Sectoral dynamics of safe assets in advanced economies ⋆

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Abstract

What is the sectoral composition of the market for safety, and does it matter for economic stability? To address these questions, we construct a novel dataset of sectoral safe asset positions in 24 advanced economies since 1980. We document that the ratio of safe to total financial assets has remained stable in most countries, despite considerable growth in gross and net safe-asset positions relative to GDP. We find that fluctuations in safe-asset positions are mainly driven by the financial and the foreign sectors, with the real economy playing a muted role, indicating that financials in advanced economies have been increasingly intermediating safety within and across borders. We conclude by showing that increases in safe asset demand by foreigners – or its counterpart, the supply by financials, – are associated with expansions in domestic risky credit and lower subsequent output growth.

Keywords: safe assets, capital flows, financial accounts, business cycles, financial stability
JEL classification codes: E42, E44, E51, F33, F34, G15

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1 Introduction

In recent decades, a large literature has emphasized the importance of understanding the role of safe assets in modern economies. Safe assets, broadly defined as those with a highly certain stream of payments, are seen as the building block of modern financial markets due to their unique ability to be reliable stores of value, act as collateral in transactions, fulfill prudential requirements, and serve as price benchmarks (Gourinchas and Jeanne, 2012). Despite their importance and perceived scarcity (Caballero et al., 2016, 2017; Caballero and Farhi, 2018), the share of safe assets over total assets in the US has been stable at around 33% since the 1960s, a fact that is puzzling considering the rapid increase of total financial assets over GDP during this period (Gorton et al., 2012). These observations have raised important concerns among academics and policymakers about the ability of modern economies to produce safe assets without increasing financial instability (Stein, 2012; Benigno and Nisticò, 2017; Moreira and Savov, 2017; Diamond, 2020; Castells Jauregui, 2023) and about the substitutability between publicly vs. privately created safety (Krishnamurthy and Vissing-Jorgensen, 2015; Kacperczyk et al., 2021; Gorton and Ordoñez, 2022)

In this paper, we contribute to this debate by addressing the following questions. First, what is the sectoral composition of the market for safety in advanced economies, i.e., which economic sectors supply and demand safe assets; and second, does it matter for financial and economic stability? To do this, we construct a new cross-country dataset of safe assets and liabilities of different economic sectors – public, household, non-financial corporate, financial, and foreign, – using financial accounts data extended backwards based on Diebold and Richter (2021). Our analysis is based on a sample of 24 advanced economies, with the data for the US going back to the 1960s, and for most of the other countries to the 1980s. We use this dataset to explore trends and fluctuations in the sectoral composition of gross and net safe-asset holdings (with the latter measured as safe assets minus safe liabilities of a given sector), across countries and over time. In what follows, we say that a sector demands (supplies) safety if its net safe-asset holdings are positive (negative).

We begin our analysis by studying the evolution of safe assets in our sample. We follow Gorton et al. (2012) and categorize as safe securities the debt-like securities issued by governments and financial intermediaries.[1] Consistent with findings in Gorton et al. (2012) for the US, we document that the safe-asset share (safe assets over total financial assets) has remained stable in the US, the EU, and the UK, despite a significant secular increase in both safe and risky asset holdings relative to GDP. Japan is a notable exception where the share of safe assets has consistently increased during our sample period,

[1]In particular, we define as safe the following financial instruments: government bonds (central and local), currency, reserves, gold, special drawing rights, deposits, money market fund shares, and bonds issued by financial intermediaries.

largely attributable to the large growth in Japanese public debt. The safe-asset share has remained relatively constant in large economies, but at different levels, suggesting that these economies may be heterogenous in their ability to either produce or to hold safe assets. Moreover, we observe some heterogeneities in the evolution of the safe-asset share across small EU countries, which given the stability of the aggregate, we interpret as evidence of substitutability between safe assets within the EU, consistent with evidence in Nenova (2023).

We identify two patterns in the evolution of the sectoral composition of the market for safety that may be relevant for financial stability. First, when looking at net positions, the increase in safe asset demand has been mainly driven by the foreign sector within each country, with its counterpart being an increase in the supply of safe assets by the domestic financial sector (pre-GFC) and the public sector (post-GFC), suggesting a substitution from private to publicly created safety after the 2008-09 crisis.[2] Second, when looking at the gross positions, we observe a large increase in the demand and in the supply of safety both for the financial and the foreign sectors, suggesting an increase in intermediation through privately produced safe assets both within and across borders. Surprisingly, the safe asset holdings of the real economy (households and firms) have been rather stable during this period.[3]

Next, we study the nature of fluctuations in the market for safety by conducting several variance decompositions to exploit the accounting identity that safe assets must equal safe liabilities. Using cross-country panel data on financial flows across sectors and instruments, we find that the variation in both gross safe asset holdings, and in gross liabilities is mainly explained by the financial and the foreign sector. Moreover, the safe-asset dynamics of these two sectors are closely interlinked. To further investigate this relationship, we conduct a similar variance decomposition of net safe asset positions. We find that almost 50% of the variation in the supply by financials is explained by variations in the demand by foreigners, with the rest attributable to the real economy (26%), and to the substitution between financials and the public sector (25%). Conversely, almost 90% of the variation in the demand by foreigners is accounted for by variation in the supply by financials, with the public sector explaining the rest.

We conclude by exploiting our cross-country dataset to study the relevance of the sectoral composition of the market for safety for financial stability and economic growth. At the financial sector level, we document that the increase in the supply of safe assets is highly correlated with expansions in risky credit, suggesting that financials in advanced economies are producing safe assets at the expense of

[2]It is worth highlighting that as these patters are observed in most countries in our sample, it is likely that the documented increase in the net demand for safety from the rest of the world is mainly driven by growing developing economies not included in our sample, such as China.

[3]Japan is again an exception, where we see a secular increase in the safe asset holdings of the real sector, driven by households' holdings of domestic public debt.

higher household and firm leverage. At the macro level, we document that higher safe-asset supply by the financial sector or its counterpart of higher foreign sector demand are associated with significantly lower medium-term output growth. These findings continue to hold when we instrument changes in the demand for safety by the foreign sector with changes in the foreign reserve demand of a group of East Asian countries (China, Taiwan, Hong Kong, Singapore, and Korea). Our instrument follows the methodology in Nakamura and Steinsson (2014) by estimating country-specific exposures to changes in the demand for safety from East Asia.

Our findings suggest that in the last four decades, advanced economies have been exporting safety produced by the public and the financial sectors to the rest of the world, consistent with views in Bernanke (2005), Bernanke et al. (2011), and Maggiori (2017). Moreover, the facts we uncover hint that it is privately created safe assets that may expose modern economies to financial instability by exposing the real economy (households and firms) and financials (banks and non-banks) to the residual risk, consistent with theories that highlight the potential risks associated with privately created safety (Stein, 2012; Moreira and Savov, 2017; Caballero and Farhi, 2018). These risks can be enhanced when the produced safe assets end up in the hands of foreigners, as we document and is argued in Caballero and Simsek (2020) and Ahnert and Perotti (2021).

Our work contributes to a growing literature on safe assets by extending Gorton et al. (2012) to many advanced economies and by providing a new perspective on the market for safety through the study of the role played by different economic sectors. Our results complement those in Barro et al. (2022), who document a stable safe-asset share on average in OECD countries in recent years, and in Gourinchas and Jeanne (2012), who document the importance of the rest-of-the-world sector in the market for safety in a small sample of advanced economies.

In recent years, academics have emphasized that safe asset shortages, i.e. the fact that the global demand for safe assets may increase faster than its supply, have contributed to the decline in real interest rates and to important global imbalances (Gourinchas and Jeanne, 2012; Caballero et al., 2016, 2017; Caballero and Farhi, 2018; Del Negro et al., 2019; Brunnermeier et al., 2021). In the same lines, a large literature has studied mechanisms through which safe-asset production by financials can pose a threat to financial stability (Stein, 2012; Gennaioli et al., 2013; Hanson et al., 2015; Dang et al., 2017; Moreira and Savov, 2017; Diamond, 2020; Kacperczyk et al., 2021; Acharya et al., 2021; Gorton and Ordoñez, 2022) and to economic stability and growth (Caballero and Farhi, 2018; Segura and Villacorta, 2023; Castells Jauregui, 2023; Altinoglu, 2023). We contribute to their views by providing suggestive evidence that which sectors demand (domestic vs. foreign) and supply (private vs. public) safety may matter for financial stability, by differentially affecting domestic credit and output growth.

The paper is organized as follows. Section 2 describes the data sources and methodology used to

construct the new dataset of safe assets and liabilities. Section 3 presents the trends in safe assets and liabilities of different economic sectors across a consistent sample of 15 countries. Section 4 studies the sectoral composition of fluctuations in the market for safety through several variance decomposition exercises. Section 5 links variation in sectoral safe asset positions to expansions in risky credit and GDP growth. Section 6 concludes with a discussion of the implications of our findings for policymakers and future research.

2 A new database of safe assets in advanced economies

Coverage. This project uses balance sheets and flows from financial accounts data to construct a new cross-country dataset of safe assets and liabilities of different economic sectors. The data are based on Diebold and Richter (2021) and come from the OECD financial accounts which can be accessed online for more recent data, while earlier financial balance sheet data have been digitized based on historical OECD publications. We extend the data in Diebold and Richter (2021) which cover amounts outstanding (balance sheet positions) with additional data on flows (changes in quantities) of financial assets and liabilities of different economic sectors.

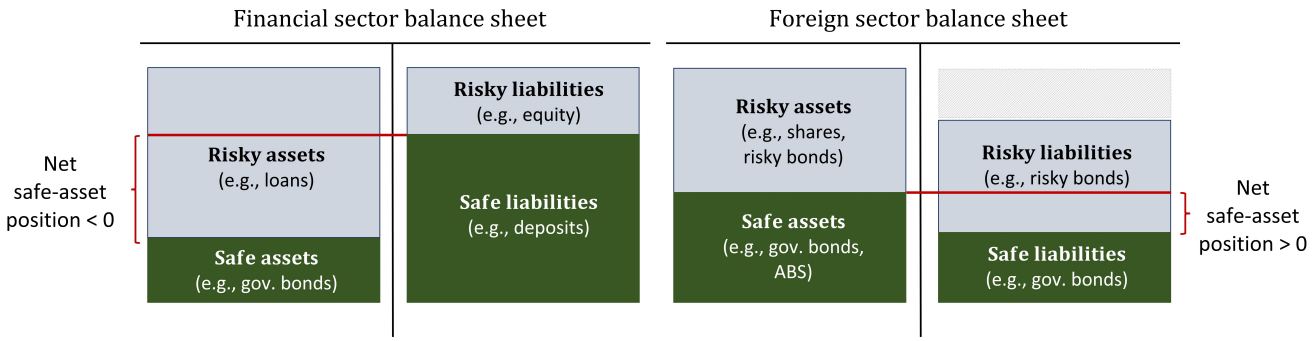
The data cover an unbalanced panel of 33 countries, and for the purposes of our analysis we focus on the subsample of 24 advanced economies. For the analysis of trends we further restrict these advanced economies to a consistent sample of 15 countries whose data go back to at least 1980 or 1990, consisting of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, UK, and the US.

Safe asset definition. We follow the definition of Gorton et al. (2012), and define safe assets as the following financial instruments issued by the government and financial sectors: government bonds (central and local), currency, reserves, gold, special drawing rights, deposits, money market fund shares, and bonds issued by financial intermediaries. This leaves non-financial corporate bonds, all loans and receivables, shares, insurance and pension assets, derivatives and stock options, and other accounts as risky assets.[4]

Sectoral safe-asset positions. We measure the amount of safe assets and liabilities of the following economic sectors within each country: the public sector (government and central bank), the financial sector (banks and non-bank financial companies), the real sector (households and non-financial

[4]Alternatively, one could characterize an asset as safe by measuring its convenience or safety premium, as in Krishnamurthy and Vissing-Jorgensen (2012); Nagel (2016); Kacperczyk et al. (2021); Mota (2023); Nenova (2023). This, however, requires granular data on prices of financial securities which we do not have for our entire sample.

Figure 1: Example financial balance sheets of different sectors



firms), and the foreign sector (rest of the world). We define the net safe asset position of a given sector as its safe assets minus its safe liabilities, and we say that a sector demands (supplies) safety if its net safe asset position is positive (negative).

Figure 1 shows an example of sectoral balance sheets to illustrate how we compute both gross and net safe-asset positions in our data. On the left, we depict a typical financial sector balance sheet with a negative net safe-asset position. That is, its safe liabilities are larger than its safe assets. This example reflects how the financial sector tends to supply safety as it finances risky loans with safe deposits. On the right, we depict a typical foreign sector balance sheet with a positive net safe-asset position. That is, the domestic safe assets held by foreigners are larger than the foreign safe assets held by the domestic sectors. This example reflects how the foreign sector of advanced economies tends to demand safety by holding relatively large amounts of safe bonds issued by the domestic sectors. Lastly, the difference between total assets and liabilities of the foreign sector captures the country's net foreign asset position.[5]

One sector's financial asset is necessarily another sector's liability. For example, a bank deposit is an asset for a household and a liability for the bank issuing it. As a result, for the economy as a whole (domestic and foreign sectors) the sum of sectoral safe assets must equal the sum of sectoral safe liabilities and the sum of sectoral net safe assets must equal zero. These identities will be essential for the variance decompositions in Section 4.

