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Sailing through this Storm? Capital Flows in Asia during the Crisis*

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Abstract

The current crisis has led to an unprecedented collapse in international capital flows, with substantial heterogeneity across regions. Asian economies were relatively unaffected, despite having been the center of the storm in the crisis of the late 1990s. The contraction in capital flows for Asian countries was limited to the most acute phase of the crisis following the collapse of Lehman Brothers, after which capital flows rebounded. We find that the stronger performance of Asia primarily reflects its more limited reliance on international banking compared to Europe and the United States. We find little evidence that the drivers of capital flows had a differentiated impact in Asia. Finally, we show that while higher initial levels of foreign reserves did not insulate countries from a turnaround in private capital flows, a larger use of reserves at the height of the crisis limited the contraction in gross private outflows.

Keywords: International Capital Flows, Banking Integration, Crisis

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1. Introduction

The global financial crisis that started in mid-2007 has led to an abrupt break in the pace of financial globalization. Global capital flows had been steadily growing throughout the 2000s, from 7 percent of world GDP to over 20 percent between 1998 and 2007. These flows collapsed during the crisis, and even went into reverse with investors liquidating their foreign holdings, especially in the wake of the failure of Lehman Brothers in September 2008 (figure 2). Given the magnitude of this turnaround, one may expect regions that experienced capital account crises in the past to have been particularly hit by investors' flight away from foreign assets. In particular, Asia could have been particularly hit as it saw a massive crisis in the late 1990s.

We assess how Asian countries fared in the recent turmoil. The bottom line is that while they were not spared by the crisis they coped quite well. International capital flows to and from Asian countries remained robust until the collapse of Lehman Brothers. They unsurprisingly collapsed in the acute turmoil of late 2008, but quickly recovered once the worst of the crisis was past. The resilience of the region, which had been at the center of the previous storm in international capital flows, highlights that while the current crisis clearly has a global dimension, it is far from an homogenous event, with substantial heterogeneity across time and countries (BIS 2009, Milesi-Ferretti and Tille 2011).

This paper builds on our earlier analysis in Milesi-Ferretti and Tille (2011) where we stress the prominent role of international bank linkages. Specifically, countries with large cross-border bank holdings (assets or liabilities) experienced a larger pullback of international capital flows. We also find evidence that the collapse in world trade (Baldwin 2009) played a role, as countries whose trading partners' growth slowed down saw a larger contraction in capital flows.

Our analysis focuses on the experience of Asian economies, both advanced and emerging, during the three phases of the crisis. We first document the patterns of capital flows. Asian countries did not experience a contraction of capital flows in the initial stage of the crisis, in sharp contrast to the situation in the United States and advanced Europe. While Asian economies did suffer from a turnaround in capital flows during the collapse stage of the crisis, its magnitude was smaller than in other regions. Furthermore, the disruption proved shorted-lived and capital flows quickly bounced back. The differentiated experience of Asia was most pronounced in banking flows, but is also observed beyond them especially in terms of the quick return to normal in the recovery phase.

We then undertake a formal econometric analysis of the behavior of capital flows. We extend the work of Milesi-Ferretti and Tille (2011) by focusing on two aspects that are particularly relevant for Asia, namely foreign exchange reserves and exposure to international trade. We allow for these variables to have a differentiated impact for Asian countries. Our econometric analysis indicates that the robustness of Asian

capital flows primarily reflects its limited exposure to international banking. In contrast, we find limited evidence of a differentiated impact of foreign reserves and trade on capital flows for Asian countries. The only effect is that foreign reserves limited the contraction in private flows during the final stage of the crisis by more in Asia than in other countries. We also document that Asian countries fared better that what we would expect based on their international banking exposure. This indicates that in addition to the size of the exposure its specificities can also matter, with Asian countries being possibly less exposed to the United States and complex financial products.

Given the large levels of foreign exchange reserves in Asia, we take a closer look at the impact of reserves on private flows, both in terms of the pre-crisis level of reserves and in terms of their actual use in the crisis. We find that while higher levels provided some cushioning benefit, the main impact of reserves was with regard to private outflows. Drawing on reserves, or at least slowing reserve accumulation, allowed countries to meet the sharp contraction in private inflows in the acute stage of the crisis with less need to abruptly cut back on private outflows.

This paper falls into a growing literature on the international transmission of the crisis. As noted above, Milesi-Ferretti and Tille (2011) consider the drivers of capital flows and stress the role of international banking linkages. Several other studies—BIS (2009), Cetorelli and Goldberg (2010), Hoggarth, Mahadeva, and Martin (2010) among others—focus on the role of banks in the international transmission of the crisis. Other studies focus on capital flows for a specific country, such as Bertaut and Pounder (2009) for the United States. An active line of research considers whether the differentiated incidence of the crisis across countries can be linked to a different exposure to the United States where it originated. Existing studies find little evidence that countries with more exposure to the United States suffered more. Kamin and Pounder (2010) find that countries where financial sectors had a relatively large exposure to the U.S. subprime market did not fare worse. Rose and Spiegel (2010) find no connection between the depth of the crisis in terms of growth and initial conditions such as current account deficits. Lane and Milesi-Ferretti (2010) find some role for the nature of financial integration, as countries with larger pre-crisis cross-border banking assets and liabilities fare worse. In the context of Asian economies, Zhang, Zhang, and Han (2009) use a DSGE model parametrized to Asian countries and show that both trade and financial channels matter in the transmission of a shock from the United States.

It is important to stress that our finding of a better outcome in Asia during the crisis does not mean that the region was spared in absolute terms, but instead that the adverse developments were less marked than in other regions of the world. While we focus on capital flows, a similar pattern can be seen in real terms. For instance, industrial production in emerging Asian economies grew briskly until the fall of 2008, and the subsequent contraction was less acute and shorter than in advanced economies.[1]

[1] See IMF (2011), figure 1.5.

The remainder of the paper is structured as follows. We document the patterns of Asian capital flows in Section 2, contrasting them against other regions. A formal econometric analysis of their determinants is conducted in Section 3. The role of reserves is analyzed in Section 4, and Section 5 concludes.

2. How Did Asia Fare?

2.1 Data and Concepts

We consider quarterly values of international capital flows. These include *capital outflows* (net purchases by domestic residents of financial instruments issued by nonresidents) and *capital inflows* (net purchases by foreign residents of domestic financial instruments). Capital flows are split between foreign direct investment (FDI), portfolio equity, reserves (only for outflows), bank lending, non-bank lending and "official" flows. The latter category includes loans by multilateral institutions, such as the IMF, as well as swap facilities between central banks that were used extensively throughout the crisis (Goldberg, Kennedy, and Miu 2010). A more detailed description of the categories of flows is given in Appendix 1.

Our analysis focuses on "private" capital flows, defined as overall flows minus reserves and official flows. The motivation for this focus is that private flows are better indicators of the stress faced by countries. For instance, a country receiving a large IMF assistance in response to a fall in private flows would show stable overall flows. Considering total flows would then lead us to mistakenly infer that the country faces no pressure.

The data are taken from the IMF Balance of Payments Statistics, with a detailed description given in Appendix 2. We use a broad sample of quarterly capital flows going to the end of 2009 for 68 countries listed in Table 1. The sample includes 13 economies from the Asia and Pacific region (Asia henceforth), which are split between 6 emerging markets (India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam) and 7 advanced economies (Australia, Hong Kong S.A.R., Japan, Korea, New Zealand, Singapore, and Taiwan). Two of the advanced economies (Hong Kong and Singapore) are financial centers with very large values of foreign assets and liabilities relative to their GDP.

Our analysis focuses on the 6 quarters preceding the crisis (2006Q1–2007Q2), the initial phase of the crisis (2007Q3-2008Q3), its most virulent phase (2008Q4-2009Q1) and the start of the recovery period (2009Q2-Q4). For each stage, we compute the average capital flows, with all flows expressed at an annualized rate for comparability. We then measure the magnitude of swings in capital flows in each crisis stage as the difference between capital flows during that stage and capital flows prior to the crisis:

$$\textit{Change(Initial)} = \textit{Average flows [2007.3-2008.3]} - \textit{Average flows [2006.1-2007.2]}$$

$$\textit{Change(Collapse)} = \textit{Average flows [2008.4-2009.1]} - \textit{Average flows [2006.1-2007.2]} \quad (1)$$

$$\textit{Change(Recovery)} = \textit{Average flows [2009.2-2009.4]} - \textit{Average flows [2006.1-2007.2]}$$

2.2 Financial Integration before the Crisis

Before describing capital flows, we contrast the extent and nature of financial integration across the world's main regions. The extent of integration is measured by the value of total assets and liabilities as a share of GDP (figure 1, top panel). Among advanced economies, Asian countries show a relatively small extent of integration (omitting financial centers) compared to the United States, and especially to Europe. By contrast, emerging markets are less integrated in world financial markets than advanced economies. This is especially the case for emerging countries in Latin America and Asia, while emerging European countries are more integrated.

In addition to the level of integration, its nature also shows substantial heterogeneity. This is illustrated in the bottom panel of figure 1, which shows the share of total assets and liabilities that consist of FDI and equity, bank lending, non-bank lending, and reserves.[2] Among industrialized economies, the share of FDI and equity is similar in the United States, Europe and Asia (excluding financial centers). Banks play a dominant role in Europe, but not so in the United States where bond holdings are twice as large. The role of banks is also smaller in Asia than in Europe, with the difference made by a larger role of reserves in Asia.

The external assets and liabilities of emerging markets are dominated by FDI and equity, while banks play a smaller role than in advanced countries. Among emerging economies, banks play a larger role in Europe. Their role is slightly smaller in emerging Asia, but the exposure of Asian countries to international bank flows is cushioned by large reserve holdings that far exceed those of Europe.

The composition of external integration also shows an interesting contrast between European and Asian financial centers. European centers' holdings consist primarily of debt securities, especially in the form of banking positions, while Asian centers are dominated by FDI and equity holdings. The behavior of international capital flows to financial centers is thus likely to differ between the two regions in a crisis where banks play a dominant role.

[2] The specific numbers are given in table 2. We do not split assets and liabilities in debt instruments between banking and non-banking categories for Asian financial centers. This is because banking positions inferred from the BIS data for Singapore substantially exceed holdings in all debt instruments from the Net International Investment Position for Singapore. This discrepancy likely reflects the treatment of fiduciary business by banks.

In short, Asian economies tend to be less closely integrated in financial markets than economies in other regions. Their integration is also less reliant on banks and involves larger reserves cushions.

2.3 Capital Flows during the Crisis: A Heterogeneous Pattern

Overall Pattern

The patterns of capital flows are illustrated in figure 2, which shows the value of capital outflows summed across all countries.[3] The sharp turnaround is clearly visible, with outflows turning negative in the wake of the failure of Lehman Brothers in September 2008 as investors liquidated foreign assets and repatriated their funds.

While the crisis clearly has a global dimension, it is far from a homogenous event. First, it unfolded in distinct stages (see for instance BIS 2009), as illustrated in the bottom panel of figure 2. The "initial" phase of the crisis goes from the outbreak of stress in financial markets in the summer 2007 to the eve of the Lehman Brothers failure (third quarter of 2007 to third quarter of 2008). During that stage capital flows were at first resilient, but then dropped in the wake of the Bear Stearns episode (second quarter of 2008). The failure of Lehman Brothers marks the beginning of the "collapse" stage of the crisis (fourth quarter of 2008 and first quarter of 2009) where capital flows turned negative as investors liquidated foreign holdings, a development that was driven by cross-border deleveraging by banks. The final "recovery" phase since the second quarter of 2009 saw a partial resumption of capital flows.

A second dimension of heterogeneity is observed across regions. Figure 3 shows the sum of outflows and inflows for various regions, with the average capital flows over the six pre-crisis quarters (first quarter of 2006 to second quarter of 2007) set to 100 for comparability. The top panel presents the pattern for advanced economies. Several noteworthy points emerge. First, while capital flows decreased in the United States and Europe in the first stage, they instead increased moderately in Asian economies, including financial centers. Second, Asian countries experienced a contraction of capital flows only during the collapse stage. Interestingly, the contraction was smaller for Asian financial centers than for other Asian economies, the pattern being opposite in Europe where financial centers saw the steepest contraction of capital flows. Third, the turmoil proved temporary for Asian countries with capital flows bouncing back during the recovery phase while they remained stagnant for the United States and Europe.

The turmoil in capital flows was also relatively limited in emerging economies (bottom panel of figure 3). Flows increased in all three emerging regions during the initial phase. While they fell abruptly during the collapse stage, they did so by less than in advanced economies. The turnaround was particularly limited in emerging Asian economies. The contraction in capital flows also proved short-lived for most emerging

[3] The value of capital inflows is essentially identical.

markets, with emerging Europe being the only region that experienced persistent problems in the recovery phase.

Composition of Capital Flows

We refine our analysis by considering how the various components of capital flows evolved in the three stages of the crisis. The evidence is summarized in figures 4a-c where we focus on inflows for brevity.[4] Each figure shows the changes in inflows relative to the pre-crisis period as computed in (1) for the initial stage (green dots), crisis stage (red dots) and recovery stage (blue dots). These changes in flows are scaled by pre-crisis GDP in figures 4a-b to capture their economic relevance. For robustness, we also scale them by the pre-crisis positions in figures 4c.

The United States and Europe stand out as they experienced larger contractions of overall outflows than other regions in all three stages of the crisis (figure 4a, top panel). Advanced Asia by contrast only experienced a contraction during the collapse stage, and to a smaller extent than the other advanced economies. Emerging economies also experienced a contraction only during the collapse part, with the notable exception of Eastern Europe. The magnitude of the swings in capital flows, relative to GDP, is also much smaller than for advanced economies. Financial centers not surprisingly experienced large swings in capital flows relative to their GDP. The contraction was larger in European centers in all three stages of the crisis, while Asian centers did not experience any reduction in the initial stage. The pattern across the various regions is similar when focusing on overall private inflows (figure 4a, bottom panel).

In light of the prominent role of banks in the crisis, we illustrate the changes in bank inflows (figure 4b, top panel) as well as in all other private inflows (figure 4b, bottom panel). For bank flows, the contrast between the United States and especially Europe on the one hand and other regions on the other hand is striking. Advanced Asian countries only saw a small contraction even in the collapse stage, and while emerging economies experienced a contraction in the collapse stage, this was short-lived—except in Europe. The contraction in banking flows was also much more marked in European financial centers than in Asian ones. The situation is less heterogeneous for non-bank flows. Advanced Asian economies saw a contraction in the collapse stage that was similar to the contraction in advanced European countries and the United States. Still, this similarity is only observed for that stage and Asian economies saw a smaller reduction in the initial and recovery stages. Similarly, the contraction in Latin America and emerging Asia during the collapse stage proved shorted-lived. Turning to financial centers, the pattern is similar in European and Asian centers, in contrast to the heterogeneity observed for bank flows.

[4] A more detailed illustration of the flows for various regions is given in Appendix figures 1a-e. The detailed numbers are in Appendix tables 1a-b (where flows are scaled by 2007 GDP) and 2 (where they are scaled by pre-crisis positions). The pattern for outflows is similar.

The limited contraction outside Europe and the United States could simply reflect the fact that these regions are highly integrated in international financial markets, as reflected in the high value of their holdings relative to GDP (figure 2). For robustness, we also examine the patterns of capital flows by scaling their changes by the stocks of assets and liabilities at the end of 2005 (figure 4c). Scaling the flows by pre-crisis holdings reduces the heterogeneity somewhat, but does not alter the main pattern. The contraction of overall flows during the collapse stage is fairly even across regions (figure 4c, top panel). However, this contraction is temporary outside the United States and Europe, with little or no contraction during the initial and recovery stages. The pattern is similar when focusing on private flows (bottom panel).

