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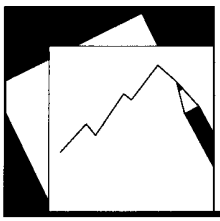

IMF Working Paper

Apocalypse Then: The Evolution of the North Atlantic Economy and the Global Crisis

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Apocalypse Then: The Evolution of the North Atlantic Economy and the Global Crisis

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Abstract

The financial crisis, originated from the collapse of US housing markets in 2008, reverberates around the world. Its destructive force was felt nowhere more keenly than Western Europe. Indeed, it continues to mire in financial volatility as the debt problem contagiously spreads around the periphery Euro area. Taking a wider historical view of the evolution over the recent decades of the North Atlantic economy, comprising North America and Western Europe, we argue that while trade links were in relative stasis, the increasing and uniquely-close Transatlantic financial relationship was a crucial conduit in transmitting US shocks into global ones.

JEL Classification Numbers: F15, F36, F47, G18

Keywords: Financial linkages, financial regulation, spillovers

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I. INTRODUCTION[1]

The financial crisis that struck the global economy in late 2008 had its origins in excesses in the US housing market. Its reverberations, however, were felt around the world and nowhere more keenly than in Western Europe. Indeed, in many ways they are still being felt as problems in the periphery of Euro area continue to mire Western Europe in financial volatility. This paper seeks to explain these developments by taking a wider historical view of the evolution over recent decades of the North Atlantic economy, comprising North America and Western Europe. I will argue that while trade links were in relative stasis, increasing financial ties coming from a combination of greater competition and divergent regulatory policies created a uniquely-close financial relationship between these two parts of the world, and that this link was a crucial conduit in siphoning US shocks into global ones (see IMF 2011).

The next section of this paper lays some ground work by tracing the evolution of trade and financial links across the North Atlantic, and discusses the forces that drove increasing close financial ties. This is followed by an examination of empirical evidence on global growth spillovers across the North Atlantic and between its three major components—the US, Euro area, and the UK—with a particular focus on how our understanding of these spillovers has been changed by the crisis, and how these results can be mapped into macroeconomic model simulations, with an emphasis on how to model financial linkages. Unsurprisingly, conclusions conclude.

II. THE EVOLUTION OF NORTH ATLANTIC TRADE AND FINANCIAL LINKS

When macroeconomists think about economic ties across regions, they naturally gravitate to trade. Direct transfers of goods and services across economies are the most visible way in which real economic developments in one region affect another. There are complications, of course. In particular, the evolution of sophisticated cross-border supply chains in intermediate goods mean that it is no longer possible to simply look at bilateral trade between (say) the United States and Germany. While these issues are most pertinent in Asia they have become increasingly so in North America—given the North American Free Trade agreement between the US, Canada, and Mexico—and Europe—given the fillip to integration produced by reintegration of eastern and Western Europe after the fall of the Berlin wall, the single market, and the introduction of the Euro.

Even given these developments within North America and Western Europe, however, the overall impression data on trade across the North Atlantic is one of stasis. Figure 1 shows heat maps of trade links between the United States and the rest of the world from 1980, 1990, 2000, and 2010. Bilateral exports and imports are reported as a ratio of recipient GDP. The United

[1] Many thanks to Francis Vitek for helpful comments and support, which hugely improved the paper, and to Katheryn Dominquez (discussant) and other members of the RBA conference "Thinking About the Australian Economy in the 2000s" held in Sydney August 15-16, for key insights.

States is chosen as the center of focus as it remains the hub of the North American trade system (see Riad and others, 2011). In the absence of a similarly dominant hub in Europe, it is probably the best node from which to analyze the North Atlantic trade system. These heat maps indicate significant changes in US trade over time, but the center of this dynamism is not with Western Europe. Rather it is within North America and with Asia. By contrast with these evolving relationships, the trade across the North Atlantic seems to be relatively fixed.

Figure 2 shows equivalent results for Germany, the center of Euro area export hub. Again, these Figures vividly illustrate the importance of growing supply chains in (Western and, in particular, Eastern) Europe as a driver of trade dynamics. But they do not change the basic conclusion of the lack of dynamism in the North Atlantic trade system since 1980.

It is possible, of course, that this appearance of lack of change misses more subtle linkages through supply chains. Accordingly, Figures 3 and 4 repeat the exercise, but looking only at manufacturing trade and taking into account the full web of international trade links using the methodology discussed in Vidon (2011).[2] Briefly, the full matrix of bilateral exports across countries in terms of recipient GDP is calculated as matrix X. Now, if demand in country A falls, this in turn implies a fall in exports from (say) country B to country A, and hence a fall in demand in country B. The impact of this fall in demand in country B will then be propagated across its trading partners. It is easy to show that if you assume a fixed global elasticity of between demand for exports of α, then the impact is simply $(I- \alpha X)^{-1}$ (in Figures 3 and 4 this elasticity is assume to be unity). As can be seen in the Figures, adding supply chains has little impact on the basic story—North Atlantic trade remains in relative stasis.

The story with regard to financial links both in terms of asset holdings and in terms of banking ties, however, is dramatically different and much more dynamic. Starting with asset holdings, Figure 5-7 shows heat maps similar to those in Figure 1, except that they measure stocks of foreign holdings of US bonds, US holdings of foreign bonds, and the net position, respectively, all as a ratio of foreign GDP. Again, the US is placed at the center of the analysis, but in this case because of data availability. These data on bilateral asset holdings come from the US Treasury International Capital System (TICs) database. No equivalently long historical data of bilateral asset holdings is available for Western Europe (or, for that matter, anywhere else)—although more recently the Fund's Consolidated Portfolio Investment Survey provides data across a wider set of countries but with more limited coverage (e.g., official holdings are not included). We start the heat maps in 1994, the earliest date for which reasonably generalized data are available, and report also for 2000, 2007 (the eve of the crisis), and 2009.

As can be seen from Figure 5, the evolution of US holdings of foreign bonds has risen over time with this increase focused on Western Europe or, more accurately, the financial centers

[2] Due to data availability, we choose the Group of Twenty and some major emerging market countries for years 1995, 2000, 2007, and 2009. The full list of countries is available upon request.

of the UK, the Netherlands, and (more recently) Ireland. A similar deepening of can be seen over time in foreign holdings of US bonds, but this is geographically much more generalized, encompassing major emerging market holders of international reserves such as China, Russia, Brazil, and Middle East oil exporters, as well as Western European financial centers (Figure 6). Indeed, it is the emerging markets who are often major net lenders to the United States (Figure 7).

Importantly, however, holdings of US assets by Western European financial centers were much more focused on private bonds than were those of the rest of the world. The TICs data allow a further division between bilateral holdings of US government bonds, Agencies (essentially, holdings of the quasi-public bonds of Freddie Mac and Fannie Mae which were often assumed to contain an implicit government guarantee), and private bonds. Figure 8 shows the evolution of holdings of private bonds using the same format as that for overall bonds shown in Figure 5. The unique dynamic evolution of the link between the US and financial centers in Western Europe is now clear; this is the region of the world that developed deep holdings of a wide variety of US bonds, rather than simply buying Treasuries as reserve managers looked for a store of value.

Bilateral equity holdings were also much deeper between the US and Western Europe. Figure 9 and 10 show the evolution of cross border holdings of US and foreign equities, again from the TIC database, in the same format as the previous four Figures. Again, Western European financial centers stand out.

We now turn to another aspect of financial linkages, namely cross-border asset holdings across banks. These data comes from the Bank for International Settlements, and are only available from 1999 and even then the coverage is limited. Hence, Figure 11 shows the evolution of these ties only for 1999, 2007 (pre-crisis), 2008, and 2009. The inclusion of 2008 and 2009 is because there is an important break in the series for US banking claims on other countries at the end of 2008. Prior to this date, only US commercial banks were included in the survey. After this date, US investment banks were included. This is important as US investment banks (which were confusingly counted as nonbanks for regulatory purposes and who were funding exclusively in wholesale markets) became an increasingly important force in the US banking system. Assets of broker-dealers (a good approximation of US investment banks available in the US Flow of Funds database) rose over time from under 3% of commercial bank assets in 1980 to around 30% in 2007, on the eve of the global financial crisis. It then halved after Lehman Brothers collapse to 15% currently as wholesale funding came under pressure.

Starting with US claims on foreign banking systems, the story coming from Figure 11 is one of close existing links with Western European financial centers over time, given a further boost by the addition of US investment banks into the data in 2009. Outside of North America and a few small countries with particular links to the United States, this is a Western European trend, not a global one. Turning to foreign banking system's claims on US banks (Figure 12), Western Europe again stands out, but in this case the story is more generalized. This involvement

had always been relatively large—particularly as regards UK banks—but increased significantly over time and faster than those of other financially-close banking systems such as that of Canada. Hence, the boom of the 2000s amplified an existing close link.[3] What is also striking, however, is the lopsided nature of the ties. Northern European banks are much more involved in US banking system than US banks are in the Western European one (a feature that is also true of Canada and Japan) (Figure 13).

In addition, the nature of these links is quite different from those of other banking systems (see also Bhatia, 2011). As can be seen in Figure 14, the current heavy involvement of the UK, Swiss, German, and Irish banks in the US reflects ownership of US investment banking operations. For Canada and Japan, by contrast, the links are mainly from commercial banking (this is also true for France and the Netherlands, but here there is a catch as the investment operations of these banks are run out of London, rather than New York). The difference is vividly illustrated in Figure 15, which shows the location of branches of commercial banks—widely spread across the US—and of investment banks—focused on New York, Connecticut, and (for regulatory reasons) Utah.

Finally, Figure 16 shows the importance of US short-term liquidity provided by nonbanks for Western Europe (see also IMF, 2010). It shows flows of global funds (investment funds, pension funds, money market mutual funds, etc.) in and out of the United States. As can be seen, major flows go to Western European onshore financial centers, such as the United Kingdom and Switzerland, and offshore ones, such as Luxembourg, where the complex plumbing of modern financial engineering is accomplished.

Putting these data from a variety of sources together shows a Western European banking system that has steadily become more dependent on US dollar wholesale funding. This growing dependence comes out in different ways in the three sets of data. Most obviously, the BIS banking data illustrate increasing US asset holding over time in a way that is significantly different from other regions. Microeconomic bank data shows that this involves major investment banking operations in Northern Europe, which then act (together with US-owned investment banks and money market mutual funds) as a conduit for dollar wholesale funding to the rest of the region. The TICs data show that this development was accompanied by increasing comingling of private sector bonds, assets that are needed for short-term funding operations such as repo operations. Finally, the funds data underline the importance of flows of dollar liquidity in and out of European onshore and offshore financial centers, confirming the existence of sophisticated, modern funding techniques across the North Atlantic.

[3] Some discussions of US-Western European bank ties emphasize the uniqueness of the 2000s boom (McGuire and von Peter, 2009), including the purchase of US securitized bonds by Western European banks. While agreeing that this development was important, a longer perspective suggests it was more evolution than revolution. See also Alessandri and Haldane (2009).

The reason that North Atlantic financial links evolved in this unique manner reflects the confluence of three underlying forces. On the North American side of the equation is the global dominance of US financial markets. On the Western European side was the push for an integrated financial system combined with the introduction of the Euro. Finally, financial arbitrage within and across these two regions helps explain how these developments became as comingled as they did. The result was a North Atlantic financial system that functioned smoothly through the boom of the early 2000s, but generated massive spillovers to European banks and—in part via this mechanism—to the rest of the world over the crisis as counterparty risk ended the availability of ready dollar wholesale funding.

The dominance of US markets is the better understood part of the equation. That US markets are globally dominant is clear from the bellwether status of the benchmarks—the yield on the 10 year Treasury note and the price of the S&P 500 stock index. For example, European bond and stock markets typically jump when US ones open. At first glance this is slightly surprising, as the value of US and European bond and equity markets are quite similar. The superior information content of US market, however, comes out in turnover and prices. As can be seen in Figure 17, US bond and equity markets have many times the turnover of any European market—including that of the UK. This is reflected in the more sophisticated market structure; lower transaction costs, larger derivatives markets, and, above all, greater analysis and research. As to price information, several studies find that European markets respond to US data releases much more than the opposite.[4] Similarly, VARs using weekly prices that endogenously measure contemporaneous causation across international markets find that US bond yields and equity prices drive UK and Euro area equivalents much more than the other way round (Neely 2010, Bayoumi and Bui, 2011a, Yue and Shen, 2011).

The push for a single European financial market drove an increase in competition across European Union banks that led to an aggressive search for profits from balance sheet expansion (see Dermine, 2002). While the US banking system had always been highly dynamic and competitive, the splintered European market was traditionally sleepy and overbanked. In 1989, however, the European Commission enacted the Second Banking Directive which allowed European banks to establish branches in other EU member countries without further authorization—later extended in 1992 to members of EFTA (except Switzerland). The implications of this directive for EU-wide bank competition were supported by the adoption in 1999 of the single currency in the Euro area. In the financial boom of the 2000s, with cross-border bank takeovers still difficult (reflecting barriers as a result of national regulations), banks rapidly expanded their balance sheets and directly expanded into other countries, exacerbating existing overcapacity. This process is vividly illustrated in Figures 18-20, which show for 14 EU countries BIS data on cross border bank presence for 1999, 2003, 2007 (the eve of the crisis) and 2010 into other European economies (Figure 18), from other European countries (Figure 19), and

[4] See, for example, Ehrmann, Frazscher, and Rigobon (2010) and references cited in.

net positions (Figure 20). Note that this trend encompassed several countries outside of the Euro area, including the UK and Sweden, suggesting it was not driven solely by the single currency, while there was little increase in intermingling of the Swiss banking system (also shown, and which was outside of the passporting system) with EU members.