The data in Diebold and Richter (2021) allow us to construct the precise quantities of safe liabilities for each of the domestic sectors. For safe asset holdings, and for rest-of-the-world liabilities, we have the precise quantities of currency, reserves, deposits, and gold, but only a total for bonds, which includes both safe bonds (government and financial) and risky bonds (issued by non-financials). For the US, we use the counterparty data from the flow of funds to construct precise quantities of safe

[5]Generally, assets are not equal to liabilities in financial accounts data as the positions only reflect financial assets. An exception tends to be the financial intermediary balance sheet which shows only small deviations between financial assets and liabilities, as this sector's business model relies on activities in financial markets.

and risky bonds held by each sector, and issued by the rest of the world, and for other countries, we split the bond holdings into safe and risky based on the ratio of domestic safe to risky bond liabilities (which we know precisely for each year and country). Since non-financial bond markets are relatively small outside of the US throughout most of our sample period (see, e.g., Darmouni and Papoutsi, 2022), on average roughly 90% of all bonds are classified as safe, so any resulting errors from this approximation are likely to be very small.

3 Trends in the market for safety

3.1 Total safe and risky assets

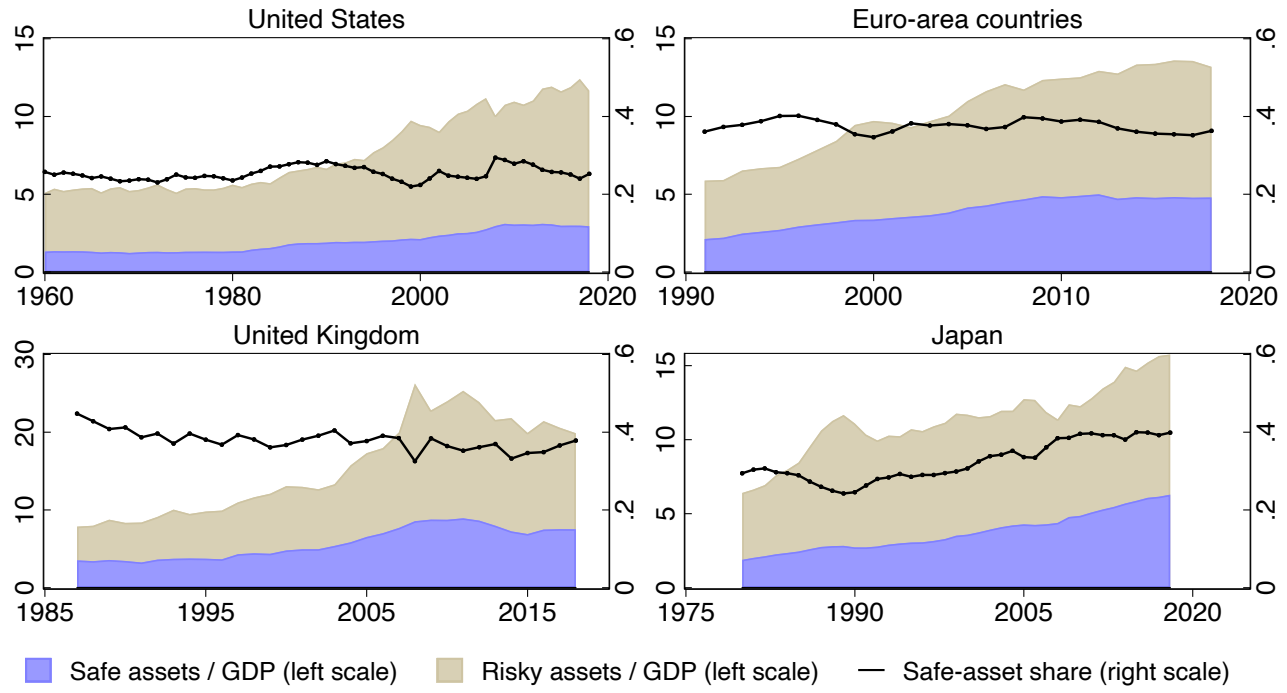
We begin by analyzing the evolution of safe asset positions in our sample. To do so, we map out the trends in economy-wide safe and risky asset positions relative to GDP, and the ratio of safe to total financial assets, the safe-asset share. In Figure 2 we show results for the US, the UK, Japan, and a euro-area composite (Austria, Belgium, Finland, France, Germany, Italy, Netherlands, and Spain).[6]

Consistent with Gorton et al. (2012), the safe-asset share has remained relatively stable since 1960 in the US, despite large increases in both safe and risky assets relative to GDP. Our new data reveal that a similar pattern holds in other advanced economies. Safe and risky asset positions have increased markedly over the past decades, with especially large growth observed in the 1990s and 2000s. The safe-asset share, however, has remained relatively constant in large advanced economies and the euro-area composite. The notable exception is Japan, where the safe-asset share has increased steadily since 1990, driven largely by the increase in domestic government debt. In Appendix Figure A.2 we depict these patters for all countries in our long-run sample, where we see that the safe-asset share is either stable or slightly declining over time in every country apart from Japan.

There are two findings that are worth highlighting. First, the safe-asset share has remained relatively constant in large economies, but at different levels. This suggests that economies may be heterogenous (and potentially constrained) in their ability to either produce or to hold safe assets (as in Maggiori, 2017). In particular, the safe-asset share is highest for the UK ($\sim$ 40%), followed by the euro-area composite ($\sim$ 35%), and the US ($\sim$ 30%), with Japan moving from the bottom to the top of this list. Second, there is substantial variation in the evolution of the safe-asset share within euro countries, which, given the stability of the aggregate, is consistent with safe assets of these countries being highly substitutable (as shown in Nenova, 2023).

[6]We include both assets produced at home and those produced abroad but held domestically. In Appendix Figure A.1 we show that the overall patterns remain unchanged when we restrict attention to assets produced domestically, similar to the approach in Gorton et al. (2012).

Figure 2: Safe and risky asset holdings, and the safe-asset share



Notes: Safe assets include currency, reserves, deposits, gold, special drawing rights, money market mutual fund shares, and bonds issued by governments and financial intermediaries. Risky assets are all other financial assets (equities, non-financial corporate bonds, loans, insurance & pension assets, derivatives, and other accounts). The safe-asset share is the ratio of safe to total (safe + risky) financial assets. The series for euro-area countries is the sum of (nominal euro) positions in Austria, Belgium, Finland, France, Germany, Italy, Netherlands, and Spain divided by the sum of the respective countries (nominal euro) GDP. The series include financial assets issued by domestic sectors, and financial assets issued abroad but held by domestic counterparties.

3.2 The sectoral allocation of safety

In this section, we study which sectors demand and which sectors supply safe assets. We begin by plotting the evolution of the gross and of the net safe asset positions for each sector. Figure 3 depicts our findings for the US, UK, euro-area composite, and Japan.[7] Tables 1 and 2 show the average sectoral safe-asset positions across 15 advanced economies in 1980, 2005 and 2015, as well as the changes for each sector as share of GDP and proportion of total economy-wide growth.[8]

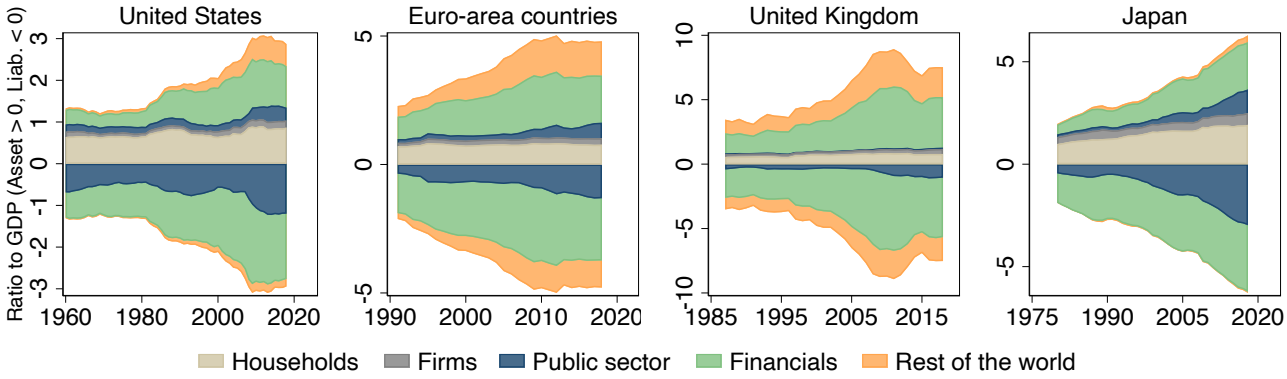
We begin by analyzing the evolution of the gross positions, depicted in the top panel of Figure 3. We see that total safe assets have increased materially since the 1980s. On average across advanced economies, total safe assets increased from 1.6x GDP in 1980 to 4.6x GDP in 2015 (Table 1). The sectoral composition of the market, however, has changed substantially during our sample period.

[7] Appendix Figures A.3a and A.3b show these trends for the 15 countries in our long-run sample.

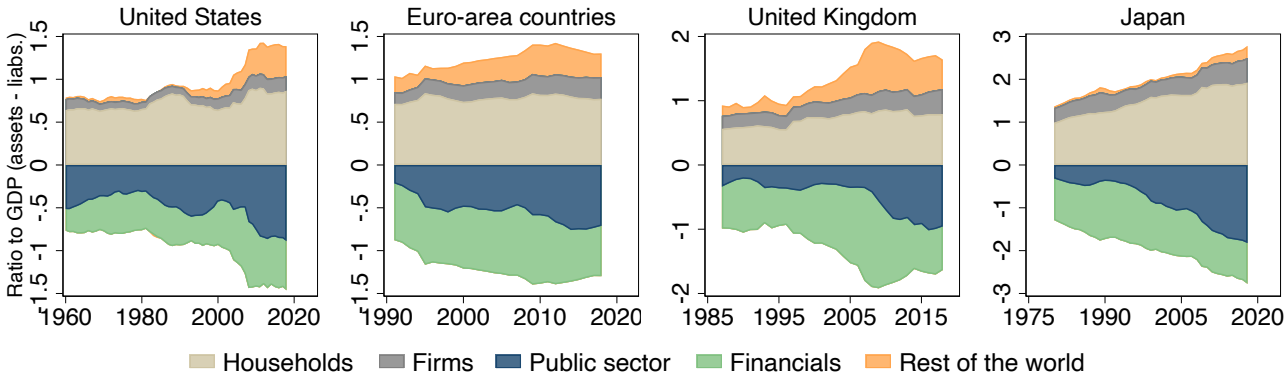
[8] We chose the periods to capture the start of our sample for most countries (1980), the pre global financial crisis level (2005), and the end of our sample (2015).

Figure 3: Trends in sectoral safe-asset positions

(a) Gross sectoral safe-asset positions (assets > 0, liabilities < 0):



(b) Net sectoral safe-asset positions (assets minus liabilities):



Notes: Safe assets include currency, reserves, deposits, gold, special drawing rights, money market mutual fund shares, and bonds issued by governments and financial intermediaries. Gross positions are the sum of total safe asset holdings, or safe liabilities of the specific sector. Net position is the difference between safe assets and safe liabilities of the specific sector. Public sector includes central government, local government, and the central bank. Financials include both banks (deposit taking institutions) and non-bank financials. The series for euro-area countries are the sum of (nominal euro) positions in Austria, Belgium, Finland, France, Germany, Italy, Netherlands, and Spain divided by the sum of the respective countries (nominal euro) GDP.

While in 1980 most safe assets were held by the real sector (households and firms), and supplied by the financial and public sectors, in the last few decades the foreign sector has become increasingly important. As seen in Figure 3a and formalized in Table 1, safe assets held by the households and firms have remained constant at around 0.8x GDP throughout our sample, while those held by the rest of the world increased, from 0.13x GDP in 1980 to 1.29x GDP in 2015 (on average across countries). In turn, safe assets held and supplied by the financial sector account for close to half of the total increase in both gross holdings (Table 1 column (7)).

Next, we study the evolution of the net safe asset positions, to better understand which sectors

Table 1: Gross sectoral safe-asset positions in selected years, average of 15 advanced economies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Level / GDP			Change 1980–2005		Change 1980–2015	
	1980	2005	2015	Absolute	% Total	Absolute	% Total
Safe asset holdings:							
Households	0.76	0.73	0.78	-0.03	-1%	0.02	1%
Firms	0.17	0.23	0.28	0.06	3%	0.11	4%
Public sector	0.14	0.26	0.45	0.12	5%	0.31	10%
Financials	0.43	1.59	1.78	1.16	51%	1.35	46%
Rest of the World	0.13	1.10	1.29	0.98	43%	1.16	39%
Total	1.63	3.92	4.57	2.29	100%	2.95	100%
Safe liabilities:							
Public sector	0.47	0.72	1.10	0.25	11%	0.63	21%
Financials	1.09	2.37	2.54	1.28	55%	1.45	49%
Rest of the World	0.03	0.84	0.94	0.81	35%	0.91	30%
Total	1.59	3.93	4.58	2.34	100%	2.99	100%

Notes: Unweighted averages of gross safe-asset positions relative to GDP in 15 advanced economies (Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, UK, and the US). Safe assets include currency, reserves, deposits, gold, special drawing rights, money market mutual fund shares, and bonds issued by governments and financial intermediaries.

effectively demand and supply safety. Figure 3b shows the trends in net safe-asset positions of each sector, with sectors demanding (supplying) safe assets displaying a positive (negative) net position. In line with the findings from the analysis of gross positions, the real sector in advanced economies displayed a stable demand for safety throughout our sample. For most countries, the increase in the demand for safety has been driven by the rest of the world, with the financial and the public sectors matching the increase in the supply (see also Table 2 and Appendix Figure A.3b).