The bottom line of our analysis is that Asia was less affected by the contraction in capital flows than other regions. Among advanced economies, Europe and the United States saw a substantial reduction in capital flows already in the initial stage, as well as a persistent reduction in flows beyond the collapse stage. By contrast, advanced Asian economies only saw a contraction in the collapse stage, followed by a substantial pickup in the recovery stage. Asian financial centers were also less affected than the ones in Europe. Asian emerging economies (as well as Latin American ones) only saw a temporary reduction in flows during the collapse stage. The contrast with other advanced economies does not merely reflect the smaller reliance on international banking in Asia, but also a more robust behavior of bank flows in the region.

3. Econometric Assessment

3.1 Approach

In this section we assess the determinants of capital flows more formally through an econometric exercise. The dependent variables are the changes in flows in the three crisis stages scaled by GDP.[5] As financial centers experienced very large fluctuations in flows relative to their GDP, we exclude them when computing our estimates.

Our specification builds on Milesi-Ferretti and Tille (2011). We consider three broad categories of drivers for capital flows, with the specific variables being described in Appendix 3. A first group of variables is related to pre-crisis international financial integration. The financial crisis has been characterized by a sharp re-evaluation of risk by investors, especially in the wake of the collapse of Lehman Brothers as scenarios that until then were thought unlikely to be proved relevant. This re-assessment led to a flight towards safer assets, such as U.S. Treasury securities. We can expect this pullback by international

[5] The changes are expressed in percentage points, so a value of -5 indicates that capital flows in the specific crisis stage were lower than their value before the crisis by 5 percent of GDP. We separately assess the determinants of capital flows for each of the three stages of the crisis.

investors to have more acutely affected countries that were more reliant on external finance, an aspect that we capture by including the pre-crisis net debt position of countries (excluding reserves). We include the pre-crisis reserves position separately as investors could have viewed countries with a large cushion to be less of a risk and thus limit their pullback from these countries. Finally, we include the pre-crisis gross international banking position (assets and liabilities). The large losses that banks faced on their holdings of securities led them to reduce leverage, including by curtailing their cross-border holdings. Countries with a large cross-border exposure in the form of bank loans were more vulnerable to this "bank run" and thus can be expected to have faced a larger contraction in capital flows.

The second group of variables reflects existing macroeconomic conditions. Countries that went through a boom before the crisis could have built vulnerabilities during the boom, such as excessive indebtedness by households and firms. The re-assessment of risk by investors during the crisis could have led them to pay more attention to these vulnerabilities and curtail their investment to these countries to a larger extent. We capture pre-crisis booms by the growth of GDP, as well as the change in private credit, the latter being a proxy for the build-up of possibly excessive levels of debt. We also consider the GDP per capita to capture the pattern that the crisis was most pronounced in advanced economies that several contributions stress (Lane and Milesi-Ferretti, 2010; Rose and Spiegel, 2010).

The final set of variables reflects the collapse of world trade during the crisis (Baldwin, 2009), which could mechanically reduce the magnitude of capital flows. We capture this aspect in two ways. We first consider how growth in a country's trading partners changed during the crisis. We also compute the turnaround of exports and imports relative to the pre-crisis situation in the same way as we compute the turnaround of capital flows (equation 1).

We also consider whether the impact of selected variables was different in Asian countries. Specifically, we focus on foreign exchange reserves and the change in trade flows. As Asian countries hold especially large amounts of foreign reserves, it could be that these large amounts are more conducive to investors' confidence than the smaller holdings of other countries. In addition, Asian countries have adopted an export-led growth strategy that could make them particularly sensitive to development in trade flows. We thus interact the foreign exchange reserves and change in trade flows with a dummy for Asian countries, allowing us to assess whether these variables have a different impact on capital flows for Asian countries.

The regressions are undertaken for each of the three stages of the crisis. We conduct separate regressions for private inflows and private outflows. The results are contrasted across the whole sample, emerging markets, and advanced economies (with fewer variables because of limited degrees of

freedom). We also present the regression results without the interactions with Asian dummies, which correspond to the results of Milesi-Ferretti and Tille (2011).[6]

3.2 Drivers of Capital Flows

The results for capital inflows in the initial stage are given in table 3. International banking positions are the strongest driver of the change in capital inflows—countries with larger cross-border bank assets and liabilities experienced a steeper reduction in inflows (a negative coefficient). We find some weak evidence that emerging countries with higher reserves fared better. Movements in capital flows also parallel the ones in trade, although this aspect lacks robustness. This is to be expected as the crisis in world trade emerged only during the collapse stage of the crisis. We find no evidence that the impact of foreign reserves and trade was different for Asian countries. The evidence for capital outflows (table 4) also indicates that countries with large international banking positions experienced a steeper contraction, the magnitude of the effect, however, being smaller than for gross inflows.

Turning to the collapse stage, international banking exposure is a robust driver of capital flows. Countries with larger cross-border holdings experienced a steeper contraction in both inflows (table 5) and outflows (table 6), especially among industrialized economies for outflows. Pre-crisis credit booms also matter in emerging markets, with countries that experienced such booms facing a larger pullback of capital inflows. The impact of the various variables shows little difference between Asian and non-Asian economies. We only find weak evidence of a different role of foreign exchange reserves. Interestingly, this is contrasted across Asian countries: while emerging countries with higher reserves saw a larger contraction in outflows, the opposite is the case for industrialized ones.

In the recovery stage, international banking exposure remains a driver of both capital inflows (table 7) and outflows (table 8), especially among industrialized economies. Countries which experienced pre-crisis credit booms also faced a persistent reduction in inflows and outflows beyond the collapse stage. The exposure to international trade matters somewhat, with inflows being more robust for countries whose trading partners experienced stronger growth. We find evidence that the impact of foreign exchange reserves and trade was different for Asian countries than for other ones. Specifically, foreign reserves are associated with higher inflows and outflows for Asian countries but not for other ones.

While countries with a high international banking exposure experienced a larger contraction in flows in all three stages of the crisis, a closer look reveals some nuances in this effect. In the initial stage the effect is more pronounced for emerging economies (tables 3 and 4). In the collapse stage by contrast, the impact of banking positions remains somewhat larger for emerging countries for inflows (table 5), but is more

[6] The results for all countries are identical, but those for emerging and advanced economies differ somewhat because this paper classifies a larger set of countries as advanced economies.

pronounced for advanced economies in terms of outflows (table 6). In the recovery, the effect is more pronounced for advanced economies (tables 7 and 8). Our results are indicative of international banking deleveraging being initially more pronounced for emerging markets, possibly because banks viewed their operations in these markets as relatively secondary. This did not translate into a large contraction of flows as a share of GDP, thanks to the more limited role of bank positions for emerging markets than for advanced economies. The deleveraging became more broadly based in the collapse stage, and shifted towards advanced economies in the recovery stage. A possible explanation is that once the crisis entered an acute stage, banks were left with little choice but to pull back from markets that were more central in their operations.

The bottom line of our analysis is that countries with larger initial cross-border bank positions and pre-crisis credit booms faced steeper contractions in capital flows, a pattern stressed by Milesi-Ferretti and Tille (2011). We find some evidence of a differentiated impact on Asian countries in the recovery stage, with foreign exchange reserves associated with stronger inflows and outflows in Asia.

3.3 Assessing the Fit

How do our econometric results fit the experience of various regions? We assess this by illustrating the overall fit and the role of various explanatory variables for private inflows and outflows in the initial stage (figure 5a), the collapse stage (figure 5b) and the recovery stage (figure 5c). Each figure presents the fit for gross private inflows (left panel) and outflows (right panel) for the various regions, excluding financial centers as these were not considered in the regressions. In each figure the red line shows the actual change in capital flows from (1). The solid blue line is the fitted value from the regression that does not include Asia-specific dummies (right panels in tables 3 to 8), and the dotted blue line shows the fit once we allow the impact of foreign reserves and trade flows to be different for Asian countries (left panels in tables 3 to 8). The figures present the contributions of various variables to the fit.[7] The impacts of foreign reserves and gross banking positions are shown by the striped green and red bars respectively. The impact of the net debt position is given by the solid blue bar. The role of country-specific macroeconomic conditions (GDP growth, credit booms, and per-capita GDP) is shown as the red dotted bar, while the impact of international trade (growth in trading partners and retrenchment in trade flows) is given by the blue striped bar.[8]

In the initial stage of the crisis (figure 5a), the fit for inflows is good for European countries, primarily reflecting their substantial international banking integration. Our specification correctly predicts a smaller contraction for Asian countries than European ones, due to their smaller international integration through

[7] As the coefficients on the variables interacted with the Asia dummy are mostly insignificant, the contributions of the various variables is computed using the regressions without these interactions.

[8] For brevity the impact of the constant is omitted.

banks. However, the specification underpredicts the contraction in U.S. inflows, and overpredicts the one for Asian economies, both advanced and emerging. This could reflect the fact that our measure of international bank holdings encompasses all positions and is not fine-tuned based on specific exposure. With problems originating in the United States, international banks possibly reduced their exposure to that market to a larger extent than predicted, based on the cross-border positions. Conversely, Asian banks may have been engaged in international businesses with little exposure to the U.S. market, and thus have been shielded from the turmoil originating there. In terms of outflows, the model fits the steeper contraction in Europe, primarily due to the large banking positions. It, however, misses the pickup of outflows in emerging Asia, and underestimates the contraction in the United States, possible for the reasons outlined for inflows.

Turning to the collapse stage (figure 5b), our estimates offer a good fit for the contraction of inflows. The model correctly predicts a deeper contraction in Europe primarily because of deeper banking integration. The negative (albeit not significant) coefficient on foreign reserves indicates a steeper contraction in emerging Europe and Asia. The pattern is broadly similar for capital outflows, with the specification predicting larger contractions in the United States and Europe because of banking integration. In the recovery stage of the crisis, our model correctly predicts more persistent weakness in capital flows in Europe and the United States (figure 5c), again reflecting their reliance on cross-border bank integration. Interestingly, the model predicts a steeper contraction of outflows in Asia.

Overall, our estimates offer a reasonable fit across the world's major regions. The primary factor behind the robustness of Asian capital flows relative to other regions, and especially Europe and the United States is the smaller reliance of Asia on international banks. Our estimates tend to predict stronger contractions in flows in Asian economies in several instances (all flows in the initial stage, and gross outflows in the last two stages) while underestimating the contraction in the United States in the initial stage. This possibly reflects the fact that our measure of banking integration does not distinguish between exposures to different countries. With Asian banks having a relatively limited exposure to the United States, the international de-leveraging for Asian economies was then more limited than what we would infer based solely on the level of international banking positions.

4. Did Foreign Exchange Reserve Help?

Our analysis finds little support for an impact of pre-crisis foreign exchange reserves on the retrenchment of international capital flows, with the exception of a cushioning role for Asian economies in the recovery stage (although this only moderately improves the fit in figure 5c). Should we infer that reserve accumulation proved of little use? This is a particularly relevant question given the large reserve holdings of many Asian economies.

We refine our analysis by looking not only at the level of reserves before the crisis, but also at the change in reserves during the crisis, computing along the same lines as the changes in flows in (1). While a country with large reserves may not have experienced a smaller contraction in private flows, we can expect it to have been more able to offset a pullback of investors by drawing on its reserves, thereby limiting the stress on its financial markets.

We first contrast the behavior of the changes in capital flows against the pre-crisis reserve levels (figure 6a) through a simple scatter plot. We distinguish between the three stages, as well as between Asian and other economies. The evidence for gross private inflows and outflows are presented in the top and bottom rows, respectively. The figures shows that higher reserves tend to be associated with a steeper contraction of flows in Asian economies, while the pattern tends to be opposite in other countries. The negative correlation in Asia was particularly large in the collapse stage, and for outflows in the recovery stage.

The link between the changes in gross private flows and changes in reserve flows is presented in figure 6b. Private flows are now plotted against reserve flows in the corresponding stage of the crisis. There is some connection between private inflows and reserve flows in the initial stage of the crisis, but this is quite contrasted between Asian economies (negative link) and other countries (positive link). The correlation is small in the collapse stage, and re-emerges in the recovery stage. The negative correlation for Asian economies indicates that countries which draw on their reserves, or at least reduced the pace of accumulation, faced a relatively small contraction in private inflows. Nonetheless, the magnitude of the effect appears small as can be seen from the relatively flat scatter for Asian countries.

A more robust correlation emerges when looking at gross private outflows. Countries which drew on their reserves saw smaller contractions in outflows, especially during the collapse stage of the crisis. Our simple graphical analysis thus indicates that the use of foreign reserves had a more pronounced impact on gross outflows than inflows. While countries that drew down on their reserves, or moderated their accumulation, did not face a smaller contraction in private inflows, they were able to meet this pullback by foreign investors without requiring any adjustment on the part of domestic investors. For instance, a pullback by foreign banks did not force a similar retrenchment by local banks on their overseas operations.

We next undertake a more formal assessment of the impact of reserves by enriching our econometric specification with the change in foreign reserves (scaled by GDP) for the relevant period. The results are presented in table 9. The regressions are the same as in the first columns of tables 3 to 8, with the addition of the change of foreign reserves. For brevity, we do not present all coefficients but instead focus on the change in reserves and pre-crisis levels of reserves.[9] In addition to the results for gross private

[9] The coefficients on the other variables do not change from the ones presented in tables 3 to 8.

inflows (first column) and gross private outflows (second column), we also compute the estimates for net private inflows (third column).

We find some evidence of a role for changes in foreign reserves in the initial stage. The positive coefficient, however, indicates that higher reserve accumulation is associated with more sustained private inflows. This is likely driven by Asian countries and emerging markets that kept accumulating reserves and were not yet affected by a contraction in private flows.

Foreign exchange reserves play a more substantial role in the collapse stage. First, countries with higher levels of reserves experienced more robust inflows. Second, countries which drew on their reserves did not have to curtail private outflows to match the reduction in private inflows. In net terms, higher initial reserves were associated with more robust net inflows, and a higher use of foreign reserves allowed countries to absorb a more pronounced retrenchment in net private inflows. A weak impact of foreign reserves is observed in the recovery stage, with higher reserve use allowing for more robust outflows.

Overall, our analysis shows that reserves played a role in the adjustment to the pullback in capital flows. This is observed more in the use of reserves than in their initial levels (with the notable exception of Asia in the recovery stage). In particular, our regressions find no evidence that countries with larger reserves experienced a larger contraction in inflows, a pattern that one would have expected if countries most vulnerable to sudden stops had accumulated larger reserves. Reserves do not appear to have limited the retrenchment by foreign investors, with the exception of a cushioning effect of initial reserve levels in the collapse stage. Their impact was much more on the outflows side, with the use of reserves allowing countries to match the pullback by foreign investors without having to drastically cut back on private outflows. This potentially limited disruptive retrenchment by domestic banks.

5. Conclusion

Our analysis shows that while Asia had been at the center of the international financial crisis of the late 1990s, the recent turmoil in international capital flows was less pronounced in Asia than in other regions. Asian economies were not spared from the crisis, and indeed faced a sharp reduction in capital flows during the global unwinding following the demise of Lehman Brothers. Capital flows to and from Asian economies, both advanced and emerging, however, were robust before that episode, and subsequently recovered faster than in other regions.

Our econometric analysis indicates that the more modest contraction in capital flows in Asian economies reflects primarily their limited reliance on international banking integration. Interestingly, Asian countries saw a contraction in capital flows that was smaller than the one predicted based on their banking links with the rest of the world. This indicates that in addition to the magnitude of international bank linkages,

the precise nature of the exposure in terms of geography and type of investments matters. An avenue of future research will be to determine whether the robustness of banking flows in Asia reflects a limited exposure to the U.S. market and / or to complex derivative products.

We also find that higher initial foreign reserves did not translate into more robust private inflows. A larger use of reserves, however, allowed countries to meet the sudden pullback of private inflows during the collapse stage of the crisis without having to go through a possibly disruptive pullback of private outflows.

