

# IMF Working Paper

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## Central and Commercial Bank Balance Sheet Risk Before, During, and After the Global Financial Crisis

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**IMF Working Paper**

Statistics Department

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**Abstract**

**This Working Paper should not be reported as representing the views of the IMF.**

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This paper presents an overview of exposures in the balance sheets of central banks, banks, and other depository institutions during the past decade, with emphasis on asset growth and currency composition. It exploits the IMF's SRF-based monetary data to show: (i) there was a widely observed buildup of assets prior to the global financial crisis, but there has been no significant reduction in its wake; (ii) the foreign currency composition of the balance sheets of banks and other depository institutions remained remarkably constant in spite of the crisis, significant changes in the composition of balance sheets, and globalization, and does not seem to have been significantly influenced by the behavior of exchange rates; and (iii) exposure to households increased prior to the crisis, but this increased risk was offset by increased capitalization.

JEL Classification Numbers: E51, E58, F31, G11, G21

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## I. INTRODUCTION

1. **This paper examines risk trends in the balance sheets of financial sector institutions during the past decade.**<sup>2</sup> It analyzes the cross border, currency, counterpart, and instrument compositions of bank balance sheets. Particular risks that are examined include the buildup of assets prior to the global financial crisis and subsequent tapering, the evolution of cross border exposures and national/foreign currency mismatches, and risks arising from changes in asset counterparts, in particular the expansion of lending to households.

2. **The data reveal a number of interesting trends in bank balance sheets.** They show that the buildup of assets especially in the United States and Europe prior to the crisis has yet to significantly unwind. In most countries, any subsequent unwinding usually represented a return to levels that prevailed shortly before the crisis. The SRF data also include comprehensive currency breakdowns of balance sheets (into national and foreign), allowing for an examination of the relationship between exchange rates and dollarization. They show that, surprisingly, bank balance sheets in most countries maintained a highly stable balance between national currency (NC) and foreign currency (FC) throughout the build up to, occurrence of, and aftermath of the crisis. This was true in spite of other major changes in the counterparts of assets and liabilities. This was the case even in Europe, meaning that the much discussed currency mismatches (see Sirtaine, and Skamnelos 2007, and Ranciere, Tornell and Vamvakidis 2010) were mostly indirect. They also clearly illustrate the buildup of household debt prior to the crisis, while at the same time showing that banks responded by increasing their capital, perhaps in response to the increased risks they were undertaking.

3. **The paper is organized as follows.** Section II describes the SRF data examined in this paper. Section III looks at the pattern of asset growth of DCs prior to the crisis, and any reductions following the crisis. Section IV examines developments in cross border exposures of DCs. Section V examines developments in the currency composition of assets and liabilities of DCs, while Section VI looks at the same topic, but looking at the short-run. Section VII compares how the currency compositions of assets and liabilities differ between CBs and other depository corporations (ODCs). Section VIII examines how exchange rates

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<sup>2</sup> Specifically, it focuses on “other depository corporations” (ODCs) and central banks (CBs). The ODC sector is made up mainly of commercial banks, but also includes money market funds and any deposit taking institutions other than commercial banks or the central bank, such as savings cooperatives or MFIs. In this paper “banks” and “ODCs” are used interchangeably. “ODCs” would be the more rigorous term, but “banks” is used as well because it is more commonly understood. The Standardized Report Forms database that was used also includes information on other financial corporations (OFCs), sometimes referred to as nonbank financial corporations, but the country coverage of OFC data is not as universal as for CBs and ODCs, and so OFCs were not included in the analysis. This is unfortunate, as OFCs were central to the crisis (particularly in the U.S. where an OFC—Lehman—initiated the crisis). ODCs and CBs together comprise the depository corporations (DC) sector.

relate to dollarization. Section IX examines other trends in assets and liabilities of ODCs and their risk implications. Finally, Section X examines some trends in the main assets and liabilities of CBs.

## II. CHARACTERISTICS AND PRESENTATION OF THE DATA

4. **This paper examines quarterly data of depository corporations (mostly banks) for 136 IMF member countries for the period 2002–13.** Most countries that reported SRF data for depository corporations (DCs) by January 2014 are included, with a handful of exceptions. “Preins” (other than Romania) are not included because they report data in a unique format that is not easily mapped to the normal SRF format.<sup>3</sup> The Euro Area and Eastern Caribbean Currency Union countries are aggregated into a single series each. Other exceptions include some countries with highly volatile data (Iceland, Iraq, Serbia) that were deliberately excluded. Thus, there are 102 separate series in the data set.

5. **Some advanced countries are not SRF reporters.** Large or medium-sized economies that are missing from the SRF data set include Argentina, Hong Kong SAR, India, Saudi Arabia, Singapore, UAE, and the UK. The country set examined for this paper therefore does not fully cover the world economy. However, it does include data on the United States, Japan, and (in a single series) the Euro Area, and it provides detailed data for countries that are often underrepresented in research and analysis, offering an opportunity to gain insights into the economic perimeter as well as the center of the global financial crisis. Further characteristics of the data are presented in Appendix II.

## III. THE GROWTH OF ASSETS

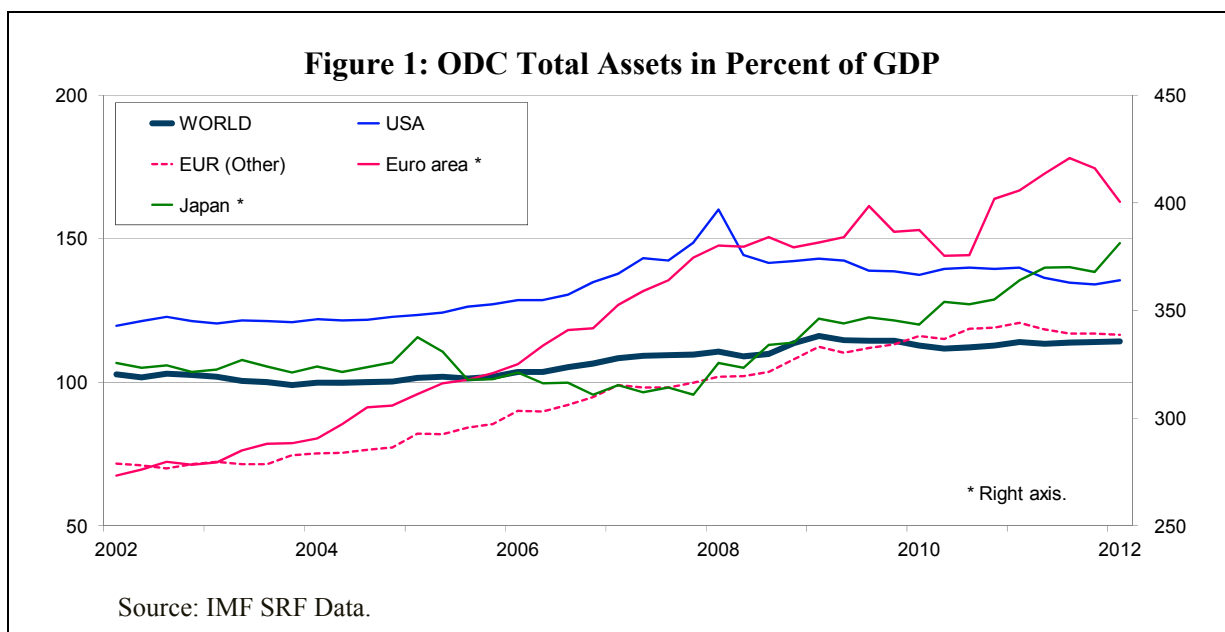
6. **In most countries prior to the crisis, there was a significant buildup of bank assets, followed by a tapering, though not a decline.**<sup>4</sup> The ratio of total assets of ODCs to GDP generally increased prior to and well into the crisis (Figure 1). In most countries, this asset growth accelerated in 2006 and any subsequent unwinding was minimal, temporary, or only to levels that prevailed shortly before the crisis. In the United States, at no time since the onset of the crisis have assets fallen to below the levels that prevailed during 2002–05 as a ratio to GDP or in real absolute terms. In many countries, in particular developing countries,

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<sup>3</sup> “Preins” refers to EU Member States that have not yet joined the Euro Area. These include Bulgaria, Croatia, Czech Republic, Denmark, Hungary, Lithuania, Poland, Romania, Sweden, and the UK. All Preins have a legal obligation to eventually join the Euro Area, with the exception of Denmark and the UK.

<sup>4</sup> It should be noted that these data only capture DCs; OFCs—such as pension funds, insurance companies, and investment funds—are not included, and at least in advanced countries much of the unwinding that was discussed after the crisis occurred among these institutions (IMF 2011; Papaioannou et al 2013). It should also be noted that the SRF data are residency-based, and therefore are not group consolidated.

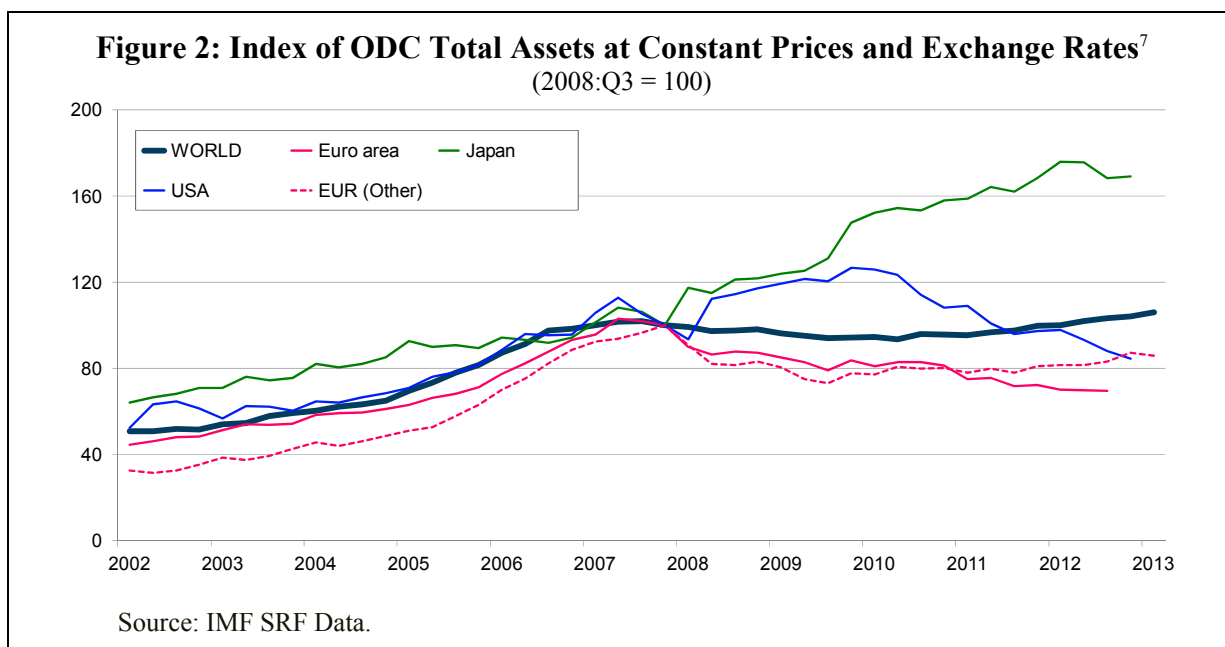
ongoing financial deepening would have accounted for at least part of the increase.<sup>5</sup> But many countries may still face a looming unwinding of the debt that was accumulated in the first years of the millennium (IMF 2012) or else a long struggle to reduce debt to GDP ratios through economic growth at a time when that growth is expected to be low.



7. **The conclusion that reductions in assets were minimal following the crisis does not change significantly if real absolute changes in assets are examined instead of ratios to GDP.** Economic growth rates declined and in many cases became negative following the crisis, particularly in Europe. Regions that experienced economic contraction might have had increases in their ODC assets to GDP ratio even if their ODC assets declined, and this was the case in Europe outside of the Euro Area, as well as in the Sub-Saharan African region. Indices of ODC assets, adjusted for inflation and keeping exchange rates constant, show some unwinding in these regions immediately after the fall of Lehman (2008:Q3 = 100), but the declines were only back to the levels of one or two years earlier (Figure 2). Other regions do not show evidence of unwinding, other than the United States (where unwinding also occurred as a ratio to GDP). In other Western Hemisphere countries, unwinding occurred as a share of GDP, but not in absolute terms, as GDP growth remained strong. Exchange rate movements also had some impact in Europe outside of the Euro Area; ODC assets to GDP in these countries fell slightly in 2009 rather than rising if measured at constant exchange rates rather than current exchange rates.<sup>6</sup> But this adjustment had little impact in other regions.

<sup>5</sup> The Economist Magazine (2012) reaches similar conclusions, and also provides detailed country by country data for several Euro Area countries.

<sup>6</sup> ODC assets at constant exchange rates are measured assuming that the FC basket includes only U.S. dollars.



8. **The increase in assets was particularly strong in Europe prior to the crisis, yet the subsequent unwinding only reverses the last two to three years of buildup.** In the Euro Area the increase was steep even though it started from a very high base, but in proportional terms the non-euro region experienced a greater increase (note that the series for the Euro Area and for Japan use the right axis). Following the crisis, assets in many regions continued to increase as a share of GDP. Discussions of unwinding at the time of the crisis (IMF 2008a, Avdjie et al 2012) emphasized reduced credit growth rather than a reduction in the stock of credit, so in the context of reduced GDP growth this could have been consistent with constant or even somewhat increased asset to GDP ratios.

9. **Most preins are not included in the set of European countries, and their inclusion might potentially reveal a stronger unwinding of European ODCs.** However, the SRF data do include several non-euro European countries that struggled to maintain financing after the crisis, including one prein (Romania) that struggled to maintain funding, but in the end experienced little decline in ODC assets, whether measured in local currency, in U.S. dollars, or as a percent of GDP. Also included are Turkey, where banks continued to accumulate assets throughout the crisis, and Moldova and Ukraine, where banks unwound immediately after the crisis, but then resumed accumulating assets.

10. **Patterns of unwinding varied across regions.** In the United States, there was a major unwinding immediately after the crisis as the United States aggressively addressed weaknesses in its banking system. This would, of course, represent a large decline in total

<sup>7</sup> NC assets are deflated by the CPI index. FC assets are deflated by the U.S. dollar exchange rate index (thus assuming all FC assets are in U.S. dollars).

world financial sector assets to world GDP (Cerutti, Hale, Minoiu; 2014). In Japan, asset growth picked up once the crisis struck as attempts were made to fend off deflation. In the Western Hemisphere region, unwinding began well before the crisis and continued throughout in jumps, though in absolute terms there was a steady increase throughout the crisis. Total assets in the Middle East, North Africa, and Central Asian (MENACA) region fluctuated as a share of GDP, but were steadier in absolute terms. Many Asian countries continued accumulating assets throughout the crisis with no slowdown.

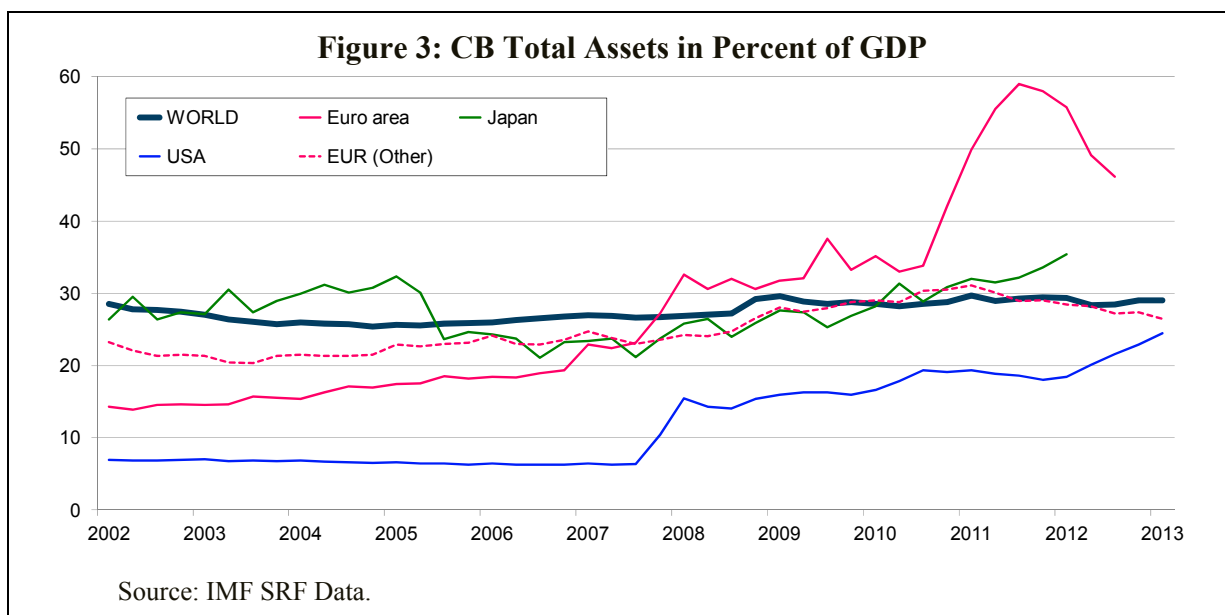
11. **Meanwhile, shadow banking activity has expanded.** Reporting of nonbank financial institutions is limited so it was not possible to include a comparable analysis of this sector.<sup>8</sup> However, detailed data were available for a small number of countries, including the United States, and they suggest that the buildup of assets may have been greater in the nonbank financial sector than in the banking sector, and that following the crisis there was a similar leveling off of asset growth without a decline.

12. **Many countries are taking actions to address the crisis legacy of debt burdens.** This includes most importantly accommodative monetary policies (when possible, e.g., when not constrained by inflation targeting regimes, etc.) to avoid putting additional stress on debtors. It also includes policies (implemented with a varying degree of effectiveness across countries) to encourage debt restructuring and recognition of loan losses. Some countries are looking into using intergenerational transfers such as through pension funds to ease liquidity constraints, though such policies may only delay facing the consequences of indebtedness.

13. **In contrast to the banking sector, most CBs did not significantly expand their balance sheets prior to the crisis, though ECB assets expanded somewhat (Figure 3).** In Japan, which has suffered from a liquidity trap, the balance sheet of the BoJ actually contracted. Following the crisis, advanced economies rapidly expanded their CB balance sheets to stimulate economic activity and to provide emergency lending (IMF 2009b). This expansion can be seen in the series for the United States, Euro Area, and Japan. In addition, though not seen in Figure 3, within regions more advanced and interconnected countries tended to have larger increases. For example, the asset to GDP ratios of the CBs of South Africa and Brazil expanded considerably more than the ratios for the AFR and WHD regions (respectively) as a whole.

