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CROSS-BORDER EXPOSURES AND FINANCIAL CONTAGION

ABSTRACT

Integrated financial markets provide opportunities for expansion and improved risk sharing, but also pose threats of contagion risk through cross-border exposures. This paper examines cross-border contagion risk over the period 1999-2006. To that purpose we use aggregate cross-border exposures of seventeen countries as reported in the BIS Consolidated Banking Statistics. We find that a shock which affects the liabilities of one country may undermine the stability of the entire financial system. Particularly, a shock wiping out 25% (35%) of US (UK) cross-border liabilities against non-US (non-UK) banks could lead to bank contagion eroding at least 94% (45%) of the recipient countries' banking assets. We also find that since 2006 a shock to Eastern Europe, Turkey and Russia affects most countries. Our simulations also reveal that the "speed of propagation of contagion" has increased in recent years resulting in a higher number of directly exposed banking systems. Finally we find that contagion is more widespread in geographical proximities.

JEL Classification Codes: G15, G20, G29

Keywords: Cross-border contagion, financial integration, financial stability.

1. INTRODUCTION

The recent financial crisis, while having its roots in the US, spread globally in a very short span of time. The higher delinquencies in the mortgage market quickly ripple through, not only other financial markets in the US, but also abroad. As a result, the US subprime crisis turned into a global macroeconomic shock leading the US, along with the Euro zone and Japan, into recession. Though the governments and international financial institutions have announced bailout packages of trillions of dollars, the crisis is still unfolding. The deteriorating conditions, despite all coordinated interventions worldwide, expose fundamental weaknesses in the international financial system. The ongoing banking problems illustrate that monitoring financial stability is important locally as well as globally. Therefore, it is worth studying the transmission channels to be able to identify the vulnerabilities in the international banking system.

Banks are important because the instability of the banking sector in a country may have severe effects on other sectors of the economy. Moreover, the banking sector has a large penetration in the international market.[1] Therefore, a shock can be easily transmitted across borders due to an unsustainable loss on bank lending to foreign counterparties. In this paper we study cross-border financial contagion, defined as the situation when an idiosyncratic shock that hits the foreign liabilities (entirely or partly) of a country starts domino effects that impact other banking systems worldwide.

Foreign claims have increased both in absolute terms as well as relative to aggregate measures of real economic activity. The Bank for International Settlements (BIS) reported an increase in international claims on banks (in absolute terms), from $584 billion at end-1977 to $21 trillion in the second quarter of 2007.[2] Similarly, in relative

[1] The reasons for international presence of banking system include: financial sector liberalization during the late 1990s has provided opportunities for international and cross-state (cross-border) banking. Second, the wave of mergers and acquisitions in the banking sector, both within and outside the United States, led to banking conglomerates at the international level that have greater financial needs and therefore establish banking relationships across the world. Third, the integration of European countries into one monetary union also increased significantly the cross-border relationships. Fourth, banks have developed risk management systems allowing them to price and manage more adequately international assets.

[2] The increase may partially be attributed to a widening of the reporting area as data for the Cayman Islands, Hong Kong SAR, Singapore and other offshore financial centres are only available from end-1983. Whereas Australia, Bermuda, Greece, Guernsey, the Isle of Man and Portugal start reporting in

terms, cross border exposures increased from 10% of world GDP in 1980 to 48% of world GDP in the second quarter of 2006.

Despite increasing foreign claims, only a few papers deal with this topic even though the ongoing credit crisis shows that cross-border contagion has become more important. The papers that deal with cross-border contagion can be subdivided in two groups, depending upon their approach. The first group employs equity prices to measure cross-border contagion (Hartmann, Straetmans and de Vries (2005), Gropp and Moerman (2005), Gropp, Duca and Vesala (2006) and Bautista, Rous and Tarazi (2007)).[3] These papers mostly study within country contagion or contagion within continents. The second group of papers uses data on bank exposures. In particular, they employ cross-border exposures, but focus on the effects on a single country (Van Lelyveld and Liedorp (2006) study interbank contagion for the Netherlands, while Degryse and Nguyen (2007) focus on Belgium), or they study contagion originating from the failure of emerging countries (McGuire and Tarashev (2007)).[4] These papers highlight the increasing importance of cross-border exposures. We contribute to this literature by focusing on foreign claims of a sample of developed and developing countries to investigate empirically the potential for contagion risk through cross-border bank exposures across a more diverse set of countries and continents. We use the BIS Consolidated Banking Statistics for this purpose. We discuss several scenarios where we assume that an exogenous, sudden and idiosyncratic shock hits the foreign liabilities (entirely or partly) of a country. Following the initial failure, the shock propagates through cross-border exposures to banks in other countries and results into domino-type effects potentially causing systemic crisis. The contagion risk is gauged through the number of banking systems in other countries that potentially default following the non-payment of foreign claims against the failing country (ies).

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or after 1998. However, banks located in these countries accounted for less than 5% of total claims of BIS reporting banks in 2006.

[3] De Bandt and Hartmann (2001) provide a survey of various studies using asset price (equity) co-movements for measuring the impact of contagion.

[4] Recently, a series of papers have studied banking contagion stemming from within country interbank exposures (see e.g. Angelini et al. (1996) and Mistrulli (2007) for Italy; Blavarg and Nimander (2002) for Sweden; Furfine (2003) for the US; Wells (2004) for the UK; Upper and Worms (2004) for Germany; Lubloy (2005) for Hungary; Elsinger, Lehar and Summer (2006) for Austria; and Muller (2006) for Switzerland).

Our paper therefore aims to contribute in several respects. First, it studies cross-border contagion for the first time using foreign claims from the BIS database. Second, while most papers focus on domestic interbank contagion at one point in time, our study provides an extension by looking at the evolution of cross-border contagion over the period 1999 and 2006. Third, we attempt to identify the size of a systemically important shock for cross-border contagion. Fourth, our analysis shows the economic impact of cross-border contagion besides indentifying highly vulnerable banking systems.

In this paper we find that contagion risk and the speed of contagion through cross-border exposures have increased during 1999-2006. We find that a shock which affects partially the liabilities of one country may undermine the stability of the entire financial system. Particularly, a shock wiping out 25% (35%) of US (UK) cross-border liabilities against non-US (non-UK) banks could lead to bank contagion eroding at least 94% (45%) of the recipient countries' banking assets, assuming 100% loss given default (LGD). We also find that since 2006 a shock to Eastern Europe, Turkey and Russia affects most countries. Our simulations also reveal that contagion is often more confined to geographical proximities (i.e. regional, if not global), and that the US is the only country immune to cross-border shocks and contagion stemming from other countries.

The remaining of this paper is organized as follows. Section 2 introduces the dataset while Section 3 elaborates on methodological details. The results are analyzed in Section 4. Section 5 concludes this paper.

2. DATA

We use *bank credit* to foreign countries as the source of cross-border exposures. These foreign claims include the exposure of a country's banking system to all sectors (i.e. bank, non-bank and public) of other countries. BIS provides information on such foreign claims of reporting countries to the rest of the world in the *Consolidated Banking Statistics*.[5] It covers data on (national) contractual lending by the headquartered banks and all of their branches and subsidiaries worldwide to

[5] 'Reporting countries' include all participating countries in the BIS consolidated banking statistics. These countries report foreign claims vis-à-vis each other as well as against all non-participating countries. These non-participating countries are hereby called the non-reporting countries.

borrowers residing outside the country of origin (where the bank's headquarter is stationed) on a consolidated basis (i.e. net of inter-office account). It is one of the two broad categories in which BIS compiles data through the central banks of the reporting countries.[6] Further, we use foreign claims on immediate borrower basis, i.e. the allocation of foreign claims of reporting banks to the country of operations of the contractual counterparty. It means that, for example, we employ the foreign claims of *British* banks on *all* financial institutions operating in the US (irrespective of their nationality).

The reporting institutions in each country include all institutions that are allowed to *receive deposits and/or close substitutes for deposits and grant credits or invest in securities on their account.* Therefore, the reporting institutions include commercial banks, savings banks, savings and loan associations, credit unions or cooperatives, building societies, and post office savings banks or other government-controlled savings banks, but not central banks.

<please insert figure 1 here>

Our sample includes foreign claims outstanding at the end of each year for the banking systems of 14 European countries, Canada, Japan and US.[7] The foreign claims of these countries' banking systems are available for a long time period (1999-2006) allowing us to study contagion risk over time. Figure 1 reports a snapshot of foreign claims of reporting countries on each other. Each country is represented by a *node*, while a *link* represents the quantum of foreign claims of one node to the other. The thickness of the links indicates the relative magnitude of such claims with respect to the global cross-border financial assets. We find that the US has central position having significant ties with the rest of the world.

<please insert table 1 here>

Table 1 provides summary statistics on foreign claims. We find that foreign exposures are clustered in geographical regions. For example, Austria has 28 percent of its foreign claims on Germany; Belgium has 32 percent on France and Netherlands;

[6] BIS also reports *locational banking statistics*, i.e. international financial claims of all banks located in reporting countries to borrowers outside the geographical boundary on a gross (unconsolidated) basis.
[7] Included European countries are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland, and United Kingdom.

Denmark has 41 percent on Germany and Sweden; Finland has 62 percent on Denmark and Sweden; Italy has 28 percent on France and Germany; Portugal has 36 percent on France and Spain; Sweden has 64 percent on Denmark, Finland and Germany; and Canada has 72 percent of foreign claims on the US only. The exceptions to the geographical proximities rule are the US and UK. Many countries (especially Japan and Switzerland) have high proportion of foreign claims on the US and UK irrespective of their location.

