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Tracking Global Demand for Advanced Economy Sovereign Debt

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This paper proposes a methodology for compiling internationally comparable estimates of investor holdings of sovereign debt. Based on this methodology, it introduces a data set for 24 major advanced economies that tracks sovereign debt holdings on a quarterly basis over 2004–11. The increased reliance on foreign investors by most sovereign borrowers may have helped reduce their borrowing costs, but it can imply higher future refinancing risks. Meanwhile, advanced economy banks' exposure to their own government debt has begun to increase after the global financial crisis, strengthening sovereign-bank linkages. [JEL F3, G01, G11]
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There has been a lot of discussion about how the *supply* of sovereign debt changed after the global financial crisis. Compilation of a comprehensive historical public debt database (Abbas and others, 2010) reflects such renewed interest in public debt. Yet, less attention has been paid to how the *demand* side has been changing. The general government gross debt of advanced economies

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increased rapidly from 74 to 105 percent of GDP over 2007–11. Based on latest IMF World Economic Outlook (WEO) projections, it will stabilize at around 110 percent of GDP in 2014. Similar statistics on the demand for sovereign debt are harder to come by, in particular regarding the holders of the debt and how they are changing their allocations. Yet, as recently witnessed in a number of euro area countries, shifts in the investor base for sovereign debt can have significant effects on government borrowing costs, as well as market access, even in the absence of material changes in the outstanding supply of government debt.

The lack of internationally comparable investor base estimates hinders the analysis of demand-side dynamics for sovereign debt, in particular for cross-country analysis. Having a cross-country view of the sovereign investor base is essential for understanding demand dynamics, as changes in the country allocations of international investors affect many countries at the same time, with some losing and some gaining an important source of demand. Similarly, only internationally comparable data allow us to aggregate investor flows across countries to examine changes in the asset allocation of international investors.

However, current existing data sources do not provide an integrated view of the changes in the global demand for government debt across a wide range of countries. There are a number of reasons why obtaining data and information on the sovereign debt investor base is challenging. In particular, various dimensions of government debt (institutional coverage of government, instruments coverage of debt, valuation of debt securities, and consolidation of intragovernment holdings) are often not consistently treated in standard data sources and make a significant difference (Dippelsman, Dziobek, and Gutiérrez Mangas, 2012). For example, investor base data available from national debt management offices (DMOs) are not always comprehensive as they usually cover only a subset of government debt (for example, central government); national flow of funds data are not always internationally comparable; and data from private sector vendors (for example, survey or custodial data) usually cover only a small share of the investor base.[1]

Against this background, this paper takes a step toward filling this data gap by compiling a comprehensive investor base data set for advanced economies. To this end, the paper introduces a data set with the following characteristics: First, a common definition of sovereign debt is used (general government gross debt on a consolidated basis). Second, a common estimation methodology is used to ensure cross-country comparability based on harmonized international data sources, such as the Bank for International Settlements (BIS), IMF, and World Bank. Third, all data are compiled either in face value or adjusted for valuation changes, where appropriate, to track investor transactions as well as holdings. Fourth, foreign investor holdings are estimated separately for the foreign official

[1]Following the euro area debt turmoil, several studies attempted to construct cross-country sovereign investor base data sets. Among others, Andritzky (2012) compiled unconsolidated government bond investor base data for 14 advanced economies based on national sources. However, the coverage of government and debt instruments as well as valuation conventions differed in this data set. Merler and Pisani-Ferry (2012a) collected a similar data set for 11 euro area countries and the United States with similar inconsistencies.

sector, foreign banks, and foreign nonbanks, in contrast to national data sources that usually classify them under one category ("rest of the world").[2] Fifth, the data set covers 24 countries that make up 98 percent of the general government debt of all advanced economies and can, therefore, provide a comprehensive view of the global demand for advanced economy sovereign debt.[3] Finally, as it is typical when attempting such a large-scale effort, a number of assumptions must be made in the compilation because of data limitations. We have tried our best to minimize those assumptions by making sure we use comprehensive and comparable data source, but those that could not be avoided are listed transparently in the section "Limitations and Extensions."

Based on this data set, the paper examines how investors changed their holdings of advanced economy sovereign debt after the global financial crisis, including during the recent euro area debt turmoil. Although recent changes in the sovereign investor base for euro area countries have been widely discussed (Lojsch, Rodríguez-Vives, and Slaví, 2011; Andritzky, 2012; IMF, 2012; Merler and Pisani-Ferry, 2012a), this paper tries to provide a more comprehensive view across all advanced economies in the postcrisis period. In doing so, this paper also examines how changes in the investor base of euro periphery countries may be linked to the investor flows to other advanced economies ("safe haven flows"). Further, this paper also analyzes how advanced economy banks are changing their exposures to their own government debt.

There are at least three reasons why the composition of sovereign debt investor base matters: shifts in the sovereign debt investor base can affect (i) governments' borrowing costs; (ii) governments' refinancing risks; and (iii) can create potentially harmful sovereign-bank linkages and threaten domestic financial stability to the extent that domestic banks become highly exposed to own government debt. In addition, the diversity of the investor base can matter for market liquidity and liability management operations in government debt markets. Below, we discuss each one of these in more detail and highlight how our paper and data set can contribute to several strands of the literature.

Borrowing Costs

Shifts in the composition of the investor base can have significant implications for governments' borrowing costs. As new investors, such as foreign or institutional investors, join the investor base, demand for government debt can increase (either

[2]The U.S. Treasury International Capital (TIC) reporting system data trace the U.S. Treasury securities holdings of foreign private and official investors, but no such country-specific data are available for other countries. The IMF Currency Composition of Official Foreign Exchange Reserve (COFER) data track investments of foreign central banks, but the data are limited to countries of major currencies.

[3]Although the data set is compiled for advanced economies, the methodology can be extended to emerging markets, with a few modifications (Arslanalp and Tsuda, 2014). In this paper, we focus on advanced economies to avoid a number of technical issues, such as exchange rate valuation adjustments, and to examine asset allocation decisions of a common class of sovereign debt investors that are traditionally interested in interest-rate risk, not credit risk.

at the auction or the secondary market) and the government's borrowing costs can decline. Several studies show that an increase in the share of foreign investors or domestic institutional investors in the investor base is associated with lower sovereign bond yields. Bernanke (2005) has attributed some of the decline in the U.S. long-term real interest rates since 2000 to a "global savings glut." Warnock and Warnock (2009) have conducted a quantitative assessment that shows foreign purchases of U.S. Treasury securities have had an economically large and statistically significant impact on U.S. long-term interest rates in the 2000s. De Santis (2012) has argued that global risk aversion and safe haven flows have increased the demand for German Bunds after 2008, affecting pricing of all euro area government bond spreads. Greenwood and Vayanos (2010) have shown that U.K. long-term interest rates experienced large and long-lasting shifts after the U.K. Pensions Act of 2004 created strong incentives for domestic pension funds to buy more government bonds.

At the same time, only a few studies have tried to analyze the implication of investor base on government borrowing costs from a cross-country perspective, mainly due to lack of comparable data. Andritzky (2012), based on national data sources from 11 G20 advanced economies and euro area countries, has found that increases in the share of government bonds held by institutional investors or nonresidents were associated with reduced sovereign bond yields. Peiris (2010), based on a similar study for 10 emerging market economies, has found similar results regarding foreign participation in local-currency government bond markets. However, these studies lack a consistent cross-comparable data set on debt and on investor holdings. One of the aims of this paper is to lift this limitation and facilitate more cross-country studies on the links between investor holdings and sovereign bond yields.

Refinancing Risk

Although it may be a sign of confidence, a rising share of foreign investors in the investor base can also heighten governments' refinancing risk. Foreign investors, in particular foreign private investors, could be a less stable source of demand, given the broader pool of assets they can invest in. As a result, they may be less willing to roll over (or more likely to sell) their holdings when the sovereign experiences a confidence shock. Some countries may also be hit by sudden stops in foreign funding simply as a result of increased global risk aversion (Calvo and Talvi, 2005). Regardless of the reason (country-specific or global), a rising share of foreign investors in the investor base can increase the exposure of a sovereign to refinancing risk. This is one reason why public debt managers pay special attention to foreign investor relations (Blommestein, Harwood, and Holland, 2011; IMF, 2011a).

These issues have been studied for emerging markets within the sudden stop literature, but the focus has recently shifted to advanced economies. The sudden stop literature for emerging markets goes back to Dornbusch and Werner (1994), Calvo (1998), and Calvo, Izquierdo, and Mejía (2004). These papers and their extensions have shown that emerging markets can be vulnerable to bouts of market volatility. Foreign investors often pull sudden stops—they stop rolling over or start

selling off their debt holdings. However, it has become apparent in recent years that advanced economy government bond markets can also experience investor outflows, and associated runs. In this respect, this paper provides a cross-comparable data set on foreign holdings of government debt that can help expand the analysis from emerging markets to advanced economies. Tracking who owns what—especially among private and official foreign institutions—can shed some light on potential risks in advanced economies' government debt markets, just as they can for emerging market economies.

Domestic Financial Stability

On the other hand, a high share of domestic banks in the investor base may jeopardize domestic financial stability. Domestic banks, being leveraged investors, have the ability to take up significant amounts of government debt, especially when other investors are selling. During the euro area debt turmoil, domestic banks in a number of countries have indeed been significant buyers of government debt when foreign investors have fled the market. However, rising bank holdings of own government debt may pose another type of risk, that is the risk to domestic financial stability stemming from a strong two-way interdependence between the sovereign and domestic bank balance sheets (BIS, 2011). Specifically, market concerns about sovereign risk could quickly undermine confidence in banks, and thus threaten domestic financial stability, if banks hold large amounts of government debt or their funding costs are closely tied to sovereign yields. In turn, domestic banks may require sovereign support, which could further elevate the sovereign-bank interdependence. Owing to these negative feedback loops, a large concentration of government bond holdings in domestic banks is a potential risk to domestic financial stability. In the extreme case, a high interdependence between the sovereign and banks may even lead to a self-fulfilling debt crisis (Adler, 2012).[4]

Sovereign-bank interdependence and its financial stability concern have been analyzed most recently in the context of the euro area debt turmoil. Several studies have shown that euro area banks are at more risk of instability due to their higher exposures to own government debt and other euro-area-specific sovereign-bank interdependencies (Acharya, Drechsler, and Schnabl, 2011; De Grauwe, 2011; Merler and Pisani-Ferry, 2012b). At the same time, this interdependence is not a specific feature of the euro area. In that context, one of the contributions of the paper is to provide a more global perspective on the issue of sovereign-bank interdependence based on a cross-comparable data set on domestic bank holdings of own government debt.