The generalized expansion in cross-European banking is illustrated in Figure 18, which shows a generalized expansion by home EU banks into other EU countries between 1999 and 2007, with only a modest subsequent reversal largely in the Benelux countries (as local banks were sold to foreign entities). Interestingly, the flip side of the coin shows that European banks mainly expanded into fast-growing periphery (including Scandinavia) between 1999 and 2007, followed by some pull out from southern Europe between 2007 and 2010. This dynamic was supported in some cases (Ireland, the UK, and Iceland) by a conscious decision to adopt "light touch" regulation that limited prudential supervision of banks, and—together with low global interest rates—helped set off unsustainable foreign acquisitions and domestic housing booms. As the net positions (Figure 20) make clear, the overall effect was to transfer funds from the EU core (France, Benelux, Germany, plus Sweden) to the EU periphery through 2007 with a modest pull back (largely in Germany and the Benelux) subsequently.

Finally, different approaches to global bank regulations across the North Atlantic led to divergent paths to higher leverage that helped drive financial interconnectedness between the US and Western Europe. In the United States, the authorities required banks to maintain a simple leverage ratio as well as a risk weighted one. As a result, US banks expanded leverage by placing assets in securitized pools and then selling them. By moving these assets off their balance sheet, this allowed them to conserve capital. In Europe, however, only a risk weighted capital ratio was used. Generous risk weights produced an incentive to buy highly rated bonds—a triple-A rated bond with a 10% risk weight required only 0.8% capital (the basic 8% ratio times the risk weight). As a result, European banks were major buyers of highly rated US securitized assets. Highly rated US assets played a dual role, both supporting profits through returns and providing collateral that could be easily used to raise dollar wholesale funding in repo markets.

The outcome was a bank-dominated Western European financial system that was structurally dependent on dollar wholesale funds, much of it provided by loosely supervised US nonbanks (including investment banks). When the unexpected bankruptcy of Lehman Brothers in late 2008 led to severe problems in US wholesale markets this instability was immediately transferred to Western Europe.

III. Empirical Estimates of North Atlantic Growth Spillovers

A. Time Series Evidence

Having mapped out trade and financial linkages across the North Atlantic economy over time, this section directly estimates growth spillovers using an innovative time series technique based on identification via heteroskedacity. This is an old form of identification revived by Rigobon (2003) and extended by Bayoumi and Bui (2010) to look at growth spillovers. The

technique works as follows. Let us suppose that there is a period of time over which underlying relationships are stable, but where regimes with differing ratios of shocks can be identified. In the case of growth spillovers across the major advanced economies, Bayoumi and Bui use the period since 1970 as the sample, and the break in regime is the onset of the great moderation that (to varying degrees) lowered growth volatility across almost all economies and started sometime in the 1980s. Causation can then be identified within a VAR by relating changes in relative variance across countries to changes in correlations of shocks. Suppose, for example, that over the great moderation the volatility of US growth relative to that of UK growth rises and that, at the same time, the correlation of US and UK growth rises. Then the methodology would identify causation as generally running from US to UK growth.

An innovation in Bayoumi and Bui (2010) is to also realize that by varying the (uncertain) date at which the great moderation started, it is possible to not only estimate the direction of contemporaneous causation but also the uncertainty around these estimated coefficients. In other words, in addition to the usual uncertainty in impulse response functions from vector autoregressions (VARs) caused by parameter uncertainty, one can overlay uncertainty over the parameters of the matrix defining the correlation of contemporaneous growth shocks across countries (the so-called A matrix that is generally identified by assumption using a Choleski decomposition rather than being estimated). This "bootstrap" technique works as Rigobon showed that the estimation technique was consistent even if the choice of the break between the two samples is incorrect. Hence, Bayoumi and Bui (2010) are able to calculate uncertainty around the impulse responses due to uncertainty about the A matrix, as well as the "usual" uncertainty as a result for potential volatility on the coefficients of the VAR.

Results for a VAR using quarterly growth for the US, Euro area, UK, Japan, and an amalgam of other countries identified as the rest of the world from 1970 to the end of 2007 are reported in Figure 21. Each graph shows the impact of a shock in one area on itself and other regions—for example, the graphs in the center panel with the US flag as background shock the estimated effect of a US shock on each of the members of the VAR over 8 quarters.

The results suggest that growth spillovers across the North Atlantic are highly asymmetric. Spillovers from US growth shocks on foreign real GDP rise gradually over time, to between half and three-quarters of the relevant US value after 8 quarters, and are generally significant. More specifically, a shock that increases US real GDP by 0.8% over 2 years increases Euro area and UK real GDP by 0.6% and 0.4%, respectively. However, the opposite effects from the Euro area to the US are much smaller and insignificant. In particular, despite its economic size, Euro area spillovers to the US rise modestly over the first few quarters and then fall to close to zero. In addition, within Europe the (marginally significant) spillovers from the UK to the much larger Euro area economy are estimated to be at least as large as those in the opposite direction.

The earlier discussion provides a plausible explanation for the strong asymmetry seen in growth spillovers between the US and European economies and within Europe between the UK

and the Euro area. If financial relationships are more important for growth spillovers than trade ones, then the large US and UK spillovers make sense. Bayoumi and Bui (2010) provide some suggestive evidence for such an explanation. Another approach is to examine the impact of the recent financial crisis. Since the shock from the US to Europe and from the UK to the Euro area was clearly channeled through financial market relationships, one would expect the inclusion of the financial crisis in the estimation to increase spillovers.

This intuition is supported by the results from VARs including the post-2008 crisis period and reported in Figure 22. The results in Figure 22 come from an estimation in which the crisis period is simply included in the VAR as if it were a continuation of the pre-great moderation period of instability. As can be seen by comparing these estimates with those in Figure 19, the crisis boosts estimates of both US and (in particular) UK spillovers. The disadvantage with this approach, however, is that it is difficult to get a clean estimate of the spillovers over the crisis as this part of the sample is mingled with data from the 1970s and 1980s. Models provide an alternative approach.

B. Macroeconomic Model Evidence

An alternative way of estimating growth spillovers is to use results from an empirically estimated macroeconomic model. While the structural VAR reported I the last section is closer to the data, macroeconomic models allow more precision on the sources and mechanisms through which these spillovers occur. This section uses the macroeconomic model described in Vitek (2010, 2011a). This model was chosen as it covers a wide range of countries (the G-20) and has sufficient financial market detail to allow financial spillovers to be modeled realistically. More precisely, the model includes bond yields, equity prices, and a spread between government and private sector short-term interest rates for each country, thereby allowing realistic cross-country correlations across bond, equity, and wholesale funding market risk premiums to be imposed.[5] A further advantage of the model is that it is linear, so that simulations can be layered on one another to provide insights as to sources of spillovers.

Results again find that US spillovers are much larger than Western European ones and come largely through financial market channels. The top panel of Figure 23 reports results from two simulations layered on top of one another for typical growth shock (more precisely, an even weighting of an aggregate demand, aggregate supply, duration risk premium, and equity risk premium shocks). The blue bars represent a pure simulation in which the model is allowed to run without imposing additional financial market correlations. This results in small and relatively similar growth spillovers across the major countries coming mainly through trade. Hence, for example, a percentage point increase US output raises demand for exports from other countries. The impact is small as bilateral trade is also small—exports to the US represent just 2% of Euro area/UK GDP. Crucially, there are few financial market spillovers. This is because domestic

[5] For other applications of this model see Vitek (2011b, 2011c)

bond yields depend only on the expected path of domestic short-term policy interest rates, themselves driven by a Taylor rule. As growth spillovers are small, there is little knock-on to monetary policy rates and bond yields. It is worth stressing that this is a typical result from conventional macroeconomic models, and is not a peculiarity of the chosen model.

Adding empirically estimated correlations of international risk premiums produces larger and more asymmetric growth spillovers. The red bars show the results of a simulation in which bond and equity risk premiums are correlated using the empirical estimates discussed earlier and reported in Bayoumi and Bui (2011b). Focusing on the North Atlantic economy, a percentage point risk in US bond yields is assumed to create around a 0.4 percentage point increase in Euro area and UK yields, while the feedback in the other direction is small. For equity prices the impact is more like 0.6. This results in much larger US growth spillovers. A percentage point increase in US output now generates a 0.4% increase in European output, while the reverse impact remains similar to the initial simulation. Further investigation reveals that the main spillover channel comes through bond yields (Vitek, 2011c). These responses, which can be regarded as estimates of spillovers for a typical shock, are much closer to the baseline empirical estimates reported in section 2 and support the supposition that financial market links explain the size and asymmetric effect of US growth spillovers.

Disruptions to bank wholesale funding markets are another powerful source of growth spillovers. The bottom panel of Figure 23 shows the results of a shock to US and European wholesale funding costs. Again, there are two simulations layered on top of one another. In the basic regression it is assumed that wholesale funding is limited to local markets, and that spillovers occur only through bank loans across regions. As can be seen, the impact of a US and a European wholesale funding shock are similar and (relatively) limited, with a multiplier of some one-quarter. In the second simulation, however, it is assume that half of all European wholesale funding comes from US markets, and hence that a percentage point increase in US wholesale funding costs leads to a ½ percentage point increase in European funding costs. Nobody knows the true extent of marginal dollar funding of European banks, but one-half is not an unreasonable estimate. This enhances the growth spillovers from US wholesale funding costs from one-quarter to more like three-quarters—considerably higher that the spillovers caused by the financial market correlations. This illustrates the important role of US-European bank links—in particular, the heavy dependence of European banks on dollar wholesale funding—in propagating global shocks.

IV. CONCLUSIONS

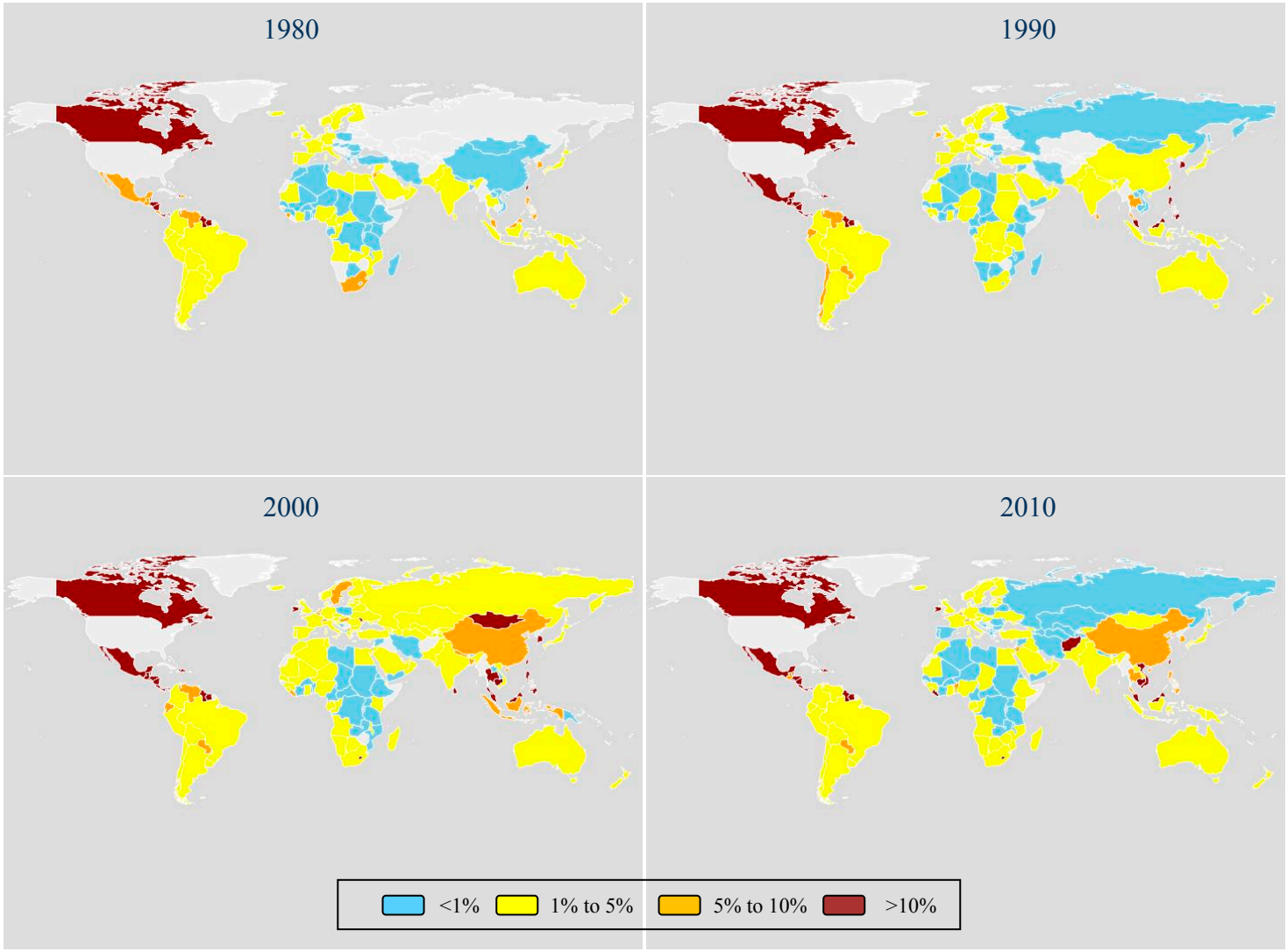
This paper has examined interrelationships across the North Atlantic economy from three perspectives. Historical data reveal a strong dichotomy between trade and financial market developments. Trade links, upon which most macroeconomists focus, were in relative stasis, the main sources of dynamism being either within these economies (NAFTA, the European single market) or with other part of the world (notably Asia). By contrast, the North Atlantic furnished a uniquely close relationship across financial institutions, as a combination of dominant US

financial markets, European competition policy, and differences in financial regulation made the European banking system heavily dependent on dollar wholesale funding. Empirical estimates and macroeconomic model simulations indicate that growth spillovers predominantly flow westwards across the North Atlantic. The bellwether nature of US financial markets creates uniquely large spillovers to the rest of the world even in normal times, and these spillovers are only enhanced if disruptions to bank wholesale funding markets are added—as occurred during the recent global crisis.

Looking forward, three things stand out from this analysis. The first is the important role played by differences between US and European financial regulation and policies to promote a single market within Europe in encouraging close financial market ties across the North Atlantic. This lesson should not be lost as global and European financial regulations are reformed. Second, the sheer size of US growth spillovers mean that the rest of the world have a legitimate interest in US policy decisions, underlining the importance of international processes promoting dialogue and cooperation across governments. Third, apparent importance of financial market ties in generating international growth spillovers emphasizes the importance of research to understand high correlations of prices across markets. The days of focusing on trade as the major source of international spillovers should be over.