The dataset we use has several advantages. The consolidated banking statistics assigns foreign offices to their country of origin. This may be a better representation if foreign offices are affected more by an adverse shock in the country of origin as compared to a similar shock in the country of operations (in the latter case they could be rescued by the headquarters). Moreover, the consolidated banking statistics though are not the interbank data; it connects domestic banking system to foreign economies thus providing a channel to gauge the impact of external shock. On the other side, the non-availability of interbank data is due to the fact that the BIS do not report the sectoral classification (i.e. bank, non-bank and public) of foreign claims of reporting countries vis-à-vis each counterparty.[8] Further, the consolidated banking statistics on immediate borrower basis does not take into account the nationality of contractual counterparties (i.e. for example, it reports foreign claims of British banks on all financial institutions in the US, but not on all American financial institutions). The BIS has managed this issue by reporting foreign claims on the ultimate risk basis, i.e. the allocation of claims of banks of reporting countries to the country of origin of the ultimate obligor. However, the data on ultimate risk basis are only available since March 2005, preventing us from evaluating contagion risk over time.

Data on bank equity for the financial institutions of each reporting country are taken from *Bankscope*. We sum up ordinary equity of all financial institutions except the Central banks to get the aggregate bank equity at country level for each year. We preferably use consolidated accounting statements of all reporting financial institutions in Bankscope in these calculations. If the consolidated statement is not available, then we use the unconsolidated/aggregate accounting statement, whatever is

[8] BIS reports sectoral classification at aggregate level only. For example, it reports foreign claims of British banks on banks of the rest of the world, but not foreign claims of British banks on banks in the US.

available. Similarly, if accounting statements are available on both IFRS and Local GAAP reporting conventions, then we use the former convention.

3. METHODOLOGY

We use the methodology of Upper and Worms (2004) for our contagion exercises. This methodology simulates a mechanical chain of domino effects caused by an exogenous initial shock. Our exogenous shock is the default of a triggering country (i.e. its bank, non-bank and public sector) on its foreign liabilities. The banking system of a recipient country defaults in the first round when its foreign claims against the bank, non-bank and public sector of the triggering country exceed its aggregate bank equity. The failing recipient countries in each round may affect other countries in successive rounds due to their combined effects. The contagion process stops when there is no new country that defaults in that round (i.e. combined foreign liabilities of both the trigger and failed recipients of previous rounds are less than the bank equity of each non-failed recipient country). We employ this methodology over our entire sample period 1999-2006 to evaluate the impact of contagion over time.

We can represent the countries' foreign claims and liabilities as follows:

$$X = \begin{bmatrix} \overbrace{x_{1,1} \cdots x_{1,j} \cdots x_{1,N}}^{\text{Re porting Countries}} & \overbrace{x_{1,N+1} \cdots x_{1,N+M}}^{\text{Non-Re porting Countries}} \\ \vdots \ddots \vdots \ddots \vdots & \vdots \ddots \vdots \\ x_{i,1} \cdots x_{i,j} \cdots x_{i,N} & x_{i,N+1} \cdots x_{i,N+M} \\ \vdots \ddots \vdots \ddots \vdots & \vdots \ddots \vdots \\ x_{N,1} \cdots x_{N,j} \cdots x_{N,N} & x_{N,N+1} \cdots x_{N,N+M} \end{bmatrix} \text{ with } \sum_{j=1}^{N+M} x_{ij} = a_i \text{ and } \sum_{i=1}^{N} x_{ij} = l_j$$

where x_{ij} are the consolidated foreign claims of the banking system of country i on the bank, non-bank and public sector of country j, N is the number of reporting countries (N=17 in our case) and M is the number of non-reporting countries. The summation $\sum_{j=1}^{N+M} x_{ij} = a_i$ represents the total foreign claims of country i on the rest of the world. Similarly, $\sum_{i=1}^{N} x_{ij} = l_j$ represents the total foreign liabilities of country j

towards the rest of the reporting countries. This matrix also shows the foreign claims on the M non-reporting countries.

The aggregate bank equity has an initial value C_i equal to the ordinary equity directly observed from the balance sheets of financial institutions in country *i.* It is reduced by the amount of the foreign claims of country i against the triggering country in the first round, and then by the cumulative amount of the foreign claims of country *i* against all failing recipient countries in each round of contagion. Therefore, the country i defaults when:

$$C_i - \sum_{j=1}^{N+M} \lambda_j \theta x_{ij} < 0$$

where C_i represents aggregate bank equity of country i, λ_j is a dummy variable whose value is 1 if the country j defaults, and 0 otherwise, θ shows the percentage of loss given default (LGD), whereas x_{ij} is obtained from the previous matrix representing the consolidated foreign claims of country i on country j .

<please insert figure 2 here>

Figure 2 depicts the same procedure in a graphical manner. The domino effect starts when the triggering country defaults on its foreign liabilities. Depending upon our assumptions on LGD, the loss on foreign claims to the triggering country is fully or partially ascertained by recipient countries. If aggregate bank equity of a recipient country is larger than the shock, the banking system survives with partial damage to the aggregate equity. On the other hand, if the aggregate bank equity of the recipient country is not sufficiently high to absorb the shock, the banking system defaults. Here we assume that the banking system's default would lead to the default of all sectors of the country through domestic spillovers; therefore the foreign claims on this country add to the shock for the next round of contagion. In each successive round, all non-defaulting countries have lower chances of survival due to combined losses on foreign claims to defaulting countries in the preceding round. The system becomes stable when no country defaults in the current round or all countries default.

There are some caveats to this simulation process. Although aggregate foreign claims at the country level are directly observable, the distribution of foreign claims among financial institutions within each country is not known. This implies that we need to make some assumptions on the distribution of foreign claims. As a first step, we assume that *all* banks share foreign claims on other countries proportional to their assets. Furthermore, we assume that *all* banks' equity is employed as a cushion to absorb the shock. Therefore the failure of a triggering country on its foreign liabilities affects all banks together. In later exercises; however, we assume that foreign claims are distributed among *large* banks only.

Further we assume an exogenously determined LGD that is kept constant over time, and during all rounds of contagion and across all countries. While this may seem a very strong assumption, we find however that all included countries have a similar and stable sovereign credit rating throughout the sample period. Therefore we deduce that all countries may have similar standing to deal with a crisis and hence a similar LGD for their respective debtors. Lastly it is also assumed that no netting of exposures occurs in the event of default.

4. RESULTS

We analyze the impact of the (partial) default by a country on its liabilities, labeled as the triggering country. The foreign claims of the banking systems of recipient countries vis-à-vis this triggering country erodes bank capital. The magnitude of the final shock is the LGD times the initial shock. In our examination we use various levels of LGD (i.e. 20%, 40%, 60%, 80%, and 100%); however, we find a significant decline in contagion when LGD is below 60%. Therefore we report simulation results for 100% LGD (worst case) and 60% LGD (threshold level) only. We present simulation results for two different cases: 1) *all* banks are internationally exposed; 2) only *large* banks are internationally exposed. In each case, we evaluate the possible contagion stemming from exposures to reporting and non-reporting countries, identify the most vulnerable banking systems, examine contagion risk over time, and report the economic significance of potential contagion.

4.1. Case 1: *All* banks are internationally exposed

In case 1, we investigate cross-border contagion of a default of the triggering country on all its foreign liabilities, under the assumption that foreign claims towards a recipient country are distributed among all banks in that country. Cross-border contagion occurs when the banking system in at least one of the recipient countries defaults at the given LGD. In this exercise, the national banking system acts as one unit, i.e. all banks hypothetically pool their equity to compensate the losses incurred on foreign claims to defaulting countries. We have 17 reporting countries that may be a trigger. We label these as *reporting triggers.* We also have the claims of the banking systems of the different reporting countries on 20 non-reporting countries, which we label as *non-reporting triggers.* These non-reporting countries include countries from Eastern Europe (plus Russia and Turkey), Latin America and Asia.

<please insert figure 3 here>

Figure 3 displays the results of our simulation exercise. It shows that contagion risk has increased over time particularly in terms of an increasing number of triggering countries that may lead to contagion, as well as more failing recipient countries to each trigger. The upper panels show the results for reporting triggers while lower panels elucidate contagion from non-reporting triggers. Each scenario is evaluated at 100% LGD and 60% LGD. Panel (a) shows that the number of reporting triggers increased to eight in 2006 (i.e. the US, UK, Germany, Italy, Netherlands, Denmark, Sweden and Finland), as compared to only four countries in 1999 (i.e. the US, UK, Germany and the Netherlands). The US, UK and Germany would have triggered cross-border contagion over the entire sample period. The contagion triggered by the US is the most severe, and spreads to almost all reporting countries in many years. The default of UK also affects a majority of other reporting countries (12 to 15 countries). The US and UK have triggering potential even at low percentages of LGD. The impact of cross-border contagion from Germany has particularly increased over time, affecting 13 countries in 2006. The Netherlands almost always affects Belgium, while default of any Scandinavian country affects the whole neighboring region. Japan triggers cross-border contagion in 2002 only affecting Ireland. Similarly Italy triggers cross-border contagion in 2006 only; however it would affect 14 out of 16

recipient countries. Panel (b) depicts a similar pattern for 60% LGD: cross-border contagion is triggered by the US, UK, Germany, and Scandinavian countries.

<please insert figure 4 here>

Similarly, panel (a) of figure 4 reports contagion triggered by non-reporting countries/regions at 100% LGD. Norway causes cross-border contagion to neighboring countries in the Scandinavian region. Moreover, the default of Latin American countries has cross-border implications for Spain throughout. Distinctively, the default of Eastern Europe (plus Russia and Turkey) affects 15 recipient countries. Though Austria is the only country that is directly exposed to the shock, the combined effect in later rounds cause Scandinavian countries to default and then the contagion spread to Ireland and other major European countries in later rounds. Panel (b) of figure 4, that reports results for 60% LGD, shows a low contagion potential from non-reporting countries.

<please insert table 2 and table 3 here>

Another interesting question is which banking systems are more vulnerable to contagion, and thus often appear as failing recipient countries. We find that the number of directly exposed banking systems (that default in first round) reaches its highest level in 2006, when 12 banking systems default immediately after the triggering countries experience the shock. Table 2 and 3 provide the direct and total cross-border contagion risk in 2006, respectively. The rows indicate the triggering countries that initiate contagion whereas the columns represent the recipient countries. Sweden and Ireland are the most directly exposed banking systems that default 5 times and 4 times respectively (see table 2). On the other hand, Italy and the US are completely immune to cross-border shocks taking into account 'all-round' contagion effects as shown in table 3.