Our findings suggest that, over the last few decades, the financial sectors in advanced economies have been increasingly intermediating safety both within and across borders. Intermediation across borders is characterized by increases in the gross safe assets and liabilities of the rest-of-the-world sectors, which capture both intermediation across financial sectors in our advanced economies and between our advanced economies and countries outside of our sample. At the same time, net safe assets of the rest-of-the-world sector are almost always positive, suggesting that the group of advanced economies we are studying is on aggregate a net exporter of safety to economies that are not in our sample, presumably emerging markets.

Finally, for the US, UK, Japan, and Euro-area, we distinguish between banks and non-banks within the financial sector. The results are depicted in Appendix Figure A.3. Consistent with existing literature and common wisdom, in the US the non-bank financial sector is a supplier of safety. This is largely explained by the important role of money market funds and GSE-sponsored mortgage-backed

Table 2: Net sectoral safe-asset positions in selected years, average of 15 advanced economies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Level / GDP			Change 1980–2005		Change 1980–2015	
	1980	2005	2015	Absolute	% Total	Absolute	% Total
Positive net safe-asset position (demand):							
Households	0.76	0.73	0.78	-0.03	-15%	0.02	5%
Firms	0.17	0.23	0.28	0.06	30%	0.11	29%
Rest of the World	0.10	0.26	0.35	0.16	84%	0.26	66%
Total	1.02	1.22	1.41	0.19	100%	0.39	100%
Negative net safe-asset position (supply):							
Public sector	0.32	0.45	0.65	0.13	52%	0.32	76%
Financials	0.66	0.78	0.77	0.12	48%	0.10	24%
Total	0.98	1.23	1.41	0.25	100%	0.43	100%

Notes: Unweighted averages of net safe-asset positions relative to GDP in 15 advanced economies (Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, UK, and the US). Positive positions are shown as safe assets minus liabilities, and negative positions as safe liabilities minus assets. Safe assets include currency, reserves, deposits, gold, special drawing rights, money market mutual fund shares, and bonds issued by governments and financial intermediaries.

securities. In contrast, in all other advanced economies in our sample, the non-bank financial sector demands safety as it is dominated by insurance and pension funds.

To summarize, safe asset positions in our sample of advanced economies have increased markedly as a share of GDP since the 1980s, while remaining relatively stable as a share of total financial assets, pointing to a stable global "safe-asset share". These increases in safe-asset positions, however, are generally not reflected as larger safe-asset holdings on the balance sheet of the domestic real sector. Instead, most of the increase in safe-asset demand is coming from rest of the world, and being met by a mix of financial and public sector supply, with financials being relatively more important before the global financial crisis of 2008–09.

4 Fluctuations in the market for safety

Next, we use a variance decomposition approach to study which sectors drive the fluctuations in both gross and net safe-asset positions.

4.1 Fluctuations in gross safety positions

We start by decomposing the variation in economy-wide gross safe assets and liabilities into the variation in the positions of each sector of the economy. The approach is based on the accounting identity that the sum of safe assets held by all sectors should equal the sum of their safe liabilities.

With this, we can address the following questions: Which sectors absorb the additional issuance of safe liabilities – that is, who are the marginal buyers of safety? And conversely, which sectors are the marginal providers of safety through their issuance of safe liabilities? To do so, we exploit the following two identities:

$$\Delta SL_{it}^{Total} = \Delta SA_{it}^{Finan.} + \Delta SA_{it}^{Public} + \Delta SA_{it}^{RoTW} + \Delta SA_{it}^{Real} \tag{1}$$

$$\Delta SA_{it}^{Total} = \Delta SL_{it}^{Finan.} + \Delta SL_{it}^{Public} + \Delta SL_{it}^{RoTW}. \tag{2}$$

Above, ΔSL_{it}^{j} and ΔSA_{it}^{j} denote the 1-year flow in gross safe liabilities and in gross safe assets, respectively, of sector j in country i in year t relative to country i's GDP, and where we made use of the fact that the real sector does not supply safe assets, i.e., $\Delta SL_{it}^{Real} = 0$.

First, we take equation (1), multiply both sides by ΔSL_{it}^{Total}, take expectations, and after some algebra obtain the following decomposition of the year-by-year cross-sectional variance in the issuance of safe liabilities:

$$\begin{aligned} Var\left(\Delta SL_{it}^{Total}\right) &= Cov\left(\Delta SL_{it}^{Total}, \Delta SA_{it}^{Real}\right) + Cov\left(\Delta SL_{it}^{Total}, \Delta SA_{it}^{Public}\right) \\ &+ Cov\left(\Delta SL_{it}^{Total}, \Delta SA_{it}^{Finan.}\right) + Cov\left(\Delta SL_{it}^{Total}, \Delta SA_{it}^{RoTW}\right) \end{aligned} \tag{3}$$

Then, dividing both sides by $Var\left(\Delta SL_{it}^{Total}\right)$ we obtain:

$$1 = \beta^{Real} + \beta^{Finan.} + \beta^{Real} + \beta^{Public} + \beta^{RoTW} \tag{4}$$

where $\beta^{j} = \frac{Cov\left(\Delta SA_{it}^{j}, \Delta SL_{it}^{Total}\right)}{Var\left(\Delta SL_{it}^{Total}\right)}$ for sector $j \in \{Real, Finan., Public, RoTW\}$ is the ordinary least square (OLS) estimate of the slope in the following regression:

$$SA_{it}^{j} = \alpha^{j} + \beta^{j} SL_{it}^{Total} + \varepsilon_{it}^{j}. \tag{5}$$

Equation 4 allows for a simple interpretation of results: the right hand side reflects the marginal absorption of safe assets by sector for a one unit higher economy-wide issuance of safe liabilities. Next, following the same procedure but for Equation 2 we obtain the variance decomposition that indicates which sector's safe liabilities co-vary with changes in total safe assets. This tells us which sectors are the marginal providers of safety for a one unit higher economy-wide holding of safe assets. Table 3 shows the resulting variance decompositions for gross safe asset (first row) and liability (second row) flows, for our long-run sample of 15 advanced economies.

From the decomposition of safe asset flows in the first row of Table 3, we find that safe assets of all sectors co-vary with changes in total safe liabilities, but they do not contribute equally. In particular,

Table 3: Variance decomposition: gross safe-asset flows

	(1) Households	(2) Firms	(3) Financials	(4) Public sector	(5) RoTW
Safe asset holdings	0.04***	0.02***	0.44***	0.10***	0.38***
	(0.01)	(0.01)	(0.03)	(0.04)	(0.03)
Safe liabilities	0.00	0.00	0.63***	0.07*	0.31***
	(.)	(.)	(0.04)	(0.04)	(0.03)
Observations	464	464	464	464	464

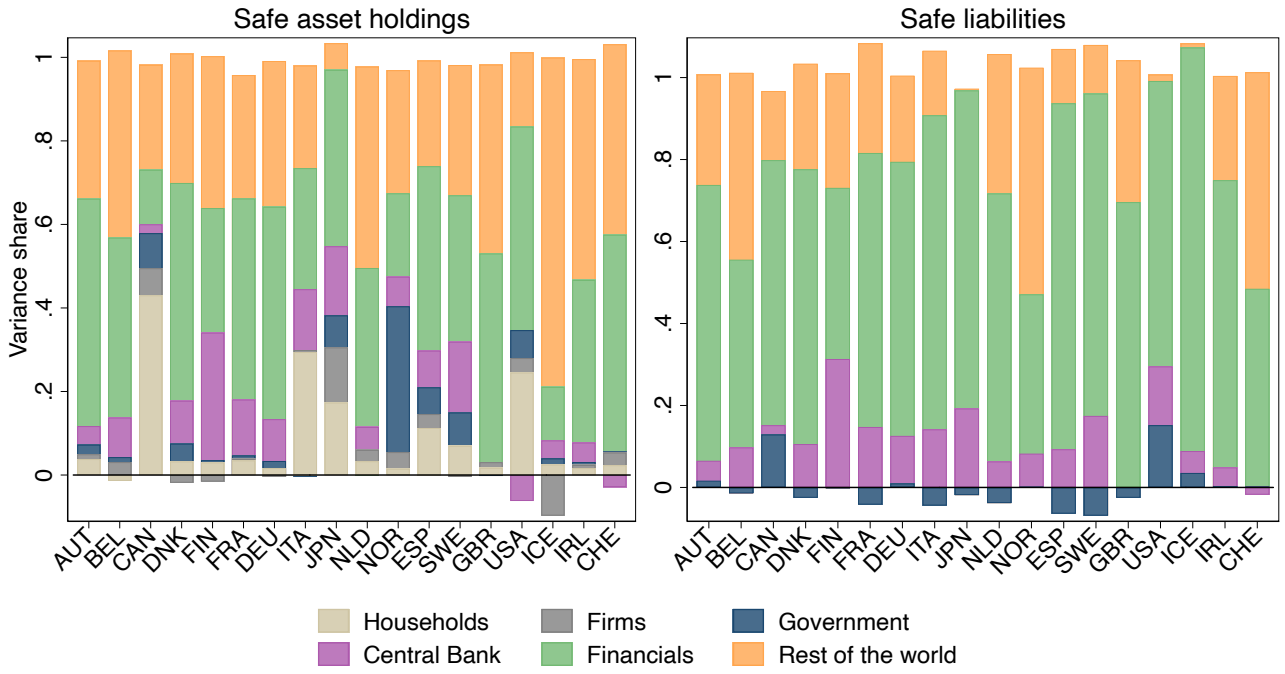
Notes: The variance decompositions are obtained by regressing the 1-year flow of safe asset holdings (liabilities) of all sectors in the economy on the 1-year flow of gross safe liabilities (asset holdings) of each sector. The variance shares add up to 1, subject to a small residual. The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. Standard errors clustered by country and year are in parentheses. *,**, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

almost all of the variation in safe-asset holdings is driven by the financial and rest-of-the-world sectors. For each additional dollar of safe liabilities issued in the economy, these sectors absorb 44 (financial) and 38 (rest-of-the-world) cents respectively on their asset side. Even though the real sector holds a substantial amount of safe assets (see Figure 3 and Table 1), these holdings are stable over time and across countries, and therefore make almost no contribution to fluctuations in the market for safety.

Turning to the decomposition of safe liabilities in the second row of Table 3, we find that the financial and rest-of-the-world sectors are responsible for most of the variation as well. The financial sector accounts for 63% of the marginal issuance in safe liabilities, and the rest-of-the-world sector for 31%. Figure 4 plots these decompositions for 18 advanced economies separately. The green (financials) and yellow (rest-of-the-world) bars are clearly dominating with only few exceptions, mainly reflecting higher absorption of safe assets by households in Canada, Japan, and the US.

We conclude by conducting a more detailed decomposition of safe asset and liability flows by re-doing the exercise for more granular economic sectors (e.g., distinguishing between banks and non-bank financials, government and the central bank), and different safe securities (e.g., bonds, money market fund shares, and deposits). Results are presented in Appendix Tables A.1 and A.2. We find that for both safe-asset holdings and liabilities, the bulk of the variation in gross flows is driven by domestic bank deposits, with a somewhat smaller part attributable to foreign deposits and bonds issued by domestic governments and financial institutions. Finally, in Appendix Table A.3 we show that our findings are robust to controlling for macro-financial observables (GDP growth, inflation and short-term interest rates), and to using 3-year as opposed to 1-year flows.

Figure 4: Variance decomposition of gross safe-asset flows by country



Notes: The variance decompositions are obtained by regressing the 1-year flow of gross safe asset holdings (liabilities) of all sectors on the 1-year flow of safe liabilities (asset holdings) of each sector in the specific country. The variance shares add up to 1, subject to a small residual.

4.2 Fluctuations in net safety positions

In the previous section, we uncover an important fact: the financial and the rest-of-the-world sectors account for most of the fluctuations in safe asset holdings and liabilities. Motivated by this, we now analyze how these two sectors contribute to fluctuations in safe asset demand and supply. To gain insight into this, we perform a variance decomposition for the financial and the rest-of-the-world net safe asset flows. Because the rest-of-the-world sector usually has a positive net position, we say it demands safety, while the financial sector has a negative net position, and thus it supplies safety.