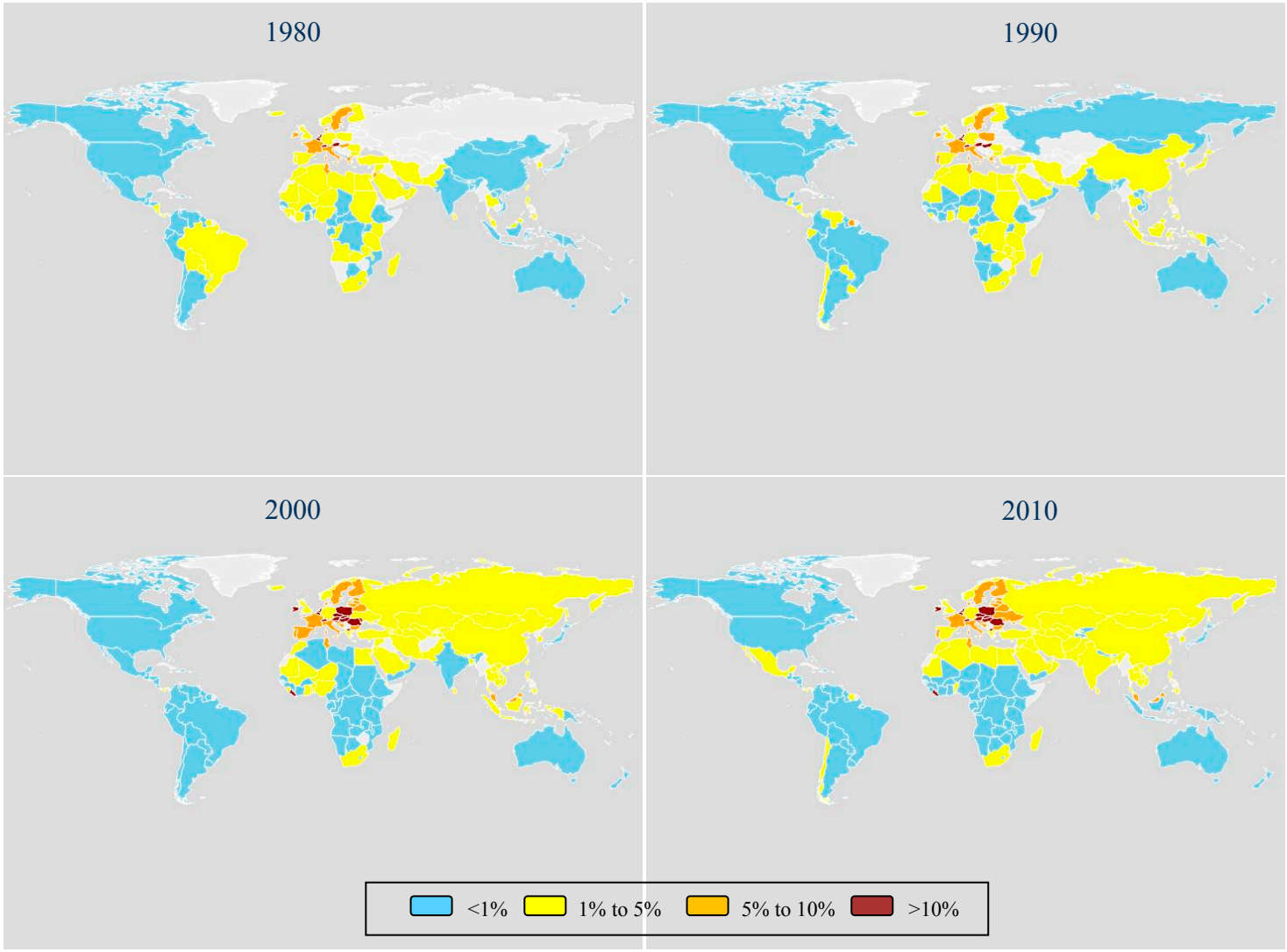
One final thought. The dominant status of US financial markets is not immutable. The status of the dollar as the main global store of value rests on many factors, including stable US macroeconomic conditions. After the crisis, others may increasingly question whether this will continue. While it will take time for the underlying market infrastructure to be created, the fulcrum of financial market activity—and associated spillovers—may gradually start to move, with interesting implications for the global business cycle.

Figure 1: US Bilateral Trade (in percent of foreign GDPs)



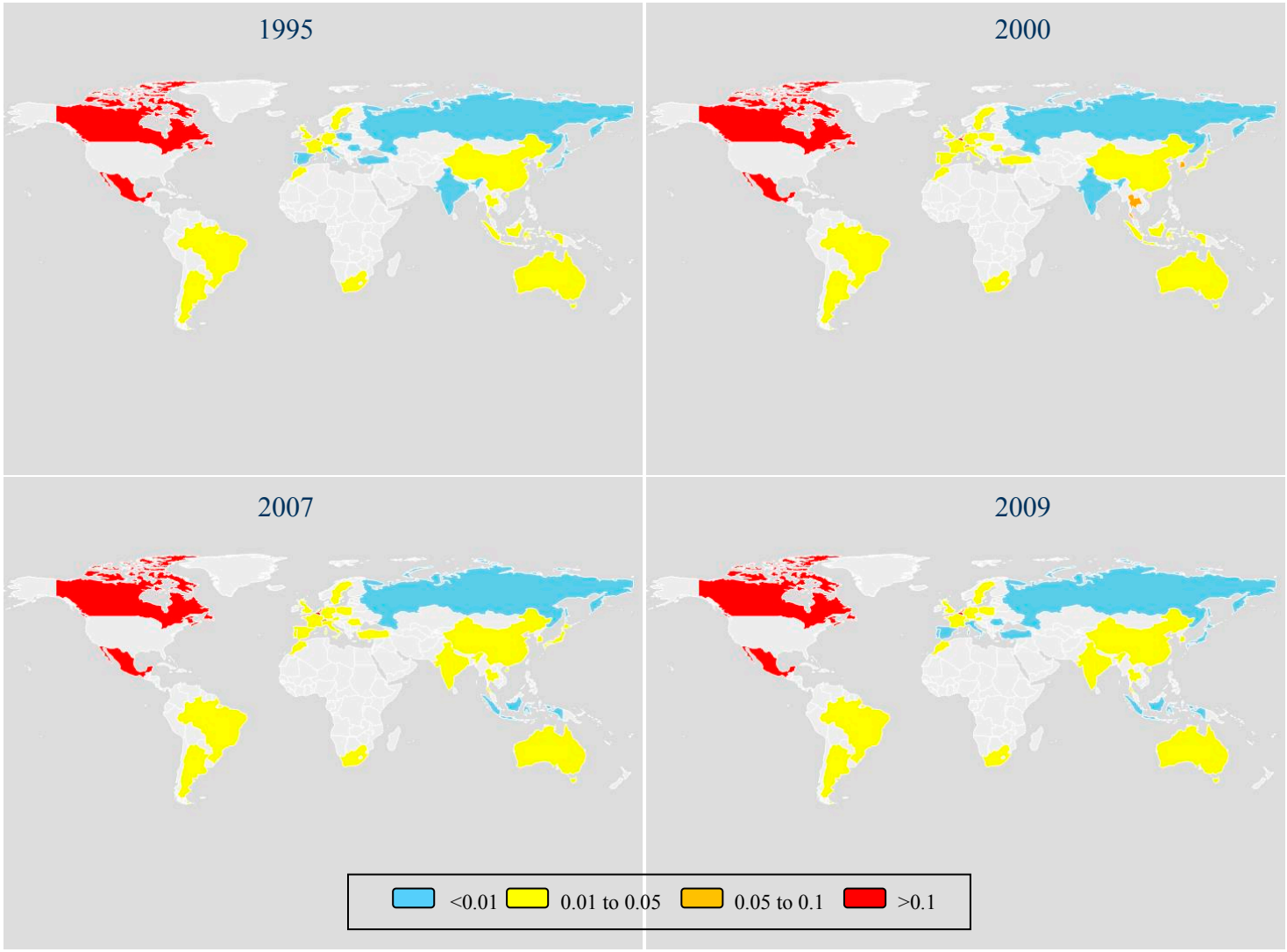
Source: UN COMTRADE, WEO, and IMF staff calculations

Figure 2: Germany Bilateral Trade (in percent of foreign GDPs)



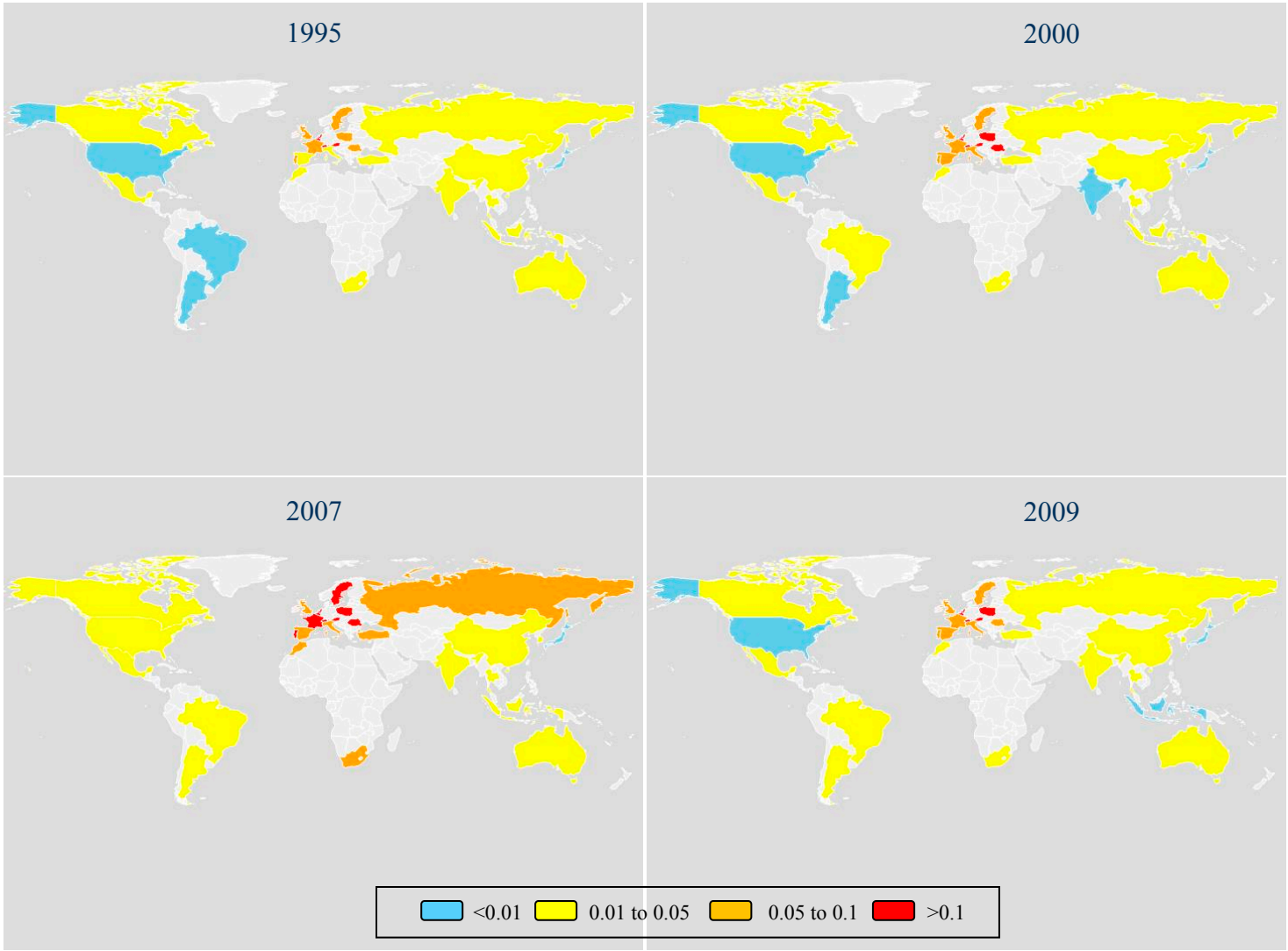
Source: UN COMTRADE, WEO, and IMF staff calculations