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<sup>8</sup> “Other financial corporations” in the SRF database.

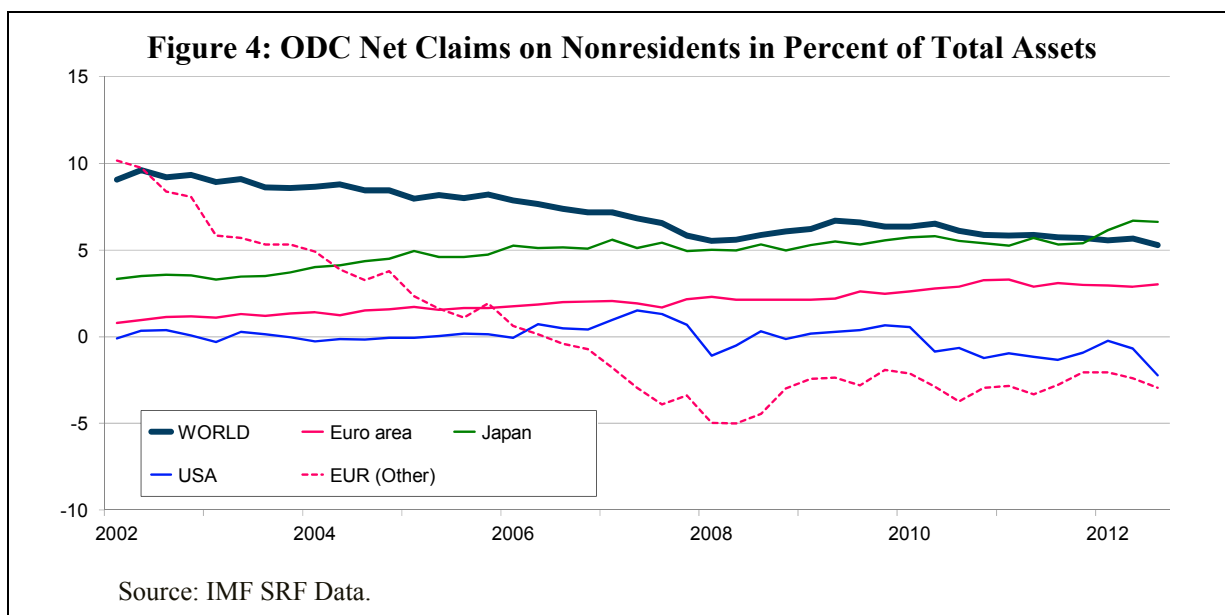


14. **Prior to the crisis, ODC assets expanded faster than CB assets.** The share of CB assets in total DC assets therefore declined (Figure A8). This did not happen in the United States, Japan, or Euro Area, but was particularly pronounced in Europe outside of the Euro Area, MENACA, and (with a delay) Sub-Saharan Africa. In many countries, this may have been mainly a function of local financial sector deepening rather than developments related to world financial markets.

#### IV. RESIDENT-NONRESIDENTS POSITIONS OF DCs

15. **The net positions of banks against nonresidents weakened for most of the world (Figure 4).** Prior to the crisis, these positions worsened largely because of increasing liabilities to nonresidents that were used to fund credit expansions, while claims on nonresidents remained flat. Following the crisis, the positions worsened as claims of nonresidents worsened while liabilities also declined, but more slowly, in many cases reflecting funding constraints.





16. **Significant deteriorations occurred among banks in a number of regions prior to the crisis as a result of economic booms that could not be fully financed locally.** Among these are the MENACA and non-euro European regions (Chung et al, 2014 and Errico 2014).<sup>9 10</sup> The average ODC nonresident balance in the MENACA region deteriorated by over 10 percent of total assets (though it remained always positive) at the same time that the price of oil was skyrocketing. In the non-euro European region, the average fell by over 15 percent of total assets and went well into a negative net position. Only in Japan was there a noticeable improvement. Most of these assets and liabilities were in FC, so changes in the net nonresident positions had roughly matching impacts on the net FC positions. Appendix I includes detailed descriptions of changes in the nonresident assets and liabilities of ODCs.

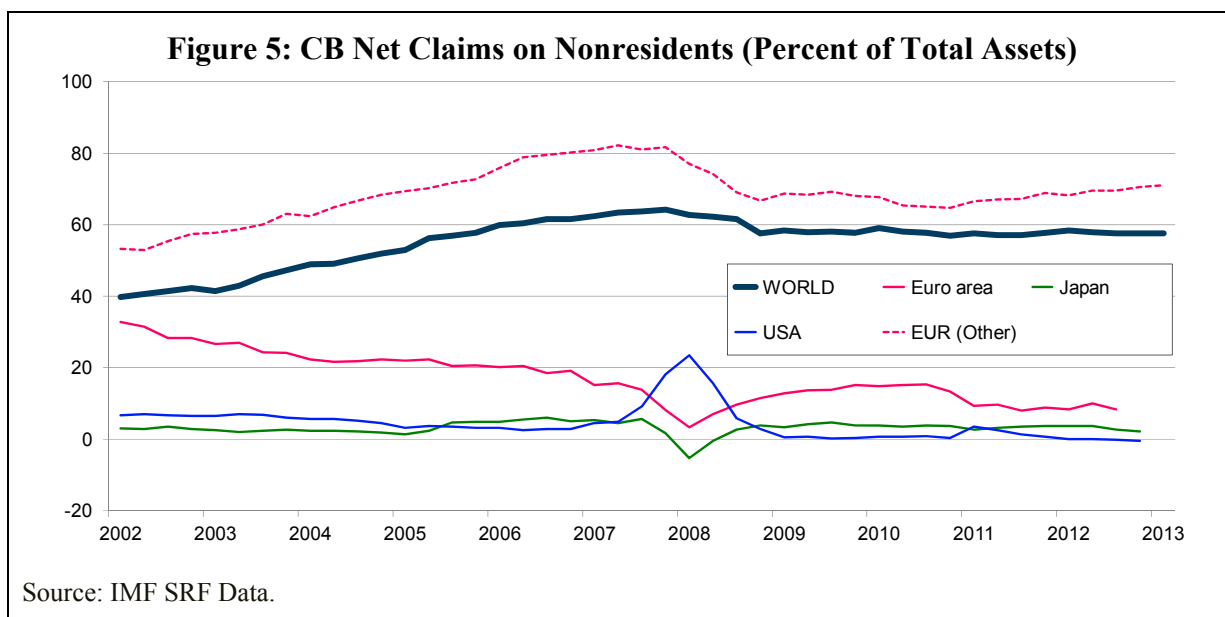
17. **Meanwhile, CBs built up buffers that more than compensated for the deterioration in banks' external positions (Figure 5).** As a result, the net international positions (e.g., positions with nonresidents) of most countries' DCs improved or remained roughly constant, with the exceptions of MENACA and non-euro European countries (Figure A9). Studies using BIS consolidated banking statistics (Cerutti and Claessens 2014) have noted the collapse of cross border lending following the crisis.<sup>11</sup> CBs may simply have

<sup>9</sup> The decline in the external position of ODCs in the MENACA region well in advance of the crisis at a time of skyrocketing oil prices is surprising and may partly reflect the absence of several, though not all, major oil producing nations from the set of SRF reporters.

<sup>10</sup> Errico et al 2014 raises an interesting question regarding the extent to which the vulnerabilities that ODCs took on may flag the likelihood of even larger OFC and shadow banking vulnerabilities.

<sup>11</sup> Such studies look at total claims, rather than averages that weight all countries equally, and look only at BIS reporting countries, which include mostly industrialized, particularly European, and emerging market countries.

accommodated residual flows left over by ODCs, deliberately offsetting the deterioration that was taking place in ODCs. In the case of emerging and developing countries, some CBs may have been wary of the possibility of their ODCs suddenly having to access international capital markets under onerous conditions and therefore may have preferred to keep their hands on their countries' foreign exchange resources. (In Figure 5, the unusual behavior of the series for the United States, Japan, and Europe in 2008 is explained by United States emergency lending equal to nearly 20 percent of assets that went largely to Japan and Europe.)



18. **Since the crisis banks' balance sheets have become less interconnected internationally (Figure A10; Appendix III).** "Less interconnected" refers to a decline in both banks' claims on and liabilities to nonresidents, not to net claims or to the ease with which funds can flow across borders. This is particularly true for Europe, within and outside of the Euro Area, and Asian and MENACA countries as cross border funding has become more difficult to obtain. ODC balance sheets in the United States, meanwhile, have become significantly more globally interconnected, as the United States has been viewed as a relatively safe haven and banks have experienced inflows, much of which were lent to nonresident banks. Euro Area balance sheets became more interconnected before the crisis, but this trend was reversed in 2008, and by 2012 nonresident assets were back to 2002 levels and liabilities were well below as external funding dried up. Prior to the crisis banks' cross border balance sheet assets declined somewhat, but liabilities rose faster than assets, so there was some increase in international interconnectedness at that time.

19. **A large portion of CB claims on nonresidents is in the form of securities.** Most of these securities would be central government securities. Meanwhile, liabilities of DCs to nonresidents are almost all in the form of deposits.

## V. CURRENCY COMPOSITION OF ASSETS AND LIABILITIES OF DCs

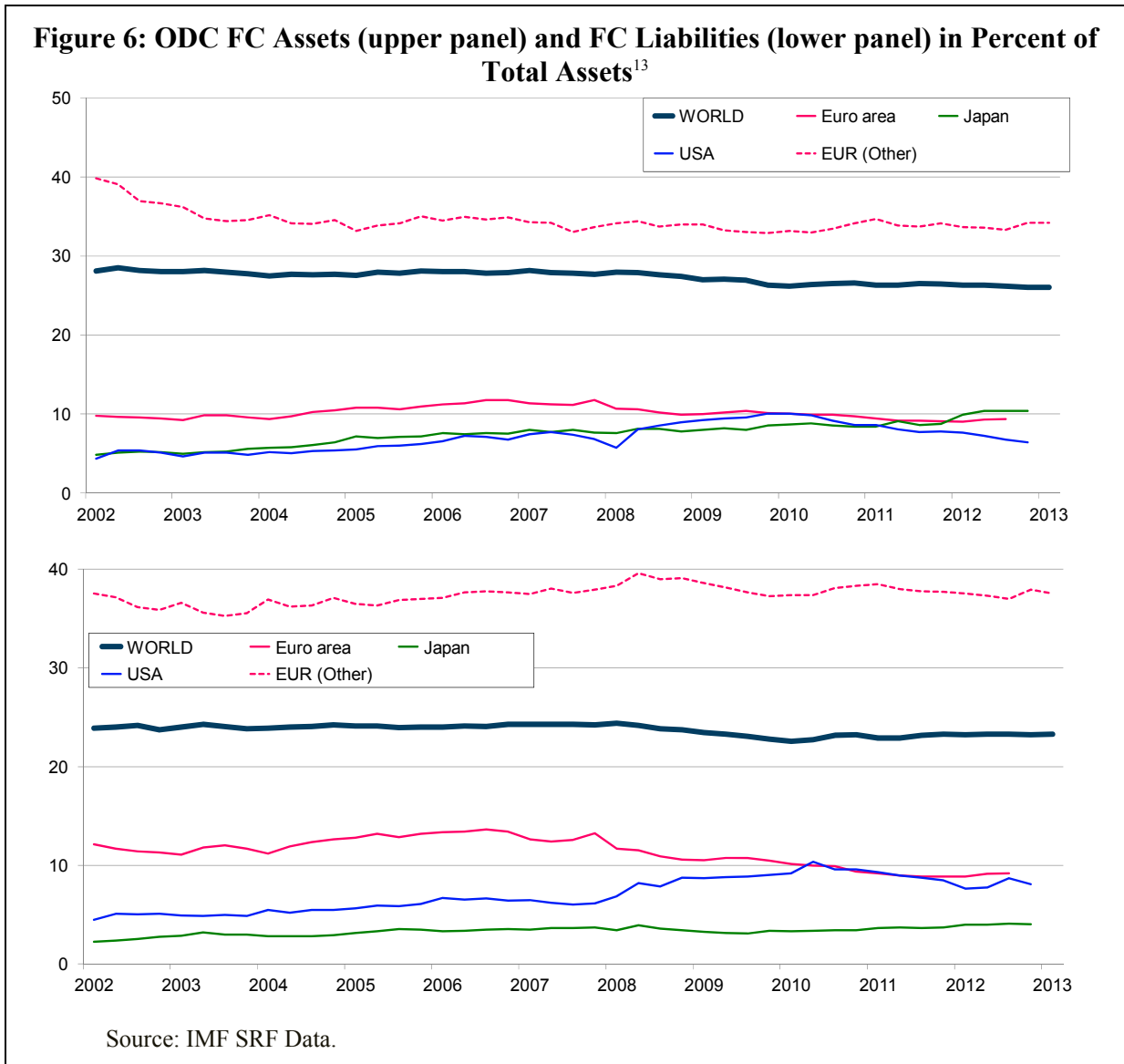
20. **The average FC shares of the assets and liabilities of banks remained remarkably stable throughout the run up to, onset of, and aftermath of the crisis (Figure 6).**<sup>12</sup> This stability was maintained in spite of the buildup of assets and subsequent disarray associated with the global financial crisis. It was also maintained in spite of significant shifts in the composition of balance sheets, in particular in the shares of nonresident assets and liabilities. In the United States and in Japan, there is some moderate increase in the FC shares of assets prior to and into the crisis, though these were starting from much lower bases than the averages for the rest of the world.

21. **Recent financial crises have been provoked at least in part, or exacerbated by, currency-related issues.** In the global financial crisis, high global liquidity is viewed as having led to large capital flows across borders, causing increased currency exposures. In Emerging Europe in particular, countries built up currency exposures that are considered to have had a significant negative impact during the global financial crisis (IMF 2008a, McGuire and von Peter, 2009), though the risks associated with Europe may have had as much to do with the cross border nature of the exposures as with the FC nature. Currency mismatches played an important role in the Asian Crisis as well (Zettelmeyer et al, 2010). And imbalances can emerge during normal times, from capital inflows or from dollarization (Cayazzo et al 2006), and can lead to crises.

22. **FC funding did not decline significantly in most regions after the financial crisis.** Early in the crisis there were reports of FC funding problems among European institutions and these may be reflected in the 2008 dip in the Euro Area series followed by a steady decline, but they are not evident in the non-Euro Area European data on FC liabilities. The 2009 IMF GFSR Report (IMF 2009) refers to FC shortages in Sub-Saharan African countries and shifts to domestic funding, yet the average FC share of ODC liabilities in the Sub-Saharan African region was flat following the crisis. The MENACA region also experienced a decline in the FC share of liabilities after the crisis, though this had begun before the crisis, and it was later reversed. The financial de-dollarization of Latin America (García-Escribano and Sosa, 2010) is reflected in the data.

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<sup>12</sup> The unexpected stability of currency composition echoes the finding of Eichengreen and Mathieson several years earlier that the currency composition of foreign exchange reserves remained stable following the introduction of the euro (Eichengreen and Mathieson, 2000).



23. **The data underlying Figure 6 indicate the currency denomination of a claim, but do not capture indirect currency exposure.** During 2002–08, the rapidly increasing net claims on banks in Emerging Europe by nonresidents, most of which were in FC, were largely offset by increased FC claims by banks on households and corporations. This minimized immediate currency exposures for banks, but increased their indirect exposures.<sup>14</sup> Ranciere et al (2010) acknowledged that even in Emerging Europe “the notional degree of

<sup>13</sup> Excluding Kosovo because of volatility.

<sup>14</sup> Even immediate currency exposures can be concealed in the SRF data if there are currency mismatch between FC assets and FC liabilities (e.g., if a country has euro assets and Yuan liabilities), though this type of mismatch was probably not important in Emerging Europe.

currency mismatch” was often small, but that indirect mismatches could be large. See also Yesin (2013). Banks that borrowed and lent in FC may have had no explicit net open position, but if their borrowers had no source of FC income then there was a vulnerability to exchange rate movements. In Emerging Europe, lending in NC but with payments linked to FC indices was widespread (examples include Croatia, Bosnia and Herzegovina, and Serbia). In Poland, some banks would lend in euros at low rates and immediately convert those euros (for a fee) to local currency.

**24. Banks in all regions had positive net open positions on average during the entire period, except in Europe, where there were substantially negative positions (Figure A11).**<sup>15</sup> Large negative positions in two countries are mainly responsible for the low average, but still seven out of the eleven non-euro European countries had negative positions for at least part of the past decade. Meanwhile, the Euro Area’s net open position improved and became positive by the 2012.

**25. Movements in U.S. dollar exchange rates suggest that maintaining this stability of FC shares required rebalancing in response to exchange rate movements.** The FC shares of the assets and liabilities of ODCs were less stable if the FC assets and liabilities are converted to local currency at constant U.S. dollar exchange rates (Figure A12).<sup>16</sup> This illustrates the impact of movements in the U.S. dollar exchange rate and suggests that the stable net open positions of ODCs were not a passive outcome. Maintaining such constant FC shares of both assets and liabilities required substantial intervention on both sides of the market (and thus do not seem likely to have been motivated primarily by surrender requirements or limits on net open positions).<sup>17</sup>

**26. The stability of the FC composition of banks can only be partly explained by measures imposed by CBs or regulators on banks.** Such measures would include restrictions on the size of net open positions, surrender requirements, special FC reserve requirements, or informal requests that ODCs deposit a large share of their FC reserves with the CB. However, surrender requirements or other FC deposit restrictions by the CB might

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<sup>15</sup> There were large variations across regions and individual countries persisted, but variations within countries were small. The average standard deviation of FC shares of ODC assets all countries in the sample set is 3.6 percentage points. A couple of notable exceptions include one country that had a steadily declining ratio from 85 percent at the start of the period to 22 percent at the end; and another, which increased from 11 percent in 2005 to 57 percent in 2009. There was also some convergence across regions in FC shares in the period before the crisis.

<sup>16</sup> U.S. dollar exchange rates are used because there is no detailed currency breakdown of FC assets and liabilities, so all FC positions are assumed to be in dollars. The accuracy of this assumption may vary by region.

<sup>17</sup> “Surrender requirements” refers to the practice in many countries of requiring that within a specified time period all or part of any FC proceeds (usually from export transactions) be turned over to the CB as a deposit or in exchange for NC.

reduce the level of FC assets, but would not eliminate the variability. They would not explain stability at a wide variety of levels ranging from single digits to well over 30 percent of total assets. And restrictions on net open positions would not explain the lack of movements of assets and liabilities in tandem, or of movements even when bank capital changed (thus changing the ceilings on net open positions). Some changes in FC positions on the liability side may have been caused by financing constraints, but again no such constraints would have existed on the asset side.