The decompositions are, again, based on financial accounting identities – in this case that the sum of total net safe asset flows of all sectors should equal zero. Given this, we can express fluctuations in the supply by financials or the demand by foreigners as follows:

$$\textbf{Financial supply:} \quad -\Delta NSA_{it}^{Finan.} = \Delta NSA_{it}^{Real} + \Delta NSA_{it}^{Public} + \Delta NSA_{it}^{RoTW} \tag{6}$$

$$\textbf{Foreign demand:} \quad \Delta NSA_{it}^{RoTW} = -\Delta NSA_{it}^{Real} - \Delta NSA_{it}^{Finan.} - \Delta NSA_{it}^{Public} \tag{7}$$

As in equations (1) and (2), the corresponding variance shares of each sector can be estimated by (pairwise) OLS regressions of the financial supply on the demand of the other sectors, and by regressing

Table 4: Variance decomposition of net safe-asset flows of financials and rest of the world

	(1) Households	(2) Firms	(3) Public sector	(4) RoTW
$-\Delta \text{NSA}^{\text{Financials}}$	0.19***	0.07***	0.25***	0.46***
	(0.05)	(0.01)	(0.05)	(0.08)
	(5) Households	(6) Firms	(7) Public sector	(8) Financials
$\Delta \text{NSA}^{\text{RoTW}}$	-0.03	0.03	0.13	0.88***
	(0.03)	(0.03)	(0.12)	(0.14)
Observations	464	464	464	464

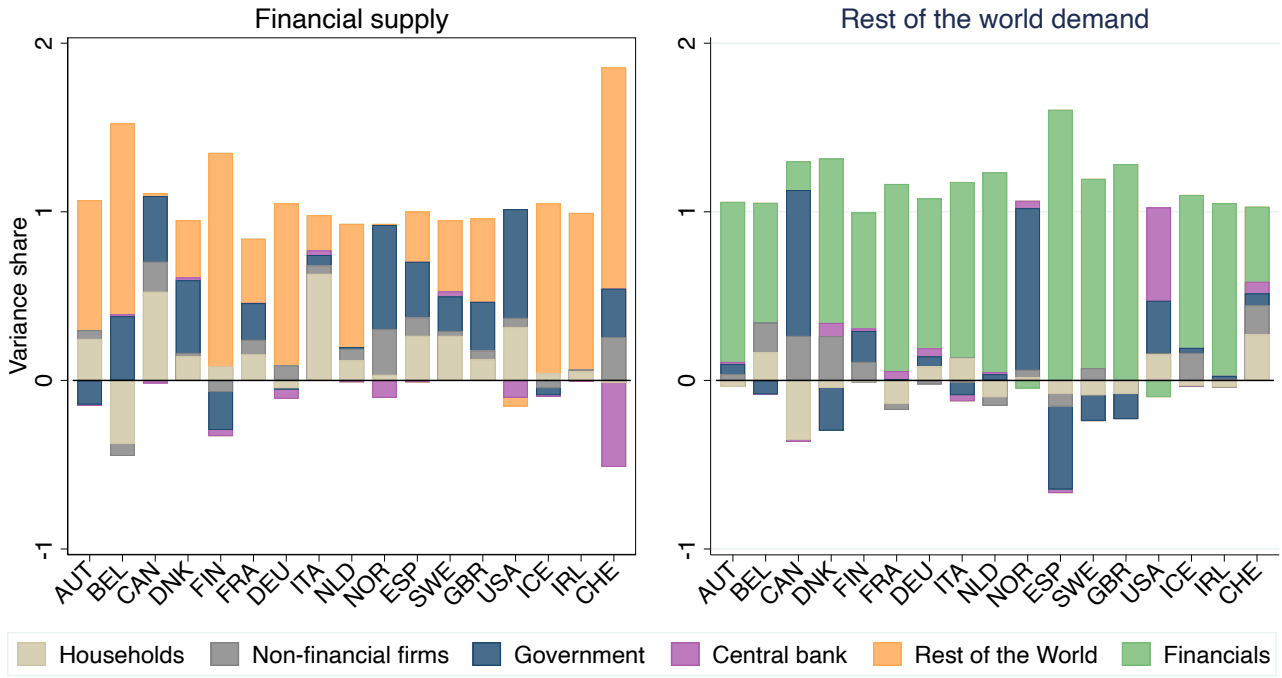
Notes: The variance decomposition is obtained by regressing the negative of the net safe-asset flows of a sector (financials or rest of the world) on the net safe asset-flows of each of the other sectors (see equations (6) and (7)). The variance shares add up to 1, subject to a small residual. The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. Standard errors clustered by country and year are in parentheses. *,**, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

the rest-of-the-world demand on the supply of the other sectors. As before, we use 1-year safe-asset flows as a measure of changes in net safe-asset holdings, and run the regression in the unbalanced panel of 15 advanced economies. The results of both exercises are shown in Table 4.

The coefficients for all the counterpart-sectors to financials in the top row of Table 4 are positive and statistically significant. This means that the financial sector effectively supplies safety to households, firms, the rest of the world (which all have positive net positions), and that financial sector safety is a substitute for public sector safety (as the latter has a negative net position), consistent with Krishnamurthy and Vissing-Jorgensen (2012). This substitution between public and private safety accounts for around 25% of the variation in financial-sector safe asset supply. However, the largest contribution to the variance of the financial sector supply (46%) comes from the rest-of-the-world sector. Put differently, for each dollar of safe assets supplied by the financial sector, 46 cents end up in the hands of the foreign sector. Appendix Table A.5 provides a decomposition of these movements into more granular sectors and financial instruments, pointing to the importance of household and foreign deposits, and of foreign and public-sector bonds.

Next, in the second row of Table 4, we find that variation in the demand of the rest of the world is met mainly by changes in the supply of the financial sector (88%), with the remaining variation explained by the public sector (13%). This means that for every dollar of safe assets demanded by the rest-of-the-world sector, 88 cents are supplied by the financial sector, and the remainder by the public sector. We interpret this finding as evidence that the financial sector plays a crucial role in satisfying the changes in safe asset demand from foreigners, a finding we will explore in more detail in the next section.

Figure 5: Variance decomposition of net safe-asset flows of financials and rest of the world by country



Notes: Each shaded bar corresponds to the variance share of 1-year net safe-asset flows for the specific sector within a specific country. The variance decompositions are obtained by regressing the 1-year flows in net safe liabilities (safe liabilities minus assets) of the specific sector (financials or rest of the world) on the 1-year flows in net safe asset holdings (safe assets minus liabilities) of the other sectors. The variance shares add up to 1, subject to a small residual.

Appendix Table A.6 provides a more granular decomposition of these movements into different economic subsectors (e.g., banks and non-banks) and financial instruments, pointing to the importance of domestic bank deposits and safe bonds issued by non-bank financials as counterparts to fluctuations in the rest-of-the-world demand. Finally, Table A.4 shows that the decompositions for both financials and rest of the world are robust to controlling for macro-financial observables, and looking at 3-year flows.

Figure 5 shows the financial and the rest-of-the-world net safe-asset flows variance decomposition for 17 advanced economies in our data.[9] Across the board, almost all of the variation in the demand of the rest of the world is explained by changes in the supply of the financial sector. For financials, the rest-of-the-world sector is also nearly-ubiquitously important, with the exception of large closed economies, where variation in the demand by the real sector, as well as the substitution with the public sector, are also important. Interestingly, for the US, changes in public and real-sector positions are important counterparts to changes in net supply and demand for safety by the financial and foreign

[9]Relative to the gross flow Figure 4, in Figure 5 we omit Japan, because its rest of the world sector is very small relative to the domestic sectors, resulting in noisy and unstable variance-share estimates.

sectors, consistent with evidence of a foreign savings glut for US public-sector bonds (Bernanke, 2005; Bernanke et al., 2011).

Altogether, our evidence suggests that the financial and foreign sectors are crucial in explaining the fluctuations in the market for safety. Moreover, these two sectors seem to be closely interlinked: around half of the variation in financial sector safe asset supply can be explained by the rest-of-the-world sector, and almost 90% of the variation in rest-of-the-world safe asset demand is explained by changes in supply by the financial sector. Next, we study whether these safe asset fluctuations, and particularly those in the financial and rest of the world sectors, are important for macro-financial outcomes.

5 The market for safety and macro-financial stability

In the previous sections, we have shown that the financial and foreign sectors play a crucial, and increasingly important, role in driving both the supply and the demand for safety. Motivated by this, we now explore the macroeconomic implications of these findings. We begin by studying the link between privately produced safe assets and domestic credit. Then, and in line with evidence that credit expansions are associated with lower subsequent growth (Mian and Sufi, 2009; Mian et al., 2017; Müller and Verner, 2023), we study the link between privately produced safe assets and medium-term future GDP growth.

5.1 Safe assets and risky lending

To gauge the effects of fluctuations in safe-asset demand on risky lending, we start with another accounting variance decomposition, building on the methodology and results explained in the previous section. Table 4 showed that an increase in net safe asset demand by the foreign sector is mostly mirrored by increased net safe asset supply of the financial sector. Importantly, for the financial intermediary sector, financial assets and financial liabilities are usually balanced. As a result, any increase in net safe liabilities has to be accompanied (mirrored) by an increase in net risky assets. Given this, we can express the change in net safe-asset holdings by the rest-of-the-world sector as follows:

$$\begin{aligned}
\Delta NSA_{it}^{RoTW} &= -\Delta NSA_{it}^{Public} - \Delta NSA_{it}^{Real} - \Delta NSA_{it}^{Finan.} \\
&\approx -\Delta NSA_{it}^{Public} - \Delta NSA_{it}^{Real} + \Delta NRI_{it}^{Finan.} \\
&\approx -\Delta NSA_{it}^{Public} - \Delta NSA_{it}^{Real} \\
&\quad +\Delta N_{it}^{Loans} + \Delta N_{it}^{Shares} + \Delta N_{it}^{Ins.} + \Delta N_{it}^{Risky\ bonds} + \Delta N_{it}^{Deriv.} + \Delta N_{it}^{Oth.Acc.},
\end{aligned} \tag{8}$$

Table 5: Variance decomposition of rest-of-the-world safe asset demand on risky financial assets

	Financials Total		Decomposition of risky financial instruments					
	Net Safe	Net Risky	Loans	Shares	Insur.	R. Bonds	Deriv.	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNSA_{it}^{RoTW}	-0.88***	0.87***	0.67***	0.18***	-0.03	0.01	0.02	0.03
	(0.14)	(0.14)	(0.15)	(0.06)	(0.02)	(0.01)	(0.01)	(0.03)
Observations	464	464	464	464	464	464	464	464

Notes: The number in column (1) corresponds to the share of the variation in the rest-of-the-world net safe asset flows explained by the financial sector, see Table 4 column (8) (a negative number means that higher net safe assets of rest of the world correspond to higher net safe liabilities of financials). The variance decomposition in columns (2)–(8) is obtained by regressing the net risky asset supply (risky liabilities minus risky assets, in total and by instrument) of the financial sector on net safe asset demand (safe assets minus safe liabilities) of the rest of the world, using 1-year flows. The variance shares of financial instruments (columns 3–8) add up to the total net risky assets position in column (2) subject to a small residual. They add up to 1 when additionally including the variance shares of the public and real sectors from Table 4. The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. Standard errors clustered by country and year are in parentheses. *,**, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

where we first replace $-NSA_{it}^{Finan.}$ from equation (7) with $NRA_{it}^{Finan.}$ (the net risky asset position), and then decompose the changes in net risky asset holdings of the financial sector by risky financial instrument (loans, shares, insurance and pension claims, risky bonds, derivatives, and other accounts). As in equations (4) and (5), the additional terms for each risky instrument can be estimated by (pairwise) OLS regressions of the financial sector's net position in each risky financial instrument on the (total) net safe-asset position of the rest of the world sector. The results of this exercise tell us which risky financial assets of intermediaries mirror the changes in safe asset demand from the rest of the world sector.

For comparison, Table 5 column (1) displays again the coefficient for $NSA^{Finan.}$ from equation (6) (in Table 4, second row, column (4)). In column (2) we replace $NSA_{it}^{Finan.}$ with $NRA_{it}^{Finan.}$, the net risky asset supply of the intermediary sector. As expected, the coefficient estimate is almost unchanged, but with a reversed sign: changes in safe asset demand of the foreign sector are not only reflected in net safe-asset flows, but also in net risky-asset flows of the financial sector. The results of the decomposition by risky instrument are shown in Table 5 columns (3) to (8). We find that an increase in the demand for safety by the rest of the world is highly correlated with an increase in the supply of risky loans by financials. If the rest of the world increases safe-asset holdings by one dollar, net risky assets of the domestic financial sector go up by 87 cents, with additional exposure to risky loans accounting for most of this increase (67 cents). These results directly link the export of safe assets to the rest of the world to domestic credit expansions.

5.2 Output responses

The dynamics in sectoral safe asset demand and the associated supply of risky financial instruments may have implications for the macroeconomy. The experience of the years leading to the 2008-09 Global Financial Crisis and subsequent theoretical work have highlighted the potential downside risks of privately created safety (Stein, 2012; Gennaioli et al., 2013; Hanson et al., 2015; Caballero and Farhi, 2018; Segura and Villacorta, 2023; Castells Jauregui, 2023; Altinoglu, 2023), especially when safe assets are held by foreigners (Caballero and Simsek, 2020; Ahnert and Perotti, 2021).

