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Is Banks' Home Bias Good or Bad for Public Debt Sustainability?

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Abstract

Motivated by the recent increase in domestic banks' holdings of domestic sovereign debt (i.e., home bias) in the European periphery, this paper analyzes implications of banks' home bias for the sovereign's debt sustainability. The main findings, based on a sample of advanced (AM) and emerging market (EM) economies, suggest that home bias generally reduces the cost of borrowing for AMs and EMs when debt levels are moderate to high. A worsening of market sentiments appears to dimish the favorable impact of home bias on cost of borrowing particularly for EMs. In addition, for AMs and EMs, higher home bias is associated with higher debt levels, and less responsive fiscal policy. The findings suggest that home bias indeed matters for debt sustainability: Home bias may provide fiscal breathing space, but delays in fiscal consolidation may actually delay problems until debt reaches dangerously high levels.

Contents   **Page**

I. I. INTRODUCTION

1.   **Issues related to the entrenched sovereign-bank nexus particularly home bias—banks' holdings of sovereign domestic debt—have gained prominence during the financial crisis in recent years as public debt was rising especially in the European periphery.**[2] Prompted by foreign investors' flight as well as cheap long-term refinancing operation (LTRO) funding from the European Central Bank (ECB), many peripheral banks absorbed sizable domestic sovereign debt both from the secondary and primary markets. The entrenched sovereign-bank nexus has raised concerns regarding the health of the banking sector as well as its potential impact on debt sustainability of the sovereign.[3] It is worth noting that the recent increase in home bias is not unique to the European periphery, but has generally been observed across many advanced economies that have seen a rise in public debt (Figure 1).

Figure 1. Banks' Holding of Domestic Sovereign Claims/Total Bank Assets and Public Debt
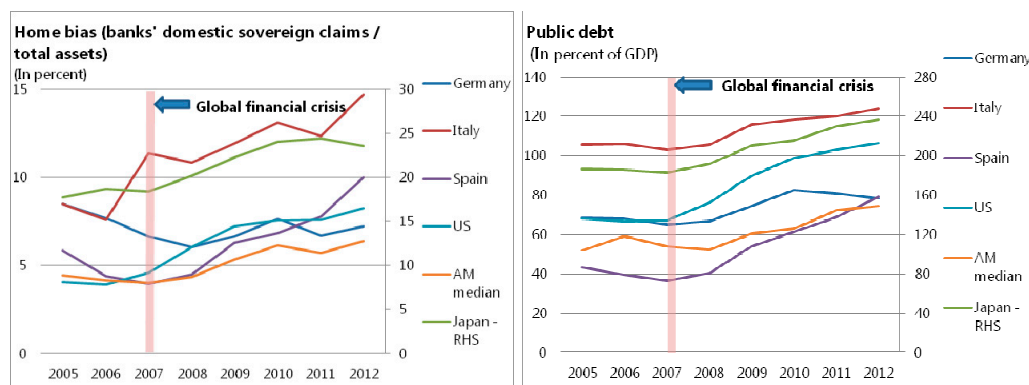
Sources: Arslanalp and Tsuda (2012); IMF IFS; IMF WEO.

2.   **This paper examines the impact of banks' home bias—banks' holding of domestic sovereign debt in total assets—on advanced markets (AMs) and emerging markets (EMs) economies by addressing four questions that have implications for debt sustainability:**

(1)   *Is the cost of borrowing lower for sovereigns with higher home bias?* Yes, for both AMs and EMs using bond spreads and domestic bond yields respectively. The

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[2]Banks' home bias typically denotes the preference of domestic banks for holding domestic sovereign debt instruments compared to other sovereign debt instruments. However, the two most commonly used measures of home bias in the literature (holding of domestic sovereign debt in percent of total assets, and in percent of total debt) tend to also capture other factors such as investor base diversification.

[3]This was one of the reasons that the 2011 EBA stress test findings were not perceived as credible so the recapitalization exercise forced European banks to mark-to-market all of their securities holdings (e.g., IMF 2011 and 2012).

negative relationship between home bias and the domestic cost of borrowing is milder for EMs. Worsening of market sentiments tend to temper the effect of home bias on borrowing cost particularly for EMs.

(2) ***Is the level of public debt higher in countries with greater home bias?*** Our panel regressions show that this is the case for both AMs and EMs.

(3) ***Is a primary balance adjustment slower in sovereigns with higher home bias?*** Our empirical results show that indeed sovereigns with a higher home bias are less willing to conduct fiscal consolidation. Even if foreign investors have reduced their exposure to domestic sovereign debt markets, the presence of domestic banks ablility to absorb the domestic debt issuances can provide a significant breathing space to struggling sovereigns but this deepens the negative sovereign-bank feedback loop and could potentially delay needed fiscal adjustment.[4]

(4) ***Do sovereigns with higher home bias enter into debt distress at a higher level of public debt?*** Our findings suggest a positive relationship between home bias and the level of debt at which countries are assessed to have experienced debt difficulties.

3. **The empirical results strongly suggest that home bias matters for debt sustainability.** High home bias which in some cases is tantamount to having a captive investor base may provide fiscal breathing space, but delays in fiscal consolidation may actually postpone problems until debt reaches dangerously high levels. The breathing space is largely the result of the favorable impact of high home bias on rollover risk which is particularly evident during crisis periods, but is not likely to yield better fiscal outcomes. The empirical analysis in this paper which examines the multi-faceted impact of home bias provides analytical support for anecdotal evidence in this regard. For example, during the recent crisis period countries with a captive domestic investor base faced less market pressure on rollover needs, and therefore enjoyed more breathing space while attempting difficult fiscal consolidations (or during periods of lax fiscal discipline).

4. **Our main findings broadly hold in robustness checks.** For instance, dropping outliers such as Greece and Japan from the country sample does not change the empirical results. The findings are also generally robust to alternative regression methodologies as well as different home bias measures. The only exception is that while we find a negative relationship between our preferred home bias measure (holdings of domestic sovereign debt relative to total assets) and AM borrowing costs, the relationship is positive for the home bias

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[4]In the European periphery, external market pressures and soaring sovereign yields have forced peripheral countries to start implementing some of the overdue reforms. Decisive monetary policy by the ECB has certainly helped to provide a backstop to the peripheral domestic banks, which was the predominant factor for compressing peripheral sovereign spreads.

measure that has total public debt as the denominator. This finding is not be surprising because while our preferred home bias measure mainly captures the banks' preference for sovereign debt, the other measure mainly reflects the diversification angle. A more diversified investor base (i.e., lower home bias) is associated with lower spreads. These findings are consistent with the literature. For example, Arslanalp and Poghosyan (2014) and Andritzky (2012) find that the diversification home bias measure and borrowing costs are positively related. However, Acharya and Steffen (2013), using the bank preference home bias measures find a negative relationship in line with our results.

5.   **A number of factors could explain banks' home bias.** Domestic sovereign debt tends to enjoy a preferential regulatory treatment with a zero risk-weighting. In this context however, risk weights on other assets, including foreign sovereign debt, might differ significantly between countries which potentially could contribute to cross-country variations in home bias. The increase in home bias during and after the recent crisis period across many countries benefited from the higher importance of domestic sovereign debt for central bank collateral (as well as market funding). There could be structural factors (such as market infrastructure or lack investment opportunities) or business cycle considerations. The supply of public debt has also increased especially in many advanced economies after the crisis. While this paper does not formally address the potential determinants of home bias, it provides some conceptual discussion to contextualize recent developments.

6.   **Given the focus of this paper on the impact of banks' home bias on debt sustainability, it does not address a number of key issues related to home bias.** First the concept of home bias generally goes beyond the banking sector and includes all domestic investors including non-bank institutions such as pension or insurance companies. While these entities can be sizable in some countries, the paucity of cross country data limits the ability to include them in the analysis. Second, while the empirical panel regression methodology attempts to account for endogeneity issues, e.g., between home bias and public debt, by using instruments, there might still be the possibility of reverse causality in some circumstances. For instance, a government faced with increased rollover risks could use moral suasion with domestic banks (e.g., primary dealers) to increase their holdings of sovereign debt.

7.   **The paper is organized as follows:** Section II briefly discusses the existing literature on home bias. Section III presents the empirical analysis on the relationship between home bias and borrowing costs, level of public debt, primary balance adjustment, and the level of debt at which countries enter distress. A discussion of robustness checks is also included. Section IV discusses a number of additional issues related to home bias, particularly its determinants. Section V concludes.

II. LITERATURE REVIEW

8.   **The growing literature on sovereign debt home bias and its implications for debt sustainability is relatively heterogeneous:**

- **One strand of literature examines potential causes for home bias in bonds.** For instance, Fidola and others (2006) find that exchange rate volatility induces a stronger home bias in bonds.[5, 6] Portes and others (2001) show that government bonds respond less to information frictions than corporate bonds or equity.

- **Existing research points to different effects of home bias on sovereign bond yields.** For example, Arslanalp and Poghosyan (2014) and Andritzky (2012), who examine the diversification angle of sovereign claims, find that an increase in the share of government debt held by domestic investors leads to an increase in sovereign bond yields in AMs. Similarly, Ebeke and Lu (2014) show that an increase in share of government bonds held by domestic residents has reduced bond yields in EMs. Acharya and Steffen (2013), on the other hand, find that home bias (measured by banks' holding of domestic sovereign debt relative to total assets) actually helped to lower spreads in the European periphery after the systemic crisis.[7]

- **Beyond the impact on bond yields, the consequences of home bias are found to be multi-faceted.** For instance, countries with high home bias tend to have high public debt (BIS, 2011) and face higher spillover risks of sovereign stress to the banks (Merler and Pisani-Ferry, 2012). Related, a high concentration of domestic sovereign claims in banks' balance sheets results in an increase of spillover risks of sovereign stress to banks (Acharya and others 2012). Domestic banks tend to also increase exposure to sovereign claims when they are hit by country-specific and common shocks on yields (Battistini and others, 2013). Moreover, domestic banks, especially large banks increase their exposure to sovereign claims during sovereign defaults (Gennaioli and others, 2014a). From a theoretical perspective, Gennaioli and

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[5]The measure of home bias here is based on the share of domestic banks' holdings of domestic sovereign claims in total holdings of sovereign claims. It reflects the degree to which banks are overweight in domestic sovereign claims and underweight in foreign sovereign claims, as compared to the benchmark portfolio on sovereign claims.