Figure 3: US Supply Chain Impacts



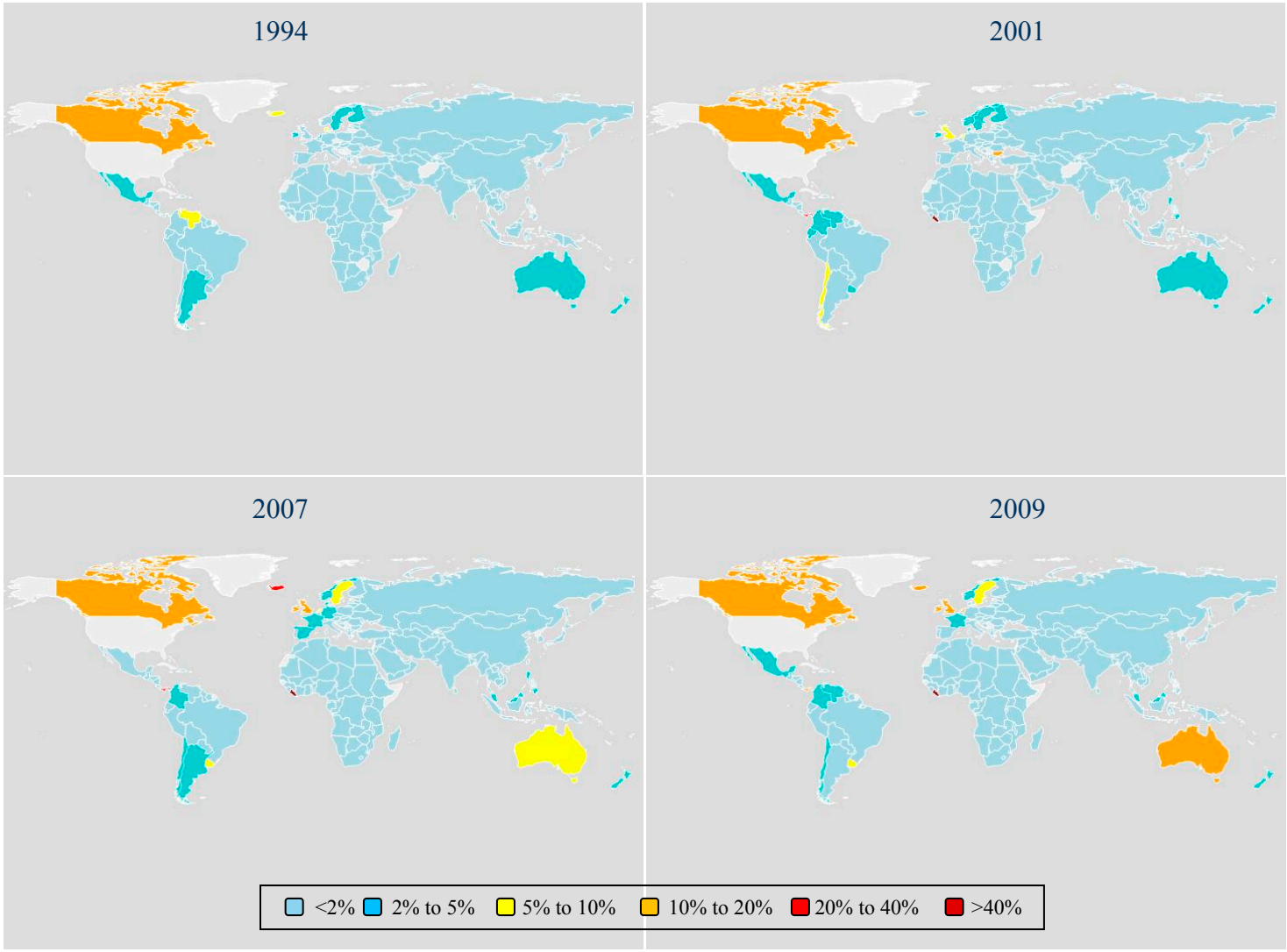
Source: UN COMTRADE and IMF staff calculations.

Figure 4: Germany Supply Chain Impacts



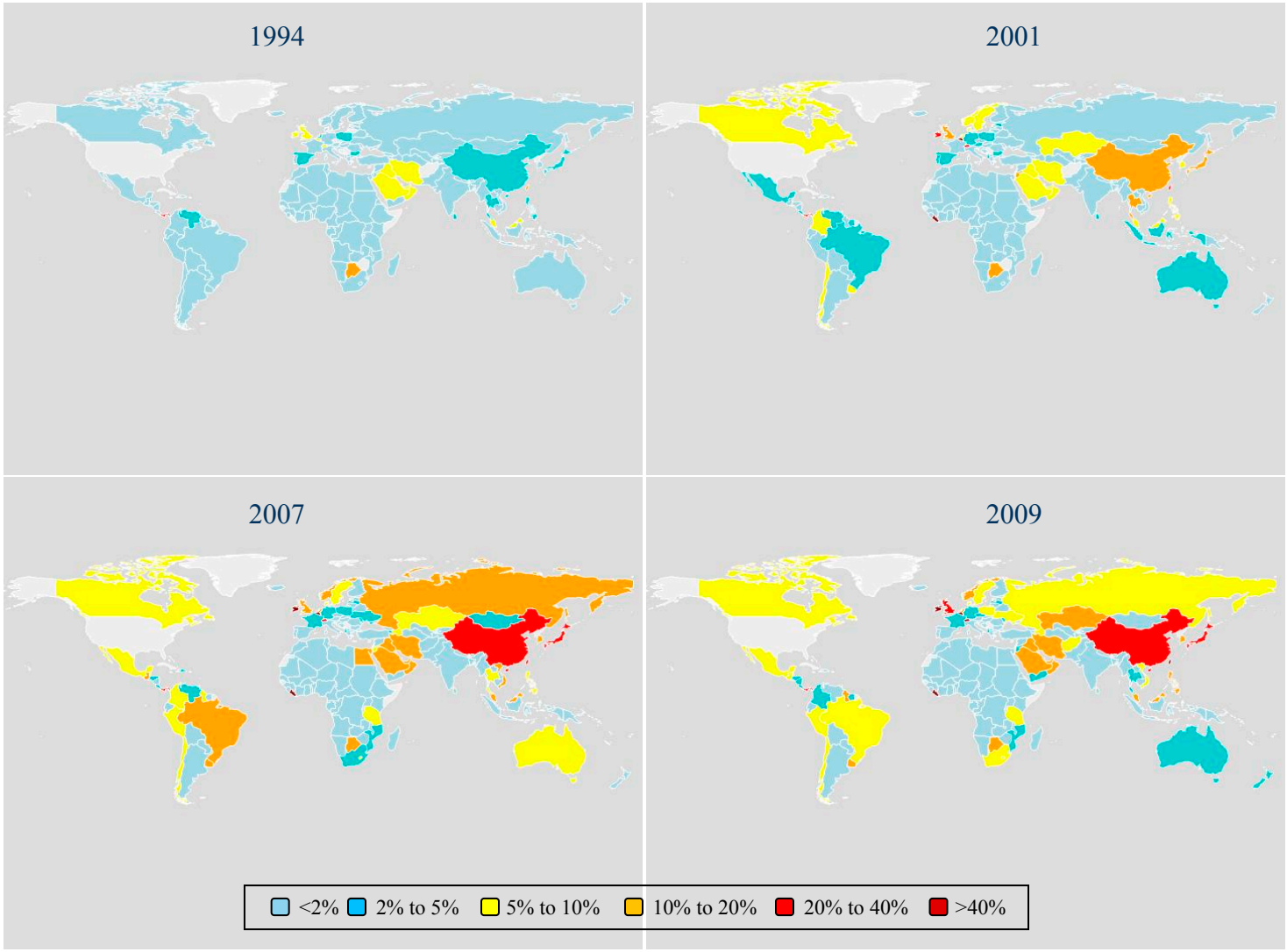
Source: UN COMTRADE and IMF staff calculations.

Figure 5: US Holdings of Foreign Bonds (in percent of foreign GDPs)



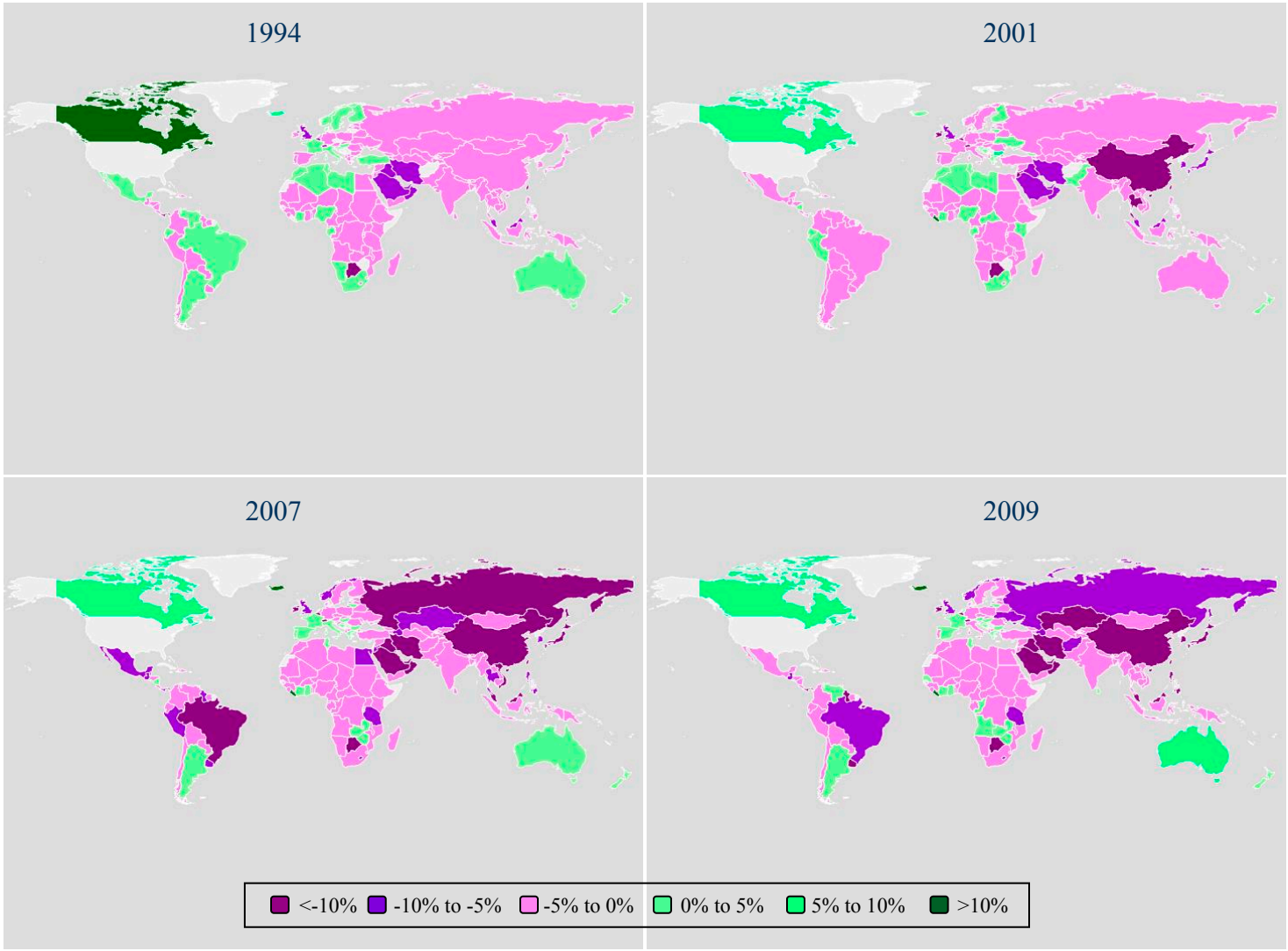
Source: Treasury TIC database, WEO, and IMF staff calculations.

Figure 6: Foreign Holdings of US Bonds (in percent of foreign GDPs)



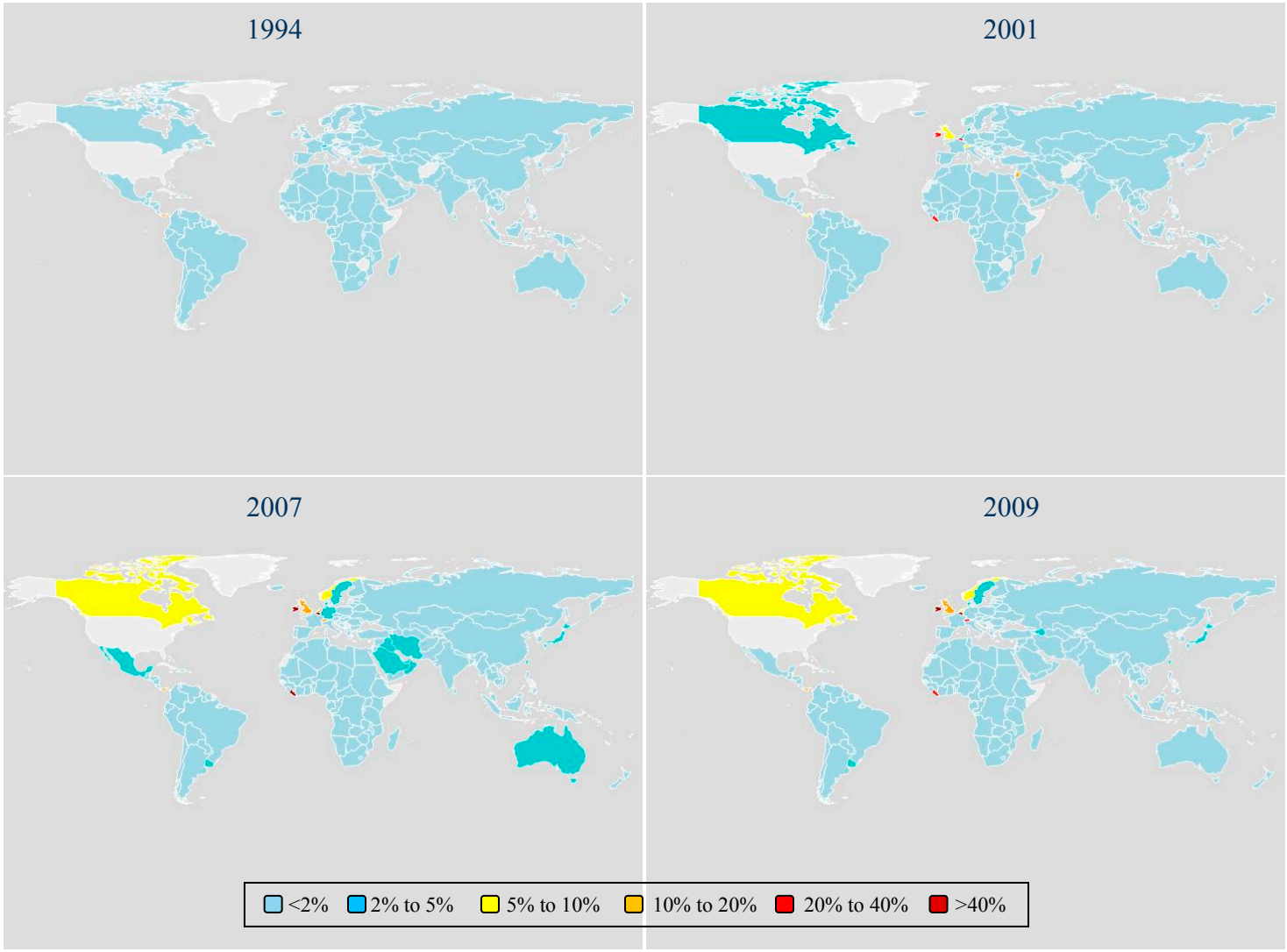
Source: Treasury TIC database, WEO, and IMF staff calculations.