To assess these dynamics, we follow the literature on credit booms (Mian et al., 2017) and study the medium-term relationship between sectoral safe asset demand and supply, and subsequent output dynamics by estimating

$$\Delta_3 y_{it+3} = \alpha_i + \alpha_t + \beta^j \Delta_3 NSA^j_{it-1} + \gamma X_{it-1} + u_{it+3}, \tag{9}$$

where $\Delta_3 y_{it+3}$ are three-year changes in real GDP between t and $t+3$, α_i are country fixed effects, α_t are year fixed effects, and X_{it-1} is a control vector that includes three lags of GDP growth, inflation, policy rate changes, and a financial crisis indicator. The coefficient of interest will be β^j for each j $\in$ {RoTW, Finan., Public} which links subsequent output dynamics to changes in net safe asset positions of the rest of the world, financials, and the public sector, respectively.

The results are shown in Table 6. From column (1) we see that an increase in the safe asset demand of the rest-of-the-world sector is associated with significantly lower subsequent GDP growth, even after controlling for business-cycle and inflation dynamics, and global shocks through year fixed effects. In column (2) we add three-year changes in net foreign assets, household credit, and firm credit relative to GDP as additional control variables. The relationship between $\Delta_3 NSA^{RoTW}$ and GDP remains unchanged, indicating that it goes beyond the dynamics associated with capital inflows and domestic credit highlighted in the previous literature. Columns (3) and (4) repeat these specifications replacing changes in safe asset demand of the foreign sector with the changes in the net safe-asset position the financial sector. The results show that higher safe asset supply (lower net safe-asset position) by the financial sector is associated with lower subsequent GDP growth. Importantly, increases in the supply of safe assets by the public sector are not related to poorer medium-term GDP outcomes (columns 5 and 6).[10]

The relationship between changes in sector-level net safe asset positions and subsequent output dynamics is a robust pattern of the data. Appendix Table A.7 shows that the effects are similar

[10]For the public sector, the coefficients are generally negative meaning that higher supply of public safety (a more negative net position) is associated with higher medium-term GDP growth.

Table 6: Sectoral safe-asset flows and subsequent output dynamics

	Dependent variable: real GDP growth$_{t \text{ to } t+3}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Δ_3NSA RoTW$_{i,t-1}$	-0.07***	-0.09***				
	(0.01)	(0.01)				
Δ_3NSA Financials$_{i,t-1}$			0.07***	0.09***		
			(0.01)	(0.01)		
Δ_3NSA Public$_{i,t-1}$					-0.04**	-0.03
					(0.02)	(0.02)
R^2	0.652	0.710	0.659	0.717	0.503	0.609
Country FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Base controls	✓	✓	✓	✓	✓	✓
Additional controls		✓		✓		✓
Observations	388	388	388	388	388	388

Notes: The dependent variable is the change in log real GDP between t and $t+3$. Explanatory variables (in rows) are changes in the ratio of the respective variable and GDP between $t-4$ and $t-1$. Base controls include three lags of GDP growth, inflation, short-term interest rates, and the financial crisis dummy. Additional controls include the three-year changes in net foreign assets to GDP, household credit to GDP, and business credit to GDP. Country and year fixed effects included. Driscoll-Kraay standard errors (5 lags) in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

when we drop financial center countries, and Appendix Figure A.9 shows results from local projection (Jordà, 2005) exercises that confirm the dynamics described above at horizons of up to eight years.

One concern in these regressions is that the results simply reflect correlations and may be driven by reverse causality. That is, foreigners may increase their demand for safe assets when financials have increased risky credit for other domestic reasons we are ommitting to control for. Ideally, we would like to observe changes in foreign demand for safety that are uncorrelated to domestic business cycle considerations, but such changes in demand are difficult to identify in the data.

To address this concern, we use data from Lane and Milesi-Ferretti (2018) on the foreign exchange reserve holdings of Asian countries that are not in our sample (China, Hong Kong, Taiwan, Korea, and Singapore). We argue that these are held for domestic reasons, mainly to defend the domestic currency when needed. Moreover, the demand for these holdings is plausibly unrelated to macroeconomic dynamics in our sample countries.[11] At the same time, our sample countries are the ones supplying safe assets over the sample period and hence most likely the ones to satisfy these changes in foreign demand.

This reasoning allows us to exploit changes in the foreign exchange reserve holdings of these Asian

[11]Minoiu et al. (2023) use a similar identification strategy for the US and Tabova and Warnock (2021) provide evidence that foreign official holdings are price insensitive in the market for US Treasuries.

Table 7: Instrumental variable estimates: net safe assets at sector level and macroeconomic dynamics

	Δ_3Real GDP$_{i,t+3}$		Δ_3NSA Financials$_{i,t-1}$		Δ_3Loans$_{i,t-1}$	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Δ_3NSA RoTW$_{i,t-1}$	-0.07***	-0.06***	-1.03***	-1.00***	0.47***	0.58***
	(0.01)	(0.01)	(0.01)	(0.03)	(0.06)	(0.04)
Country FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
K-P Weak ID		345.99		345.99		345.99
Observations	388	388	388	388	388	388

Notes: The dependent variable is the change in log real GDP between t and $t+3$ in columns (1) and (2); the three-year change in the financial sector net safe asset position (relative to GDP) in columns (3) and (4); and the change in loans to the real sector (relative to GDP) between $t-4$ and $t-1$ in columns (5) and (6). Coefficients shown are for the three-year change in the instrumented rest-of-the-world sector net safe asset position (relative to GDP) between $t-4$ and $t-1$. Controls include three lags of GDP growth, inflation, short-term interest rates, and the financial crisis dummy. Country and year fixed effects included. Driscoll-Kraay standard errors (5 lags) in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

countries as exogenous variation in net safe asset holdings of the rest of the world in our sample of countries, i.e. for $\Delta_3 NSA^{RoTW}$. As shown above, some of our sample countries are more likely to supply safe assets to the foreign sector than others. This allows us to implement an identification strategy similar to Nakamura and Steinsson (2014) and Guren et al. (2020) who use as an instrument the interaction of local elasticities and aggregate changes. In our setting, we can estimate the country-level sensitivity of safe asset supply to the rest of the world $\Delta_3 NSA_{it}^{RoTW}$ to changes in Asian demand for foreign reserves, $\Delta_3 AD_t$, by running the following regression:

$$\Delta_3 NSA_{it}^{RoTW} = \alpha_i + \sum_{i \in I} \gamma_i \Delta_3 AD_t I_i + v_{it}. \tag{10}$$

Importantly, γ_i is a country-specific coefficient, and I_i is a dummy which equals 1 for country i and 0 for all other countries. We then use the predicted values $z_{it-1} = \hat{\gamma}_i \Delta_3 AD_{t-1}$ as an instrument for $\Delta_3 NSA_{it-1}^{RoTW}$ in equation (9).

The left panel in Appendix Figure A.10 shows a strong relationship between the net safe asset position of foreigners in our set of advanced economies and the instrument, suggesting a strong first stage. The right panel plots the reduced-form relationship between the instrument and residualized GDP growth, using the baseline control vector as described above. This reduced-form relationship is strongly negative, in line with the negative effect of changes in rest of the world demand for safety on future domestic GDP growth implied by the coefficients in Table 6 columns (1) and (2).

More formally, Table 7 shows the estimated coefficients for equation (9) with OLS and IV results in

columns (1) and (2) respectively. In line with the visual impression in Figure A.10, the Kleibergen-Paap statistic suggests a strong first-stage relationship. As can be seen, the IV results are highly significant with an almost unchanged coefficient. In the other four columns we link the plausibly exogenous demand for safe assets to our previous findings. Instrumented changes in rest of the world demand for safe assets are mirrored by contemporaneous changes in the net safe position of the financial sector almost one-for-one (columns (3) and (4)), and linked to domestic credit expansions (columns (5) and (6)), with instrumental variable estimates being highly significant and very similar in size to the OLS estimates.

6 Conclusions

This paper provides key insights into the role of safe assets in modern economies by studying the sectoral composition of the market for safety in an extensive cross-country sample. Analyzing harmonized financial accounts data across countries and over time shows the pivotal role of the foreign sector in driving safe asset demand, and the role of the financial sector in supplying privately produced safe assets. Finally, we relate our findings to macro outcomes and show that expansions in safety demand from the rest of the world, or equivalently in supply by financials, are associated with lower subsequent GDP growth and expansions in risky credit to households and firms.

Our results point to some important issues. After 2008, there has been some substitution from private to public safety through expansions in central bank balance sheets and government debt and a retrenchment in private debt issuance, which has created some concerns among policymakers and academics. Our findings suggest that these public balance sheet expansions may also have a positive side-effect through reducing the need for the private provision of safety, and thus ameliorating the associated negative effects on macro-financial stability. These types of trade-offs should be an important consideration in the design of macro-prudential regulation.

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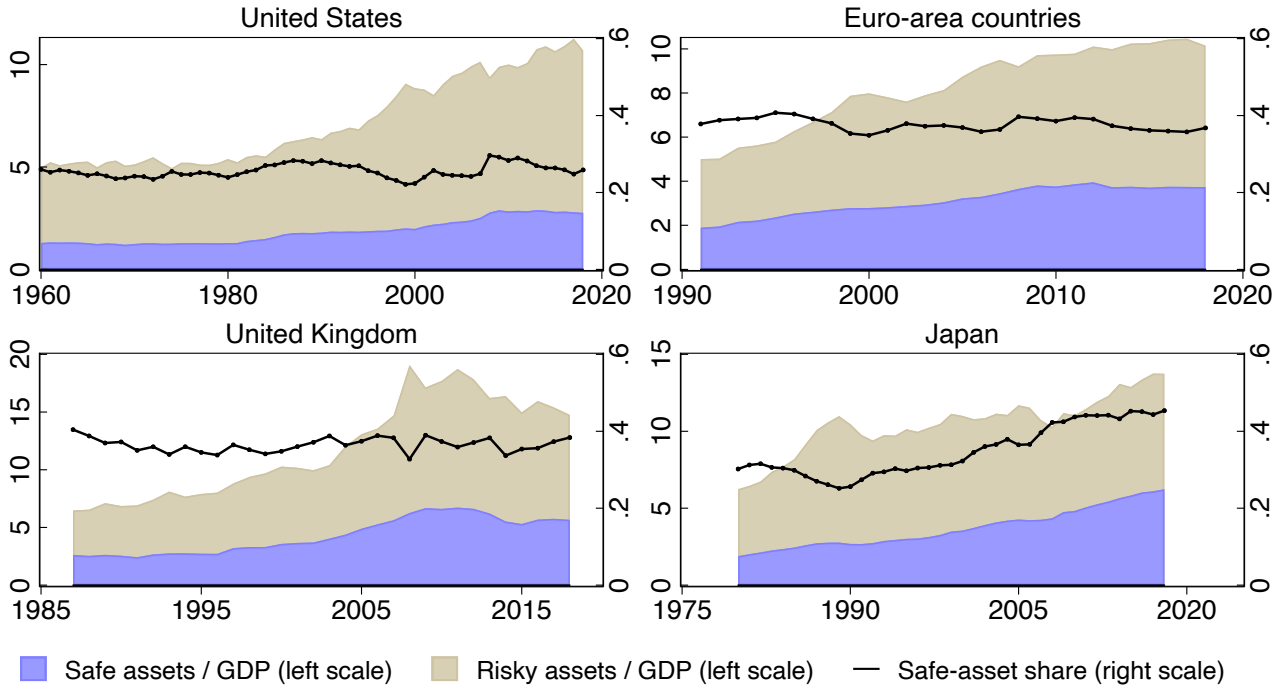
Appendix

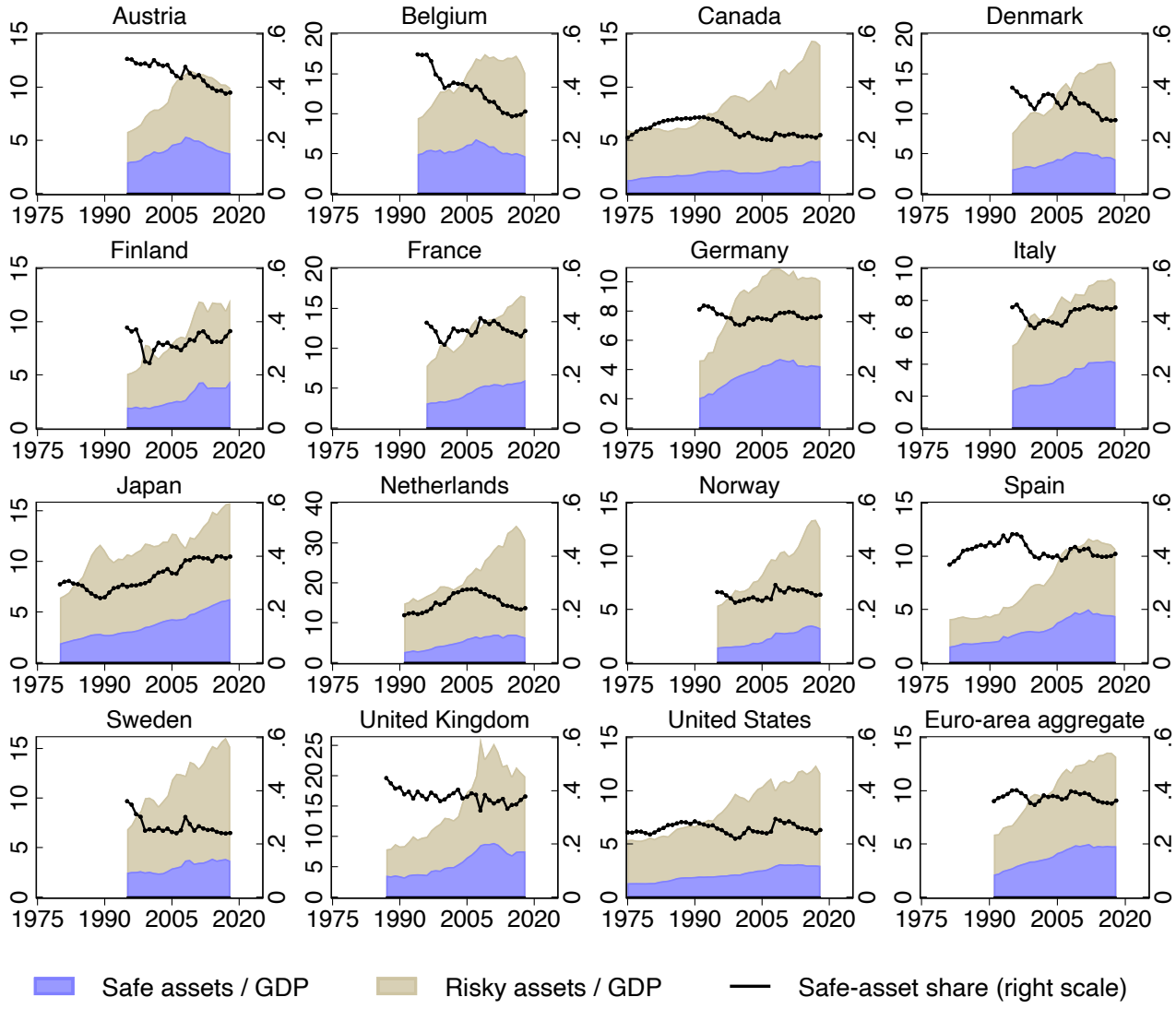
A Trends in sectoral safe-asset positions: additional results

