannan, and Rabanal, 2021). Debt liabilities incur interest payments that are largely invariant to the economic cycle in the country holding the asset or the liability. Although periods of slower global economic activity could reduce benchmark interest rates and thus income flows, such effects would only apply to a small portion of the portfolio and could be outweighed by increases in risk premia. In contrast, FDI exhibits risk-sharing properties. For example, faster domestic economic growth or a positive terms of trade shock would tend to boost profits, including those repatriated abroad, while a large negative shock could drive such flows to a standstill – for example, oil profit payments in Colombia (Behar, 2021).

In AEs, debt contributes just over half of both assets and liabilities. In these countries, the NFA net of debt is only 5 percent of GDP on average. In EMs, debt securities account for about 60 percent of assets. As is the case for AEs, debt liabilities account for about half of all liabilities. Importantly, although the NFA for the EMs in the sample is approximately 30 percent of GDP, excluding net debt would reduce the liability closer to 20 percent of GDP.

Table 2: International investment positions and corresponding income values of IIB account. Asset's corresponding income is the credit (receipts) value, and similarly, for net assets, the income is the net investment income. Stock's foreign currency (FC) share is also shown in percent. Stocks are divided to all and debt only for further details. The last two column groups show net assets in foreign currency, FC, and domestic currency, DC, as a percent of GDP. The stocks are 2017 values, and the incomes are 2018 values. We restrict the results to the 50 countries in the data provided by Bénétrix et al., (2019), with 26 advanced countries and 24 emerging ones. Assets and liabilities' foreign currency shares are directly compiled in Bénétrix et al., (2019), and we calculate net asset's FC shares with accounting identities.

			Stock	Asset		Liability		Net Asset	
Sample			Unit	Mean	Median	Mean	Median	Mean	Median
All	All	Stock	% of GDP	256.2	128.9	260.1	154.3	-3.93	-20.8
		Stock's Income	% of GDP	5.53	0.93	12.16	4.33	-4.47	-2.63
		Stock's FC Share		83%	96%	36%	33%		
		FC Stock	% of GDP	198.3	87.2	80.4	46.8	117.9	46.6
	Debt	Stock	% of GDP	145.7	71.0	140.0	87.2	5.74	-10.34
		Stock's Income	% of GDP	1.98	0.21	1.90	0.77	0.08	-0.33
		Stock's FC Share		79%	95%	66%	77%		
		FC Stock	% of GDP	105.8	41.2	80.4	46.7	25.41	2.73
Advanced	All	Stock	% of GDP	431.9	247.7	407.6	257.3	24.3	5.2
		Stock's Income	% of GDP	22.4	6.2	23.7	6.4	-1.3	-0.01
		Stock's FC Share		69%	87%	29%	27%		
		FC Stock	% of GDP	322.2	123.7	116.5	63.4	205.7	74.4
	Debt	Stock	% of GDP	242.5	144.0	222.7	172.8	19.9	-27.2
		Stock's Income	% of GDP	7.6	0.94	5.7	1.6	1.9	-0.30
		Stock's FC Share		62%	84%	52%	53%		
		FC Stock	% of GDP	166.9	67.5	116.5	63.4	50.3	6.7
Emerging	All	Stock	% of GDP	65.8	52.2	100.3	92.7	-34.5	-32.8
		Stock's Income	% of GDP	2.3	0.92	6.1	5.2	-3.8	-3.6
		Stock's FC Share		98%	99%	44%	40%		
		FC Stock	% of GDP	64.2	52.0	41.3	33.6	22.9	15.6
	Debt	Stock	% of GDP	40.9	35.0	50.4	49.2	-9.6	-9.6
		Stock's Income	% of GDP	0.27	0.15	1.01	0.88	-0.75	-0.71
		Stock's FC Share		98%	99%	81%	80%		
		FC Stock	% of GDP	39.7	34.8	41.34	33.62	-1.6	-0.4

The NFA position and its currency composition can also influence the stabilizing properties of the income balance through the exchange rate channel. For example, if trying economic circumstances prompt a depreciation, liabilities denominated in foreign currency would increase payment obligations in local currency and assets denominated in foreign currency would increase local-currency income from abroad. Thus, the net effect on a country would depend on the relative sizes of income receipts from assets denominated in foreign currency and income payments on liabilities denominated in foreign currency:

i. *As noted earlier, most countries have negative IIBs.* Other things equal, a negative IIB tends to deteriorate following a depreciation.

ii. *However, the share of foreign assets that is denominated in foreign currency exceeds the share of foreign liabilities that is denominated in foreign currency.* Table 2 reports that, for AEs, the median foreign currency (FC) share of foreign assets is close to 90% (though the mean is lower), and the FC share of foreign liabilities is almost 30 percent. EMs have a FC share of foreign assets that is close to 100 percent, and a FC share of foreign liabilities that is closer to 40 percent.[5] [6] It is sensible to assume that the foreign income from assets or liabilities is denominated in the same currency as the corresponding stocks. Thus, while a depreciation could be expected to mechanically increase local-currency income receipts from almost all foreign assets, this would be the case for less than half of income payments due on foreign liabilities. Therefore, other things equal, the IIB would improve following a depreciation.

iii. Taking the product of the two observations above provides an insight into the effects of a depreciation on the NFA position and IIB. Regarding the stock position, the AE median is 74 percent of GDP (and almost all AEs have positive FC NFAs). For EMs, the median FC NFA position is 16 percent of GDP. Moreover, for 80 percent of the countries in the sample, the NFA would mechanically improve following a depreciation as they have a positive FC NFA. Regarding investment income flows, the median FC-denominated income flow is 1.5 percent of GDP in AEs and -0.5 percent of GDP in EMs. Therefore, a depreciation would mechanically increase the IIB for the median AE and decrease the IIB for the median EM in this sample.

III. Correlation and variance decomposition

To understand whether the IB stabilizes or destabilizes the CA, we study the comovement of the TB and IB over time. We start by calculating within-country correlations between the TB and IB over time for each country. Next, we calculate the mean and median of those estimates for different groups of countries.

Panel A of Table 3 shows that IB and TB negatively correlate over time in most countries. In particular, the first column group shows the aggregate sample's results, where, in the first row, the correlation of IB and TB is -0.35 on average and -0.42 at the median. The correlations are statistically significant and negative in 60 percent of countries (results available on request). The results indicate that a negative correlation is present for all components of the income balance. The TB is more negatively correlated with the total IB than any IB elements, which suggests that the correlation structure across IB elements does not significantly dampen their correlation with the TB. In the following three column groups, we calculate the same values for the three income-per-capita groups. The results indicate that the negative correlation is considerably stronger in EMs and LICs; AEs' correlation between IB and TB is much smaller. Furthermore, in EMs, the negative correlation can be traced back mainly to the IIB, whereas, in LICs, both the PIB and SIB are responsible.

[5] Within liabilities, there is a starker difference between EMs and AEs in the FC share of debt that illustrates the well-known 'Original Sin' (Eichengreen, Hausman, and Panizza, 2003): 80% of EM debt liabilities are in foreign currency, whereas this number is only 52% for AEs.

[6] Benetrix et al (2019) note that foreign currency exposures have generally shifted towards long positions over time (i.e. net foreign currency asset positions have risen, including through a shift toward non-debt liabilities, which are typically denominated in local currency, and a rise of local currency debt issuance by some EMs.

Table 3: Correlation and variance decomposition of IB. Correlations and variances are all estimated on at least 25 observations.

	All		Advanced		Emerging		Low-Income	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
A. Correlation with TB								
Cor(tb,ib)	-0.35	-0.42	-0.10	-0.11	-0.41	-0.48	-0.43	-0.49
Cor(tb,pib)	-0.27	-0.35	-0.08	-0.07	-0.35	-0.44	-0.26	-0.35
Cor(tb,sib)	-0.14	-0.14	0.07	0.09	-0.13	-0.13	-0.30	-0.35
Cor(tb,iib non-FDI)	-0.15	-0.13	0.04	0.17	-0.18	-0.18	-0.26	-0.17
Cor(tb,iib FDI)	-0.09	-0.16	-0.06	-0.10	-0.21	-0.24	0.12	0.15
Partial Cor(tb,ib)|trend	-0.27	-0.32	0.01	-0.06	-0.31	-0.38	-0.38	-0.43
Cor(tb,ib) in first differences	-0.21	-0.23	0.00	-0.00	-0.22	-0.24	-0.31	-0.30
B. CA Variance Decomposition								
Var(ib)/Var(ca)*100	59	28	46	19	49	27	87	58
Var(tb)/Var(ca)*100	143	113	106	81	143	117	172	125
2Cov(tb,ib)/Var(ca)*100	-98	-37	-49	-11	-93	-43	-145	-70

Negative correlations have also been observed by Colacelli et al., (2021), who interpret the patterns as diverging trends between the IB and TB, such as profit shifting, migration, and aging. Another interpretation is that income flows tend to stabilize the current account. To help disentangle these interpretations, we account for the trend component by estimating partial correlations conditional on a time trend as well as correlations in first differences. In EMs and LICs, the still-sizeable partial and first-difference correlations suggest a bigger role for the stabilization interpretation. For AEs, the partial and first-difference correlations are at or close to zero, which suggests the small levels correlation is driven by diverging trends.

To gain further insight into the economic significance of the negative comovement between income and trade flows, we decompose the variance of the current account. The negative correlation is inconclusive because it could be inconsequential if the most negative correlations are concentrated in countries with more negligible IB levels or low volatility of IB compared to TB. Therefore, we need a measure that reflects sizes and volatilities and corresponds to an economically meaningful and interpretable value. Since $CA = TB + IB$, we can decompose CA's variance into three terms: $Var(ca) = Var(tb) + Var(ib) + 2Cov(tb, ib)$. From here on, lower case terms show values normalized by nominal GDP. To make the measure comparable among countries with different ca volatilities, we divide both sides by the $Var(ca)$ term, resulting in the following equation for each country i:

$$\frac{Var(tb_i)}{Var(ca_i)} + \frac{Var(ib_i)}{Var(ca_i)} + \frac{2Cov(tb_i, ib_i)}{Var(ca_i)} = 1 \quad (1)$$

We are primarily interested in $2Cov(tb_i, ib_i) / Var(ca_i)$, the covariance share of the volatility, as our measure of the economic impact of the relationship between trade and income. Note that this measure captures both the correlation between income and trade and their individual volatilities. For example, if the correlation is small, or if the IB has negligible variance, the measure will show a small impact. This variance decomposition is theory-neutral and does not rely on a specific underlying causal mechanism.

Panel B of Table 3 shows the average results of the decomposition for all countries and different income groups. We see that on average of all countries, the share of correlation term is an astounding -98%. For perspective, a covariance share of -100 percent means that the variance of the CA is cut in half relative to a zero-correlation counterfactual. The median country's covariance share is -37%, which means that the CA variance is cut by 27%. This counterfactual assumes the extra volatility in the CA would be accommodated through financial flows or changes in reserves. These results indicate that these negative correlations contribute strongly to dampening CA volatility during the cycle.

Figure IV-1 illustrates the three terms of (1) for each country. In 80 percent of countries, the covariance term, shown in green, is negative. The black circles represent the zero-correlation hypothetical variance of CA as the percent of the historical variance. Among the nine notable contributors to global current account imbalances (see IMF, 2020, 2021a), the USA, the Netherlands, Germany, the UK, and Russia are towards the right side of the figure and present prominent examples of positive or negligible covariance between the IB and TB. Some of the largest contributors, namely Canada, Switzerland, Poland, and Mexico, can also be found on the left of the chart with covariance shares near or below -100%.

Comparing the analysis across income groups, we see that the comovement is more important in poorer countries. In particular, the median covariance share in AEs is a modest -11% percent. In EMs and LICs, the shares are -43 percent and -70 percent respectively. We noted earlier that, in the cross-section, some EMDEs have large positive income balances alongside trade deficits. This could be consistent with income inflows being the dominate source of trade deficits financing in LICs and supplementing financial flows in EMs as a source of trade deficit financing.

We investigate possible relationships over time further by breaking down IB and TB into their gross components. The result is the following relationship:

$$Cov(tb, ib) = cov(ex - im, cr - db) = cov(ex, cr) + cov(im, db) - cov(im, cr) - cov(ex, db) \qquad (2)$$

Where ex & im are the exports and imports of goods and services, and cr & db are the income credits and debits. Table 4 reveals that, on average, all four terms are positive and sizeable. On aggregate, the largest driver is the larger size of the covariance between imports and income credits; that is Cov(cr,im). In a simplistic mechanical sense that holds other covariances constant, Cov(ib,tb) would not be negative in the absence of a covariance between imports and income credits. Cov(cr,im) is especially important in LICs, where much of the covariance is driven by secondary income. Cov(cr,im) is also important in AEs and EMs, where the most important driver is Cov(db,ex) and much of the covariance is driven by primary income.