Our results show that the US banking system is always resilient to cross-border contagion risk. Also, in recent years, the Italian banking system has become resilient to contagion risk from any of the triggering countries. This may stem from the large number of small banks in Italy that are not exposed heavily. Therefore the result here may be driven by our strong assumption that all banks, including small banks, are internationally exposed. We relax this assumption in the next exercise. Other recipient

countries including Austria, Denmark and Finland are not completely resilient to contagion risk but default occasionally only in the last rounds. Therefore, we classify them as less vulnerable recipient countries. Lastly, Japan, France and Portugal have moderate level of contagion risk as they default in intermediate rounds.

<please insert figure 5 here>

We also find that the number of banking systems that default in the first two rounds has increased for each triggering country in recent years. The increase is more profound when the triggers are the US and UK as shown in figure 5. Specially, the US affects 13 or more countries in just two rounds (see figure 5, panel (a)). Similarly, the default of UK leads to a cross-border contagion affecting 9 or more countries in first two rounds throughout the sample period as shown in panel (b) of figure 5.

<please insert figure 6 here>

The economic impact of possible contagion is shown in figure 6. We measure the economic impact of contagion as the percentage of total assets of the defaulting banking system(s) compared to total assets of all banking systems that could potentially be affected (excluding the triggering country). We find that the failure of the US has the largest economic impact throughout the time period. Its failure would potentially affect more than 90 percent of the global banking assets. Next to the US, the impact of the failure of UK is the most severe as it would affect around 50 percent of the banking assets in many years. The impact of Germany's failure is increasing over time and would potentially affect around 50 percent of banking assets in 2006 (similar to the UK). Other countries' cross-border exposures generate a much lower impact.

4.2. Case 2: Only *large* banks are internationally exposed

In case 2, we assume the same initial shock as in case 1; however, foreign claims are assumed to be distributed among large banks only. Large banks are defined as banks with more than $10 billion in assets. There are 947 banks of the total 6392 banks that report to Bankscope, that have $10 billion or more total assets. Large banks are generally assumed to have the required expertise to interact with international players whereas small banks may not. Large banks, therefore, may be more prone to

contagion risk via cross-border exposures. This is in line with findings in Gropp and Vesala (2004) showing that small banks neither cause nor suffer from cross-border contagion, even though all banks are equally likely to experience domestic contagion. Moreover, we assume that the selected large banks in each country act as one unit and hypothetically pool their equity to safeguard against contagion risk. Here we investigate whether the aggregate bank equity of the large banks is sufficient to absorb the shock. In this case, our assumption about domestic spillovers is more stringent (i.e., the failure of large banks leads to the default of all sectors of the recipient country). In general, we expect more contagion to take place compared to case 1, as we only include banks' equity of large banks as a cushion for default on foreign claims.

<please insert table 4 and figure 7 here>

Table 4 describes our sample of 947 large banks. We find that the banking industry in Italy is relatively less concentrated since large banks hold only 48.35 percent of the aggregate equity of all banks. We show the domino effects of possible contagion in figure 7. We find more intense contagion as expected. More specifically, as shown in panel (a), the US affects all other countries. UK would impact all but the US, while Germany has gradually increased the number of failing recipient countries. Contrary to case 1, now France, Italy and Japan could also initiate contagion. Particularly, in recent years Italy is both a failing recipient as well as a triggering country. In 2006, Italy triggers contagion through Ireland in the first round and then affects Belgium, Germany, and Netherlands in the second round. This suggests that large Irish banks have large claims on Italian counterparties, whose default would lead to failure of the Irish banking system. In the second round, Belgian, German and Dutch banks also default and start a chain of bank failures that ultimately lead to the default of all banking systems except the US. However, the speed of contagion is low, as it takes several rounds to complete the contagion process. Other triggers include countries from the Benelux, and the Scandinavian region. These countries have mainly a regional impact.

In panel (b) of figure 7, the results for a similar contagion exercise are shown with a 60 percent LGD. We find that the US remains the crucial triggering country leading to default of all other countries over the entire sample period. Similarly, the UK also

affects major countries except the US and Japan. These two countries are gaining contagion momentum in recent years, especially in 2006. Germany triggers contagion, but only on a limited scale. Lastly, Scandinavian countries only trigger regional contagion.

<please insert figure 8 here>

As we have the claims of the reporting countries to a set of non-reporting countries, we can check contagion possibilities stemming from their failures. In panel (a) of figure 8 we observe that Norway, Latin America and Eastern Europe (plus Russia and Turkey) cause contagion in some years at 100 percent LGD. Norway's contagion impact is limited to the Scandinavian region; however, Latin America and Eastern Europe (plus Russia and Turkey) may lead to global contagion in recent years. Panel (b) shows that with an LGD of 60%, there is no possibility of global contagion stemming from non-reporting countries/regions.

<please insert table 5 and table 6 here>

In terms of direct exposure (recipient countries which fail in the first-round), we find a similar pattern as the one we observe in case 1. Table 5 reports direct cross-border contagion in 2006 and reveals that the banking systems that are directly exposed are also the same as in case 1. We find that the Netherlands and Switzerland are directly exposed to 3 triggering countries whereas Sweden and Ireland are directly affected by 5 and 4 triggering countries, respectively. Finally, table 6 shows that the US is the only country that is not affected by cross-border contagion.

<please insert figure 9 here>

Figure 9 displays the economic impact of contagion for the US, UK and Germany. We assume that only large banks are internationally exposed and an LGD of 100 percent. We observe that an exogenous shock to the US would lead to 100 percent loss of total assets of all other banking systems. Similarly, an exogenous shock to the UK would affect around 70 percent of total assets over the entire sample period. The economic impact of Germany is increasing over time and equal to the impact of UK in 2006.

It is important to note that the US remains completely resilient to contagion risk in case 2 as well. Moreover, Italy as well as Austria, Finland and Portugal may be classified as less vulnerable countries.

4.3. Systemically Important Country Shock/Bank

The recent subprime crisis also raises questions whether a single large bank or a group of banks can trigger a chain of dominos that potentially leads to cross-border contagion. We investigate this possibility by considering a shock to a fraction of a country's cross-border exposure only. We simulate initial shocks ranging from 5 percent to 100 percent, in steps of 5 percent each. This allows us to check the critical magnitude of the initial shock that would potentially cause a significant loss of banking assets of recipient countries through cross-border contagion, and compare it with the concentration of the triggering countries banking system. There is no clear definition of a systemically important bank/shock. For our analysis, we consider a systemically important bank/shock to be one affecting 20 percent of other banking systems assets.

<please insert figure 10 here>

Figure 10 panels, (a), (b), and (c), display the results for our three most important triggers, US, UK and Germany, respectively. Figure 10 panel (a) shows that, in 2006, an initial shock of as low as 25 percent of the US's foreign exposure would have triggered cross-border contagion, eroding 95 percent of the banking assets at 100% LGD, of which 80 percent of banking assets are lost in the first round. Whereas the same initial shock would erode only 3 percent of banking assets at 60% LGD. However, an increased initial shock of 60 percent shock could lead to a massive erosion of 72 percent of the banking assets.

A similar analysis for the UK is reported in panel (b) of figure 10, again assuming a LGD of 100%. It reveals that an initial shock of 35 percent of its cross-border exposures lead to an erosion of 45 percent of the banking assets of all recipient countries. Compared to this 35 percent shock, a 100 percent default of UK would lead to the erosion of 49 percent of the banking assets, of which 33 percent would happen

in the first round. On the other hand, assuming 60 percent LGD, a 75 percent initial shock would have resulted in cross-border contagion eroding 45 percent of the banking system. Lastly, panel (c) reports the results for Germany: an initial shock wiping out 60 percent of Germany's cross-border liabilities affects 50 percent of the banking assets assuming 100 percent LGD. However, Germany would not trigger any significant contagion assuming 60 percent LGD during our sample period.[9]

In sum, based on an LGD of 100% and for 2006, we find that a 25%, 35%, and 60% shock to respectively the US, UK and Germany, can be classified as a systemically important shock. This compares to three-bank concentration ratios of 20%, 44% and 25% for the US, UK and Germany, respectively. This shows that a shock that would affect the liabilities of the three largest banks (and an equal fraction of the non-bank and public sector) in the US and the UK has the potential to lead to a systemically important shock. In unreported exercises, we also find that over time a smaller shock might become a systemically important one. For example, the size of a systemically important bank/shock dropped for the US from 45% in 1999 to 25% in 2006, and for the UK from 50% to 35%.

4.4. Is contagion a result of high exposures or limited capital?

Our results show that contagion risk exhibits considerable heterogeneity among countries as well as important time variation. We now investigate how sensitive contagion risk is to high cross-border exposures and to insufficient bank capital during our sample period. We do this by employing a probit model where the dependent variable is a binary number that equals one whenever a country is a failing recipient after a triggering country fails, and zero otherwise. The independent variables employed in the regression include the ratio of capital to total assets of the recipient, the ratio of foreign claims to total assets of the recipient and the ratio of foreign claims against the triggering country. We also control for year fixed effects in a separate model.

<please insert table 7 and table 8 here>

[9] We have also checked the systemically important shock for the US, UK and Germany during initial years of the sample period. Our findings are similar to what we have found in 2006 as reported above.

We report the summary statistics of the capital to asset ratio and the foreign claims to asset ratio in table 7. We find that financial institutions in Finland, the US, Belgium and Switzerland, on average, have 10 percent or more equity capital relative to their total assets. Whereas Canada, Japan and Germany are on the lower side of the equity capital ratio, financial institutions around the globe have a capital ratio of 8 percent on average. With respect to the foreign claims to assets ratio, we find that Japanese institutions are not highly exposed (only 6 percent foreign claims relative to total assets), while European institutions have around 40 percent foreign claims relative to total assets. The standard deviation of the entire sample is 4% for the capital to asset ratio and 16% for the foreign claims to asset ratio. Table 8 reports that the variables in the probit model (1) explain 38 percent of the variation in the probability of being a recipient country. With the addition of year fixed effects, the fit improves to 39 percent. The likelihood ratio test rejects the null hypothesis that the joint effect of all independent variables is equal to zero. We find that both the foreign claims to total assets ratio and ratio of foreign claims to trigger are statistically significant at 1 percent, whereas the capital to asset ratio is significant at 5 percent. The marginal effects show that a one standard deviation increase in capital to asset ratio decreases the probability of the default of recipient country by 2.2 percentage points. Similarly, one standard deviation increase in foreign claims to total assets ratio increases the probability of the default of a recipient country by 4.5 percentage points. Moreover, all signs are robust to year fixed effects whereas marginal effects slightly decline.