Figure A.1: Safe assets, risky assets, and the safe-asset share: domestic-produced safe assets only



Notes: Safe assets include currency, reserves, deposits, gold, special drawing rights, money market mutual fund shares, and bonds issued by governments and financial intermediaries. Risky assets are all other financial assets (equities, non-financial corporate bonds, loans, insurance & pension assets, derivatives, and other accounts). The safe-asset share is the ratio of safe to total (safe + risky) financial assets. The series for euro-area countries is the sum of (nominal euro) positions in Austria, Belgium, Finland, France, Germany, Italy, Netherlands, and Spain divided by the sum of the respective countries (nominal euro) GDP. The series include financial assets issued by domestic sectors only, and exclude those issued by rest-of-the-world counterparties.

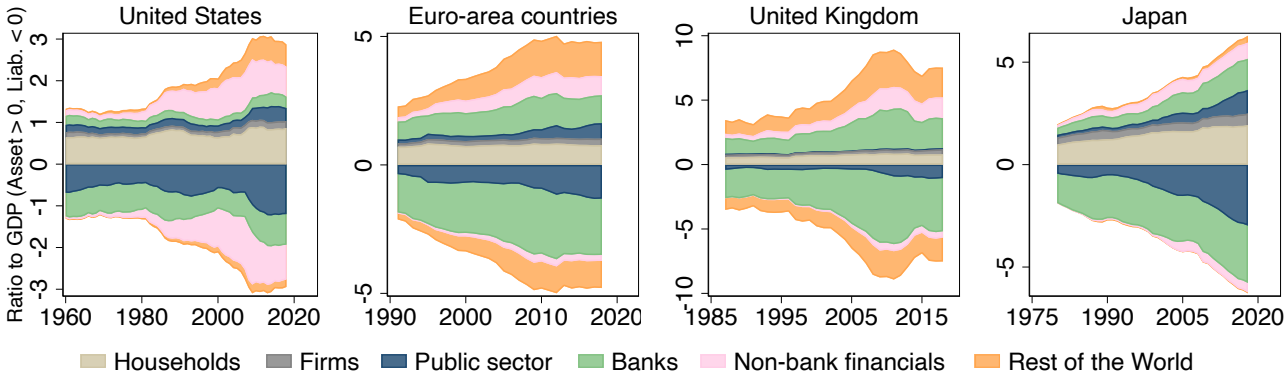
Figure A.2: Safe and risky asset positions in individual countries



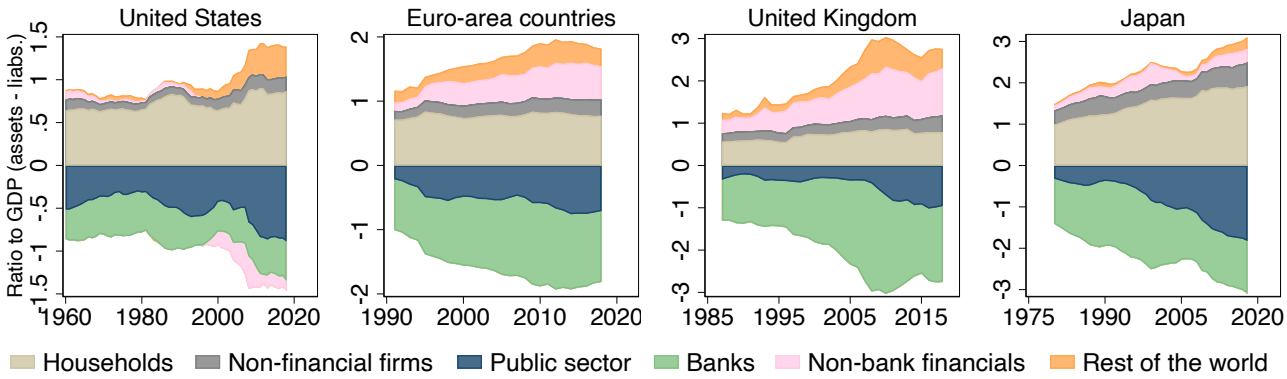
Notes: Safe assets include currency, reserves, deposits, gold, special drawing rights, money market mutual fund shares, and bonds issued by governments and financial intermediaries. Risky assets are all other financial assets (equities, non-financial corporate bonds, loans, insurance & pension assets, derivatives, and other accounts). The safe-asset share is the ratio of safe to total (safe + risky) financial assets. The series for euro-area countries is the sum of (nominal euro) positions in Austria, Belgium, Finland, France, Germany, Italy, Netherlands, and Spain divided by the sum of the respective countries (nominal euro) GDP.

Figure A.3: Trends in sectoral safe-asset positions – banks and non-bank financials split

(a) Gross sectoral safe-asset positions (assets > 0, liabilities < 0):

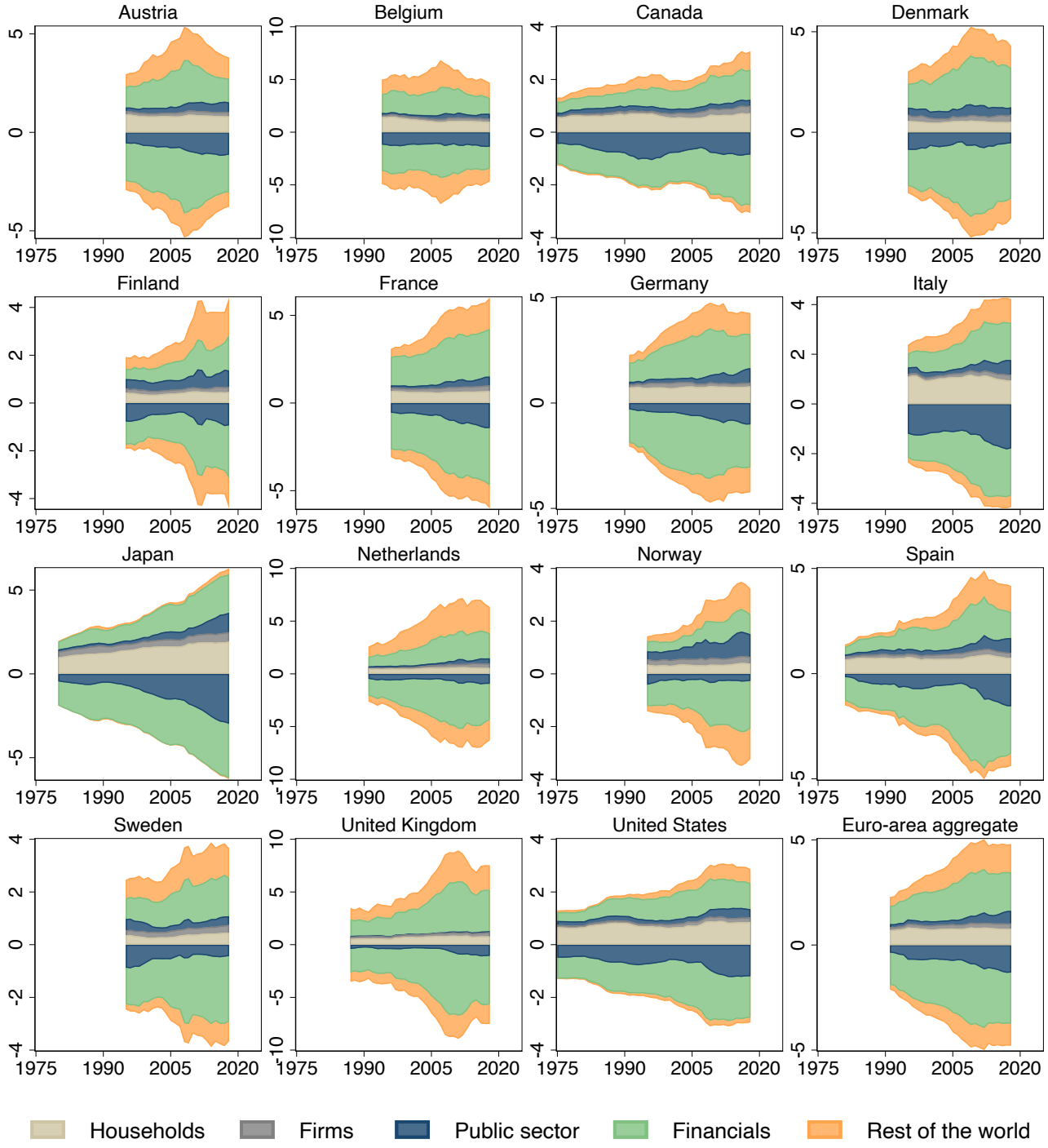


(b) Net sectoral safe asset positions (assets minus liabilities):



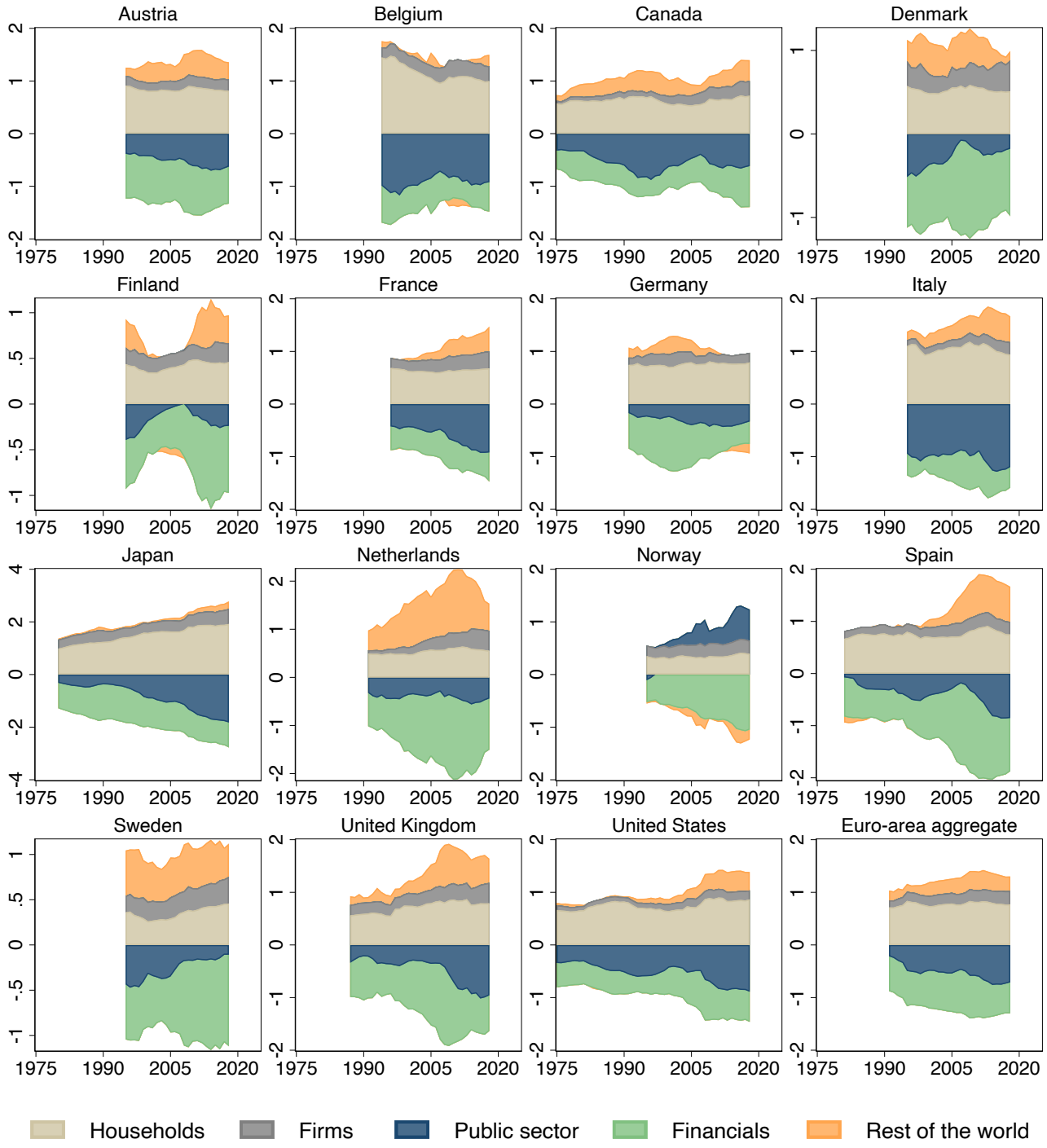
Notes: Safe assets include currency, reserves, deposits, gold, special drawing rights, money market mutual fund shares, and bonds issued by governments and financial intermediaries. Gross positions are the sum of total safe asset holdings, or safe liabilities of the specific sector. Net positions are the difference between safe assets and safe liabilities of the specific sector. Public sector includes central government, local government, and the central bank. Banks are deposit taking institutions, and non-bank financials are all other financial institutions (insurance & pension funds, money market funds, broker-dealers etc). The series for euro-area countries are the sum of (nominal euro) positions in Austria, Belgium, Finland, France, Germany, Italy, Netherlands, and Spain divided by the sum of the respective countries (nominal euro) GDP.