Other

The composition of the investor base, in particular its diversity, can have other important implications. A diverse investor base, reflecting different investor

[4]Apart from these feedback loop effects between banks and their own sovereign, the health of the domestic banking sector could be influenced by cross-border spillover effects, if the domestic banking sector holds a significant amount of debt of high-risk foreign sovereigns.

Table 1. Sample of Countries

Australia	Finland	Japan	Slovenia
Austria	France	Korea	Spain
Belgium	Germany	the Netherlands	Sweden
Canada	Greece	New Zealand	Switzerland
Czech Republic	Ireland	Portugal	United Kingdom
Denmark	Italy	Norway	United States

characteristics in terms of risk tolerance and trading motives, may increase the liquidity of government debt securities in the secondary market (World Bank and IMF, 2001). Markets may better reflect sovereign credit risk with a large and diverse investor base (Ejsing, Grothe, and Grothe. 2012). At the same time, a more concentrated investor base, in terms of the number of creditors holding the debt, may facilitate easier liability management operations in government debt markets (Das, Papaioannou, and Trebesch, 2012).

The focus of the paper is on the implications of changes in sovereign investor base for governments' refinancing risks and domestic financial stability. The first issue (that is, the relationship between the investor base and sovereign borrowing costs) has been explored in various studies.[5] On the other hand, the importance of the other two issues (that is, the relationship between the investor base and the government's refinancing risk and domestic financial stability) was highlighted only after the recent financial crisis, in particular for advanced economies. Hence, the focus of the paper is on these two issues, which are of particular importance for public debt management and financial sector supervision. Finally, the paper does not deal with diversity of the investor base or debt sustainability issues.

The rest of the paper is organized as follows. Section I describes the methodology and data sources used to compile our investor base estimates. Section II highlights the main trends we identify in the data set, in particular in terms of their impact on refinancing risk and domestic financial stability. The final section examines some of the policy implications of our findings for public debt management, financial stability, and sovereign risk measurement.

I. Methodology for Sovereign Investor Base Estimates

Methodology

This section explains the methodology and data sources used to compile our investor base estimates. The estimates are compiled on a quarterly basis and cover the period from 2004 to 2011 for 24 major advanced economies. The sample covers U.S.$42 trillion of government debt and represents 98 percent of the general government debt of all advanced economies as of end-2011, based on the October

[5]Recently, there has also been interest in portfolio balance models of government debt to explain how central bank quantitative easing policies are affecting interest rates. Addressing these issues, which requires empirically identifying the demand function for government debt, is beyond the scope of this paper.

Table 2. Summary of Data Sources

	Primary Data Sources	Coverage, by Sector	Coverage, by Instrument	Valuation
Total debt[1]	Eurostat, *Government Financial Statistics*	General Government	Currency and Deposits; Loans; Securities	Country practices differ (see Table 4)
Foreign Holders[2]	IMF/World Bank, *Quarterly External Debt Statistics (QEDS)*	General Government	Loans and Securities	Country practices differ (see Table 4)
Foreign Banks	BIS, *International Banking Statistics*	General Government	Loans and Securities	Country practices differ (see Table 4)
Foreign Official: Foreign Central Banks[3]	IMF, *Currency Composition of Official Foreign Exchange Reserves (COFER);* IMF, *Coordinated Portfolio Investment Survey (CPIS)*	General Government	Securities	Market value
Foreign Official: Securities Markets Program (SMP)	ECB, *Eurosystem Financial Statements*	General Government	Securities	Acquisition value
Foreign Official: Official Loans	IMF/World Bank, *Quarterly External Debt Statistics (QEDS)*	General Government	Loans	Face value
Domestic Banks	IMF, *International Financial Statistics* (IFS)	General Government	Loans and Securities	Country practices differ (see Table 4)
Domestic Central Bank	IMF, International Financial Statistics (IFS)	General Government	Loans and Securities	Country practices differ (see Table 4)

[1]For Australia, Canada, Japan, Korea, New Zealand, and the United States, we rely on national flow of funds data to construct the data series for consolidated general government debt (Table 3).

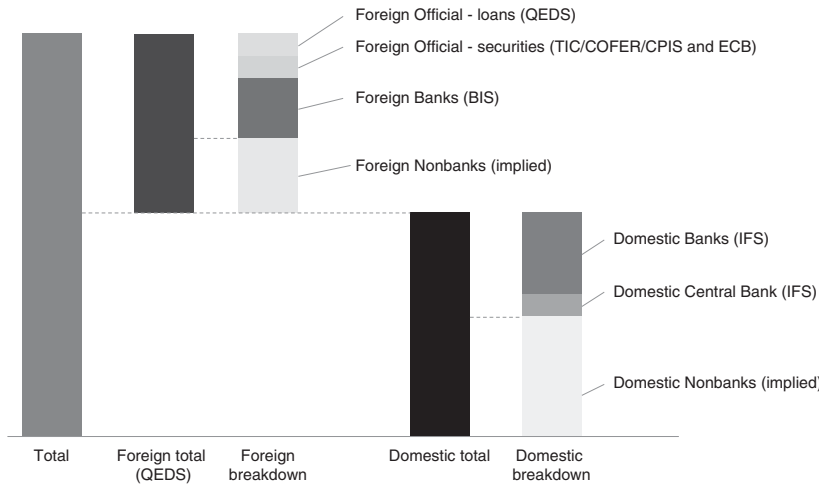
[2]New Zealand does not provide data to the QEDS, necessitating data extraction from Reserve Bank of New Zealand ("Table D0: New Zealand Government Securities Held for Non-residents").

[3]For the United States, we rely on U.S. Treasury International Capital (TIC) reporting system.

2012 IMF World Economic Outlook (WEO) figures. Table 1 provides the list of countries in our data set. Table 2 provides a summary of the data sources used in the compilation of our estimates. Figure 1 provides an overview of our estimation methodology. The data set is publicly available and regularly updated (www.imf.org/external/pubs/ft/wp/2012/Data/wp12284.zip).

Throughout the exercise, we use a common definition of government debt—general government gross debt on a consolidated basis. General government gross debt covers the debt of the central government, local and state governments, and social security funds. When it is consolidated, all intragovernmental holdings, such as central government debt held by social security funds, are netted out. Our definition of government debt includes three types of financial instrument: currency

Figure 1. Summary of Methodology



Source: Authors' methodology.
Note: Dotted lines lead to calculation of implied values.

and deposits; securities other than shares; and loans.[6] This definition does not include other types of government liabilities, such as accounts payable, insurance and pension reserves, or social security obligations.[7] Government liabilities in the form of financial derivatives or government guaranteed debt are not part of government debt either. Finally, all debt figures are expressed in face value and on a gross basis.[8] For European Union (EU) countries, this definition matches with the definition of "Maastricht debt," which is used for one of the euro convergence criteria. The data on Maastricht debt are readily available from Eurostat's Quarterly Government Finance Statistics.[9] For others, they are constructed from national flow of funds data using the same definition of government debt (Table 3).

We adopt a common definition of debt in order to facilitate international comparability and to avoid institutional differences across countries in intragovernmental

[6]Currency and deposits mainly represent saving certificates and retail bonds that can be redeemed before maturity, and are generally a relatively small share of total debt for most advanced economies. They are usually included in short-term debt unless detailed information is available to make the short-term/long-term attribution.

[7]For some countries, these types of liabilities can account for a significant portion of government debt. For example, in Italy accounts payable in the forms of government obligations to Italian firms amounted to €95 billion (about 5 percent of general government debt) at end-2012. Some countries can also have large future pension fund liabilities, but there is no internationally agreed method of accounting for these obligations.

[8]Although some countries may use the "net debt" concept by subtracting various types of financial assets from gross debt, there is no internationally recognized common definition of net debt.

[9]Norway and Switzerland also provide government debt figures consistent with the definition of "Maastricht debt." The data for Switzerland are on an annual basis, so quarterly figures are interpolated.

Table 3. Construction of General Government Gross Debt on a Consolidated Basis for Non-European Countries, end-2011

	Currency and Deposit	Loans	Securities	Total
		(in billions of local currency)		
Australia[1]	3	25	461	489
Canada[2]	5	26	1,206	1,237
Japan[3]	0	164,123	877,657	1,041,780
Korea[4]	0	7,581	401,829	409,410
New Zealand[5]	0	8	60	67
United States[6]	0	0	12,919	12,919

Sources: National authorities and authors' calculations.

[1]Australian Bureau of Statistics, Financial Accounts, Financial Assets and Liabilities of National, State and Local Governments, and Central Borrowing Authorities (Tables 15, 18, 19). Currency and deposits come from series A3428366R. Loans are calculated as the sum of (i) loans incurred by the national government (A3427856L), excluding those held by state and local governments (A3545161A); (ii) loans incurred by state and local governments (A3430703J and A3428981T), excluding those held by the national government (A3372109A) and central borrowing authorities (A3362881W and A3367426K); and (iii) loans incurred by central borrowing authorities (A3429518J and A3428141A), excluding those held by the national government (A3372634X) and state and local governments (A3374662V and A3545157K). Securities are calculated as the sum of (i) bonds issued by the national government (A3429809J and A3431234W), excluding those held by state and local governments (A3366454A) and central borrowing authorities (A3361453J); (ii) one name paper issued by the national government (A3426527F and A3426221R), excluding those held by state and local governments (A3544923T) and central borrowing authorities (A3371917F); (iii) bonds issued by state and local governments (A3426545K and A3432266J); (iv) one name paper issued by state and local governments (A3424715C and A3426785W); (v) bonds issued by central borrowing authorities (A3431996T and A3429233C), excluding those held by the national government (A3369037T) and state and local governments (A3368482W); (vi) one name paper issued by central borrowing authorities (A3431984J and A3427286W); excluding those held by state and local governments (A3361780T); and (vii) bills of exchange issued by the national government (A3429770K), state and local governments (A3428918A), and central borrowing authorities (A3426203K);

[2]Statistics Canada, National Balance Sheet Accounts: Book value, Financial Liabilities of Consolidated General Government: currency and deposits (V52224939), loans (V52224940), short-term paper (V52224942), and bonds (V52224943);

[3]Bank of Japan, Flow of Funds, Financial Assets and Liabilities (Major Sectors and Transaction items), General Government Sector: currency and deposits, securities other than shares, and loans;

