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Banking Crises, Firms and their International Affiliates in the EU *

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This study analyzes how banking crises affect European economies. First, we show that European firms grow more slowly if they have relationships to crisis banks in their home country. Second, we argue that the international affiliates of multinational corporations grow more slowly when their parent firm is hit by a banking crisis in its home country. This suggests that the internal networks of multinational firms can transmit banking crises across European countries. The effects could be sizable: for example, back-of-the-envelope calculations suggest that a banking crisis in the US could lead to an estimated decrease in sales in the German business economy of about 21 billion euros each year, while a banking crisis in the UK could induce a sales loss of about 13 billion euros in the German business economy. The results suggest that measures to prevent banking crises, for example reductions in political risks (like Brexit) or Eurozone reforms (averting the "diabolical loop"), would significantly reduce cross-country contagion of crises via firms – and this way contribute to a smooth functioning of the real economy in the Single Market.

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I Introduction

The relationship between banks and the real economy has generated substantial interest in recent years. For example, many advanced economies experienced severe banking crises in 2008/09 and thereafter the deepest recessions since World War II (Gertler and Gilchrist 2018). In early 2019, the weakness of several Italian banks and the poor performance of Deutsche Bank, the largest financial institution in Germany, have again raised worries that a new episode of banking distress might harm real growth in Europe (Reuters 2019a,b). In general, there is a widespread view that banking crises can lead to severe recessions in the real economy (Brunnermeier et al. 2013).

In this paper, we consider empirical evidence on the relationship between banking crises and the growth of firms in the real economy. In particular, we discuss two questions. First, if banks in a given country are in crisis, how does this affect firms resident in that country? Do firms borrowing from crisis banks grow more slowly? Second, how are firms with operations in multiple countries affected when their banks go into crisis? If a multinational firm is affected by a banking crisis in its home country, does this also harm international affiliates of the multinational firm in other countries?

This study documents that firms grow more slowly when their banks are in crisis and that multinational firms transmit domestic banking crises to other countries through their foreign affiliates. For example, we find that a banking crisis in the US could reduce sales in the German business economy by more than 0.3% because of the transmission through affiliates of US multinationals located in Germany. In case of a banking crisis in the UK, sales losses in Germany could amount to about 0.2% because of this mechanism. We establish these results by relying on recent research: Huber (2018) finds that firms with ties to crisis banks grow more slowly in terms of investment and employment. Moreover, we also build on the findings in Biermann and Huber (2019), who study the effect of a domestic banking crisis on foreign affiliates of multinational firms. They find that international affiliates of multinational firms hit by a banking crisis have lower sales growth.

These findings are relevant to ongoing reform debates in the Eurozone. A widely discussed aspect of the ongoing Eurozone crisis has been the “diabolical loop” between banks and governments: When the risk of government default rises, banks with high exposure to government debt struggle to obtain funding and cut lending to the real economy (Brunnermeier et al. 2016). This, in turn, can worsen the state of the domestic economy and increase the risk of government default. For example, as seen in Ireland, a banking crisis can require massive fiscal engagement and put fiscal stress on governments. Hence, there is a "vicious circle" between the financial health of banks and sovereigns. One suggested reform to address the diabolical loop is the EU banking union – an EU internal market for banking with common rules. The aim of the banking union is to reduce the exposure of banks to sovereign risk and thereby to lower the probability of banking crises. For example, one pillar of the banking union would be a common European deposit insurance scheme, which could ensure that depositors do not withdraw funds from banks only because the national government is under fiscal stress (Schnabel and Véron 2018). The findings of this paper show that banking crises in one EU member state can have effects across the whole EU because of multinational firms. This strengthens the case for coordinated reforms across countries that could reduce the probability of banking crises in the EU, such as the banking union.