[6]Applying a similar approach, Chan, and others (2005) show that transaction costs are less important than informational asymmetries in explaining equity home bias.

[7]Jaramillo and Zhang (2013) find that an increase in bond yields due to high debt to GDP ratio is partly offset if this debt is in the hands of real money investors—domestic nonbanks and national and foreign central banks.

others (2014b) show that home bias reduces the probability of default on public debt due to high cost of default on the domestic economy.[8, 9]

9.   **This paper contributes to the existing literature by taking a broad perspective on the implications of home bias for debt sustainability.** On the impact of home bias on borrowing costs, we also explicitly account for the role of public debt levels as well as market sentiment when examining the relationship between home bias and borrowing cost and account for potential differences between AMs and EMs. The paper also sheds light on the role of banks' home bias in explaining cross country differences in public debt levels, primary balance adjustments, and the level of debt at the time of fiscal distress.

III. EMPIRICAL ANALYSIS ON HOME BIAS

10.   **We analyze the role of home bias in debt sustainability by examining the relationship between home bias and** (A) borrowing costs of sovereigns, (B) the level of public debt, (C) the fiscal primary balance of sovereigns, and (D) the level of debt at which sovereigns enter debt distress.

11.   **Throughout the paper, we focus on the home bias indicator that reflects the banks' holding of domestic sovereign claims in total assets as in Acharya and Steffen (2013).** This allows for the widest country coverage in the sample (22 AMs and 29 EMs) and longer coverage of time horizon (1999–2012) in annual frequency, which reflects banks' preference on domestic sovereign claims over other assets. Two other measures of home bias are used for robustness checks in Section III.E.[10]

Home Bias = Banks' holding of domestic sovereign claims / Banks' total assets[11]

12.   **The choice of macro variables in the regression analysis follows the academic literature on borrowing costs, debt accumulation, and fiscal reaction function.** In line with Ghosh and others (2011), control variables for the fiscal reaction function include the level of lagged public debt, output gap, fiscal expenditure gap, and trade openness. Following Ardagna and others (2007), conventional determinants of bond yields / spreads include the

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[8]The above studies measure home bias as the share of domestic banks' sovereign holdings in total bank assets.

[9]In a theoretical model of defaultable sovereign debt and banks, Boz and others (2014) find that sovereign default amplifies the business cycle as banks' losses due to a default hampers lending to firms.

[10]Details of the country sample, calculations of home bias measures, and sources of data are reported in Appendix I.

[11]The home bias measure uses banks' holding of claims to general government given data constraints in some countries that make it more difficult to consistently examine the home bias measure for only the central government. Similarly, debt-to-GDP and the primary balance-to-GDP refer to general government. In contrast, both the sovereign borrowing costs and sovereign default events relate to the central government.

level of lagged debt, GDP growth rate and inflation rate. The VIX is used as a proxy for global risk aversion of investors. Details on macro variables are provided in Appendix II.

13.   **AMs and EMs with high home bias tend to have high public debt in both the pre- and post-global financial crisis periods (Table 1 and Figure 2).** The average public debt level of AMs and EMs whose home bias is in the top (bottom) quartile of the distribution is higher (lower) than the the mean of the corresponding sample. This evidence is found to be robust with any sample period during 1999–2012. Home bias in EMs on average tends to be higher than that in AMs because of potentially narrower portfolio allocation options available for banks in EMs and relatively limited access to international capital markets.

Table 1. Summary of Home Bias Indicators (average, 2005–07 and 2009–11)

		Advanced markets		Emerging markets	
		Home Bias	Public debt / GDP	Home Bias	Public debt / GDP
2005-7	Mean (whole sample)	5.5	56.4	12.8	51.1
(debt - 2007)	Mean of observations				
	- Above 75th percentile	11.3	95.1	28.6	75.9
	- Below 25th percentile	1.8	37.8	1.7	20.3
2009-11	Mean (whole sample)	6.5	79.9	13.5	54.0
(debt - 2011)	Mean of observations				
	- Above 75th percentile	14.8	120.2	26.7	78.8
	- Below 25th percentile	1.3	61.1	3.5	24.1

Sources: Arslanalp and Tsuda (2012); IMF IFS; IMF WEO.

Figure 2. Average Public Debt (2007) and Home Bias (average, 2005–07) in AM and EM[1]
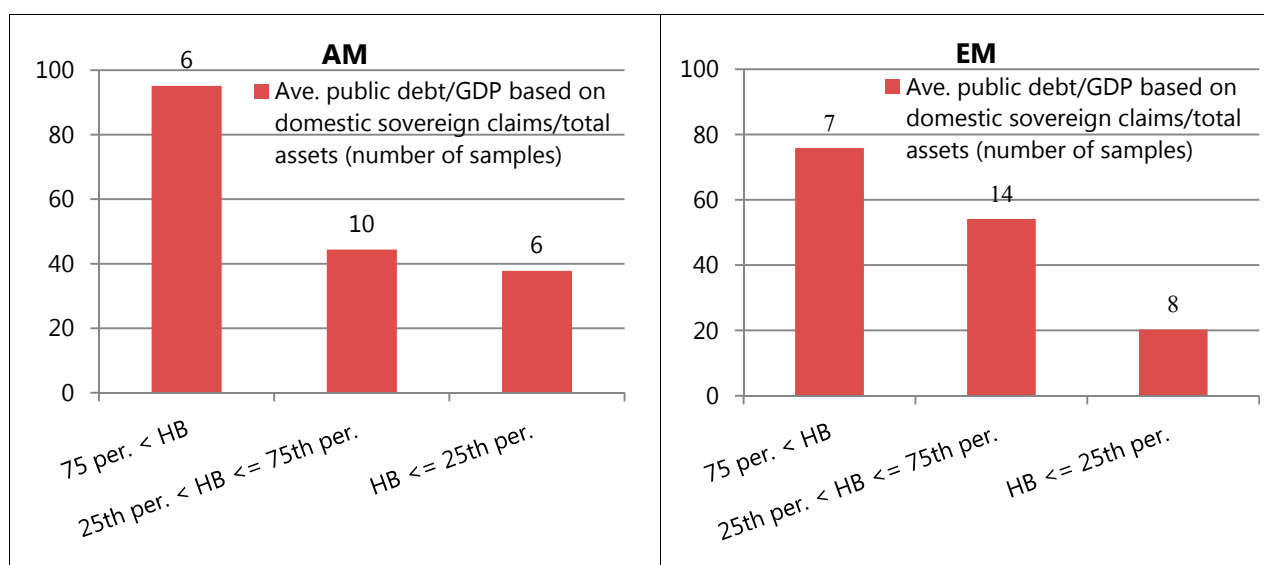
Sources: Arslanalp and Tsuda (2012), IMF IFS, IMF WEO.
[1]Excluding Japan, average public debt for AMs is 76 percent of GDP in countries whose HB falls in the top quartile of the distribution.

A. Borrowing Costs of Sovereigns

Sovereign's Borrowing Costs—Panel Analysis

14.   **We assess the impact of home bias on sovereigns' borrowing costs in AMs and EMs based on a panel regression approach.** Our method is a two-step generalized method of moment (GMM) estimation with housing price and lagged credit-to-GDP ratio as instruments to control for home bias in order to deal with potential endogeneity issues. The housing price variable is considered to be appropriate as one of the instruments because it is correlated with banks' holdings of domestic sovereign claims but not with bond yields or spreads. In addition, the lagged credit-to-GDP variable is predetermined, and thus it is correlated with neither bond yields nor spreads but affects the portfolio allocation of banks. These two instruments are significant and have significant explanatory power supported by an Adj-R^2 of 0.54 (AM), 0.66 (EM) and 0.59 (AM & EM).

15.   **Model specifications closely follow Ardagna and others (2007) in terms of determinants of spreads and shown as**:

$$r_{i,t} = \beta_1 b_{i,t-1} + \gamma_0 (hb_{i,t} - \overline{hb}_t) + \gamma_1 ((hb_{i,t} - \overline{hb}_t) * b_{i,t-1}) + \gamma_2 ((hb_{i,t} - \overline{hb}_t) * VIX_t) + x_{i,t}\delta + y_t\phi + \varepsilon_{it}$$

--- (1)

where $r_{i,t}$ captures long-term bond yields or spreads of country i at t,[12,13] $b_{i,t}$ is the level of public debt of country i at t, respectively. The variable $hb_{i,t}$ is the home bias for country at t, $\overline{hb}_t$ is the sample average of home bias at time t, VIX_t is a proxy for global risk aversion at time t, and $x_{i,t}$ is a vector of macroeconomic variables. The first lagged debt term reflects the effect of debt on borrowing costs pointed out by Ardagna and others (2007).[14] While the second term reflects the direct influence of home bias, the third and fourth terms capture how home bias interacts with debt and global risk aversion, respectively. To account for the multi-dimensional impact of home bias on borrowing costs, we introduce a non-linear function of home bias. Though a majority of home bias observations fall around the sample median, a sizable fraction of observations is close to zero. An introduction of an interactive term of

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[12]Throughout our empirical analysis, we focus on yields or spreads of long-term bonds, i.e. benchmark 10-year bond yields or equivalent bond yields in the local market. There could be some possibility that the impact of home bias on bond yields/spreads varies across different maturity of bonds, but data limitations prevent a closer look at this issue.

[13]For AMs, we use bond spreads against the German bonds for European countries and the US bonds for non-European countries since we are interested in how borrowing costs for sovereigns deviate from those of "risk-free" bonds, i.e. the German or US bonds. For EMs, we use sovereign bond yields.

[14]Using a panel of 16 OECD countries over several decades, Ardagna and others (2007) use both linear and nonlinear (including quadratic term) model specifications to have an increasing function of spreads and find that the effect of the debt level on interest rates is nonlinear only for countries with above-average levels of debt.

home bias and debt (VIX)—home bias multiplied by these variables—provides asymmetric and biased effects in the range of home bias. To correct asymmetry and bias effects and capture symmetrically and precisely its interaction with the level of debt and market sentiment (VIX), the home bias variable is entered as a deviation from its sample median.