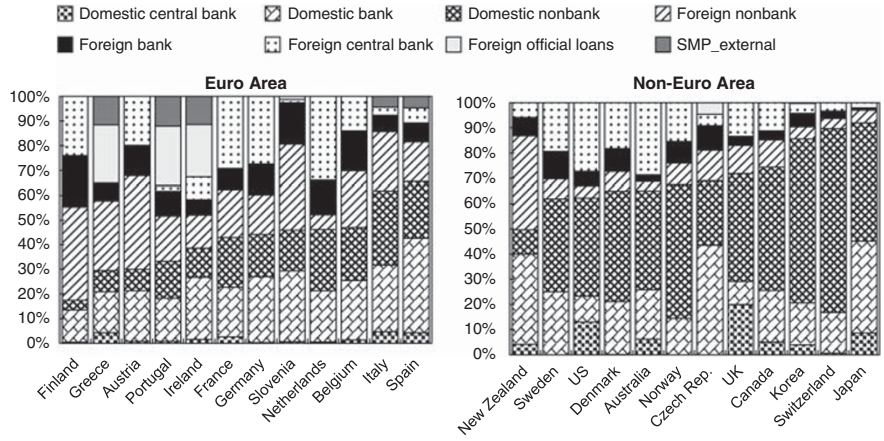
[4]Bank of Korea, Flow of Funds, Financial Liabilities of General Government Sector: currency & deposits, securities other than shares, loans, and other foreign claims and debts;

[5]Reserve Bank of New Zealand, Table D2: Ownership of New Zealand's Government Securities (all government securities on issue excluding those held by public accounts and dependent administrative bodies; accident and superannuation accounts, earthquake commission; and local authorities and public administrative organisations); and Statistics New Zealand, Local Government Statistics;

[6]U.S. Federal Reserve, Flow of Funds, Consolidated Statement for Federal, State, and Local Governments (Table L.105.c).

relations. Taking general government debt as a whole avoids inconsistencies because of country-specific institutions and circumstances. For example, estimates on central government debt alone can be sensitive to intragovernmental transfer arrangements; in some countries, central government borrowing agencies issue securities on behalf of local governments (the Netherlands), while in others local governments issue their own debt (the United States). Similarly, focusing solely on securities would miss the fact that loans are now a large part of the debt stock for a number of advanced economies

Figure 2. Advanced Economies: Holders of Government Debt, end-2011



Source: Authors' calculations.

Note: Government debt indicates general government gross debt on a consolidated basis, which excludes intergovernmental holdings. Domestic banks are depository corporations residing in the country (IFS definition). Foreign banks are BIS reporting banks residing outside the country. Foreign central bank indicates government debt holdings as foreign exchange reserves. SMP_external indicates SMP holdings of foreign central banks. Foreign nonbanks and domestic nonbanks are imputed from external and total debt.

(Greece, Ireland, and Portugal). Finally, we look at loans and securities together because investors would, in principle, make investment decisions based on the totality of their sovereign exposure, not just the securitized or the marketable part.

The investor base for each country's government debt is decomposed into six investor classes—domestic central bank; domestic banks; domestic nonbanks; foreign official sector; foreign banks; and foreign nonbanks. Banks comprise depository corporations other than central banks, based on the definition used in the IMF's International Financial Statistics (IFS). Nonbanks include institutional investors other than banks (insurance companies, pension funds, and investment funds), as well as households and nonfinancial corporations.[10] The foreign official sector includes foreign central banks and other foreign official creditors. Figure 2 shows the estimated holdings of these investors for our sample countries, as of end-2011.

We ensure that all debt holdings, in particular securities holdings, are compiled either in face value or adjusted for valuation changes, where appropriate. In most international data sources, such as external debt statistics, the BIS international banking statistics, and the IFS, it is recommended that tradable securities are, in

[10]Although household or nonfinancial corporate holdings of government debt account for a sizable portion of nonbanks in some countries (Italy and the United Kingdom), institutional investors usually make up the bulk of nonbank holdings. At end-2010, assets under management of institutional investors in advanced economies amounted to U.S.$70 trillion, of which U.S.$25 trillion belonged to investment funds, U.S.$23 trillion belonged to insurance companies, and U.S.$21 trillion belonged to pension funds, according to OECD estimates.

Table 4. Valuation of Debt Securities in Various Databases[1]

	Domestic Bank/Domestic Central Bank	Foreign Bank	External Debt
Data sources	*IFS / National Sources*	*BIS*	*QEDS*
Australia	Book value	Book value	Market value
Austria	Market value	Book value	Market value
Belgium	Book value	Book value	Market value
Canada	Book value	Book value	Face value
Czech Republic	Book value	NA	Market value
Denmark	Market value	Market value	Market value
Finland	Book value	Book value	Market value
France	Book value	Book value	Market value
Germany	Book value	Book value	Market value
Greece	Book value	Market value	Market value
Ireland	Book value	Book value	Face value
Italy	Book value	Book value	Market value
Japan	Book value	Book value	Market value
Korea	Book value	Book value	Market value
the Netherlands	Book value	Book value	Market value
New Zealand	Book value	NA	Face value
Portugal	Book value	Book value	Market value
Norway	Book value	Book value	Market value
Slovenia	Book value	NA	Market value
Spain	Book value	Book value	Market value
Sweden	Book value	Book value	Market value
Switzerland	Book value	Book value	Market value
United Kingdom	Market value	Market value	Market value
United States	Book value	Book value	Face value

Sources: IMF Dissemination Standards Bulletin Board; BIS Guidelines to International Locational Banking Statistics; and national authorities.

[1] "Book value" indicates an accounting treatment that is based on national accounting standards, which, generally, values the trading portfolio at market value and the banking portfolio at nominal value.

principle, valued at market prices. However, it is also recognized that national accounting rules may require different valuation methods.[11] Based on the metadata available in our data sources, we identify the valuation method used by each country in its reporting, and where appropriate, convert securities holdings in market value to face value (Table 4). This valuation adjustment allows us to track investor flows, as well as their holdings—one of the unique contributions of this data set. Specifically, valuation adjustment for debt securities is done as follows:

- For EU countries, the market-to-face value ratio is calculated by comparing the value of outstanding government securities (excluding financial derivatives) in government financial accounts (market value), available from the ECB, with the

[11] More details on valuation principles for securities can be found in the BIS *Guide to the International Banking Statistics*; IMF *Coordinated Portfolio Investment Survey Guide*; IMF *External Debt Statistics: Guide for Compilers and Users*; and IMF *Monetary and Financial Statistics: Compilation Guide*.

value of outstanding government securities reported under the Maastricht debt definition (face value), available from Eurostat. Where market and face values are available for the debt holdings of subgroup of investors, we calculate investor-specific market-to-face value ratio (Belgium, Italy, the Netherlands, and Portugal). Finally, where transaction data by investor type are available, investor-specific market-to-face value ratios are calculated from estimated face values from transactions (Greece and the United Kingdom).

- For non-EU countries, we use the Barclays Capital Global Treasury Index, which provides both the market and face values of outstanding government debt securities.

Finally, all statistics provided in U.S. dollars are converted into respective national currencies. In particular, BIS international banking statistics and IMF/World Bank Quarterly External Debt Statistics (QEDS) are converted into the respective national currencies using end-quarter exchange rates obtained from the IFS.

Our estimates rely on a number of broadly compatible international data sources. Our primary data sources are the BIS International Locational Banking Statistics, the IMF International Financial Statistics (IFS), and the IMF/World Bank QEDS. All the data sources are based on the same residency principle of the investor, include comparable definitions of general government, and use similar definitions of debt instruments. At the same time, as discussed earlier, the valuation of securities in these data sources may differ, requiring appropriate adjustments.

Estimation Methodology for Each Investor Type

Below we discuss in more detail how we calculate the holdings of various investors:

Foreign Holdings

Foreign holdings are estimated from the IMF/World Bank QEDS database. The QEDS database, launched in 2004, brings together external debt statistics that are compiled by countries that subscribe to the IMF's Special Data Dissemination Standard (SDDS) to provide access to comparable and standardized external debt data. The data are made available on a quarterly basis.[12] Using this database, we estimate foreign holdings as the sum of (i) general government securities (money market instruments; bonds and notes) held externally; and (ii) general government loans held externally, consistent with the definition of debt used in the paper. Since debt securities are recorded at market value in QEDS (except for Canada, Ireland, and the United States), they are converted into face value based on the valuation adjustment discussed earlier (Tables 2 and 4). For New Zealand, which does not

[12]External debt statistics in QEDS can sometimes differ from corresponding figures in national flow of fund (FoF) data. We stick to external debt statistics because these are based on a common compilation methodology (IMF's *External Debt Statistics: Guide for Compilers and Users* published in 2003), while compilation for FoF data differs across countries. Furthermore, external debt statistics do not include financial derivatives in debt statistics, in line with our definition of government debt, while national FoF data may include them.

provide data to the QEDS, external debt estimates are obtained from the Reserve Bank of New Zealand.

Foreign Official Sector Holdings

Foreign official sector holdings consist of (i) government securities held by foreign central banks as foreign exchange reserves; (ii) government securities held by foreign central banks within the Eurosystem as part of the Securities Markets Program (SMP); and (iii) foreign official loans. To be consistent with the residency principle applied throughout this paper, the second item includes only SMP holdings of foreign central banks (that is, excluding domestic central bank holdings of own government securities as part of the SMP).

Foreign Central Bank Holdings

Foreign central bank holdings are estimated in the following manner: For the United States, we use the U.S. Treasury International Capital (TIC) reporting system because it provides the most reliable estimate of foreign official holdings of U.S. government debt, in particular U.S. Treasury securities.[13] For other countries, foreign official holdings are estimated from IMF's Currency Composition of Official Foreign Exchange Reserves (COFER) and Coordinated Portfolio Investment Survey (CPIS) databases. In particular:

- *COFER database*. As of end-September 2012, 34 advanced and 109 emerging and developing economies report the currency composition of their foreign exchange reserves to the IMF COFER database. In terms of size, these represent about half of worldwide foreign exchange reserves. COFER provides quarterly data on the currency breakdown of these "allocated" reserves into five major currencies (USD, EUR, GBP, JPY, and CHF) and "other currencies." We assume that the currency composition of the "unallocated" part is the same as the "allocated" part. We also assume that 80 percent of foreign exchange reserves in a currency consists of government securities of the country/countries issuing that currency.[14] With these assumptions, we estimate foreign central bank holdings of government securities for Japan, Switzerland, and the United Kingdom, and, with additional information from the CPIS database (see below), for the euro area and other advanced economies.
- *CPIS database*. As of end-September 2012, more than 100 economies report to the IMF CPIS database. Table 6 of the CPIS database reports the residency

[13]Although TIC data cover only U.S. Treasury securities, U.S. Federal Reserve flow of funds data indicate that foreign holdings of local and state government debt are relatively small (less than U.S.$90 billion).

[14]Based on *IMF Data Template on International Reserves and Foreign Currency Liquidity* and *IMF CPIS data* during 2008–10, we estimated that, on average, 80 percent of foreign exchange reserves consisted of national debt securities, while the rest comprised currency and deposits with foreign banks and central banks, debts of international institutions, and equities. We also checked this assumption for Spain, which used to provide data on foreign central bank holdings of national debt, and latest official estimates were in line with our estimates.