Table 4: Covariance decomposition

	Addition Sign	All		Advanced		Emerging		Low-income	
			% Var (CA)		% Var (CA)		% Var (CA)		% Var (CA)
Cov(cr,ex)	+	7.18	58.4%	14.79	115.6%	3.82	28.3%	8.29	70.3%
Cov(db,im)	+	8.17	55.9%	14.53	128.6%	5.20	26.0%	8.56	62.5%
Cov(db,ex)	-	11.99	66.4%	19.77	125.9%	11.12	47.9%	8.83	59.6%
Cov(cr,im)	-	16.02	95.3%	16.04	135.2%	10.64	41.4%	24.54	157.0%
Cov(ib,tb)	=	-12.67	-47.5%	-6.50	-16.9%	-12.74	-35.0%	-16.51	-83.8%

The mechanical links are consistent with intuitive behavioral relationships, but a holistic framework is needed to capture covariances across all components. The positive relationship between income receipts and imports may suggest that secondary receipts (e.g., remittances, official transfers) help pay for consumption, which includes imports. The positive Cov(db,ex) may illustrate that higher profits from exports by foreign-owned firms lead to higher repatriation of investment income outflows to the parent company. However, a more comprehensive framework would be needed to explain the individual covariances, why they vary across income group or other country characteristic (e.g., poor countries reliant on remittances), and how the components might interact.

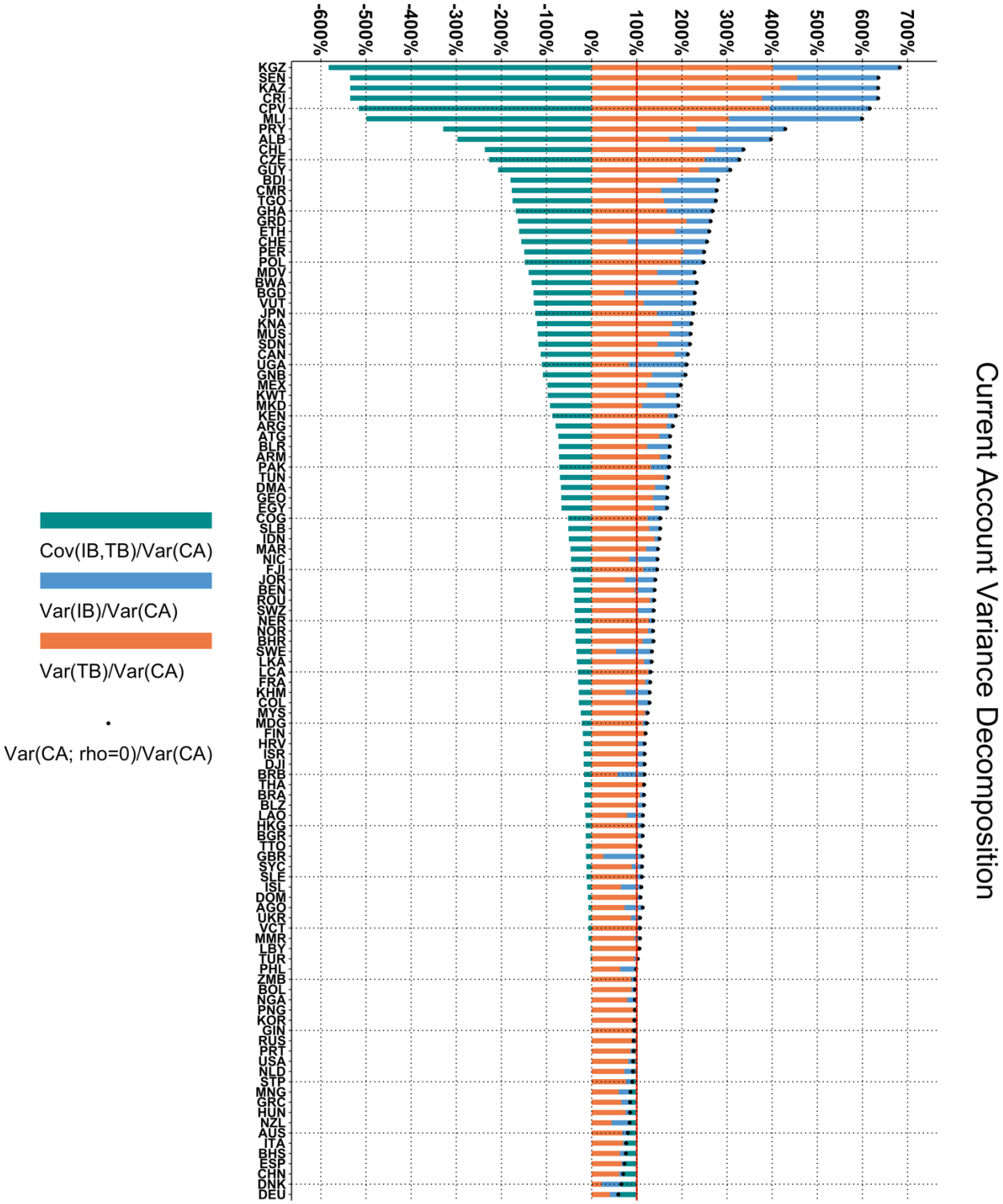


Figure IV-1: Variance decomposition of the current account.

IV. The Behavior of the IB During Crisis Episodes

We investigate the behavior of the IB around crisis episodes to understand the interaction of the IB with vulnerabilities, specifically their dampening or amplifying roles. This section describes how we use the Fixed-Effect Counterfactual (FEct) estimator to address heterogeneity in crisis episode behavior and to formally test for differences in trends prior to crises. We then present results comparing the conditional mean of the IB before, during, and after crises relative to tranquil times. Next, we discuss and implement methodological refinements that can permit a causal interpretation of the crisis event on the IB.

A. Methodology

The crises episodes studied in this section follow the Vulnerability Exercise performed by the IMF (2021b). We define four types of crises: external, fiscal, financial, and real. Detailed definitions of the crises are provided in Appendix B. In the sample of 177 countries, 25 new crises happen in an average year (Appendix Figure 1) and last 2 years on average. We are primarily interested in estimating conditional dynamic means of the IB shortly before, during, and after a crisis, benchmarked against tranquil "non-crisis" times.

We use an event-study approach similar to that applied elsewhere for the CA or trade. Gourinchas and Obstfeld (2012) observe a significant improvement in the CA in the aftermath of defaults and currency crises, especially for EMs. AEs have large deficits prior to banking crises that improve but persist. Catão and Milesi-Ferretti (2014) find that current account gaps are significant predictors of external crises and that these gaps close in their aftermath. These two papers employ two-way fixed-effects (TWFE) estimators, and control for country and time fixed effects and focus on a series of dummies to capture the crisis events. Kolerus (2021) includes country and time fixed effects in a local projection approach to show that the CA balance strengthened significantly and persistently after recessions.

For our event study, we apply methodological advances in the policy evaluation literature. The literature has devoted considerable attention to the use of "traditional" TWFE as controls for estimating "treatment effects" using panel data. Examples in macroeconomics include the effects of minimum wages on employment (Jardim et al, 2020) and of German reunification on GDP (Abadie et al., 2015; 2021). Concerns in that literature include heterogeneous treatment effects and that the treatment and outcome might be correlated:

- Failure of the homogeneity assumption (over time or across groups) in any method that is not robust to heterogeneity may lead to large biases or inconsistencies in the estimated average effect (Chernozhukov et al., 2013; de Chaisemartin & d'Haultfoeuille, 2020). Because the change in the IB is likely to vary by type of crisis or country characteristics, traditional TWFE would not accurately summarize the average behavior of the IB before, during, and after a crisis.

- Correlation between the treatment and the outcome can result in biased estimates of causal effects. The linear and separable functional form of the year and fixed effects may inadequately control for interactive effects, which in macroeconomics could represent unobservable common shocks and their heterogeneous impacts (Bai, 2009; Gobillon & Magnac, 2016). Relatedly, there can be divergent trends prior to the treatment (Abadie et. al., 2003). For example, some crises are preceded by larger than normal current account deficits.

We, therefore, employ the FEct estimator described in Gobillon & Magnac (2016) and Liu et al. (2021a).[7] FEct is robust to heterogeneity in behavior during crises and facilitates testing of pretrends, which we can use to see if the IB is statistically significantly different before a crisis than in normal times (and apply analogous tests for during and after crises). Therefore, we address two of our main challenges, heterogeneity in behavior and divergent trends, using this method. Appendix C describes the underlying technical assumptions of the FEct methodology, and Appendix D describes the estimation procedure.

Although we are primarily interested in comparing and describing conditional means around crisis episodes, we will subsequently augment the model to remove pretrends and estimate "treatment effects" of crises relative to an unobserved counterfactual of no crisis in that same country-year (see Appendix E). We utilize placebo tests[8] recommended by Liu et al. (2021) and Hartman & Hidalgo (2018) to test and measure the difference in pre-trends formally. In the placebo test, P periods before the onset of the actual crisis are hidden, as if the 'placebo' crisis started a few years earlier than the actual one. We then use the same counterfactual estimators to estimate the dummies for periods -P to 0. If the coefficients in the placebo periods are statistically different from zero, then the parallel trends assumption is rejected. We set P to three years. For our purposes, we interpret rejection as evidence that the variable of interest is a significant pre-crisis *predictor*. As we will discuss later, it also means further refinements are needed to identify a counterfactual causal "treatment effect" of crises.

B. Conditional Means Results

Table 5 shows the estimates for IB and TB. Specifically, it shows the estimated conditional means of these variables in the three years before the crisis, during the crisis (of varying length), and the three years after the crisis compared to normal times. The result regarding the sample of all countries during any type of crisis, the first row, shows that the IB is 0.709 percent of GDP lower than normal in the years leading up to the crisis and 1.017 percent of GDP lower than normal during crisis years. In the three years after a crisis, the IB is 0.309 percent of GDP lower than normal, albeit insignificantly so, and this value represents a small improvement relative to the pre-crisis years. The TB is also lower than in normal times in the years preceding a crisis. However, unlike the IB, but consistent with other studies, the TB improves such that, during the crisis years and beyond, the TB is broadly in line with normal years.

[7] The open-source package developed by Liu et al (2021a), fect, is available in R and Stata.

[8] This Placebo estimator compares outcome in groups treated in t-l and groups not-treated until time t (so far the same as the actual estimator); however, the comparison is in periods t-2l-2 and t-1-1 (both groups still untreated in these periods). Therefore, the null hypothesis is of common trends while an estimate significantly different from zero would reject the common trends assumptions.

Table 5: Difference in levels (as a share of GDP) before, during, and after a crisis. These results show average differences for the IB and TB during different types of crises relative to non-crisis times. The before and after periods are three years each. The period during a crisis varies in length. P-values are estimated with a block bootstrap method with 500 iterations.

		IB						TB					
Sample	Crisis	Before	p-value	During	p-value	After	p-value	Before	p-value	During	p-value	After	p-value
All	Any	-0.709***	0.007	-1.017***	0.000	-0.309	0.198	-0.89**	0.028	0.078	0.853	-0.116	0.804
	External	-0.856**	0.026	-1.038*	0.086	-0.144	0.649	-1.182***	0.009	-0.42	0.603	0.328	0.562
	Financial	-0.729*	0.073	-1.521***	0.002	-1.32***	0.005	-1.205**	0.046	1.131*	0.053	1.093*	0.075
	Fiscal	-0.076	0.821	-0.19	0.634	0.046	0.879	-1.124**	0.024	-0.926	0.156	0.486	0.346
	Real	-0.584	0.167	-0.892**	0.033	-0.36	0.348	-0.93*	0.074	0.516	0.357	0.939	0.104
AEs and EMs	Any	-1.193***	0.000	-1.595***	0.000	-0.372	0.238	-1.404**	0.011	0.355	0.464	-0.03	0.950
	External	-1.435***	0.000	-1.829***	0.001	-0.334	0.296	-1.983***	0.000	0.679	0.334	0.599	0.388
	Financial	-0.329	0.427	-1.692***	0.002	-0.566	0.311	-2.141***	0.004	1.55**	0.015	1.545**	0.019
	Fiscal	-0.481	0.356	-0.659	0.253	-0.917**	0.030	-2.074**	0.022	-1.744	0.108	1.455*	0.062
	Real	-0.6	0.268	-1.202*	0.059	0.008	0.982	-1.969***	0.005	0.867	0.251	1.14	0.138
LICs	Any	-0.517	0.389	-0.476	0.491	0.023	0.976	-0.489	0.288	-0.133	0.762	-0.372	0.379
	External	-0.647	0.415	-2.707**	0.030	-0.423	0.587	0.004	0.994	0.4	0.597	0.342	0.598
	Financial	-0.063	0.960	-0.719	0.518	-0.966	0.385	-1.586*	0.073	-1.317	0.206	-2.293**	0.011
	Fiscal	-0.143	0.785	0.534	0.400	0.313	0.622	0.034	0.942	0.138	0.811	0.45	0.286
	Real	-0.244	0.765	-0.113	0.899	0.064	0.920	-0.275	0.694	-0.155	0.791	-0.591	0.357

Figure V-1 provides more details on the dynamics of the responses to the crisis of the IB and TB in the first row. In the next rows, it shows those dynamic responses for three components of the IIB: FDI, debt, and portfolio equity. It also shows the response of the aggregate equity income, defined as the sum of FDI and portfolio equity. On the x-axis, each of the three years before the onset of crisis are labelled "-3", "-2", and "-1". Since crises can last more than one year, the average effect across all crises is collapsed into one data point labelled "During Crisis". The three years after the end of the crisis are labelled "1", "2", and "3".