Finally, this paper is also relevant to the current debate on the UK’s plan to leave the EU (Brexit). Some observers suggest that Brexit may weaken the UK banking system (Partington 2018). Our results suggest that a banking crisis in the UK could lead to a significant sales losses of UK affiliates in other EU countries. Repercussions of this kind are not much part of the current debate on economic effects of Brexit – but they suggest that beyond the mere increase in trade costs, other EU countries’ real economies could be significantly affected by Brexit. Furthermore, we show that the UK itself has a relatively high share of sales by foreign affiliates. Thus, the UK economy could be negatively affected if foreign-owned firms reduce their operations in the UK as a result of Brexit.

II The Effect of a Banking Crisis on Firms Borrowing from Crisis Banks

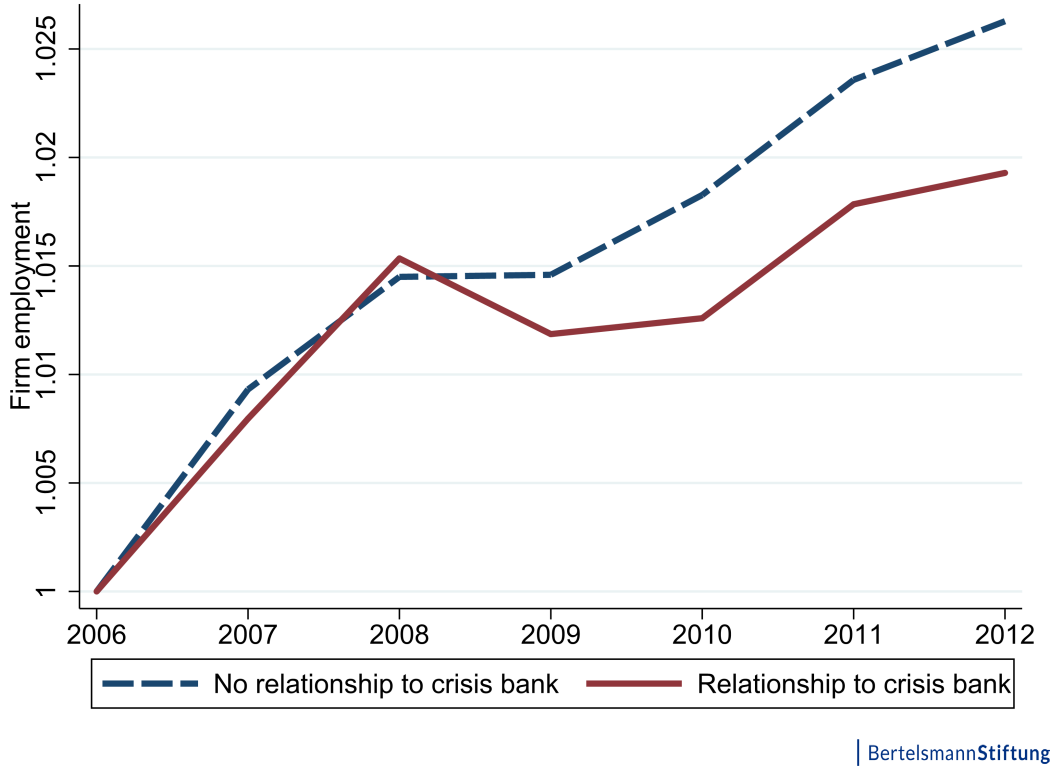
The first question we want to understand is how firms evolve when banks in their country are in crisis. A recent paper by Huber (2018) addresses the effect of a banking crisis on firm growth in the context of German firms and the financial crisis of 2008/09. The key institutional feature that Huber (2018) exploits is the system of relationship banking in Germany. Economic history (Jeidels 1905; Calomiris 1995), case studies (summarized in Guinnane 2002), and recent evidence (Harhoff and Körting 1998; Elsas and Krahnen 1998; Elsas 2005) suggest that relationship banking has played an important role in German corporate finance from the start of the 19th century until today. Relationship banking means that firms of all sizes form close and durable business ties to their banks, which can reduce asymmetric information and improve banks' monitoring capabilities (Sharpe 1990; Boot 2000). The literature provides empirical evidence from a number of countries and episodes that firms depend on the loan supply of their relationship banks and that idiosyncratic shocks to relationship banks have real effects on firms. Episodes that have been studied include the US Great Depression (Benmelech et al. 2017), Japan in the 1990s and 2000s (Amiti and Weinstein 2011), the 2008/09 financial crisis in the US (Chodorow-Reich 2014), and the Great Recession in Spain (Bentolila et al. 2018).