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Table 1. Country Classification

Advanced Economies 31, including 10 financial centers			Emerging Economies 37, including 1 financial center	
Europe (21)	United Kingdom	*	Europe (14)	Belarus
	Austria			Bulgaria
	Belgium	*		Croatia
	Cyprus	*		Czech Republic
	Finland			Estonia
	France			Hungary
	Germany			Latvia
	Greece			Lithuania
	Ireland	*		Poland
	Italy			Romania
	Luxembourg	*		Russia
	Netherlands	*		Serbia
	Portugal			Turkey
	Slovakia			Ukraine
	Slovenia		Asia (6)	China
	Spain			India
	Denmark			Indonesia
	Iceland	*		Malaysia
	Norway			Philippines
	Sweden			Thailand
	Switzerland	*	Latin America (12)	Argentina
Asia (7)	Japan			Brazil
	Australia			Chile
	New Zealand			Colombia
	Hong Kong	*		Costa Rica
	Korea			Ecuador
	Singapore	*		El Salvador
	Taiwan			Guatemala
Other (3)	United States			Mexico
	Canada			Peru
	Israel			Uruguay
				Venezuela
			Other (5)	Kazakhstan
				Lebanon *
				Morocco
				Pakistan
				South Africa

Note: countries marked with an asterisk are financial centers

Table 2. Financial Integration: Assets + Liabilities, 2007, % of GDP

	Total	FDI and equity	Debt: total	Debt: banks	Debt: nonbank	Reserves
United States	204%	81%	104%	34%	70%	0%
Canada	198%	119%	77%	23%	54%	3%
United Kingdom	744%	187%	555%	371%	184%	2%
Euro Area	345%	140%	197%	125%	72%	2%
Adv. Europe (wo fin ctrs)	328%	110%	210%	121%	89%	3%
European fin centers	1021%	372%	638%	417%	222%	3%
Japan	155%	44%	91%	41%	49%	18%
Adv. Asia (wo fin ctrs)	160%	55%	82%	39%	43%	20%
Asian fin centers	1273%	664%	518%			80%
Latin America	97%	47%	40%	5%	35%	9%
Emerging Europe	119%	45%	56%	15%	40%	18%
Emerging Asia	91%	30%	31%	15%	16%	30%

Note: the data for Asian financial centers do not allow for a split between bank and nonbank debt.

Table 3. Initial Stage, Capital Inflows Net of Official Flows

Dependent variable: annualized change in capital flows between 2006Q1-2007Q2 and 2007Q3-2008Q3, scaled by 2007 GDP

	All		Emerging		Advanced		All		Emerging		Advanced	
Net debt position excl. reserves	-5.26		-21.25	+	-3.08		-4.67		-20.99	+	-1.68	
	5.52		14.28		6.86		5.24		13.53		4.28	
Foreign exchange reserves	18.04		40.73	+			4.58		26.56	+		
	19.83		29.83				9.28		18.87			
Gross debt (banks)	-7.68	***	-21.62	**	-5.43	*	-9.00	***	-24.40	**	-5.27	**
	2.25		8.93		2.83		2.43		9.58		2.46	
GDP growth 2005-07	-0.93		-0.07		-0.97		-0.83		-0.17		-0.85	
	0.78		0.79		1.51		0.74		0.73		1.22	
Change in private credit / GDP	2.74		7.26				4.15		11.99			
	6.15		15.46				6.54		13.16			
Log GDP per capita	-0.54		1.17				0.06		2.62	+		
	0.92		2.33				0.78		1.87			
Change in growth in trading partners	-0.27		0.13				-0.41		0.08			
	1.20		2.30				0.94		1.53			
Change in trade flows	0.46	*	0.44	+	0.65	*	0.48	***	0.41	**	0.63	**
	0.25		0.32		0.32		0.16		0.17		0.27	
Foreign exchange reserves	-10.61		-17.09		6.06							
* Asia dummy	20.62		33.88		14.11							
Change in trade flows	-0.18		-0.12		-0.15							
* Asia dummy	0.31		0.42		0.52							
Constant	3.42		-18.70		-2.81		-2.19		-28.99	*	-2.80	
	9.59		19.67		4.68		7.48		16.68		4.17	
Observations	57		36		21		57		36		21	
R-squared	0.48		0.54		0.47		0.44		0.50		0.46	

Note: Robust standard errors below the coefficient. *** indicates p<0.01, ** indicates p<0.05, * indicates p<0.1, and + indicates p<0.2. Regressions exclude all financial centers.

Table 4. Initial Stage, Capital Outflows Net of Official Flows

Dependent variable: annualized change in capital flows between 2006Q1-2007Q2 and 2007Q3-2008Q3, scaled by 2007 GDP

	All		Emerging		Advanced	All		Emerging		Advanced
Net debt position excl. reserves	-4.80		-5.10		-4.30	-4.07		-4.39		-4.77
	5.31		13.52		7.85	4.60		12.31		5.24
Foreign exchange reserves	-2.62		4.56			1.94		11.91	+	
	15.07		19.53			5.54		8.91		
Gross debt (banks)	-4.81	**	-8.18	+	-1.93	-4.95	**	-8.52	*	-2.65
	2.28		5.12		2.70	2.13		4.81		2.41
GDP growth 2005-07	0.03		-0.14		-0.33	0.05		-0.17		0.03
	0.64		0.57		1.71	0.64		0.54		1.60
Change in private credit / GDP	0.89		2.27			0.91		2.31		
	3.34		2.84			3.15		2.35		
Log GDP per capita	0.03		2.64			0.36		2.82	+	
	0.85		2.00			0.77		1.92		
Change in growth in trading partners	0.20		0.35			-0.17		0.01		
	0.86		1.57			0.77		1.07		
Change in trade flows	0.25		0.21		0.27	0.16		0.11		0.16
	0.25		0.31		0.34	0.15		0.16		0.31
Foreign exchange reserves	9.53		11.26		-7.72					
* Asia dummy	19.17		23.90		14.59					
Change in trade flows	-0.25		-0.18		0.63					
* Asia dummy	0.27		0.32		0.51					
Constant	-2.12		-22.28	+	-5.74	-6.32		-24.91	+	-4.63
	8.29		14.90		5.64	6.67		15.75		5.33
Observations	57		36		21	57		36		21
R-squared	0.21		0.21		0.24	0.19		0.20		0.17

Note: Robust standard errors below the coefficient. *** indicates p<0.01, ** indicates p<0.05, * indicates p<0.1, and + indicates p<0.2. Regressions exclude all financial centers.

Table 5. Collapse Stage, Capital Inflows Net of Official Flows

Dependent variable: annualized change in capital flows between 2006Q1-2007Q2 and 2008Q4-2009Q1, scaled by 2007 GDP

	All		Emerging		Advanced		All		Emerging		Advanced	
Net debt position excl. reserves	17.68	**	18.32		11.36		17.29	**	12.61		5.78	
	7.97		17.31		11.26		8.25		19.95		6.95	
Foreign exchange reserves	-16.57		-2.62				-21.10	*	-13.85			
	21.91		18.98				10.99		13.14			
Gross debt (banks)	-18.00	***	-22.16	***	-18.42	***	-17.96	***	-26.01	***	-17.52	***
	4.78		7.72		5.97		4.42		7.82		5.45	
GDP growth 2005-07	-1.49	*	-0.94		-2.03		-1.49	*	-0.75		-3.11	***
	0.75		0.94		2.26		0.76		0.88		0.95	
Change in private credit / GDP	1.37		-42.86	***			2.79		-25.27	*		
	11.83		13.53				11.44		12.40			
Log GDP per capita	-2.59	*	-1.98				-2.79	**	-1.56			
	1.36		2.54				1.35		2.73			
Change in growth in trading partners	1.82		0.31				1.98	+	1.19			
	1.48		1.66				1.39		1.80			
Change in trade flows	-0.24		-0.29		-0.92		0.01		0.27		-0.21	
	0.51		0.45		1.08		0.31		0.30		0.29	
Foreign exchange reserves	-1.29		-22.27		-27.69							
* Asia dummy	16.61		20.37		29.08							
Change in trade flows	0.55		1.09	+	0.04							
* Asia dummy	0.57		0.74		1.70							
Constant	39.39	**	27.52		4.61		42.09	***	24.85		4.69	
	15.56		22.26		7.12		15.44		23.86		5.32	
Observations	57		36		21		57		36		21	
R-squared	0.60		0.74		0.48		0.59		0.72		0.45	

Note: Robust standard errors below the coefficient. *** indicates p<0.01, ** indicates p<0.05, * indicates p<0.1, and + indicates p<0.2. Regressions exclude all financial centers.

Table 6. Collapse Stage, Capital Outflows Net of Official Flows

Dependent variable: annualized change in capital flows between 2006Q1-2007Q2 and 2008Q4-2009Q1, scaled by 2007 GDP

	All		Emerging		Advanced		All		Emerging		Advanced	
Net debt position excl. reserves	-15.27	**	-0.26		-28.45	**	-15.19	**	-0.14		-18.37	*
	7.51		13.48		10.69		7.35		14.50		10.13	
Foreign exchange reserves	9.92		46.91	*			10.85		23.30			
	20.73		24.21				11.22		19.67			
Gross debt (banks)	-13.88	***	-4.93		-16.69	***	-14.21	***	-7.85		-17.93	***
	3.79		12.11		4.55		3.75		13.53		3.93	
GDP growth 2005-07	0.39		0.29		-2.83		0.38		0.03		-0.74	
	0.69		0.75		2.31		0.68		0.80		1.86	
Change in private credit / GDP	-3.76		-3.52				-3.16		-2.55			
	6.72		7.47				6.41		7.52			
Log GDP per capita	-2.46	*	-3.76	+			-2.23	*	-1.62			
	1.26		2.36				1.31		1.97			
Change in growth in trading partners	0.76		1.00				0.59		0.72			
	1.10		1.44				1.03		1.50			
Change in trade flows	0.61	+	0.35		1.96	*	0.42	+	0.29		0.61	
	0.45		0.50		1.01		0.29		0.35		0.61	
Foreign exchange reserves	-3.36		-31.15	*	45.74	*						
* Asia dummy	16.10		17.57		23.53							
Change in trade flows	-0.49		-0.37		-0.42							
* Asia dummy	0.55		0.49		1.18							
Constant	14.59		24.65		-6.96		11.64		9.65		-8.04	
	12.30		22.27		9.90		12.59		20.16		9.86	
Observations	57		36		21		57		36		21	
R-squared	0.60		0.35		0.67		0.59		0.26		0.56	

Note: Robust standard errors below the coefficient. *** indicates p<0.01, ** indicates p<0.05, * indicates p<0.1, and + indicates p<0.2. Regressions exclude all financial centers.

Table 7. Recovery Stage, Capital Inflows Net of Official Flows

Dependent variable: annualized change in capital flows between 2006Q1-2007Q2 and 2009Q2-2009Q4, scaled by 2007 GDP

	All		Emerging		Advanced		All		Emerging		Advanced	
Net debt position excl. reserves	-3.93		20.48		-9.74		-3.42		18.72		-6.42	
	8.15		22.24		8.63		8.65		20.27		5.42	
Foreign exchange reserves	-31.09	+	-19.44				4.13		-6.41			
	20.42		19.79				13.00		15.86			
Gross debt (banks)	-11.77	**	-12.12	*	-11.35	*	-9.16	*	-9.49		-11.49	*
	5.01		6.88		6.34		5.12		7.62		5.93	
GDP growth 2005-07	0.67		-0.27		1.62		0.53		-0.07		2.35	*
	1.03		1.03		2.42		1.00		0.92		1.35	
Change in private credit / GDP	-9.25		-37.78	*			-15.07	**	-38.65	***		
	8.16		18.70				7.43		13.24			
Log GDP per capita	2.05	+	-0.20				1.34		-1.83			
	1.23		3.68				1.13		3.47			
Change in growth in trading partners	3.92	**	1.07				4.18	**	1.27			
	1.48		1.97				1.71		1.69			
Change in trade flows	0.45		0.19		-0.50		0.19		0.43	+	-0.84	**
	0.37		0.42		0.96		0.27		0.25		0.33	
Foreign exchange reserves	41.01	**	16.06		12.06							
* Asia dummy	15.62		24.20		15.62							
Change in trade flows	-0.23		0.42		-0.39							
* Asia dummy	0.47		0.51		0.97							
Constant	-5.21		13.07		-7.76		0.58		24.08		-8.35	
	11.92		29.84		8.70		10.75		29.21		7.25	
Observations	57		36		21		57		36		21	
R-squared	0.44		0.57		0.54		0.38		0.55		0.52	

Note: Robust standard errors below the coefficient. *** indicates p<0.01, ** indicates p<0.05, * indicates p<0.1, and + indicates p<0.2. Regressions exclude all financial centers.

Table 8. Recovery Stage, Capital Outflows Net of Official Flows

Dependent variable: annualized change in capital flows between 2006Q1-2007Q2 and 2009Q2-2009Q4, scaled by 2007 GDP

	All		Emerging		Advanced		All		Emerging		Advanced	
Net debt position excl. reserves	-12.37	+	11.33		-26.32	*	-11.52	+	11.81		-20.20	*
	7.64		17.45		13.91		7.95		16.87		9.66	
Foreign exchange reserves	-19.50	+	-1.25				4.14		-0.08			
	14.67		13.42				11.73		13.10			
Gross debt (banks)	-11.61	**	7.82		-16.51	**	-10.75	*	7.61		-16.56	**
	5.71		9.19		7.10		5.56		8.55		6.63	
GDP growth 2005-07	1.25	+	0.42		-1.40		1.20	+	0.38		0.49	
	0.84		0.69		2.60		0.81		0.67		1.93	
Change in private credit / GDP	-7.38	*	-6.60	*			-7.89	**	-6.49	*		
	3.93		3.71				3.86		3.50			
Log GDP per capita	-0.53		-1.87				-0.62		-1.69			
	1.18		2.90				1.17		2.64			
Change in growth in trading partners	0.72		1.08				0.96		1.04			
	1.12		1.15				1.12		1.11			
Change in trade flows	0.28		0.09		0.66		-0.10		0.01		-0.26	
	0.29		0.31		0.94		0.17		0.18		0.49	
Foreign exchange reserves	26.34	**	1.50		24.55	+						
* Asia dummy	12.47		12.71		17.89							
Change in trade flows	-0.54	+	-0.15		-1.25							
* Asia dummy	0.33		0.26		0.98							
Constant	0.19		17.83		-2.25		0.90		16.61		-4.77	
	11.31		25.29		13.52		10.56		23.19		11.61	
Observations	57		36		21		57		36		21	
R-squared	0.47		0.18		0.58		0.44		0.18		0.51	

Note: Robust standard errors below the coefficient. *** indicates p<0.01, ** indicates p<0.05, * indicates p<0.1, and + indicates p<0.2. Regressions exclude all financial centers.

Table 9. Impact of Reserves Changes on Capital Outflows Net of Official Flows

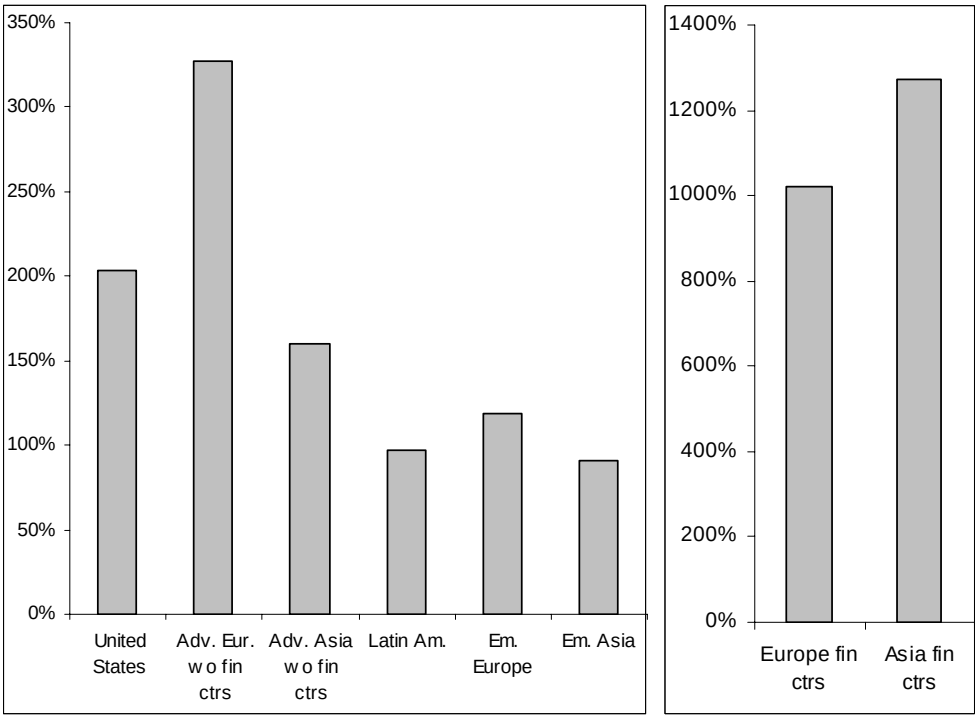
Dependent variable: annualized change in capital flows, scaled by 2007 GDP.