16.   **Findings suggest that for AMs with moderate to high debt levels, borrowing costs (measured by the spreads over German/US bonds) generally decline as home bias increases especially in normal times (Figure 3, panel A).** Lower spreads with high home bias reflect reduced expectation of default whenever domestic banks own a sizable portion of domestic sovereign claims because of the anticipated high cost of default. As shown in the panel regression results (3rd column of Table A1), bond spreads are negatively influenced by interactive terms of home bias and debt whereas positively affected by interactive terms of home bias and VIX (a proxy for investor risk aversion). The former effect clearly dominates the latter leading to a decrease in spreads due to higher home bias when the level of debt is above 50 percent of GDP. This is also highlighted in a downward sloping curve of bond spreads. When debt is below 50 percent of GDP, the interaction between home bias and debt level is low, and therefore the interaction between home bias and VIX dominates. Thus the overall impact of home bias on bond spreads is smaller compared to the case of high debt. In cases of high debt levels and large spreads, sovereigns enjoy larger reductions in spreads due to a "real money investors"—domestic nonbanks and national and foreign central banks point increase in home bias (relative to its median). This is highlighted by a steeper slope of the line associated with debt at 100 percent of GDP.[15] These results mentioned above remain robust if we omit Greece, Japan and Portugal from the sample (4th column of Table A1).

17.   **However, during crisis periods when risk aversion rises, the negative impact of home bias on spreads diminishes and may turn positive (Figure 3 panel B).**[16] For example when VIX is 80 points above the sample mean and debt is relatively low (60 percent of GDP), the interaction of home bias and VIX could surpass the interaction of home bias and debt. The intuition is that banks demand higher risk premia during periods of increased risk aversion, while continuing to hold more domestic sovereign claims.[17] Coefficient on control variables have the expected signs and significance: higher growth rate and higher

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[15] In addition, the steepness of the slope is explained by the fact that a small change in the ratio of the home bias indicator is generated by a large increase in the numerator. There also can be some difference between AMs and EMs since banks' total assets are significantly large in AMs (440 percent of public debt), compared to those in EMs (220 percent).

[16] Throughout our analysis, we consider a "crisis period" as a period when investor risk aversion, proxied by the VIX, deviates substantially from its sample mean (22.7 point).

[17] In a similar vein, Broner and others (2014) theoretically find that discrimination between domestic and foreign creditors in turbulent times provide incentives for domestic purchases of debt. Creditor discrimination could be due to sovereigns' incentive to avoid defaults on domestic debt or ad hoc domestic regulations imposed during these turbulent periods.

institutional quality significantly reduce bond spreads, whereas an increase in credit increases bond spreads (3rd column of Table A1).

Figure 3. Bond Spreads and Home Bias in AMs

(A) "Normal Times"[1]

(B) "Increased risk aversion" Period[2]
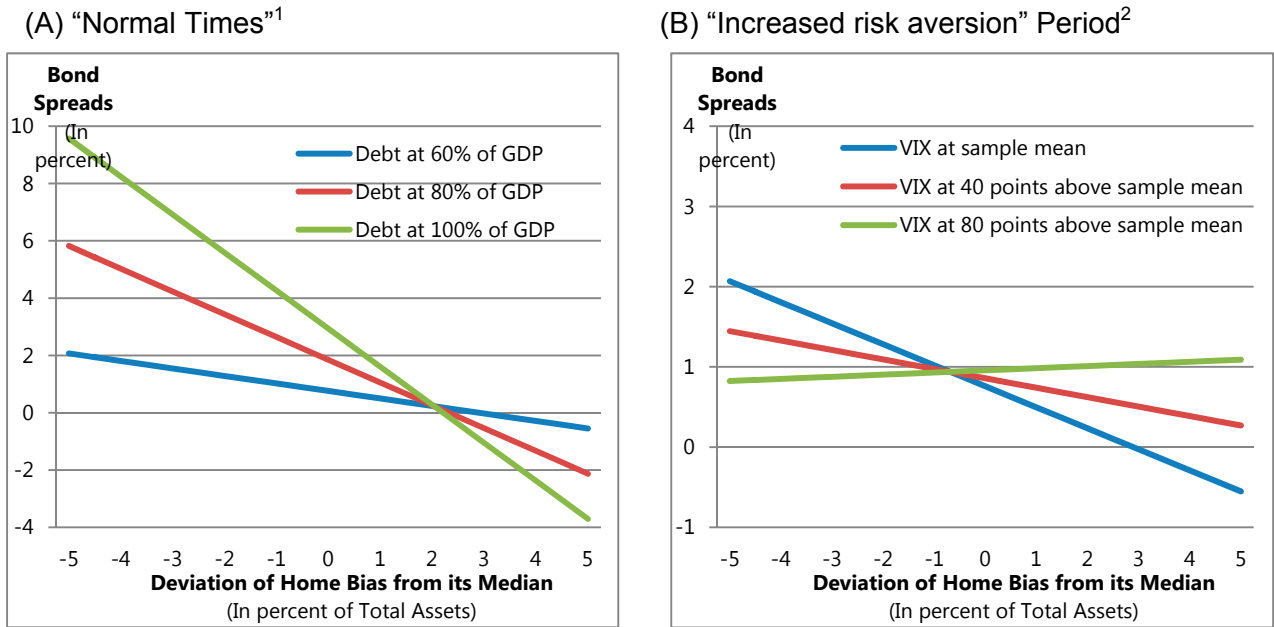
Sources: IMF WEO; and Fund staff estimates.

[1]VIX is fixed at sample mean (22.7 point).
[2]Debt is fixed at 60 percent of GDP.

18.   **Similar to the results for AMs, home bias is also in general negatively associated with bond yields in EMs.** This also reflects the lower expectation of sovereign default when domestic banks hold sovereign debt. However, home bias seems to have a milder impact on cost of borrowing as seen in the flatter lines in Figure 4 panel A and 3rd column of Table A2. On the contrary, market sentiments seem to play a bigger role in EMs than AMs. In particular, for debt level of 60 percent of GDP the impact of home bias on cost of borrowing becomes positive when VIX is slightly above its mean as seen Figure 4 panel B. Control variables enter with expected signs and significance: higher growth rate and lower inflation rate remarkably reduce bond spreads, whereas an increase in investor' risk aversion (VIX) and US long-term interest rates increases bond yields in EMs (3rd column of Table A2).

Figure 4. EM Sovereigns Borrowing Costs in the Domestic Market

(A) "Normal Times"[1]

(B) "Increased risk aversion" Period[2]
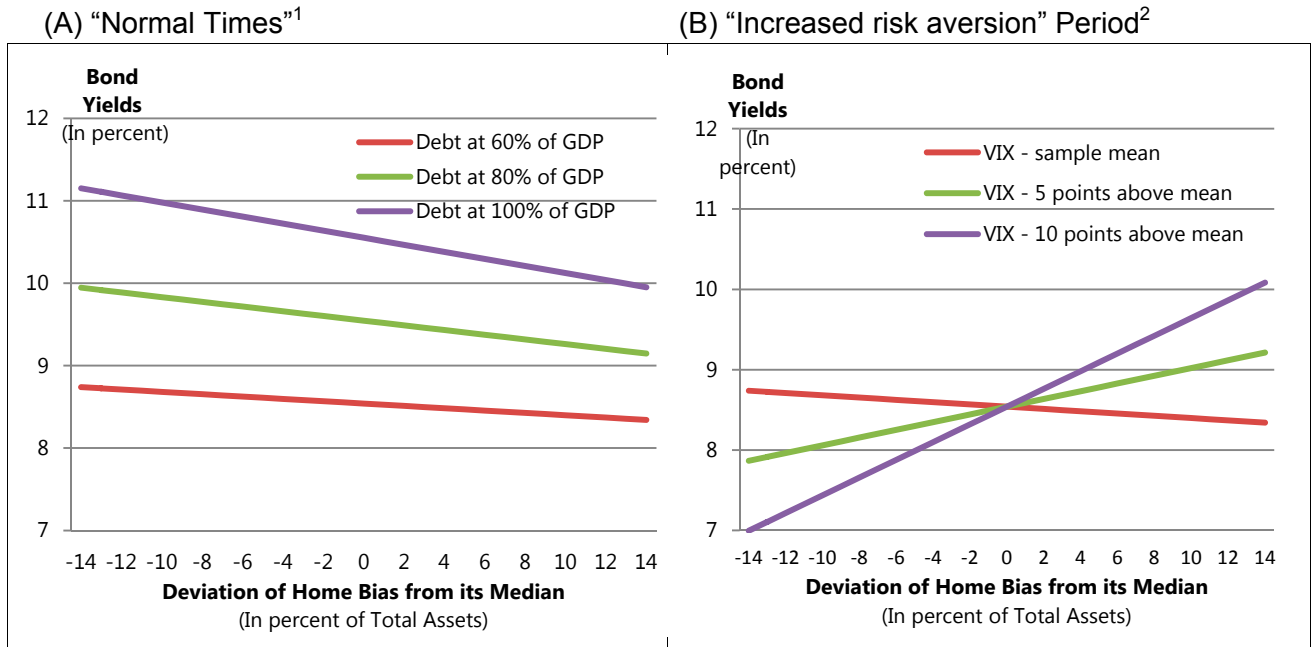

Sources: IMF WEO; and Fund staff estimates.
[1]VIX is fixed at sample mean (18.5 point).
[2]Debt is fixed at 60 percent of GDP.

19.   **The relatively large importance of market sentiments in EMs is supported by the strong correlation between the VIX and EM bond spreads.** We apply a multivariate generalized autoregressive conditional heteroskedasticity (GARCH) framework on a sample of monthly data from 1999 to end August 2013. The GARCH allows for heteroskedasticity of the data and a time-varying correlation in the conditional variance. The methodology is explained in Appendix III. For AMs, we calculate the spread to German Bunds (based on 10-year instruments) for European countries, while for the non-European countries; the spread to the 10-year U.S Treasury bonds is calculated. For EMs we use the EMBI Global spread because of the lack of high frequency domestic yield data. The dynamic conditional correlation (DCC) GARCH models are estimated in first differences to account for the nonstationarity of the variables in crisis periods. Figure 5 illustrates the GARCH findings for a selective sample of EM and AM countries, respectively. The estimated correlation coefficients between spreads and the VIX increase for both EMs and AMs during periods of financial stress, e.g., 2008 and 2011, but overall co-movements are higher for EM. The average estimated co-movement between EM spreads and the VIX is 43 percent for the full sample period (1999–2013) compared with 14 percent for AM countries. The large difference holds for different sample periods (pre-Lehman, during and post global financial

crisis) as well (Table 2).[18] The relatively low co-movement in AMs is consistent with the safe asset role AM sovereign bonds play particularly during crisis periods.