Figure 7: Net US Holdings of Bonds (in percent of foreign GDPs)



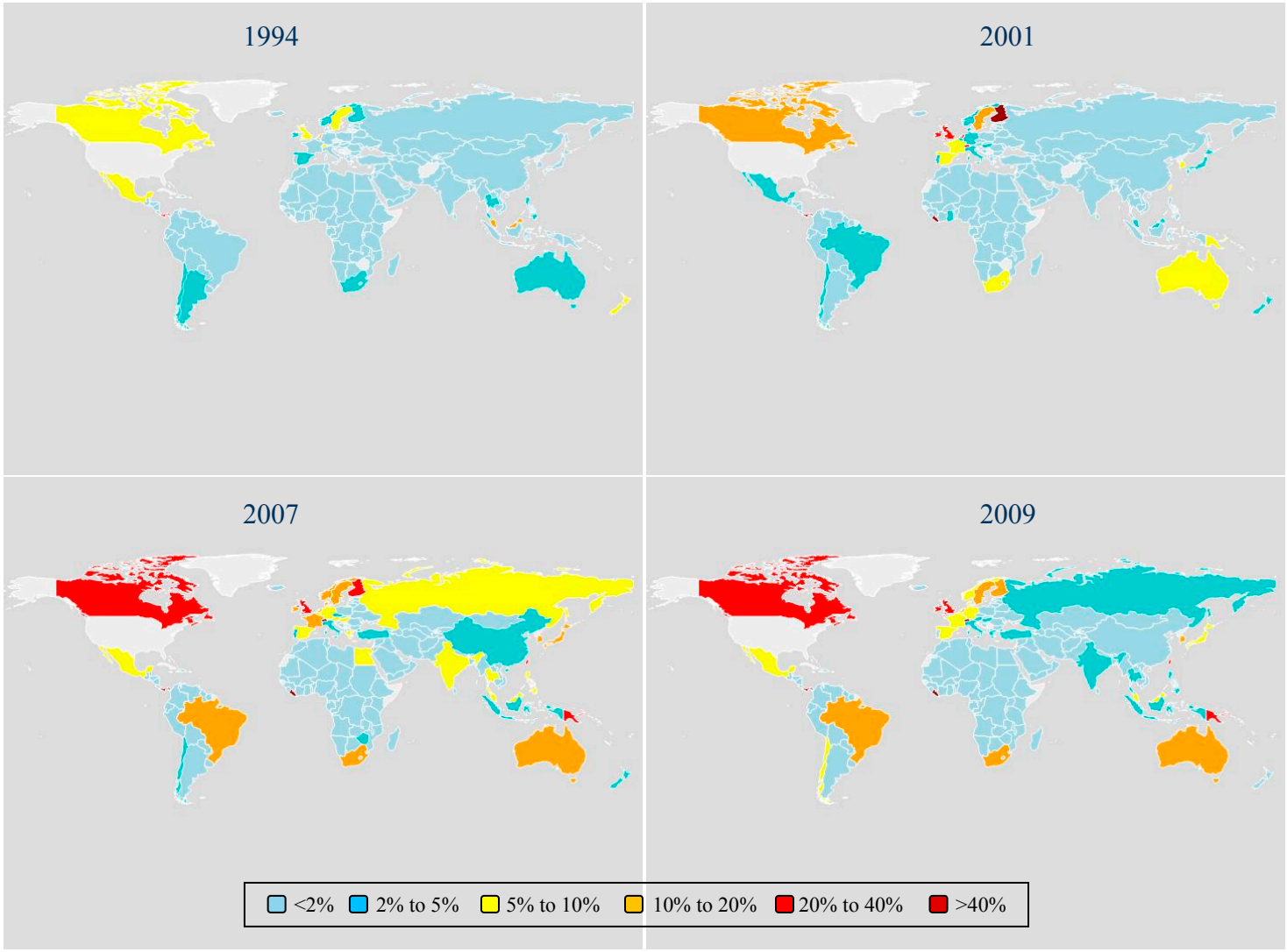
Source: Treasury TIC database, WEO, and IMF staff calculations.

Figure 8: Foreign Holdings of US Corporate Bonds (in percent of foreign GDPs)



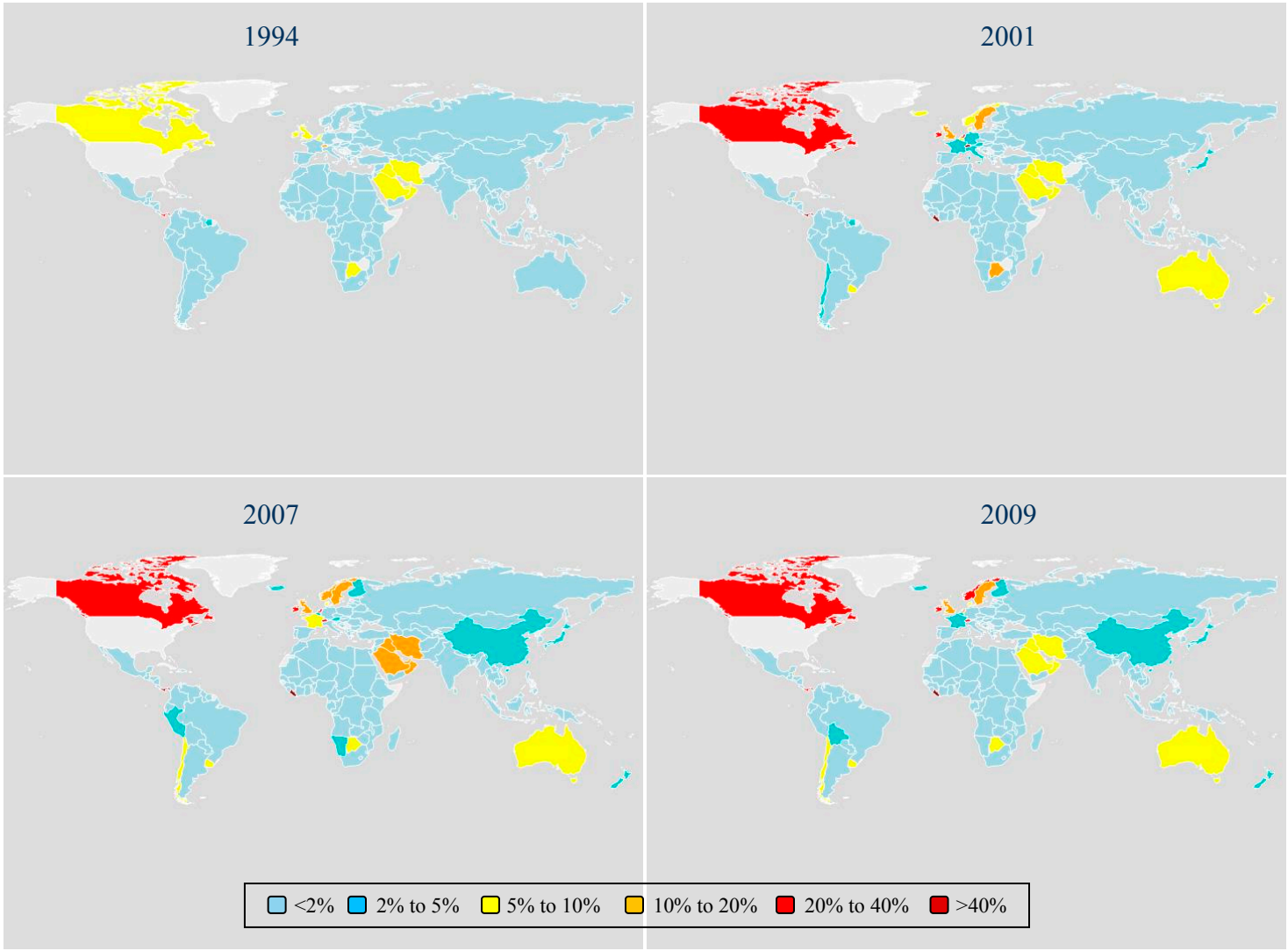
Source: Treasury TIC database, WEO, and IMF staff calculations.

Figure 9: US Holdings of Foreign Equities (in percent of foreign GDPs)



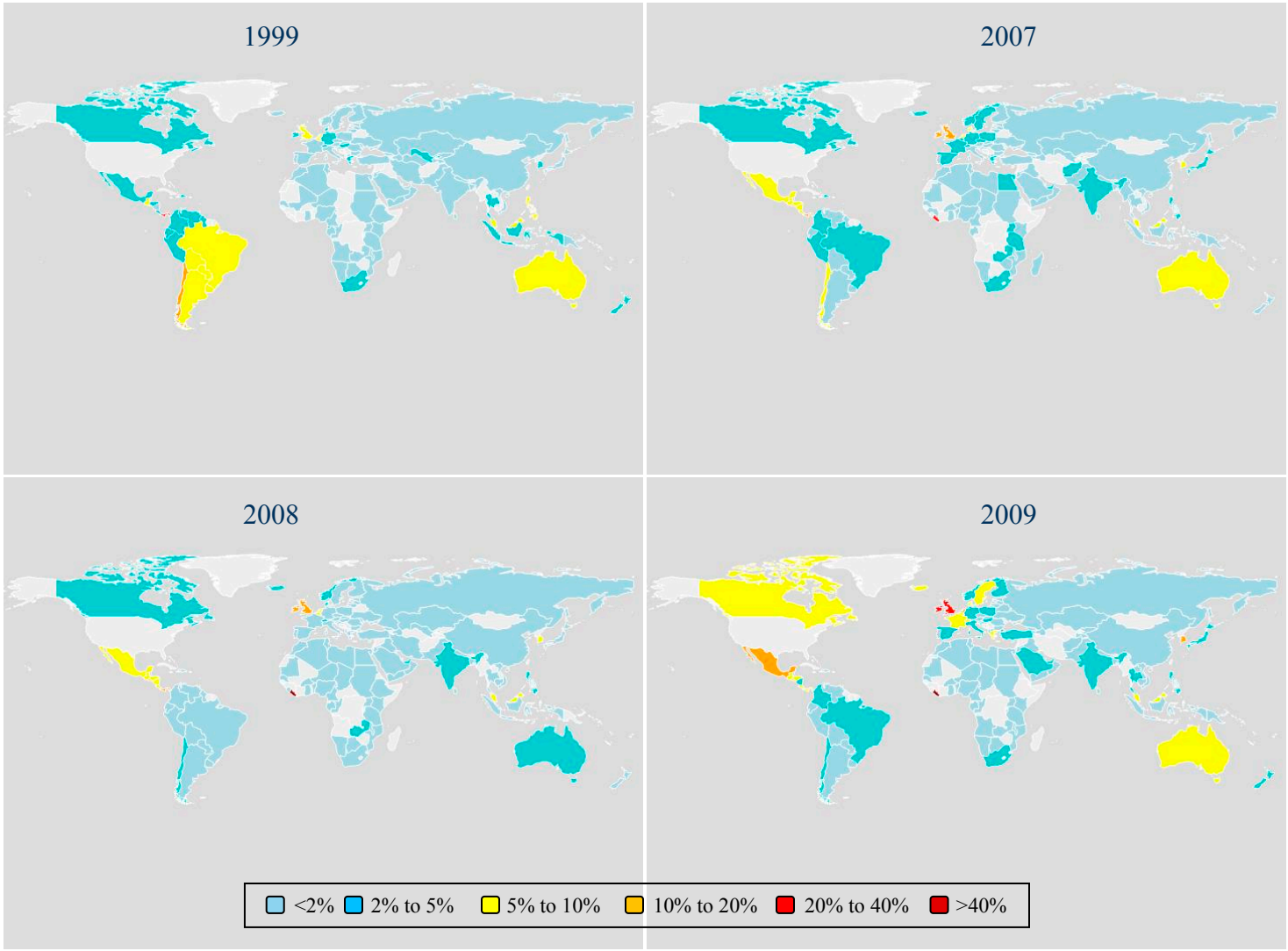
Source: Treasury TIC database, WEO, and IMF staff calculations

Figure 10: Foreign Holdings of US Equities (in percent of foreign GDPs)



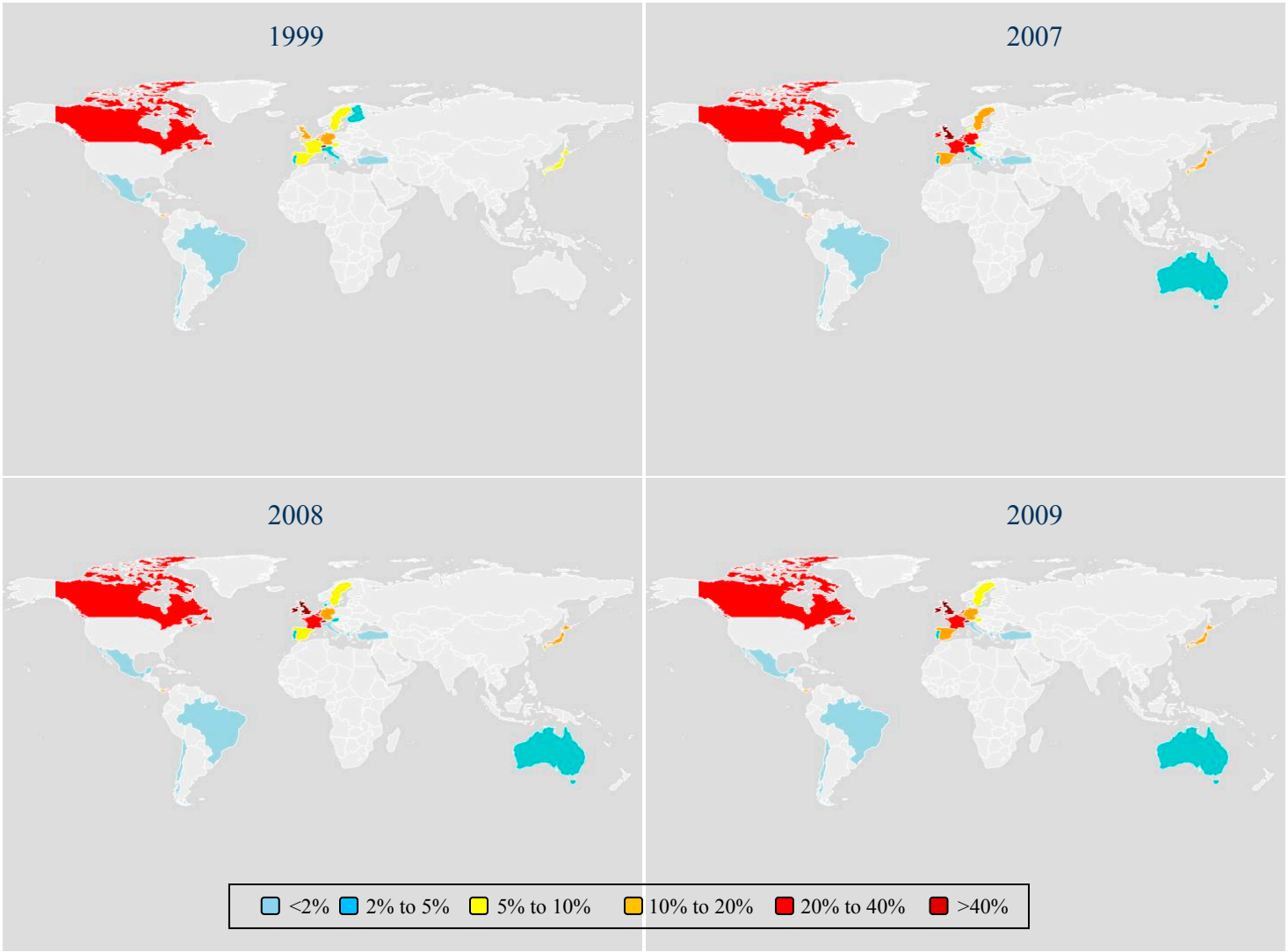
Source: Treasury TIC database, WEO, and IMF staff calculations