As we expected from the average effects, previously discussed, the figures in the first row show that the IB is lower than the no crisis benchmark in all three years before the crisis. There is a small negative change during the crisis. In the aftermath of the crisis, the IB improves but remains below the benchmark. In the second column, we see that TB deteriorates relative to the benchmark before the crisis. However, the TB improves sharply during the crisis and remains close to the no crisis benchmark 3 years after the crisis. These results suggest that the IB, in contrast to the TB, plays a destabilizing role during a crisis.

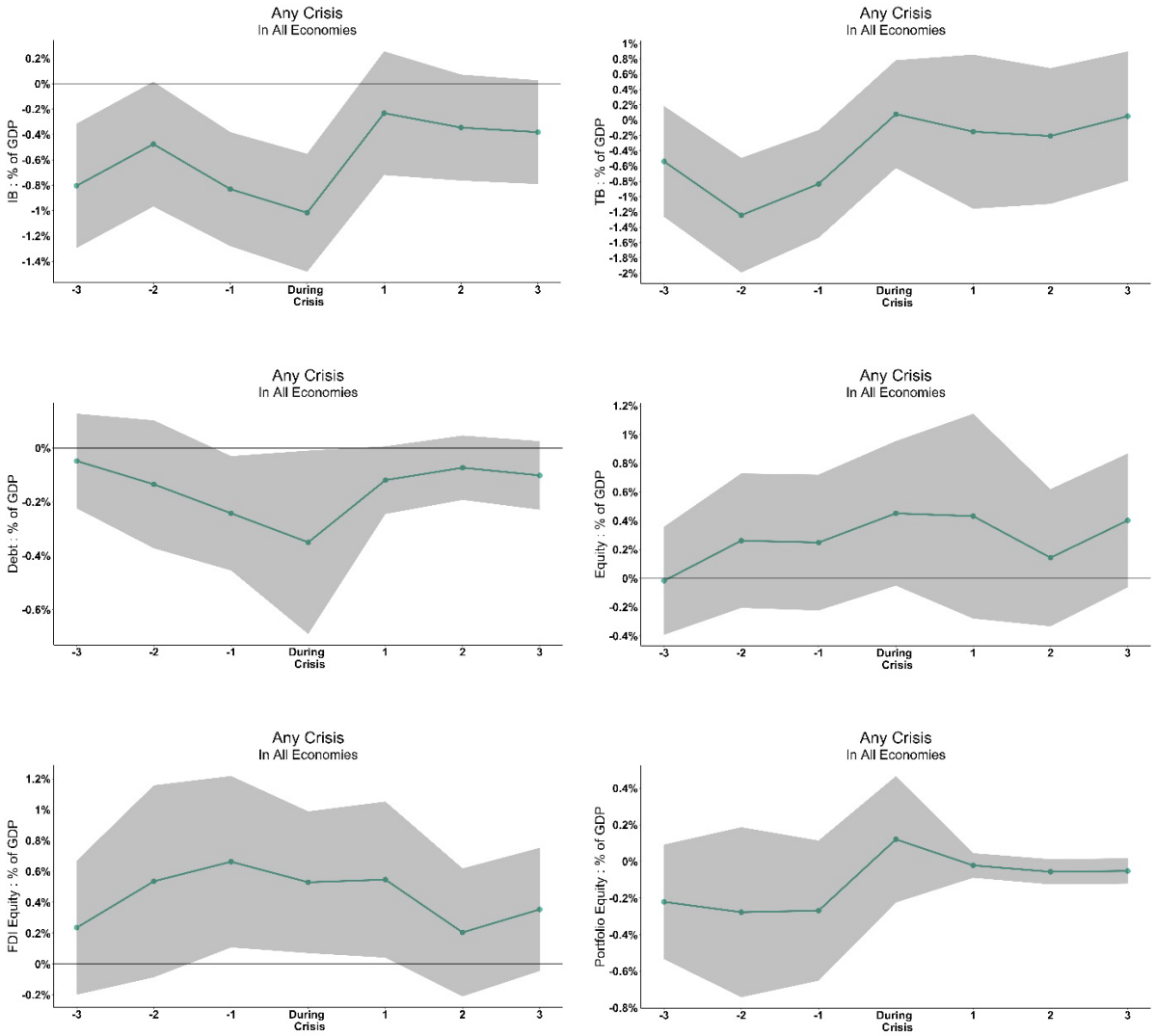


Figure V-1: Dynamic average effect of crises. The sample includes all economies. The shaded areas show the 90% confidence intervals of estimates, achieved via block bootstrapping. On the x-axis, each of the three years before the onset of crisis are labelled "-3", "-2", and "-1". Since crises can last more than one year, the average effect across all crises is collapsed into one data point labelled "During Crisis". The three years after the end of the crises are labelled "1", "2", and "3".

Repeating the analysis for different crisis types shows that the IB does not play a stabilizing role in any type of crisis. In financial crises, the IB's destabilization is particularly pronounced, and the contrast with the TB response is particularly sharp. The IB is about 0.7 percent of GDP lower than the no financial crisis benchmark in the years leading up to the crisis, 1.5 percent of GDP lower than normal during crisis years, and still 1.3 percent of GDP lower than normal (see Table 5 and Appendix Figure 2). The results also point to destabilization in external and real crises, but negligible effects for fiscal crises. Comparing the IB after a crisis with the IB before a crisis, whether there is an improvement depends on the type of crisis. Comparing the TB after and before a crisis, the improvement is more pronounced when the crisis type is disaggregated than we observed when crises are combined.

Splitting the sample by country income group reveals some differences between LICs and the rest of the sample. In the sample of AEs and EMs for all crises combined, the IB is worse, relative to the benchmark, before and during the crisis, than was the case for the entire sample, while the coefficients for LICs are closer to zero and insignificant. Among AEs and EMs, in addition to the destabilization observed for external, financial, and real crises, there is some evidence of deterioration after fiscal crises. Among LICs, the destabilization appears more limited to external crises, but the IB does not play a stabilizing role in other crises. That destabilization behavior is more robust AEs and EMs and likely stems from deeper financial integration.

Table 6 and Appendix Figure 3 report the results for primary and secondary income. Prior to a crisis, the PIB is not generally statistically significantly lower than in tranquil times, but there is a deterioration during the crisis. Primary income is especially low in external and financial crises and in AEs and EMs. After the crises, the PIB slowly recovers but remains significantly lower than tranquil times after the end of external and financial crises. In contrast to the PIB, the SIB is already lower before a crisis than in tranquil times but does not deteriorate further during the crisis. The decrease in net secondary income is generally larger and more significant in fiscal crises and among AEs and EMs, though the SIB sharply increases and reaches the tranquil times' benchmark after crises end. For LICs, the SIB reaches the benchmark sooner (during the crisis), possibly because of countercyclical remittances. Differentiating by the type of crisis, the SIB is significantly positive after external crises, and it is significantly negative after financial crises.

Table 6: Behavior of PIB and SIB before, during, and after crises. These results show the average difference for PIB and SIB relative to non-crisis times. The before and after periods are three years each. The period during a crisis varies in length. P-values are estimated with a block bootstrap method with 500 iterations.

		PIB						SIB					
Sample	Crisis	Before	p-value	During	p-value	After	p-value	Before	p-value	During	p-value	After	p-value
All	Any	0.000	0.999	-0.579*	0.076	-0.191	0.289	-0.59***	0.004	-0.616***	0.008	0.01	0.954
	External	-0.754	0.142	-1.018*	0.061	-0.698*	0.065	-0.223	0.588	-0.36	0.438	0.587*	0.087
	Financial	-0.617*	0.077	-1.148***	0.003	-0.702**	0.033	-0.168	0.553	-0.26	0.502	-0.49*	0.076
	Fiscal	-0.091	0.589	-0.373	0.195	-0.233	0.259	-0.02	0.945	0.011	0.970	0.205	0.418
	Real	0.004	0.991	-0.403	0.197	-0.244	0.360	-0.468	0.192	-0.501	0.123	-0.17	0.520
AEs and EMs	Any	-0.431	0.181	-1.037**	0.041	-0.266	0.311	-0.911***	0.000	-0.929***	0.000	-0.128	0.458
	External	-1.53**	0.021	-1.701**	0.026	-0.916*	0.066	-0.208	0.684	-0.792	0.105	0.34	0.429
	Financial	-0.541	0.262	-1.674***	0.002	-0.574	0.181	-0.023	0.941	-0.028	0.924	0.084	0.638
	Fiscal	-0.151	0.614	0.008	0.983	-0.522	0.142	-0.603**	0.028	-0.762**	0.024	-0.521*	0.053
	Real	-0.304	0.542	-0.588	0.245	-0.046	0.891	0.021	0.961	-0.351	0.339	-0.03	0.885
LICs	Any	0.223	0.393	0.08	0.766	-0.036	0.908	-0.349	0.372	-0.045	0.910	0.034	0.923
	External	0.245	0.690	0.108	0.820	-0.36	0.461	-0.059	0.903	0.488	0.445	0.991*	0.087
	Financial	-0.814	0.252	-0.506	0.373	-1.096*	0.071	-0.329	0.686	-0.496	0.609	-1.022	0.164
	Fiscal	-0.168	0.486	-0.769*	0.085	-0.102	0.664	0.265	0.572	0.592	0.223	0.459	0.234
	Real	0.418	0.541	-0.127	0.694	-0.48	0.312	-0.699	0.250	-0.392	0.526	-0.208	0.668

Next, we turn to two of investment income's components with interesting contrasts, namely FDI and debt income (Table 7). The results suggest that the decrease in the PIB shown above is mainly driven by a negative and robust decrease in net debt income before and during crises relative to tranquil times. Possible reasons for the importance of interest payments are higher borrowing needs as well as higher spreads during crises. Moreover, the PIB decrease is more persistent than the change of IB, as they persist in the years after the end of the crisis. Performing the test on subsamples shows that the debt income behavior is exclusive to AEs and EMs, and there appears to be an exception for financial crises in LICs. In contrast, the results show that net FDI income increases before and during crises and remains higher than the no crisis benchmark even after crises. These results illustrate the shock absorbing and risk-sharing properties of FDI investment and imply a smoother and stronger current account for countries with high FDI exposures. One would expect domestic profits of foreign-owned companies to fall during crises. Results for portfolio equity income suggest small and insignificant changes and are available on request.

Table 7: The behavior of FDI and debt income before, during, and after crises. These results show average differences for FDI and debt income during different types of crises relative to non-crisis times. The before and after periods are three years each. The period during a crisis varies in length. P-values are estimated with a block bootstrap method with 500 iterations.