Figure 5. Estimated GARCH Correlations with VIX
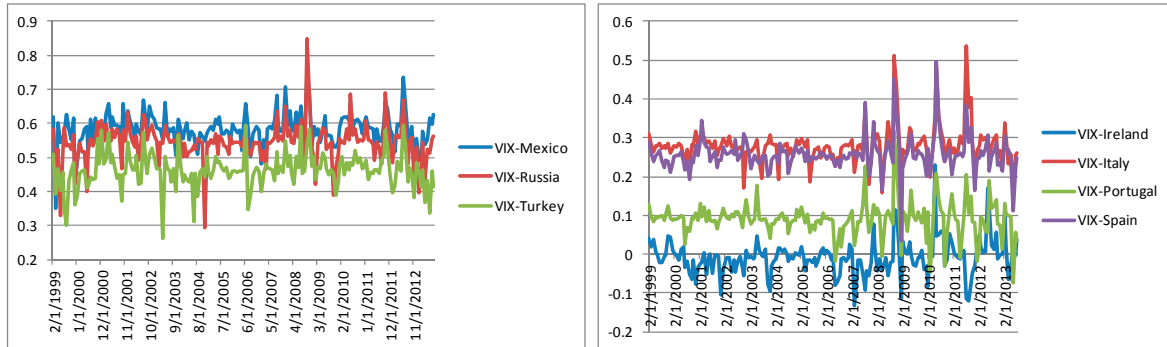
Sources: Bloomberg and Fund staff estimates.

Table 2. Average EM and AM Estimated GARCH Correlations with VIX

Correlation with VIX	Mexico	Poland	Russia	Turkey	China	Malaysia	Philippin	Brazil	Peru	Venezuel	Bulgaria	Hungary	EM Av
Average	58%	41%	54%	46%	25%	35%	46%	57%	43%	46%	46%	14%	43%
Pre-Lehman	58%	40%	54%	46%	24%	34%	47%	55%	39%	44%	45%	13%	42%
During GFC	60%	40%	57%	49%	25%	35%	45%	66%	57%	53%	47%	14%	46%
Post-GFC	58%	42%	54%	46%	26%	36%	46%	59%	47%	51%	46%	16%	44%
	Ireland	Italy	Portugal	Spain	Austria	Finland	France	letherland	Australia	Canada	Japan	UK	AM Av
Average	-1%	28%	9%	26%	29%	14%	11%	6%	-6%	23%	17%	7%	14%
Pre-Lehman	-2%	27%	9%	25%	29%	13%	11%	5%	-5%	23%	17%	6%	13%
During GFC	2%	32%	13%	27%	32%	18%	16%	9%	-11%	15%	10%	9%	14%
Post-GFC	1%	29%	9%	26%	30%	14%	11%	6%	-7%	25%	19%	9%	14%

Note: The pre-Lehman period is before September 2008, the Global Financial Crisis (GFC) between September 2008 and June 2009, while the post- GFC period is July 2009–August 2013 (end of sample period). Correlation between domestic yields and EMBI spreads in annual frequency is 0.38 over the period 1999–2012.

Sources: Bloomberg and Fund staff estimates.

B. Public Debt

20. **We analyze whether home bias contributes to a high public debt level in AM and EM possibly through reduced borrowing costs.** To avoid the endogeneity problem (as in the borrowing cost regressions), we apply a two-step generalized method of moment (GMM) estimation using housing price and lagged credit-to-GDP ratio as instruments for home bias.[19] Our model specifications are as follows:

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[18]The focus here is on the overall correlation magnitudes between AM and EM. Low correlation magnitudes are unlikely to be statistically significant.

[19]Similar to the borrowing costs regressions, we use the housing price and lagged credit-to-GDP variables as instruments. The housing price variable is correlated with banks' holdings of domestic sovereign claims but not with public debt. Moreover, the lagged credit-to-GDP ratio is predetermined and thus not correlated with public debt. These two instruments have enough explanatory power supported by a high Adj-R^2.

$$b_{i,t} = \gamma_1 hb_{i,t} + x_{i,t}\delta + \varepsilon_{it} \qquad \text{--- (2)}$$
$$b_{i,t} = \gamma_2 hb_{i,t-1} + x_{i,t}\delta + \varepsilon_{it} \qquad \text{--- (3)}$$

where $b_{i,t}$ is the level of public debt at t, $hb_{i,t}$ and $hb_{i,t-1}$ are home bias at t and $t-1$, respectively, and $x_{i,t}$ is a vector of macroeconomic variables.

21.   **An increase in home bias in AMs and EMs is associated with a high public debt level (Figure 6 and Table A3).**[20] Given the potentially high demand of banks for domestic sovereign claims, sovereigns, ceteris paribus, tend to issue relatively larger amounts of debt (Figure 6). Panel regression results on AM and EM samples confirm that home bias has concurrent effects on the level of debt (2nd and 4th columns of Table A3). Moreover, the subsequent debt level is significantly influenced by home bias due to its persistent feature (3rd and 5th columns of Table A3). Other macro variables result in expected signs and significance: an increase in credit leads to increase in public debt whereas sovereigns with high inflation rates, low institutional quality and high degree of capial openness tend to accumulate high debt (7th column of Table A3). As mentioned in the introduction, we do recognize circumstances of reverse causality. While analytically we accounted for these endogeneity issues, there are still cases where a rise in public debt might lead sovereigns to use moral suasion to ensure that new debt can be safely placed with domestic banks, which increases the home bias indicator.[21]

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[20]For the regressions on public debt on a combined sample of AMs and EMs, we introduce a dummy variable for AMs to account for heterogeneity between the AM and EM samples.

[21]Disentangling potential feedback mechanisms between home bias and public debt can be difficult despite our efforts to control for such endogeneity by using strong instruments, i.e., house prices and the lagged credit-to-GDP ratio.

Figure 6. Public Debt-to-GDP and Home Bias (Average, 2005–07)
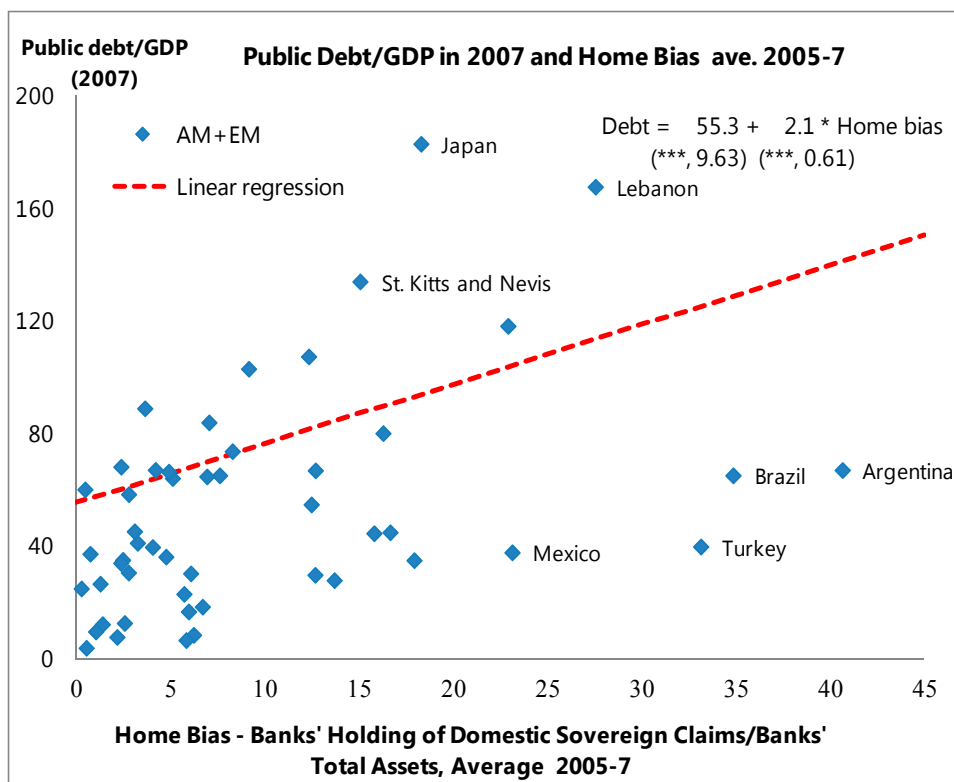
Source: Fund staff estimates.

C. Primary Balance Adjustments

22.   **This section considers whether the primary fiscal balance tends to adjust less to lagged debt level in countries with high home bias.** Our model specifications closely follow Ghosh and others (2011) to include both square and cubic terms of lagged debt to capture two inflexion points in the fiscal reaction function. Specifically, Ghosh and others (2011) explain the appropriateness of the nonlinear fiscal reaction function as follows: At a very low level of debt, there is little (or even a slightly negative) relationship between lagged debt and the primary balance. As debt increases, the primary balance rises but the responsiveness eventually begins to weaken, and then actually decreases at high levels of debt.

$$pb_{i,t} = \beta_1 b_{i,t-1} + \beta_2 b_{i,t-1}^2 + \beta_3 b_{i,t-1}^3 + \gamma_0 (hb_{i,t} - \overline{hb}_t) + \gamma_1((hb_{i,t} - \overline{hb}_t) * b_{i,t-1} + x_{i,t}\delta + \varepsilon_{it} \quad \text{-- (4)}$$

where $pb_{i,t}$ is the primary balance at time t, $b_{i,t-1}$, $b_{i,t-1}^2$, $b_{i,t-1}^3$ are linear, quadratic and cubic terms of lagged public debt at t, $hb_{i,t}$ is the country-specific home bias and $\overline{hb}_t$ is the sample median of home bias at t, and $x_{i,t}$ is a vector of macroeconomic variables. The fourth and fifth terms on the right hand side of equation capture effects of home bias per se and the interaction between home bias and lagged debt on current primary balance, respectively. As

before, we apply a two-step generalized method of moment (GMM) fixed effects estimation using housing price and lagged credit-to-GDP ratio as instruments for home bias to deal with potential endogeneity issues.[22] The fixed effects estimation accounts for significant variations in primary balance adjustments across countries.[23]

23.   **We find that fiscal policy is less responsive to lagged public debt in AMs and EMs with a higher home bias (Figure 7).**[24] The average primary balance of countries whose home bias falls in the top quartile of distribution is substantially lower than that of the whole sample for a given level of lagged debt. If a country's home bias deviates from the median by 5 percent, its primary balance is lower by 0.6 percent of GDP compared to the sample mean (Table 3). Given domestic banks' interest in domestic sovereign claims, sovereigns might be less willing to commit to fiscal consolidation, ceteris paribus, despite a high level of debt.[25] As shown in the panel regression results (2nd column of Table A4), the primary balance is negatively affected by home bias (entered as a deviation from its median). Overall, an elevated home bias might provide the sovereign with more fiscal breathing space since it potentially reduces the cost of borrowing, even when the debt level is high. As expected, signs and significance of other macroeconomic variables are the same with Ghosh and others (2011): primary balance responds positively to the output gap and trade openness, but negatively to temporary increases in government outlays (captured by government expenditure gap). In other words, having a captive domestic investor base can reduce rollover risks for the sovereign and that, ceteris paribus, might translate into lower fiscal consolidation. While we attempt to address endogeneity issues in the panel regression framework, we recognize that reverse causality could be an issue in some circumstances (similar to the home bias-public debt relationship).