4.5. Robustness

<please insert figure 11 here>

We investigate the robustness of our results to a set of extensions. The contagion potential is evaluated with different loss given default on short and long term liabilities. We also use an alternative classification of foreign claims, ultimate risk basis, for robustness check. We refer to short-term liabilities as foreign claims of less than one-year maturity. While analyzing contagion potential we assume 100 percent LGD for the short-term foreign claims whereas 0 percent LGD for the long-term. This presents an extreme scenario when short-term claims have no collateral whereas long-term loans are completely secured. Therefore, in this exercise, only short-term liabilities scrap completely in case of default. The results are shown in Figure 11.

Panel (a) reveals that the UK is the most important triggering country while the US now has very low triggering potential. For example, Figure 11 panel (a) shows that UK can affect 9 recipient countries while the US affects only one country in 2006. The main reason could be the dominance of European countries in our sample. Since London is the financial hub for international banking, UK owes relative more short-term claims than long-term claims. Further, Switzerland and Ireland emerge as the most directly exposed countries in our sample period. Particularly, in 2006, UK directly affects Ireland and Switzerland while the US affects Switzerland only as shown in table 9. However, in later rounds, UK affects 7 more countries as shown in table 10.

<please insert table 9 and table 10 here>

Second, our analysis up to now employed foreign claims on immediate borrower basis (i.e. allocation of foreign claims to the country of operations of the contractual counterparty). The BIS has started compiling data of foreign claims on ultimate risk basis (i.e. allocation of foreign claims to the nationality of the contractual counterparty) in March 2005, but only for eleven countries in our sample. These countries are Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Portugal, Switzerland, UK and the US. We replicate case 1, where we assumed that all banks are internationally exposed, but now with foreign claims on ultimate risk basis for December 2006 for these 11 countries only.

Assuming 100 percent LGD, we find contagion results similar to case 1. The US again is the most devastating triggering country and may lead to contagion that affects all other reporting countries except Italy. Similarly, the default of UK poses contagion threat to 7 other countries, Germany is important for 3 other countries, and the Netherlands only affects Belgium. The speed of contagion increases in this exercise as all triggering contagion takes at most two rounds.

The economic impact is also similar to our findings as discussed for case 1: an exogenous default to the US may affect 94 percent of total assets of other banking systems. Similarly, the contagion triggered by the UK, Germany and Netherlands affect 40.9 percent, 12.8 percent and 3.6 percent of total assets of other banking systems respectively. Finally, we observe that the pattern of direct exposure is also

exactly the same in both cases (i.e. comparing directly exposed contagion from ultimate risk basis with immediate borrower basis of the corresponding reporting countries).

The results on direct exposure are also robust: the US causes five recipient countries to fail immediately due to cross-border contagion. Similarly, the UK affects three recipient countries, while the Netherlands and Germany affect one recipient country each. Further, using cross-border claims on ultimate risk basis we find the Netherlands to be the most vulnerable recipient country for cross-border contagion. This is in line with earlier findings using cross-border claims on immediate borrower basis.

Finally, we also wanted to check the possibility for contagion with risk-weighted capital instead to total ordinary equity capital as reported in balance sheets on financial institutions. However, we find that financial institutions in many countries do not report risk-weighted capital in a consistent manner. Therefore, the results would be highly biased towards the countries reporting the risk-weighted capital only.

5. CONCLUDING REMARKS

The risk of contagion through the banking system is not limited to domestic boundaries. In recent years, foreign claims held by the banking system have increased substantially suggesting that cross-border contagion needs further consideration as it may pose serious threats to financial stability. We find for 2006 that a shock wiping out 25% (35%) of US (UK) cross-border liabilities against non-US (non-UK) banks could lead to bank contagion eroding at least 94% (45%) of the recipient countries' banking assets. We also find that since 2006 a shock to Eastern Europe, Turkey and Russia affects most countries. Moreover, our simulations reveal that contagion risk and the "speed of propagation of contagion" have increased over time during the period 1999 to 2006. Finally, we find that contagion is more widespread in geographical proximities.

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Figure 1: The Network of Cross-Border Exposures

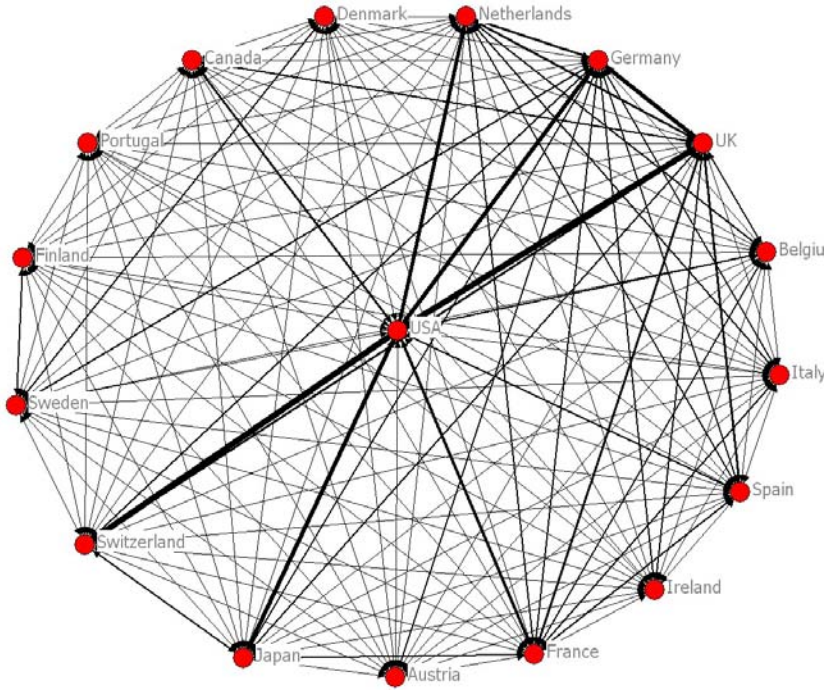

Figure 1 shows foreign claims of the 17 reporting countries in 2006. Each node represents a reporting country and the link between nodes shows the gross amount of foreign claims of the two countries relative to total foreign claims. The thickness of the links indicates the relative importance.

Figure 2: The Contagion Process

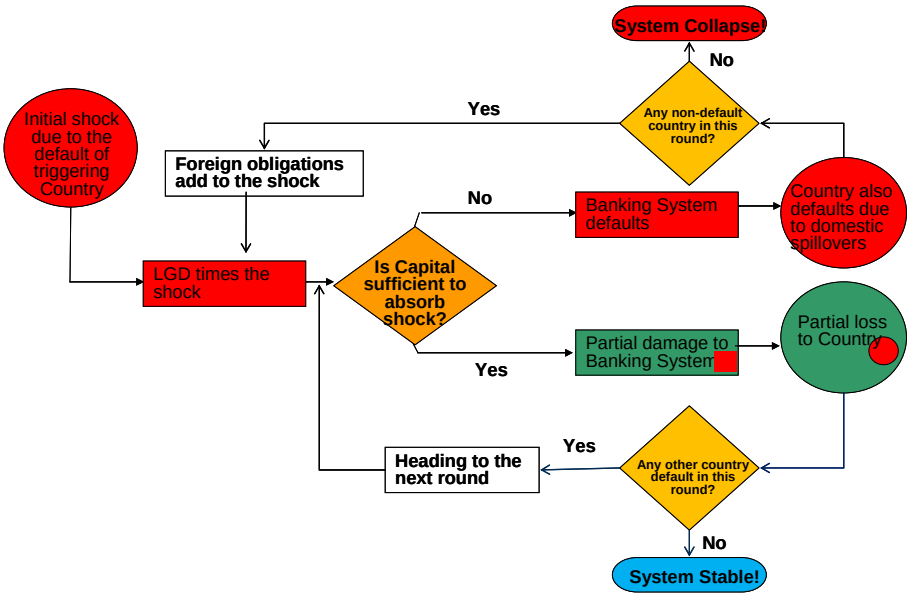

Figure 2 shows the contagion process. The red circle on the left represents an initial shock triggered by the default of a reporting country. The shock is then multiplied by the Loss Given Default (LGD) to determine the effective burden on recipient countries; if that burden is less than the aggregate bank capital then the country survives to the next round though it loses bank capital partially. Such country is represented by a green circle and the partially lost capital is represented by the red circle inside. On the other hand, if the burden is greater than aggregate bank capital then the recipient country would also default as represented by the red circle on the right. Contagion would continue to the next round if there is at least one additional country defaulting in the current round.