Table 5. Estimation of Foreign Central Bank Holdings of Government Debt, end-2011 ***(in billions of U.S dollar)***

Countries	Total Foreign Exchange Reserves (COFER)[1]	Sovereign Debt in Foreign Exchange Reserves[2]	Country Share (CPIS)(%)	Country Allocation
Euro	2,553	2,042	99.4	2030
Austria	…	…	3.2	66
Belgium	…	…	3.0	62
Finland	…	…	1.6	33
France	…	…	34.5	705
Germany	…	…	39.8	814
Greece	…	…	0.0	0
Ireland	…	…	0.9	18
Italy	…	…	3.5	72
Netherlands	…	…	9.4	191
Portugal	…	…	0.2	4
Slovenia	…	…	0.0	0
Spain	…	…	3.2	64
Others	546	437	94.7	414
Australia	…	…	35.9	157
Canada	…	…	31.2	136
Czech Rep.	…	…	0.0	0
Denmark	…	…	7.8	34
Korea	…	…	3.1	14
New Zealand	…	…	0.8	3
Norway	…	…	5.2	23
Sweden	…	…	10.6	46

[1]Assuming unallocated foreign exchange reserves have the same currency composition as allocated foreign exchange reserves;
[2]Assuming 80 percent of foreign exchange reserves represent sovereign debt.

of the issuer of debt securities held as reserve assets (including those held by international organizations). We use this information to distribute the COFER data for EUR and "other currencies" to individual euro area and other advanced economies. Table 5 shows this calculation for end-2011.

A final issue regarding our foreign central bank estimates is valuation. The TIC data are a hybrid of market and face value: foreign holdings of Treasury bonds are reported at market value, while those of Treasury bills are reported at face value. Hence, we apply a valuation adjustment only on the Treasury bond component of TIC data. The valuation adjustment for that component is calculated from face value of long-term U.S. government debt securities held by nonresidents (available from QEDS) and market value of long-term U.S. Treasury securities held by foreigners (available from TIC). For COFER/CPIS data, which are reported at market value in line with IMF recommendations for reporting of foreign exchange reserves, we apply the same valuation adjustment applied on total foreign holdings.

Securities Market Program (SMP) Holdings

Euro area government securities held by the Eurosystem central banks for the Securities Market Program (SMP) are relevant for a number of countries (Greece, Ireland, Italy, Portugal, and Spain). The total size of SMP, as a separate item from foreign exchange reserves, can be obtained from the ECB (Consolidated financial statements of the Eurosystem: Asset item 7.1. Securities held for monetary policy purposes). We estimate the country composition of SMP, as its historical time series are not publicly disclosed.[15] First, we assume that SMP purchases were made in proportion to the outstanding Maastricht debt of SMP countries. Then, we estimate the composition of SMP holdings within the Eurosystem by assuming that national central banks participated in the bond purchases in line with their contribution to the capital base of the ECB. Finally, we assume that SMP initially targeted Greece, Ireland, and Portugal (starting from 2010:Q2), and then Italy and Spain (staring from 2011:Q3). Regarding valuation, since SMP holdings are recorded on a cost basis in the financial statements of the Eurosystem, we apply our valuation adjustment to estimate the face value of these holdings.

Foreign Official Loans

Foreign official loans can include official loans from other countries or multilateral loans from international financial institutions (IFIs). In this case, they include EU/IMF program loans for Greece, Portugal, and Ireland after 2010 and project loans for Czech Republic, Greece, Korea, and Slovenia from IFIs, such as the European Investment Bank (EIB) and the World Bank. We rely on external loan statistics in QEDS to capture both types of loans for these countries.[16]

Foreign Bank Holdings

Foreign bank holdings are estimated primarily from BIS International Locational Banking Statistics. Banks resident in 43 countries currently provide these statistics to the BIS (a list of BIS reporting banks is available on the BIS website on *Guidelines to the International Locational Banking Statistics*). These statistics provide creditor-side information on BIS reporting banks' claims on nonresident borrowers, consistent with the residency principle of external debt statistics. However, they do not provide information on the share of external claims on the government sector vs. other nonbank borrowers. To address this data limitation and estimate this share, we use information from the BIS International Consolidated Banking Statistics (on an immediate borrower basis). In particular, foreign banks'

[15]The ECB published, on a one time basis, the country composition of SMP as of end-2012. The figures are available at www.ecb.europa.eu/press/pr/date/2013/html/pr130221_1.en.html. Our estimation approach matches closely the reported figures at end-2012.

[16]For other countries, foreign official loans are negligible or nonexistent. Only for Norway, external loans are large, but those mainly represent repurchase agreements of the Government Pension Fund (SPU) with foreign financial institutions. These are recorded as liabilities of the SPU and hence the general government. The volume of these operations was reduced significantly after the crisis, in particular in 2011.

holdings of government debt are estimated as follows:

$$Foreign\ bank\ holdings = Locational\ claims\ on\ nonbank\ sector * \alpha,$$

where:

Locational claims on the nonbank sector = External positions of reporting banks vis-à-vis, nonbank sector (BIS Locational Banking Statistics Table 6B).

α = Total international claims on public sector on an immediate borrower basis (BIS Consolidated Banking Statistics Table 9 A:G) divided by the sum of total international claims on public sector on an immediate borrower basis and nonbank private sector on an immediate borrower basis (BIS Consolidated Banking Statistics Tables 9 A:G and 9 A:H, respectively).

Although claims on an immediate borrower basis are most comparable to our measure of external debt, the use of Consolidated Banking Statistics in the calculation of the share parameter does not fully comply with the residency principle used in this paper. However, in countries with limited international banking business, there is often little difference between external debt owed to banks based on locational statistics and the same variable based on the international component of consolidated statistics (McGuire and Wooldridge, 2005).

Regarding valuation, BIS recommends that banks report their holdings of loans at face value and securities at market value. However, BIS also recognizes that national accounting rules may require different valuation methods for debt securities. In particular, country practices often make a distinction between the banking book and trading book portfolios for securities holdings, in which the banking book is generally valued at cost or face value and the trading book is valued at market value (a summary of reporting practices by reporting country is available on the BIS website for *Guidelines to the International Locational Banking Statistics*). This presents a challenge for valuation adjustment, because the exact share of debt securities classified in each of these two categories is unknown. However, data provided by the 2011 European Banking Authority stress tests indicate that the share of major European banks' sovereign exposures in the trading book is only about 12 percent (IMF, 2011b). We believe that this may also be broadly reflective of non-European banks. As a result, instead of making an *ad-hoc* valuation adjustment on BIS statistics, we report them as they are, since that would be more appropriate for the loan portfolio as well as the debt securities classified under the seemingly larger banking book.

Foreign Nonbank Holdings

Foreign nonbank holdings are estimated as the difference between total foreign holdings and the holdings of the foreign official sector and foreign banks.

Domestic Investor Holdings

Domestic investor holdings are estimated as the difference between total debt and foreign debt holdings.

Domestic Central Bank And Domestic Bank Holdings

Domestic central bank and domestic bank holdings of government debt are obtained from the IFS, based on gross claims of monetary authorities and "other depository corporations" (IFS definition) on general government, respectively. For a number of countries that do not report these statistics to the IFS, data are collected from national sources (Australia, Canada, Korea, New Zealand, Norway, Switzerland, and the United Kingdom).[17]

In terms of valuation for domestic banks, the treatment is similar to foreign banks. IFS compilation guidelines recommend reporting of bank loans at face value and security holdings at market value. However, country practices differ (Table 4); in particular, similar to BIS statistics, most countries report IFS statistics based on national accounting standards ("book value"), which usually values securities in the trading portfolio at market value and securities in the banking book portfolio at face value. Hence, similar to our treatment of BIS statistics, we do not apply a valuation adjustment on IFS statistics, except for countries that report all securities holdings at market value (Austria, Denmark, and the United Kingdom).

Domestic Nonbank Holdings

Domestic nonbank holdings are estimated as the difference between total domestic holdings and the holdings of domestic banks and the central bank.

Robustness Checks and Adjustments

We undertook the following tests to check the robustness of our estimates, in particular for domestic nonbanks and foreign nonbanks, which are calculated as residuals in our methodology.

Comparison with National Data

If countries publish comprehensive data on holders of government debt, such data can be used for testing the robustness of our estimates. An exact comparison often turns out to be difficult, because national data vary in terms of sector (central or general government), instrument (securities or total debt), and/or valuation (face or market value). Despite these limitations, we compared our estimates with national data for 12 advanced economies.[18] For countries that provide the national data for general government at face value, we were able to do a consistency check. In all

[17]Specifically, we use the following sources for these countries: Australia (Australian Bureau of Statistics, Flow of Funds), Canada (Bank of Canada, Chartered Bank Balance Sheets), Korea (Bank of Korea, Flow of Funds), New Zealand (Reserve Bank of New Zealand, Table D2), Norway (Statistics Norway), Switzerland (Swiss National Bank, Banks in Switzerland), and United Kingdom (Bank of England, MFI Consolidated Balance Sheets). The data for Switzerland are on an annual basis, so quarterly figures are interpolated.

[18]The national data for these countries have been recently collected into a database and made publicly available by Bruegel ("Bruegel database of sovereign bond holdings"), as described in Merler and Pisani-Ferry (2012a).

cases, we found that our estimates, including for domestic nonbanks, were in line with the national data.

Comparison with ECB Statistics on Euro Area Institutional Investors

For euro area countries, we compared our estimates of total nonbank holdings (domestic and foreign) with ECB's *Insurance Corporations and Pension Funds Statistics* and *Investment Fund Statistics* ("ECB data"). This check is important because foreign nonbanks account for a significant share of the investor base particularly in euro area countries (Figure 2). Our comparison suggests that 70 percent of our domestic and foreign nonbank estimates for euro area countries can be explained by the ECB data (the remaining part most likely reflects non-euro area holdings as well as domestic household and nonfinancial corporate holdings, which are not in the ECB data).

Basic Consistency Checks

Finally, we checked the following basic identities. First, we checked whether foreign central bank holding are lower than total foreign holdings of debt securities. This turns out to be the case except for two cases (Australia and Ireland) for several quarters. We adjust these estimates to comply with the general trend in total foreign holdings of debt securities. Second, we check whether foreign bank holdings are less than the difference between total foreign holdings and foreign official holdings. This turns out to be the case except for four cases (Australia, Ireland, Korea, and Switzerland) for several quarters. We adjust these estimates such that the difference between total foreign holdings and foreign official holdings is distributed between foreign banks and foreign nonbanks in line with the ratio in previous quarters for each country. Finally, we check and confirm that domestic nonbank estimates are positive.