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[22]These two instruments have enough explanatory power supported by a high Adj-R^2.

[23]Mauro and others (2013) find that there are significant variations in primary balance adjustments across countries and time periods.

[24]Due to data limitations (particularly for primary balance-to-GDP ratio and home bias in EMs), the regression is based on the combined sample of AMs and EMs.

[25]A close relationship between sovereigns and domestic banks creates amplification effects, which could result in an insufficient degree of fiscal consolidation: With banks willing to absorb domestic sovereign claims, they also anticipate a low risk of sovereign default given the sovereign is unlikely to impose high default costs on the banks. In turn and with a captive domestic investor base, sovereigns are less willing to commit to fiscal consolidation despite a high debt level.

Figure 7. Fiscal Policy Reactions and Home Bias
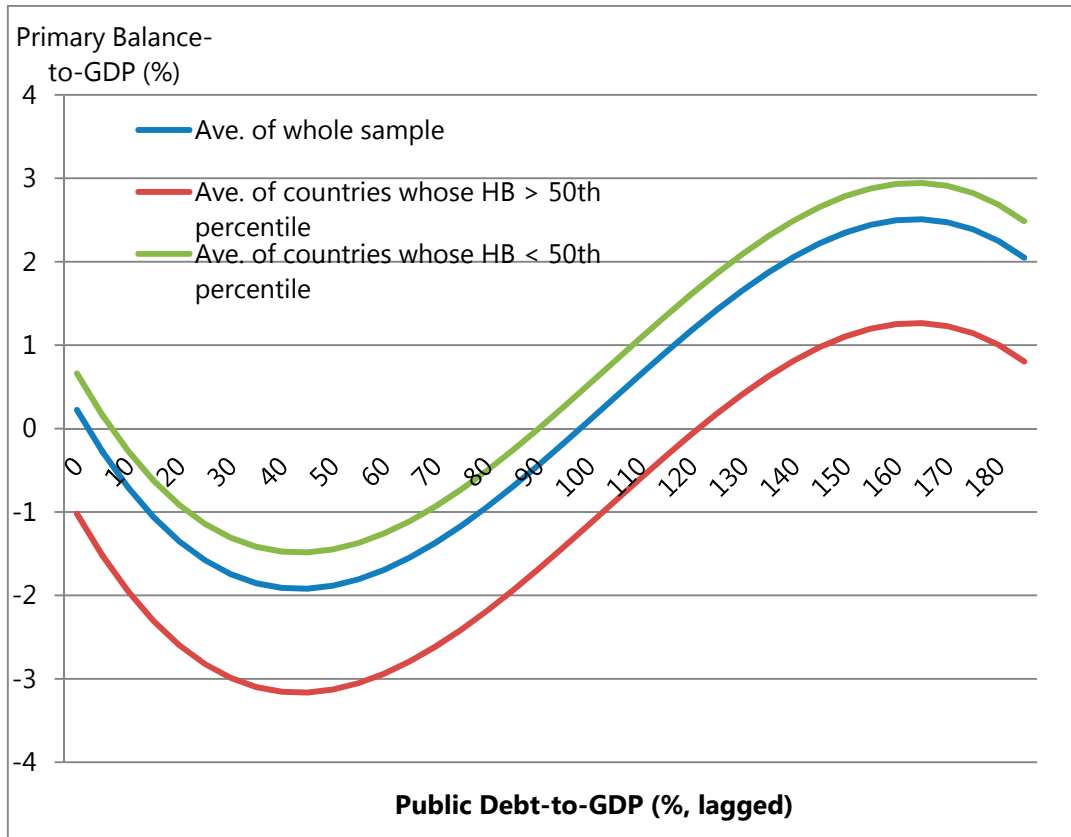
Sources: IMF WEO; and Fund staff estimates.

Table 3. Estimated Fiscal Policy Reactions

Public debt-to-GDP, lagged (%)	Primary balance-to-GDP (%)		
	HB 5% below Median	Median of whole observation	HB 5% above Median
80	-0.4	-0.9	-1.5
100	0.7	0.1	-0.5
120	1.8	1.2	0.6
160	3.1	2.5	1.9

Sources: IMF WEO; and Fund staff estimates.

D. Debt under Distress

24. AMs and EMs with high home bias tend to experience debt difficulties at a higher level of public debt (Figure 8). This finding is based on an event study analysis using a sample of 17 episodes of debt difficulties based on the methodology of Baldacci and others (2011) and Cruces and Trebesch (2013). In particular, Baldacci and others (2011) define debt distress events for AMs as (1) Default: a sovereign not current on its debt obligations (Standard and Poor definition); (2) Restructuring and rescheduling: any operation which alters the original terms of the debtor-creditor contract; (3) IMF financing: in excess of 100 percent of quota; or (4) Inflation: greater than 35 percent per annum. For EMs, debt distress events are defined as: (1) Default: arrears on principal or interest payments to commercial or official creditors; (2) Restructuring and rescheduling: any operation which alters the original terms of the debtor-creditor contract; or (3) IMF financing: addressing liquidity issues associated with sovereign debt distress.

25. There is a positive relationship between the level of debt at which countries are assessed to have experienced debt difficulties and home bias (3 year average). The intuition is that whenever a large share of domestic sovereign claims is held by domestic banks, sovereigns are less likely to default because defaults would have severe adverse effects on banks (Gennaioli and others, 2014b). Moreover, due to relatively lower borrowing costs, sovereigns can tolerate higher levels of debt. Therefore, debt accumulates further before debt sustainability concerns arise.

Figure 8. Debt Distress and Home Bias
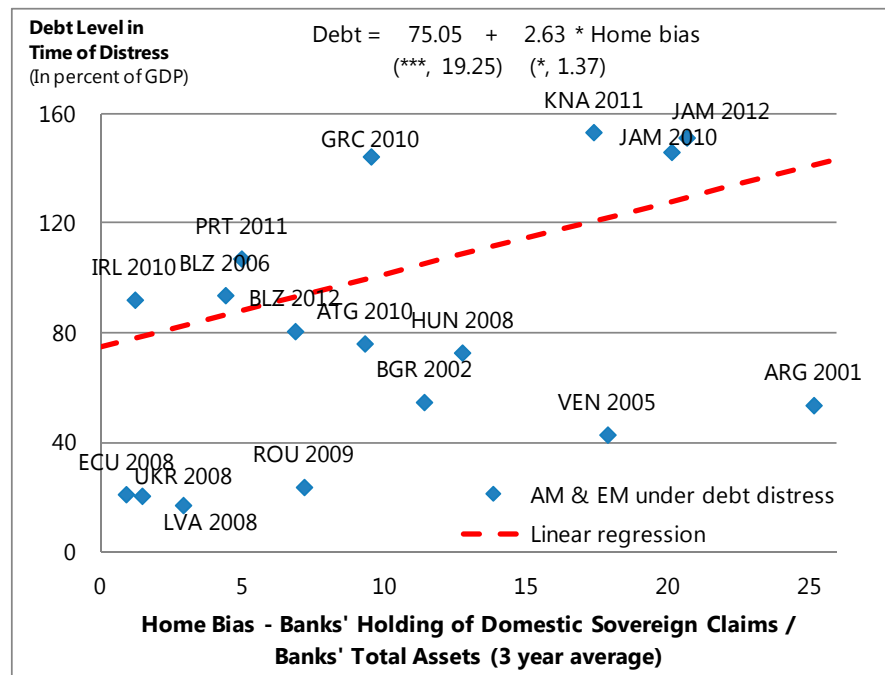
Sources: Baldacci and others (2011); and Cruces and Trebesch (2013).

E. Robustness Tests

26.   **To support our main empirical findings, we use two other measures of home bias which reflect banks' sovereign portfolio allocation (A) and diversification of sovereign claims by residency of investors (B).** Following the existing academic literature, these measures are defined below (see also appendix I).

Home Bias (A) = Banks' holding of domestic sovereign claims / Banks' holding of sovereign claims

Home Bias (B) = Banks' holding of domestic sovereign claims / Public debt

27.   **The main empirical results hold when we use the home bias measure (A) which is only available for AMs.** AMs' borrowing costs are substantially lower for countries with high home bias (2nd column of Table A5). Furthermore, higher home bias in AMs contributes to higher public debt concurrently and subsequently (2nd and 3rd columns of Table A6). Fiscal policy is less responsive to lagged public debt in AM countries with higher home bias (2nd column of Table A7).

28.   **Using the second measure (B) gives different results for AMs, namely that an increase in banks' holding of sovereign claims as a percent of total debt leads to an increase in borrowing costs in AMs.** This is not surprising given that this measure in fact captures investor diversification rather than banks' assets allocation preference. When foreign investors' purchases of domestic sovereign claims increase (indicating a low home bias), borrowing costs in AM are reduced, partly due to higher competition (3rd column of Table A5). This is consistent with findings in the academic literature (e.g., Arslanalp and Poghosyan, 2014, Andritzky, 2012, and Warnock and Warnock, 2009). For EMs in contrast, an increase in this measure reduces domestic borrowing costs similar to our results using our preferred home bias measure (4th columns of Table A5). It appears that for EMs, the influence of banks' portfolio allocation dominates investor diversification effect.

29.   **Quantile regression techniques using our preferred measure of home bias also support the previous findings and partly strengthen them.** We use the median least squares (MLS) estimator, which minimizes the median square of residuals rather than the average and thus reduces the effect of outliers. For instance, we focus on the higher percentile of countries with home bias and find that the borrowing costs of AM countries are more sensitive to the home bias variable than in the panel regression framework (5th column in Table A1). This is not surprising since one would expect a higher sensitivity of the home bias and sovereign borrowing link for countries in say the 75th or 90th percentile distribution.