Figure 11: US Banks' Claims on Foreigners (in percent of foreign GDPs)



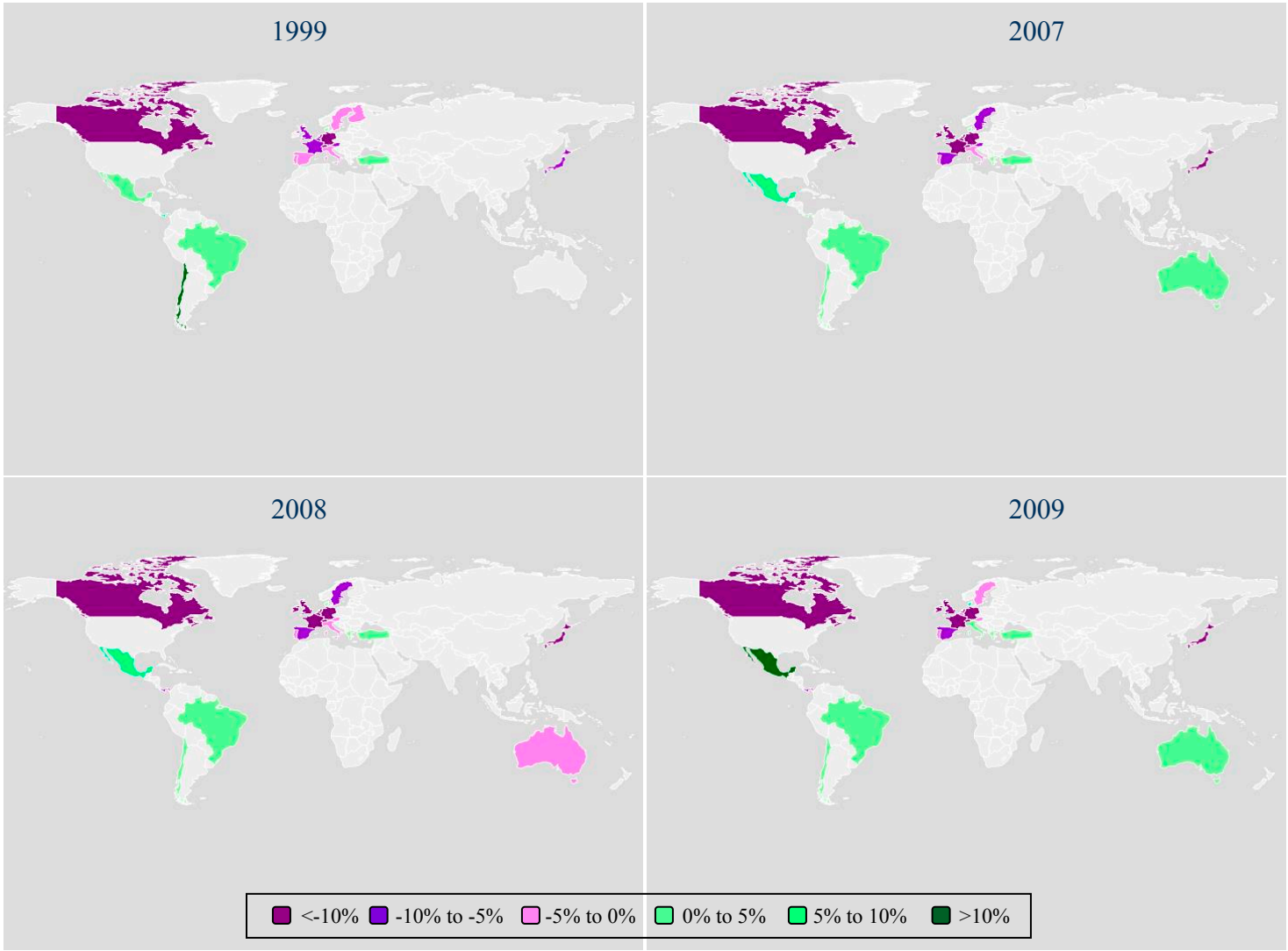
Source: BIS, WEO, and IMF staff calculations.

Figure 12: Foreign Banks' Claims on US (in percent of foreign GDPs)



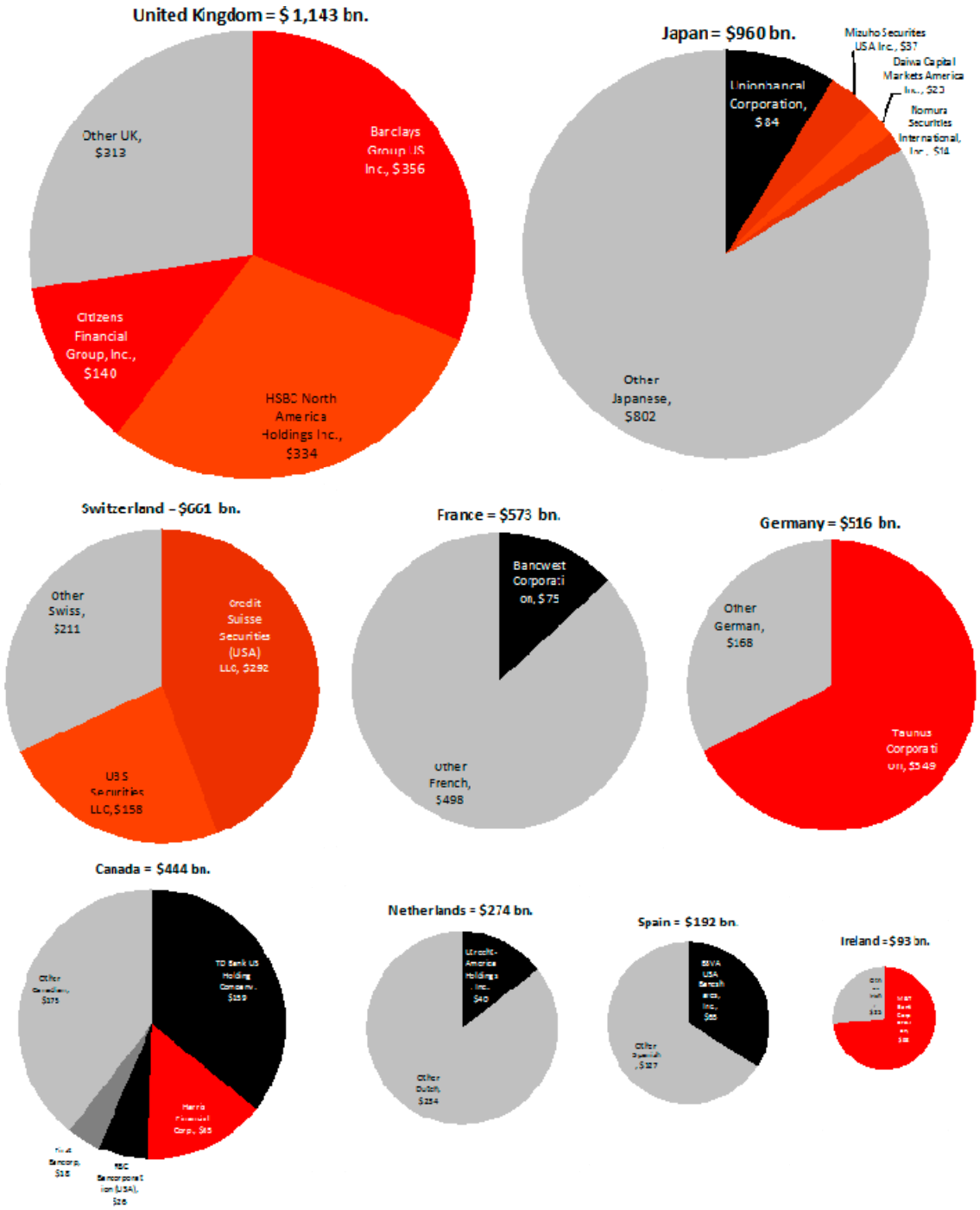
Source: BIS, WEO, and IMF staff calculations.

Figure 13: Net US Banks' Claims (in percent of foreign GDPs)



Source: BIS, WEO, and IMF staff calculations.

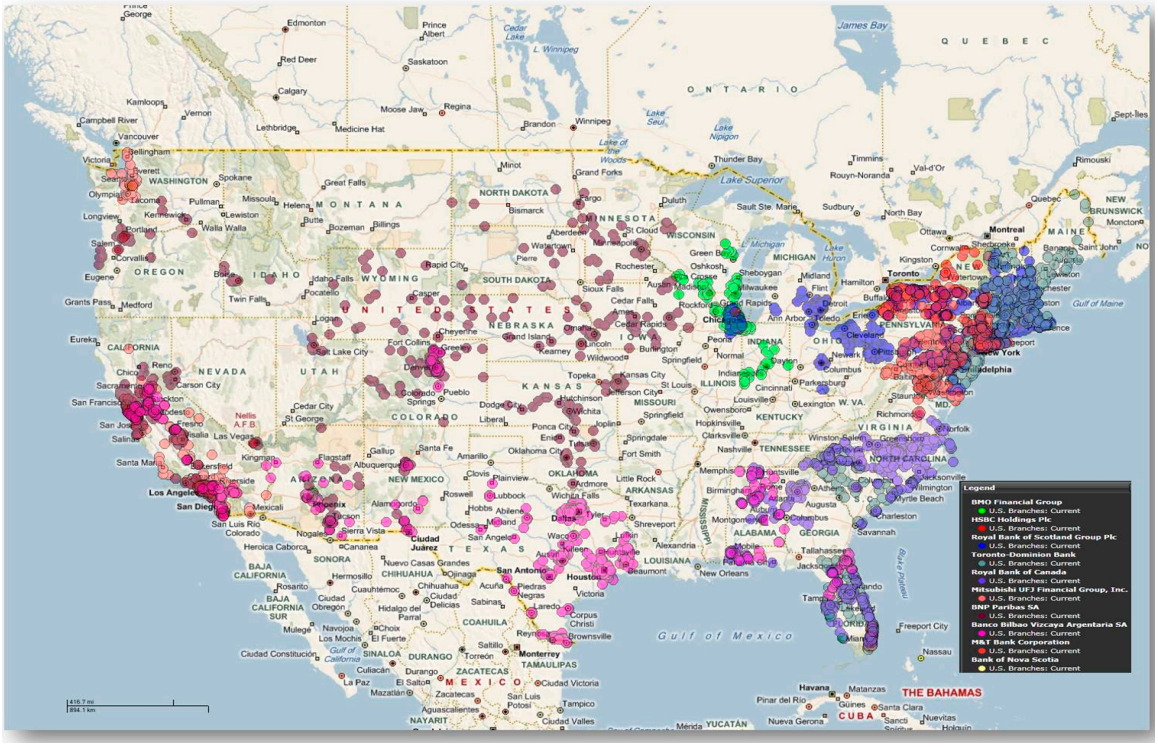
Figure 14: Claims on US by Foreign-Owned Large BHCs or Primary Dealers
(BIS Ultimate Risk Basis, billion dollars)



Key: Red/orange for investment banks/primary dealers; black/dark grey for commercial banks; light grey for unallocated.
Sources: Bank for International Settlements, *BIS Quarterly Review*; and Federal Reserve, *Bank Holding Company Performance Reports*.