Figure 3: Contagion Triggered by Reporting Countries - All Banks are Internationally Exposed

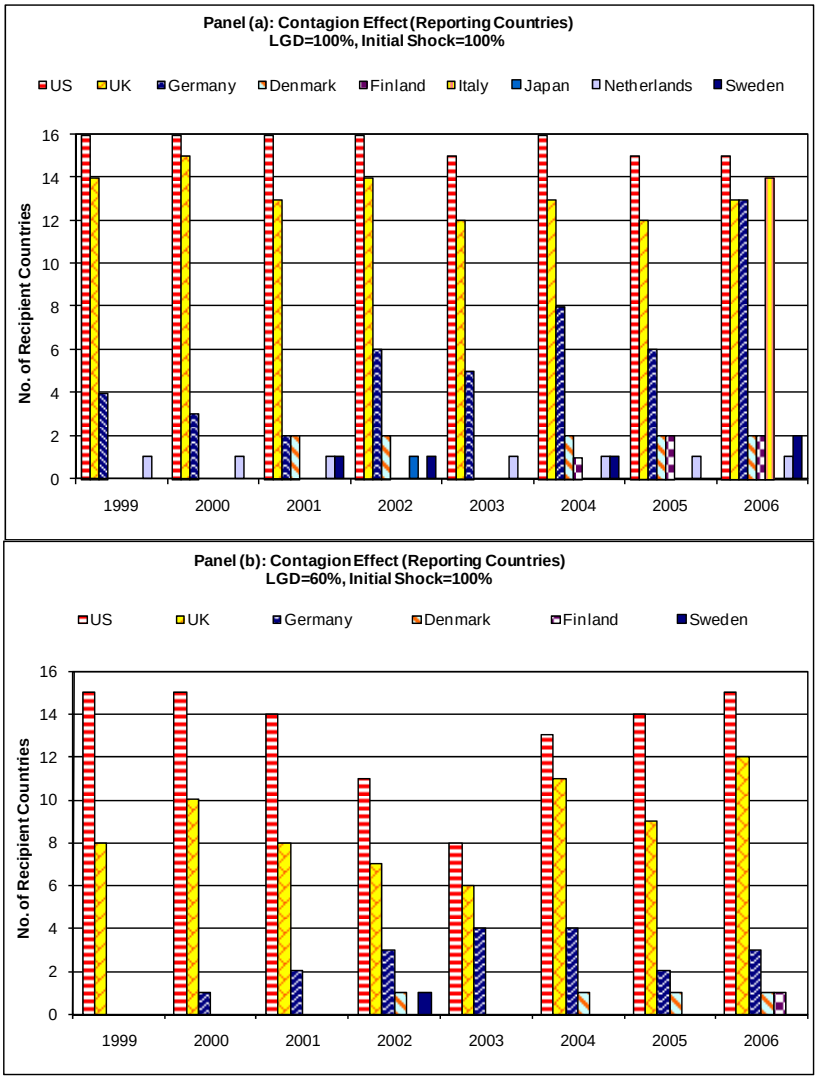

Figure 3 illustrates the number of countries (on y-axis) that default due to cross-border contagion from reporting countries. Each column represents a triggering country during 1999-2006. Panel (a) is based on 100 percent Loss Given Default (LGD) whereas panel (b) is based on 60 percent LGD.

Figure 4: Contagion Triggered by Non-Reporting Countries - All Banks are Internationally Exposed

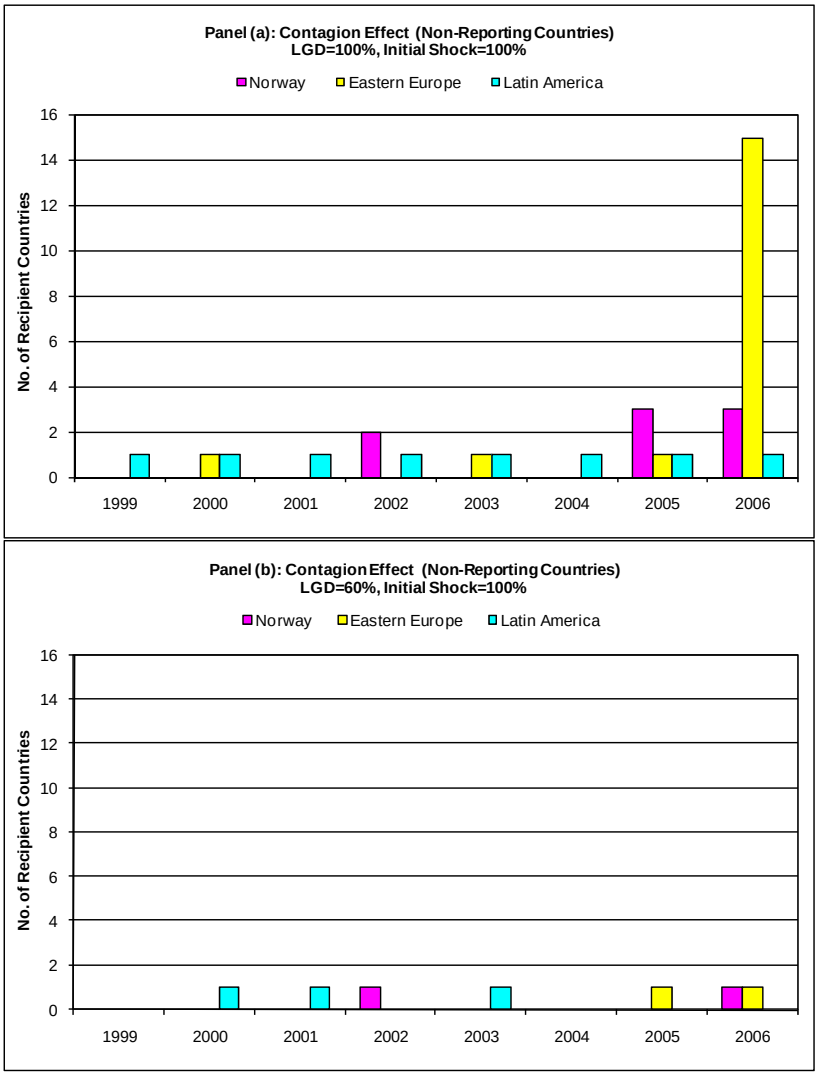

Figure 4 illustrates the number of countries (on y-axis) that default due to cross-border contagion from non-reporting countries. Each column represents a trigger during 1999-2006. Panel (a) is based on 100 percent Loss Given Default (LGD) whereas panel (b) is based on 60 percent LGD.

Figure 5: Speed of Contagion – All Banks are Internationally Exposed

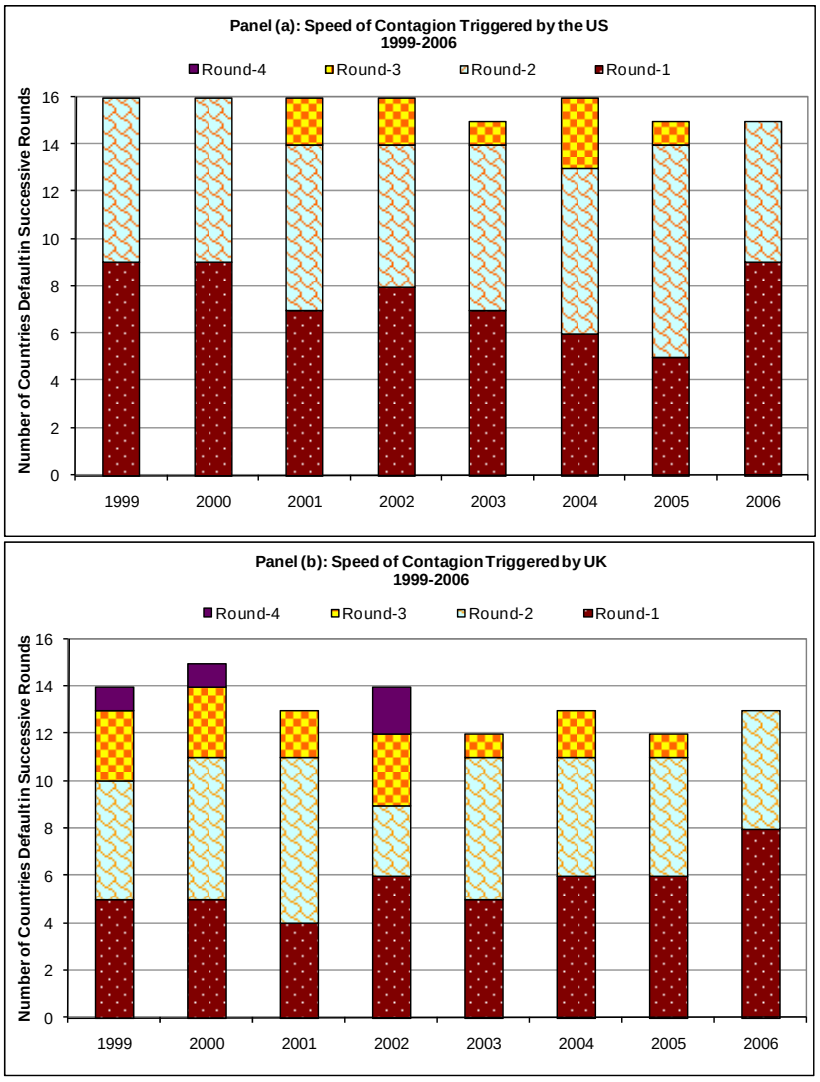

Figure 5 shows the number of recipient countries in each round. Segments in columns represent the number of countries that default in each round. Panel (a) depicts the contagion effect due to the US whereas panel (b) reflects contagion that is triggered from UK. The analysis is based on 100% LGD during 1999 and 2006.