IV. OTHER HOME BIAS ISSUES

30.   **While the paper does not analyze the determinants of home bias, it is worth noting that a multitude of factors could potentially explain differences in home bias across countries.**

- **The preferential treatment of domestic sovereign debt in the context of banking sector regulatory frameworks is universal (see also IMF, 2014).** The zero risk-weighting for capital requirements has substantially contributed to the elevated home bias. In this context however, risk weights on other assets, including foreign sovereign debt, might differ significantly between countries which potentially could contribute to cross-country variation in home bias.

- **In the context of financial sector vulnerabilities, domestic sovereign debt has become increasingly important as central bank collateral** as well as for secured wholesale funding combined with more demanding liquidity requirements (e.g., the Liquidity Coverage Ratio).

- **The supply of public debt has substantially increased in many advanced countries during the crisis,** and led to domestic banks absorbing much of new sovereign debt issuances especially when there was a foreign investor retrenchment.[26] In particular, this occurred in an environment of increased global risk aversion and is typically accompanied by other home bias factors (as discussed here).

- **Structural factors, for example, the availability of other investment opportunities relative to the size of the banking sector could affect domestic banks' holding of domestic sovereign debt.** Market infrastructure such as liquidity or the presence of capital controls (especially in EMs) could also lead to differences in home bias across countries. In some countries there may be a seemingly inherent preference of local investors (including banks) to invest in domestic sovereign debt due to, for instance, asymmetric information.

  - **Business cycle considerations could also play a role,** as banks might move towards more domestic sovereign debt due to decline in investment opportunities and for flight-to-safety reasons during economic downturns.

31.   **The increased home bias for European peripheral banks during the crisis reflects a number of factors.** For instance, with foreign investors' flight from the peripheral sovereign debt market, peripheral banks absorbed much of the sovereign debt sales of

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[26]If public debt is increasing but the share of foreign investors or domestic banks' preferences remain the same, home bias would not increase per se.

nonresidents as well as new debt issuances.[27] The ECB LTROs also provided peripheral banks with cheap and abundant liquidity to increase their sovereign exposure, which sizably contributed to banks' pre-provisioning profits (especially after the Outright Monetary Transactions (OMT) caused declining sovereign yields) at a time of deteriorating asset quality and supervisory requirement for continuing NPL provisioning. With credit growth in peripheral countries significantly declining during the crisis, banks tended to invest in sovereign debt during times of crisis (flight-to-safety). A higher level of sovereign debt also augmented banks' eligible amount of collateral for both ECB and other market funding.

32.   **Increasing home bias has raised some concerns regarding its impact on the health of the banking sector in the European peripheral countries.** According to European Banking Authority (EBA) data as of June 2013 for a cluster of banks, Italian banks' investments in domestic sovereign bonds represent 204 percent of their core equity, which is among the highest for European banks, and similar for Spanish banks with 156 percent. Interestingly, German banks also have a sizable sovereign exposure to their sovereign relative to their capitalization (214 percent) but with obviously less sovereign risk given the higher perceived safety of the German sovereign. The concerns about European banks' sovereign exposure led to the mark-to-market (MTM) of all sovereign securities in the EBA recapitalization exercise in late 2011.

33.   The sovereign exposure of peripheral banks could potentially decline given the ECB LTRO expiry in 2015. To counteract potential market concerns from a deepened sovereign-bank nexus and to signal financial strength to rating agencies in the run up to the European Asset Quality Review (AQR) and stress test, some peripheral banks have started to reduce their sovereign exposure (e.g., via LTRO repayments). Peripheral sovereign debt markets have seen a resurgence of interest by foreign investors in the recent period including successful debt issuances by countries such as Ireland and Portugal. Solvent credit demand could increase with the economic recovery potentially also helping to reduce peripheral banks' sovereign debt holdings.

Domestic holdings of sovereign debt, as percent of Core Tier 1

Source: EBA. Data as of 1H2013

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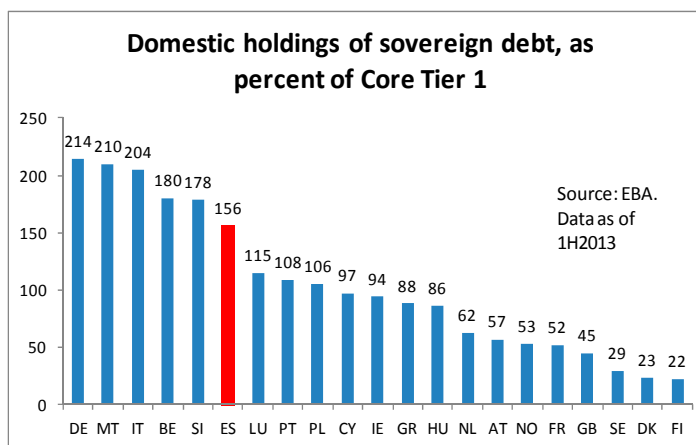
[27]For instance, Acharya and Steffen (2013) find that increased home bias contributed to compressing peripheral bond spreads after the European crisis. Results by Arslanalp and Poghosyan (2014) also show that foreign investor outflows have significantly raised bond yields in Italy and Spain.

Nonetheless, the continued need to finance large deficits implies that the overall share of peripheral banks' debt holdings is likely to remain high unless nonresident investors and other peripheral non-banking institutions substantially increase their shares.

V. CONCLUSION

34.   **The paper empirically examined home bias and the sovereign-bank nexus from a broad perspective.** It attempted to empirically address such pertinent issues such as the link between home bias and borrowing costs, public debt, fiscal policy reactions as well as debt distress. To account for possible cross-country and time series heterogeneity, a large sample of AM and EM countries was chosen for a long sample period between 1999–2012.

35.   **The main empirical results indicate that AM and EM countries seem to benefit from a higher home bias in terms of lower borrowing costs.** Furthermore, market sentiments play a more important role for EMs and the negative relationship between home bias and EM borrowing costs could become positive during crisis periods. As experienced by previous sovereign debt crises, EMs tend to be highly sensitive to sudden changes in risk sentiments which explain the sharp increase in EM borrowing costs in spite of large home bias.

36.   **We also find that countries with higher home bias tend to have larger debt levels and to undertake less fiscal adjustments.** In other words, sovereigns with a highly captive domestic banking system are more likely to exhibit an impaired and delayed fiscal reaction function and might overly rely on the ability of domestic banks to fund the sovereigns. While this allows the sovereign to carry higher debt burdens, it also leads to stress at times when debt reaches dangerously high levels and when the sovereign-bank nexus has become more entrenched.

37.   **The empirical findings are well reflected in the European debt crisis experience.** The experience has shown that especially peripheral countries with a very captive domestic banking sector have been more reluctant to undertake necessary fiscal reforms. External market pressures and soaring sovereign yields have forced peripheral countries to start implementing some of the overdue reforms. Decisive monetary policy by the ECB has certainly helped to provide a backstop to the peripheral domestic banks.

38.   **The empirical analysis could be extended in a number of ways.** It is possible to integrate non-bank holdings of domestic sovereign debt into the home bias coverage. Furthermore, an extension could aim to better deal with potential concerns on reverse causality, e.g., between home bias and public debt, by using some case studies. While the regression framework attempts to control for the standard macro-financial and institutional factors, the set of explanatory variables could be expanded.

Appendix I. Computations of Home Bias Indicators

(1) Banks' holding of domestic sovereign claims / Banks' total assets
      AMs: Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, Portugal, Slovenia, Spain, Sweden, United States.

      EMs: Antigua and Barbuda, Argentina, Belize, Brazil, Bulgaria, Chile, Ecuador, Estonia, Egypt, Hungary, Indonesia, Jamaica, Jordan, Latvia, Lebanon, Lithuania, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Romania, Russia, Saint Kitts and Nevis, Thailand, Turkey, Ukraine, Venezuela.

   Nominator
    - **Banks' holding of domestic sovereign claims (A)**
       (1) IFS "CLAIMS ON GENL GOVT IN CTY"
                 complemented by
       (2) Arslanalp and Tsuda (2012, IMF WP)
          "Domestic banks' holding of domestic sovereign claims"
              Six countries: Australia, Canada, New Zealand, Norway, Switzerland,
  U.K.

   Denominator
    - **Banks' total assets = (A) + Banks' holding of claims on nonresidents (B)**
                         + Banks' holding of claims on central bank (C)
                         + Banks' holding of claims on other sectors (D)

    - Banks' holding of claims on nonresidents (B)
       IFS "CLAIMS ON NONRESIDENTS"
    - Banks' holding of claims on central bank (C)
       IFS "CLAIMS ON CENTRAL BANK"
    - Banks' holding of claims on other sectors (D)
       IFS "CLAIMS ON OTHER SECTORS"

(2) Banks' holding of domestic sovereign claims / Banks' holding of sovereign claims
      AMs: Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong SAR, Ireland, Israel, Italy, Japan, Korea, Luxembourg, New Zealand, Netherlands, Norway, Portugal, Singapore, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States.

   Nominator-(defined above)
   Denominator
    - **Banks' holding of sovereign claims = (A) + Banks' holding of other sovereign**
                                   claims (E)

    - **Banks' holding of other sovereign claims (E) = Foreign assets (F)**
                 * Proxy (ratio of banks' exposure to foreign public claims) (G)

- Foreign assets
    IFS "FOREIGN ASSETS"
- Proxy (Ratio of banks' exposure to foreign public claims) (G) = Banks' exposure
    to foreign public sector / banks' exposure to total foreign claims
- Banks' exposure to foreign public sector
        BIS banking sector statistics (Table 9E) "G: Public sector claims"
- Banks' exposure to total foreign claims
        BIS banking sector statistics (Table 9E) "S: Foreign claims"
    * available for Belgium, France, Germany, Italy, Japan, Spain, Switzerland,
      U.K., U.S. For others, European average or non-European average is used.
    ** Data is available for the period over 2010–12, 2010 data is used for
       period prior 2009.