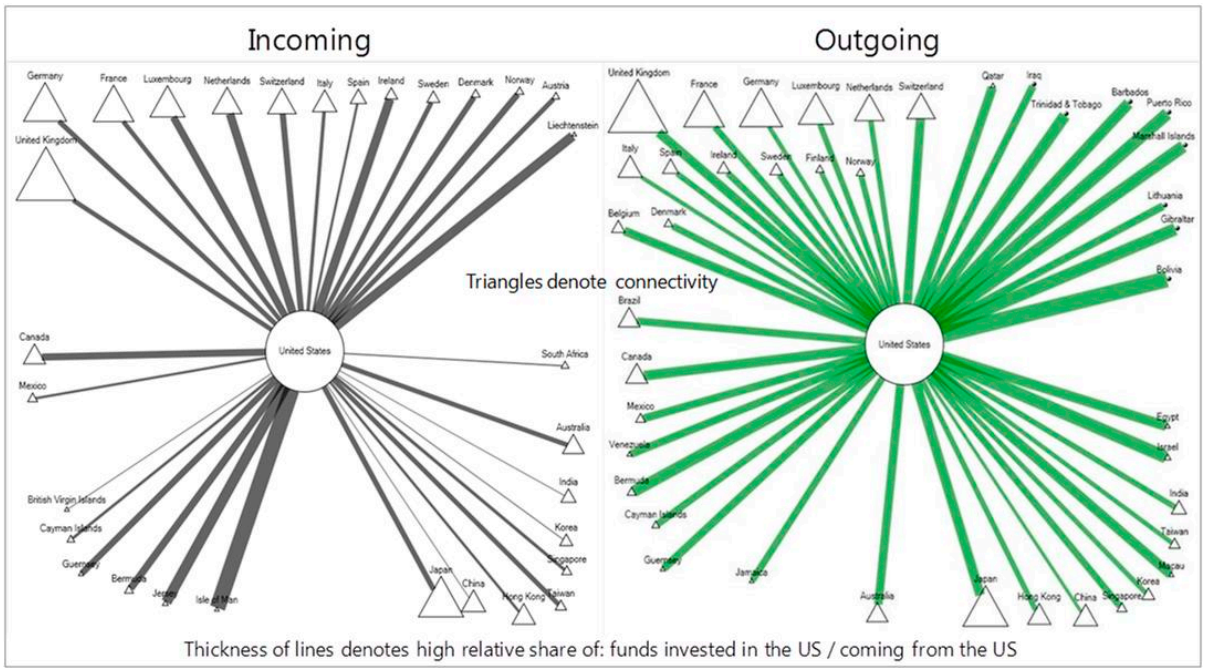
Figure 15: US Locations of Foreign Commercial and Investment Banks' Branches

(a) Commercial Banks



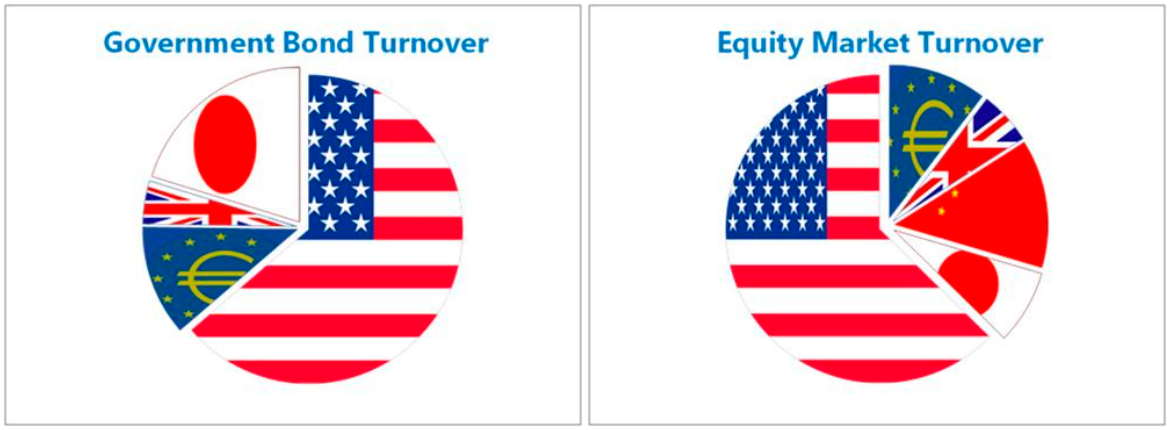
(b) Investment Banks

Figure 16: Fund Flows In and Out of the US



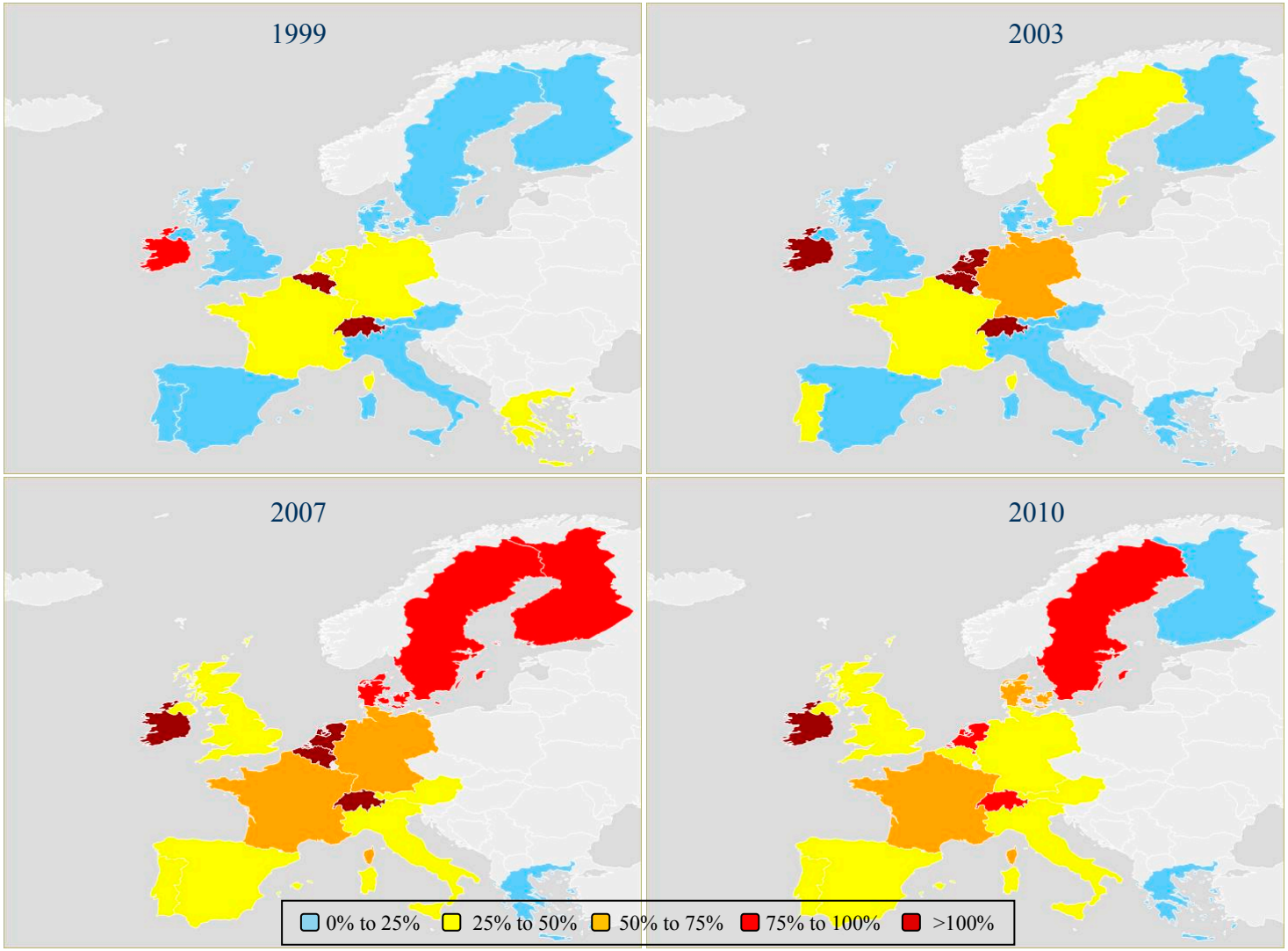
Source: Lipper and IMF staff calculations.

Figure 17: Turnovers in the Systemic Government Bond and Equity Markets (2009)



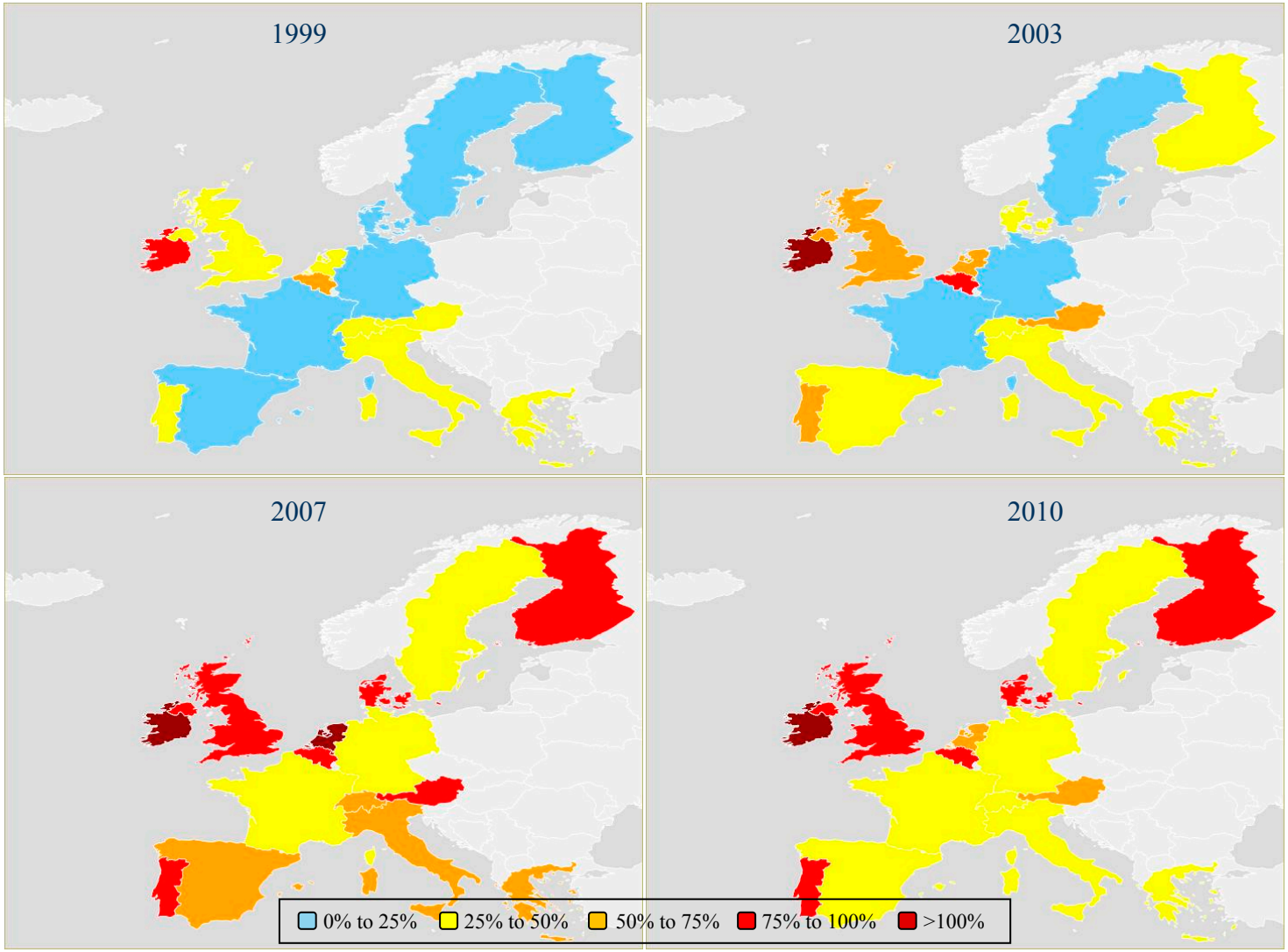
Source: National Debt Agencies, JSDA, FRB NY, WFE, and IMF staff calculations.

Figure 18: Claims By European Banking Systems On Other European Banking Systems (in own GDP)



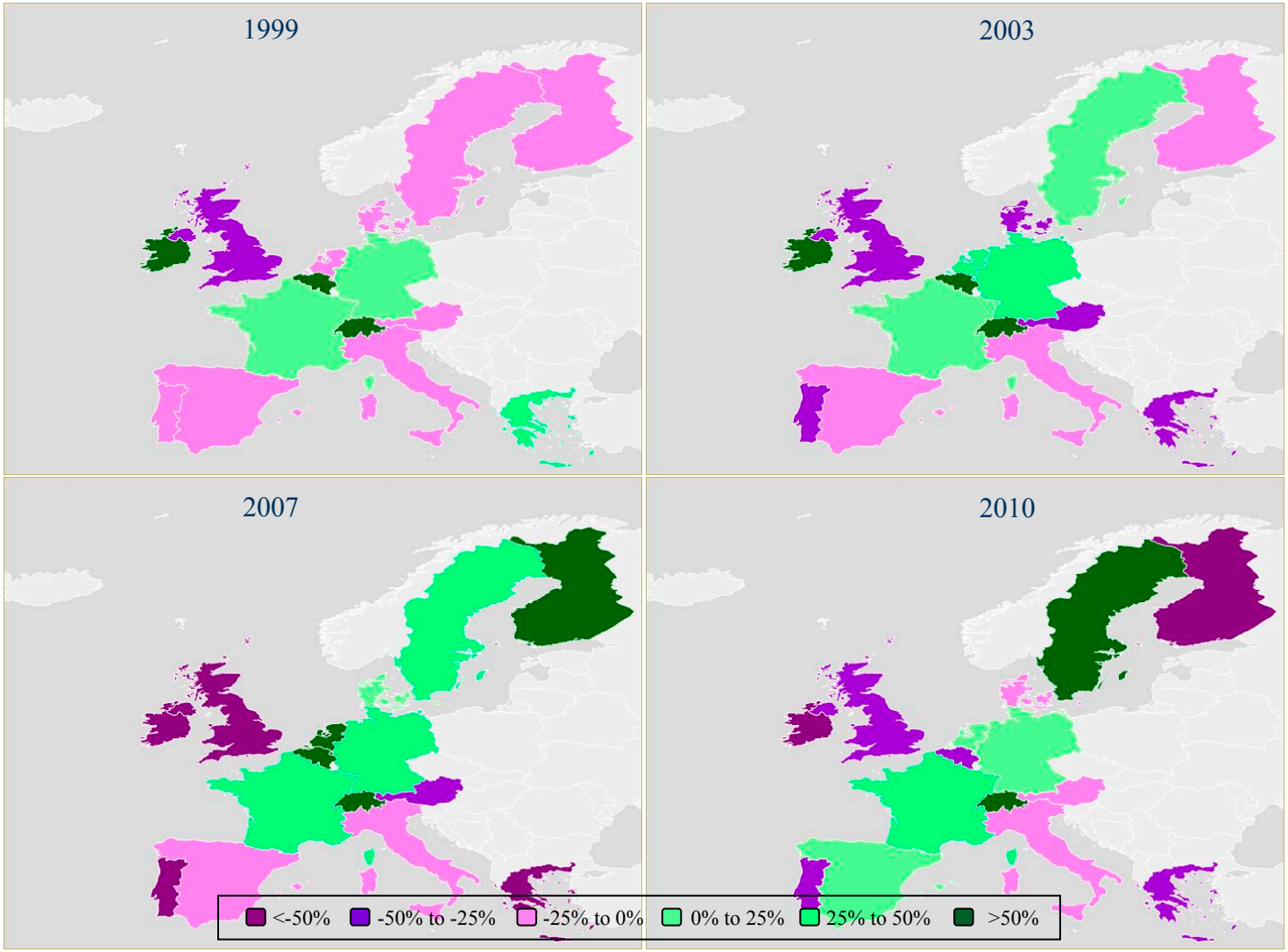
Source: BIS, WEO, and IMF staff calculations.