Limitations and Extensions

Investor Holdings

Although our estimates of investor holdings are based on an internationally comparable method, like all estimates, they have a number of limitations. These limitations, which are mainly because of data constraints, include:

- *Foreign central bank holdings.* The currency breakdown in COFER data covers only about half of all foreign exchange reserves (we assume the same composition for the other half). Also, we assume foreign exchange holdings in a currency mainly reflect government debt securities of the country/countries issuing that currency.
- *SMP*. The historical series of country decomposition of SMP holdings, as well as its distribution among Eurosystem central banks, is not publicly disclosed. As a result, we make our own estimates based on simplifying assumptions. Our estimates are broadly in line with market estimates and match closely the figures reported by the ECB as of end-2012.

- *Foreign banks*. Our foreign bank estimates partially rely on BIS consolidated banking statistics to gather the share of claims on government within total nonbank claims, as this information is not provided by BIS locational statistics. Effectively, this means our foreign bank estimates may be somewhat overstated for countries with large international financial centers. In a number of such cases, we have made adjustments to our foreign banks holdings, as explained in the section "Robustness checks and adjustments."
- *Foreign and domestic nonbanks*. Foreign and domestic nonbanks are calculated as implied variables in our method, and, as residuals, may include measurement errors. Foreign nonbanks may include holdings of foreign banks residing in countries that do not report locational banking statistics to the BIS (for example, China, Russia), although these are likely to be a relatively small share of the cross-border assets of banks globally.

Investor Transactions

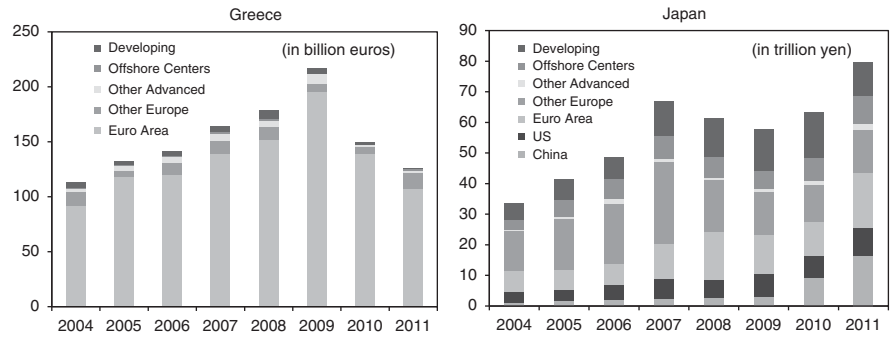
Although our data set is primarily about tracking investor holdings, it can also be used to gather information about investor transactions. In general, changes in investor holdings between two periods are because (i) transactions; (ii) price revaluations; (iii) exchange rate changes (in the case of instruments denominated in currencies other than the local currency); or (iv) statistical reclassifications. Regarding our data set, we believe issues related to (ii), (iii), and (iv) are relatively minor, and, as such, changes in our estimate of investor holdings reflect mainly investor transactions.

However, a few caveats are in order:

- *Price revaluations*. As our estimates are compiled at face value, or converted to face value as appropriate, this issue is, in principle, already addressed by the way we construct our estimates. However, our valuation adjustments should only be seen as a top-down approximation of actual price revaluations in individual portfolios (more accurate estimates would require security-by-security price information). At the same time, in a number of cases when data are available, we tailor our valuation adjustment to different investor classes reflecting differences in the maturities of their holdings, as well as different valuation practices used by countries in different data sources.
- *Exchange rate changes*. Although this is an important issue, in general, we believe it does not pose a significant problem for our sample of advanced economies because most, if not all, of their outstanding debt is denominated in local currency (80 percent or more as of end-2011).
- *Statistical reclassifications*. We are aware of a few important cases of statistical reclassifications in our data sources: For Italy, domestic banks in IFS include a large public financial institution (Cassa Depositi e Prestiti) starting from 2006. The list of BIS reporting banks changed significantly in 2008–09, especially as some large U. S. nonbanks became banks. Canadian banks adopted the International Financial Reporting Standards (IFRS) in 2011.There could be other cases.[19]

[19]A more comprehensive list of statistical reclassifications can be found directly from our data sources.

Figure 3. Foreign Holdings of Government Debt by Country of Origin, 2004–11[1,2]



Sources: IMF CPIS and authors' calculations.
[1]Excluding foreign official loans and SMP holdings of foreign central banks.
[2]Regional groups are based on country classifications of BIS international banking statistics.

Investor Holdings by Country of Origin

Finally, our data can be extended to estimate the country of origin of investor holdings. Although we do not directly address this issue in this paper, we can also make rough estimates of the country of origin of investments in the general government debt markets using our data set and the CPIS database on portfolio holdings. For that, we assume that the country of origin of general government debt investors is in line with the country of origin of all external debt holders. The higher the percentage of government debt in external debt, the more plausible this assumption is and the more reliable our method. For illustration, Figure 3 shows country decompositions for investors of general government debt for Greece and Japan, where this assumption should hold well, as government debt in external debt is more than 90 percent for these countries. Examining investors' country of origin can help in assessing spillover channels (for example, euro area holdings of Greek debt), as well as emerging financial linkages between countries (for example, Chinese investment in Japan).[20]

II. Key Trends in The Postcrisis Period

In this section, we explore how demand for advanced economy sovereign debt has changed after the global financial crisis. In particular, we explore two main questions based on the issues raised in the first section: (i) How did foreign demand for government debt, and the related refinancing risk, change for advanced economies?

[20]At the same time, these estimates cannot attribute country origin with complete accuracy, in particular if a security is purchased by a foreign investor and held in a custodial account in another country, say, an offshore center. Put differently, these estimates reflect exposures on an *immediate borrower*, not *ultimate risk*, basis.

(ii) How did changes in demand from domestic banks for own government debt affect bank-sovereign linkages and what are the implications for domestic financial stability? More specifically:

Government Refinancing Risk

- Once government debt of some advanced economies lost the perception of being risk-free, how did foreign investors change their portfolio allocations? Which countries, both in the euro area and the non-euro area, had large inflows and outflows?
- Were there differences among foreign investors in their portfolio reallocation? Specifically, how did the investment decisions of foreign central banks, foreign banks, and foreign nonbanks vary?

Domestic Financial Stability

- In countries where foreign demand dried up, how did domestic investors respond? Were there differences between domestic banks and nonbanks in their ability to "take up the slack"?
- More generally, for all advanced economies, how is domestic banks' demand for own government debt changing in the postcrisis period? Are there signs of rising sovereign-bank linkages? What are the implications for domestic financial stability?

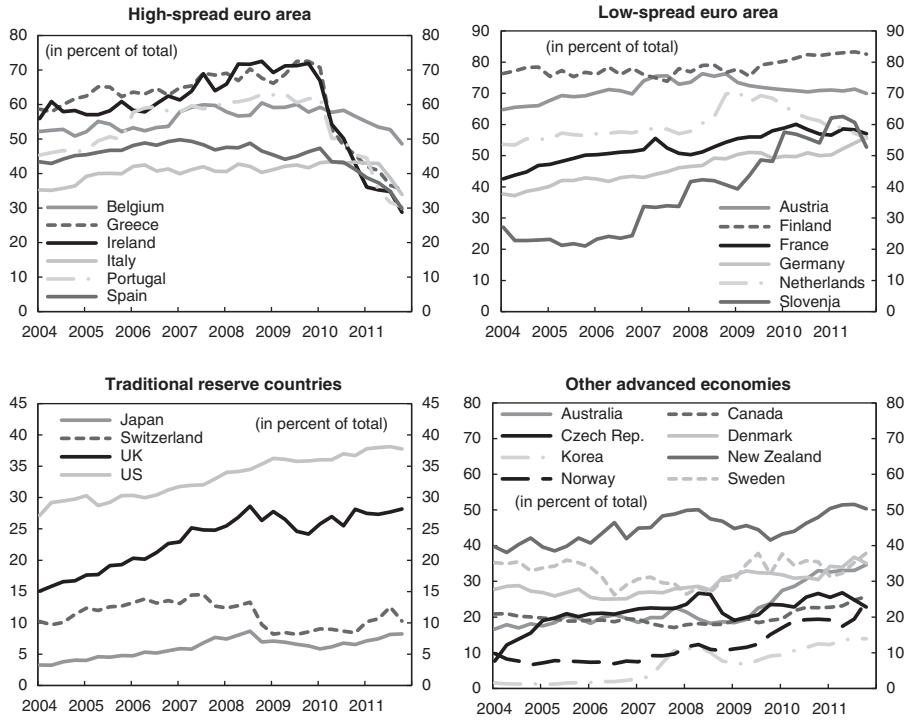
While examining these questions, we focus on two separate but related episodes in the postcrisis period: (i) the global financial crisis (2008–09), and (ii) the euro area debt turmoil that started in 2010. Where appropriate, we also group countries to draw out common trends beyond specific country circumstances (Appendix).

How Did Foreign Demand Change?

The first issue we explore in this section is how the foreign demand for advanced economy sovereign debt has changed in the postcrisis period. For the purposes of this section, foreign demand includes foreign banks, foreign nonbanks, and foreign central banks only. Other foreign holdings, in particular foreign official loans and SMP holdings, are not included as these mainly reflect responses to the changing foreign demand environment.

Our data suggest that the share of foreign investors in the investor base has continued to rise for most advanced economy sovereigns outside the high-spread euro area. Aggregate foreign ownership of advanced economy sovereign debt more than doubled from U.S.$5 trillion to U.S.$12 trillion between 2004 and 2011, driven by large purchases by foreign central banks and foreign nonbanks. Foreign bank ownership, on the other hand, remained relatively unchanged at around U.S.$2 trillion. As a result, in many countries, foreign banks now account for a declining share of government debt markets. At the same time, through the entire sample period (2004–11), we find that the average share of foreign investors in the investor base of advanced economy sovereign debt increased from 50 to 62 percent for the low-spread euro area countries, from 20 to 31 percent for

Figure 4. Advanced Economies: Foreign Share in Government Debt Stock, 2004–11[1]



Source: Authors' calculations.

[1]Excluding foreign official loans and SMP holdings of foreign central banks. For Norway, excluding all external loans.

the "other advanced economies," and from 14 to 21 percent for the traditional reserve countries. The foreign share in total debt of high-spread euro area countries largely stopped rising at end-2009, and then declined from 60 to 35 percent during the euro area debt turmoil. Figure 4 provides more details on change in the foreign ownership for individual countries in our sample.

A distinction can be made as to how foreign investors changed their holdings during the global financial crisis (2008–09) and the euro area debt turmoil (starting in 2010). Figure 5 shows the estimated investment flows of foreign investors since 2008 across our entire sample. All investor flows are de-trended and scaled by the inverse of country-specific standard deviations to make them cross-comparable (that is, based on *z*-scores). The mean and the standard deviation for the *z*-scores are calculated using an expanding window starting from 2004:Q1, in line with the sudden stop identification methodology of Calvo, Izquierdo, and Mejía (2004).[21]

[21]Specifically, we calculate *z*-scores for each observation, based on the 4-quarter moving average of foreign investor flows.