27. **The NC/FC composition of CB assets fluctuated much more than that of banks (Figure A13).** CBs have some control over exchange rate movements and would thus be less vulnerable to risk from exchange rate movements. Also, CBs cannot fail and thus are somewhat less vulnerable to a decline in their net value. The FC share of CB assets increased significantly prior to the crisis and tapered off afterwards, accounting for about two thirds of the total assets of CBs during 2008–13. The timing of the drop off in the share of FC assets differed across regions. Changes in the average FC shares of CB assets were mainly a result of changes in counterparts (between nonresidents and government), while changes in the average FC shares of liabilities were mainly a result of changes in the currency composition of claims on nonresidents. Prior to the crisis, one can see substantial buildups of claims on nonresidents and shedding of liabilities by central banks. Following the crisis one sees a drawdown of those assets. One can also see a sharp increase in the United States Fed’s FC assets that resulted from capital inflows as the United States was viewed as a safe haven for investors.

## VI. CURRENCY COMPOSITION OF SHORT-TERM LIABILITIES

28. **While the overall position in FC was stable and balanced, an estimate of the net open FC position in short-term instruments reveals a very modest increase in vulnerabilities (Figure A14).**<sup>18</sup> A negative net open short-term position in FC may represent a greater vulnerability than if it were in NC as FC deposits might be less stable than NC deposits and because they include an exchange rate risk component. World-wide there was a negative open short-term position in FC equal to about five percent of total assets on average at end-2013. This compares favorably with the average gap of about thirty percent between total short-term assets and liabilities in all currencies (a gap that is not surprising given that a key task of banks is to transform maturities).

29. **In non-Euro Area Europe, however, the short term FC gap was significantly larger than in other regions.** If Kosovo and Macedonia, FYR are removed from the sample, the region had the worst balance in the world in 2002 and from 2006 to 2009 the gap widened to a negative balance of over 15 percent of total assets.

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<sup>18</sup> Short-term instruments are assumed to be currency, deposits, and securities on the assets side, and deposits on the liabilities side.

## VII. EXCHANGE RATES AND DC POSITIONS IN FC

30. **Consideration of the separate asset and liability positions of CBs and banks suggests that CB net open positions are residuals.** The average standard deviation of the net open position as a share of assets during 2002–13 was about four times higher for CBs than for banks on a country by country basis (Table 1). Furthermore, for banks, on average, the standard deviations of the net open positions in FC are smaller than those of either FC assets or FC liabilities separately. The movement of FC assets and FC liabilities is correlated for banks as banks can target their net open position while allowing the separate asset and liability positions to move in tandem. Meanwhile, the opposite is the case for CBs. CBs absorbed the residual FC flows, presumably in order to avoid significant exchange rate movements.

	<b>World</b>	<b>U.S.</b>	<b>Euro Area</b>	<b>Japan</b>
<b>Net open position</b>				
Depository corporations	<b>5.9</b>	2.1	0.8	1.2
Central banks	<b>12.1</b>	15.9	5.1	1.7
Commercial banks (ODCs)	<b>3.1</b>	0.7	1.0	1.2
<b>Assets</b>				
Depository corporations	<b>5.7</b>	3.3	0.8	1.4
Central banks	<b>8.4</b>	15.9	4.1	0.7
Commercial banks (ODCs)	<b>4.5</b>	1.7	0.8	1.5
<b>Liabilities</b>				
Depository corporations	<b>4.5</b>	1.4	1.5	0.4
Central banks	<b>7.9</b>	1.0	1.7	1.5
Commercial banks (ODCs)	<b>3.5</b>	1.7	1.5	0.4
Source: IMF SRF Data.				

31. **The volatility of the FC shares of CB balance sheets was lower in countries with less flexible exchange rates.**<sup>19</sup> This is an unexpected result, since in countries with fixed or managed currency regimes the CB is required to absorb shocks to FC supply and demand,

<sup>19</sup> “Less flexible exchange rates” refers to the half of the countries in the sample that had lower normalized standard deviations of their exchange rates with respect to the U.S. dollar. Of course this analysis does not capture the effect of fixing or managing one’s exchange rate with respect to currencies other than the U.S. dollar.

whereas CBs that oversee floating rate regimes have the option not to intervene. But the data indicate that in countries with more flexible exchange rates, the standard deviations of the open positions as a share of assets are 14.9 percentage points, versus only 9.4 percentage points in countries with less flexible exchange rates. (Table 2).<sup>20</sup>

<b>Table 2. Average Standard Deviations Across Countries of Foreign Currency Assets and Liabilities</b>			
	<b>NOP 1/</b>	<b>FC Assets</b>	<b>FC Liabilities</b>
<b>Countries with more flexible exchange rates</b>			
<b>Average share of total assets</b>			
Depository corporations	13.0	37.8	24.8 2/
Central banks	39.9	64.5	24.5
Commercial banks (ODCs)	3.1	27.7	24.6
<b>Average standard deviation of share of total assets</b>			
Depository corporations	6.0	5.6	5.9
Central banks	14.9	9.1	11.3
Commercial banks (ODCs)	2.9	4.7	3.9
<b>Countries with less flexible exchange rates</b>			
<b>Average share of total assets</b>			
Depository corporations	20.1	40.3	20.3
Central banks	57.6	70.7	13.2
Commercial banks (ODCs)	4.3	27.1	22.8
<b>Average standard deviation of share of total assets</b>			
Depository corporations	5.7	5.7	3.1
Central banks	9.4	7.6	4.5
Commercial banks (ODCs)	3.3	4.3	3.1
Source: IMF SRF Data.			
1/ Net open position.			
2/ The DC share of liabilities can be higher than the share of both components because it is an average of averages.			

32. **This result suggests that the choice of exchange rate regime may depend at least partly on FC pressures.** In countries with greater exchange rate flexibility, the volatility of the combined open position for CBs and banks was slightly higher (6.0 versus 5.7). This is a counterintuitive result, since among countries with equal FC pressures one might expect a

<sup>20</sup> Similar results are obtained using different methods of measuring exchange rate volatility, including ranking countries by standard deviation of their exchange rate versus the U.S. dollar, by average absolute percent change in the exchange rate, and if exchange rate movements are detrended.



more flexible exchange rate regime to partly absorb fluctuations in FC supply and demand so that the volatility of the net open positions should be smaller, not higher. This result suggests that greater exchange rate flexibility might in some cases be adopted because FC pressures on CB balance sheets are greater. The alternative explanation would be that some countries have active exchange rate policies characterized by larger CB interventions than what would have been required simply to keep the exchange rate stable.

33. **In contrast to those of CBs, the level and volatility of the net open positions of banks were slightly higher in countries that had exchange rates that were less flexible** (a standard deviation of 2.9 versus 3.3 percentage points). This would most likely be because banks face less risk from net open positions in countries with less flexible exchange rates. Another factor could be that CBs might be more aggressive about managing the exchange rate in countries where the banks have larger open positions in FC. These factors could also at least partly explain the relationship between the volatility of FC shares and the exchange rate for CBs.

34. **Also, while the overall open positions of banks were somewhat less volatile in countries with more flexible exchange rates, the FC shares of the separate asset and liability positions were more volatile.** Thus, the lower volatility of the open positions occurs in spite of greater underlying volatility of the components. Furthermore, while the net open position represented a smaller share of total assets in countries with more flexible exchange rates, the FC asset and FC liability shares were higher.

35. **Prior to the crisis, banks increased their capacity to issue debt externally in local currency.** During 2004–08, there was a significant increase in the share of bank liabilities that were to nonresidents. At the same time, however, the FC share of bank liabilities remained constant. Thus an increasing share of bank liabilities to nonresidents was denominated in NC.

### VIII. EXCHANGE RATES AND DOLLARIZATION

36. **The data show little evidence of a long-run correlation between exchange rate volatility and dollarization of bank assets and liabilities.** In countries with more flexible exchange rates, the net open position as a share of assets is slightly lower than average, but there is slightly higher dollarization. The differences are not large, however, and regression analysis does not show strong evidence of a relationship. “Dollarization” here refers to the use of FC rather than NC as money, often measured as the share of FC and FC denominated deposits at domestic banks. Most often dollarization occurs because inflation causes NC to be a less effective store of value. In extreme cases a country may adopt the currency of another country.

37. **It is not clear what type of relationship should be expected between exchange rates and dollarization. There are reasons why exchange rate volatility could be correlated with greater dollarization and reasons why it could be correlated with lower**

**dollarization.** A negative correlation could represent reluctance on the part of banks to hold a large share of FC assets when the exchange rate fluctuates, even if these assets are offset by FC liabilities, as this could expose banks to indirect exchange rate risk if their borrowers are exposed; or that in systems where banks have such exposures the authorities are more reluctant to allow exchange rate flexibility. De Nicolo et al (2003) found that more credible macroeconomic policies, which would include a more stable exchange rate, were associated with reduced dollarization. On the other hand, a positive correlation could indicate that banks' clients have a greater demand for FC assets and liabilities in countries with more flexible exchange rates for hedging reasons, or that larger FC accounts suggest larger FC flows that could be associated with larger pressures on the exchange rate. The level of the exchange rate could also be a factor. García-Escribano and Sosa (2010) found a negative relationship between the level of the exchange rate and dollarization.

### A. Simple OLS Regressions

38. **Simple OLS regressions of dollarization on exchange rate variability suggest no relationship.** Six dependent variables (top row in Table 3) were tested: the FC share of both assets and of liabilities for DCs, CBs, and ODCs. These variables were regressed on the normalized standard deviation of the exchange rate (“E-rate standard deviation, 2002–13”). All variables were calculated over the entire sample period.

39. **In none of the regressions was either the normalized standard deviation or the average percent change significant.**<sup>21</sup> Furthermore, the coefficients are small.<sup>22</sup> Similar regressions (not shown) were run using the average absolute value of the percentage change in the exchange rate rather than the standard deviation of the exchange rate to capture the possibility that the exchange rate changes that matter are the short-term ones rather than ones over time, but the results of these regressions were similar.

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<sup>21</sup> T-statistics are shown in parentheses.

<sup>22</sup> If the negative 11.91 coefficient on the FC share of assets for DCs accurately reflected the relationship, this would mean that if the normalized standard deviation of the exchange rate increased by 10 percent—a significant increase—the FC share of assets would increase by only 1.191 percent.

Dependent Variable:	DC	CB	ODC	DC	CB	ODC
	Assets FC share	Assets FC share	Assets FC share	Liabilities FC share	Liabilities FC share	Liabilities FC share
Constant	40.64 (19.29)	21.79 (16.21)	18.85 (11.67)	22.65 (10.47)	6.19 (6.23)	16.39 (10.19)
E-rate standard deviation, 2002-13	-11.91 (-1.68)	-7.07 (-1.56)	-4.85 (-0.89)	-0.91 (-0.13)	2.46 (0.74)	-1.80 (-0.33)
Adjusted R-Square	0.018	0.014	-0.002	-0.010	-0.005	-0.009
Observations	102	102	102	102	102	102

### B. Panel Regressions

40. **Panel regressions suggest weak relationships between exchange rates and dollarization.** Exchange rate movements may be related to dollarization in response to depreciation, and to a lesser degree exchange rate volatility. Fixed effects panel regressions were run with the FC shares of assets and liabilities of DCs, CBs, and ODCs as the dependent variables. The independent variables used were the average absolute values of the changes in the exchange rate over the sample period (“E-rate absolute change”) and the average of the changes in the exchange rate over the sample period (“E-rate change”). An AR(1) term was added to control for serial correlation.

41. **The coefficient on the average change in the exchange rate is positive and significant with a high degree of certainty in regressions of DC, CB, and ODC assets (Table 4).** Increases in the FC share of assets are positively associated with devaluation. Coefficients that are smaller, negative, and significant to a lesser degree of certainty are obtained when the FC shares are instead regressed on the *absolute* change in the exchange rate. This result is somewhat at odds with the simple averages in Table 1 that suggest a positive relationship between exchange rate flexibility and dollarization, which further weakens the evidence in favor of a relationship. Thus, evidence of a negative relationship between exchange rate volatility and dollarization is weak.

42. **When both simple and absolute changes in the exchange rate are included in the regression the simple changes are most significant.** The coefficients on the absolute changes decline substantially when the simple changes are added and they are either not significant or significant only with 95 percent certainty. The coefficients on the simple changes do not decline when the absolute changes are added, and they remain significant

with well beyond 99 percent certainty. As with the OLS regressions, however, all of these coefficients are small.<sup>23</sup>

Dependent Variable	DC Assets FC share	CB Assets FC share	ODC Assets FC share	DC Assets FC share	CB Assets FC share	ODC Assets FC share	DC Assets FC share	CB Assets FC share	ODC Assets FC share
Constant	38.56 (81.01)	21.17 (52.43)	17.36 (59.31)	38.49 (80.23)	21.14 (52.32)	17.30 (59.12)	38.56 (80.10)	21.16 (52.29)	17.35 (59.00)
E-rate absolute change 2/	<b>-4.56</b> *** (-5.23)	-1.64 * (-1.96)	<b>-2.90</b> *** (-4.46)				<b>-2.50</b> ** (-2.84)	-0.71 (-0.82)	<b>-1.78</b> ** (-2.69)
E-rate change 2/				<b>7.31</b> *** (11.39)	<b>3.25</b> *** (5.20)	<b>4.06</b> *** (8.41)	<b>6.89</b> *** (10.48)	<b>3.13</b> *** (4.89)	<b>3.77</b> *** (7.61)
AR(1)	0.91 (138.41)	0.90 (129.44)	0.89 (128.58)	0.91 (140.05)	0.90 (129.82)	0.89 (129.19)	0.91 (140.27)	0.90 (129.80)	0.89 (129.48)
Adjusted R-Square	0.98	0.96	0.98	0.98	0.96	0.98	0.98	0.96	0.98
Observations	4,014	4,014	4,014	4,014	4,014	4,014	4,014	4,014	4,014
DW	2.04	2.06	2.12	2.03	2.05	2.12	2.03	2.05	2.12
1/ Fixed effects. 2/ Coefficients expressed in percent.							* - 90 percent significance ** - 95 percent significance *** - 99 percent significance		

43. **The same panel regressions yield similar results when the dependent variables are FC shares of liabilities instead of FC shares of assets (Table 5).** The coefficients have the same sign regardless of whether the dependent variable is the FC share of assets or of liabilities. The positive sign in the asset regression could simply represent a desire to hold more FC assets in order to profit from depreciation, but the positive coefficient in the liability regression indicates that devaluation is associated with dollarization of both assets and liabilities. Thus, the increased dollarization may be driven largely by ODC depositors; depositors would want to increase their FC holdings when there is an expectation that the NC will devalue.<sup>24</sup>

44. **There is also evidence that banks attempt to increase their net open positions in FC during devaluations.** The coefficient on the changes in the exchange rate in the asset regression for ODCs is larger than that in the liability regression, and a panel regression using ODCs' net open position as a share of assets as the dependent variable (not shown) yields significant coefficients on the change in the exchange rate. So there could indeed be some attempt by ODCs to profit by increasing their net open FC positions during

<sup>23</sup> For example, the coefficient of 6.89 on the simple change in the exchange rate in the regression of FC shares of DC assets implies that a 10 percent currency devaluation would only be associated with an 0.69 percent increase in the FC share. Meanwhile, the -2.50 coefficient on the absolute change suggests that this increase would be offset by an 0.25 percent decrease, presumably because of risk management concerns.

<sup>24</sup> It is also consistent with the findings of Jeanne (2003) that decreasing monetary credibility can induce firms to dollarize their liabilities, even though this makes them vulnerable to a depreciation of the domestic currency.

devaluations. Meanwhile, in a similar net open position regression for CBs the coefficient on the change in the exchange rate is not significant, which is not surprising since one would not expect central bank decisions to be driven by a profit motive. The significant coefficient in the ODC net open position regression is smaller than the coefficients in the asset or liability regressions, suggesting a stronger reaction on the part of ODCs' depositors than on the part of the ODCs to the profit opportunity.

Dependent Variable	DC	CB	ODC	DC	CB	ODC	DC	CB	ODC
	Liabilities FC share	Liabilities FC share	Liabilities FC share	Liabilities FC share	Liabilities FC share	Liabilities FC share	Liabilities FC share	Liabilities FC share	Liabilities FC share
Constant	20.94 (52.93)	5.39 (17.96)	16.57 (65.16)	20.86 (53.12)	5.36 (17.95)	16.55 (64.88)	20.92 (53.08)	5.38 (17.99)	16.57 (64.74)
E-rate absolute change	<b>-3.82</b> *** (-4.69)	-1.71 (-2.88) **	<b>-1.68</b> *** (-3.24)				<b>-2.34</b> ** (-2.82)	-0.98 (-1.62)	-0.83 (-1.57)
E-rate change				<b>5.37</b> *** (8.87)	<b>2.60</b> *** (5.90)	<b>3.06</b> *** (7.93)	<b>4.98</b> *** (8.03)	<b>2.44</b> *** (5.40)	<b>2.92</b> *** (7.40)
AR(1)	0.90 (176.97)	0.90 (215.00)	0.90 (127.63)	0.90 (177.91)	0.90 (215.56)	0.90 (128.46)	0.90 (178.24)	0.90 (215.66)	0.90 (128.61)
Adjusted R-Square	0.00	0.00	0.99	0.00	0.00	0.99	0.98	0.97	0.99
Observations	3,703	3,703	3,703	3,703	3,703	3,703	4,014	3,996	3,703
DW	4.85	4.21	2.06	4.84	4.20	2.05	2.19	2.36	2.05

1/ Fixed effects.  
2/ Coefficients expressed in percent.