(3) Banks' holding of domestic sovereign claims / Public debt of sovereign
                (sample available AM & EM)
Nominator - (defined above)
Denominator
  - Public debt   IMF WEO

Appendix II. Details and Sources of Macroeconomic Variables

Variable	Description	Frequency	Source
Dependent variables			
Long-term bond yields	In percent	Annual / Monthly	IMF's World Economic Outlook (WEO) / IFS
EMBI stripped spreads	In percent	Annual / Monthly	Bloomberg
Debt-to-GDP	In percent	Annual	WEO database
Primary balance to GDP ratio	In percent	Annual	WEO database
Explanatory variables			
Lagged debt to GDP ratio	In percent	Annual	WEO database
GDP growth rate	In percent	Annual	WEO database
Inflation rates	Three year lagged moving average CPI inflation	Annual	Staff calculations based on WEO database
Exchange rate depreciation	In percent	Annual	Staff calculations based on WEO database
Institutional quality index	Smaller (larger) values indicating higher (lower) political risk.	Annual	International Country Risk Guide (ICRG) dataset.
Credit to GDP ratio	In percent	Annual	IFS database
Capital account openness	Higher indices indicating a high degree of capital account openness	Annual	Chin and Ito (2006)
VIX	Chicago Board Options Exchange Market Volatility Index	Annual / Monthly	Bloomberg
U.S. long-term bond yields	In percent	Annual	WEO database
Output gap	Difference between actual and potential (calculated using the Hodrick-Prescott filter real GDP)	Annual	Staff calculations based on WEO database
Government expenditure Gap	Difference between actual and potential (calculated using the Hodrick-Prescott filter real GDP)	Annual	Staff calculations based on WEO database
Trade openness	Sum of exports and imports to GDP (in percent)	Annual	Staff calculations based on WEO database
Oil price	Log of (trend) oil price applied to oil exporters only.	Annual	Staff calculations based on WEO database

Appendix III. Outline of the DCC GARCH Method

The Dynamic Conditional Correlation (DCC) specification by Engle (2002) is adopted, which provides a generalization of the Constant Conditional Correlation (CCC) model by Bollerslev (1990).[28] The DCC framework allows us to analyze the monthly co-movement of both AM and EM spreads against the VIX, which proxies for global risk sentiment. Specifically, each of the DCC GARCH models includes the VIX as well as four EM or AM spreads.

The DCC model is estimated in a three-stage procedure. In general, let r_t denote an *n x 1* vector of asset returns, exhibiting a mean of zero and the following time-varying covariance:

$$r_t \mid \Im_{t-1} \sim N\left(0, D_t R_t D_t\right)$$

$$\text{where } D_t = diag\left\{\sqrt{h_{it}}\right\}$$

(A1)

Here, R_t is made up from the time dependent correlations and D_t is defined as a diagonal matrix comprised of the standard deviations implied by the estimation of univariate GARCH models, which are computed separately, whereby the ith element is denoted as $\sqrt{h_{it}}$. In other words in this first stage of the DCC estimation, we fit univariate GARCH models for each of the five variables in the specification. In the second stage, the intercept parameters are obtained from the transformed asset returns and finally in the third stage, the coefficients governing the dynamics of the conditional correlations are estimated. Overall, the DCC model is characterized by the following set of equations (see Engle, 2002, for details):

$$
\begin{aligned}
D_t^2 &= diag\left\{\omega_i\right\} + diag\left\{\kappa_i\right\} \circ r_{t-1} r'_{t-1} + diag\left\{\lambda_i\right\} \circ D_{t-1}^2 \\
\varepsilon_t &= D_t^{-1} r_t \\
Q_t &= S \circ (\iota\iota' - A - B) + A \circ \varepsilon_{t-1}\varepsilon'_{t-1} + B \circ Q_{t-1} \\
R_t &= diag\left\{Q_t\right\}^{-1} Q_t diag\left\{Q_t\right\}^{-1} \\
S &= E\left[\varepsilon_t \varepsilon'_t\right]
\end{aligned}
$$

(A2)

Here, S is defined as the unconditional correlation matrix of the residuals ε_t of the asset returns r_t. As defined above, R_t is the time varying correlation matrix and is a function of Q_t, which is the covariance matrix. In the matrix Q_t, ι is a vector of ones, A and B are square, symmetric and $\circ$ is the Hadamard product. Finally, λ_i is a weight parameter with the contributions of D_{t-1}^2 declining over time, while κ_i is the parameter associated with the squared lagged asset returns. The estimation framework is the same as in Frank, Gonzalez-Hermosillo and Hesse (2008) or Frank and Hesse (2009).

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[28]Given the high volatility movements during the recent financial crisis, the assumption of constant conditional correlation among the variables in the CCC model is not very realistic especially in times of stress where correlations can rapidly change. Therefore, the DCC model is a better choice since correlations are time-varying.

Table A1. Regression of Bond Spreads—(1) AM

Dependent variable: **Bond Spreads 1/**	(1) HB HB/Debt	(2)Baseline - HB. HB/Debt, HB/VIX	(3) Omitting Greece, Japan, Portugal	(4) Quartile regression
	IV pooled estimation	IV pooled estimation	IV pooled estimation	Quartile regression
β_1 (Public debt/GDP, lagged)	0.055*** (0.013)	0.054*** (0.013)	0.038** (0.010)	-0.0068 (0.016)
β_1 (Public debt/GDP, square, lagged)	-	-	-	0.000014 (0.00006)
γ_0 (Deviation of home bias from median)	1.361*** (0.493)	1.255** (0.515)	1.226* (0.620)	
γ_1 (Deviation of home bias from median * Public debt/GDP, level, lagged)	-0.027*** (0.009)	-0.027*** (0.012)	-0.026*** (0.012)	-0.013** (0.0065)
γ_2 (Deviation of home bias from median * VIX)	-	0.004 (0.012)	0.007 (0.013)	0.0084 (0.021)
δ_1 (GDP growth rate)	-0.045*** (0.012)	-0.045*** (0.016)	-0.024* (0.014)	-0.139*** (0.052)
δ_2 (Inflation rate, 3-year MA)	-0.089 (0.101)	-0.087 (0.101)	0.026 (0.109)	0.178 (0.124)
δ_3 (Institutional quality)	-0.046*** (0.012)	-0.045*** (0.012)	-0.028** (0.011)	-0.118*** (0.022)
δ_4 (Exchange rate depreciation)	-0.009* (0.005)	-0.009* (0.005)	-0.008* (0.006)	-0.019 (0.019)
δ_5 (Credit-to-GDP ratio)	0.009** (0.004)	0.009** (0.004)	0.005** (0.002)	-0.007** (0.003)
ϕ_1 (VIX)	0.011* (0.006)	0.007 (0.016)	0.004 (0.017)	-0.017 (0.031)
Adj. R-squared	0.252	0.253	0.202	-
Sample of years	1999–2012	1999–2012	1999–2012	1999–2012
Sample of observations	313	313	276	313
Root MSE	0.681	0.682	0.636	-

Note: ***, **, * show significance at 1%, 5%, and 10%. Error term assumed to follow an AR(1) process.
1/ Bond spreads is defined as difference between yields of countries' long-term bonds and those of the U.S. bonds (non-European countries) or those of German bonds (European countries).

Table A2. Regression of Bond Yields—(2) EM

Dependent variable:	Local Currency Bond Yields (long-term)	
	(1) HB, HB/VIX	(2) Baseline—HB, HB/debt, HB/VIX
	IV pooled	IV pooled
β_1 (Public debt/GDP, lagged)	0.046*** (0.010)	0.050*** (0.015)
γ_0 (Deviation of Home bias from median)	-0.223** (0.088)	-0.202** (0.088)
γ_1 (Deviation of Home bias from median * Public debt/GDP, level, lagged)	-	-0.0007 (0.002)
γ_2 (Deviation of Home bias from median * VIX)	0.012*** (0.0035)	0.012*** (0.0036)
δ_1 (GDP growth rate)	-0.258*** (0.063)	-0.264*** (0.066)
δ_2 (Inflation rate, 3-year MA)	0.201* (0.102)	0.202* (0.105)
δ_3 (Exchange rate depreciation)	-0.0012 (0.021)	-0.002 (0.021)
δ_4 (Capital account openness)	0.054 (0.214)	0.068 (0.217)
δ_5 (Credit-to-GDP ratio)	0.0028 (0.015)	0.0028 (0.015)
ϕ_1 (VIX)	0.057** (0.026)	0.055** (0.026)
ϕ_2 (U.S. long-term bonds)	0.977*** (0.313)	0.960*** (0.313)
Adj. R-squared	0.747	0.742
Sample periods	1999–2012	1999–2012
Sample of observations	113	113
Root MSE	1.574	1.578

Note: ***, **, * show significance at 1%, 5%, and 10%. Error term assumed to follow an AR(1) process.

Table A3. Regression of the Public Debt/GDP—AM, EM, AM&EM

Dependent variable: **Public debt to GDP ratio**	(A) AM		(B) EM		(C) AM & EM	
	(1) IV pooled regression	(2) Least Square—pooled regression	**(1) IV pooled estimation**	(2) Least Square—pooled regression	(1) IV pooled regression	**(2) Least Square—pooled regression**
γ_1 (Home bias)	**2.307**</br>**(1.127)**	-	**1.104***</br>**(0.392)**	-	0.420</br>(0.518)	-
γ_1 (Home bias, lagged)		3.753***</br>(0.520)		1.919***</br>(0.157)		**2.529***</br>(0.242)**
δ_1 (Output gap)	**-1.742***</br>(0.669)**	-2.342***</br>(0.666)	**-0.913***</br>(0.320)**	-0.863***</br>(0.318)	-1.356***</br>(0.458)	**-0.907***</br>(0.307)**
δ_2 (Government expenditure gap)	**-1.095</br>(1.146)**	-0.414</br>(1.166)	**-0.132</br>(0.165)**	0.043</br>(0.120)	-0.427</br>(0.264)	**0.188</br>(0.160)**
δ_3 (Trade openness)	**-0.074*</br>(0.045)**	-0.137***</br>(0.047)	**-0.082</br>(0.070)**	0.287***</br>(0.064)	-0.131***</br>(0.041)	**-0.052***</br>(0.032)**
δ_4 (Inflation rate, 3-year MA)	**-4.318**</br>**(1.901)**	-10.604***</br>(1.870)	**0.093***</br>(0.028)**	0.032***</br>(0.023)	0.172***</br>(0.041)	**0.087***</br>(0.032)**
δ_5 (Oil price, lagged)	-	-	**-5.186***</br>(1.145)**	-1.655**</br>(0.774)	-4.502***</br>(1.414)	**-1.018</br>(0.782)**
δ_6 (Capital account restriction)	**18.223***</br>(3.036)**	13.179***</br>(2.618)	**-4.301***</br>(1.073)**	4.430***</br>(0.977)	-4.502***</br>(1.414)	**7.821***</br>(1.251)**
δ_7 (Credit-to-GDP ratio)	**0.087</br>(0.068)**	0.197***</br>(0.042)	**-0.111</br>(0.126)**	-0.207**</br>(0.092)	4.712**</br>(2.051)	**0.181***</br>(0.049)**
δ_8 (Institutional quality)	**-1.243**</br>**(0.484)**	-0.857**</br>(0.406)	**-0.225</br>(0.350)**	-0.567</br>(0.774)	-1.094***</br>(0.393)	**-0.865***</br>(0.279)**
Constant	**118.25**</br>**(46.961)**	96.480***</br>(34.614)	**56.22</br>(36.016)**	44.079***</br>(27.290)	121.442***</br>(34.916)	**63.275***</br>(20.937)**
Dummy variable for AM	-	-	-	-	37.076***</br>(7.891)	**23.936***</br>(6.174)**
Sample period	**1999–2012**	1999–2012	**1999–2012**	1999–2012	1999–2012	**1999–2012**
Adj. R-squared	**0.420**	0.635	**0.879**	0.588	0.387	**0.493**
Sample of observations	**202**	207	**70**	184	272	**391**
Sample of countries	**19**	20	**9**	18	28	**38**
Root MSE	**21.654**	24.392	**11.084**	21.892	23.68	**27.388**
Wald chi-squared	**210.73**	-	**2227.36**	-	352.74	-