Figure 6: Economic Impact of Contagion - All Banks are Internationally Exposed

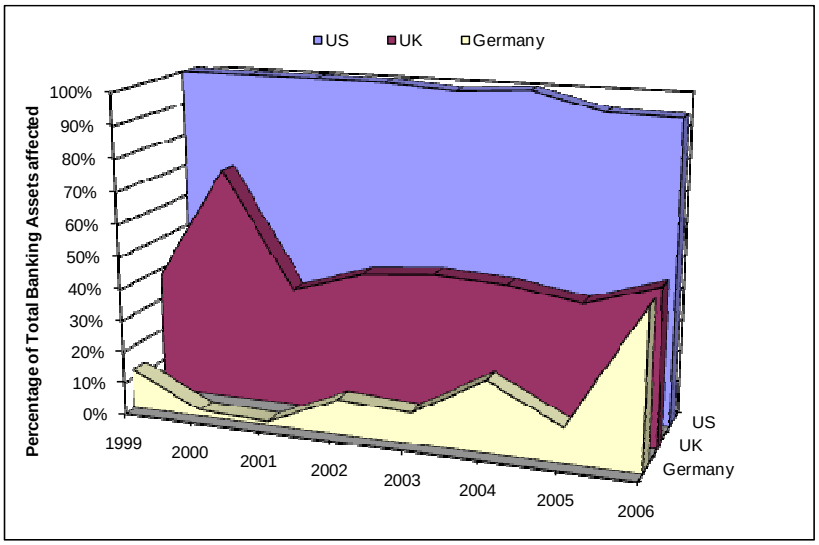

Figure 6 shows the economic impact of contagion that is triggered by the US, UK and Germany during 1999 and 2006. It is measured as the percentage of total assets of banking systems recipient countries relative to total assets of all banking systems (excluding triggering country). The analysis is based on 100% LGD

Figure 7: Contagion Triggered by Reporting Countries – Only Large Banks are Internationally Exposed

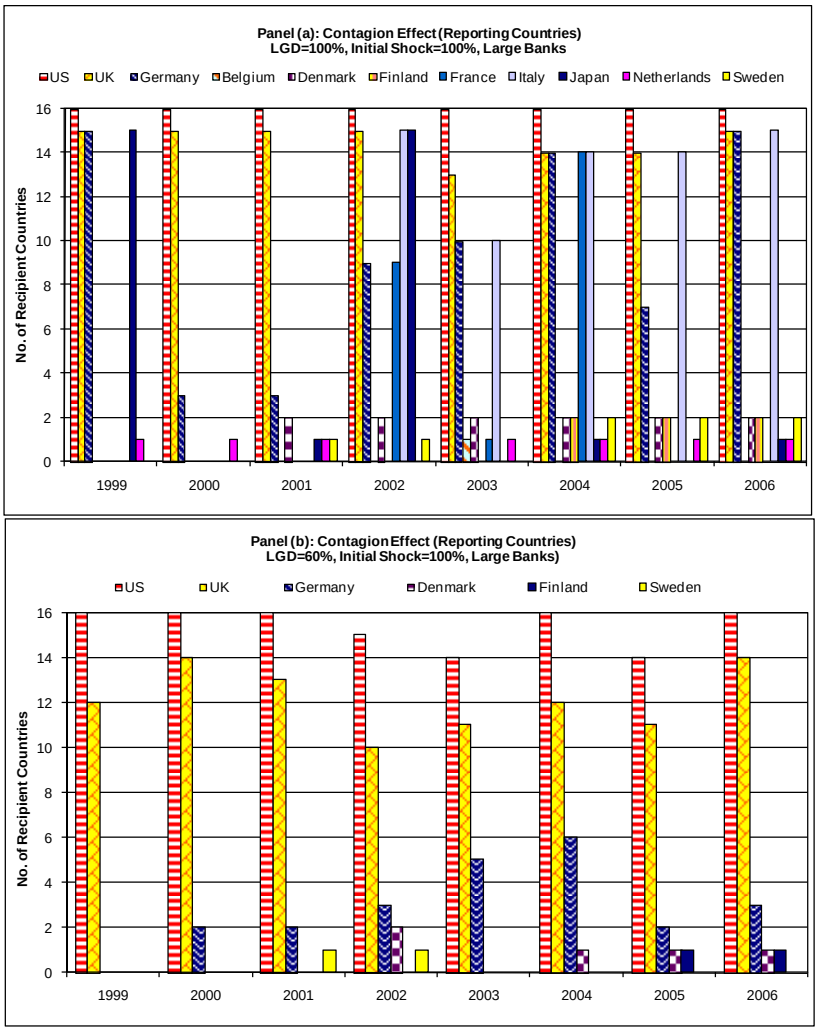

Figure 7 shows the number of countries (on y-axis) that default due to cross-border contagion from large banks of reporting countries. Each column represents a triggering country during 1999-2006. Panel (a) is based on 100 percent Loss Given Default (LGD) whereas panel (b) is based on 60 percent LGD.

Figure 8: Contagion Triggered by Non-Reporting Countries – Only Large Banks are Internationally Exposed

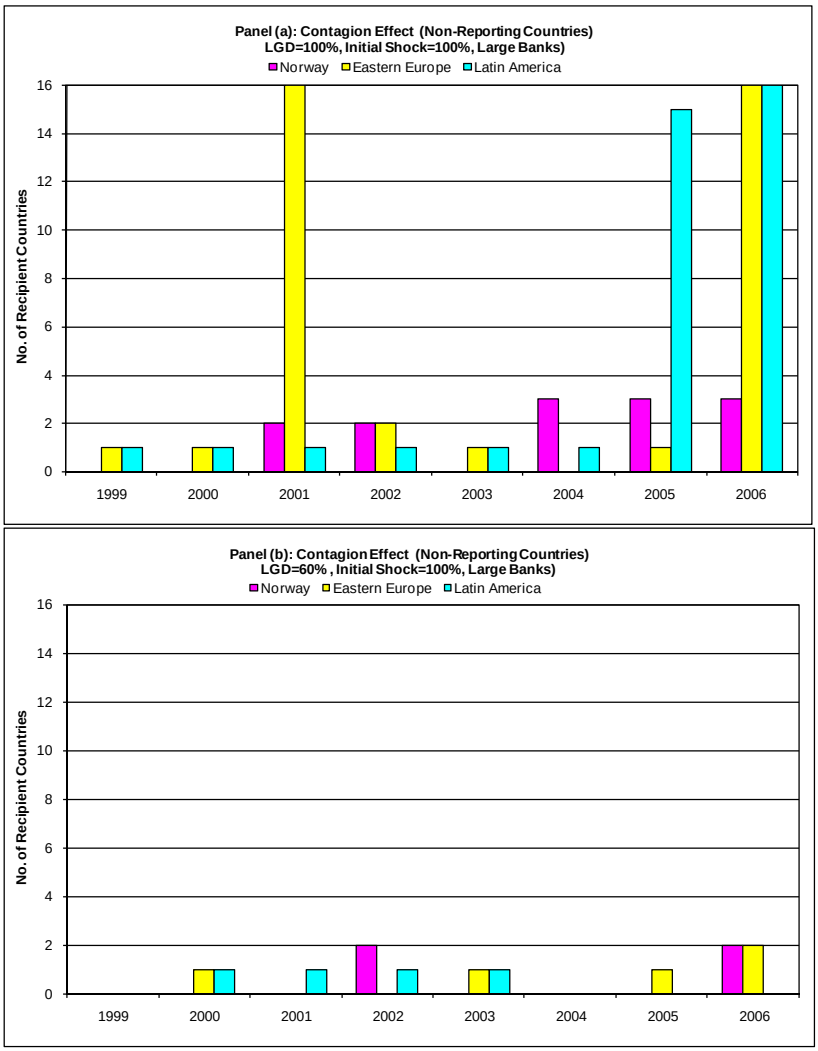

Figure 8 shows the number of countries (on y-axis) that default due to cross-border contagion from large banks of non-reporting countries. Each column represents a triggering country during 1999-2006. Panel (a) is based on 100 percent Loss Given Default (LGD) whereas panel (b) is based on 60 percent LGD.

Figure 9: Economic Impact of Contagion – Only Large Banks are Internationally Exposed

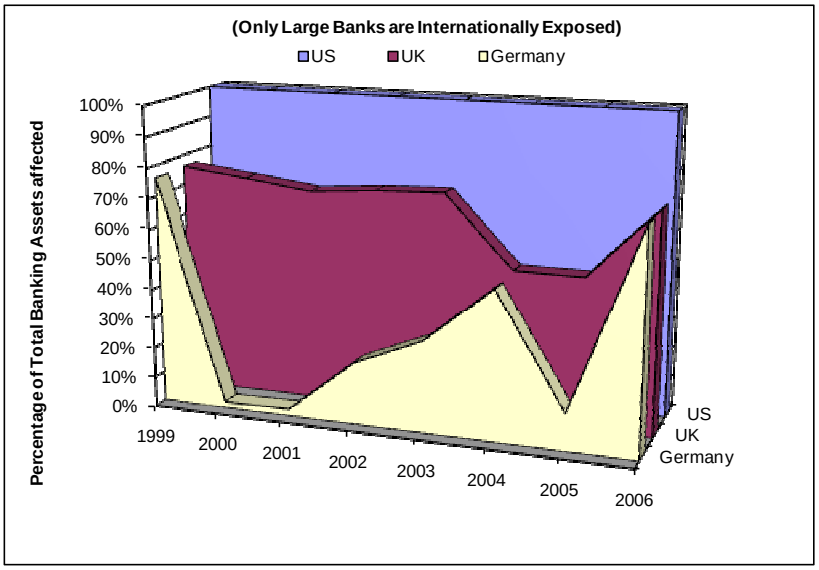

Figure 9 shows the economic impact of contagion that is triggered by the US, UK and Germany during 1999 and 2006 assuming only large banks are internationally exposed. The economic impact is measured as the percentage of total assets of banking systems (defaulting) recipient countries relative to total assets of all banking systems (excluding triggering country). The analysis is based on 100% LGD