Figure A.4: Gross sectoral safe-asset positions in individual countries



Notes: Safe assets include currency & deposits, gold, money market mutual fund shares, and bonds issued by governments and financial intermediaries. Gross positions are the sum of total safe asset holdings, or safe liabilities of the specific sector. Financials include both banks (deposit taking institutions) and non-bank financials. The series for euro-area countries are the sum of (nominal euro) positions in Austria, Belgium, Finland, France, Germany, Italy, Netherlands, and Spain divided by the sum of the respective countries (nominal euro) GDP.

Figure A.5: Net sectoral safe-asset positions in individual countries



Notes: Safe assets include currency, reserves, deposits, gold, special drawing rights, money market mutual fund shares, and bonds issued by governments and financial intermediaries. Net position is the difference between safe assets and safe liabilities of the specific sector. Public sector includes central government, local government, and the central bank. Financials include both banks (deposit taking institutions) and non-bank financials. The series for euro-area countries are the sum of (nominal euro) positions in Austria, Belgium, Finland, France, Germany, Italy, Netherlands, and Spain divided by the sum of the respective countries (nominal euro) GDP.

B Fluctuations in the market for safety: additional results

B.1 Fluctuations in gross safety positions: additional results

Table A.1: Gross safe asset holdings flows variance decomposition – granular sectors and instruments

	Total	Depo.and Cur.	MMF shares	Bonds
Total Economy	0.99***	0.77***	0.00	0.21***
	(0.00)	(0.04)	(0.00)	(0.04)
1) Real Sector	0.05***	0.05***	0.00	0.01
	(0.01)	(0.01)	(0.00)	(0.01)
→ Households	0.04***	0.03***	0.00	0.01
	(0.01)	(0.01)	(0.00)	(0.01)
→ Firms	0.02***	0.02***	-0.00	0.00
	(0.01)	(0.00)	(0.00)	(0.00)
2) Financial Sector	0.44***	0.34***	0.00	0.10***
	(0.03)	(0.03)	(0.00)	(0.01)
→ Banks	0.35***	0.28***	-0.00	0.07***
	(0.02)	(0.02)	(0.00)	(0.01)
→ Non banks	0.09***	0.06***	0.00	0.03***
	(0.02)	(0.02)	(0.00)	(0.01)
3) Public Sector	0.11***	0.10***	0.00	0.01
	(0.04)	(0.03)	(0.00)	(0.01)
→ Government	0.02**	0.01**	0.00	0.01
	(0.01)	(0.01)	(0.00)	(0.01)
→ Central bank	0.08**	0.08**	0.00	0.00
	(0.04)	(0.03)	(0.00)	(0.01)
4) RoTW Sector	0.39***	0.29***	0.00	0.10***
	(0.03)	(0.04)	(0.00)	(0.03)

Notes: The variance decompositions are obtained by regressing the total safe liabilities of all sectors on the safe asset holdings of each sector and safe-asset instrument, e.g. household holdings of deposits. The variance shares add up to 1 across sectors and instruments, subject to a small residual (which, for instruments, includes the shares accounted for by gold flows). The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. Standard errors clustered by country and year are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A.2: Gross safe liability flows variance decomposition – granular sectors and instruments

	Total	Depo.and Cur.	MMF shares	Bonds
Total Economy	1.01***	0.78***	0.00	0.22***
	(0.00)	(0.04)	(0.00)	(0.04)
1) Real Sector	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)
→ Households	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)
→ Firms	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)
2) Financial Sector	0.63***	0.48***	0.00	0.15***
	(0.04)	(0.03)	(0.00)	(0.04)
→ Banks	0.57***	0.47***	-0.00	0.10***
	(0.03)	(0.03)	(.)	(0.02)
→ Non banks	0.06**	0.01	0.00	0.05**
	(0.03)	(0.01)	(0.00)	(0.03)
3) Public Sector	0.07*	0.09**	0.00	-0.02**
	(0.04)	(0.04)	(.)	(0.01)
→ Government	-0.02***	0.00**	0.00	-0.02***
	(0.01)	(0.00)	(.)	(0.01)
→ Central bank	0.09**	0.09**	0.00	0.00
	(0.04)	(0.04)	(.)	(0.00)
4) RoTW Sector	0.31***	0.22***	0.00	0.09***
	(0.03)	(0.03)	(0.00)	(0.01)

Notes: The variance decompositions are obtained by regressing the total safe asset holdings of all sectors on the safe liabilities of each sector and safe-asset instrument, e.g. bank deposits. The variance shares add up to 1 across sectors and instruments, subject to a small residual (which, for instruments, includes the shares accounted for by gold flows). The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. Standard errors clustered by country and year are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A.3: Variance decomposition of gross safe-asset flows: alternative specifications

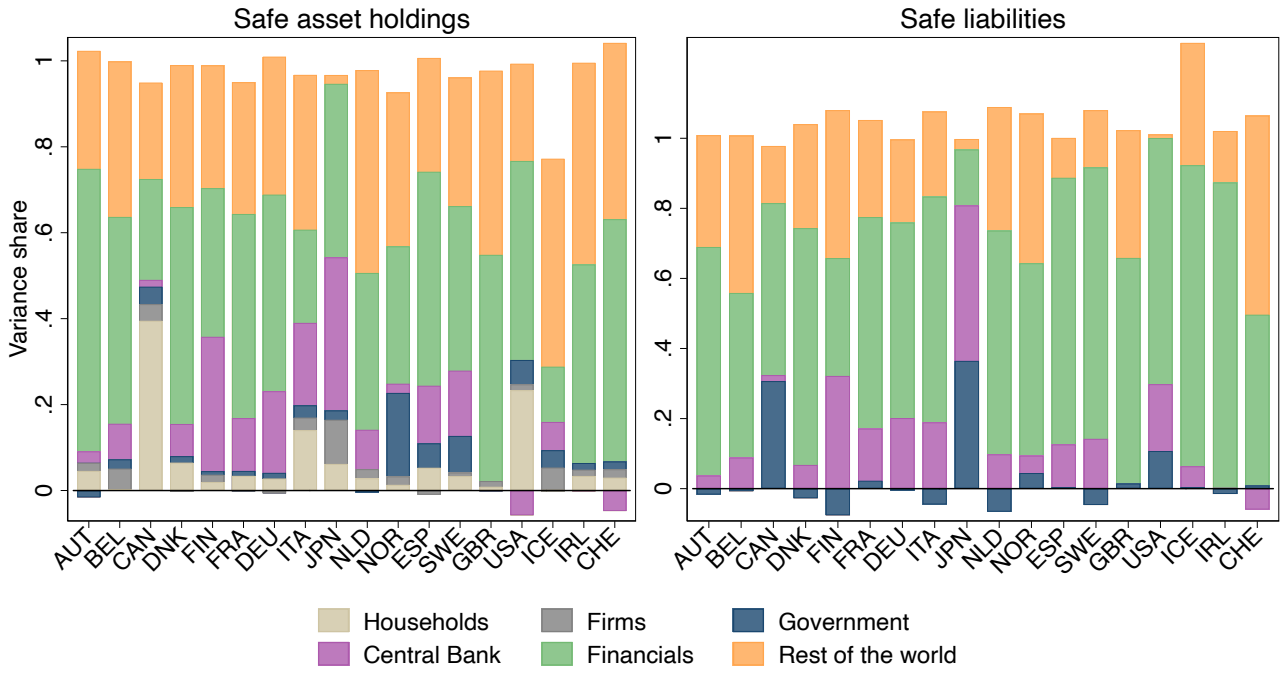
	(1) Households	(2) Firms	(3) Financials	(4) Public sector	(5) RoTW
Safe asset holdings:					
Baseline	0.04***	0.02***	0.44***	0.10***	0.38***
	(0.01)	(0.01)	(0.03)	(0.04)	(0.03)
Controls	0.03***	0.02***	0.45***	0.10***	0.39***
	(0.01)	(0.00)	(0.03)	(0.04)	(0.03)
3-year flows	0.05**	0.02***	0.45***	0.06**	0.40***
	(0.02)	(0.01)	(0.03)	(0.03)	(0.04)
Safe liabilities:					
Baseline	0.00	0.00	0.63***	0.07*	0.31***
	(.)	(.)	(0.04)	(0.04)	(0.03)
Controls	0.00	0.00	0.61***	0.10***	0.31***
	(.)	(.)	(0.04)	(0.04)	(0.03)
3-year flows	0.00	0.00	0.70***	0.02	0.29***
	(.)	(.)	(0.05)	(0.03)	(0.04)

Notes: The variance decompositions are obtained by regressing the total safe asset holdings (liability) flows of all sectors on the safe liability (asset holdings) flows of each sector. The variance shares add up to 1, subject to a small residual. Baseline specification is that in Table 3. The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. "Controls" specification controls for contemporaneous values and two lags of real GDP growth, inflation, and the short-term interest rate. 3-year flow specification uses 3-year instead of 1-year safe-asset flows. Standard errors clustered by country and year are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Figure A.6: Variance decomposition of gross safe-asset flows by country, 3-year flows

Notes: Each shaded bar corresponds to the variance share of 3-year safe-asset flows for the specific sector within a specific country. The safe asset holdings variance decomposition is obtained by regressing the total safe liability flows of all sectors on the safe asset holdings flows of each sector, within each country. The safe liability variance decomposition is obtained by regressing the total safe asset holdings flows of all sectors on the safe liability flows of each sector. The variance shares add up to 1, subject to a residual.

Figure A.7: Variance decomposition of gross safe-asset flows by country, with controls



Notes: Each shaded bar corresponds to the variance share of 1-year safe-asset flows for the specific sector within a specific country, conditional on contemporaneous values and 3 lags of real GDP growth, inflation, and short-term interest rates. The safe asset holdings variance decomposition is obtained by regressing the total safe liability flows of all sectors on the safe asset holdings flows of each sector, within each country. The safe liability variance decomposition is obtained by regressing the total safe asset holdings flows of all sectors on the safe liability flows of each sector. The variance shares add up to 1, subject to a residual.

Figure A.8: Variance decomposition of gross safe-asset flows by decade

Notes: Each shaded bar corresponds to the variance share of 1-year safe-asset flows for the specific sector within a specific decade. The safe asset holdings variance decomposition is obtained by regressing the total safe liability flows of all sectors on the safe asset holdings flows of each sector, within each country. The safe liability variance decomposition is obtained by regressing the total safe asset holdings flows of all sectors on the safe liability flows of each sector. The variance shares add up to 1, subject to a residual. The sample is an unbalanced panel of 15 advanced economies.