Note: ***, **, * show significance at 1%, 5%, and 10%. Estimation including capital adequacy ratio is also examined, but due to availability of data on capital adequacy ratio, sample period and observation are limited to 2008–10 and 75. Thus, we do not report the results in the table.

Table A4. Regression of the Fiscal Reaction Function—AM&EM

Dependent variable: **Primary balance to GDP ratio**	(1) HB indicator—constant	(2) HB indicator—constant/linear	(3) HB indicator—linear interactive	(4) HB indicator—quadratic interactive	(5) HB indicator—cubic interactive
β_1 (Public debt/GDP, lagged)	-0.143* (0.084)	-0.130 (0.083)	-0.150* (0.085)	-0.151* (0.086)	-0.148* (0.085)
β_2 (Public debt/GDP, square, lagged)	0.00166** (0.0007)	0.0014* (0.00075)	0.00179** (0.00074)	0.00181** (0.00074)	0.0018** (0.00072)
β_3 (Public debt/GDP, cubic, lagged)	-0.0000048** (0.0000020)	-0.0000044** (0.0000020)	-0.0000052*** (0.0000020)	-0.0000051*** (0.0000020)	-0.0000047** (0.0000019)
γ_0 (Deviation of HB from median)	-0.096** (0.050)	-0.169* (0.092)	-	-	-
γ_1 (Deviation of HB from median * Public debt/GDP, lagged)	-	0.00096 (0.00099)	-0.00024 (0.00046)	-	-
γ_2 (Deviation of HB from median * Public debt/GDP, square, lagged)	-	-	-	-0.0000023 (0.0000031)	-
γ_3 (Deviation of HB from median * Public debt/GDP, cubic, lagged)	-	-	-	-	-0.000000022 (0.000000019)
δ_1 (Output gap)	0.151*** (0.050)	0.140*** (0.050)	0.155*** (0.052)	0.157*** (0.052)	0.158*** (0.052)
δ_2 (Government expenditure gap)	-0.065** (0.028)	-0.060** (0.027)	-0.062** (0.029)	-0.062** (0.028)	-0.062*** (0.028)
δ_3 (Trade openness)	0.070*** (0.020)	0.072*** (0.020)	0.071*** (0.020)	0.070*** (0.020)	0.070*** (0.020)
δ_4 (Inflation rate, lagged)	-5.869 (7.790)	-7.372 (7.793)	-7.124 (7.881)	-7.013 (7.800)	-6.879 (7.730)
δ_5 (Oil price, lagged)	-12.734*** (3.887)	-13.118*** (3.834)	-12.491*** (4.002)	-12.404*** (4.020)	-12.305*** (4.018)
δ_6 (Capital account openness)	0.060 (0.346)	-0.009 (0.348)	0.105 (0.344)	0.124 (0.347)	0.148 (0.348)
δ_7 (Credit-to-GDP ratio)	-0.067*** (0.013)	-0.067*** (0.013)	-0.068*** (0.013)	-0.068*** (0.013)	-0.068*** (0.013)
Adj. R-squared	0.424	0.434	0.418	0.417	0.417
Sample of years	1999–2012	1999–2012	1999–2012	1999–2012	1999–2012
Sample of observations	453	453	453	453	453
Sample of countries	45	45	45	45	45
Root MSE	2.423	2.417	2.433	2.432	2.423
Transformed DW	1.670	1.664	1.680	1.682	1.685

Note: ***, **, * show significance at 1%, 5%, and 10%. Country-specific fixed effect included, and error term assumed to follow an AR(1) process. All specifications are regressed by two-step GMM fixed effects estimation

Table A5. Robustness Check for Bond Spreads Regression—AM, EM

Dependent variable:	(A) Banks' holding of domestic sovereign claims / Total sovereign claims—AM	(B) Banks' holding of domestic sovereign claims / Public Debt—AM & EM	
	Bond spreads-AM	Bond spreads-AM	Bond yields-EM
β_1 (Public debt/GDP, lagged)	0.032***	0.052***	0.049***
	(0.012)	(0.012)	(0.014)
γ_0 (Deviation of Home bias from median)	-	0.657**	-0.201**
		(0.274)	(0.087)
γ_1 (Deviation of Home bias from median * Public debt/GDP, level, lagged)	-0.0012**	-0.014***	-0.001
	(0.00047)	(0.005)	(0.016)
γ_2 (Deviation of Home bias from median * VIX)	0.0018**	0.0019	0.012***
	(0.00086)	(0.006)	(0.0035)
δ_1 (GDP growth rate)	-0.049***	-0.045***	-0.264***
	(0.016)	(0.013)	(0.066)
δ_2 (Inflation rate, 3-year MA)	-0.059	-0.086	0.201*
	(0.095)	(0.101)	(0.105)
δ_3 (Exchange rate depreciation)	-0.0085	-0.009*	-0.002
	(0.0053)	(0.005)	(0.021)
δ_4 (Capital account openness)	-	-	0.068
			(0.217)
δ_5 (Credit-to-GDP ratio)	0.009**	0.009**	0.0026
	(0.004)	(0.004)	(0.015)
ϕ_1 (VIX)	0.012*	0.007	0.059**
	(0.007)	(0.015)	(0.026)
ϕ_2 (U.S. long-term bonds)	-	-	0.952***
			(0.312)
Adj. R-squared	0.228	0.252	0.744
Sample periods	1999–2012	1999–2012	1999–2012
Sample of observations	313	313	113
Sample of countries	25	25	16
Root MSE	0.689	0.682	1.576

Note: ***, **, * show significance at 1%, 5%, and 10%. Error term assumed to follow an AR(1) process.

Table A6. Robustness Check for Public Debt Regression

Dependent variable: **Public debt to GDP ratio**	(A) Banks' holding of domestic sovereign claims / Total sovereign claims—AM		(B) Banks' holding of domestic sovereign claims / Public Debt—AM & EM
	(1) IV pooled regression	(2) Least Square—pooled regression	(1) IV pooled regression
γ_1 (Home bias)	**1.573*** **(0.902)**		**2.075*** **(1.224)**
γ_1 (Home bias, lagged)	-	0.148** (0.074)	-
δ_1 (Output gap)	**-0.846** **(1.482)**	-1.569*** (0.185)	**-0.926** **(1.191)**
δ_2 (Government expenditure gap)	**-0.383** **(01.443)**	-0.182 (0.216)	**0.182** **(0.419)**
δ_3 (Trade openness)	**0.096*** **(0.056)**	0.045 (0.033)	**-0.184**** **(0.085)**
δ_4 (Inflation rate, 3-year MA)	**-10.951** **(10.192)**	-2.860** (1.278)	**0.163***** **(3.884)**
δ_5 (Oil price, lagged)	-	-	**0.270** **(3.884)**
δ_6 (Capital account openness)	**27.191***** **(4.355)**	-6.780 (3.982)	**5.562**** **(2.460)**
δ_7 (Credit-to-GDP ratio)	**0.333** **(0.249)**	-0.019 (0.049)	**0.00015** **(0.092)**
δ_8 (Institutional capacity/political risk)	**-1.441*** **(0.786)**	-0.347* (0.198)	**0.231** **(0.343)**
Constant	-	52.8** (19.682)	-
Dummy variable for AM	-	-	-
Sample period	**2005–12**	2005-2012	**2005–12**
Adj. R-squared	-	0.490	-
Sample of observations	**172**	127	**334**
Sample of countries	**26**	26	**39**
Root MSE	**33.885**	4.682	**41.454**

Note: ***, **, * show sgnificance at 1%, 5%, and 10%. Estimation including capital adequacy ratio is also examined, but due to availability of data on capital adequacy ratio, sample period and observation are limited to 2008–10 and 75. Thus, we do not report the results in the table.

Table A7. Robustness Check for Fiscal Reaction Function—AM

Dependent variable: **Primary balance to GDP ratio**	**(A) Banks' holding of domestic sovereign claims / Total sovereign claims - AM**
β_1 (Public debt/GDP, lagged)	-0.270* (0.108)
β_2 (Public debt/GDP, square, lagged)	0.0033*** (0.00070)
β_3 (Public debt/GDP, cubic, lagged)	-0.0000094** (0.0000031)
γ_0 (Deviation of HB from median)	-0.117* (0.067)
γ_1 (Deviation of HB from median * Public debt/GDP, lagged)	0.0019** (0.00094)
δ_1 (Output gap)	0.811*** (0.102)
δ_2 (Government expenditure gap)	-0.450*** (0.097)
δ_3 (Trade openness)	0.048** (0.020)
δ_4 (Inflation rate, lagged)	0.978 (0.350)
δ_5 (Oil price, lagged)	19.756*** (19.756)
δ_6 (Capital account openness)	-1.141 (0.1.422)
δ_7 (Credit-to-GDP ratio)	-0.041 (0.015)
Adj. R-squared	0.851
Sample of years	2005–12
Sample of observations	181
Sample of countries	28
Root MSE	2.060
Transformed DW	1.691

Note: ***, **, * show significance at 1%, 5%, and 10%. Country-specific fixed effect included, and error term assumed to follow an AR(1) process.

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