Figure 5. Advanced Economies: Foreign Net Purchases and Sales of Government Debt

	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1	2009Q2	2009Q3	2009Q4	2010Q1	2010Q2	2010Q3	2010Q4	2011Q1	2011Q2	2011Q3	2011Q4
Australia	0.4	0.1	0.0	-0.2	0.3	1.2	2.0	1.7	2.5	2.0	1.8	1.9	1.3	1.1	1.2	1.2
Austria	-0.2	-0.4	-0.6	0.2	0.1	0.0	-0.1	-0.3	-0.3	-0.1	0.0	0.1	0.1	0.0	0.1	0.0
Belgium	-0.1	-0.3	-0.4	0.4	0.4	0.5	0.6	-0.3	0.0	-0.1	-0.2	-0.1	-0.3	-0.4	-0.3	-0.5
Canada	-0.3	0.5	0.6	1.5	1.5	1.4	1.0	1.0	0.6	1.2	1.4	1.1	1.1	0.6	0.9	1.0
Czech Republic	-0.5	0.3	0.1	-0.7	-0.7	-0.8	-0.6	0.5	0.7	0.3	1.0	0.4	0.3	0.5	-0.5	-0.7
Denmark	0.2	0.2	-0.1	1.5	0.8	1.1	1.3	0.4	0.4	0.2	0.2	0.0	0.5	0.4	1.0	0.6
Finland	-0.1	0.1	0.0	0.0	0.5	-0.2	0.6	0.6	0.3	1.0	0.6	0.5	0.2	0.0	0.1	0.1
France	-0.4	-0.9	-0.2	0.5	0.8	1.0	0.8	0.9	0.8	0.9	0.2	-0.3	-0.4	-0.4	-0.1	0.0
Germany	0.3	0.2	0.9	0.4	0.8	1.2	0.4	-0.1	-0.2	-0.7	-0.2	1.5	0.9	1.3	1.4	0.7
Greece	0.0	-0.3	0.1	-0.3	-0.1	0.8	0.8	0.9	0.7	-2.8	-1.4	-1.6	-1.7	-0.7	-0.7	-0.6
Ireland	0.4	1.0	0.7	1.5	1.4	1.4	0.8	0.6	0.8	-0.9	-0.5	-1.0	-1.5	-0.7	-0.8	-0.8
Italy	-0.1	0.0	-0.3	-0.2	0.1	-0.1	0.2	0.2	0.2	0.1	-0.1	0.2	-0.1	-0.2	-1.1	-1.6
Japan	0.3	0.9	0.5	-1.4	-0.5	-0.9	-1.3	-0.5	-0.8	-0.5	0.0	0.0	0.5	0.5	0.6	0.7
Korea	1.3	1.4	0.1	-0.8	-0.8	-1.0	-0.2	0.3	0.6	1.0	0.9	0.8	0.6	0.6	0.4	0.3
Netherlands	0.0	0.1	0.7	3.4	1.4	0.8	0.8	-0.4	-0.7	-0.3	-0.5	-0.4	-0.3	-0.2	-0.3	-0.4
New Zealand	0.4	0.5	-0.2	-0.1	0.0	0.3	0.7	0.4	0.6	0.4	0.8	1.5	1.6	1.9	1.6	0.7
Portugal	-0.2	-0.3	-0.1	0.2	0.3	0.7	0.0	0.2	0.1	-1.8	-0.6	-1.2	-1.3	-1.0	-1.3	-1.2
Norway	0.6	0.2	-0.1	0.2	-0.2	-0.4	0.3	0.4	1.1	1.9	1.3	0.9	0.6	-1.0	-0.6	-0.8
Slovenia	0.3	0.2	0.3	0.2	-0.1	0.7	1.3	1.0	1.8	0.9	0.3	0.3	0.9	0.4	0.4	0.2
Spain	-1.2	-0.9	0.1	0.8	1.2	1.4	1.4	1.9	1.6	0.7	0.4	-0.4	-0.8	-0.5	-1.1	-1.8
Sweden	-0.5	-0.3	-0.1	0.3	0.4	1.0	1.1	0.4	0.9	0.0	-0.2	0.4	-0.6	0.0	0.1	0.2
Switzerland	-0.5	-0.7	-0.6	-1.1	-0.9	-0.9	-1.1	-0.3	0.1	0.0	0.1	0.0	0.2	0.3	0.7	0.3
United Kingdom	0.2	0.0	1.4	0.7	1.6	0.8	-0.2	0.1	0.8	1.0	0.9	1.6	0.4	0.2	0.5	0.0
United States	0.2	0.2	0.8	1.2	1.2	1.3	1.1	0.6	0.5	0.5	0.9	0.8	0.9	0.6	0.4	0.3

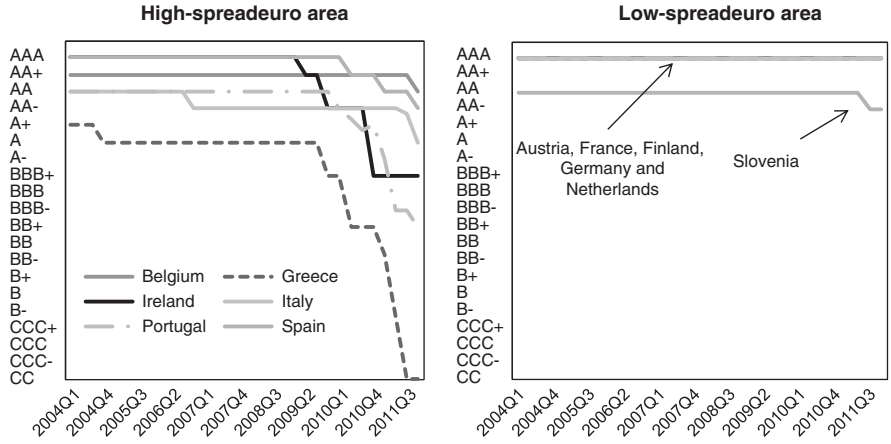
Note: The *z*-scores measure the relative size of net sales (black) or purchases (dark grey) of government debt by foreign investors, compared with historical norms. They are color coded as follows: black (less than −1); grey (between −1 and −0.5); white (between −0.5 and 0.5); pale grey (between 0.5 and 1); and dark grey (greater than 1).

The figure shows that, during the global financial crisis (2008–09), foreign investors increased their holdings of virtually all advanced economy sovereign debt (except for Czech Republic, Japan, Korea, and Switzerland), reflecting the perceived risk-free status of most advanced economy sovereign debt during that time. In the later period, however, foreign investors seem to have taken a much more differentiated view across advanced economy sovereigns, with some countries significantly gaining and some losing demand from foreign investors. The figure also shows how quickly foreign investors can change sentiment. For example, foreign investors were net buyers of the sovereign debt of Greece, Ireland, and Portugal up until 2010:Q1.

Foreign investors started to differentiate more among countries during the euro area debt turmoil (2010–11). Between mid-2010 and end-2011, foreign investors cumulatively reduced their exposure to high-spread euro area sovereign debt by about U.S.$400 billion. This was part of the total foreign outflows these countries experienced during this time, resulting in large TARGET2 imbalances (Merler and Pisani-Ferry, 2012c). In contrast, non-euro area countries, in particular "other advanced economies," received large inflows during this period, as a percent of their total debt stock.

Why did foreign investors show such country differentiation during 2010–11? A number of factors seem to have played a role. First, the emergence of credit risk (perceived and real) in a number of euro area countries likely altered the behavior of advanced economy sovereign investors that had previously focused primarily on interest rate risk. Second, large-scale sovereign downgrades, especially for high-spread euro area countries, may have caused some institutional investors to divest from countries that no longer complied with their investment policies (Figure 6). Finally, the unusually high volatility of yields in some advanced economy

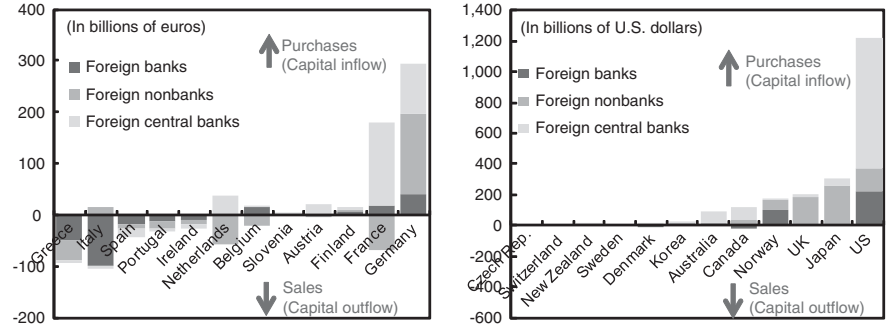
Figure 6. Advanced Economies: Sovereign Credit Ratings, 2004–11



Sources: S&P, Moody's, Fitch Ratings.

Note: Ratings at the end of each quarter. For each country, the rating was computed based on either the best two out-of-three ratings or simple average when all three agencies assigned different ratings.

Figure 7. Euro and Non-Euro Area Countries: Foreign Net Purchases of Government Debt, Cumulative over 2010–11[1]



Source: Authors' calculations.

[1]Excluding foreign official loans and SMP holdings of foreign central banks. For Norway, excluding all external loans.

sovereign bonds, compared with historical norms, likely caused some foreign investors to switch to countries with better perceived risk-return tradeoffs.

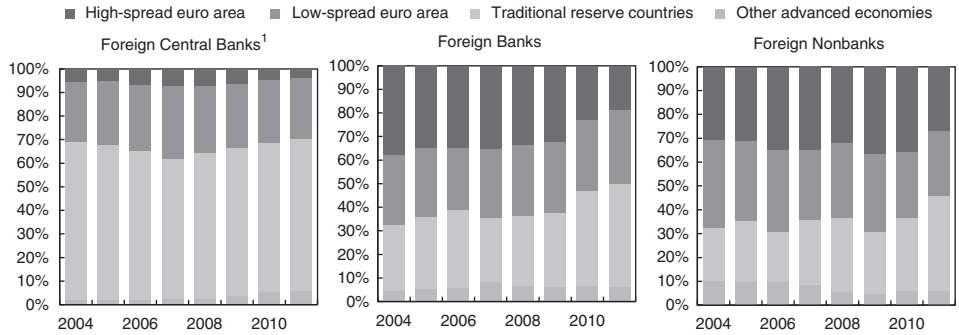
At the same time, international investors' exposure to the euro area as a whole still remains strong, but mainly due to Germany. Figure 7 shows cumulative sales and purchases of government debt by foreign investors during 2010–11. It shows that the reduction in exposure of foreign investors to high-spread euro area countries has been more than offset by their increased exposure to other euro area

countries, in particular to Germany. This may partly explain why the euro has held up relatively well against major currencies despite the euro area debt turmoil.