Figure 10: Systemically Important Shock

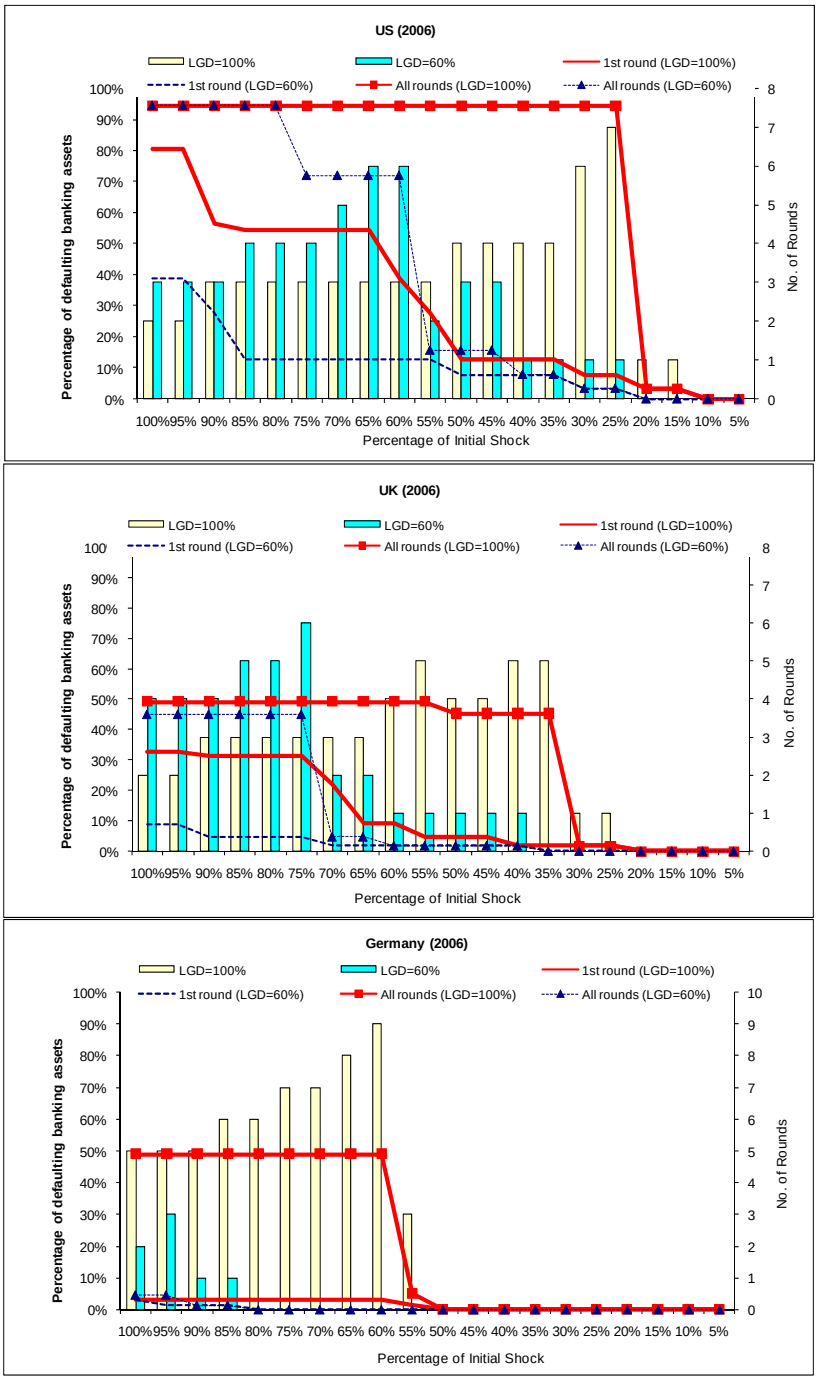

Figure 10 shows results for the exercise on a systemically important shock, for the US, UK and Germany at 100 percent and 60 percent LGD. The columns show the number of rounds, measured on the y-axis (right side). The lines show the percentage of total assets of defaulting banking systems relative to total assets of all banking systems (excluding triggering country), measured on the y-axis (left side).

Figure 11: Contagion Results Considering Only Short-Term Claims

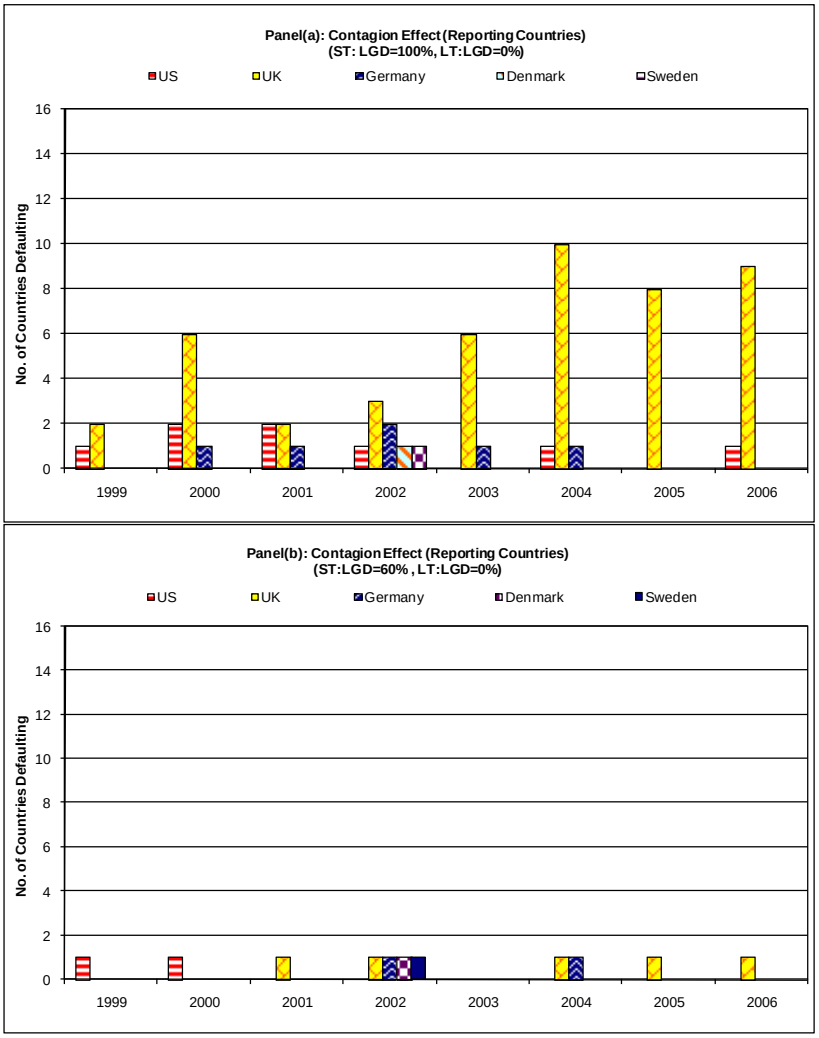

Figure 11 shows the contagion results due to the default of triggering country assuming different LGD on short-term liabilities and long-term liabilities. Each column depicts the number of recipient countries for the triggering country during 1999 and 2006. Panel (a) evaluates the effect with 100 percent LGD on short-term liabilities and 0 percent LGD on long-term liabilities. Whereas panel (b) evaluates the similar effect due to 60 percent LGD on short-term liabilities and 0 percent LGD on long-term liabilities.

Table 1: Foreign Claims of Reporting Banks to all 17 Countries

	AT	BE	CA	DK	FI	FR	DE	IE	IT	JP	NL	PT	ES	SE	CH	GB	US
Austria	---	1%	1%	0%	1%	1%	5%	2%	1%	0%	1%	1%	1%	0%	1%	1%	1%
Belgium	2%	---	1%	2%	1%	4%	2%	1%	8%	1%	7%	2%	3%	1%	1%	2%	3%
Canada	1%	0%	---	0%	1%	1%	1%	1%	1%	2%	2%	1%	0%	0%	1%	2%	8%
Denmark	1%	1%	0%	---	**28%**	0%	1%	1%	0%	0%	1%	2%	0%	**23%**	0%	1%	2%
Finland	1%	0%	0%	3%	---	0%	1%	1%	0%	0%	0%	0%	0%	**17%**	0%	0%	0%
France	5%	**11%**	2%	2%	2%	---	7%	5%	**14%**	6%	6%	**16%**	8%	2%	3%	9%	7%
Germany	**28%**	8%	3%	**12%**	6%	**10%**	---	**24%**	**14%**	**10%**	**14%**	7%	**10%**	**24%**	4%	7%	**16%**
Ireland	5%	6%	2%	4%	1%	2%	4%	---	5%	2%	2%	4%	3%	1%	1%	6%	2%
Italy	**10%**	9%	1%	1%	2%	**11%**	7%	8%	---	3%	7%	6%	7%	1%	2%	4%	5%
Japan	1%	1%	2%	0%	0%	**10%**	5%	3%	2%	---	3%	0%	0%	0%	7%	5%	**12%**
Netherlands	7%	**21%**	1%	2%	2%	5%	5%	2%	3%	3%	---	5%	4%	2%	2%	4%	7%
Portugal	1%	1%	0%	0%	0%	1%	1%	0%	3%	0%	1%	---	**11%**	0%	0%	1%	0%
Spain	2%	3%	0%	1%	1%	6%	5%	5%	5%	2%	5%	**20%**	---	1%	1%	4%	3%
Sweden	1%	0%	0%	**29%**	**34%**	1%	1%	1%	1%	1%	1%	1%	0%	---	0%	1%	1%
Switzerland	5%	1%	0%	2%	0%	3%	3%	1%	2%	1%	1%	2%	1%	1%	---	1%	3%
UK	**16%**	**20%**	**14%**	**32%**	9%	**17%**	**26%**	**35%**	**25%**	**12%**	**18%**	**18%**	**38%**	**13%**	**20%**	---	**30%**
US	**15%**	**14%**	**72%**	9%	**14%**	**28%**	**25%**	**10%**	**16%**	**56%**	**30%**	**14%**	**14%**	**13%**	**56%**	**52%**	---

Table 1 provides the distribution of foreign claims of reporting countries. Each column gives the percentage of foreign claims of a reporting country vis-à-vis other reporting countries averaged over time.

Table 2: Directly Exposed Banking Systems when All Banks are Internationally Exposed

Year 2006 (First Round) LGD=100%	Recipient Countries																	
Triggering Countries	DK	FI	SE	AT	BE	FR	DE	IE	IT	NL	PT	ES	CH	GB	JP	CA	US	Total
Denmark (DK)			■															1
Finland (FI)			■															1
Sweden (SE)	■																	1
Italy (IT)								■										1
Netherlands (NL)					■													1
Germany (DE)			■					■										2
UK (GB)	■		■		■		■	■		■		■	■					**8**
US			■			■	■	■		■		■	■	■	■	■		**9**
Total	2	0	**5**	0	2	1	2	**4**	0	2	0	1	2	1	1	1	0	24

Table 2 shows the details of directly exposed banking systems in 2006. For each triggering county (left column), the (defaulting) recipient countries are marked with a red box. The total on the right column gives total number of recipient countries for each triggering country. Whereas the total number of times a country defaults in the first round is mentioned at the bottom.