\* - 90 percent significance  
\*\* - 95 percent significance  
\*\*\* - 99 percent significance

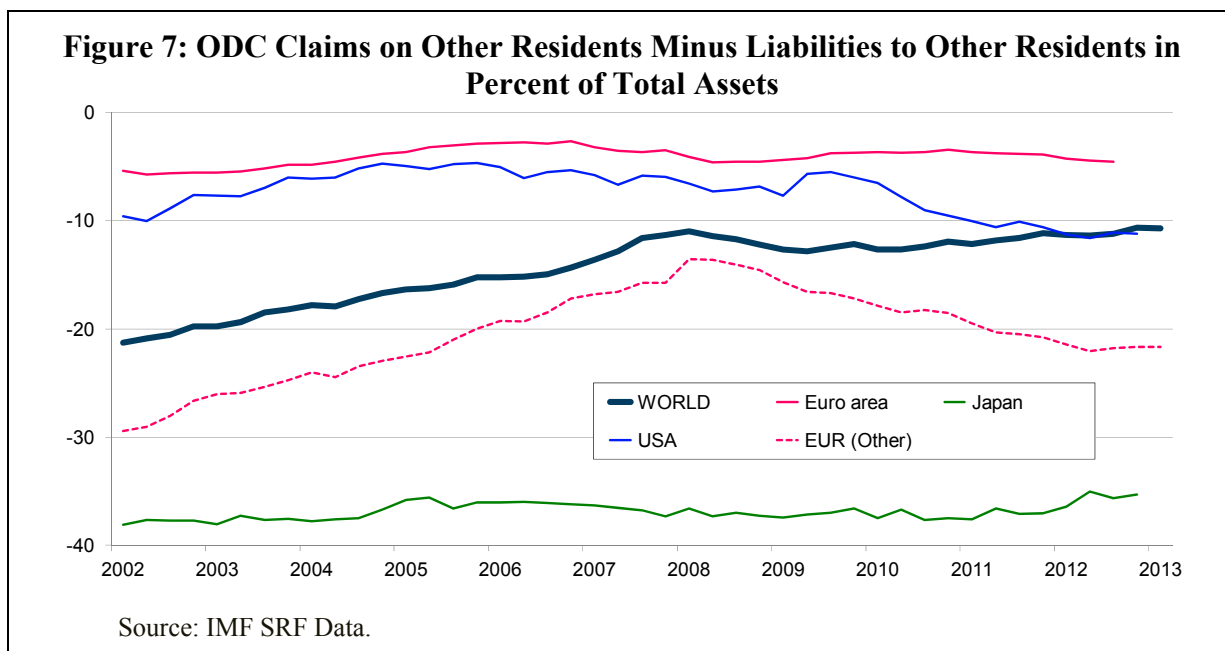
## IX. OTHER ASSET AND LIABILITY TRENDS OF ODCs AND THEIR RISK IMPLICATIONS

### A. The Growth of Household Lending

45. **The most significant financial development prior to the crisis may have been the significant worsening in the net position of other residents vis-à-vis ODCs, in other words, greater household net indebtedness to banks (Figure 7).**<sup>25</sup> This is reflected in a strong improvement in the position of ODCs with other resident counterparts. This trend was much weaker in the United States, Euro Area, and Japan than in other areas, in spite of the much discussed large increases in those countries. In other areas of the world, financial deepening—including improved credit markets—may have been responsible for a large part of the change, and, even after the change, other residents in these areas still had more favorable balances than other residents in the United States and Euro Area (though not in Japan). In many regions, other residents may not have experienced or at least not perceived a worsening of their balance sheets because of increases in other assets that they held,

<sup>25</sup> “Other residents” includes households and nonprofit institutions serving households, in line with the System of National Accounts sectorization.

particularly housing. However, the valuation of these other assets turned out to be a significant vulnerability. The currency mix of liabilities to other residents changed little.



46. **This change in net position was driven most heavily by the asset side, but the liability side contributed as well (Figure A15).** This reflects the widely observed pattern of increasing credit to households, particularly mortgages and particularly in Europe (Sirtaine and Skamnelos 2007). Claims on other residents increased, on average, from about 16 percent of total assets to 21 percent by the time of the crisis, leveling off thereafter. Meanwhile, the average share of other resident liabilities to total liabilities declined steadily during the period—a decline that temporarily accelerated during the crisis—most likely reflecting drawing down of savings first because of overconfidence in the future and increasing housing prices, and later because of lower household incomes when the economy worsened.

47. **The increase in lending to households was caused at least partly by an increasing willingness to tolerate risks in the pre-crisis environment.** This development is viewed negatively by many analysts as having contributed to the global financial crisis. In Europe, there is evidence that the expansion was faster among weaker banks (Tamirisa and Igand, 2008). However, in many regions, this expansion reflects deepening financial markets that better enabled banks to reach out to individual borrowers including households with limited access to financial services, a development that has been strongly encouraged. Development objectives, as well as stimulus concerns about low credit growth (IMF 2013), could help explain why the increase in claims on other residents was not reversed after the crisis.

48. **The strongest trend was in Europe outside the Euro Area.** The steep increase in claims on other residents drives much, but not all, of the overall world-wide increase in

assets for the non-Euro Area European area ODCs. Meanwhile, ODCs in the United States and the Euro Area reacted in advance of the crisis, reining in other resident lending starting in 2005.

49. **The increase in lending to households was not driven by foreign currency lending (Figure A16).** In fact, the foreign currency share of ODC claims on other residents steadily declined starting in about 2003. This is at odds with reports that households and corporates in a number of countries built up large foreign exchange exposures in the run-up to the crisis (IMF 2009). Even in the non-Euro Area European region the ratio declined between 2004 and 2006, prior to the crisis, though it then increased into 2008.

### **B. Increased Risks Associated with Increased Household Lending**

50. **The average loan to deposit ratio increased prior to the crisis, in line with claims on other residents (Figure A17).** It increased significantly prior to the crisis, briefly declined, and then resumed a modest upward trend. In Europe, outside of the Euro Area, the initial growth prior to the crisis (2002–08) was much more pronounced, and there has been no resumption of growth following the crisis. In the United States, it grew moderately until 2006, at which point it gradually began a steep decline. The United States therefore entered the crisis with a significantly lower loan to deposit ratio than the rest of the world, though it should be noted that the United States has a particularly deep non bank financial sector. This trend represents an increase in vulnerability in many countries, but in others it represents financial deepening, including through a reduction in exposures to government. There was a steady increase in loan to deposit ratios in Sub-Saharan Africa through the crisis and afterwards, and in Asian countries after the crisis starting in 2010.

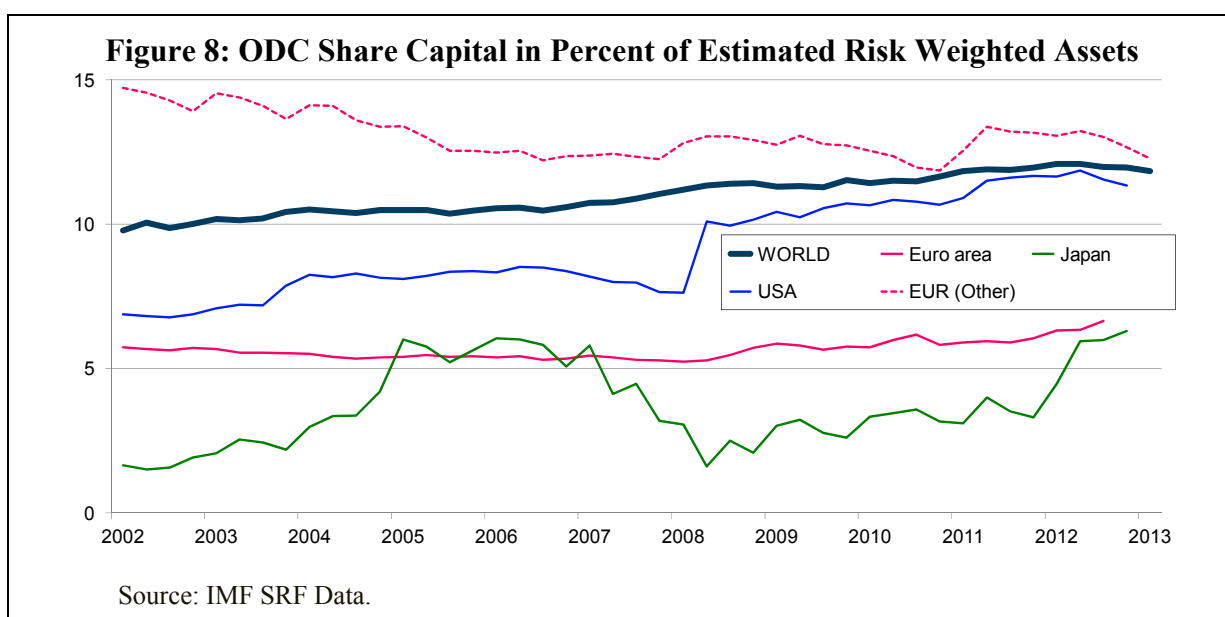
51. **A rough estimate of risk weighted assets (RWA) reflects the increased risk associated with the increase in household lending (Figure A18).**<sup>26</sup> The shift was most dramatic in the European region, where the ratio of RWAs to total assets went from the lowest of all regions to the highest, increasing by about 15 percentage points. The next most dramatic shift was in the opposite direction; the United States went from almost the highest ratio to the lowest with a sharp drop off immediately following the Lehman collapse as banks were forced to write off loans and became more conservative in their lending. Asian countries experienced a moderate rise in RWA before the crisis that was reversed afterwards, and Sub-Saharan African countries experienced a rise in RWA following the crisis that may have been largely related to financial deepening.

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<sup>26</sup> Estimated as 100 percent of loans, shares, derivatives, trade credits, settlement accounts, and other, plus 50 percent of securities. Deposits are assigned a weight of zero.

### C. Mitigation of the Increased Risks: Increased Capitalization

52. **Share capital as a percent of total assets increased, offsetting the increased riskiness of assets.** A rough estimate of risk weighted assets (RWA) calculated using the SRF data suggests that CAR ratios increased slightly (Figure 8), as increased share capital counterbalanced the risks from the shift in lending from government to households (see Costa Navajas and Thegeya, 2013). Again, the non-Euro Area European countries are an exception to this pattern; non-Euro Area European estimated CAR ratios declined substantially prior to the crisis as a result of the rapid increase in RWAs, and did not substantially increase afterwards. It should be noted, however, that they began with by far the highest average ratio of any region in 2002, perhaps in recognition of the risks associated with their transition status, and remained at or above the world average for most of the period. CAR ratios in the United States increased substantially immediately after the Lehman collapse.



53. **There are elements of loan quality that are not captured by the SRF categories.** The SRFs do not distinguish, for example, between ordinary and subprime mortgage portfolios. In spite of improving CAR ratios, it is clear in retrospect that insufficient safeguards were put in place prior to the crisis. But the data suggest that at least there was an awareness of increasing risks and that banks took some actions to address them. It should also be emphasized that the measurement of risk weighted assets derived from this data set is only an estimate.

### D. Claims on Government: Reduction in Safe Assets

54. **Commercial banks reduced their claims on central governments prior to the crisis (Figure A19).** When the global economy was strong, banks sought high returns in



expanding new credit markets, while government securities offered lower returns and healthy tax bases reduced the need for governments to borrow. Moreover, market-oriented policies, including directing bank lending more towards the private sector and increasingly meeting public sector borrowing needs with direct debt issuance to the public were widely encouraged by academics and policy advisors, and questions could be raised about whether bank purchases of public sector debt were made free of influence.

55. **After the crisis, there was a renewed interest in government securities.** Banks often did not have a wide choice of loans to make that they considered safe, many found themselves holding large quantities of excess reserves, and many public sectors were in need of financing because of budgetary circumstances. Thus, there was an increase in ODC claims on central government in a number of countries, though sovereign budget crises and downgrading of government securities in many countries revealed that these securities also could be subject to more risk than previously thought. Claims on state and local governments, which were much smaller, followed similar patterns of decline before the crisis followed by increases afterwards.

56. **Only a very small share of these credits was in FC.** Decreases in claims on government therefore would have tended to increase the FC share of total assets. The existence of this upward pressure, and the fact that it did not result in an increase in the FC share of ODC assets, adds support to the hypothesis that the FC shares of ODC assets were stable by design.

#### **E. Claims on Private Nonfinancial Corporations (NFCs) Remained Steady**

57. **In contrast to the rapid increase in household lending, the average asset share of claims on private NFCs—the largest sector of ODC claims—increased only slightly (Figure A20).** This suggests that confidence in the economy or a drive to orient the financial sector more towards private sector activity may not have been the most important factors in the increase in credit to households, as these factors ought to have had a comparable impact on corporate credit. This strengthens the arguments that increases in household credit were instead due more to factors related to financial innovation, financial deepening, aggressive exploration of new markets, or alternatively that they were simply driven by increasing asset prices in the housing sector. The currency composition of claims on private NFCs remained constant.

58. **Lending in FC to private nonfinancial corporations (NFCs) remained flat in spite of increasing openness and globalization of trade and finance.** World Bank data indicate that world merchandise trade as a share of world GDP increased steadily from about 44 percent in 2004 (the earliest year available) to about 54 percent in 2008.<sup>27</sup> This increase

<sup>27</sup> <http://data.worldbank.org/indicator/TG.VAL.TOTL.GD.ZS/countries?display=graph>; it then dropped but subsequently recovered following the crisis.

would have been consistent with an increase of several percent in the FC share of claims on private nonfinancial enterprises. The lack of any increase weakens the argument that banks were taking on greater indirect risks by lending to unhedged borrowers (OJEU 2011). On the contrary, this might suggest that banks did not take advantage of new export related opportunities in the corporate lending sector. FC liabilities to private NFCs also remained flat, so there was little change in total FC liabilities to corporations and therefore little change in the net open position of the corporate sector.

59. **Claims on public nonfinancial companies followed a similar pattern.** There was little change in the overall share in total assets, and there was a shift away from FC lending. The amounts involved were several times smaller than for private sector enterprises

#### F. Other ODC Assets and Liabilities

60. **Other bank assets and liabilities are small.** Liabilities to OFCs increased before the crisis, but from a very low base. The average share of liabilities to OFCs in total liabilities grew from three or four percent to about five percent at the time of the crisis, while claims on OFCs remained small at about two percent of total assets. The world-wide average of liabilities to government (central, state, and local) to total liabilities remained at about four percent during 2002–2012. Liabilities to CBs were small and the currency composition changed little. Other items net (OIN) assets and liabilities declined. A discussion of other details of the assets and liabilities of ODCs is found in Appendix I.

### X. ASSETS AND LIABILITIES OF CBS

#### A. Assets

61. **The increase in CB claims on nonresidents (above) was offset by a decline in claims on central governments.** CB claims on central governments fell by about 10 percent of total assets during 2002–08 (Figure A21). This reflected stronger local economies with, in many cases, smaller budget deficits, as well as efforts to limit central bank financing of budget deficits. The huge decline in the share of claims on central government for the United States largely reflected increases in CB claims on banks related to recapitalization following the Lehman collapse.

62. **Claims on central governments and claims on nonresidents represent the vast majority of CB assets.** Together they accounted for about 90 percent of the total. Claims on ODCs and OIN each represent another four to five percent each, while claims on all other institutions were negligible.

#### B. Liabilities

63. **Increases in average CB liabilities to ODCs largely offset the decline in average liabilities to nonresidents.** A steady rise from about 20 percent of total liabilities to about

30 percent from 2002 until the crisis, associated with the expansion of ODC assets and the growth of excess reserves at banks in the slow economy, tapered off following the crisis, but the level remained steady (Figure A23: upper panel). The average share of CB liabilities to central governments peaked at the time of the crisis, as did the financial soundness of central governments (Figure A23: lower panel). The enormous increase in CB liabilities to ODCs in the United States reflected an increase in excess bank reserves following the Lehman collapse and corresponds to an increase in U.S. ODC liabilities to nonresidents that resulted from the United States being viewed as a relatively safe haven for deposits in the wake of the collapse.

64. **The financial crisis increased people’s willingness to hold reserve currencies.** On average, currency rose only slightly as a ratio to GDP following the crisis (Figure A22), but there were jumps in demand for the U.S. dollar, euro, and yen. This jump in demand may have reflected demand from nonresidents as well as residents for these reserve currencies.

65. **Currency, liabilities to ODCs, and liabilities to central governments account for two thirds to three quarters of CB liabilities.** Liabilities to nonresidents, OIN, and share capital account for most of the rest. The average FC share of CB liabilities gradually fell during the first part of the decade until the financial crisis, and then, net of an increase in the IMF’s SDR allocation, roughly leveled off at the start of the financial crisis. CB assets and liabilities broken down by instrument are discussed in Appendix I.

### C. SDR Allocation

66. **The IMF’s SDR allocation was increased substantially in 2009.** A general SDR allocation of SDR 161.2 billion was made on August 28, 2009, to help mitigate the effects of the financial crisis, and in addition a separate one-time allocation of SDR 21.5 billion was provided for by the Fourth Amendment to the Articles of Agreement, which became effective August 10, 2009. This increase in the IMF’s SDR allocation resulted in a sharp increase in FC liabilities to nonresidents for CBs around the world (Figure A24). A dip in the FC share of liabilities to nonresidents around that time would appear to be in anticipation of the SDR allocation. The dip was particularly pronounced among Sub-Saharan African countries.

## XI. SUMMARY AND CONCLUSIONS

67. **The data suggest that many potential financial sector risks were well-managed, at least in aggregate, prior to the crisis.** Banks in most countries did not build up significant currency mismatches, and generally increased their capitalization in response to increased lending and higher risks. There were important differences between regions, in particular that the United States and Europe often behaved differently from the rest of the world, but many patterns were remarkably consistent across countries. Some well-publicized buildups—such as of imbalances in European countries outside of the Euro Area—are not necessarily representative of the whole world.

68. **Outside of the United States, there has been little unwinding of debt since the crisis.** The ratio of total assets of ODCs to GDP increased prior to and, in many countries, well into the crisis, while CB balance sheets remained more flat, particularly for less advanced and interconnected countries. The United States was an exception, with significant unwinding of ODCs immediately after the crisis. In the Euro Area, the increase in ODC assets was far steeper than in other regions prior to the crisis. In some countries, there was an unwinding that was subsequently reversed, or that simply reversed a recent increase, and in many cases the question of whether unwinding occurred depends on whether one looks at ratios to GDP or absolute levels.

69. **The net FC positions of most countries' DCs with respect to the rest of the world improved or remained constant prior to the crisis.** ODCs' positions worsened, though they still remained positive in most regions, and CBs built up FC buffers that on average more than offset the deterioration among ODCs.

70. **In most regions of the world, the net open positions of banks as a share of assets remained remarkably stable throughout the period 2002–13.** By contrast, the net open positions of CBs as a share of assets showed substantial variation, as CBs absorbed residual fluctuations in supply of and demand for FC.

71. **Little association was found between the FC composition of assets or liabilities of banks and exchange rate volatility.** OLS regressions did not show any correlation over time. Panel regressions found dollarization to be associated with devaluation, and to a lesser extent with exchange rate stability.

72. **There was a significant worsening in the net position of households (other residents) vis-à-vis banks.** This trend was mirrored by a reduction in claims on government. The trend was weaker in the United States, Euro Area, and Japan than in other areas where financial deepening may have been a factor. Other driving factors may have included search for yield and increased tolerance for risk. While there was a trend towards encouraging private sector activity, lending to private NFCs did not expand. The increase in lending to other residents resulted in higher ratios of risk-weighted assets to total assets for ODCs, but this increases risk was offset by better capitalization.