B.2 Fluctuations in net safety positions: additional results

Table A.4: Variance decomposition of net safe-asset flows of financials and rest of the world: alternative specifications

	(1) Households	(2) Firms	(3) Public sector	(4) RoTW
Financial sector supply ($-\Delta \text{NSA}^{\text{Financials}}$):				
Baseline	0.19***	0.07***	0.25***	0.46***
	(0.05)	(0.01)	(0.05)	(0.08)
Controls	0.12***	0.05***	0.13***	0.64***
	(0.04)	(0.02)	(0.03)	(0.06)
3-year flows	0.22***	0.08***	0.25***	0.43***
	(0.05)	(0.01)	(0.06)	(0.09)
Rest of the world demand ($\Delta \text{NSA}^{\text{RoTW}}$):				
	(5) Households	(6) Firms	(7) Public sector	(8) Financials
Baseline	-0.03	0.03	0.13	0.88***
	(0.03)	(0.03)	(0.12)	(0.14)
Controls	-0.02	0.04	0.16**	0.83***
	(0.04)	(0.03)	(0.08)	(0.09)
3-year flows	-0.05	0.00	0.13	0.94***
	(0.04)	(0.03)	(0.12)	(0.15)

Notes: The variance decomposition is obtained by regressing the negative of the net safe-asset flows of a sector (financials or rest of the world) on the net safe asset-flows of each of the other sectors (see equations (6) and (7)). The variance shares add up to 1, subject to a small residual. The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. Baseline specification is that in Table 3. "Controls" specification controls for contemporaneous values and two lags of real GDP growth, inflation, and the short-term interest rate. 3-year flow specification uses 3-year instead of 1-year safe-asset flows. Standard errors clustered by country and year are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A.5: Financial safe-asset supply variance decomposition – granular sectors and instruments

	(1)	(2)	(3)	(4)
	Total	Depo. and Cur.	MMF shares	Bonds
Total other sectors	0.97***	0.48***	0.01	0.48***
	(0.01)	(0.05)	(0.01)	(0.04)
1) Real Sector	0.23***	0.16***	0.00	0.07*
	(0.05)	(0.03)	(0.01)	(0.03)
→ Households	0.17***	0.12***	0.00	0.05
	(0.05)	(0.03)	(0.01)	(0.03)
→ Firms	0.06***	0.04***	0.00	0.02**
	(0.02)	(0.01)	(0.00)	(0.01)
2) Public Sector	0.24***	0.06***	0.00	0.18***
	(0.06)	(0.02)	(0.00)	(0.06)
→ Government	0.25***	0.02**	0.00	0.22***
	(0.06)	(0.01)	(0.00)	(0.05)
→ Central bank	-0.01	0.04*	0.00*	-0.04**
	(0.01)	(0.02)	(0.00)	(0.02)
3) RoTW Sector	0.50***	0.25***	0.00	0.24***
	(0.08)	(0.06)	(0.00)	(0.07)

Notes: The financial supply variance decomposition is obtained by regressing the net safe liability flows (safe liabilities minus safe assets) of the financial sector on the net safe asset flows (safe assets minus safe liabilities) of each of the other sectors, for each safe-asset instrument. Depo. and Cur. stands for deposits and currency, RoTW for rest of the world. The variance shares add up to 1 across sectors and instruments, subject to a small residual (which, for instruments, includes the shares accounted for by gold flows). The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. Standard errors clustered by country and year are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A.6: Rest-of-the-world safe-asset demand variance decomposition – granular sectors and instruments

	(1)	(2)	(3)	(4)
	Total	Depo. and Cur.	MMF shares	Bonds
Domestic Economy	1.01***	0.44***	0.01	0.56***
	(0.02)	(0.08)	(0.00)	(0.09)
1) Real Sector	0.00	-0.02	0.01	0.01
	(0.05)	(0.03)	(0.01)	(0.03)
→ Households	-0.03	-0.04*	0.01	0.00
	(0.03)	(0.02)	(0.00)	(0.02)
→ Firms	0.03	0.02	0.00	0.01
	(0.03)	(0.02)	(0.00)	(0.01)
2) Financial Sector	0.88***	0.47***	-0.00	0.40***
	(0.14)	(0.07)	(0.01)	(0.13)
→ Banks	0.73***	0.58***	0.00	0.15***
	(0.14)	(0.10)	(0.00)	(0.05)
→ Non banks	0.15	-0.10*	-0.00	0.25**
	(0.09)	(0.06)	(0.01)	(0.10)
3) Public Sector	0.13	-0.02	-0.00	0.14
	(0.12)	(0.02)	(0.00)	(0.11)
→ Government	0.11	0.01	-0.00	0.10
	(0.11)	(0.01)	(0.00)	(0.10)
→ Central bank	0.02	-0.02	-0.00	0.04*
	(0.01)	(0.02)	(0.00)	(0.02)

Notes: The rest-of-the-world demand variance decomposition is obtained by regressing the net safe-asset flows (safe assets minus safe liabilities) of the rest of the world sector on net safe liability flows (safe liabilities minus safe assets) of each of the other sectors, for each safe-asset instrument. Depo. and Cur. stands for deposits and currency. The variance shares add up to 1 across sectors and instruments, subject to a small residual (which, for instruments, includes the shares accounted for by gold flows). The sample is an unbalanced panel of 15 advanced economies over years 1960 to 2018. Standard errors clustered by country and year are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

C The market for safety and macro-financial stability: additional results

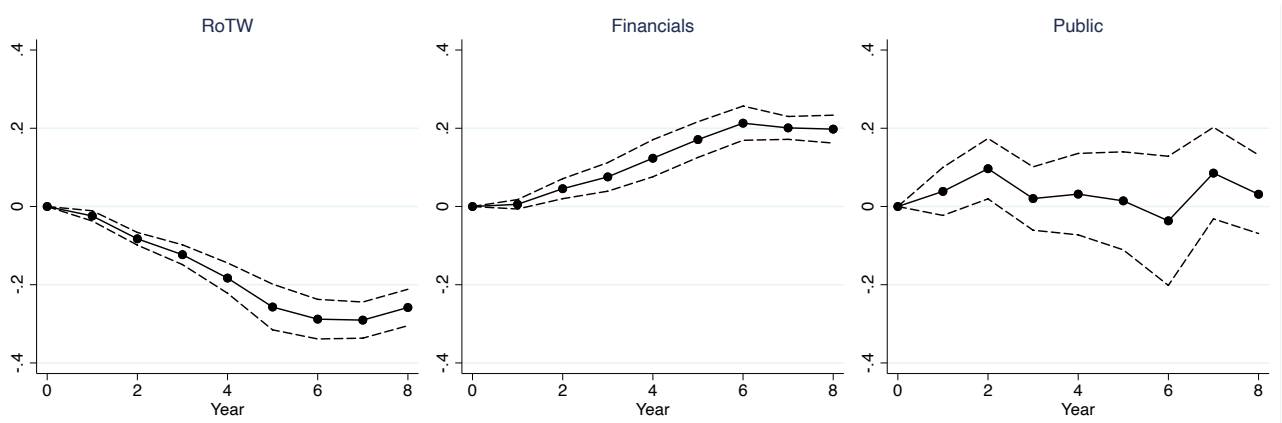
Table A.7: Net sectoral safe-asset flows and subsequent output dynamics, excluding financial centers

	Dependent variable: real GDP growth$_{t \text{ to } t+3}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Δ_3NSA RoTW$_{i,t-1}$	-0.12***	-0.10***				
	(0.02)	(0.03)				
Δ_3NSA Financials$_{i,t-1}$			0.11***	0.11***		
			(0.01)	(0.01)		
Δ_3NSA Public$_{i,t-1}$					-0.01	-0.01
					(0.02)	(0.02)
R^2	0.596	0.608	0.599	0.605	0.551	0.583
Country FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Base controls	✓	✓	✓	✓	✓	✓
Additional controls		✓		✓		✓
Observations	311	311	311	311	311	311

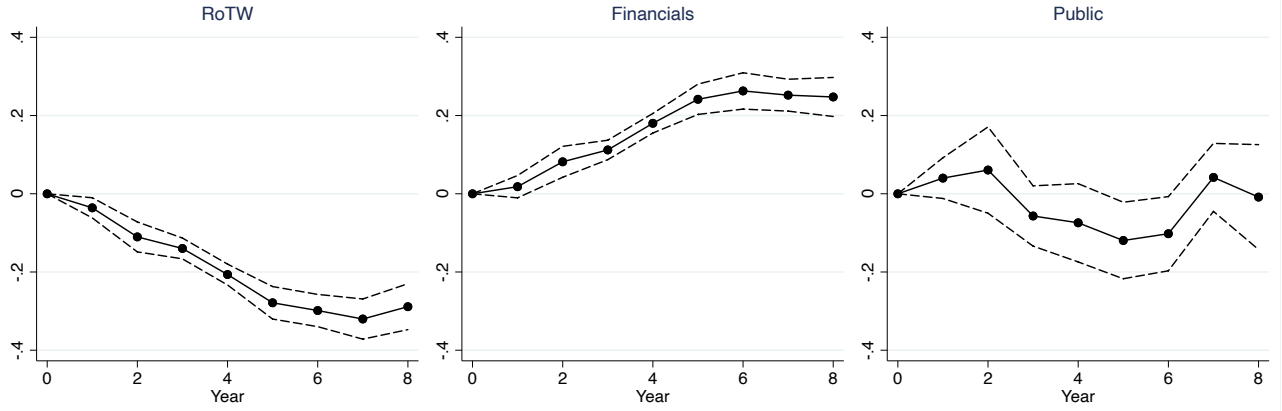
Notes: The sample excludes Ireland, Iceland, Switzerland, the Netherlands, and the United Kingdom. The dependent variable is the change in log real GDP between t and $t+3$. Explanatory variables are changes in the ratio of the respective variable (in rows) and GDP between $t-4$ and $t-1$. Base controls include three lags of GDP growth, inflation, short-term interest rates, and the financial crisis dummy. Additional controls include the three-year change in net foreign assets to GDP, household credit to GDP and business credit to GDP. Country and year fixed effects included. Driscoll-Kraay standard errors (5 lags) in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Figure A.9: Net sectoral safe-asset flows and future GDP growth: local projections

(a) Baseline controls:



(b) Additional controls:



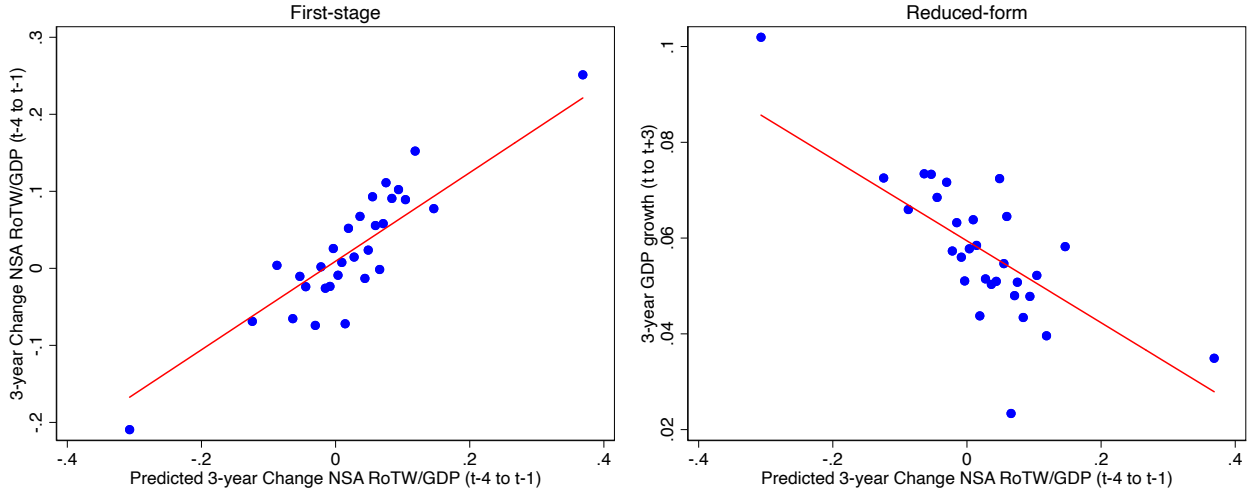
Notes: Local projections for real GDP growth (in percentage points) at horizons $h = 1, ..., 8$ years ahead, following a 1% GDP change in net safe asset flows of a given sector. Top panel controls for current levels and four lags of GDP growth, inflation, policy rate changes and the financial crisis dummy, as well as country and year fixed effects. Bottom panel additionally includes changes in net foreign assets, household credit, and firm credit relative to GDP. 95% confidence intervals are computed based on Dricoll-Kraay standard errors (ceiling (1.5×h) lags).

We estimate local projections (Jordà, 2005) to characterize the dynamics of output following net safe asset flows across economic sectors

$$\Delta_h y_{it+h} = \alpha_{i,h} + \alpha_{d,h} + \sum_{j=0}^{4} \beta_{h,j}^{sector} \ \Delta NSA_{it-j}^{sector} + \sum_{j=0}^{4} \beta_{h,j}^{y} \ \Delta y_{it-j} + \gamma_h X_{it} + \epsilon_{it+h} \,, \tag{11}$$

where $\Delta_h y_{it+h} = y_{it+h} - y_{it}$ is the growth of log real GDP for $h = 1, ..., 8$. ΔNSA_{it}^{RoTW}, e.g., denotes the yearly net safe asset flow of the RoTW sector relative to GDP. We will be interested in the $\beta_{h,0}$ coefficients for each of the three sectors. The specifications control for contemporaneous GDP growth as well as four lags of GDP growth and of the net safe asset flow variables, country and year fixed effects. Additionally, we include the contemporaneous values and four lags of changes in policy rates, inflation and banking crisis dummies in $X_{i,t}$. The bottom panel graphs additionally control for changes in the net foreign asset position, household credit and firm credit, all relative to GDP and include year fixed effects.

Figure A.10: Binscatters for IV first-stage and reduced-form relationships



Notes: Binned scatter plots, 50 bins. The left panel shows the first-stage relationship between three-year changes in cumulated holdings of foreign exchange reserves of China, Taiwan, Hong Kong, Singapore and Korea relative to world GDP (both in USD), and the three-year change in the rest-of-the-world sector net safe-asset position. The right panel shows the reduced-form relationship between changes in these FX reserve holdings and subsequent GDP growth. Both graphs show the residual relationship after controlling for lags of GDP growth, inflation, policy rate changes, and the banking crisis dummy.