Table 3: Contagion Effect when all Banks are Internationally Exposed

Year 2006 (All Rounds) LGD=100%	Recipient Countries																	
Triggering Countries	DK	FI	SE	AT	BE	FR	DE	IE	IT	NL	PT	ES	CH	GB	JP	CA	US	Total
Denmark (DK)		■	■															2
Finland (FI)	■		■															2
Sweden (SE)	■	■																2
Italy (IT)	■	■	■	■	■	■	■	■		■	■	■	■	■		■		**14**
Netherlands (NL)					■													1
Germany (DE)	■	■	■	■	■	■		■		■	■	■	■			■		**13**
UK (GB)	■	■	■	■	■	■	■	■		■	■	■				■		**13**
US	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■		**15**
Total	6	6	6	4	5	4	3	4	**0**	4	4	4	4	3	1	4	**0**	62

Table 3 shows the extent of contagion in 2006 taking into account all round effects when all banks are internationally exposed. For each triggering country (left column), the (defaulting) recipient countries are marked with a red box. The total on the right column gives total number of recipient countries for each triggering country. Whereas the total number of times a country defaults is mentioned at the bottom.

Table 4: Selected Large Banks

	Total Banks	Large Banks	%age share of Equity
Austria	264	21	71.26%
Belgium	70	18	91.92%
Canada	87	20	78.08%
Denmark	106	14	75.25%
Finland	17	5	94.86%
France	331	72	88.61%
Germany	1775	89	72.99%
Ireland	48	19	77.70%
Italy	681	52	48.35%
Japan	677	158	81.53%
Netherlands	67	31	93.54%
Portugal	38	9	75.58%
Spain	196	39	85.99%
Sweden	112	10	81.10%
Switzerland	484	32	74.10%
UK	330	90	85.12%
US	1109	268	88.07%
Total	6392	947	

Table 4 shows the fraction of large banks in total banking system for each reporting country. Our large banks include all banks having total assets of at least $ 10 billion. The last column shows the percentage of aggregate equity that large banks hold relative to all banks in the country.

Table 5: Directly Exposed Banking Systems when Only Large Banks are Internationally Exposed

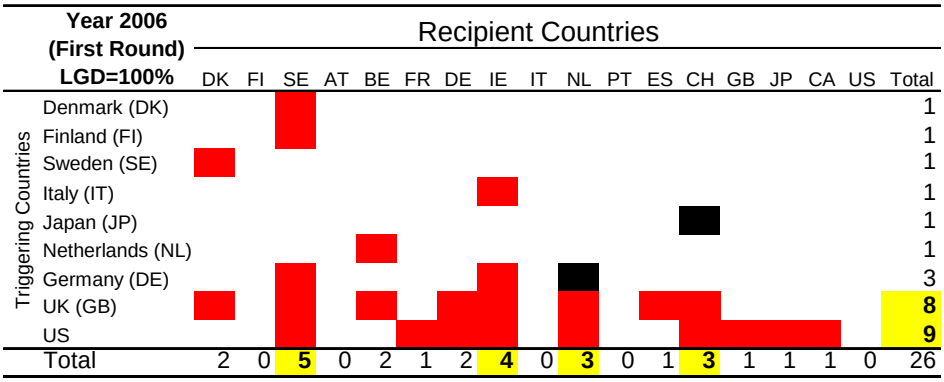

Table 5 shows the details of directly exposed banking systems in 2006 when only large banks are internationally exposed. For each triggering country (left column), the (defaulting) recipient countries are marked with a red box. The black boxes represent additional contagion effect compared to previous case. The total on the right column gives total number of recipient countries for each triggering country. Whereas the total number of times a country defaults in the first round is mentioned at the bottom.

Table 6: Contagion Effect when Only Large Banks are Internationally Exposed

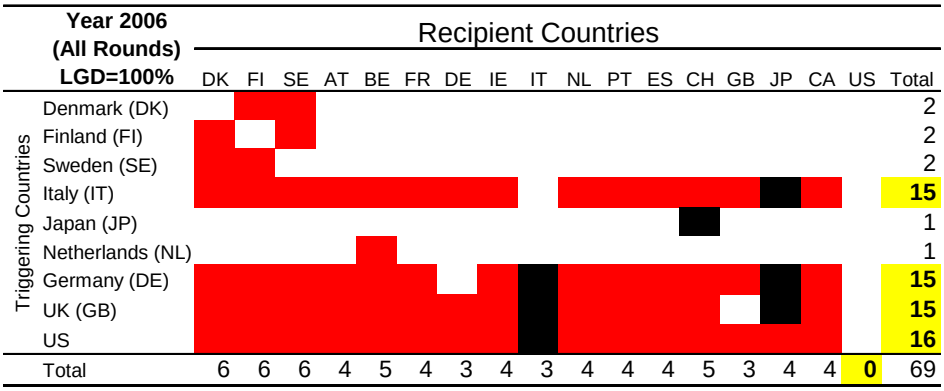

Table 6 shows the extent of contagion in 2006 taking into account all round effects when only large banks are internationally exposed. For each triggering country (left column), the (defaulting) recipient countries are marked with a red box. The black boxes represent additional contagion effect compared to previous case. The total on the right column gives total number of recipient countries for each triggering country. Whereas the total number of times a country defaults is mentioned at the bottom.

Table 7: Summary Statistics

	Capital to Asset Ratio			Foreign Claims to Asset Ratio		
	Mean	Median	St. Dev	Mean	Median	St. Dev
Austria	0.06	0.05	0.02	0.35	0.36	0.06
Belgium	0.11	0.11	0.01	0.38	0.38	0.04
Canada	0.04	0.04	0.01	0.21	0.20	0.03
Denmark	0.08	0.07	0.03	0.34	0.33	0.07
Finland	0.17	0.19	0.06	0.76	0.82	0.19
France	0.08	0.07	0.02	0.25	0.24	0.03
Germany	0.05	0.05	0.01	0.22	0.22	0.03
Ireland	0.06	0.05	0.01	0.53	0.53	0.17
Italy	0.09	0.09	0.02	0.39	0.38	0.04
Japan	0.05	0.04	0.02	0.06	0.06	0.01
Netherlands	0.09	0.09	0.02	0.41	0.40	0.04
Portugal	0.06	0.06	0.01	0.44	0.45	0.06
Spain	0.08	0.08	0.02	0.25	0.24	0.04
Sweden	0.07	0.07	0.02	0.38	0.36	0.07
Switzerland	0.10	0.09	0.02	0.38	0.38	0.05
UK	0.09	0.09	0.02	0.44	0.41	0.07
US	0.12	0.12	0.01	0.33	0.32	0.06
Total Sample	0.08	0.07	0.04	0.36	0.36	0.16

Table 7 reports descriptive statistics of capital to asset ratio and foreign claims to asset ratio averaged over time.

Table 8: Regression Results

	Model 1		**Model 2**	
Number of obs	2312		2312	
LR chi2(3)	759.94		785.59	
Pseudo R2	0.3768		0.3896	
Log likelihood	-628.35		-615.53	
PROBIT REGRESSION	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Constant	-2.120 ***	0.111	-2.179 ***	0.158
Capital to Asset Ratio	-2.961 **	1.253	-2.752 **	1.287
Foreign Claims to Asset Ratio	1.498 ***	0.288	1.267 ***	0.297
Exposure to Trigger	10.127 ***	0.462	10.354 ***	0.470
Year Fixed Effect			YES	
MARGINAL EFFECTS	**dF/dx**	**Std. Err.**	**dF/dx**	**Std. Err.**
Capital to Asset Ratio	-0.557 **	0.236	-0.504 **	0.236
Foreign Claims to Asset Ratio	0.282 ***	0.054	0.232 ***	0.054
Exposure to Trigger	1.906 ***	0.113	1.898 ***	0.113
Year Fixed Effect			YES	

Table 8 reports probit regression results. The dependent variable is a binary number being 1 if country defaults and 0 otherwise.
** Significant at 5 percent
*** Significant at 1 percent

Table 9: Directly Exposed Banking Systems when a Country Defaults Only on Short-term Liabilities

Year 2006 (First Round) LGD=100%	Recipient Countries																		
Triggering Countries	DK	FI	SE	AT	BE	FR	DE	IE	IT	NL	PT	ES	CH	GB	JP	CA	US	Total
Denmark (DK)																		0
Finland (FI)																		0
Sweden (SE)																		0
Italy (IT)																		0
Japan (JP)																		0
Netherlands (NL)																		0
Germany (DE)																		0
UK (GB)																		**2**
US																		1
Total	0	0	0	0	0	0	0	1	0	0	0	0	**2**	0	0	0	0	3

Table 9 shows the details of directly exposed banking systems in 2006 when a country defaults only on short-term liabilities. We use the same set of triggering countries (left column) though only UK and the US trigger contagion in this case. The (defaulting) recipient countries are marked with a red box. The total on the right column gives total number of recipient countries for each triggering country. Whereas the total number of times a country defaults is mentioned at the bottom.

Table 10: Contagion Effect when a Country Defaults Only on Short-Term Liabilities

Year 2006 (All Rounds) LGD=100%	Recipient Countries																		
Triggering Countries	DK	FI	SE	AT	BE	FR	DE	IE	IT	NL	PT	ES	CH	GB	JP	CA	US	Total
Denmark (DK)																		0
Finland (FI)																		0
Sweden (SE)																		0
Italy (IT)																		0
Japan (JP)																		0
Netherlands (NL)																		0
Germany (DE)																		0
UK (GB)																		**9**
US																		1
Total	1	0	1	0	1	1	1	1	0	1	0	1	2	0	0	0	0	10

Table 10 shows the extent of contagion in 2006 taking into account all round effects when a country defaults only on short-term liabilities. We use the same set of triggering counties (left column), though only UK and the US trigger contagion in this case. The (defaulting) recipient countries are marked with a red box. The total on the right column gives total number of recipient countries for each triggering country. Whereas the total number of times a country defaults is mentioned at the bottom.