73. **The geographical breadth and consistency of the SRF-based data offer a unique perspective into worldwide financial institution balance sheet developments during the past decade, and ongoing enhancements to these data should present opportunities for further research.** The analysis of CBs and banks in this paper could be deepened by including the OFC sector when SRF coverage expands to include a large enough set of countries reporting comprehensive OFC data. Including the prein countries would also be an important addition when prein data are converted to the standardized SRF format, making them comparable to those of other countries. The analysis could also be enhanced by examining balance sheet information for counterpart sectors, in particular the government,

corporate, and household sectors, though of course no convenient comprehensive database analogous to the SRF exists for all of these sectors and even minimal data may not exist for some of these sectors in many countries. The analysis on foreign currency exposures presented in this paper could be expanded on with more sophisticated measurements of exchange rate volatility, a more detailed analysis of exchange rate regimes, and adjustments for interrelations between exchange rates and rates of dollarization. Ongoing analysis of currency imbalances should take into consideration the result that the currency composition of bank assets has been highly stable; there should be more focus more on risks arising from indexation to FC or to indirect risks through unhedged counterparts.

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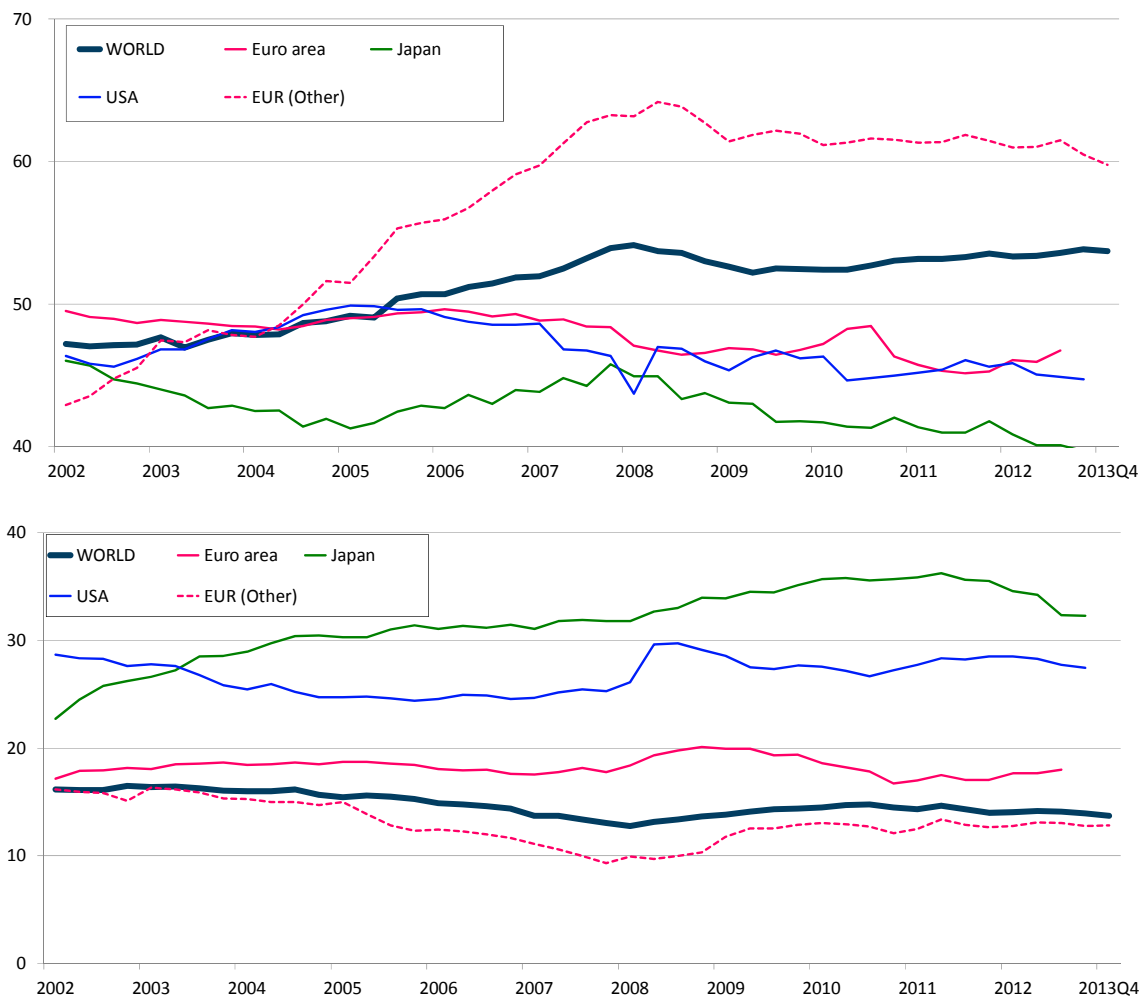


## **APPENDIX I: ADDITIONAL CHARACTERISTICS OF THE ASSETS AND LIABILITIES OF DCs**

### **I. ASSETS AND LIABILITIES OF ODCs BY INSTRUMENT**

1. **Loans, deposits, and securities account for almost all of ODC assets.** “Other” assets also account for a nonnegligible share of total assets. The main trends in these instruments are that the average share of loans to total assets increased significantly (Figure A1, upper panel); and that this increase was offset by roughly equal declines in securities and “other” assets (Figure A1, lower panel). A large share of loans is claims on other residents, and a large share of securities is claims on government, so the behavior of loans and securities closely mirrors that of claims on nonresidents and government with increased lending to households replacing purchases of government securities. The FC share of loans declined, further indicating that the lending boom was not driven by FC lending pressures.

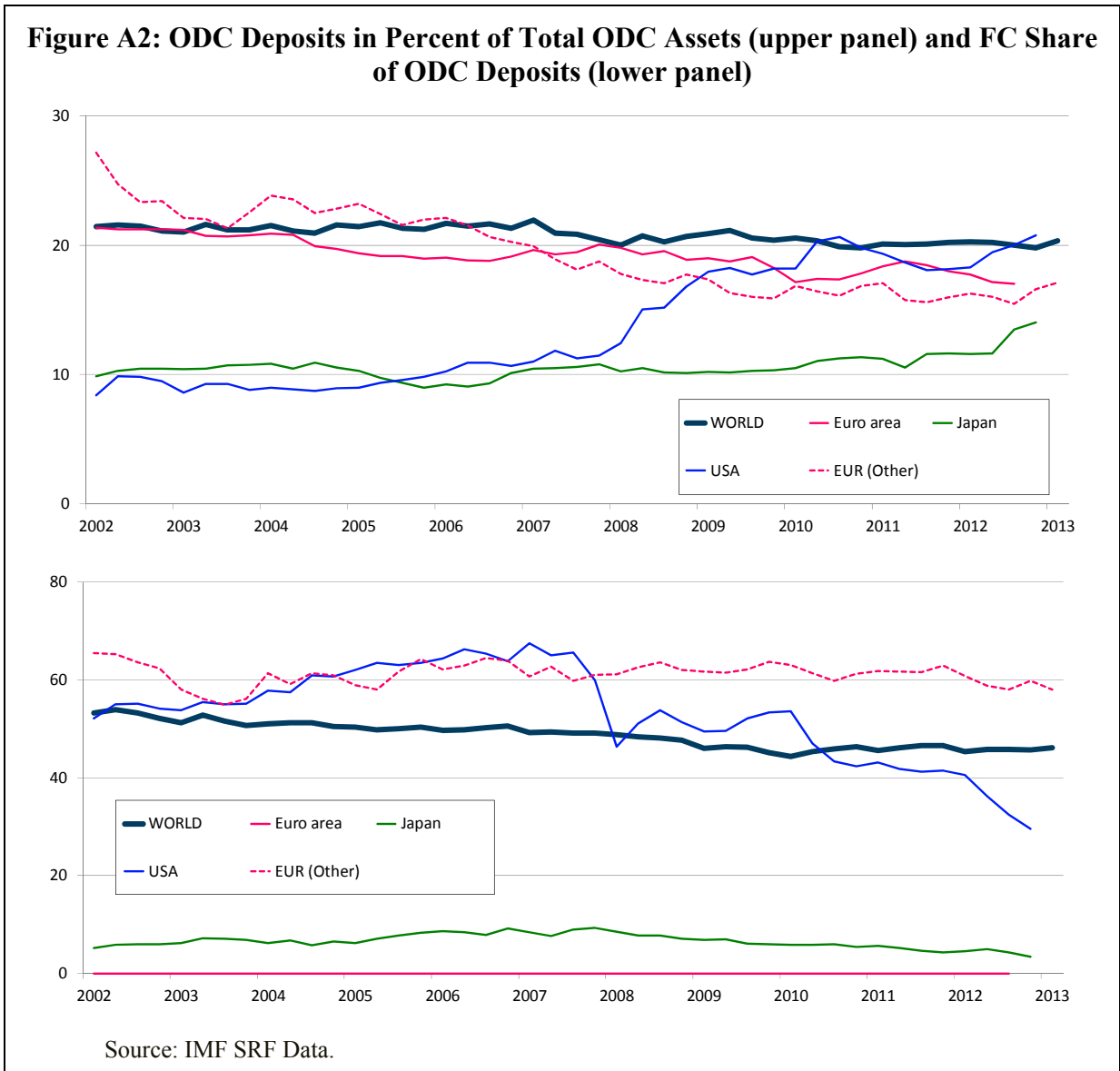
**Figure A1: ODC Loans (upper panel) and Securities (lower panel) in Percent of Total ODC Assets**



Source: IMF SRF Data.

2. **Loans account for over half of all ODC assets worldwide.** The average share of loans in total assets increased from 47 percent in 2002 to 54 percent in 2013, also driven by the household credit boom. The FC share of loans fell. Most FC loans were made to residents, with the resident share increasing from about 87 percent to 90 percent of FC loans.

3. **Deposits represent a fifth to a quarter of the assets of most ODFCs (Figure A2).** About two thirds of ODC deposits are accounted for by reserves at the CB. There was only a minor decline in the average asset share of deposits, but there was a change in the currency composition, with the FC share declining from a peak of 54 percent in 2002 to 47 percent in 2013. The FC share of loans and securities also fell, but the decline in the FC share of deposits accounts for over half of the modest decline in the average FC share of total assets.

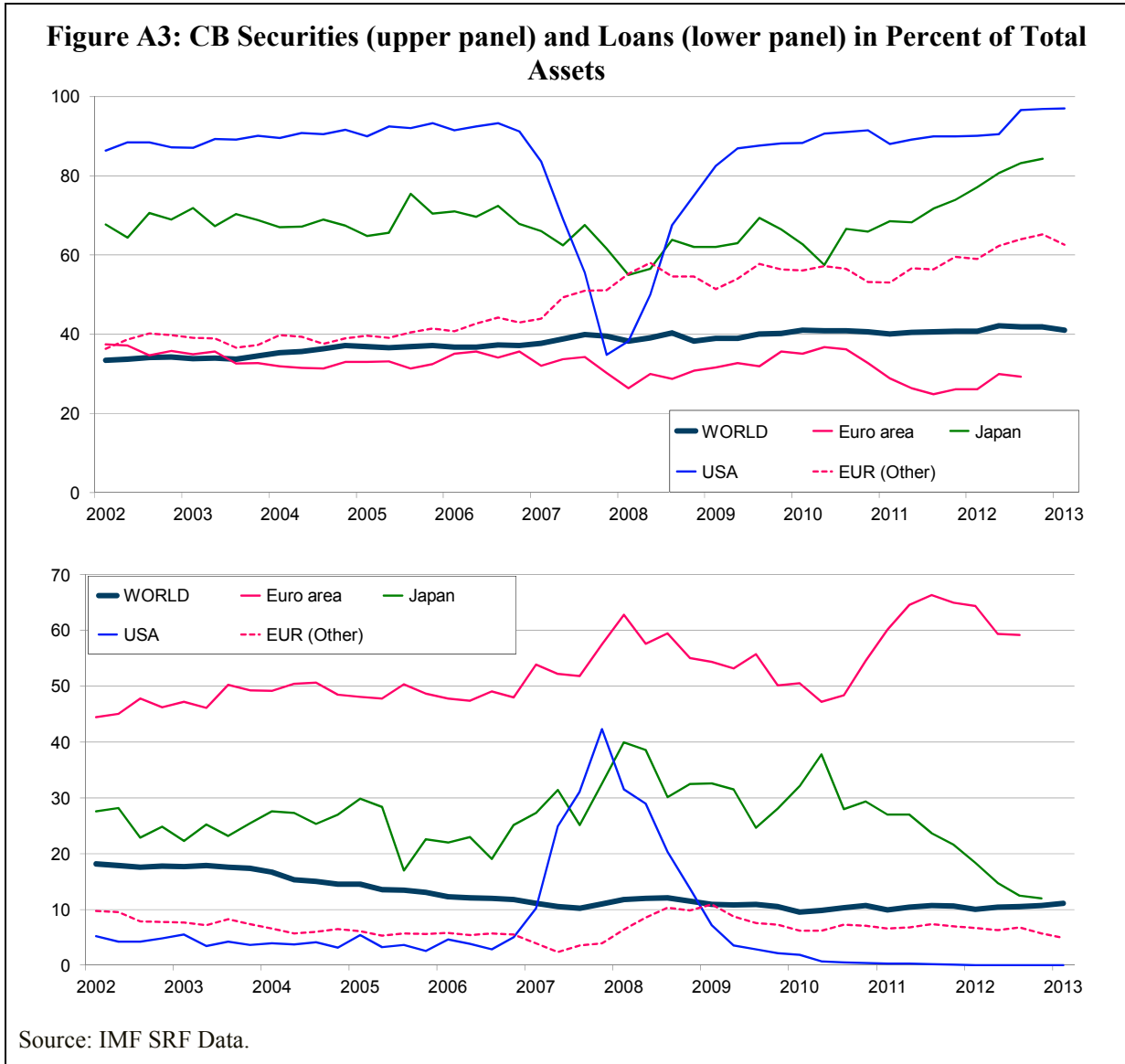


4. **The breakdown of ODC liabilities by instruments as well as the currency composition of each category of instrument remained mostly steady during the entire period.** Deposits represented almost 70 percent of total liabilities, loans represented seven percent, and securities three percent. These shares changed little. The remaining 20 percent was roughly divided between other assets and share capital.

5. **Share capital increased steadily during the period.** As discussed above, this steady trend persisted before, during, and after the financial crisis. During 2002–13, average share capital increased from just under 10 percent of total liabilities to over 12 percent.

## II. ASSETS AND LIABILITIES OF CBS BY INSTRUMENT

6. **By instrument, CB assets are mostly made up of deposits, securities, and loans.** Deposits and securities each represented around 40 percent of liabilities, with loans accounting for most of the rest. There were some divergences across regions, with the Western Hemisphere having fewer deposits and more securities and loans, while Sub-Saharan Africa, with less well-developed securities markets, had more deposits and fewer securities.

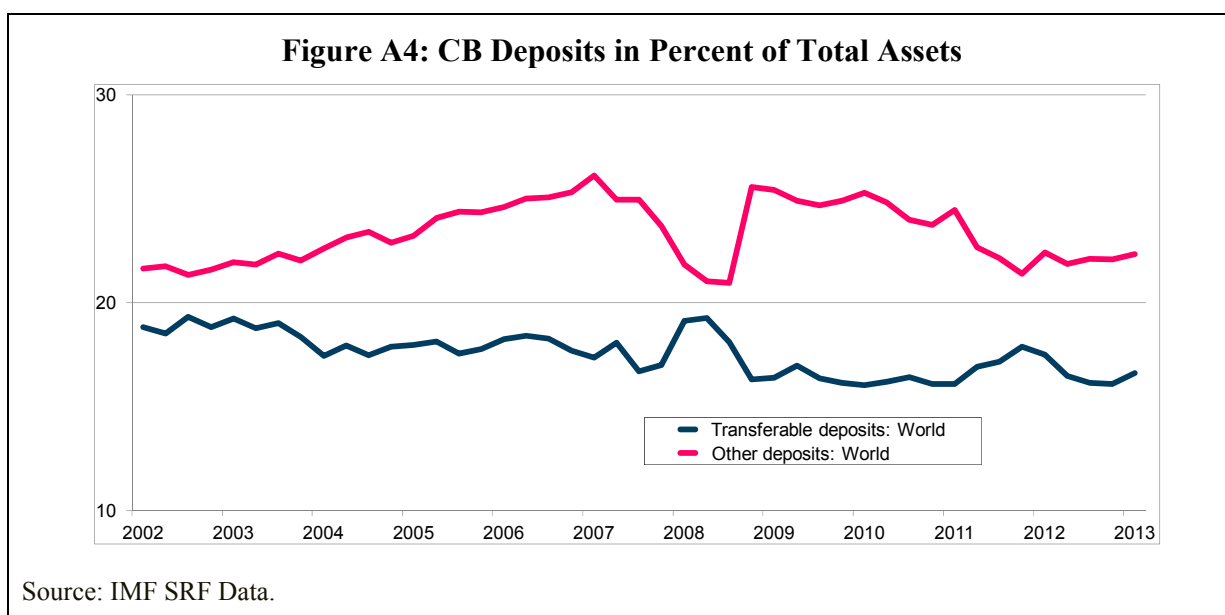


7. **The main trend in CB assets by instrument during the period is a general shift from loans to securities (Figure A3).** This trend slowed following the financial crisis and may reflect developments in monetary instruments. For example, many countries increased

auctions of securities to conduct monetary policy, and reduced reliance on direct central bank funding of government.

8. **The share of deposits in CB assets remained mostly steady, with a dip at the start of the crisis.** In the non-Euro Area European countries, a large drawdown at the start of the crisis was not later reversed. The average FC share of CB deposits remained at 98-99 percent for the entire period.