Huber (2018) identifies a set of German firms whose relationship banks reduced lending in the financial crisis of 2008/09. The reason for the lending cut was bank exposure to losses on international financial markets in 2008/09. Since German firms depend on the loan supply of their relationship banks, this meant that a few firms were hit with an exogenous shock to their bank loan supply that was independent of the performance of the firm. By comparing firms with a crisis bank to firms without a relationship to a crisis bank, Huber (2018) estimates how a banking crisis causally affects firms.

A main finding of Huber (2018) is summarized by Figure I. This figure plots raw employment data for two groups of firms: those with a relationship to a crisis bank and those without. Employment at firms with a relationship to a crisis bank developed in parallel to other firms before 2008. Following the crisis of their banks in 2008/09, firms with a relationship to a crisis bank experienced lower employment growth for two years. From 2011 onward, crisis banks had generally stabilized, thanks to support by the government. Analyzing a survey conducted

by the Munich ifo Institute among German firms, Huber (2018) finds that firms with a relationship to a crisis bank reported that their bank loan supply had returned to normal by 2011. Standard economic theory predicts that firms with a relationship to a crisis bank should return to the employment levels of unaffected firms once their credit supply normalizes. Nevertheless, the affected firms remained on a lower parallel trend from 2011 until 2012.

Figure I: Effect of a banking crisis on firm employment



Notes: This figure plots mean employment (in logs) of firms without a relationship to a crisis bank and with a relationship to a crisis bank. The data are normalized by their 2006 values. Source: Huber (2018).

The statistical results in Huber (2018) suggest that, following the reduction in bank lending, employment at firms with only a crisis bank as relationship bank was 4.4 percent lower than at firms with no relationship to a crisis bank. To test the robustness of this result, Huber (2018) controls for a range of potentially confounding variables. There are industry fixed effects at the three-digit level of the German industrial classification scheme WZ. There are also fixed effects for four firm size bins, based on the firm's number of employees in 2006. The bins are for 1-49, 50-249, 250-999, and over 1000 employees. Further controls are the export share out of total revenues, the import share out of total inputs, the firm's age, and fixed effects

for the county, in which the headquarter of the firm is located. Adding the set of control variables, increases the estimate of the effect of a banking crisis on employment only slightly, to 5.3 percent. This suggests that including the control variables does not strongly affect the conclusions of the empirical analysis. Studies from other countries estimate firm-level effects of a similar magnitude. For instance, Chodorow-Reich (2014) for the United States and Bentolila et al. (2018) for Spain find that firms connected to distressed banks reduced employment by 4 to 5 percentage points.[1]

Other indicators of firm performance also responded to the lending cut. Firms with only a crisis bank as relationship bank held on average 20.5 percent less bank debt over the period 2009 to 2012. This suggests that affected firms were not able to substitute other lenders for their crisis banks, consistent with a financial system working through relationship banking. The average investment rate of affected firms was 4.3 points lower over the four years after the lending cut, while the capital stock fell by an average of 13 percent. The capital-labor ratio fell by 7.7 percent, which suggests that firms use bank debt primarily to finance investment into their capital stock.

The literature on the United States has found that large firms are less sensitive to credit shocks (Gertler and Gilchrist 1994; Chodorow-Reich 2014). Huber (2018) finds no statistically significant difference for large firms (over 1,500 employees) in the response of firm employment to a banking crisis. This suggests there were no heterogeneous effects by firm size. This finding is in line with evidence from Spain in Bentolila et al. (2018) and with the conventional wisdom that German firms of all sizes depend on bank debt, including multinational firms.