How Did Foreign Demand Change by Investor Type?

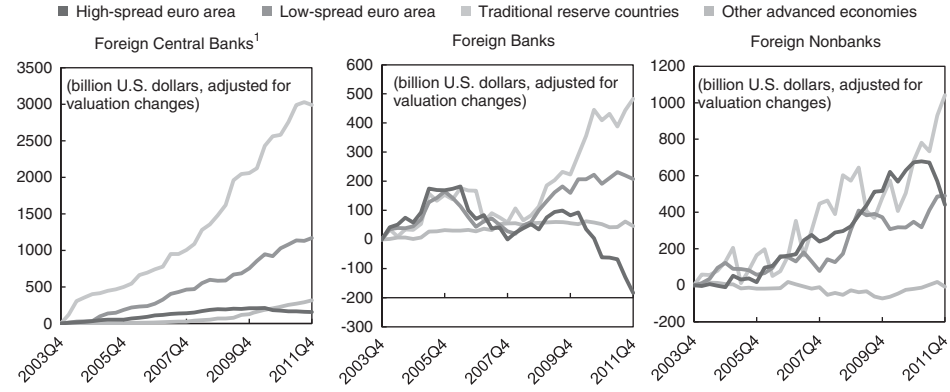
Our findings suggest that a large international portfolio reallocation took place among foreign investors, especially during the euro area debt turmoil, but their responses varied. Although their investment decisions had common elements, foreign investor responses varied in terms of scale, speed, and timing. Figures 8 and 9 show the estimated country allocations and investment flows of three types of

Figure 8. Advanced Economies: Country Allocation of Foreign Investors, 2004–11
(In percent of total holdings of advanced economy sovereign debt)



Source: Authors' calculations.
[1]Excluding SMP holdings of foreign central banks.

Figure 9. Advanced Economies: Cumulative Net Foreign Purchases of Government Debt, 2004–11



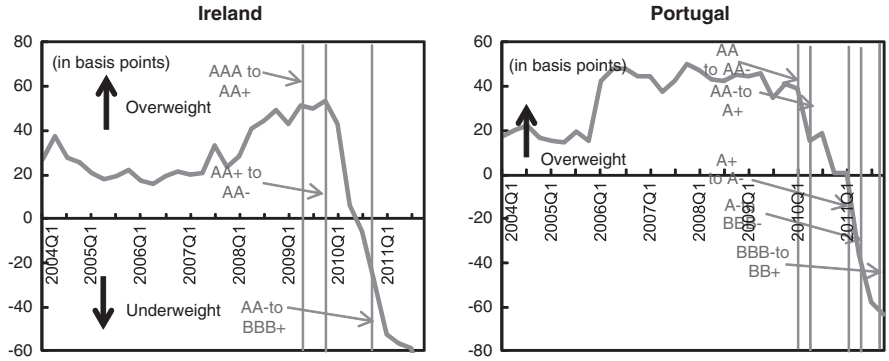
Source: Authors' calculations.
[1]Excluding SMP holdings of foreign central banks.

foreign investors (foreign central banks, foreign banks, and foreign nonbanks), from which several observations can be drawn:

- *Portfolio shifts of foreign central banks.* Foreign central banks had negligible exposure to the high-spread euro area before the euro area debt turmoil (less than 7 percent). Hence, compared with other foreign investors, their investment outflows were much more limited (about U.S.$60 billion during 2010:Q2–2011:Q4), mainly reflecting outflows from Ireland and Spain (AAA countries before the debt turmoil). Meanwhile, they have continued to increase their holding of low-spread euro area government debt (about U.S.$240 billion during the same period). In other words, they were net purchasers of euro area government debt during this period (unlike foreign banks and foreign nonbanks). At the same time, the share of euro area government debt has been declining in their total government debt portfolio, as they have significantly diversified their portfolios toward "other advanced economies." In particular, the share of "other advanced economies" in the advanced economy sovereign debt holdings of foreign central banks has risen from 2 to 6 percent since 2007, according to our estimates. This is in line with the rise in foreign central bank demand for "alternative" reserve currencies documented elsewhere (Hyde, 2012).
- *Portfolio shifts of foreign banks.* Foreign banks began cutting exposure to high-spread euro area countries starting from early 2010, much earlier than foreign nonbanks. Our estimates suggest that they started reducing their exposure to Greece in 2010:Q1, followed by Portugal and Italy in 2010:Q2, and then Ireland and Spain in 2010:Q3. Overall, the reduction in their exposure to high-spread euro area countries was around U.S.$170 billion during 2010:Q2–2011:Q4. In contrast, they have increased exposure to low-spread euro area countries, especially to Germany, albeit in a smaller amount (around U.S.$50 billion). In fact, we find that they have been shifting their portfolio away from euro area government debt since 2008, while increasing exposure to government debt of traditional reserve countries (Japan, Switzerland, the United Kingdom, and the United States). As a result, their government debt portfolios have become more concentrated. As of end-2011, we estimate that half of the sovereign exposure of foreign banks was to the United States and Germany alone.
- *Portfolio shifts of foreign nonbanks.* Foreign nonbanks have reduced exposure to high-spread euro area countries also in a significant way, pulling out a cumulative U.S.$160 billion during 2010:Q2–2011:Q4, most of which took place in late 2011. Their outflows, which happened only after the euro area debt turmoil intensified in 2011, represented an abrupt reversal of their long-term buying trend (Figure 9). Although some of these outflows were offset by inflows into low-spread euro area countries (U.S.$110 billion), foreign nonbanks were net sellers of euro government debt during this period. In contrast, they were net buyers of the government debt of traditional reserve countries and, to a lesser extent, "other advanced economies."[22]

[22]A notable example of this trend is the Norwegian sovereign wealth fund, which recently announced a strategy to gradually reduce the fund's share of European bonds, while increasing bond investments in other regions.

Figure 10. Foreign Investors Position and Sovereign Downgrades, 2004–11
(Deviations from benchmark position in basis points)

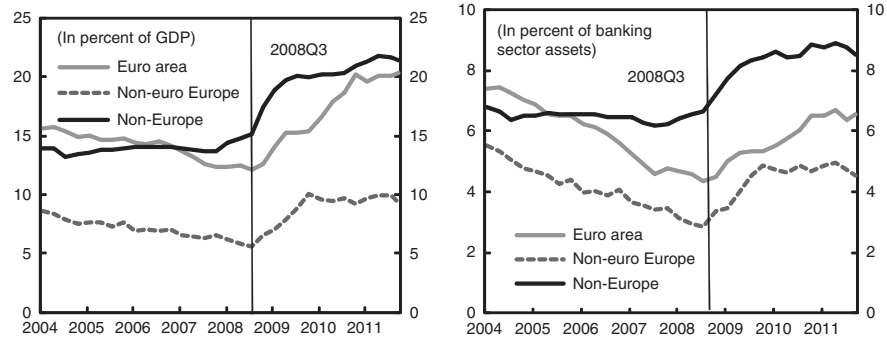


As a result, advanced economies experienced large inflows and outflows in government debt markets, especially in 2011. Overall, the cumulative portfolio reallocation of foreign investors during 2011 suggests that foreign banks and nonbanks have reallocated their investment mainly within advanced economies. In contrast, foreign central banks have continued to increase their holdings mostly in a secular fashion. Countries that have received the largest demand from central banks include the United States, France, Germany, but also Canada, Australia, and Norway. The countries that received the largest demand from foreign banks include Japan, Germany, the United Kingdom, the United States, and France. Similarly, Japan, Germany, the United States, the United Kingdom, and Canada received the largest demand from foreign nonbanks.

The changes in foreign investors' positions seem to have been especially large during changes in sovereign credit ratings of high-spread euro area countries. Figure 10 shows our estimates of foreign investors' position (excluding official sector loans and SMP holdings of foreign central banks) for Ireland and Portugal before and after major sovereign downgrades. The foreign investor positions are calculated as the difference between each country's share in foreign holdings and each country's share in total debt outstanding. Based on this measure, foreign investor holdings were initially overweight Ireland and Portugal, but quickly became underweight as multinotch sovereign downgrades for these countries took place.[23] Although downgrades from AAA did not seem to have triggered large sales, foreign sales seem to have accelerated once credit ratings fell toward the lower end of AA rating.

[23]IMF (2010) discusses some of the reasons why some investors may be more sensitive to rating actions, rather than market signals.

Figure 11. Advanced Economies: Bank Holdings of Own Government Debt, 2004–11



Sources: IMF International Financial Statistics, IMF Monetary and Financial Statistics, and authors' calculations.

How Did Domestic Investors React to Falls in Foreign Demand?

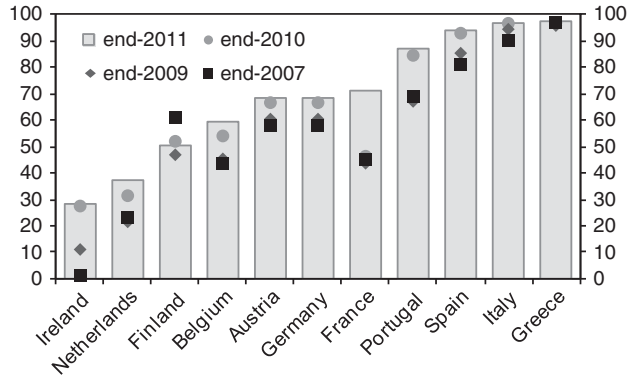
Falls in foreign demand for sovereign debt and the resulting refinancing gaps were filled mostly by domestic banks, if not the foreign official sector or domestic nonbanks. In those countries where outflow of foreign investors have been most severe (Greece, Ireland, and Portugal), domestic banks have had to take up most of the slack that was not taken by the foreign official sector. In other high-spread euro area countries, domestic nonbanks also contributed to additional demand for government debt, such as in Belgium, which had a successful retail bond issue to domestic households to alleviate funding pressures in November 2011. However, in general, funding gaps for countries that lost market access were filled by domestic banks. This resilience of domestic banks is not a universal phenomenon, because net capital outflows can be led by portfolio shifts of domestic investors, as observed in some of the past emerging market crisis episodes (Cowan and others, 2008). Further empirical research may be needed to examine the source of domestic banks' behavior, possibly by contrasting demand for sovereign debt of foreign investors and that of domestic investors.[24]

How Did Domestic Bank Demand Change More Generally?