		FDI income						Net Debt Income					
Sample	Crisis	Before	p-value	During	p-value	After	p-value	Before	p-value	During	p-value	After	p-value
All	Any	0.504	0.111	0.53*	0.072	0.379**	0.050	-0.153	0.213	-0.35*	0.062	-0.098	0.187
	External	0.19	0.463	0.531*	0.085	0.315	0.220	-0.424	0.145	-0.387*	0.071	-0.373***	0.001
	Financial	0.007	0.985	-0.287	0.407	0.057	0.758	-0.309	0.305	-0.554	0.154	-0.243**	0.013
	Fiscal	0.148	0.520	0.636*	0.082	0.339*	0.082	0.022	0.802	-0.207*	0.056	-0.218	0.302
	Real	0.393	0.236	0.698*	0.056	-0.062	0.837	-0.446*	0.062	-0.634**	0.048	-0.339*	0.051
AEs and EMs	Any	0.692	0.270	0.465	0.202	0.308	0.170	-0.302	0.127	-0.493**	0.037	-0.209**	0.011
	External	0.259	0.412	0.313	0.377	0.302	0.316	-0.474	0.115	-0.548**	0.011	-0.447***	0.000
	Financial	0.283	0.565	-0.281	0.475	0.093	0.695	-0.406	0.191	-0.749*	0.078	-0.258**	0.023
	Fiscal	-0.15	0.681	0.705	0.248	0.265	0.324	-0.003	0.982	-0.254**	0.047	-0.373	0.270
	Real	0.569	0.387	0.797	0.122	-0.126	0.772	-0.618**	0.030	-0.72**	0.037	-0.407**	0.049
LICs	Any	0.585*	0.090	0.897	0.124	0.287	0.352	-0.057	0.550	-0.014	0.964	-0.041	0.741
	External	0.079	0.840	1.102*	0.093	0.337	0.526	-0.204	0.539	0.612	0.101	0.141	0.496
	Financial	-1.246***	0.000	-1.089***	0.004	-0.156	0.757	0.879**	0.029	1.069	0.122	-0.004	0.968
	Fiscal	0.113	0.716	0.335	0.299	0.227	0.380	0.102	0.379	-0.094	0.487	-0.045	0.500
	Real	0.803*	0.078	0.487	0.222	-0.16	0.739	0.407	0.214	-0.073	0.822	0.192	0.379

C. Causal Inference

So far, we have described the dynamic behavior of the IB and its components around different crisis episodes; we did not intend to infer any causality from the crises on the IB. It can be of interest to estimate the average treatment effect on the treated (ATT); that is, the effect of a crisis on the IB relative to a counterfactual of not having had a crisis, holding other factors constant.[9]

For such causal estimates, it is necessary for us to account for the significant differences we observed for the IB before the onset of a crisis, i.e., the divergent pretrends. To achieve that objective, we take an *agnostic* approach and use a factor-augmented version of equation (8). One or more common *latent* factors, which may drive income flows, are estimated from the data, along with country-specific factor loadings as in Gobillon & Magnac (2016). See Appendix E for details.

The main result, as seen in Table 8, is that there is a stark difference in ATTs between AEs and EMs on the one hand and LICs on the other hand. In the sample of AEs and EMs, the change in IB is large, negative, and significant, meaning that, during crises, the IB coefficient is -1.519 or about 1.5 percent of GDP lower than an unobserved counterfactual in which the country had not experienced a crisis. This coefficient is highly statistically significant and much larger than the effect implied by comparing the "during" and "before" conditional means in Table 5 (i.e., -1.6 - -1.2 = -0.4). However, in LICs, the ATT is +0.9. The positive and significant value implies that the LIC IB is better than an unobserved counterfactual of no crisis, while Table 5 describes an IB that is (statistically insignificantly) lower before or during crises than in observed tranquil times. This behavior in LICs could be due to a larger share of secondary income and a smaller share of non-FDI investment income compared to AEs and EMs.

[9] We do not seek to fully mimic the policy evaluation literature by making a normative recommendation on whether a crisis is an effective means of securing external adjustment.

Table 8: Factor-augmented counterfactual tests. These results show the ATT in crisis for IB, equity and debt income during different types of crises. Following eq (11), we increase the number of latent factors, starting from zero, until the null hypothesis of no placebo effect is not rejected, leading to ATT estimates with causality indications. The number of factors is two or fewer. These results indicate the difference between historical values and values under a hypothetical no-crisis state. The placebo test interval is three years. P-values are estimated with a block bootstrap method with 500 iterations.

Sample		IB		Net FDI Income		Net Debt Income		SIB	
	Crisis	ATT	p-value	ATT	p-value	ATT	p-value	ATT	p-value
All Countries	Any	0.303	0.641	0.53*	0.072	-0.35*	0.062	-0.289	0.507
	External	-0.082	0.885	0.531*	0.085	-0.387*	0.071	-0.36	0.414
	Financial	-0.58	0.210	-0.287	0.407	-0.554	0.154	-0.26	0.473
	Fiscal	-0.19	0.634	0.636*	0.082	-0.207*	0.056	0.011	0.97
	Real	-0.892**	0.033	0.698*	0.056	-0.125	0.646	-0.501	0.104
AEs and EMs	Any	-1.519***	0.004	0.465	0.202	-0.493**	0.037	0.28	0.418
	External	-0.315	0.795	0.313	0.377	-0.548**	0.011	-0.792	0.106
	Financial	-1.692***	0.002	-0.281	0.475	-0.749*	0.078	-0.028	0.922
	Fiscal	-0.659	0.253	0.705	0.248	-0.254**	0.047	0.28	0.48
	Real	-1.202*	0.059	2.679*	0.092	-0.285	0.290	-0.351	0.33
LICs	Any	0.915*	0.090	0.361	0.465	insufficient observations		0.581	0.328
	External	0.4	0.597	1.102*	0.093	0.612	0.101	0.488	0.43
	Financial	0.934	0.202	-0.646	0.530	0.713	0.561	0.93	0.287
	Fiscal	0.138	0.811	0.335	0.299	-0.094	0.487	0.607*	0.07
	Real	-0.155	0.791	1.273*	0.060	insufficient observations		0.643	0.51

Breaking the results down by crisis type, the negative ATTs among AEs and EMs are strongest for financial and real crises, although coefficients are also negative for fiscal and external crises. For LICs, the positive ATT effect seems strongest for financial crises, but it is not significant, and the coefficient is not positive for real crises.

We also see the results for net FDI income and net debt income as well as secondary income. The results suggest that crises lead to large increases in net FDI income across country income groups and for most crisis types. Our results indicate a special feature of FDI investments, namely their robust stabilizing role on the current account in crises. Net debt income, on the other hand, is negatively impacted by any type of crisis, though the impact is concentrated in AEs and EMs.

For LICs, the ATT for secondary income is sizably positive, and in the case of fiscal crises significant, which weakly suggests that crises increase the net secondary income receipts received by LICs.

V. The income balance and exchange rate adjustment

This section outlines conceptual issues related to exchange rate misalignment, estimates semi-elasticities of the IB with respect to the REER, and derives implication for exchange rate misalignment estimates and whether the exchange rate aids external adjustment through the IB.

A. Background

Exchange rate adjustment is often associated with episodes of current account rebalancing (e.g., Obstfeld and Rogoff, 1995; Freund and Warnock, 2005; Gervais, Schembru, and Suchanek, 2016). It is also associated with crises, including as an empirically observed behavioral response (e.g., Kolerus, 2021) or in the definition of the crisis itself (IMF, 2021a, Rose and Spiegel, 2011). The primary channel through which adjustment is posited is the TB. However, the possible role of the IB as a channel through which the exchange rate might help stabilize the current account remains underexplored.

The responsiveness of the current account to the exchange rate is an important factor in assessing exchange rate misalignments as part of external sector assessments such as those conducted by the IMF.[10] For example, the macrobalance approach uses a model of the equilibrium current account to measure the gap between the actual current account based on fundamentals and desirable policy settings.[11] To translate the CA gap to a REER gap, a CA-REER semi-elasticity is used.

The current account balance and the current account gap, as a share of GDP, are defined, respectively, as $\frac{\widehat{CA}}{Y} \equiv \frac{CA}{Y} - \frac{CA^*}{Y}$. * indicates the estimated current account norm based on explanatory macroeconomic fundamentals and desirable policy settings. $\frac{\widehat{CA}}{Y} < 0$ indicates a negative current account gap and that the current account is, depending on the size of the gap, moderately weaker, weaker, or substantially weaker than fundamentals and desirable policies. Since the EBA approach treats the current account and exchange rate as a system, there is an equivalent REER gap $\hat{R} \equiv \frac{R-R^*}{R}$. R is defined so that a rise denotes an appreciation. One can show that the semi-elasticity of the current account to the exchange rate is

$$\eta^{\mathrm{CA}} \equiv \frac{d\, CA/Y}{dR/R} = \eta^{TB} + \eta^{IB},$$

η^{TB} is the semi-elasticity of the nominal trade balance and η^{IB} is the semi-elasticity of the nominal income balance. Using η^{CA} to translate the current account gap to an exchange gap *implied* by the current account gap:

[10] See Phillips et al. (2013), Cubeddu et al.(2019), IMF (2021) and IMF staff reports for individual countries.

[11] NFA stock and income flow dynamics motivate the inclusion of some of the explanatory variables in estimates deployed in the macrobalance approach to estimating current account norms. The EBA framework also uses an external sustainability approach to calculate current account gaps before using the CA-REER elasticity. The interplay between stock and income flow variables is more explicit in this approach.

$$\hat{R} = \frac{1}{\eta^{CA}} \frac{\widehat{CA}}{Y}$$

η <0 implies that a depreciation would increase (improve) the current account balance. In that case, a negative current account gap implies an overvalued exchange rate.

In previous estimates, the sole channel for closing the current account gap is the trade balance. This assumption is explicit (Cubeddu et al. 2019)[12] and goes back at least to Isard and Faruqee (1998). Country teams are encouraged to apply their expertise to tailoring η^{CA}. There are many documented cases where this is done for η^{TB}. However, with the caveat that we have not conducted an exhaustive search across all country staff reports, we are not aware of cases where countries have explicitly incorporated estimates of η^{IB} including, for example, in IMF External Sector Reports (IMF 2021). Therefore, in what appears to be the predominant, if not exclusive, usage, $\hat{R} \equiv \frac{1}{\eta^{TB}} \frac{\widehat{CA}}{GDP}$.

For countries where $\eta^{IB} = 0$, the practice of assuming all adjustment occurs through the TB is not misleading for external sector assessments. However, if $\eta^{IB} \neq 0$, estimates of exchange rate gaps could be biased. It thus seems natural to test the null hypothesis, $\eta^{IB} = 0$.

There are established theoretical reasons for why net export volumes should rise in response to an exchange rate depreciation and it is typical for $\eta^{TB} < 0$. However, the theory on nominal income balance responses is not well established. Earlier in this paper, we discussed potential mechanical effects that could increase investment income inflows and outflows after a depreciation. Investment income could possibly increase through other channels. For example, if a depreciation increases local-currency profits (e.g., if commodity exports are priced in foreign currency and costs are largely denominated in local currency), then one could see more profit repatriation abroad (Colacelli et al., 2021; Behar, 2021). Furthermore, the anticipation of future depreciation could increase the required rate of return, and hence investment income outflows or currency volatility might affect intra-year profit accounting. Regarding secondary income, there is some evidence that depreciations in the home relative to the host country partially increase remittance inflows to the home in the home country's currency and, equivalently, partially decrease remittance outflows when measured in the host's currency (Yang, 2008).[13] Official flows, including those from multilateral institutions, are often priced in international currency, so one might expect a depreciation in recipients to lead to a rise in local-currency official inflows. Although the list is not exhaustive, it does suggest that income inflows and outflows would rise after a depreciation. However, the size of the response and the net effect of income credits and debits on the income balance is an empirical question.

Alberola et al. (2018) analyze the impact of foreign stock positions on the CA balance and its components and find that the income balance is mostly determined by the NFA position while no statistically significant role is identified for exchange rates. While they use the income balance as the regressand, Colacelli et al. (2021) estimate credit and debit equations separately and combine them using a "CGER-inspired" approach analogous to that used for exports and imports (Cubeddu et al, 2019). They separately estimate the elasticity of income

[12] From Cubeddu and others (2019): "*Assuming that the current account gap will be closed by an adjustment in the trade balance,…*".

[13] Consistent with this finding, if there is an international market for migrant labor, a depreciation in the host country would need to be compensated by an increase in the host country wage. Flows to the home country could be related to the motive for remittances. For example, whether there are target expenditure needs for family members being supported, or alternatively substitution between consumption in the home country and present or future consumption in the home country.

credits with respect to the exchange rate and income debits with respect to the exchange rate using a panel of 40 AEs and EMs. They combine panel-wide elasticities with country-specific income credits as a share of GDP and income debits as a share of GDP. Consistent with the priors established in the previous paragraph, they find that both receipts and payments rise following a depreciation. In particular, income credit elasticities are approximately -1/2, and income debit elasticities are about -1/4 – in both cases mostly due to mechanical effects of the type discussed earlier. Due to the offsetting effects of income debits and credits and the relatively smaller sizes of income flows, they argue that income balance semi-elasticities should generally be small, for example -0.03 in Japan. For Colombia, the implied estimate is up to -0.01 (Behar, 2021). These results are consistent with those in Alberola et al. (2018).