	Gross inflows		Gross outflows		Net inflows	
			Initial stage			
Change in Foreign exchange reserves	0.70	*	-0.09		0.82	**
	0.37		0.29		0.35	
Initial Foreign exchange reserves	15.06		-4.61		-1.07	
	16.80		5.20		4.47	
Observations	57		57		57	
R-squared	0.55		0.21		0.58	
			Collapse stage			
Change in Foreign exchange reserves	0.16		-0.49	***	0.50	***
	0.18		0.16		0.17	
Initial Foreign exchange reserves	16.67	*	-9.04	+	32.26	***
	8.42		6.87		9.59	
Observations	57		57		57	
R-squared	0.68		0.56		0.56	
			Recovery stage			
Change in Foreign exchange reserves	0.10		-0.37	+	0.31	
	0.27		0.26		0.29	
Initial Foreign exchange reserves	-3.88		-11.64	+	13.27	*
	8.20		7.42		6.68	
Observations	57		57		57	
R-squared	0.48		0.50		0.50	

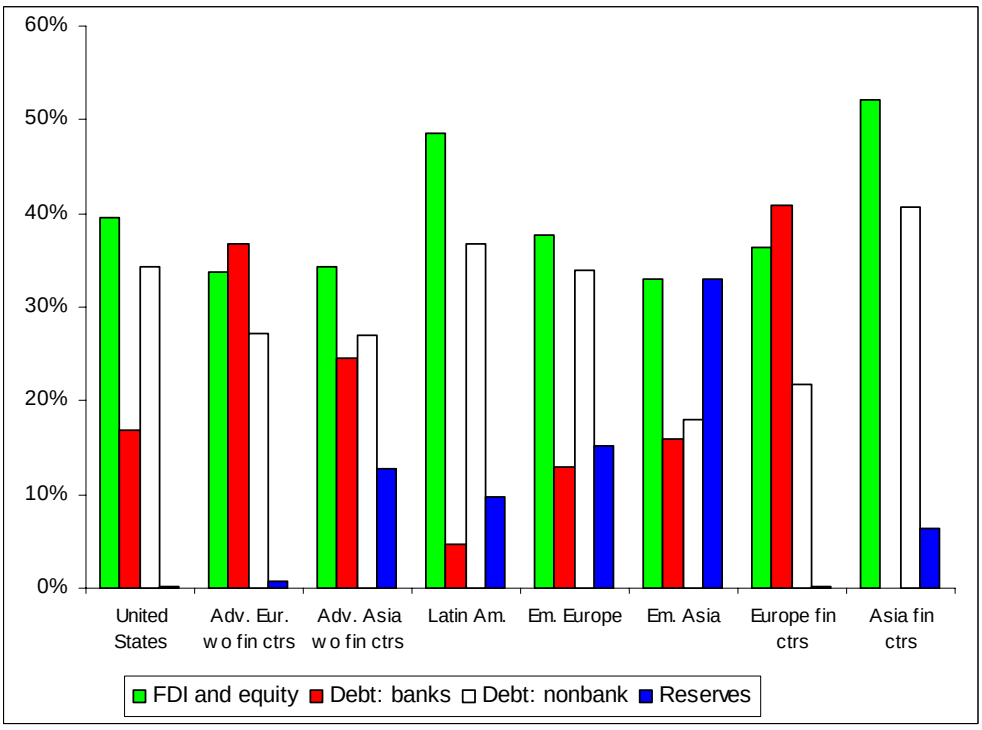
Note: All regressions include the controls of tables 3-8 which are not shown for brevity. Robust standard errors below the coefficient. *** indicates p<0.01, ** indicates p<0.05, * indicates p<0.1, and + indicates p<0.2. Regressions exclude all financial centers.

Figure 1. Financial Integration, End 2005

Assets + Liabilities, % of GDP



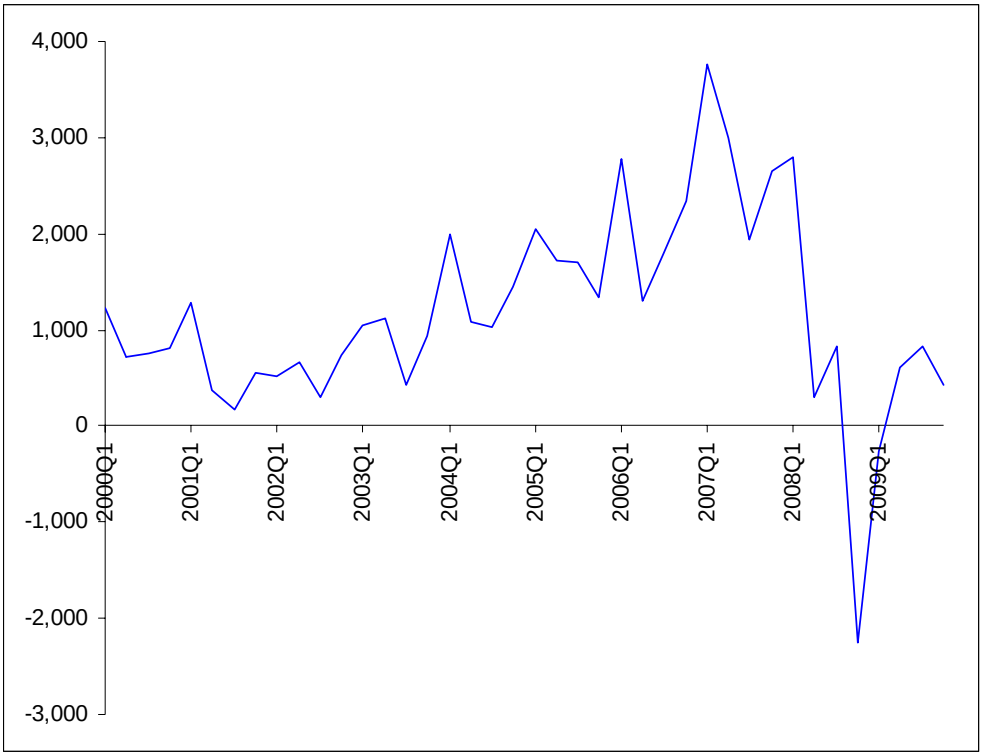
Composition of total assets and liabilities



Note: the data do not allow for a distinction between bank and non-bank debt in Asian fin. Centers

Figure 2. International Capital Flows

Gross outflows, Billions of USD



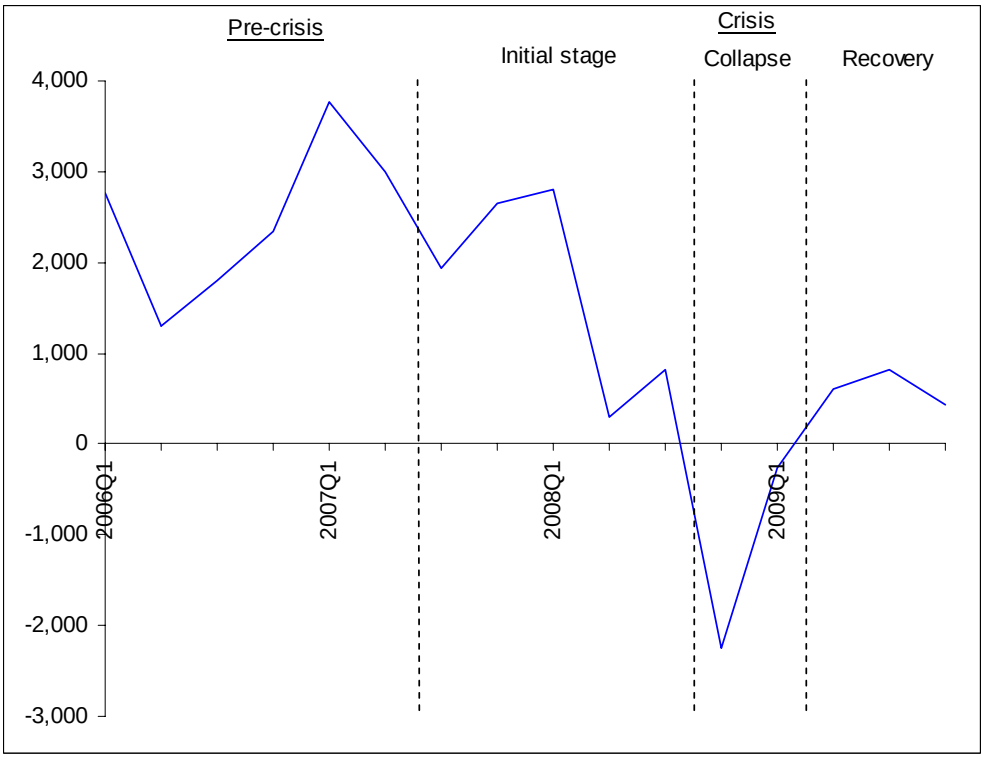
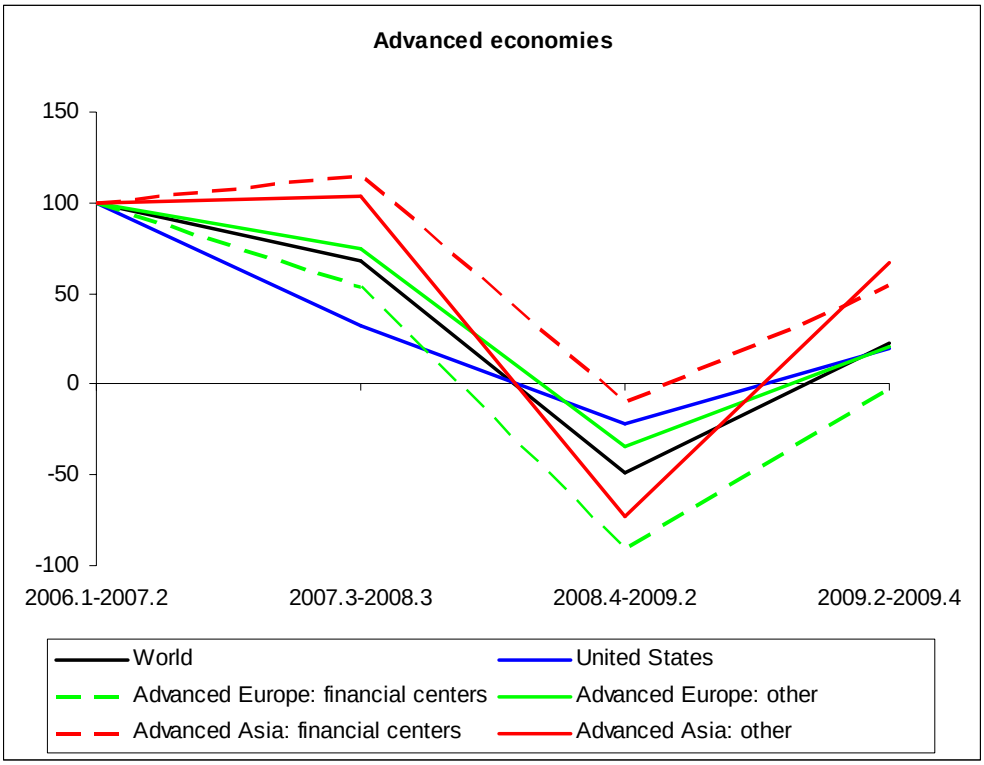


Figure 3. Sum of Gross Outflows and Inflows

Average quarterly value, 2006.1-2007.2 = 100



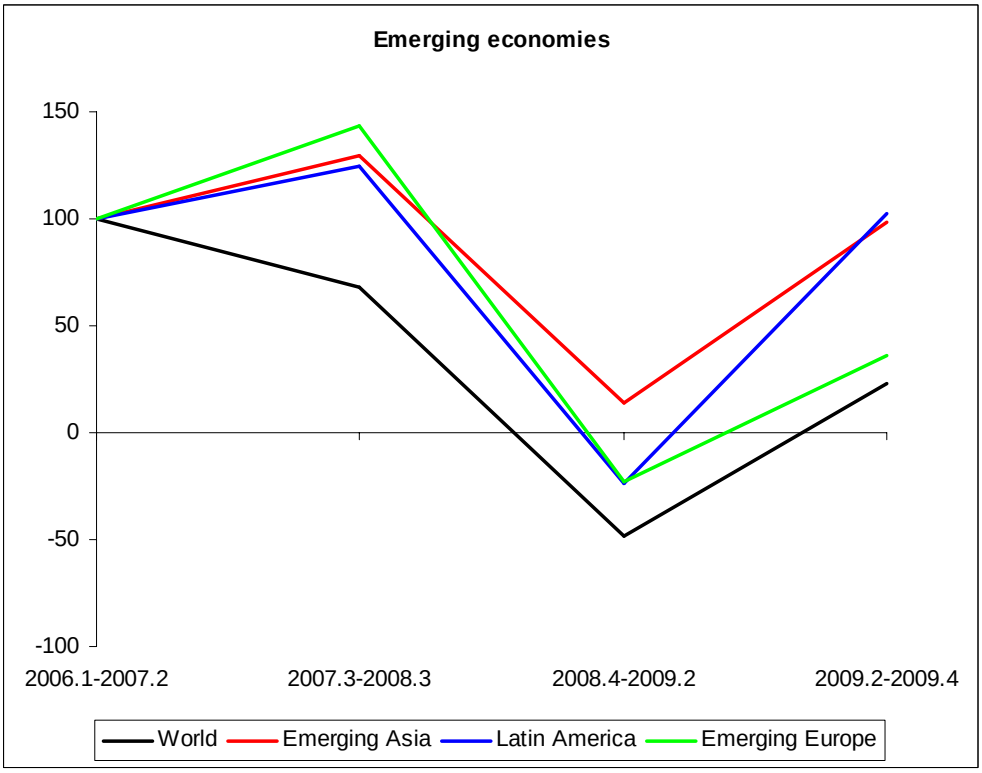
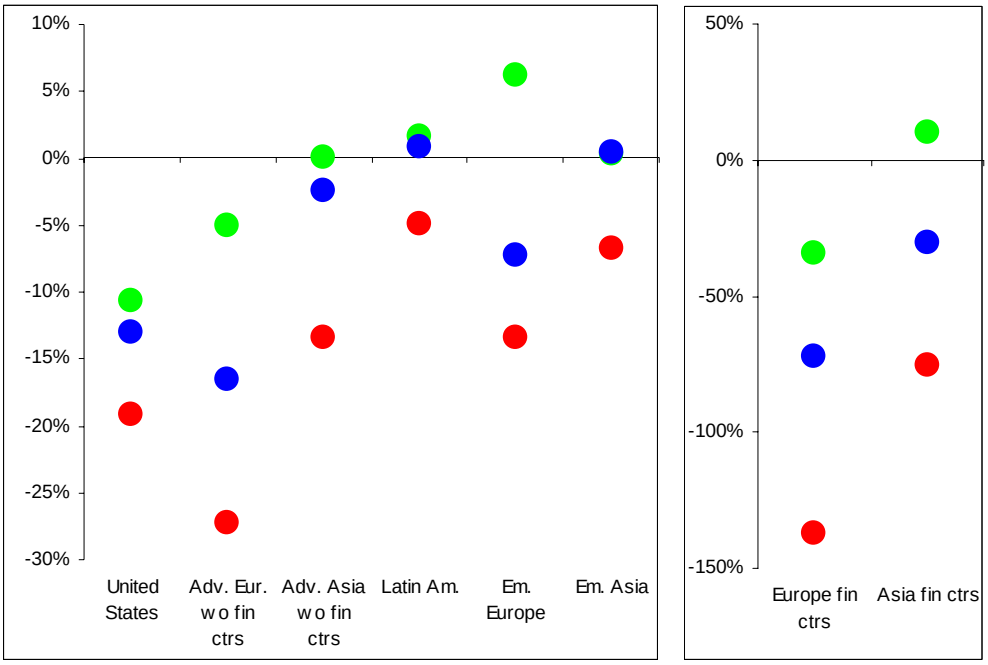