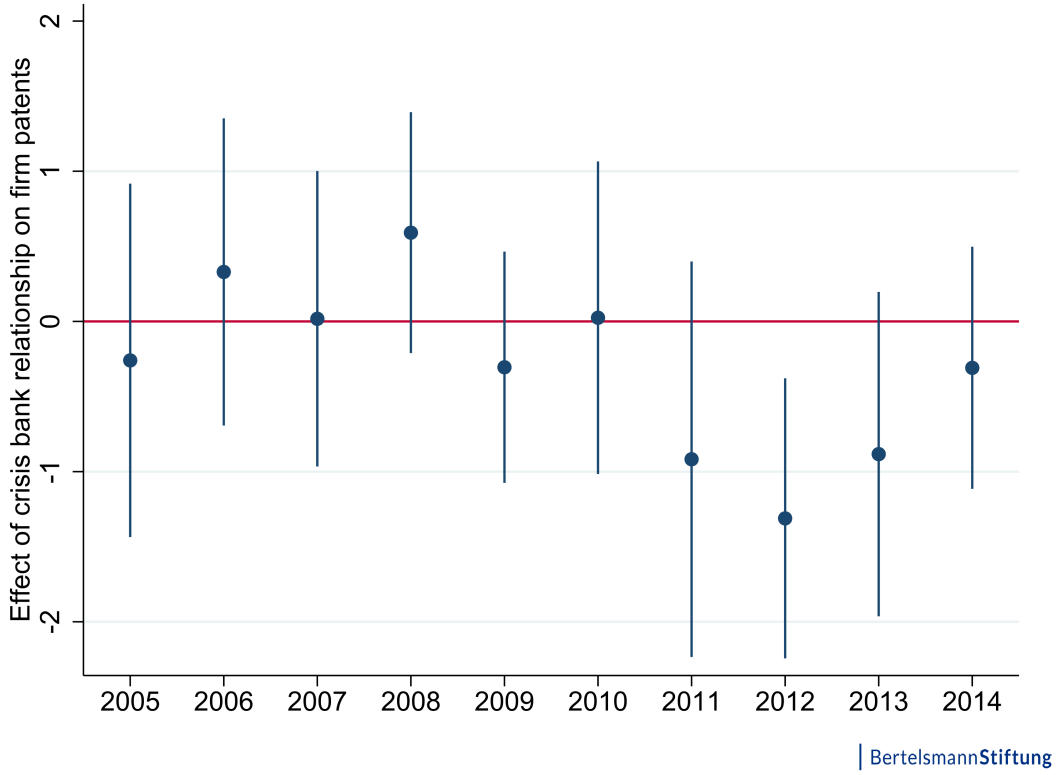
Figure II examines the effect of the lending cut on the patenting of firms. Patents are a proxy for how much innovation a firm carries out. The sample for this figure includes only firms that issued at least one patent from 1990 to 2004. These firms are interesting because they are often large and control multinational affiliates. The results show that growth rate of the number of patents at patenting firms was approximately 55 percentage points lower when they only had a crisis bank as relationship bank. The average patenting process takes around

[1]Other related studies that estimate firm-level effects of banking crises include Gan (2007); Khwaja and Mian (2008); Amiti and Weinstein (2011); Almeida et al. (2012); Schnabl (2012); Paravisini et al. (2015); Garicano and Steinwender (2016); Cingano et al. (2016).

two years. This is why the effect on patents is entirely driven by the years after 2011. There was no significant difference before 2011.

Taken together, the effect on the patenting of large firms as well as the absence of heterogeneous effects by firm size suggest that also large firms were affected by a reduction in their bank loan supply.