However, there may be cases where the absolute size or asymmetry of the income balance leads to non-negligible income balance semi elasticities. To investigate this possibility, we extend the Colacelli et al (2021) framework to a bigger sample that includes LICs. In particular, we cover an unbalanced panel of 145 countries between 1985 and 2019.

B. Estimation Methodology

η shows a semi-elasticity and μ an elasticity to the REER.[14] The exchange rate semi-elasticity of the nominal income balance is

$$\eta^{IB} \equiv \frac{\Delta\left(\frac{IB}{Y}\right)}{\frac{\Delta ER}{ER}}$$

We decompose the η^{IB} as follows:

$$\eta^{IB} = \mu^{Credit} S^{Credit} - \mu^{Debit} S^{Debit} \quad (3)$$

Where, μ^{Credit} (μ^{Debit}) is the exchange rate elasticity of nominal income credits (debits) over GDP; and $S^{Flow} \equiv \frac{Flow}{Y}$ is the nominal share of GDP. The equivalent in trade terms (Cubeddu et. al., 2019) is $\eta^{TB} = \mu^{Export} S^{Export} - \mu^{Import} S^{Import}$.[15] Although S^{Flow} is readily observable, elasticities are estimated econometrically. The regression corresponding to income credits is:

$$\ln\left(\frac{IC}{GDP}\right)_{it} = \delta_1^{IC} \ln\left(\frac{IC}{GDP}\right)_{it-1} + \sum_{j=0}^{1} \beta_j^{IC} \ln(\mathrm{ER}_{it-j}) + \gamma_1^{IC} \ln\left(\frac{F.Asset}{GDP}\right)_{it-1} + \lambda^{IC} ln\,(RGDP_{it}) + C_i + \Gamma_t + \varepsilon_{it} \quad (4)$$

Regression (4) includes country and year fixed effects, and the preferred specification includes one lag of the dependent variable and the exchange rate to account for dynamic responses. It also includes the size of financial assets. The regression for income debit is similar but has liabilities instead of assets. We also estimate regressions for subcomponents and adjust specifications accordingly. For example, the regression estimating

[14] We use the REER to facilitate combination with and comparison to TB elasticities and owing to their widespread availability. However, they may not be the most appropriate for the income balance. First, real exchange rates adjust for relative prices to get a more accurate measure of competitiveness for trade, while some of the mechanisms described may respond exclusively to nominal changes. Second, REERs use trade weights, but other weights (e.g., the geography of assets and liabilities) may be more appropriate. See Benetrix et al (2019) and Colacelli et al (2021).

[15] These elasticities and formulas refer to trade values. The original CGER approach, which is still used, distinguished between trade volume elasticities, and assumed price implications (Bayoumi and Faruqee, 1998).

the elasticity of secondary income does not include financial assets/liabilities as they, unlike investment income, do not correspond to foreign positions. The long-run elasticities are calculated as:

$$\mu^{Credit} = \frac{\sum_{j=0}^{1}\beta_j^{IC}}{1-\delta_1^{IC}} \ , \ \mu^{Debit} = \frac{\sum_{j=0}^{1}\beta_j^{DB}}{1-\delta_1^{DB}} \quad (5)$$

C. Empirical Results

Results from our preferred specifications are in Table 9. Consistent with the earlier literature, we find a significant effect for assets/liabilities on income credits/debits. Notably, the exchange rate appears to have a significant effect on both income credits and debits. Real GDP appears insignificant in this table, which suggests that domestic economic activity does not have a robust impact on these aggregate gross flows. However, results available on request show opposing impacts on investment income debits. FDI outflows show procyclical behavior and decrease in low GDP times, supporting a risk-sharing effect on the current account. However, non-FDI outflows are acyclical in dollar terms, meaning that in lower GDP times the outflow is a larger share of GDP.

Table 9: Elasticity panel regressions, following equation (4). The standard errors are shown in parenthesis. All regressions include time and country fixed effects (not reported).

	All Countries		AEs		EMs		LICs		Primary Income		Secondary Income	
	IB Credit	IB Debit	IB Credit	IB Debit	IB Credit	IB Debit	IB Credit	IB Debit	PIB Credit	PIB Debit	SIB Credit	SIB Debit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Y (t-1)	0.84***	0.77***	0.83***	0.88***	0.78***	0.74***	0.81***	0.74***	0.75***	0.69***	0.79***	0.78***
	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.02)	(0.02)
log (REER(t))	-0.89***	-0.87***	-0.30	-0.47***	-1.14***	-0.91***	-0.53***	-0.95***	-0.87***	-0.91***	-0.59***	-0.32*
	(0.11)	(0.1)	(0.24)	(0.13)	(0.1)	(0.10)	(0.16)	(0.27)	(0.16)	(0.11)	(0.12)	(0.17)
log (REER(t-1))	0.78***	0.70***	0.31	0.44***	0.86***	0.66***	0.48***	0.78**	0.46***	0.71***	0.42***	0.17
	(0.15)	(0.15)	(0.21)	(0.13)	(0.15)	(0.12)	(0.20)	(0.33)	(0.16)	(0.16)	(0.12)	(0.14)
log (Real GDP(t))	-0.06	0.08	-0.11	-0.08	-0.14	-0.07	-0.13	0.28	-0.24**	0.11	-0.09	0.06
	(0.11)	(0.07)	(0.10)	(0.09)	(0.09)	(0.09)	(0.10)	(0.19)	(0.11)	(0.09)	(0.06)	(0.06)
log (Fin Asset or Liab. (t-1))	0.06**	0.07***	0.05	0.04	0.12***	0.13***		0.02	0.14***	0.11***		
	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)		(0.03)	(0.04)	(0.04)		
Observations	2,568	2,572	700	701	1,027	1,039	1,929	827	2,547	2,577	4,178	4,009
Number of Countries	143	143	32	32	56	56	79	55	142	143	176	176
Adjusted R-sq	0.96	0.93	0.99	0.99	0.96	0.91	0.93	0.89	0.96	0.91	0.95	0.92

*p<0.1; **p<0.05; ***p<0.01

Table 10 shows the estimates of μ. In panel A, we include all countries in the estimation and use the total credits and debits of the IB. The results show that income credit and debit have an elasticity of -0.63 and -0.74, respectively, such that both debits and credits decrease in response to ER appreciation. The signs are consistent with the channels described earlier. The magnitudes are large, especially on the debit side, compared to Colacelli

et al. (2021) and compared to absolute values of elasticities for exports and imports, as shown in panel E. However, while the negative sign for exports and positive sign for imports guarantees a negative semi-elasticity for the trade balance, the negative signs for income debits imply that these will tend to cancel and that the sign of the net effect will be country-specific.

Next, we try to capture more heterogeneity among countries. First, we estimate countries of different income-per-capita levels separately. Specifically, we repeat the same exercise separately on the sample of advanced, emerging, and low-income countries, allowing us to use the corresponding elasticity to construct IB semi-elasticities in the next step. The results are reported in panel B of Table 10. The results reveal large disparities among income groups. We see that EMs and LICs have higher elasticities than AEs. Possible reasons include a higher share of foreign assets and liabilities denominated in foreign currency and a greater reliance on foreign transfers.[16] Additionally, AEs have a strong asymmetry between credits and debits, whereas other income groups have similar magnitudes. Finally, in panel C, primary income is more responsive in credits than in debits, which is consistent with a higher share of assets denominated in FC than liabilities denominated in FC, and more responsive than secondary income.

Table 10: Income credits and debits exchange rate elasticity estimates.Standard errors are estimated using the delta method.

Estimation Sample	μ^{Credit}	μ^{Debit}
A. All Countries Income flows	-0.63	-0.74***
	(0.74)	(0.28)
Sub-sample of 29 ESR countries	-0.84***	-0.63**
	(0.35)	(0.32)
B. By Country Income Group:		
Advanced	0.04	-0.29
	(0.45)	(0.83)
Emerging	-1.28***	-0.96***
	(0.36)	(0.28)
Low-income	-0.28	-0.65**
	(0.46)	(0.29)
C. By Income Type:		
Primary	-1.62***	-0.64***
	(0.46)	(0.25)
Secondary	-0.82***	-0.69*
	(0.33)	(0.36)
D. Trade values:	μ^{Export}	μ^{Import}
Cubeddu et al (2019)	-0.11	+0.57
IMF EBA-Lite template	-0.44	+0.29

Although the estimates presented so far incorporate possible other behavioral effects and multiple components of income flows, we briefly focus on investment income to compare econometric panel estimates with those implied by the possible mechanical relationship between the FC share of assets or liabilities and the income balance. Let w^{Credit} and w^{Debit} show these FC shares of credits and debits, and we have a special case of equation (3) in which

[16] Lower values for LICs could be due to a larger degree of attenuation bias owing to measurement error.

$$\mu_{Mech}^{Credit} = -w^{Credit}, \quad \mu_{Mech}^{Debit} = -w^{Debit}$$

We focus on the IIB and on 50 countries with FC shares compiled and shared by Bénétrix et al., (2019). We are unaware of a systematic data source on the currency decomposition of income payments; therefore, we try another approach to obtain a proxy. We proxy the FC share of investment credits (debits) flows with the FC share of assets (liabilities). In other words, we assume $w^{IIB\ Cr} \cong w^{Assets}$ and $w^{IIB\ Db} \cong w^{Liabilities}$ (see Table 2) and use those values in equation (3).[17] We average the FC shares over the same period as the regression estimation.

Table 11 shows the results of this comparison. In the first row, we see that the panel regression shows $\mu^{Credit} = -0.77$ and $\mu_{Mech}^{Credit} = -0.82$, which are close to each other, while $\mu^{Debit} = -0.32$ and $\mu_{Mech}^{Debit} = -0.45$. Overall, the results indicate that the mechanical elasticity is a large and perhaps dominant part of the total elasticity of investment income. EMs' higher FC shares of assets compared to AEs and compared to liabilities are reflected in higher mechanical estimates and also in higher regression estimates. However, even though FC liability shares are higher in EMs than in AEs, regression estimates are lower.

Table 11: Mechanical and regression elasticities compared.

	Regression		Mechanical	
Estimation Sample	μ^{Credit}	μ^{Debit}	$-w^{Assets}$	$-w^{Liabilities}$
The 50 Countries with FC share data	From Panel Regressions		Sample Means	
All Countries Investment IB	-0.77	-0.32	-0.82	-0.45
Divided by Income-per-capita:				
Advanced Investment IB	-0.54	-0.61	-0.68	-0.36
Emerging Investment IB	-1.10	-0.40	-0.98	-0.54

Returning to more general estimates in Table 10, we use elasticities for income groups (Panel B) and country-specific values for the average *S* during the years 2010-19 to calculate η^{IB} and η^{TB} as per equation (3). To update η^{TB}, we use μ^{Export} and μ^{Import} estimated by Cubeddu et al (2019) for all countries in our sample. Figure VI-1 depicts the cross-sectional distribution of η^{IB} and η^{TB} via histograms. The mode is at 0.0 but the distribution is broadly symmetric, and there are many countries with non-trivially large positive values for η^{IB} (which occurs if income debits dominate credits) and non-trivially large negative values. Table 12 offers more precision. The η^{IB} has a median of -0.002, and its 10th and 90th percentiles are -0.095 and 0.062. Consistent with this, η^{IB} is statistically significant in only a minority of cases. We list values of η^{IB} and η^{TB} for ESR countries in the appendix, noting that $\eta^{IB} > 0$ for almost all of them. Calculations based on other alternatives from Table 10 are in Appendix G. In particular, the distribution is very similar for calculations that do not distinguish by country income per capita, while the distribution is more to the left (i.e., most countries have negative elasticities) for those that distinguish between primary and secondary income.

[17] An immediate concern about the accuracy of this proxy is that it implicitly assumes the yields on investments in foreign and domestic currency are the same. To the extent that domestic currency returns exceed foreign currency returns for a particular asset, the weights are an overestimate and could be seen as an upper bound. Illustrative calculations available on request suggest the bias is small.