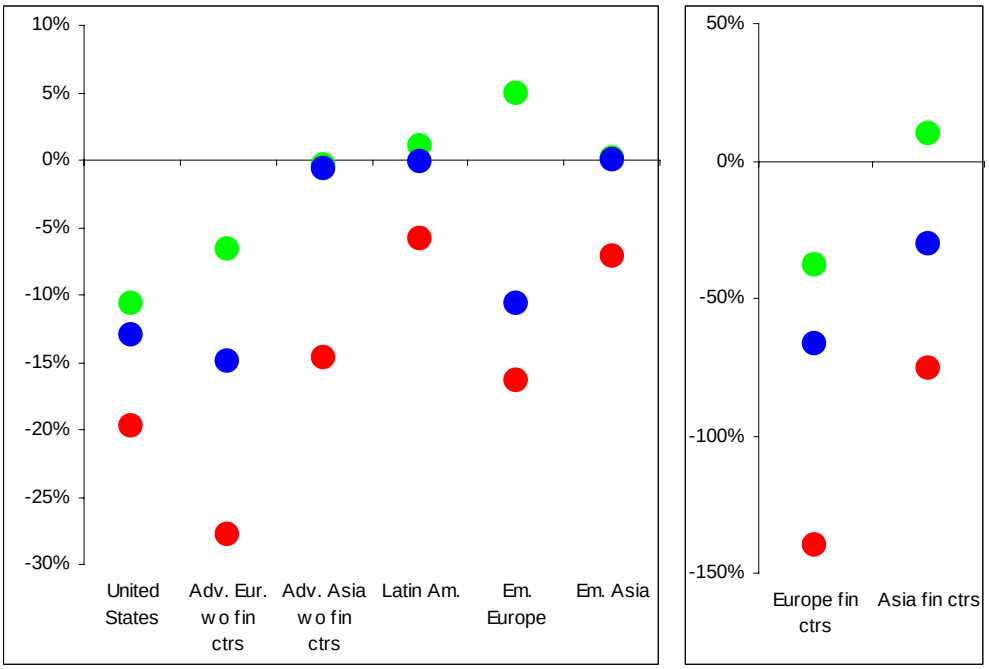
Figure 4a. Change in Gross Capital Inflows

Percent of 2007 GDP. Flows relative to pre-crisis flows (06.1-07.2). All flows are at annualized rates.

All inflows



Private inflows



Initial: 07.3-08.3 Collapse: 08.4-09.1 Recovery: 09.2-09.4

Figure 4b. Change in Gross Capital Inflows

Percent of 2007 GDP. Flows relative to pre-crisis flows (06.1-07.2). All flows are at annualized rates.

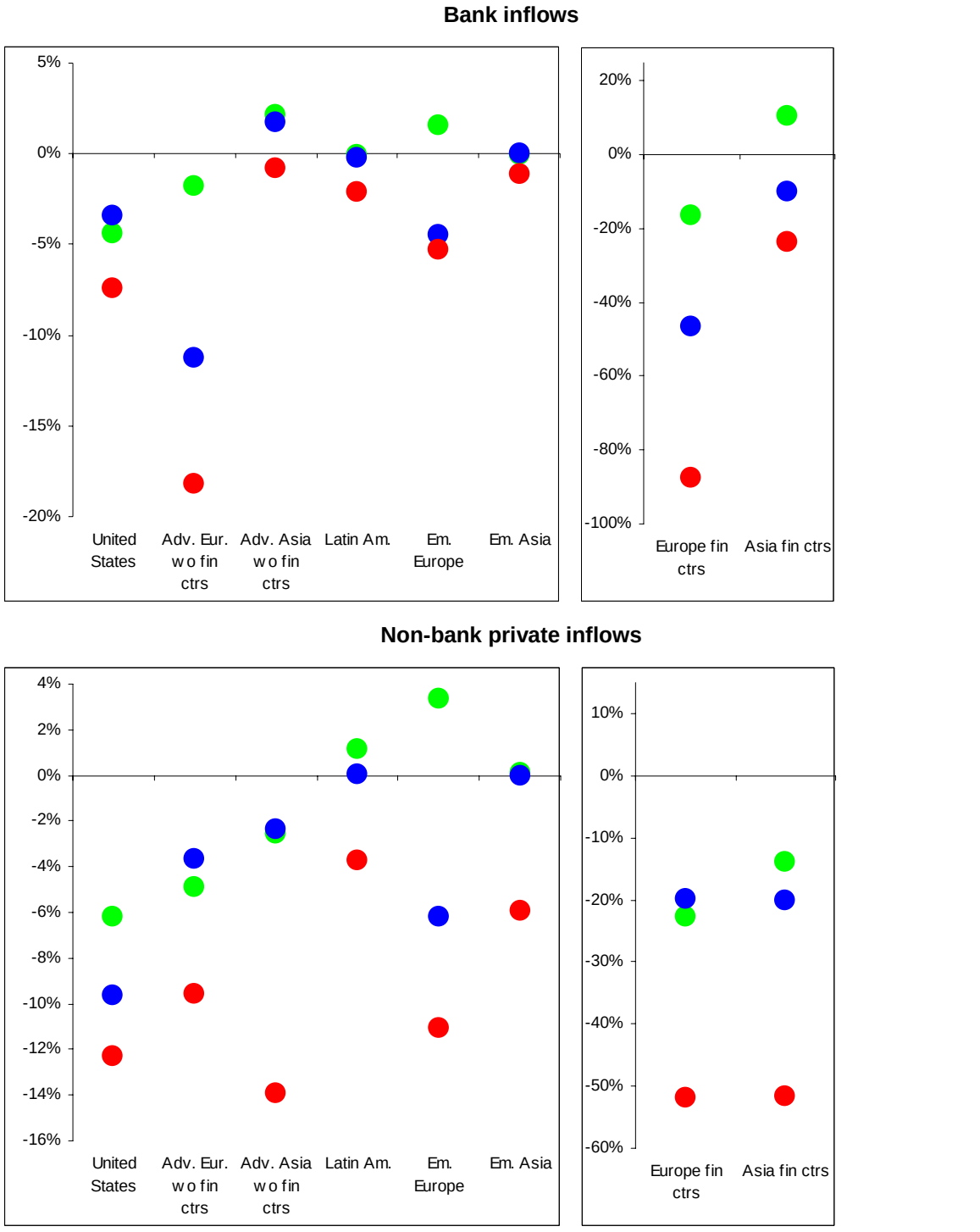


Figure 4c. Change in Gross Capital Inflows

Percent of 2005 Positions. Flows relative to pre-crisis flows (06.1-07.2). All flows are at annualized rates.