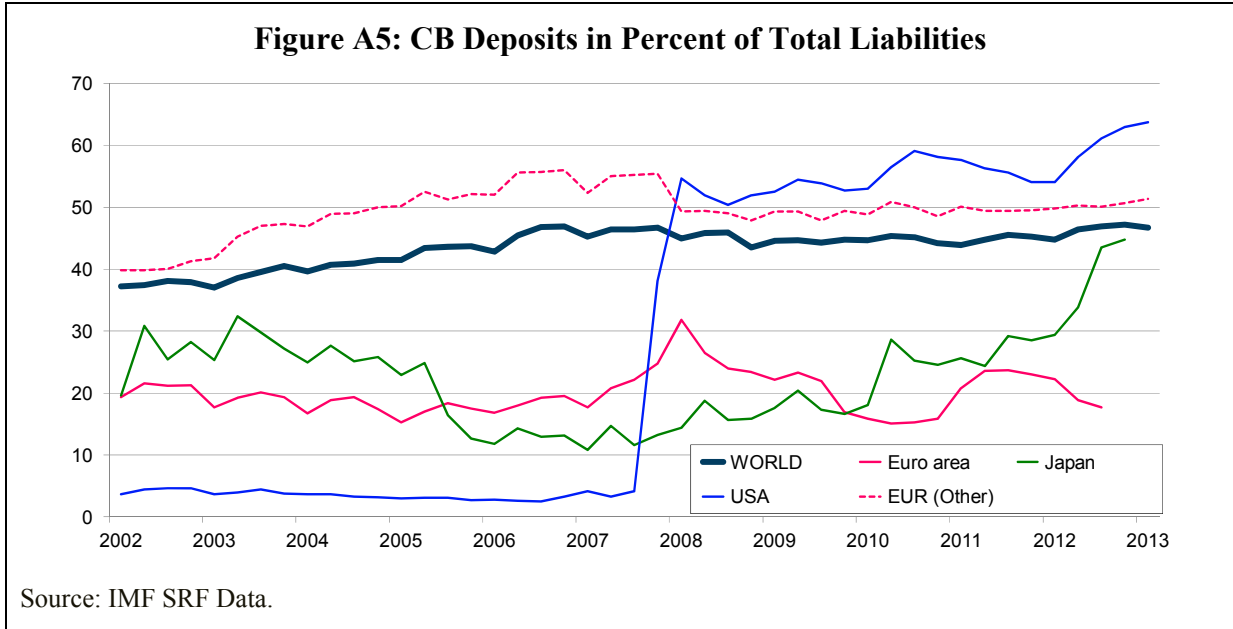
9. **The breakdown between transferrable deposits and other deposits experienced a sharp temporary shift towards more liquid transferable deposits at the start of the crisis (Figure A4).** Other deposits fell significantly and there was a corresponding, though smaller, increase in transferrable deposits. This shift was quickly reversed after one year. The initial shift occurred most noticeably in Europe and MENACA countries, while the subsequent reversal was uniform throughout the world.



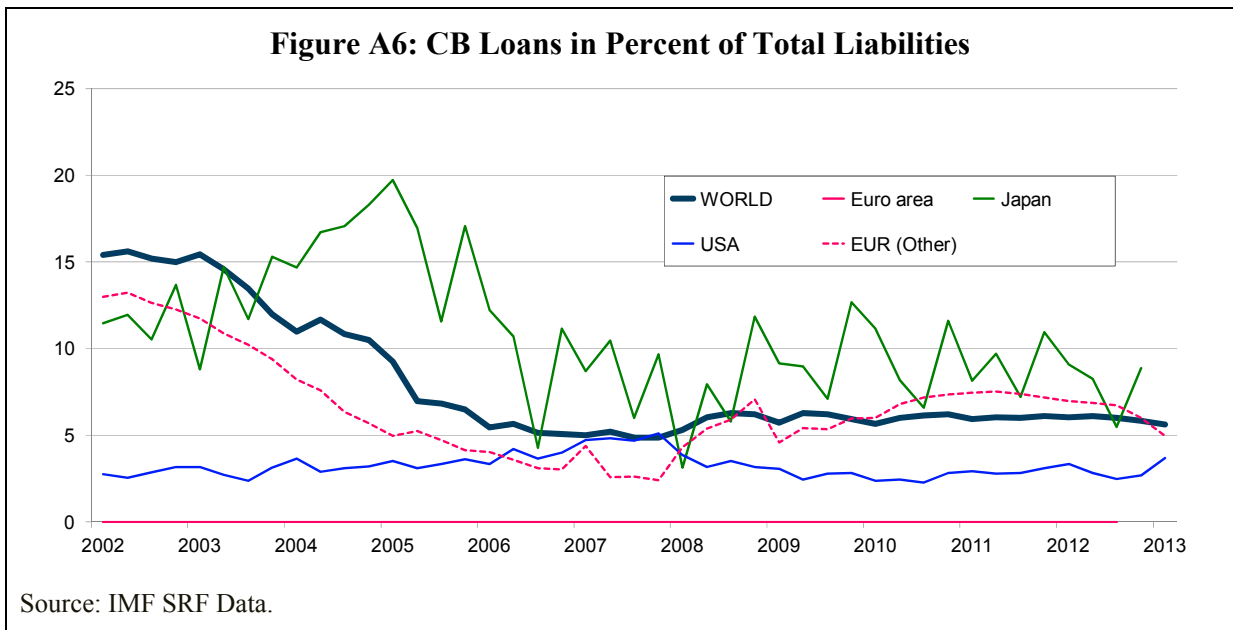
### A. Liabilities of CBs by Instrument

10. **Currency and deposits account for two thirds to three quarters of all CB liabilities.** Loans and other liabilities account for most of the rest. As discussed in the main text, currency liabilities remained roughly constant.

11. **Deposit liabilities with many CBs increased significantly before the crisis in line with the expansion of lending and other CB assets (Figure A5).** About three quarters of deposits were transferrable deposits, much of which represents required reserves on the expanding deposit base.

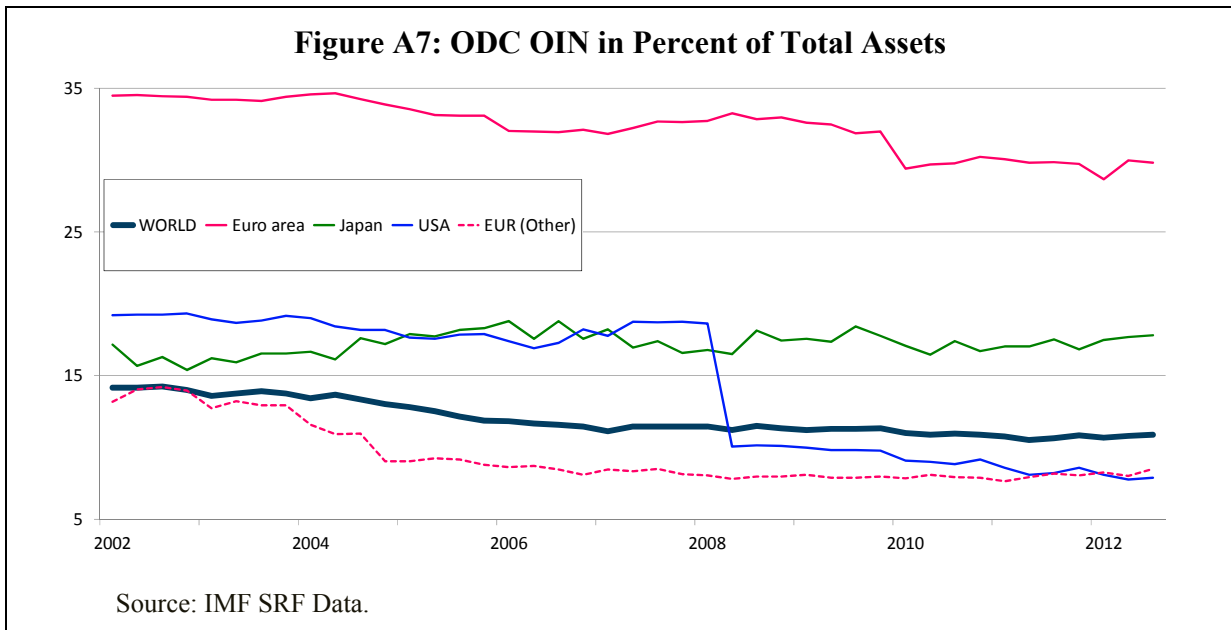


12. **This increase in deposit liabilities before the crisis was mainly offset by a decline in loan liabilities and “other” liabilities (Figure A6).** The decline in other liabilities was more uniform across regions. It subsided around the time of the crisis. Loans are denominated mostly in FC, while deposits are denominated mostly in NC, so this shift from deposits to loans accounts for most of the decline in the FC component of CB liabilities prior to the crisis.



### III. DECLINING OTHER ITEMS NET

13. **There was a general decline in the OIN of DCs on both the asset and liability side during 2002–13.**<sup>28</sup> This generally reflects improvements in information systems and classification methodologies that result in fewer unclassified items. At least half of the decline in OIN occurred in the “unclassified assets” subcategory. The average share of OIN on the asset side of ODCs is shown below (Figure A7). While there were some differences in timing, there was a similar decline in all regions. “Other assets” in the breakdown by instrument accounted for a similar share of total assets and showed a similar decline. OIN liabilities moved roughly in tandem with OIN assets, in total and by subregion.



<sup>28</sup> For most countries, the largest component of OIN on both the asset and liability side is “miscellaneous”, which includes unclassified items or items that have not yet been defined with certainty. Other OIN items accrued wages, taxes, or other expenses; deferred wages, taxes, or other expenses; and suspense accounts.

## APPENDIX II: The Standardized Report Forms Data

- 1. This paper benefits from monetary data reported to the IMF by member countries using the Standardized Report Forms (SRFs).** The SRF-based data have a unique combination of country coverage (including many non advanced countries), detail, and consistency of methodology across countries. These data are harmonized across countries, facilitating a direct cross-country comparison of the monetary and financial statistics of all IMF member countries that are SRF reporters with minimal inconsistencies and with no need to reconcile different reporting patterns. The SRF data reflect the methodology recommended in the *Monetary and Financial Statistics Manual (MFSM)* and its companion *Compilation Guide* (<http://www.imf.org/external/pubs/ft/mfs/manual/index.htm> and <http://www.imf.org/external/pubs/ft/cgmfs/eng/index.htm>).
- 2. The SRF Database includes breakdowns of all subcategories of assets and liabilities into NC and FC.** Currency composition is a central topic in policy discussions and in economic literature, but many data sets lack currency breakdowns.<sup>29</sup> The breakdowns in the SRF data include assets and liabilities of financial corporations, cross-classified by instrument and by counterpart sector (consistent with other macroeconomic statistics manuals), as well as a breakdown by currency (domestic and foreign) for all instruments. Moreover, the reported monetary data are harmonized across all countries that have adopted the SRFs. Data for Euro Area countries and “preins” each follow a somewhat different format, though efforts are underway to harmonize their reporting with the standard SRFs, and a standardized single series for the Euro Area as a whole has been developed. All SRF-reporting authorities make their best efforts to adhere to the MFSM methodology—with the benefit of technical assistance from the IMF’s STA Department as needed—ensuring comparability of concepts across countries.

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<sup>29</sup> Allen et al, 2002.



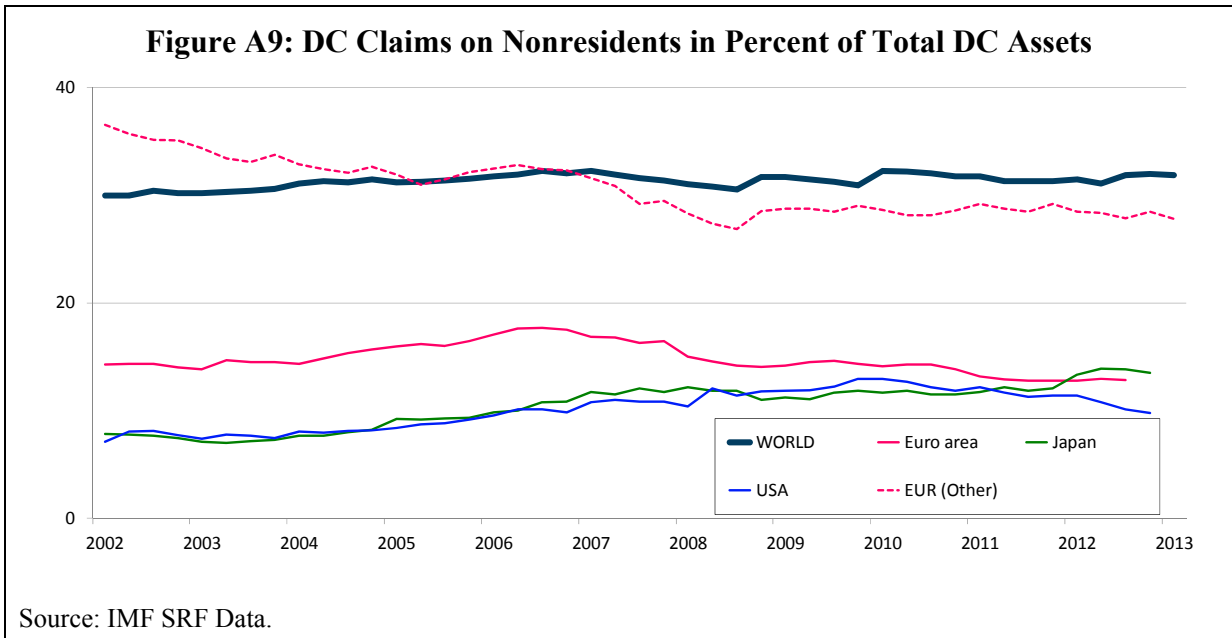
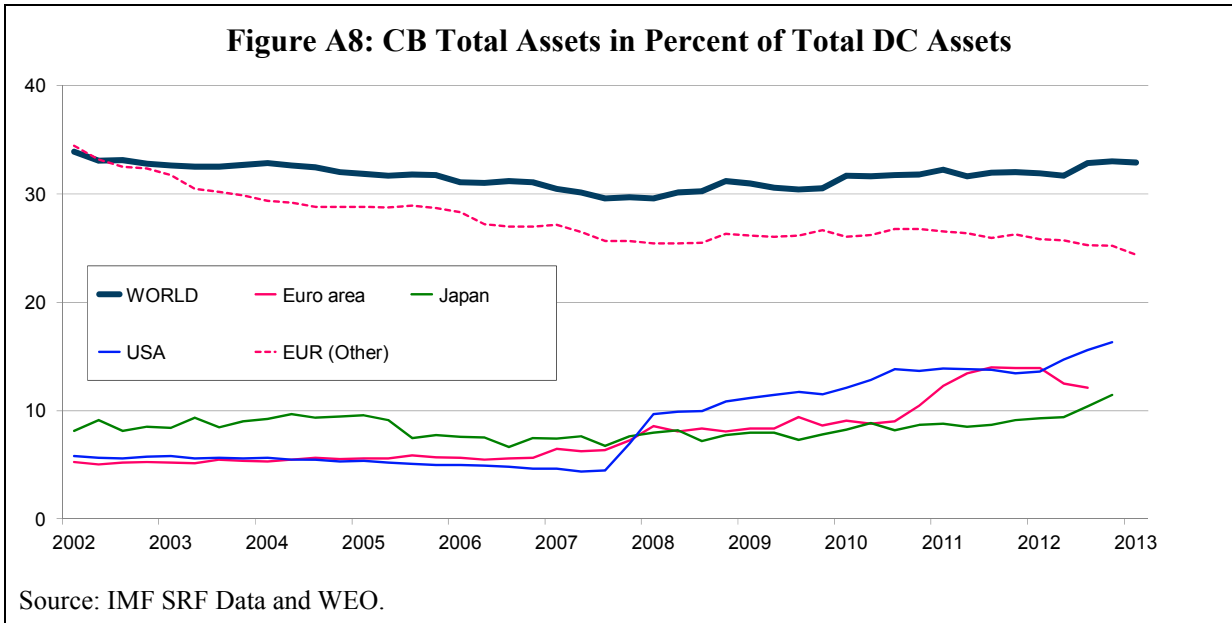
### APPENDIX III: Further Characteristics of the Data

1. **Series aggregated by region are presented as simple averages.** Analysis of weighted averages was considered to be less useful because all regions tend to be dominated by one or two countries. The data of smaller countries would therefore be unnoticeable if weighted by any measure of the size of the country, such as GDP, and included with similar data for much larger countries. The Euro Area, Japan, and the United States are presented as separate series and are not included in the averages for the European, Asian, or Western Hemisphere regions respectively. In the calculation of the world average, the Euro Area, Japan, and the United States have the same weighting as any other individual country (not region).
2. **The calculation of averages is complicated by missing data points.** To address this problem, simple year-end averages are calculated for 2006—a period chosen somewhat randomly, but also because it is prior to the crisis and because it has fewer missing data points than many other quarters. Averages for earlier or later quarters are then calculated using the average of all available percent changes for individual countries.<sup>30</sup>
3. **There are questionable figures in the data.** In cases where a single country causes an important unexplained change in the overall series, either the series for that country has been removed (and noted) or in some cases a data point has been removed when further investigation revealed that it was an erroneous figure or an adjustment that did not reflect economic developments. For example, in some cases where countries have improved their statistical reporting during the coverage period, a series may be blank and then abruptly show large numbers, or an erroneous reporting method may have been identified and corrected for only part of the coverage period.
4. **There are variations within and across regions, but consistent patterns emerge across the world, particularly outside of the largest economies.** Within regions, Asia as an example had several countries with FC shares of total assets that remained in the low single digits, while Cambodia had a series that was above 90 percent for most of the period. Across regions, the Asian average FC share at the start of the period was more than double that of the Sub-Saharan African region and many times that of the United States. However, there was much greater consistency in the changes of variables than in the levels. There are in many cases remarkably consistent patterns across the world.