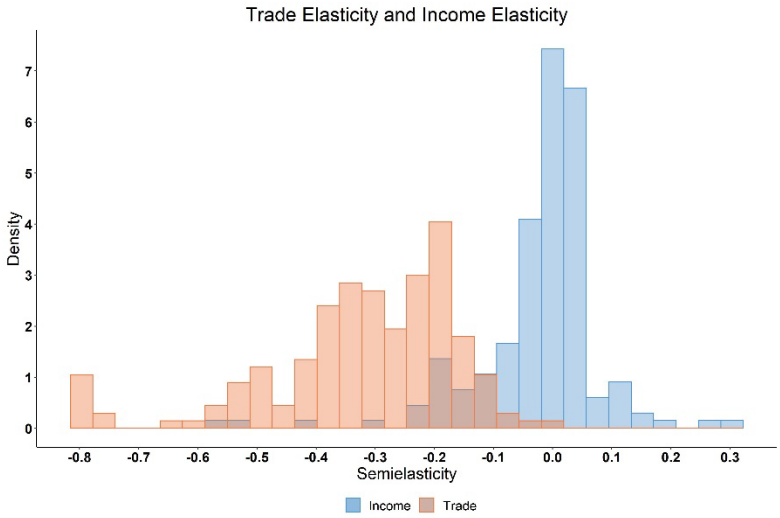


Figure VI-1: Empirical cross-sectional distribution of income and trade REER semi-elasticity.

η^{IB} values that are close to zero, as is the case for most countries, suggest that the IB channel is not an important one through which the exchange rate stabilizes the current account. However, in the outer parts of the distribution, negative values suggest a potentially overlooked channel through which the exchange rate acts as a stabilizer, while positive values imply that the IB channel counters the stabilizing properties of the exchange rate through the TB channel.

Equivalently, overlooking a positive η^{IB} results in underestimating exchange rate gaps, and similarly, ignoring a negative η^{IB} results in the overestimation of exchange rate gaps. That means countries with large income balance deficits are likely to have underestimated exchange rate gaps. To investigate the quantitative importance of omitting the income balance for the gap, Table 12 also reports ER gap multipliers, which are $1/\eta^{CA}$, or the ER gap in percent implied by a +1% of GDP CA gap. Table 12 shows that when $\eta^{CA} = \eta^{TB}$ the ER multiplier is -3.98 on average, and it is -4.03 when $\eta^{CA} = \eta^{TB} + \eta^{IB}$, showing no change in the average level. Next, we look at $\frac{\eta^{TB}}{\eta^{TB}+\eta^{IB}}$, which is the multiplicative bias in ER gap estimates resulting from imposing $\eta^{IB} = 0$ assumption. Consistent with a mean value of $\eta^{IB} \approx 0$, $\eta^{TB}/\eta^{CA} \approx 1$ on average and the average REER gap has no multiplicative bias. The p75 value implies that, for about a quarter of the countries, the multiplicative bias is 11 percent or higher, while the p25 value implies that, for about a quarter of countries, the multiplicative bias is -15 percent or lower.

Table 12: Summary statistics. Shares are average of 2010 to 2019

Variable	Mean	Std. Dev.	p10	p25	Median	p75	p90
η^{IB}	-0.002	0.078	-0.095	-0.025	0.009	0.030	0.062
η^{TB}	-0.319	0.163	-0.532	-0.384	-0.291	-0.201	-0.154
$\eta^{CA} = \eta^{TB} + \eta^{IB}$	-0.345	0.203	-0.587	-0.420	-0.304	-0.201	-0.147
$1/\eta^{TB}$: baseline ER Gap Multiplier	-3.982	2.247	-6.419	-4.881	-3.430	-2.600	-1.879
$1/\eta^{CA}$: adjusted ER Gap Multiplier	-4.032	2.673	-6.784	-4.972	-3.292	-2.379	-1.705
η^{TB}/η^{CA} : what a baseline 1% ER gap adjusts to	0.995	0.235	0.693	0.849	0.996	1.114	1.227
η^{IB}/η^{TB}	0.062	0.257	-0.185	-0.103	0.004	0.177	0.444

It can also be instructive to describe pairwise combinations of η^{IB} and η^{TB} to understand the relative importance of the former. Figure VI-2 shows the semi-elasticity of the CA with and without the impact of the IB on the adjustment. The red line indicates cases where the current account semi-elasticity is underestimated by 15 percent and the blue line indicates where it is overestimated by 15 percent. Most countries are between the lines, suggesting a marginal loss of accuracy from excluding the income balance. However, some countries are outside the lines, pointing to a significant bias in the external adjustment process.

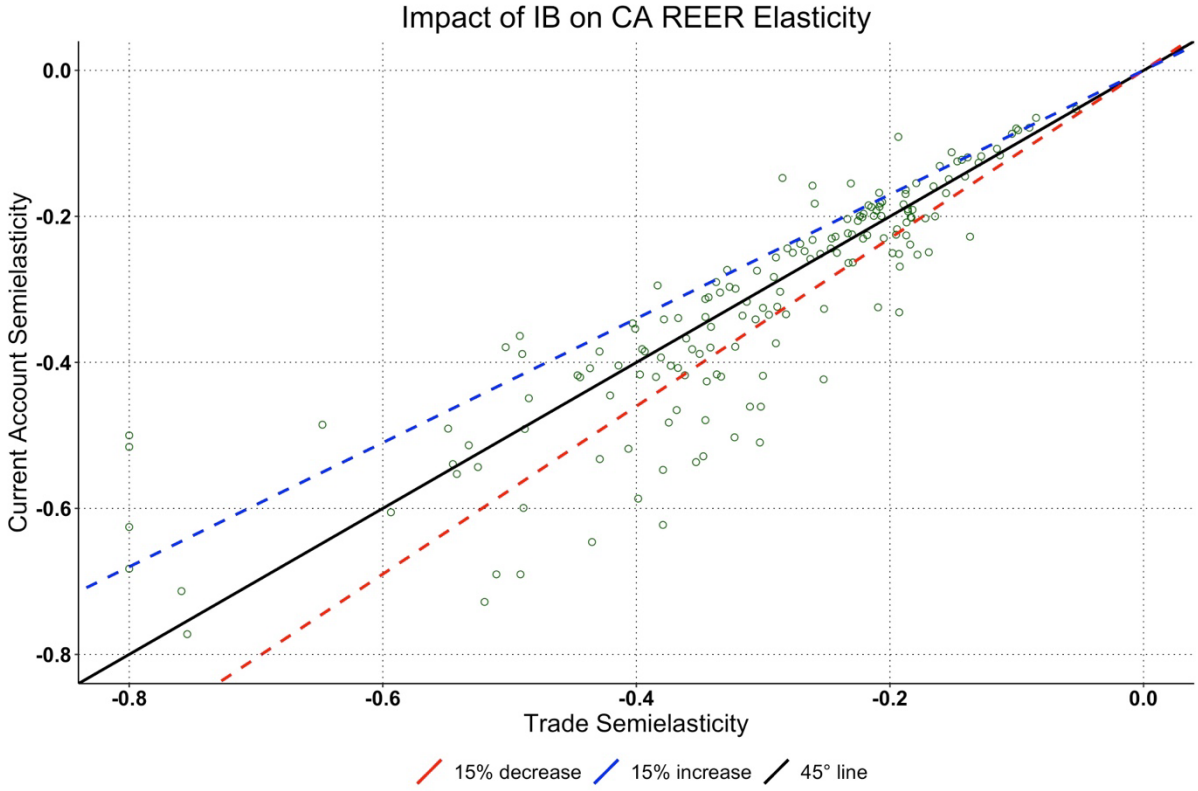


Figure VI-2: Current account and trade balance semi-elasticities of the economies in the sample.

For countries where $|\eta^{IB}|/|\eta^{TB}|$ is relatively large and where η^{TB} is relatively small, the implications for assessed exchange rate gaps can be significant. Figure VI-3 shows REER multipliers, which can be interpreted as the REER gap arising from an illustrative CA gap of -1 percent of GDP. We selected countries with sizeable changes to their REER multipliers (e.g., Argentina, Brazil, Guatemala, and Pakistan) as well as notable contributors to global imbalances listed in IMF (2020).

Exchange rate misalignments could be understated for some large contributors to global imbalances. The United States has a low TB semi-elasticity ($\eta^{TB} = -0.1$) and a small but positive IB semi elasticity $\eta^{IB} = +0.02$ makes the CA semi-elasticity even smaller $\eta^{CA} = 0.08$, such that the multiplier is almost 12.5. Taking the CA gap of -1.3 percent of GDP from the 2020 ESR, the implied overvaluation is 16 percent instead of 13 percent based exclusively on the TB. For the United Kingdom, the current account gap of -2.9 percent of GDP from the 2020 ESR implies an overvaluation of 17 percent instead of 14 percent. Among countries with large positive gaps, the Netherlands has a large positive estimate of $\eta^{IB} = +0.13$ but the estimated value for the TB elasticity is also large ($\eta^{TB} = -0.49$), so the effect on the REER multiplier is fairly modest.[18] Nevertheless, its large current account gap

[18] Financial centers are among the countries with positive values for η^{IB} that are in the top decile.

of 4.9 percent of GDP means that, by our measure, the exchange rate undervaluation is about 13 percent instead of 10 percent. For Germany, with a gap of 4.3 percent of GDP, the undervaluation would rise from about 15 percent to 17 percent.

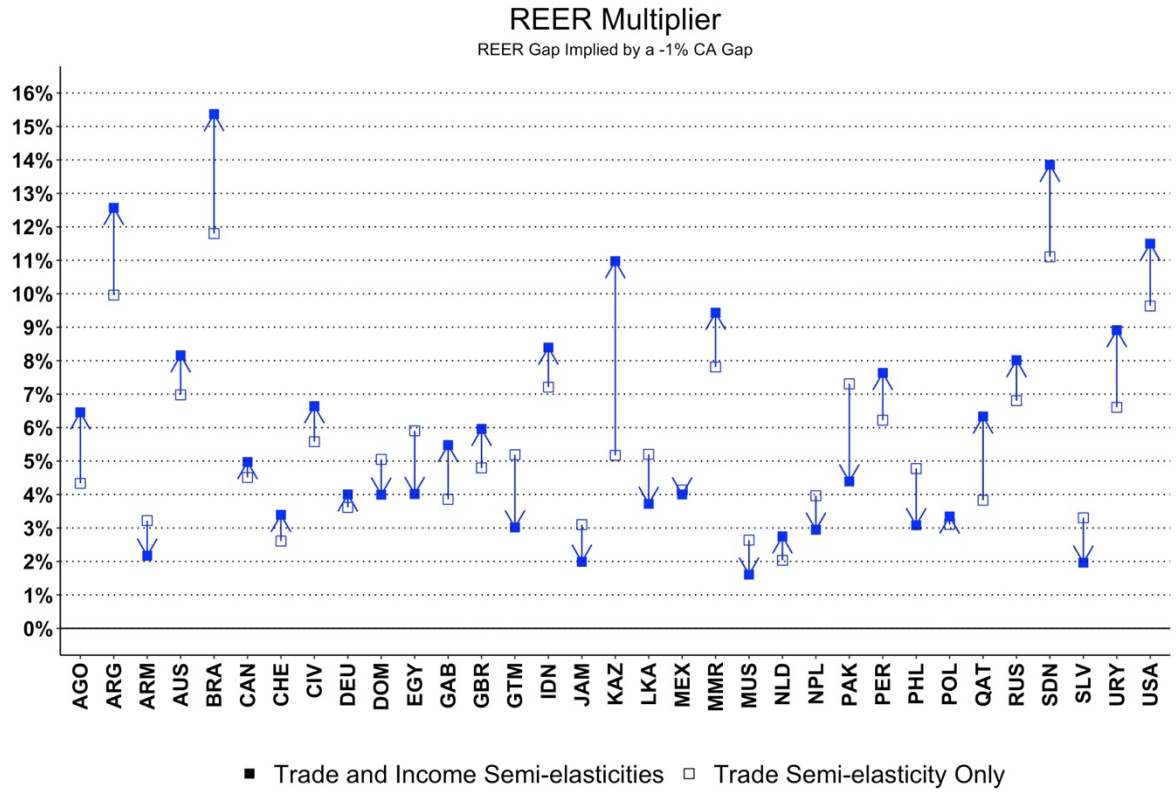


Figure VI-3: Some countries with significant bias in their REER gap multipliers.

We caution that parameter estimates (μ and hence η) are subject to uncertainty like in related empirical work, and many values of η^{IB} or η^{TB} are not statistically significantly different from zero. This is a common issue in the macro-balance approach to assessing exchange rate misalignment, but we mention it here to caution against a sense of false precision in the results. Since REER multipliers are the inverse of often small values of η^{CA}, the implied confidence bands can also be wide. Similarly, estimates of current account misalignment are also subject to their own empirical uncertainty, so exchange rate misalignments can have wide confidence bands in estimates.

VI. Concluding comments

This paper has argued that the importance of the IB merits more attention to its properties, including its role as a stabilizer or amplifier of external imbalances.