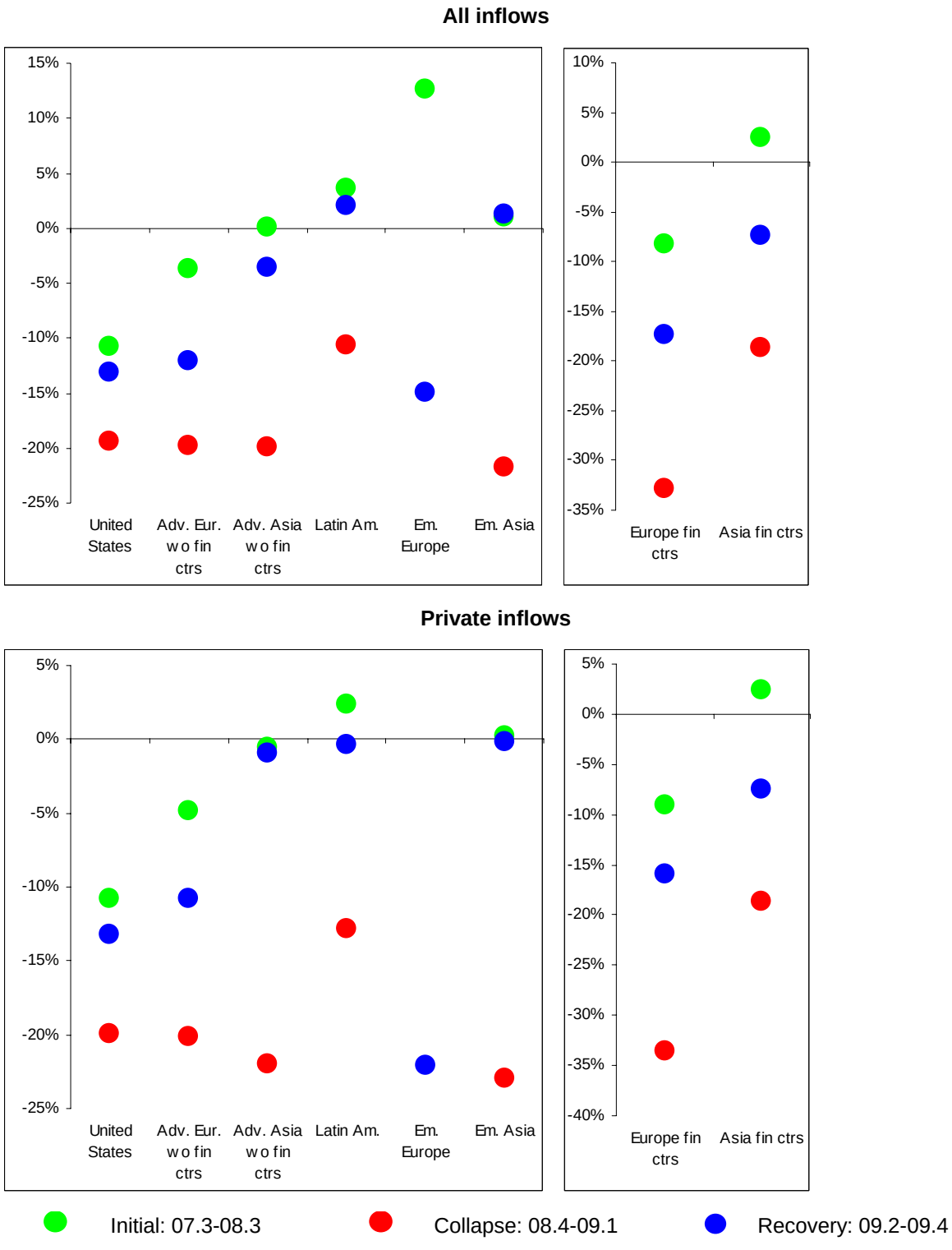


Figure 5a. Private Flows, Initial Stage of the Crisis

Percent of 2007 GDP

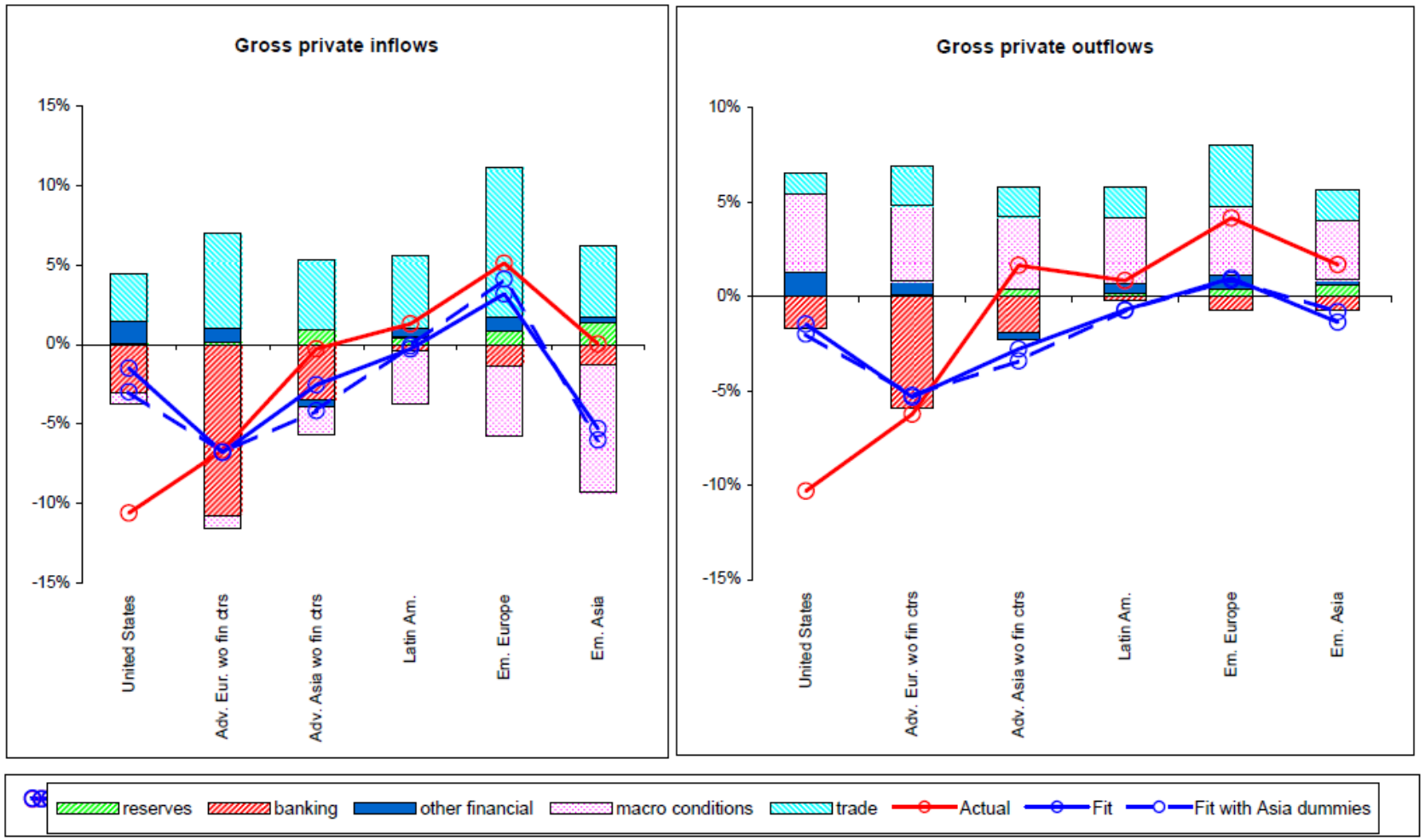


Figure 5b. Private Flows, Collapse Stage of the Crisis

Percent of 2007 GDP

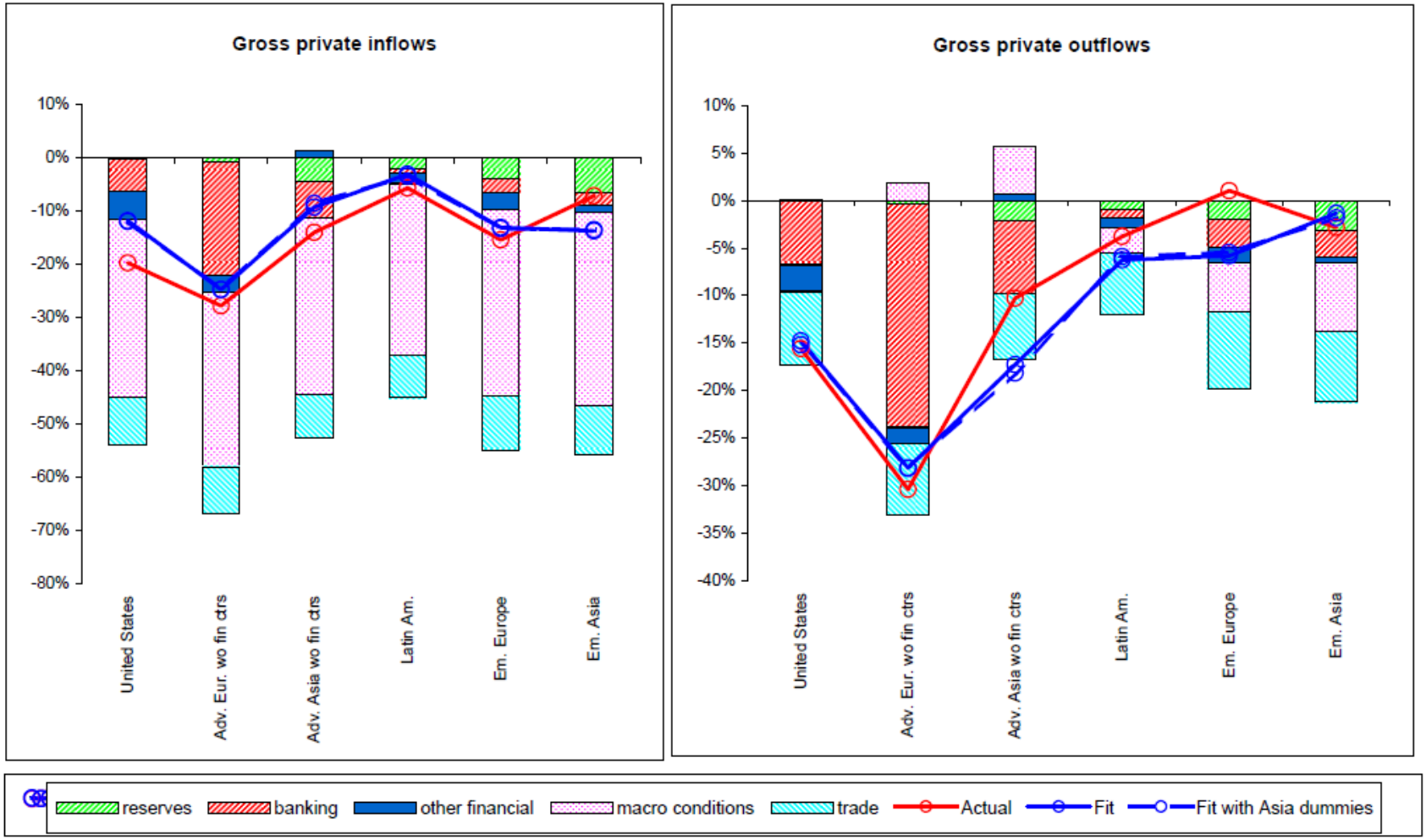


Figure 5c. Private Flows, Recovery Stage of the Crisis

Percent of 2007 GDP

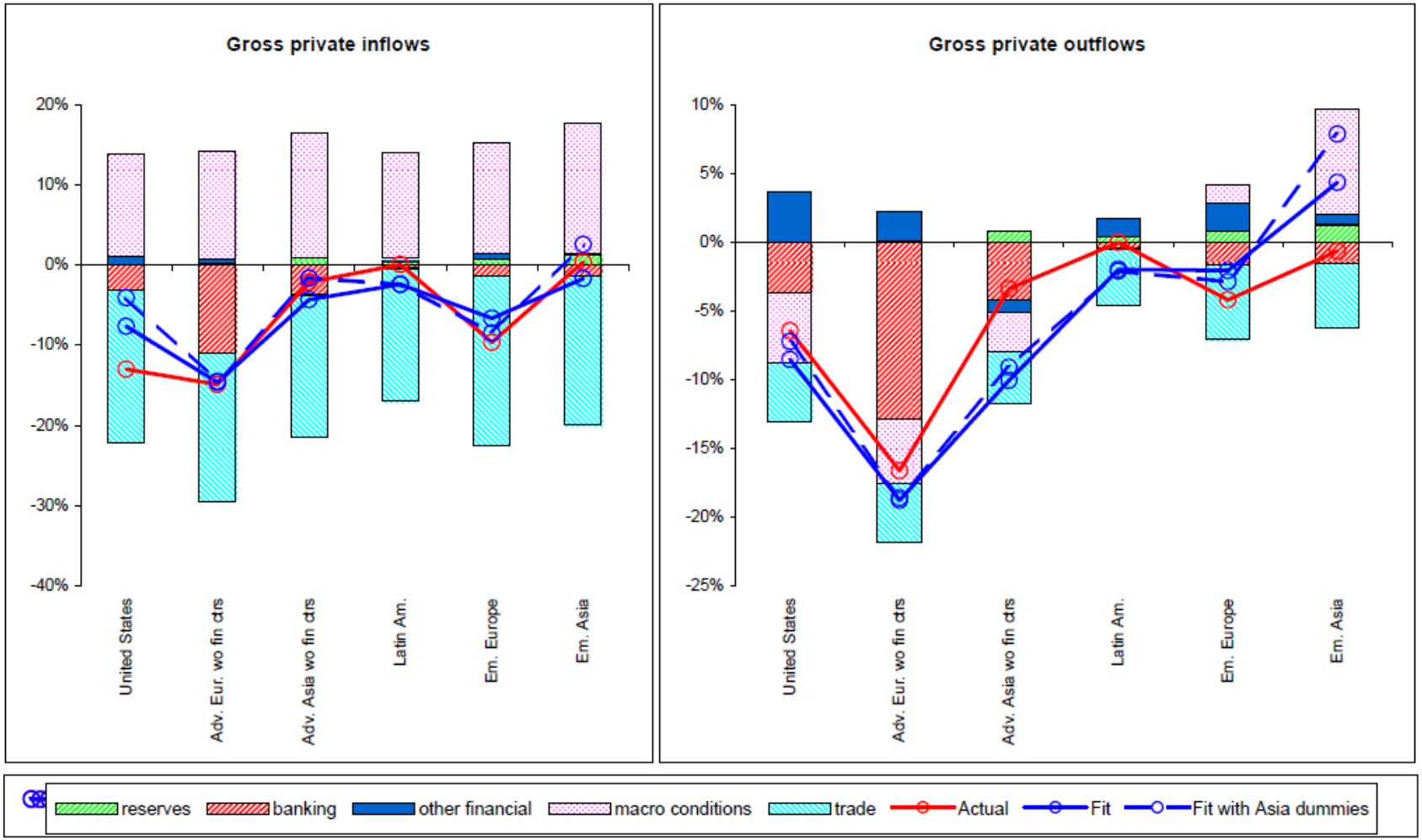


Figure 6a. Changes in Private Flows and Pre-Crisis Reserves

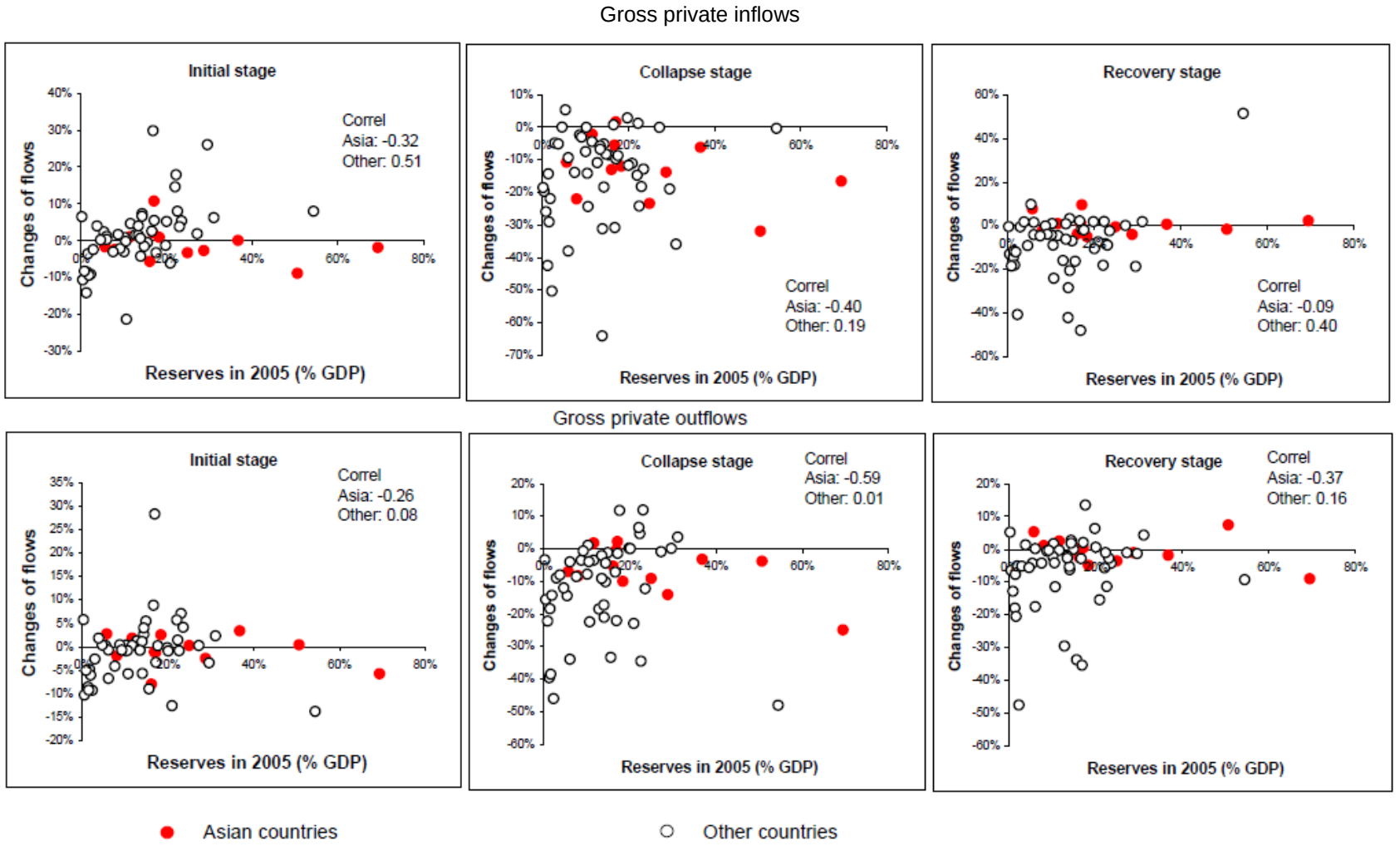
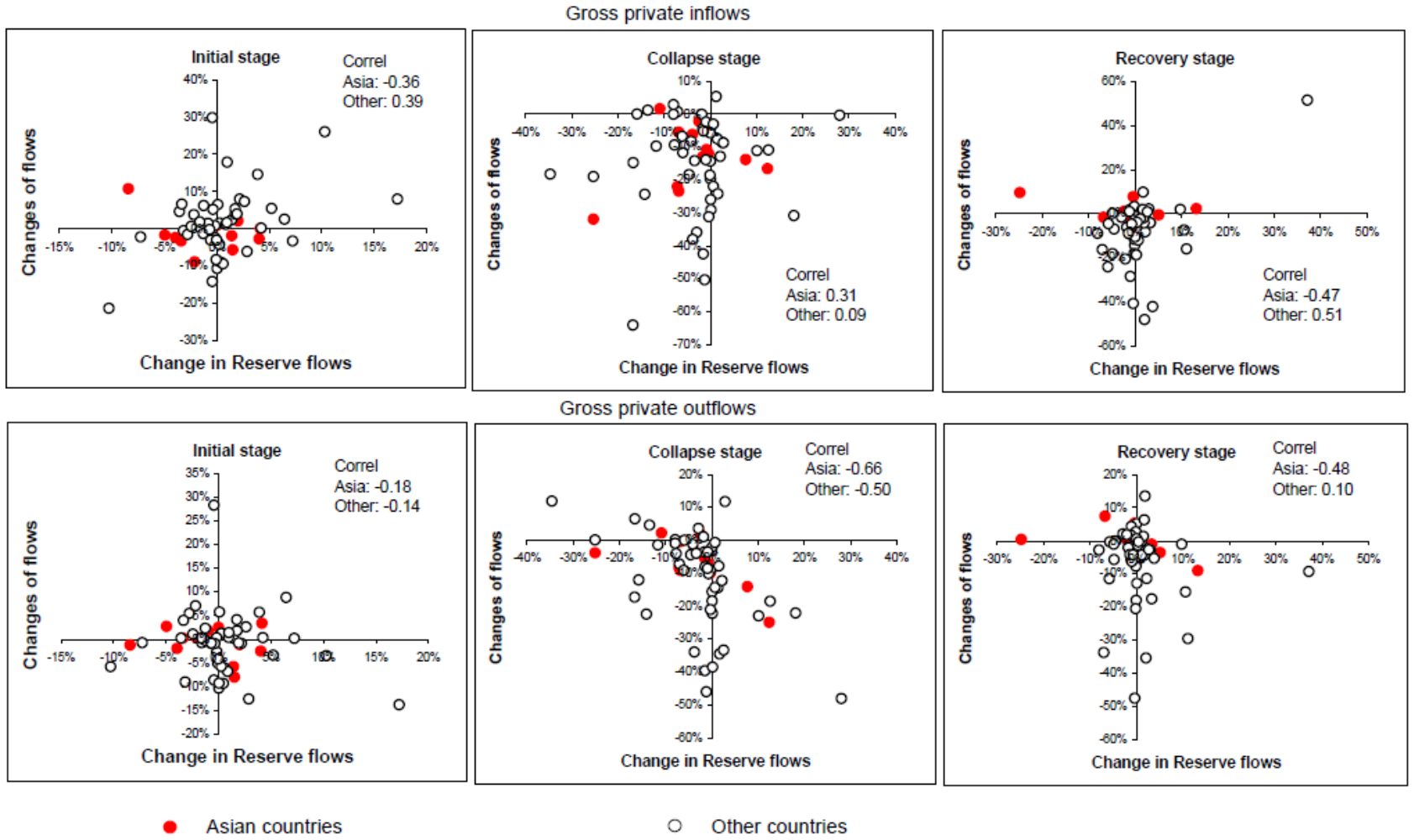


Figure 6b. Changes in Private Flows and Change in Reserves Outflows



Appendix 1. Concepts and Measures of International Financial Integration

International capital flows are based on the residency criterion of the balance of payments, and cover transactions where one of the counterparty is a resident of the country (say the euro area) and the other a resident of the rest of the world. *Capital outflows* denote net purchases by domestic residents of financial instruments issued by nonresidents, while *capital inflows* denote net purchases by foreign residents of domestic financial instruments. The difference between capital inflows and outflows (the financial account balance) corresponds to the current account balance (up to a statistical discrepancy).

International capital flows (acquisition of claims) and the corresponding stocks (value of outstanding claims) are broken down into several categories.

- Foreign direct investment represents a controlling claim in a company (a stake of at least 10 percent), either by the setting up of foreign operations or the acquisition of a company abroad by a domestic one.
- Portfolio investment covers holdings of bonds and equity that do not lead to a controlling stake.
- "Other investment" includes a broad residual array of transactions/holdings between residents and nonresidents, such as loans and deposits, trade credits etc. Within this category, we separate out those transactions or holdings in which the domestic counterpart is a bank.
- Reserves denote assets held abroad by the country's government or monetary authority, primarily in the form of liquid assets (this category only exists for outflows).
- Financial derivatives flows are payments and receipts between residents and nonresidents related to new or outstanding derivatives positions. In our analysis of capital flows, we classify the value of net transactions in financial derivatives on the inflows side of the balance of payments.