Figure 19: Claims On European Banking System By Other European Banking Systems (in own GDP)



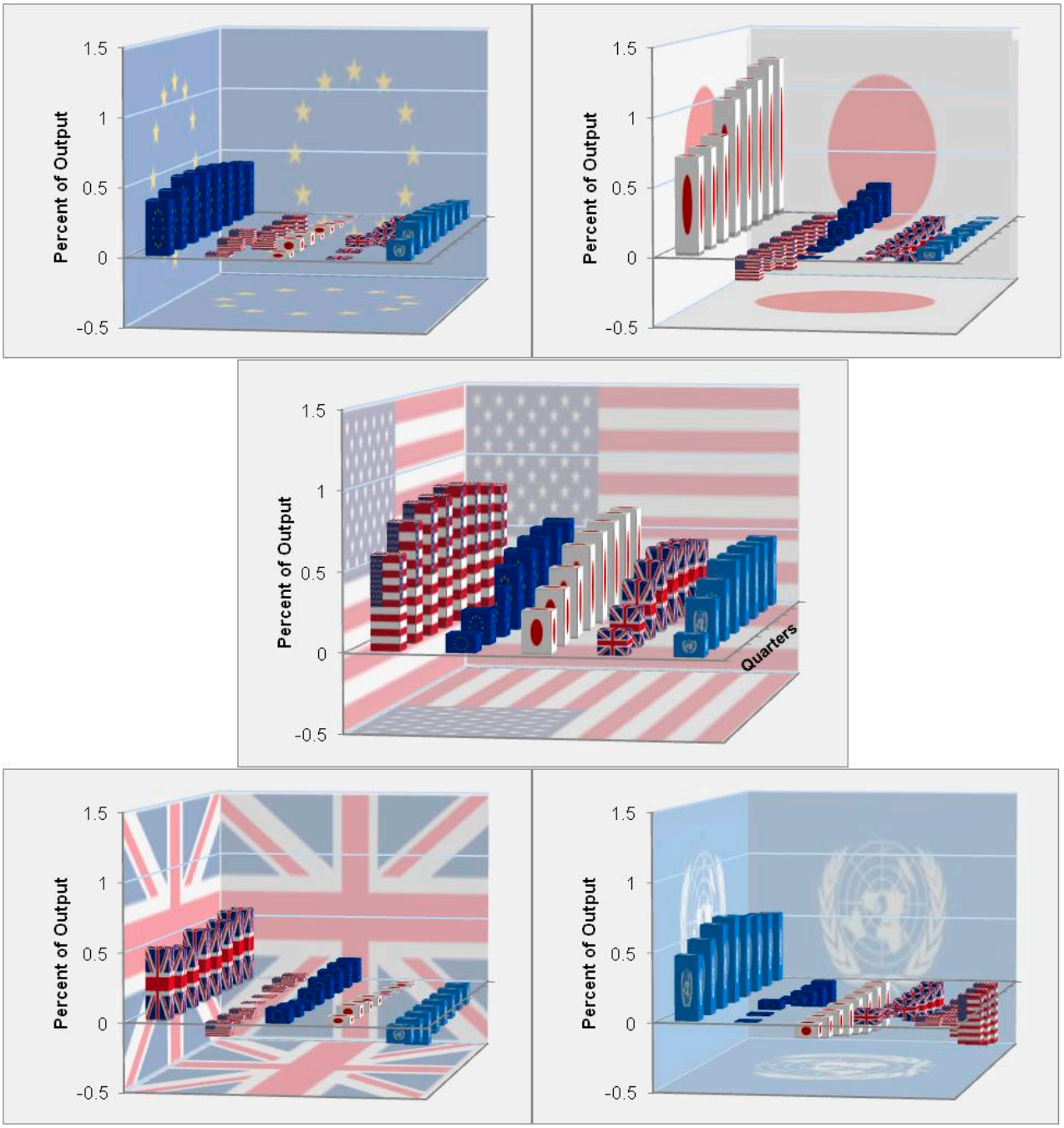
Source: BIS, WEO, and IMF staff calculations.

Figure 20: Net European Banking Systems' Claims On Other European Banking Systems (in own GDP)



Source: BIS, WEO, and IMF staff calculations.

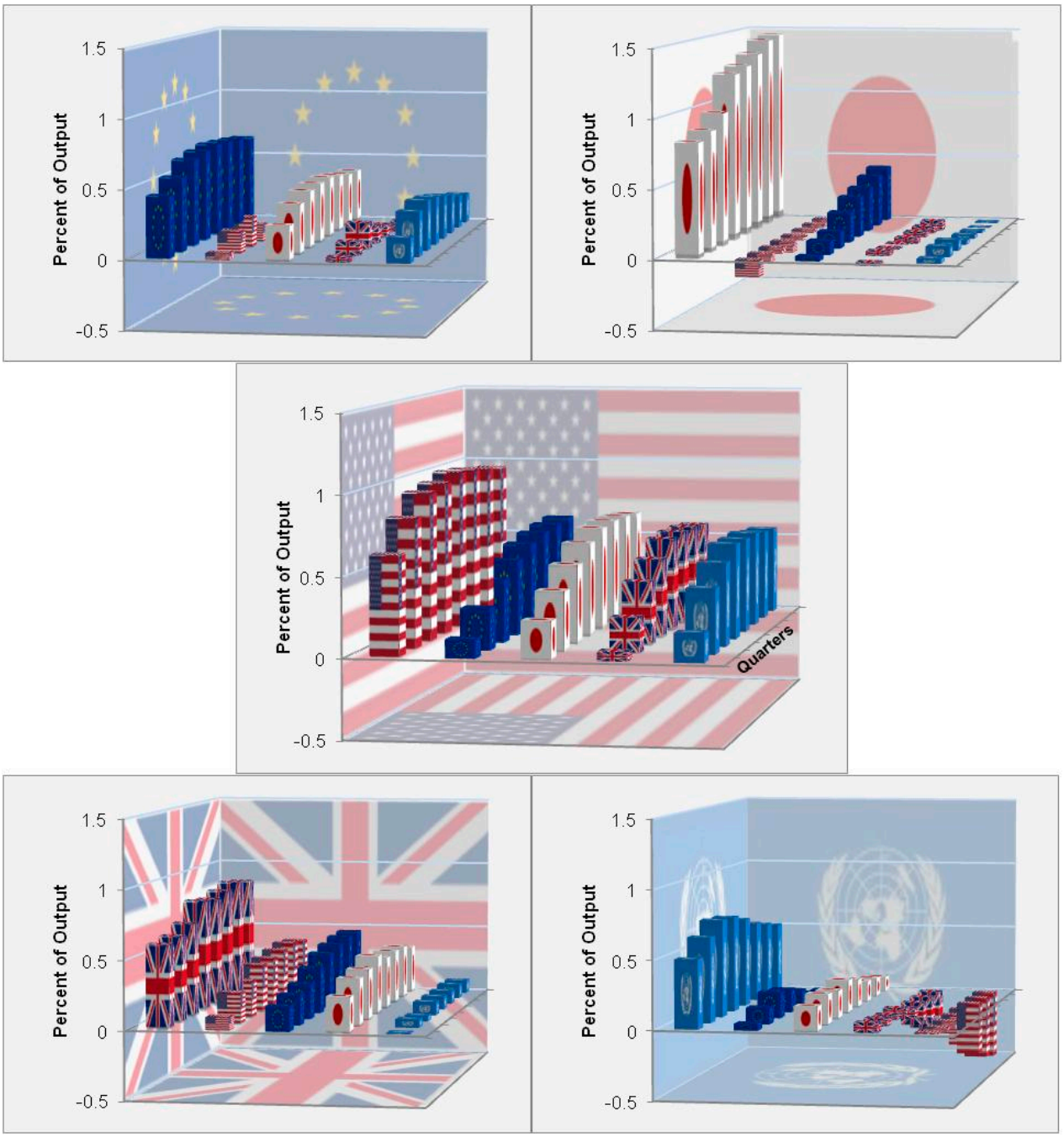
Figure 21: Empirical Growth Spillovers (1970-2007)



Note: Origin of shock is depicted by country flag embedded on the background.

Source: Bayoumi and Bui (2010)

Figure 22: Empirical Growth Spillovers (with 2008-2010 crisis added)

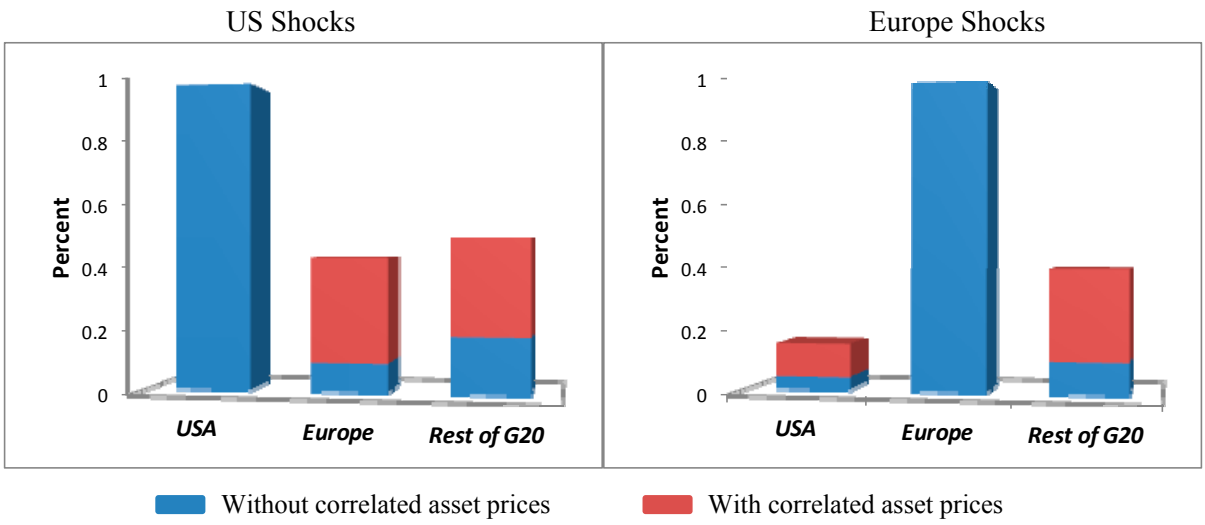


Note: Origin of shock is depicted by country flag embedded on the background.

Source: Bayoumi and Bui (2010)

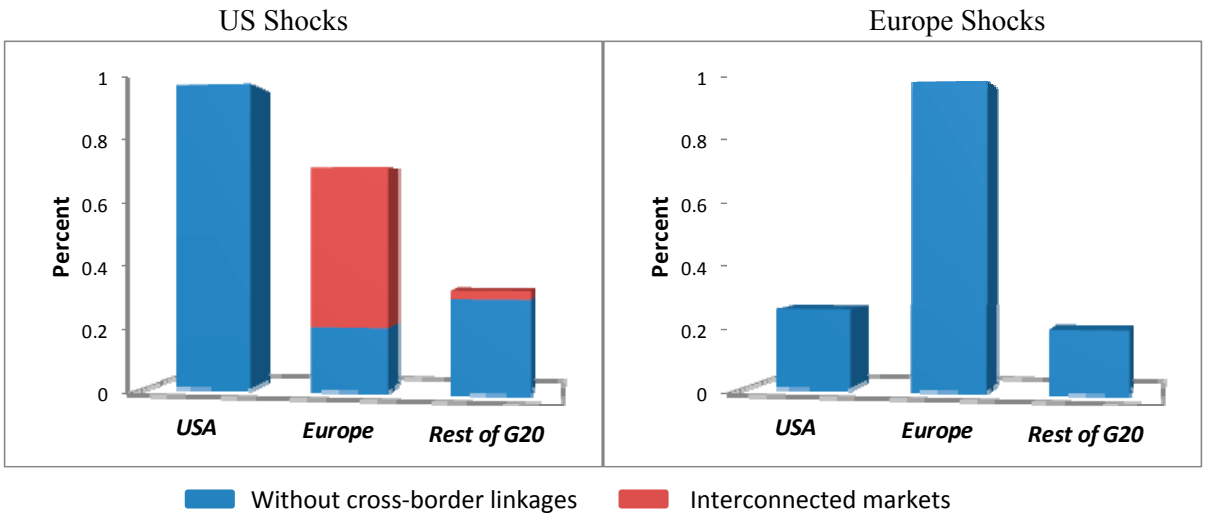
Figure 23: Simulated Growth Spillovers from G-20 Model with Macro-Financial Linkages

(a) Indirect Financial Linkages



Note: Depicts average peak output loss from demand, supply, duration risk premium and equity premium shocks, which generate peak output loss of one percent in country where shocks originated.

(b) Banks' Wholesale Funding Market Disruption



Note: Depicts average peak output loss from shocks to wholesale funding costs, which generate peak output loss of one percent in country where shocks originated.

Source: Vitek (2011)

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