We showed that the negative correlation between the IB and TB dampens the volatility of the CAB relative to a counterfactual of zero correlation and an unchanged TB. The dampening effect is more substantial in EMs and LICs, where a positive covariance between imports and income credits, including remittances, is particularly pronounced. Therefore, analysis of a country's external sector vulnerabilities, for example, to adverse trade shocks, should incorporate the potentially mitigating response of the IB.

Our event study showed that the IB is lower before a crisis than in tranquil times. Moreover, in contrast to the TB, the IB generally deteriorates during a crisis and remains worse during the crisis aftermath than in tranquil times. Therefore, crisis contingency planning exercises could be underestimating external financing gaps and thus underestimating foreign exchange reserves losses and the amount of financial support needed from the international community. The IB deterioration is stronger (and thus financing gaps larger) for financial crises and more robust among AEs and EMs than among LICs. In contrast to the general IB behavior, equity (including FDI) income starts improving on the eve of crises. Our estimates of causal effects suggest that crises worsen the IB relative to an unobserved counterfactual of no crisis among AEs and EMs, but there is some evidence that crises improve the IB for LICs, perhaps due to the importance of secondary income and a small share of non-FDI investment income. Further work could distinguish between income derived from domestic and foreign yields/dividends. Extending our application of the FEct methodology to a range of outcome variables could inform the literature on the costs of crises (see Cerra and Saxena (2008).

We estimate that IB semi-elasticities with respect to the ER are broadly symmetric and mostly close to zero. Depreciations tend to deteriorate IB deficits and increase IB surpluses. The distribution suggests that the IB is generally not an important channel through which the ER can stabilize the current account. Relatedly, omitting the IB channel does not generally seriously bias CAB semi-elasticities and need not be systematically included in external sector assessments for such cases. However, the arithmetic of ER misalignment estimates means that some estimates are biased even when IB semi-elasticities are moderate. For those countries and/or those that are potentially important contributors to global current account imbalances, the explicit inclusion of the IB channel in external sector assessments should be explored. More generally, the semi-elasticities approach could be extended by decomposing primary income into debt and non-debt income.

Taken together, the above results imply, at best, a mixed picture for the stabilizing role of the IB. By dampening CAB volatility, the IB has a stabilizing effect over the cycle, which consists mostly of normal (non-crisis) times. But lower CAB volatility can also be the outcome of a rigid IB that does not adjust when it is needed most, and our results for crisis episodes imply that the IB is, if anything, destabilizing. One possible reason why the IB does not adjust more helpfully in crises is an unfavorable response of the often-negative IB to an often-depreciating currency. Further work could ascertain what country characteristics or policies (e.g., financial account openness, exchange rate regime) could bolster the IB's shock-dampening role.

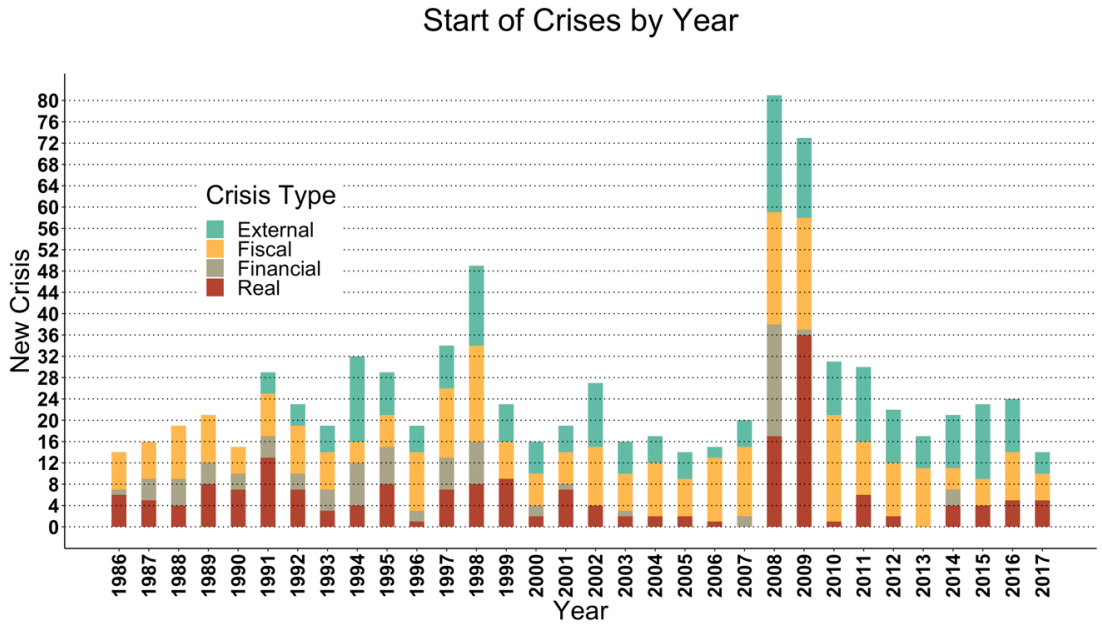
The results also suggest the IB could amplify long-run debtor/creditor stabilization asymmetries and crisis risks. A debtor with a negative IB experiencing an (endogenous) depreciation would tend to have a worse IB and thus accelerate its accumulation of external liabilities (which would also experience adverse stock valuation effects). This vicious cycle increases vulnerabilities to a crisis. A creditor with an (endogenous) appreciation would experience stabilizing dynamics in the form of lower-income surpluses and valuation losses. Such dynamics add to the costs of adjustment for both creditors and debtors and underscore the importance of collective action to reduce global imbalances.

Annex I.

A. Stylized Facts

Appendix Table 1: Summary statistics by income group, percent of GDP.

	Advanced Economies			Emerging Economies			Low-income Economies		
Statistic	Mean	25% Prct.	75% Prct.	Mean	25% Prct.	75% Prct.	Mean	25% Prct.	75% Prct.
Income Balance. - Net	-3.13	-3.07	0.54	2.53	-3.81	6.78	8.54	0.16	9.51
Debt Inv. Inc. - Credit	7.49	0.71	1.88	0.27	0.02	0.45	0.56	0	0.13
Debt Inv. Inc. - Debit	5.6	0.99	2.1	1.01	0.32	1.47	0.41	0.05	0.58
Debt Inv. Inc. - Net	1.89	-0.97	0.37	-0.74	-1.1	-0.14	0.22	-0.39	0
Port. Equity Inc. - Credit	3.97	0.63	1.69	0.12	0	0.07	0.3	0	0.01
Port. Equity Inc. - Debit	7.52	0.44	1.77	0.1	0	0.06	0.04	0	0.01
Port. Equity Inc. - Net	-3.55	-0.27	0.32	-0.01	-0.01	0.03	0.26	-0.01	0
FDI Equity Inc. - Credit	9.02	1.65	4.42	0.47	0.01	0.44	0.12	0	0.09
FDI Equity Inc. - Debit	9.03	1.18	7.04	3.48	1.83	4.97	1.81	0.58	2.73
FDI Equity Inc. - Net	-0.01	-1.12	1.82	-3.01	-4.68	-1.24	-1.72	-2.77	-0.29
Empl. Comp. - Credit	0.48	0.13	0.47	1.15	0.04	1.11	3.71	0.05	1.04
Empl. Comp. - Debit	1.35	0.11	0.97	0.4	0.05	0.49	5.04	0.09	0.39
Empl. Comp. - Net	1.82	0.36	1.55	1.59	0.17	1.74	8.43	0.2	1.4
Primary Inc. - Credit	21.14	4.31	13.02	4.1	0.88	3.38	7.51	0.34	2.36
Primary Inc. - Debit	25.42	4.22	12.57	6.55	3.59	7.8	13.15	1.78	4.51
Primary Inc. - Net	-2.28	-2.7	1.21	-2.45	-5.29	-1.14	-4.36	-3.3	0.02
Secondary Inc. - Credit	2.09	0.72	1.9	7.65	1.56	8.79	18.72	4.62	12.33
Secondary Inc. - Debit	2.95	1.32	2.91	2.67	0.71	2.62	3.37	0.55	2.25
Secondary Inc. - Net	-0.86	-1.47	-0.39	4.98	0.04	7.53	12.89	3.35	9.51
Income - Credit	25.23	6.41	13.39	11.78	3.95	14.57	31.04	5.49	16.03
Income - Debit	28.37	6.94	16.57	9.22	4.46	11.61	19.66	2.93	7.14
Trade Balance	6.46	0.21	6.49	-5.85	-11.13	2.33	-20.23	-20.75	-3.51
Trade Exports	61.59	31.91	76.88	43.99	29.01	53.54	73.69	15.03	35.21
Trade Imports	54.79	31.99	54.01	49.85	30.47	59.75	151.92	27.93	51.58
Current Account Balance.	3.33	-0.95	4.79	-3.32	-6.18	0.67	-11.69	-10.43	-2.12
Current Account - Credit	86.82	41.27	95.17	55.59	35.73	63.53	104.73	23.55	50.35
Current Account - Debit	83.16	39.69	82.71	59.07	36.33	70.62	171.58	32.36	58.27



Appendix Figure 1: Number of new crises started each year. In the sample, 25 new crises happen in an average year. Crises last 2 years on average.

B. Definition of Crises

We follow the definitions of the Vulnerability Exercise, performed by the IMF. Crises are in four categories: external, fiscal, financial, and real. Here we define them in detail.

External Crisis

It involves two different definitions, sudden stops and exchange market pressure events.

A) Sudden stops in capital flows:
Sudden stops are defined as occurring when net private capital inflows as a percentage of GDP are at least two percentage points lower than in the previous year and two years before and when the country gets approved to tap large IMF financial support.

B) Exchange market pressure (EMP) events:
This definition is used EMP for those countries for whom the sudden stop cannot be measured. They capture episodes of sudden exchange rate depreciation or reserves depletion for all economies. EMP events are defined as when a weighted average of the annual percentage depreciation in the nominal exchange rate lies in the lower 15th-percentile of the whole panel or when the country gets approved for large IMF support. The EMP database covers 192 countries during the 1990-2017 period.

Fiscal Crises

The definition of a fiscal crisis event is in line with Medas and others (2018). A country is classified as being in a fiscal crisis in any given year if any of the four criteria are met: (1) occurrence of a sovereign default or debt restructuring; (2) substantial official IMF financing; (3) high inflation or accumulation of domestic arrears (implicit

default); and (4) loss of market access or spikes in sovereign yields. The crisis dataset covers 188 economies from 1980 to 2017.

Financial Crises

The financial sector crises meet two sets of criteria: evidence of significant financial distress (e.g., sizable bank runs, bank losses, or bank liquidations) and significant policy interventions (e.g., emergency liquidity support, public recapitalization, or nationalization). The crisis dataset covers 117 countries from 1980 to 2017.

Real Crises

Real sector crisis episodes capture a mix of sharp slowdowns in economic activity and more moderate but prolonged episodes, typically described as V- and U-shaped recoveries. Crises are defined based on four different GDP series and four different thresholds. The four series are i) a country's annual growth rate, ii) its cumulative growth rate over the past three years, iii) its growth performance relative to the most recent five-year average, and iv) its average GDP level relative to the previous three-year average. Values of these series are flagged as being in a crisis if they fall below the 10th percentile of observations in one of the following groups: i) all countries in the sample, ii) all countries in the same income group iii) by income group according to the WEO classification in 1980, and iv) countries in the same tercile of the total sample for year-on-year growth volatility. These four series and four thresholds lead to sixteen crisis criteria. A country in one particular year is recorded as experiencing a real sector crisis whenever nine or more indicators signal a crisis.

C. Assumptions Underpinning FEct Methodology

Assumption 1 (linear functional form): For any country i and period t

$$Y_{it} = \delta_{it} D_{it} + X'_{it}\beta + \alpha_i + \xi_t + \varepsilon_{it} \quad (6)$$

Where Y_{it} is the outcome for country i at year t; D_{it} is a treatment dummy indicator that equals one if country i is in crisis at year t; δ_{it} is the crisis effect on Y_{it}. The X_{it} are the exogenous covariates in a $p \times 1$ vector. This assumption, in essence, is imposing a linear relationship in the functional form.

Two of the implications of Assumption 1 are:

a) No carry-over effect, i.e., $Y_{it}(D_{it}, D_{it-1}, D_{it-2}, \dots, D_{i1}) = Y_{it}(D_{it})$ which says the response of Y to a crisis at time t is independent of the history of crises that had occurred before time t.
b) No lagged dependent variable, i.e., past outcomes do not directly affect the current variable.