Appendix 2. Data Sources

International Capital Flows

Capital flows are taken from the International Monetary Fund's Balance of Payments Statistics database ('standard presentation'). Capital flows are measured at a quarterly frequency for the 68 countries listed in table 1.

As the crisis saw a substantial use of swap lines between central banks and support from multilateral institutions, we break the "other" category further between central banks' swap lines, IMF lending, and official lending. While the balance of payments statistics do not include a specific line for the swaps between central banks, we estimate them as the sum of the loans, deposits and other assets by the monetary authority, both for gross outflows and inflows. The gross outflows under these categories are distinct from exchange rate reserves. Our estimates are consistent with data from the major central banks (United States, Switzerland, Euro area). The balance of payments data for the United Kingdom do not indicate the capital outflows and inflows linked to the monetary authorities. Our estimate for the gross swap inflows are then built based on the changes in the "other liabilities" category reported on the Bank of England's balance sheet.

On the capital inflows side, IMF lending (use of Fund credits and loans) is recorded as a liability of monetary authorities, while official lending from other sources (for example, EU loans to Hungary and Latvia) are recorded as other investment liabilities of the government. Another adjustment to the data is related to the issuance of IMF Special Drawing Rights (SDR) to member countries in the 3rd quarter of 2009, which totaled over $250 billion. This allocation was recorded as an increase in foreign exchange reserves in that quarter, offset by a corresponding increase in the liabilities of monetary authorities. Our 2009Q3 data on total capital inflows and outflows—as well as on reserve flows and flows related to monetary authorities' transactions—net out the impact of the SDR allocation.

International Bank Claims

The Bank for International Settlements publishes data on international banks' exposure under two complementary concepts. Data under the *locational* concept cover the international assets and liabilities of all banks located in a country. These banks include banks headquartered in the country, as well as affiliates of foreign banks. For instance, the Czech subsidiary of a German bank is counted as a Czech entity. These data correspond to the residency concept of the balance of payments.

Appendix 3. Definition of Variables

Our econometric analysis builds on Milesi-Ferretti and Tille (2011). The variables used in the regressions are defined as follows:

GDP per capita: GDP per capita in current U.S. dollars, 2007. Source: IMF, World Economic Outlook (WEO) database.

GDP growth 2005-2007: average GDP growth during the period 2005-2007. Source: IMF, WEO database.

Gross Debt (banks): sum of bank external assets and liabilities in the form of debt instruments divided by GDP, end-2005. Source: authors' calculations based on IMF, Balance of Payments Statistics and BIS, locational banking statistics.

Net Debt (excluding reserves): difference between debt assets (excluding reserves) and debt liabilities, divided by GDP, end-2005. Source: Lane and Milesi-Ferretti, EWN II database.

Foreign exchange reserves: ratio of foreign exchange reserves to GDP, end-2005. Source: IMF, International Financial Statistics.

Change in private credit/GDP: World Bank Financial Structure database (Beck, Demirgüç-Kunt and Levine (2000, 2009) and updates in Lane and Milesi-Ferretti (2010).

Change in trade flows: difference between the sum of annualized exports and imports during the crisis period (2008Q4-2009Q1 or 2009Q2-2009Q4) and annualized exports + imports during the period 2006Q1-2007Q2, scaled by 2007 GDP.

Change in growth in trading partners: difference in GDP growth in trading partners between the 2008-09 average and the 2005-2007 average. Source: IMF, WEO database.

Appendix Table 1a. Change in Capital Flows Relative to the Pre-Crisis Situation, % of 2007 GDP

	All flows								
	Gross outflows			Gross inflows			Net inflows		
	Initial	Collapse	Recovery	Initial	Collapse	Recovery	Initial	Collapse	Recovery
United States	-8.7%	-15.2%	-9.2%	-10.6%	-19.1%	-13.0%	-2.0%	-3.9%	-3.7%
Canada	-2.8%	-9.2%	-5.3%	-2.4%	-4.8%	-0.5%	0.4%	4.3%	4.8%
United Kingdom	-39.0%	-133.5%	-57.9%	-39.7%	-134.6%	-58.7%	-0.7%	-1.0%	-0.9%
Euro Area	-6.4%	-31.4%	-19.8%	-5.2%	-29.9%	-19.7%	1.2%	1.5%	0.1%
Adv. Europe (wo fin ctrs)	-5.9%	-29.3%	-16.4%	-5.1%	-27.2%	-16.5%	0.8%	2.1%	-0.1%
European fin centers	-35.7%	-140.0%	-72.3%	-34.1%	-136.9%	-72.4%	1.6%	3.1%	-0.2%
Japan	2.5%	-10.4%	-5.4%	1.5%	-11.8%	-4.4%	-1.1%	-1.4%	1.0%
Adv. Asia (wo fin ctrs)	0.5%	-11.1%	-2.4%	0.1%	-13.3%	-2.4%	-0.4%	-2.2%	0.0%
Asian fin centers	11.9%	-77.1%	-32.1%	9.9%	-75.3%	-30.1%	-2.0%	1.9%	2.0%
Latin America	0.8%	-7.9%	-0.7%	1.7%	-4.8%	0.9%	0.9%	3.0%	1.6%
Emerging Europe	3.7%	-15.1%	-7.2%	6.1%	-13.4%	-7.2%	2.4%	1.8%	-0.1%
Emerging Asia	4.5%	-7.3%	-0.6%	0.3%	-6.7%	0.4%	-4.2%	0.6%	1.0%
	Private flows								
	Gross outflows			Gross inflows			Net inflows		
	Initial	Collapse	Recovery	Initial	Collapse	Recovery	Initial	Collapse	Recovery
United States	-10.3%	-15.6%	-6.4%	-10.6%	-19.7%	-13.0%	-0.3%	-4.1%	-6.6%
Canada	-2.6%	-9.0%	-5.1%	-2.4%	-4.8%	-0.5%	0.2%	4.1%	4.6%
United Kingdom	-39.0%	-133.6%	-57.9%	-40.5%	-134.8%	-58.4%	-1.5%	-1.2%	-0.5%
Euro Area	-6.4%	-30.9%	-19.8%	-7.2%	-30.8%	-17.1%	-0.8%	0.1%	2.8%
Adv. Europe (wo fin ctrs)	-6.2%	-30.4%	-16.6%	-6.7%	-27.8%	-14.9%	-0.4%	2.7%	1.7%
European fin centers	-36.7%	-143.1%	-72.3%	-37.6%	-139.6%	-66.3%	-0.9%	3.5%	5.9%
Japan	2.5%	-10.0%	-4.9%	0.9%	-13.1%	-2.7%	-1.6%	-3.1%	2.2%
Adv. Asia (wo fin ctrs)	1.6%	-10.3%	-3.4%	-0.4%	-14.7%	-0.6%	-2.0%	-4.5%	2.8%
Asian fin centers	7.2%	-86.4%	-52.7%	9.9%	-75.3%	-30.1%	2.7%	11.1%	22.6%
Latin America	0.8%	-3.7%	0.0%	1.1%	-5.8%	-0.2%	0.2%	-2.1%	-0.1%
Emerging Europe	4.1%	1.0%	-4.2%	5.0%	-16.3%	-10.7%	0.8%	-17.4%	-6.5%
Emerging Asia	1.6%	-2.8%	-0.6%	0.1%	-7.1%	-0.1%	-1.6%	-4.3%	0.6%

Note: Pre-crisis: 2006.1-2007.2; initial period: 2007.3-2008.3; collapse period: 2008.4-2009.1; recovery period 2009.2-2009.4. All flows at annualized rates.

Appendix Table 1b. Change in Capital Flows Relative to the Pre-Crisis Situation, % of 2007 GDP

	Bank flows								
	Gross outflows			Gross inflows			Net inflows		
	Initial	Collapse	Recovery	Initial	Collapse	Recovery	Initial	Collapse	Recovery
United States	-2.3%	-6.4%	-2.2%	-4.4%	-7.4%	-3.4%	-2.1%	-1.0%	-1.2%
Canada	0.6%	-2.7%	1.1%	-1.5%	-0.5%	-1.4%	-2.0%	2.2%	-2.5%
United Kingdom	-14.3%	-67.1%	-45.6%	-18.6%	-83.3%	-49.5%	-4.3%	-16.3%	-3.9%
Euro Area	-3.5%	-16.7%	-9.3%	-2.6%	-17.6%	-10.2%	0.8%	-0.9%	-0.9%
Adv. Europe (wo fin ctrs)	-1.9%	-15.2%	-9.0%	-1.8%	-18.2%	-11.2%	0.2%	-3.0%	-2.2%
European fin centers	-12.5%	-79.4%	-49.6%	-16.3%	-87.7%	-46.4%	-3.8%	-8.3%	3.1%
Japan	1.8%	-8.9%	-2.9%	2.2%	3.3%	3.1%	0.4%	12.2%	6.0%
Adv. Asia (wo fin ctrs)	1.6%	-5.4%	-2.0%	2.1%	-0.8%	1.7%	0.5%	4.6%	3.7%
Asian fin centers	15.8%	-38.6%	-38.9%	10.4%	-23.7%	-9.9%	-5.3%	14.9%	29.0%
Latin America	0.0%	-1.4%	0.1%	-0.1%	-2.1%	-0.2%	0.0%	-0.7%	-0.3%
Emerging Europe	1.1%	-1.3%	-1.1%	1.6%	-5.3%	-4.5%	0.5%	-4.0%	-3.4%
Emerging Asia	0.2%	-0.1%	-0.9%	0.0%	-1.2%	0.0%	-0.2%	-1.0%	0.9%
	Private non-bank flows								
	Gross outflows			Gross inflows			Net inflows		
	Initial	Collapse	Recovery	Initial	Collapse	Recovery	Initial	Collapse	Recovery
United States	-8.0%	-9.1%	-4.3%	-6.2%	-12.3%	-9.6%	1.8%	-3.2%	-5.3%
Canada	-3.2%	-6.3%	-6.3%	-0.9%	-4.4%	0.9%	2.3%	1.9%	7.1%
United Kingdom	-24.7%	-66.5%	-12.3%	-21.9%	-51.5%	-8.9%	2.8%	15.0%	3.4%
Euro Area	-2.9%	-14.3%	-10.5%	-4.5%	-13.2%	-6.8%	-1.7%	1.0%	3.7%
Adv. Europe (wo fin ctrs)	-4.3%	-15.2%	-7.6%	-4.9%	-9.5%	-3.7%	-0.6%	5.7%	4.0%
European fin centers	-24.2%	-63.7%	-22.7%	-21.3%	-51.9%	-19.9%	2.9%	11.8%	2.8%
Japan	0.7%	-1.1%	-2.0%	-1.3%	-16.5%	-5.7%	-2.0%	-15.3%	-3.8%
Adv. Asia (wo fin ctrs)	0.0%	-4.9%	-1.4%	-2.5%	-13.9%	-2.4%	-2.5%	-9.0%	-0.9%
Asian fin centers	-8.6%	-47.8%	-13.8%	-0.5%	-51.6%	-20.2%	8.0%	-3.8%	-6.4%
Latin America	0.9%	-2.4%	-0.1%	1.1%	-3.7%	0.1%	0.2%	-1.4%	0.2%
Emerging Europe	3.1%	2.3%	-3.1%	3.4%	-11.1%	-6.2%	0.3%	-13.4%	-3.1%
Emerging Asia	1.5%	-2.6%	0.3%	0.1%	-5.9%	0.0%	-1.4%	-3.3%	-0.3%

Note: Pre-crisis: 2006.1-2007.2; initial period: 2007.3-2008.3; collapse period: 2008.4-2009.1; recovery period 2009.2-2009.4. All flows at annualized rates.

Appendix Table 2. Change in Capital Flows Relative to the Pre-Crisis Situation, % of 2005 Positions

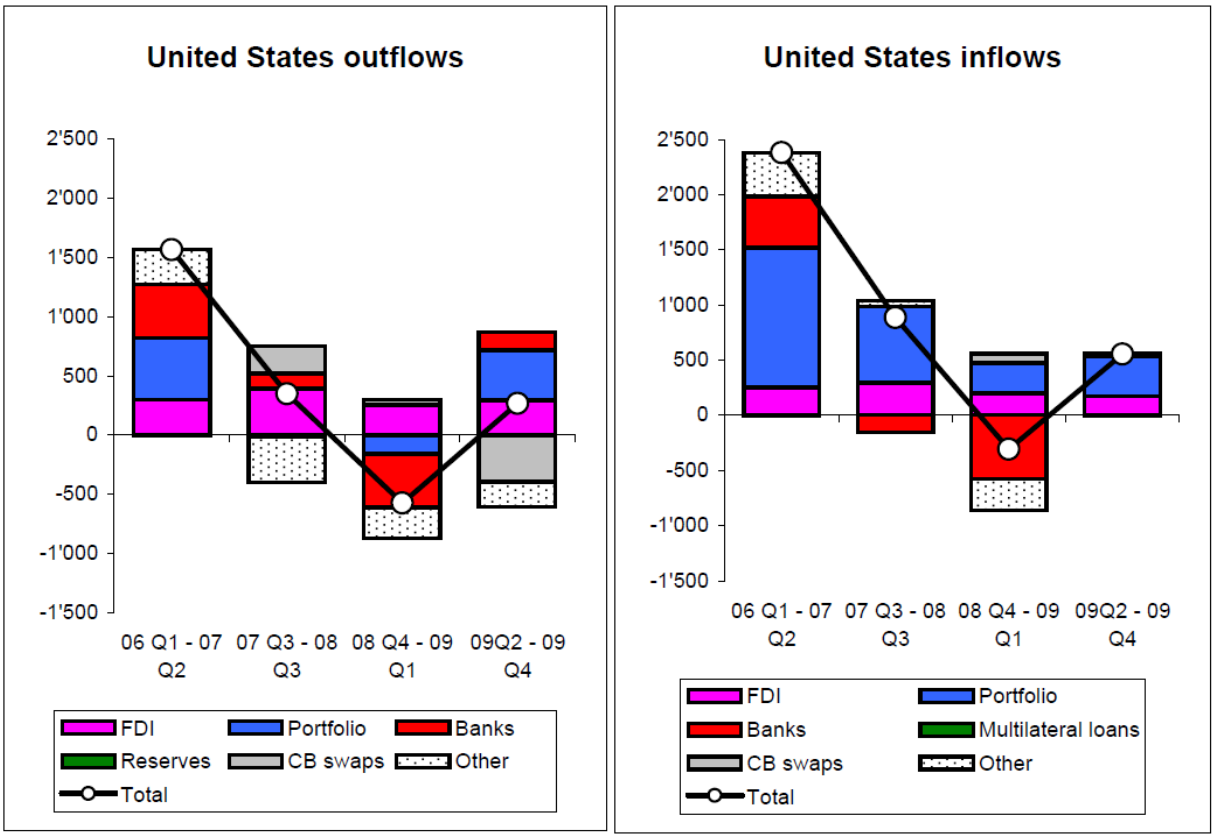
	All flows						Private flows					
	Gross outflows			Gross inflows			Gross outflows			Gross inflows		
	Initial	Collapse	Recovery	Initial	Collapse	Recovery	Initial	Collapse	Recovery	Initial	Collapse	Recovery
United States	-10.3%	-18.1%	-11.0%	-10.7%	-19.3%	-13.1%	-12.3%	-18.6%	-7.7%	-10.8%	-20.0%	-13.2%
Canada	-3.7%	-12.2%	-7.0%	-2.9%	-5.9%	-0.6%	-3.6%	-12.3%	-7.1%	-2.9%	-5.9%	-0.6%
United Kingdom	-13.2%	-45.2%	-19.6%	-12.7%	-43.3%	-18.9%	-13.3%	-45.4%	-19.7%	-13.0%	-43.3%	-18.8%
Euro Area	-3.9%	-19.1%	-12.0%	-2.9%	-16.5%	-10.9%	-3.9%	-19.0%	-12.2%	-4.0%	-17.1%	-9.4%
Adv. Europe (wo fin ctrs)	-4.5%	-22.3%	-12.5%	-3.7%	-19.8%	-12.0%	-4.8%	-23.5%	-12.9%	-4.8%	-20.2%	-10.8%
European fin centers	-8.5%	-33.5%	-17.3%	-8.2%	-32.8%	-17.4%	-8.8%	-34.4%	-17.4%	-9.0%	-33.5%	-15.9%
Japan	2.6%	-10.6%	-5.5%	2.3%	-18.7%	-7.0%	3.2%	-12.7%	-6.2%	1.5%	-20.8%	-4.2%
Adv. Asia (wo fin ctrs)	0.5%	-12.9%	-2.8%	0.1%	-19.9%	-3.6%	2.5%	-15.5%	-5.1%	-0.6%	-22.0%	-0.9%
Asian fin centers	2.0%	-12.9%	-5.4%	2.4%	-18.6%	-7.4%	1.3%	-16.1%	-9.8%	2.4%	-18.6%	-7.4%
Latin America	3.2%	-33.0%	-3.0%	3.7%	-10.6%	2.0%	4.9%	-22.0%	-0.2%	2.3%	-12.8%	-0.4%
Emerging Europe	12.5%	-50.5%	-24.0%	12.7%	-27.6%	-14.9%	23.0%	5.7%	-23.2%	10.2%	-33.8%	-22.1%
Emerging Asia	14.7%	-23.7%	-2.0%	1.0%	-21.8%	1.3%	15.7%	-26.3%	-5.9%	0.2%	-23.0%	-0.2%