Domestic bank holdings of own government debt started increasing after the global financial crisis across most advanced economies, both in nominal terms and as a percent of banking sector assets. The increase is most evident in the euro area, where government debt held by domestic banks increased from 15 percent to about 20 percent of GDP (Figure 11). The increase can also be seen in terms of banking

[24]In particular, it would be useful to establish an empirical strategy that differentiates demand for sovereign debt of foreign investors from that of domestic investors. One possible strategy would be to characterize differentiated responses to a shock in yields or credit ratings in a model that controls for additional factors such as regulation, capital account openness and other domestic components.

Figure 12. Euro Area: Bank Holdings of Own Government Debt Securities, 2007–11[1]



Sources: IMF International Financial Statistics, and authors' calculations.
[1]In percent of bank holdings of all euro area government securities.

sector assets, indicating growing exposure of banks to their own government, which suggests stronger sovereign-bank linkages.

Our findings also suggest a growing home bias in the euro area. The extent of home bias can be measured by the proportion of own sovereign debt held by banks within their overall sovereign debt holdings (Acharya, Drechsler, and Schnabl, 2012). Based on this measure, home bias is large and growing in the euro area (Figure 12). Even before the crisis (at end-2007), euro area banks held, on average, 57 percent of their overall euro area government holdings in their own government debt, despite the fact that, for euro area banks, zero percent risk weights can be applied to the debt issued by any euro area sovereign. By end-2011, this ratio has increased to 69 percent. Although the emergence of sovereign risk in parts of the euro area can explain some of the increase in home bias, it cannot fully explain it as the increase in own government holdings of euro area banks has been higher than the cumulative amount of foreign banks outflows from the high-spread euro area during this period. It also does not explain why home bias is a common trend across the euro area, including in the high-spread euro area. In some of these countries (Greece, Italy, and Spain), the ratio of own government debt to overall euro government debt holdings is now close to 100 percent.

The increased demand from domestic banks for their own government debt is a global phenomenon, suggesting that common factors are likely at play. Below we list some of these factors. Although it is difficult to quantify the relative importance of each factor, they all seem to have played a significant role after the onset of the global financial crisis.

- *The global recession*. The reduced economic activity after the 2008 global financial crisis and the weak private sector growth in its aftermath—mostly in

advanced economies— has reduced demand for bank loans and, as a result, banks have been accumulating government debt instead.

- *Bank deleveraging*. The deleveraging of advanced economy banks after the financial crisis has likely pushed banks to tilt their assets toward own government debt to reduce risk-weighted assets (RWA). The application of 0 percent regulatory risk weights on debt issued by their own sovereigns creates such an incentive.
- *Basel III and new financial regulations.* Banks are likely to have increased their demand for government debt in light of moves toward implementing Basel III and other regulatory changes that require tougher capital and liquidity standards and more use of collateral.[25]
- *Rising home bias.* As explained above, our findings suggest a growing home bias for domestic banks, in particular in the euro area. This cannot be explained only by the emergence of sovereign risk in other parts of the euro area.
- *Other factors.* An additional factor could be central bank operations in the post-crisis period. For instance, the ECB's long-term refinancing operations (LTROs) and changes in collateral criteria (for example, no minimum rating thresholds for some euro area government debt) may have induced euro area banks to increase government debt holdings. At the same time, quantitative easing programs in Japan, the United Kingdom, and the United States may have worked in the opposite direction, given their intended goal to reduce private holdings of government debt, including those held by domestic bank holdings. Placing of bank recapitalization bonds in domestic banks (for example, Ireland) or changes in national prudential norms may also have played a role.

The rise in bank holdings of own government debt risks stronger sovereign-bank linkages and negative feedback loops between the sovereign and its banks, potentially affecting domestic financial stability. On the one hand, strong demand from domestic banks helps public debt managers by providing a more stable investor base. On the other hand, too strong an interdependence between the sovereign and banks risks domestic financial stability, as discussed in the first section.[26] For example, although Basel III liquidity reforms, which encourage banks to hold high-quality liquid assets such as sovereign debt, can help improve banks' liquidity conditions, they can also create stronger interdependence between the balance sheets of the sovereign and its banks. Alternatively, overexposure of

[25]The 2011 EBA stress tests suggested that major European banks may have a collective shortfall of €1.2 trillion that must be filled with liquid assets such as government bonds. Santos and Elliott (2012) estimate that European, Japanese, and U.S. banks may collectively need U.S.$2 trillion of net additional liquid assets in the next three years before the Liquidity Coverage Ratio (LCR) becomes effective in 2015. At the same time, another Basel III liquidity measure, Net Stable Funding Ratio (NSFR), scheduled to take effect in 2018, may induce some banks to reduce demand for *long-term* government debt.

[26]Merler and Pisani-Ferry (2012b) argue that the interdependence between banks and sovereigns is especially strong in the euro area, due to the absence of a supranational banking resolution framework and domestic banks holding a considerable share of the debt issued by their domestic government.

banks to their own sovereign may hurt growth in the long run, as banks move away from their traditional role of credit intermediation to the private sector ("crowding out").

III. Conclusion

We introduce a methodology for compiling internationally comparable estimates of sovereign debt holdings. Based on this methodology, we construct a comprehensive data set for advanced economies. The methodology can be used to track U.S.$42 trillion of advanced economy sovereign debt held by six different investor classes—domestic central banks, domestic banks, domestic nonbanks, foreign official sector, foreign banks, and foreign nonbanks. The data set, which covers 24 countries during the period from 2004 to 2011 on a quarterly basis, is publicly available along with this paper.

Based on our analysis of the data set, we identify a number of common trends across investors of advanced economy sovereign debt, with several policy implications. In general, for most advanced economies, we find a rising share of foreign investors in sovereign debt markets and a rising exposure of banks to own government debt after the global financial crisis. The main policy implications are as follows:

- Public debt managers should continue to pay attention to investor relations and monitor government refinancing risk closely through scenario analysis. With large sovereign debt repayments looming over the next few years, the ability to retain market access will depend critically on the predictability and stability of the investor base. Coupled with the fact that most advanced economies are increasingly reliant on foreign investors, this means that debt managers need to have a rigorous investor relations program and market surveillance operations. In formulating debt management strategies, closer attention should be placed on investors' asset allocation strategies. Further, debt managers need to remain flexible in their issuance strategies. In this context, the principles brought out in the "Stockholm Principles" for public debt management provide a good operating framework.[27]
- Financial sector supervisors should place more emphasis on macrofinancial risks emanating from bank holdings of sovereign debt. In the short run, higher domestic bank ownership of sovereign debt may help provide a more stable investor base for the government. However, in the longer run, any deterioration in the sovereign's credit quality can increasingly trickle into the health of the domestic banking system. In turn, contingent liability risks from banks to the sovereign may increase. In order to reduce these negative feedback loops, strengthening backstop mechanisms to support banking systems, along with higher loss-absorbing capital at banks may be needed. Financial stability

[27]The "Stockholm Principles" are a set of guiding principles for managing sovereign risk and high levels of public debt, as facilitated by the IMF and agreed by the debt managers and central banks who attended the 10th Annual Consultations on Policy and Operational Issues facing Public Debt Management on 1–2 July 2010.

authorities may also need to consider conducting regular systemic stress tests with credible sovereign risk scenarios. The results of these tests could be announced to the public to help reduce undue market concerns. Such stress test exercise could also be coordinated with public debt managers to better capture refinancing risks in government debt markets.

- Standard debt sustainability analyses (DSA) should be complemented with investor base risk indicators to better capture sovereign risk. The euro area debt turmoil highlighted the importance of investor base dynamics. These market and investor factors are increasingly becoming an important source of sovereign risk (Das, Oliva, and Tsuda, 2012). Against this background, we have constructed a number of risk indicators that policy makers can use, along with conventional debt sustainability indicators, to capture vulnerabilities to sudden investor outflows.
- Further efforts to reduce data gaps on investor holdings of sovereign debt could be of significant benefit to policy makers. Our data set is a first attempt at this goal, but this agenda could be developed further. For example, more granular information on holders of sovereign debt can provide further information on how spillovers from one sovereign bond market could be transmitted to another. More granular data on different foreign investors, often treated as a single unit in national statistics, can also be useful, given the importance of these investors and differences in their investment strategies. Ongoing initiatives that can help reduce data gaps include the 2009 G20 Data Gaps Initiative, which includes a recommendation to improve data collection on securities holdings (Recommendation 7). In response, a joint BIS-ECB-IMF initiative has released a handbook in 2010 to improve data collection on debt securities holdings (Handbook on Securities Statistics, Part 2). For the euro area, there is an ongoing initiative of the ECB to collect further information on holdings of securities through the Centralized Securities Database.

There are a number of areas that were not tackled in this paper and would benefit from further research. The methodology and the data set provided in this paper could form the beginning of a wider research agenda on sovereign debt and sovereign debt holdings. Issues that have not been tackled in this paper include: (i) empirically examining the relationship between the level and volatility of sovereign bond yields and different investor holdings (the latter can be an important omitted variable in regressions that attempt to explain sovereign bond yields); (ii) examining how the diversity of the investor base affects the liquidity of sovereign debt markets; (iii) analyzing how investor base should be factored when crisis-related monetary and financial policies are eventually unwound; and (iv) assessing how the impact of new financial regulations may be affecting sovereign debt markets through their impact of investor holdings.

APPENDIX

The four country groups in our sample are constructed along the following dimensions: (i) exchange rate regime (independent or currency union), (ii) reserve currency status, and (iii) perceived credit risk in 2011. In particular:

High-spread euro area includes euro area countries identified by the IMF in the April 2012 *Global Financial Stability Report* (GFSR) as having sovereign CDS spreads of more than 200 basis points as of August 2011 (Belgium, Greece, Ireland, Italy, Portugal, and Spain). Although spreads for Belgium have come down in 2012, it is included in this group as our analysis is mainly about trends until end-2011. Together, these countries account for nearly half of the euro area government debt market and 11 percent of the total advanced economy sovereign debt outstanding, at end-2011.

Low-spread euro area includes the other euro area countries in our sample (Austria, Germany, France, Finland, Netherlands, and Slovenia). Except for Slovenia, all were rated AAA by at least two out of the three major credit rating agencies, as of end-2011. This group accounts for 14 percent of the total advanced economy sovereign debt outstanding.

Traditional reserve countries include non-euro area countries that have traditionally enjoyed reserve currency status (Japan, Switzerland, United Kingdom, and United States). These countries have deep and liquid markets, attracting large demand from foreign central banks; as a result, they are traditional beneficiaries from flight to safety. They represent 68 percent of total advanced economy sovereign debt outstanding.

Other advanced economies include the remaining countries in our sample (Australia, Canada, Czech Republic, Denmark, New Zealand, Norway, Korea, and Sweden), some of which have recently been seen as "new safe havens." They represent 6 percent of total advanced economy sovereign debt outstanding.

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