Assumption 2 (strict exogeneity): For any two countries i and j and any two periods t and s

$$\varepsilon_{js} \perp D_{it}, X'_{it}, \alpha_i, \xi_t \quad (7)$$

Assumption 2 implies the central identifying assumption, the parallel trends assumption (among other implications). It means that the baseline outcomes (outcomes of the hypothetical or actual $D_{js} = 0$) are mean independent of the crisis and its timing, conditional on the covariates X_{it}. It additionally implies that the crisis is not anticipated or predicted before it happens.

D. Estimation Procedure of FEct

The estimating strategy has three steps. First, we estimate a TWFE model for an outcome variable using only the tranquil times. Crisis years, and the years before and after them, are retained as missing data:

$$Y_{it}(0) = \mu + \alpha_i + \xi_t + \varepsilon_{it} \mid D_{it} = 0 \tag{8}$$

(8) provides estimates of $\hat{\mu}, \widehat{\alpha_i}, \widehat{\xi_t}$[19]. Also, α_i, ξ_t are (for now) additive country and year fixed effects; and ε_{it} are the unobserved idiosyncratic shocks with a zero mean.

Second, we predict values using coefficients estimated from the first step for those observations that had been retained as missing data. That is, we estimate what the Y_{it} variable would be before, during, and after the crisis as if there had been no crisis at time t in country i ($\hat{Y}_{it}(0)$).[20]

$$\hat{Y}_{it}(0) = \hat{\mu} + \widehat{\alpha_i} + \widehat{\xi_t} \mid D_{it} = 1 \tag{9}$$

Third, we obtain the average change in the variable associated with the crisis. For each crisis in each country, $\widehat{\delta_{it}} = Y_{it} - \hat{Y}_{it}(0) \mid D_{it} = 1$, and the average change in crisis is the simple empirical average of $\widehat{\delta_{it}}$. Note that we are not imposing any assumptions on δ_{it} being constant across time and country, which leads to the robustness of the estimates to heterogeneity.[21] At this stage, we do not include any covariates other than the TWFE, since the inclusion of other covariates hampers the descriptive interpretation of the crisis event. When there are no covariates, the FEct can be written as a synthetic control method (Abadie et al., 2003); that is, each treated observation is matched with a counterfactual $\hat{Y}_{it}(0)$ that is a weighted sum of control observations.

E. Causal Inference under FEct

Let us rewrite eq (9) and introduce the potential outcomes of the Y_{it} variable. $Y_{it}(D_{it})$ is the outcome variable as a function of treatment. Then, $Y_{it}(0) = X'_{it}\beta + \alpha_i + \xi_t + \varepsilon_{it}$ and, $Y_{it}(1) = Y_{it}(0) + \delta_{it}$. The main causal parameter of interest is the ATT, defined as

$$ATT = E[\delta_{it} | D_{it} = 1] \tag{10}$$

Under certain assumptions, it is the *causal* impact of a crisis on outcome variable Y averaged across countries/years that had a crisis relative to a counterfactual of not experiencing a crisis. Note that δ_{it} is still not constant.

Regarding exogeneity (assumption 2 in Appendix C), the 'no anticipation' of crisis assumption is plausible, as crises are considered 'close' to unpredictable, especially at horizons longer than one year before the onset of the crisis. However, we already saw several examples where the IB or its components had significant pre-crisis deviations. Although pre-crisis effects provide valuable insights, they also mean that the assumption of the

[19] Without loss in generality, we normalize α, ξ to sum to 1, to be able to identify them. Parameter μ absorbs the average levels.

[20] The FEct estimator is a special case of the generalized synthetic control method, where the number of factors is set to zero.

[21] In particular, the regression coefficient in standard TWFE can be a weighted sum of heterogenous treatments in which some weights are negative (Chaisemartin & D'Haultfoeuille, 2020). By taking the simple average of the effects of simple crisis episodes, this approach assigns uniform weights to the treated observations after the weights are imputed.

'parallel trends' does not hold. In the terminology of Liu et al. (2021), the null hypothesis of the placebo test is rejected.

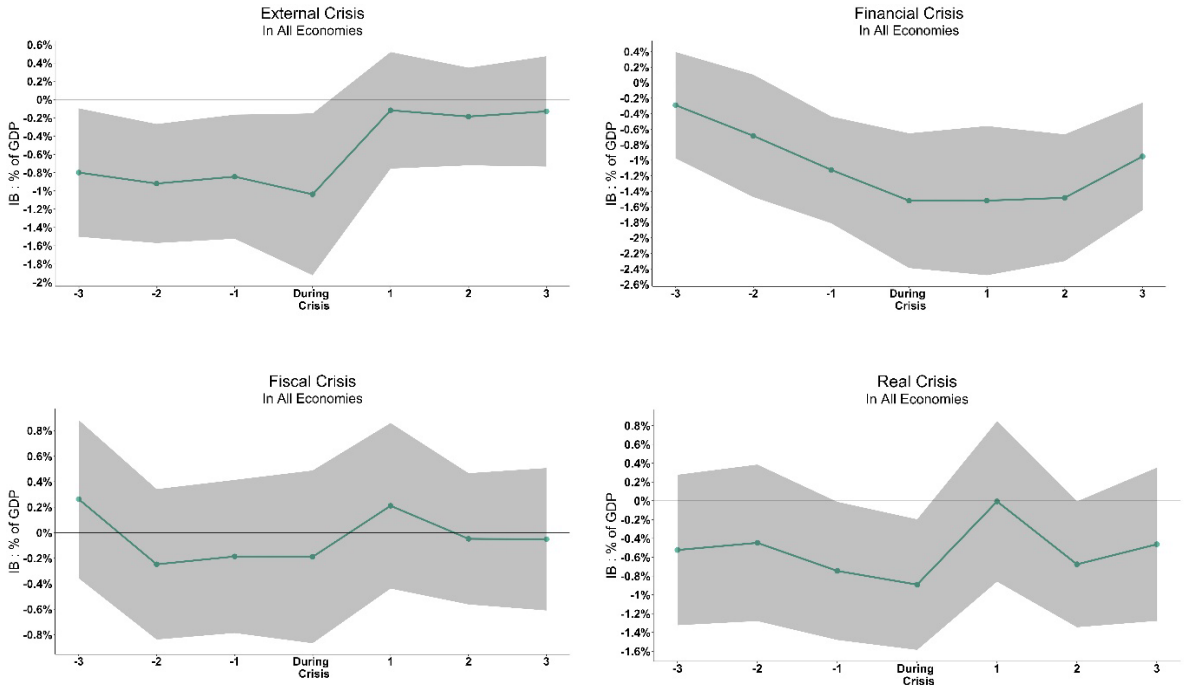
To overcome these obstacles to causal inference, especially the parallel trends assumption, we take an agnostic approach and use a factor-augmented version of equation (8). That is, we relax functional form assumption 1 to achieve the validity of assumption 2. One or more common *latent* factors that may drive income flows are estimated from the data, along with country-specific factor loadings as in Gobillon & Magnac (2016).[22] The model is specified as in eq (11), with the interactive effects decomposed into time-specific (latent) factors interacted with unit-specific factor loadings.

$$Y_{it}(0) = \mu + X'_{it}\beta + \lambda_i f_t + \alpha_i + \xi_t + \varepsilon_{it} \quad (11)$$

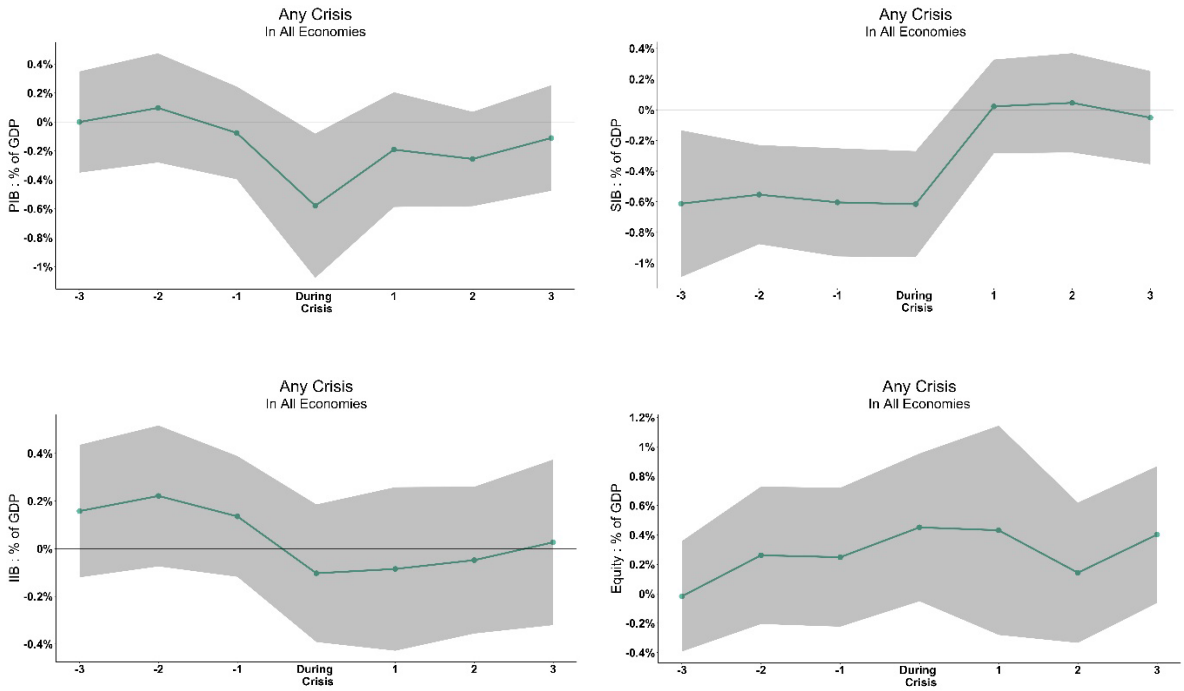
f_t is a vector of time-specific factors, common to all countries, and λ_i is a country-specific factor loading vector for country i, which represents the heterogeneous impact of common shocks on country i. The estimation process is like the baseline model, except that, in step 1, the factor and factor loadings are estimated as well using a maximum likelihood algorithm. The idea behind the factor augmented model is that these common factors could be covariates that impact the Y variable and the probability of crisis at the same time. If that is true, then these models result in statistically zero pre-trend differences. To choose the number of factors, we pick the minimum number of factors that satisfy the placebo test for divergent pre-trends. The number of factors were zero, one, or two in all cases.

[22] Numerous studies that show and argue for the existence of common factors in international markets (Fratzscher, 2012; Miranda-Agrippino & Rey, 2020; Rey, 2015). These factors are often treated as latent and are estimated from the data, and further tests have shown that, in many instances, these factors closely correlate with certain key international macroeconomic variables, e.g., the VIX index, the commodity prices, and the US monetary policy.

F. Crisis Response Additional Results



Appendix Figure 2: Income balance dynamic crisis response in different types of crises



Appendix Figure 3: Dynamic crisis response of PIB, SIB, IIB, and total equity income in any type of crisis.

G. Current Account REER Elasticity Additional Results

Appendix Table 2: Summary statistics of different constructions of the income balance REER semi-elasticity.

Construction	Mean	Std. Dev.	p10	p25	p50	p75	p90
Aggregate Sample	-0.025	0.112	-0.090	-0.034	0.003	0.024	0.045
Income Group Samples	-0.002	0.078	-0.095	-0.025	0.009	0.030	0.062
Primary and Secondary Income	-0.097	0.171	-0.274	-0.102	-0.050	-0.007	0.010
Mechanical (Investment)	-0.018	0.054	-0.052	-0.019	-0.002	0.005	0.015

Appendix Table 3: IB and TB semi-elasticity for selected economies.

Country	η^{TB} (From EBA 2018)	η^{IB}
Argentina	-0.11	0.021
Australia	-0.15	0.021
Belgium	-0.58	0.058
Brazil	-0.09	0.020
Canada	-0.22	0.021
China	-0.12	-0.005
France	-0.22	0.027
Germany	-0.28	0.027
Hong Kong SAR	-	0.174
India	-0.16	-0.031
Indonesia	-0.14	0.020
Italy	-0.2	0.018
Japan	-0.12	0.008
Korea	-0.27	0.009
Malaysia	-0.42	0.029
Mexico	-0.27	-0.008
Netherlands	-0.53	0.128
Poland	-0.35	0.023
Russia	-0.16	0.022
South Africa	-0.2	0.026
Spain	-0.22	0.025
Sweden	-0.28	0.037
Switzerland	-0.39	0.089
Thailand	-0.41	0.010
Turkey	-0.2	0.006
United Kingdom	-0.2	0.041

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