	Bank flows						Private non-bank flows					
	Gross outflows			Gross inflows			Gross outflows			Gross inflows		
	Initial	Collapse	Recovery	Initial	Collapse	Recovery	Initial	Collapse	Recovery	Initial	Collapse	Recovery
United States	-16.8%	-46.4%	-15.6%	-26.3%	-44.1%	-20.1%	-5.5%	-13.1%	-6.1%	-7.6%	-15.0%	-11.8%
Canada	9.3%	-44.4%	18.4%	-12.0%	-3.8%	-11.3%	0.1%	-9.4%	-9.3%	-1.3%	-6.2%	1.3%
United Kingdom	-9.8%	-45.8%	-31.2%	-11.9%	-53.3%	-31.6%	19.0%	-45.0%	-8.3%	-14.2%	-33.3%	-5.7%
Euro Area	-6.2%	-29.6%	-16.5%	-3.8%	-25.5%	-14.8%	9.7%	-13.4%	-9.9%	-4.1%	-11.9%	-6.1%
Adv. Europe (wo fin ctrs)	-4.2%	-33.3%	-19.8%	-3.3%	-34.0%	-21.0%	10.7%	-18.2%	-9.1%	-5.8%	-11.3%	-4.4%
European fin centers	-7.5%	-47.9%	-29.9%	-9.3%	-50.1%	-26.5%	17.1%	-25.5%	-9.1%	-8.8%	-21.5%	-8.2%
Japan	7.7%	-37.2%	-12.1%	11.8%	17.7%	16.2%	20.8%	-2.1%	-3.6%	-2.9%	-37.3%	-13.0%
Adv. Asia (wo fin ctrs)	9.1%	-30.0%	-11.0%	10.8%	-4.1%	8.8%	14.5%	-10.2%	-3.0%	-5.4%	-29.4%	-5.0%
Asian fin centers												
Latin America	-2.8%	-82.7%	7.0%	-3.3%	-126.7%	-13.7%	14.3%	-15.5%	-1.0%	2.5%	-8.5%	0.1%
Emerging Europe	26.0%	-31.6%	-26.6%	26.1%	-87.5%	-74.1%	39.2%	16.8%	-22.1%	8.0%	-26.1%	-14.7%
Emerging Asia	2.7%	-1.9%	-13.6%	-0.8%	-35.8%	-0.7%	46.2%	-68.4%	7.4%	0.3%	-21.5%	-0.1%

Note: Pre-crisis: 2006.1-2007.2; initial period: 2007.3-2008.3; collapse period: 2008.4-2009.1; recovery period 2009.2-2009.4. All flows at annualized rates.

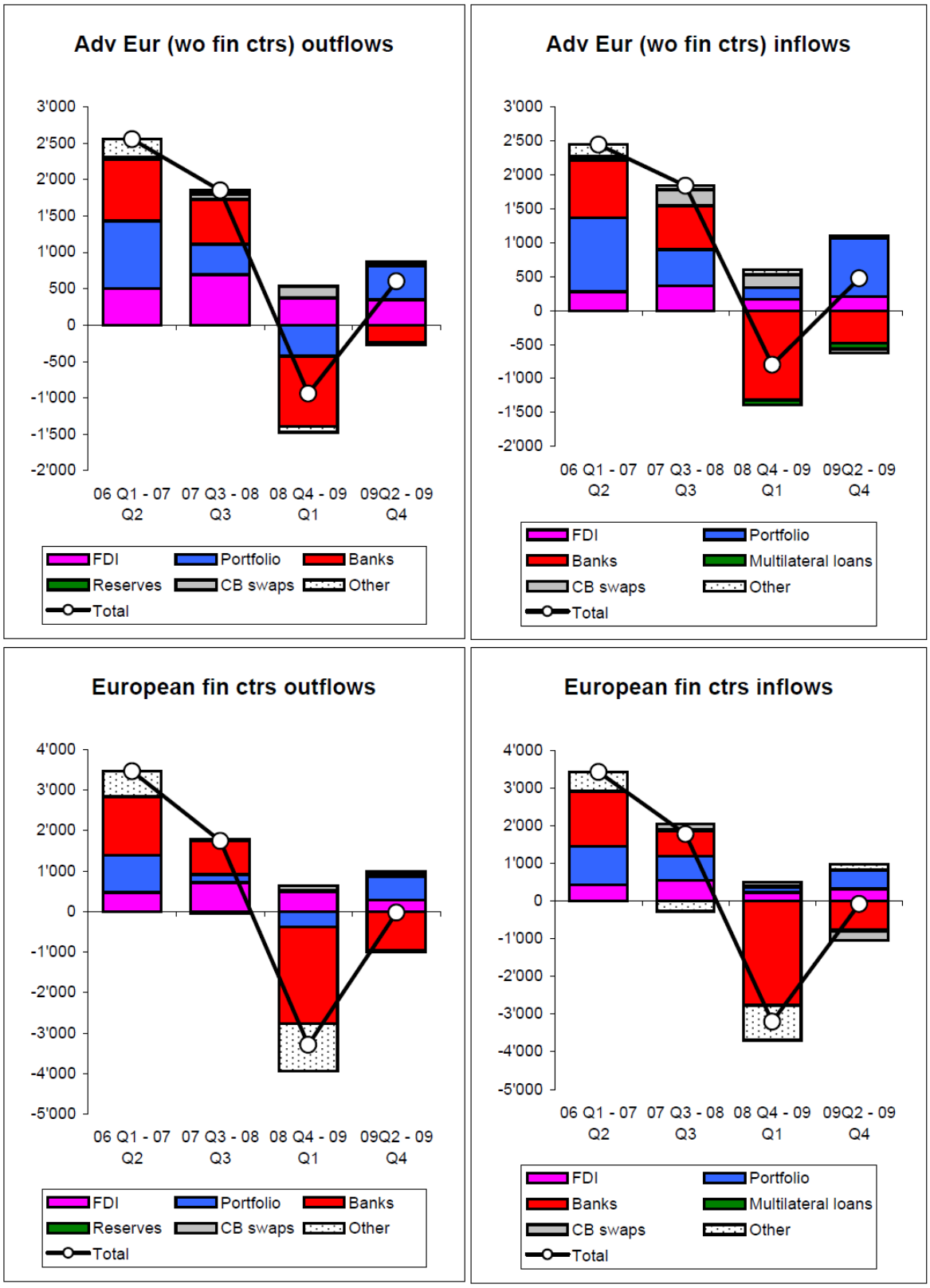
Appendix Figure 1a. Capital Flows during the Crisis

Billions of USD, annualized rates



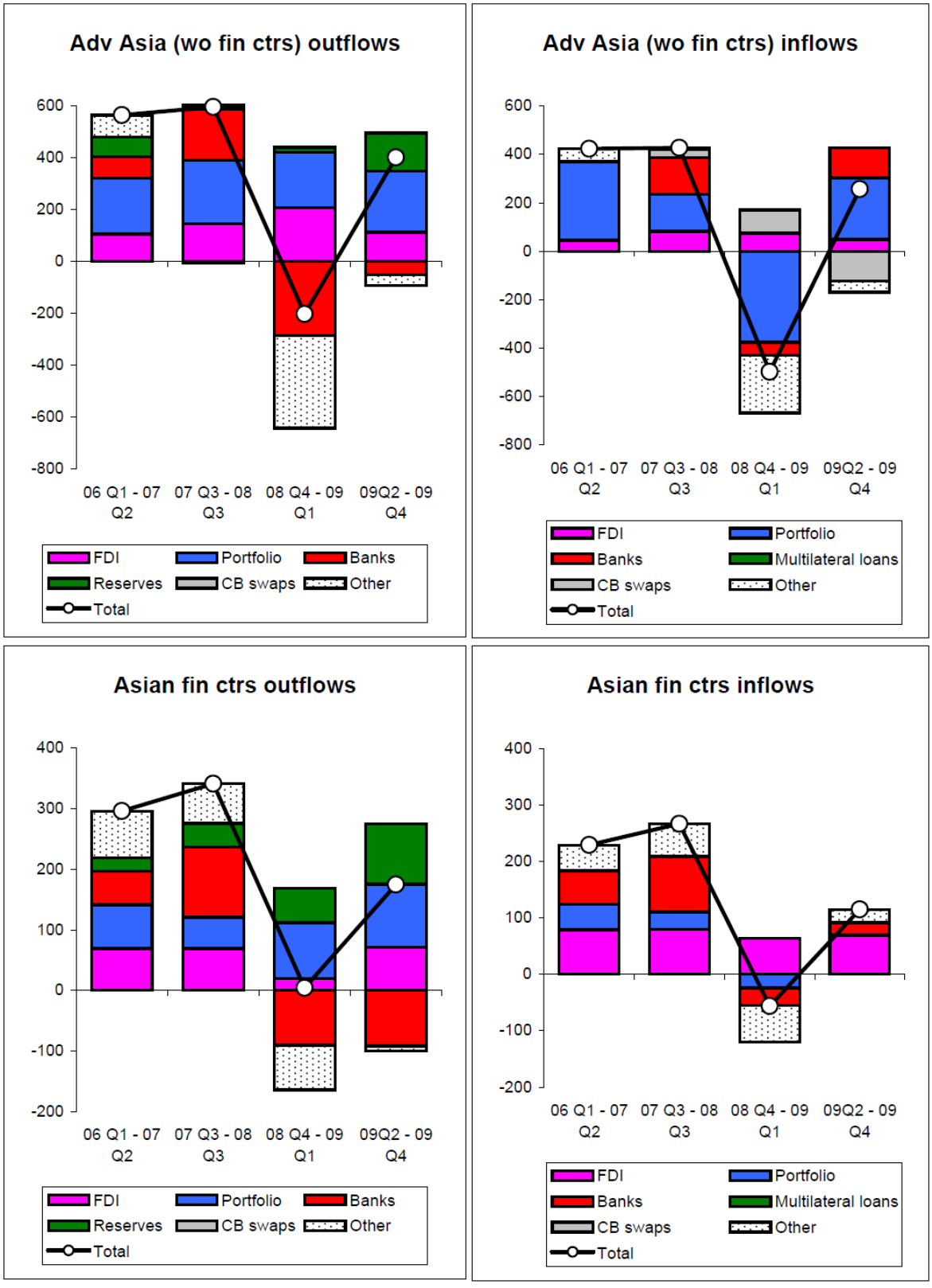
Appendix Figure 1b. Capital Flows during the Crisis

Billions of USD, annualized rates



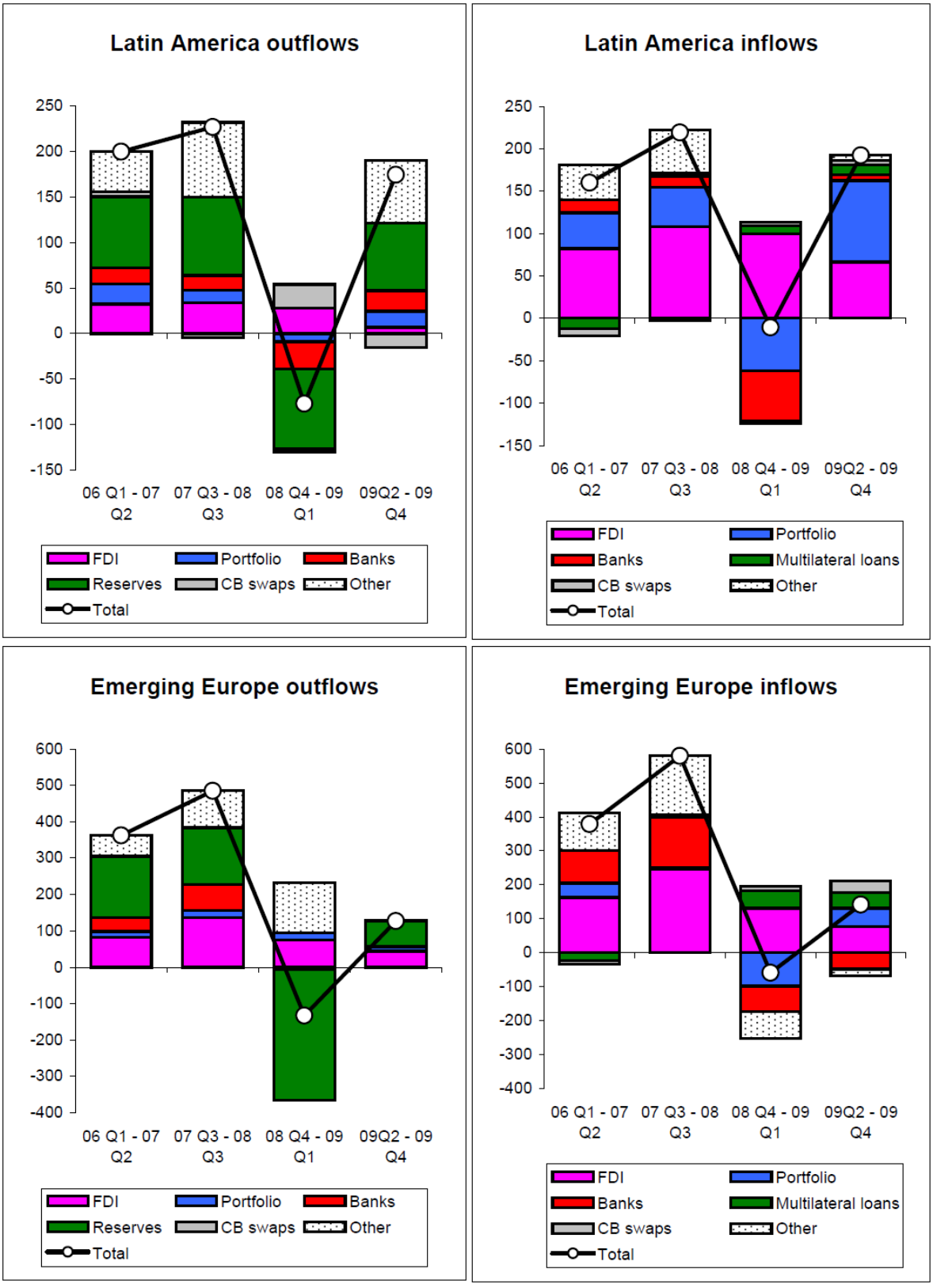
Appendix Figure 1c. Capital Flows during the Crisis

Billions of USD, annualized rates



Appendix Figure 1d. Capital Flows during the Crisis

Billions of USD, annualized rates



Appendix Figure 1e. Capital Flows during the Crisis

Billions of USD, annualized rates