Figure II: Effect of a banking crisis on firm patents



Notes: This figure plots the estimated relationship between firm patents and the firm having a relationship to a crisis bank. The estimates are from negative binomial count models, where the outcome is the firm's number of patents in the given year. The estimation controls for pre-existing differences in firm's number of patents 1990-2004 (in logs), firm size, age, industry, export and import share, and federal state of the firm's headquarter. The vertical lines are 95 percent confidence intervals. Source: authors' calculations based on data from German firms affected by crisis banks, as in Huber (2018).

III The Effect of a Domestic Banking Crisis on the Foreign Affiliates of Multinational Firms

Having established that, on average, firms grew more slowly when they were affected by a banking crisis, we now turn to our second question of interest. This concerns the effect of a banking crisis in one country on firms and the real economy in another country. We focus on

one specific channel: We consider whether the international affiliates of multinational corporations grow more slowly when their parent organization is hit by a banking crisis in its home country.

Whether a firm is deemed a foreign affiliate depends on who controls the firm. If firm A has the power to determine the business policy of foreign firm B, then firm B is a foreign affiliate of firm A. In practice, a commonly used measure of control is the ownership of voting rights in the firm. For example, the statistical agency of the European Union, Eurostat (2019), argues that a firm is controlled by another entity if that entity "controls – directly or indirectly – more than half of the shareholders' voting power or more than half of the shares."

Biermann and Huber (2019) estimate how the growth of an affiliate responds when its multinational parent corporation is hit by a banking crisis. The empirical challenge is that multinational firms and their affiliates are subject to common shocks. For example, if both affiliates and parents operate in the same industry and the industry experiences a global reduction in demand, it would be spurious to attribute the co-movement between parents and affiliates to shock transmission between them. Biermann and Huber (2019) overcome the empirical challenge by identifying a set of multinational parent corporations that were affected by a banking crisis during the financial crisis 2008/09. They compare the foreign affiliates of parents with a relationship to a crisis bank to the affiliates of parents without a relationship to a crisis bank. Their analysis includes affiliates located in countries all over the world during the years 2002 until 2015.

The main outcome of interest is the sales growth of foreign affiliates. Sales growth is often used as proxy for the productivity growth of firms in empirical studies. Furthermore, low sales growth can indicate that firms face constraints in their production process. The empirical results in Biermann and Huber (2019) show that, for the years before the financial crisis 2008/09, there was no statistically significant relationship between the sales growth of affiliates and an indicator for whether the parent had a relationship to a crisis bank. But after the crisis began in 2008, the sales of affiliates fell sharply if their parent had a relationship to a crisis bank. The sales of affected affiliates remained lower than those of other affiliates in 2009 and 2010. After 2011, the relationship between the sales growth of affiliates and the parent having a relationship

to a crisis bank essentially disappeared. This indicates that affiliates took around three years to recover from the banking shock to their parents.

The estimates imply that, from 2008 to 2010, a one percent decrease in bank loans held by the parent corporation lowered the average sales of international affiliates by 0.25 percent. Biermann and Huber (2019) subject this finding to several robustness checks. The estimated effects are robust when controlling for the size of the affiliate, its industry, and its country of residence. This suggest that shocks to firms of certain sizes, to certain industries, or to certain countries cannot explain the results. Overall, the findings suggest that a banking crisis in one country can have real effects in other countries, due to the transmission of the shock through the internal networks of multinational firms.

Having analyzed the effect on affiliate sales, Biermann and Huber (2019) turn toward the mechanisms through which banking shocks to parents can affect affiliates. First, they examine the asset side of the affiliate balance sheet. Affiliates that had parents with a relationship to a crisis bank increased long-term loans to their parents from 2008 to 2010. This finding is consistent with an efficient internal capital market. As parents faced a shock to credit supply, affiliates stepped in and provided financing. The effect on long-term loans from affiliates to the parent from 2011 to 2015 remained positive, although not statistically significant.