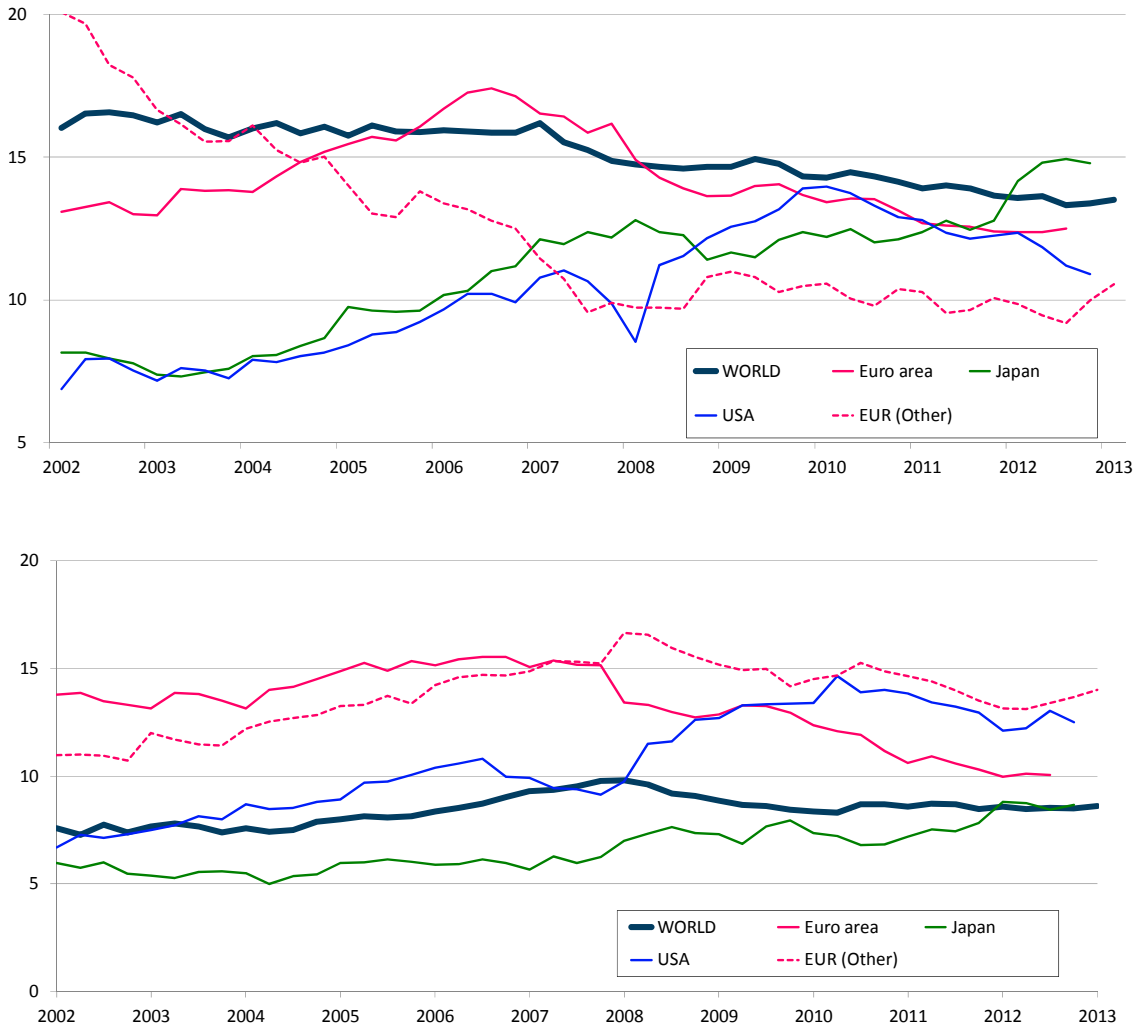
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<sup>30</sup> Thus, if three countries provide data for a series in 2006, but only two provide it in 2007 indicating changes of two and four percent, the 2007 figure is calculated as the 2006 figure increased by the average percent increase for the two reporting countries in 2007; in other words the 2007 figure will be three percent higher than the 2006 figure.

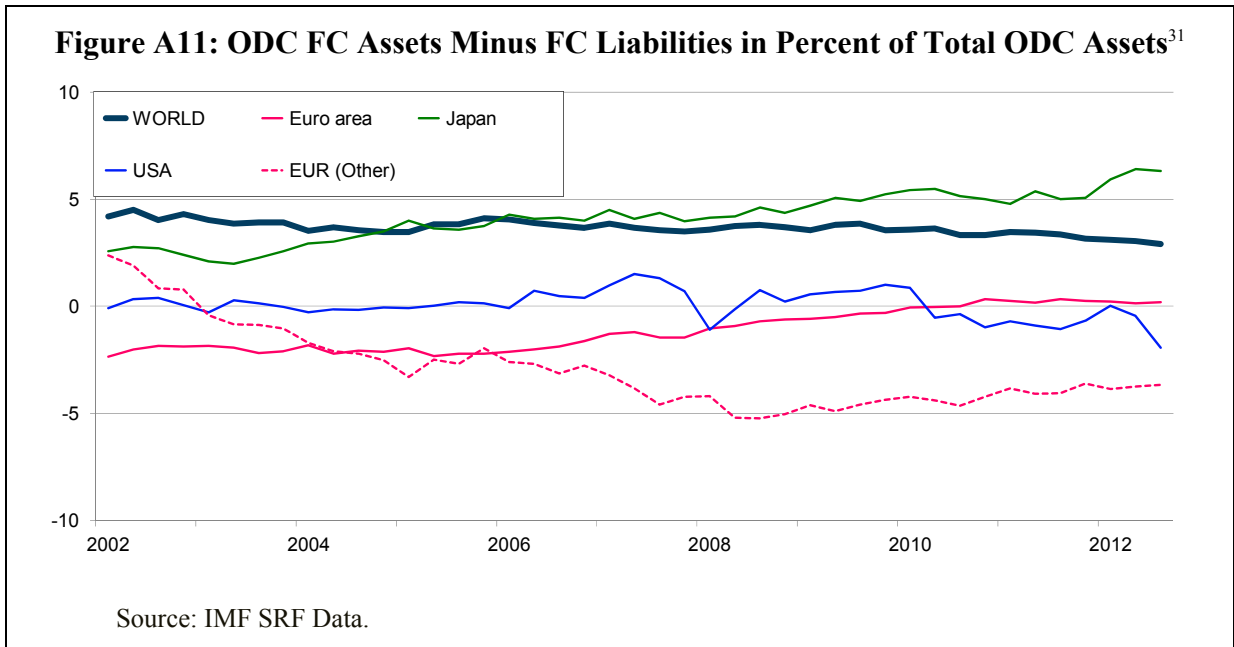
APPENDIX IV: ADDITIONAL CHARTS



**Figure A10: ODC Claims on (upper panel) and Liabilities to (lower panel) Nonresidents in Percent of Total ODC Assets**

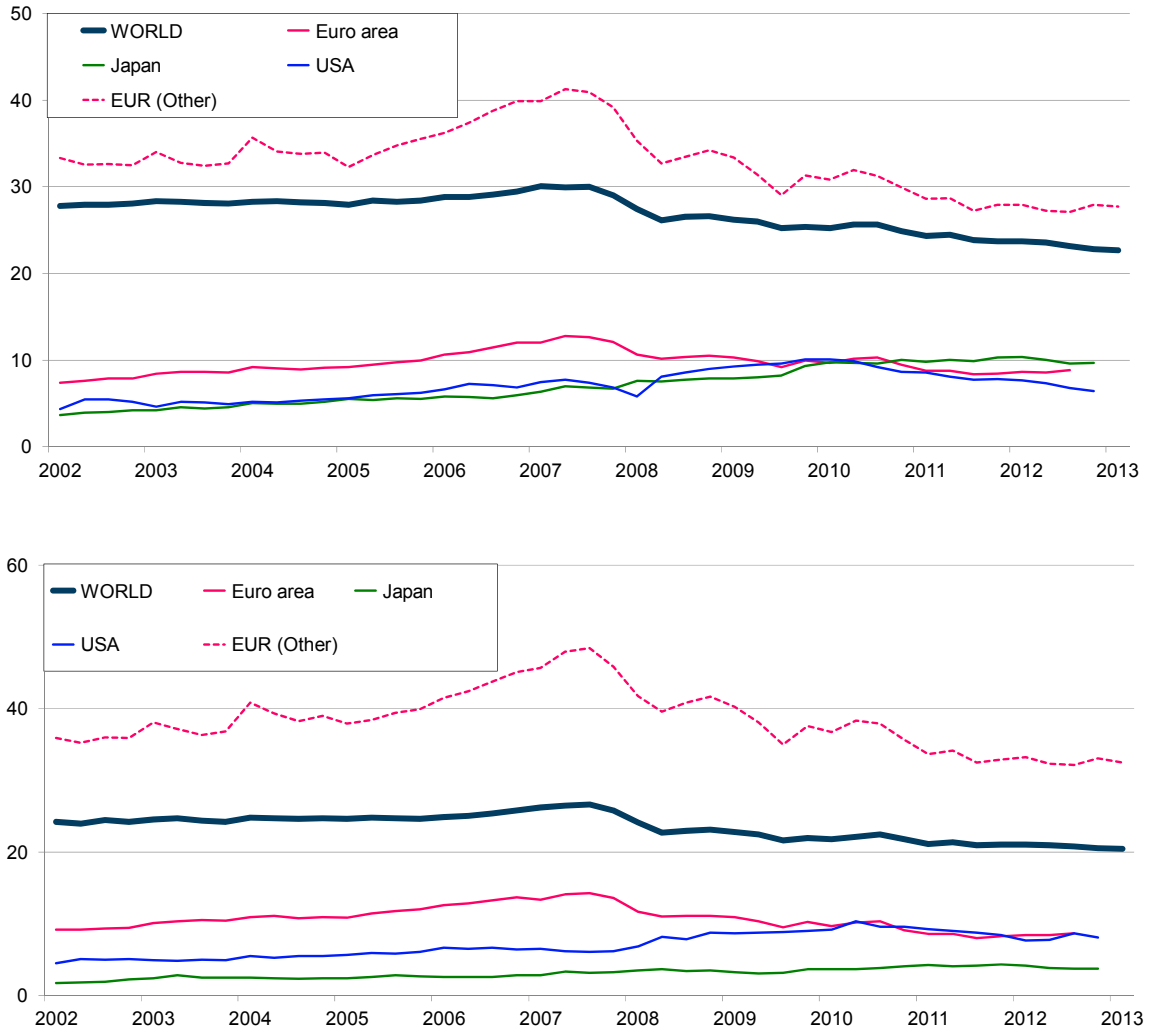


Source: IMF SRF Data.



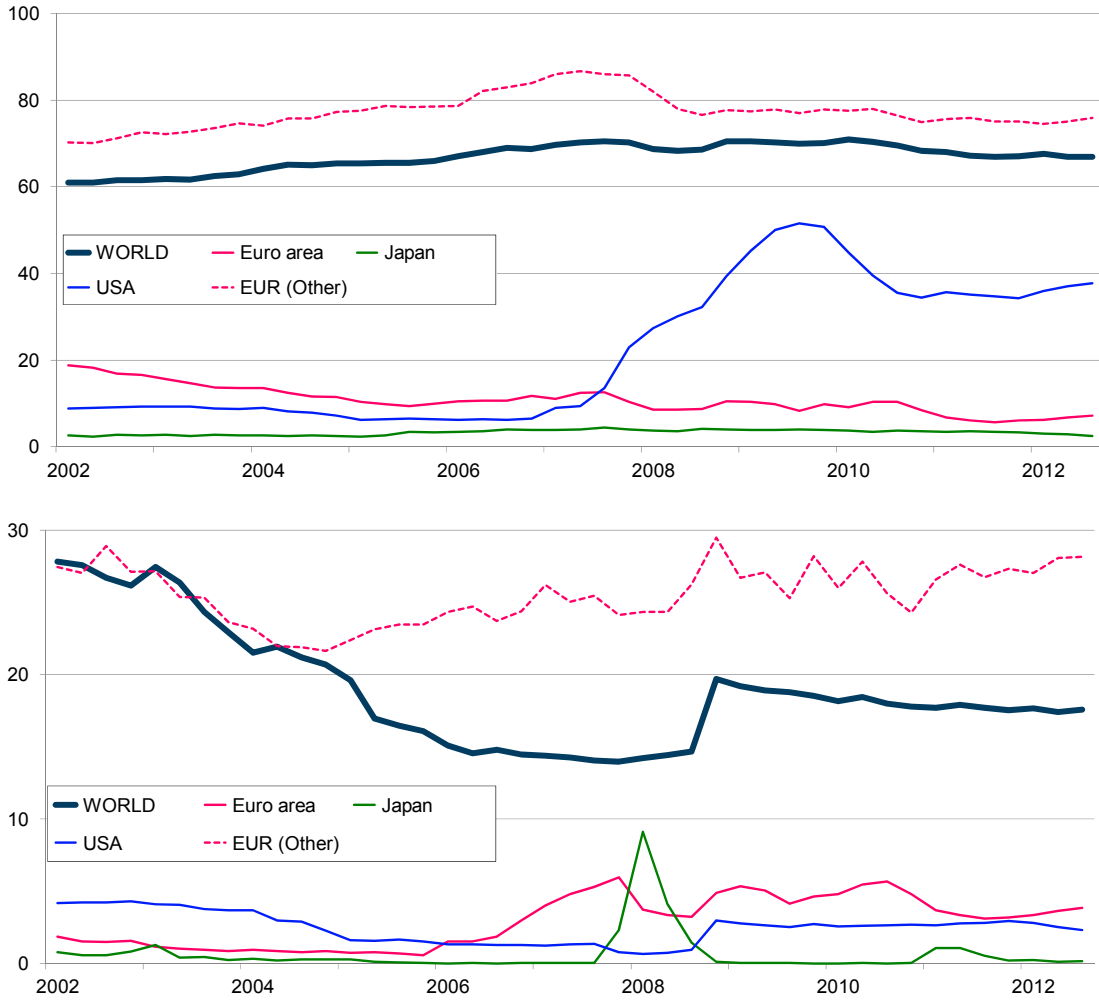
<sup>31</sup> Excluding Kosovo, whose NOP fell sharply during the period, distorting the European (Other) series.

**Figure A12: ODC FC Assets (upper panel) and FC Liabilities (lower panel) at Constant Exchange Rates in Percent of Total ODC Assets**



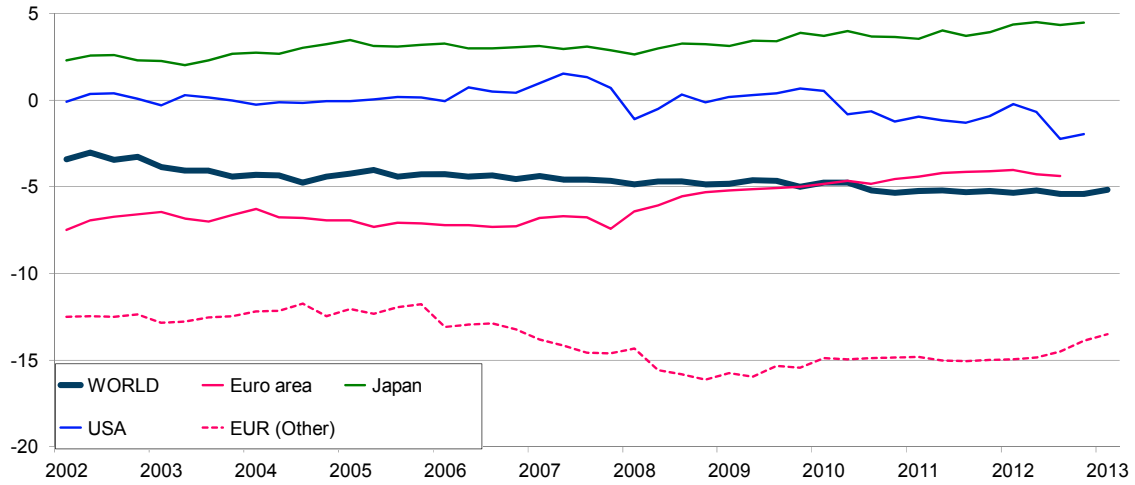
Source: IMF SRF Data.

**Figure A13: CB FC Assets (upper panel) and FC Liabilities (lower panel) in Percent of Total CB Assets at Fixed Exchange Rates**



Source: IMF SRF Data.

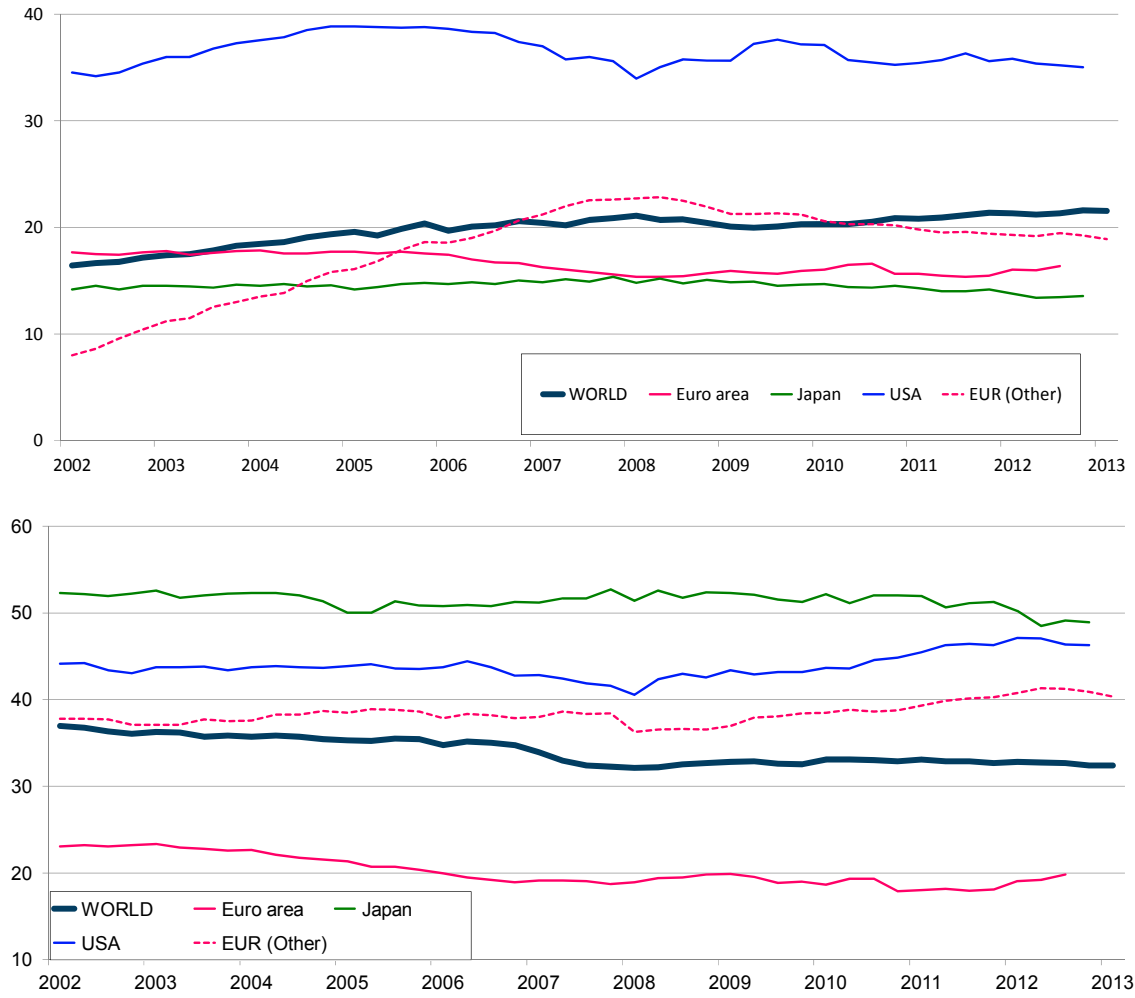
**Figure A14: ODC Short-Term FC Assets Minus Short-Term FC Liabilities in Percent of Total ODC Assets (excluding Kosovo and Macedonia)<sup>32</sup>**



Source: IMF SRF Data.

<sup>32</sup> Kosovo and Macedonia's net open positions (positive and negative) fell sharply during the period, distorting the European (Other) series.

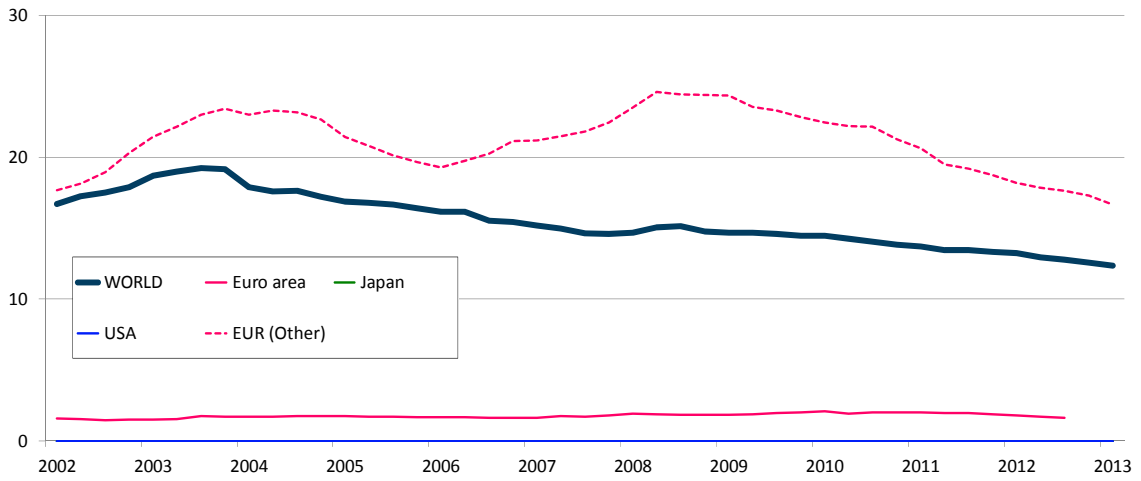
**Figure A15: ODC Claims on Other Residents (upper panel) and Liabilities to Other Residents (lower panel) in Percent of Total ODC Assets**



Source: IMF SRF Data.

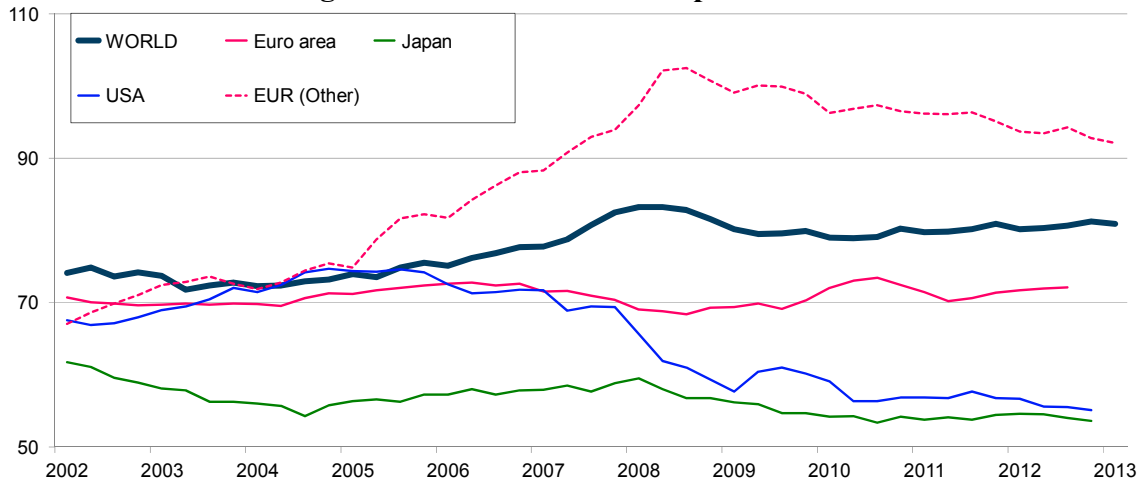


**Figure A16: ODC FC Share of Claims on Other Residents**



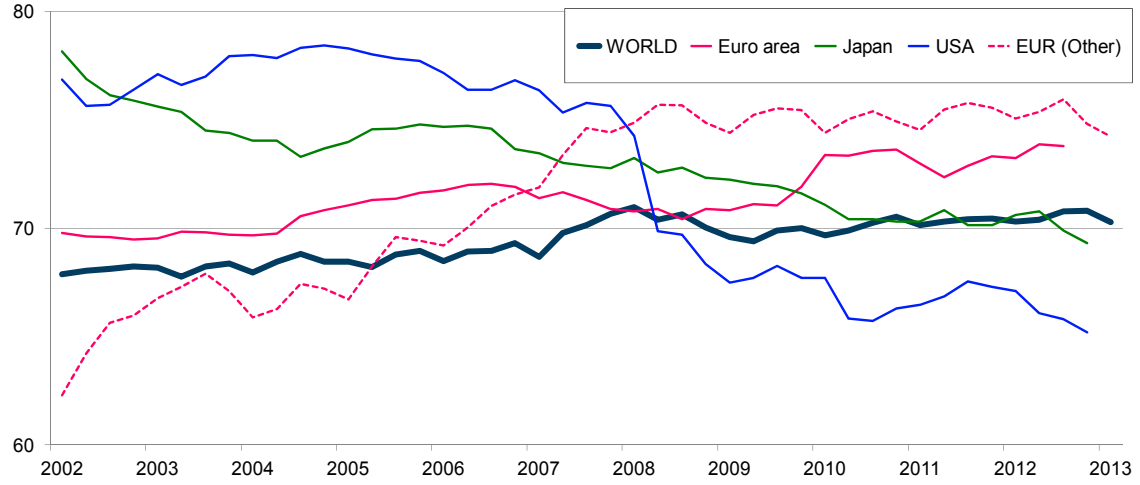
Source: IMF SRF Data.

**Figure A17: ODC Loan to Deposit Ratios**



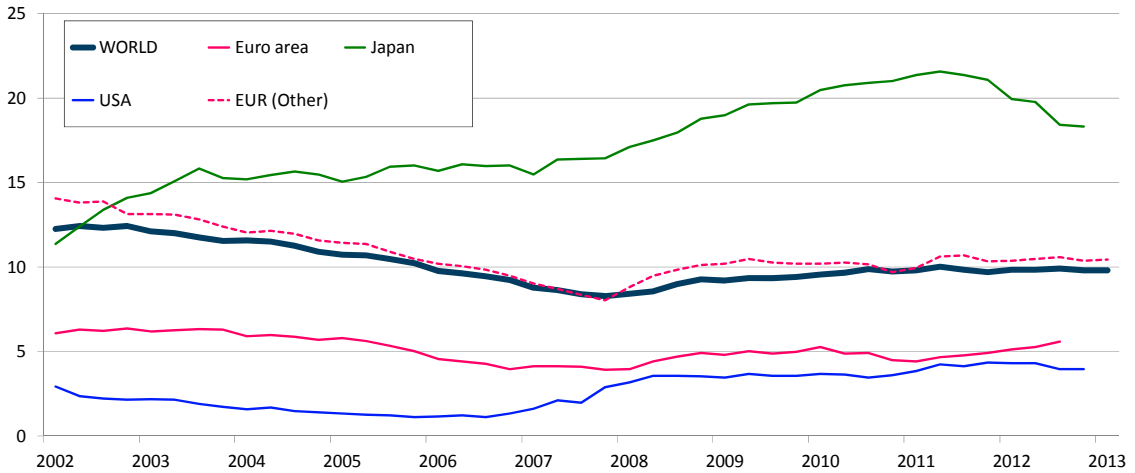
Source: IMF SRF Data.

**Figure A18: ODC Estimated Risk Weighted Assets in Percent of Total ODC Assets**

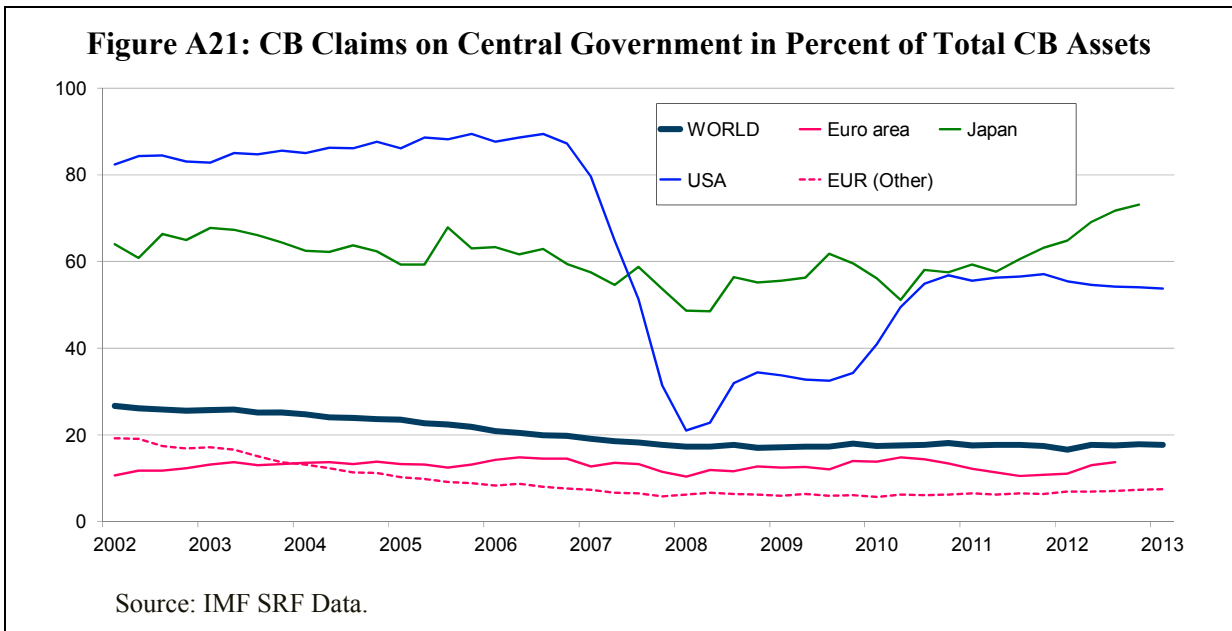
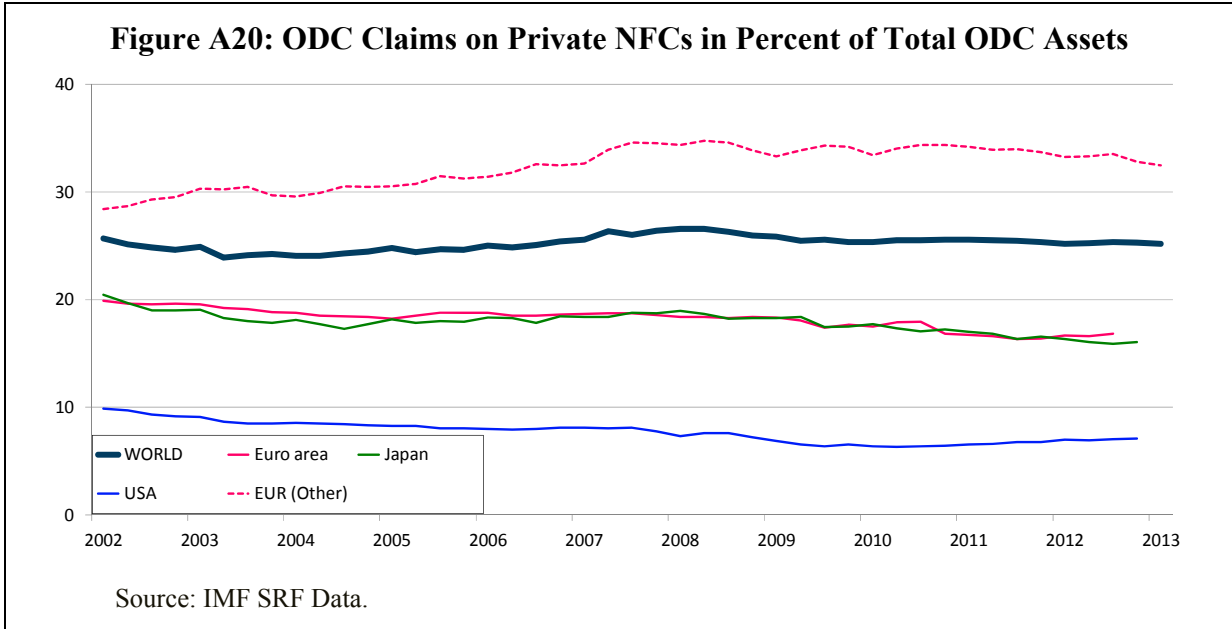


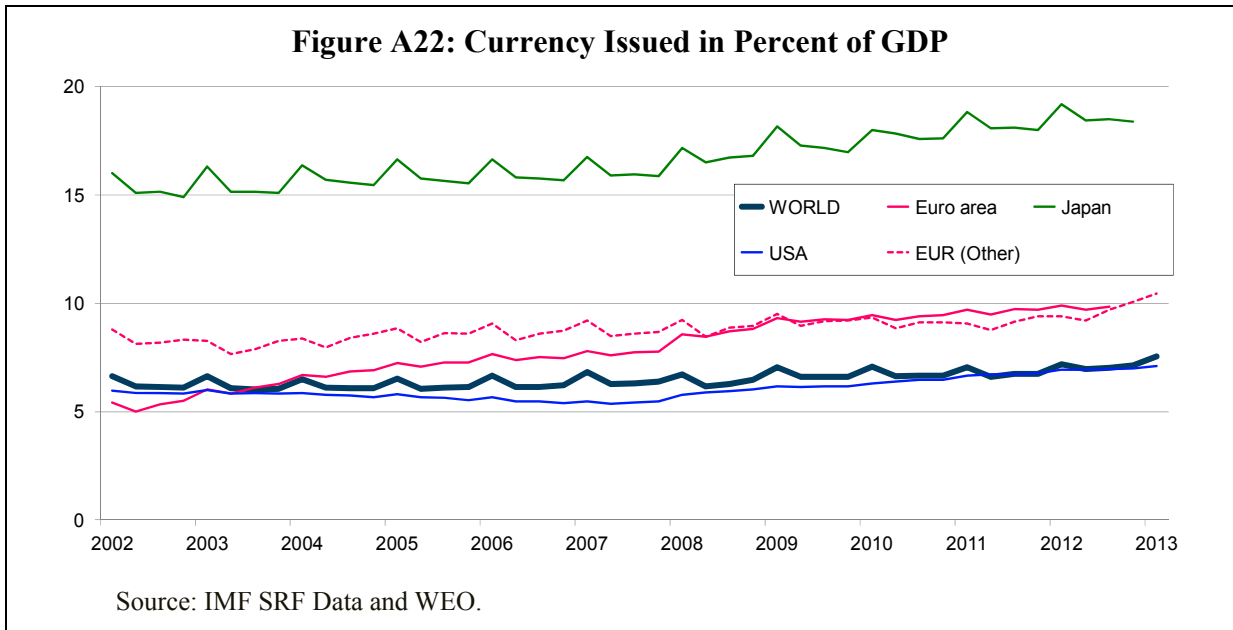
Source: IMF SRF Data.

**Figure A19: ODC Claims on Central Government in Percent of Total ODC Assets**

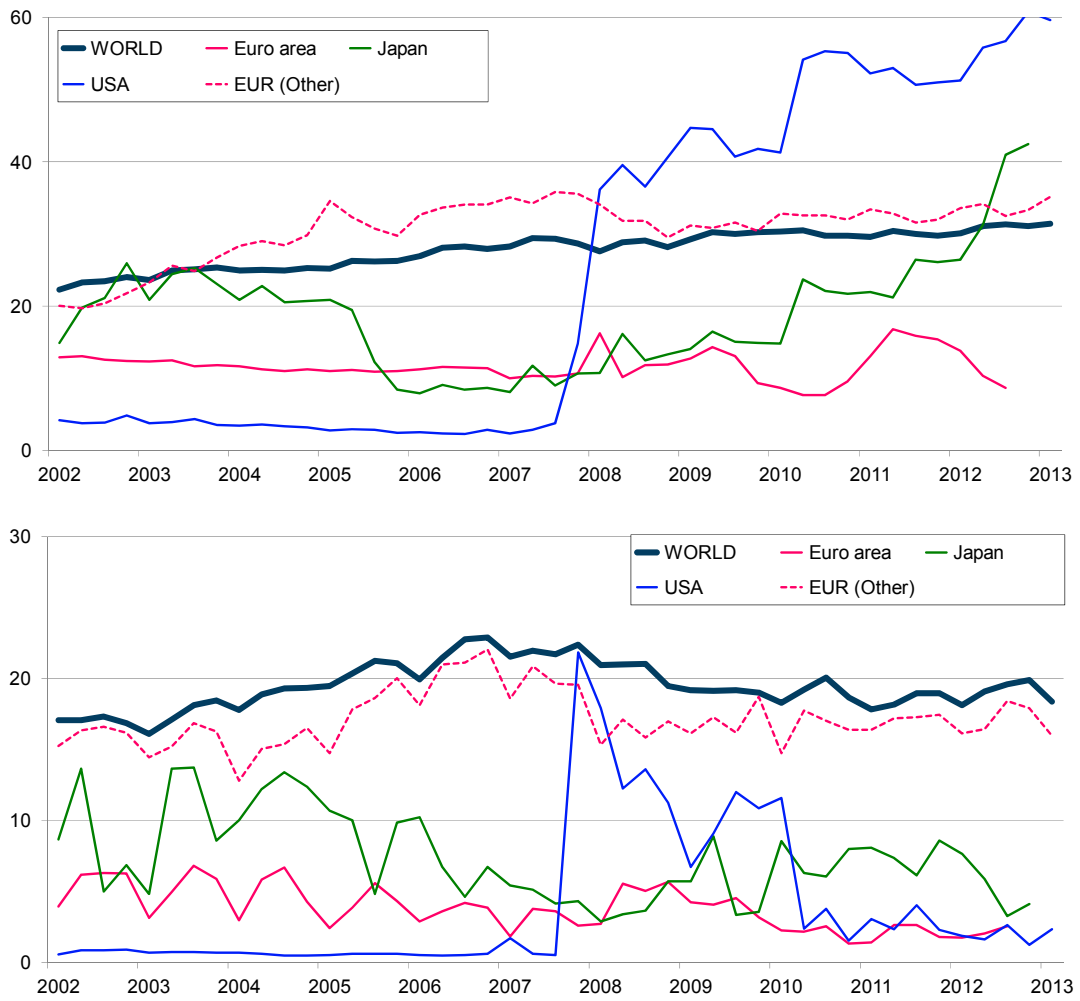


Source: IMF SRF Data.





**Figure A23: CB Liabilities to ODCs (upper panel) and to Central Government (lower panel) in Percent of Total Liabilities**



Source: IMF SRF Data.