The next balance sheet item of interest are short-term claims on parents by affiliates. Short-term claims within firms are a commonly used proxy of input-output flows between parents and affiliates. Affiliates that had parents with a relationship to a crisis bank reduced short-term claims on parents from 2008 to 2010. A decrease in short-term claims on the parent suggests that there was a decrease in internal trade from affiliates to parents. A likely reason is that there was a decrease in the demand for affiliates' products by parents, which led to reduced trade flows from affiliates to parents from 2008 to 2010. The coefficient for 2011 to 2015 is statistically insignificant and implies a smaller decrease, compared to the 2008 to 2010 drop. This partial recovery of short-term claims suggests that parents slightly increased their demand for internal inputs from 2011. This could be one reason why affiliate sales were only lower from 2008 to 2010 and subsequently recovered. Finally, Biermann and Huber (2019) also consider the equity that parents held in their affiliates. Parents significantly and persistently reduced

equity, starting in 2008. This reduction in equity persisted until the end of the sample period in 2015. Since parent equity was on average 88 percent of total affiliate equity before 2008, this represents a substantial financial shock to affiliates.

The next question is whether affiliates were able to overcome the effects of the banking crisis by using other balance sheet channels. Liabilities to non-parents and equity from non-parents hardly changed from 2008 to 2010, suggesting that initially affiliates were not able to use other sources of funding to compensate for the loss of equity funding by parents. Liabilities to non-parents were marginally higher from 2011 to 2015, although the effect is imprecisely estimated. This indicates that affiliates may have raised debt from non-parents to finance their sales recovery from 2011.

There was no significant effect on other long-term assets (i.e. total long-term assets minus long-term loans to non-parents). Hence, affiliates did not cut lending to non-parents to make up for increased lending to parents. The effect on other short-term assets (i.e. total short-term assets minus short-term claims on parents) is negative and statistically significant from 2008 to 2010. This suggests that affiliates may have produced less for other, non-parent trading partners after the banking crisis, possibly because they became financially constrained. Alternatively, affiliates may have reduced their inventory holdings of raw materials because the parent demanded fewer products from the affiliate. The effect on other short-term assets disappears from 2011, as the coefficient is positive and insignificant from 2011 to 2015. The full recovery of other short-term assets suggests that affiliates' production fully recovered from 2011. This finding is consistent with the full recovery of sales from 2011. Overall, however, there is no evidence that before 2011 affiliates were able to overcome the effects of the banking crisis by using other balance sheet channels.

IV The Importance of Foreign Affiliates in European Economies

So far, we have established that firms grow more slowly when they are exposed to a banking crisis. In addition, we have documented that foreign affiliates grow more slowly when their parents are exposed to a banking crisis. Next, we consider whether the transmission of banking crises through the internal networks of multinational firms can affect aggregate outcomes

in European economies. Is the transmission through multinationals large enough to make a difference to aggregate sales?

To address this question, we first need to understand how important the affiliates of multinational firms are relative to aggregate European economies. Table I gives an overview of the aggregate importance of foreign affiliates in European Union member states. The data are for the year 2016 and provided by Eurostat, the statistical office of the European Union. Column 1 gives the total value of sales by firms in the business economy in million euros.[2] Column 2 lists the share of sales that is generated by foreign-owned affiliates. To be clear, this column does not include the share of sales generated by multinational parents. It only measures the sales share of foreign affiliates that are resident in the given country but controlled by organizations in another country.

[2]The business economy is defined as firms in NACE Rev. 2 Sections B to N, excluding section K, plus division S95. This means the business economy includes mining; manufacturing; electricity, gas, and water supply; waste management; construction; real estate; wholesale and retail trade; transportation and storage; accommodation and food service; information and communication services; professional, scientific and technical services; administrative services. It does not include the financial, insurance, public, education, health, and arts sectors. For details, see Eurostat (2019).

Table I: The importance of foreign affiliates in European economies

Country	Sales by firms, in million euros	Sales share by foreign affiliates
Austria	436,223	0.35
Belgium	684,247	0.34
Bulgaria	80,925	0.33
Croatia	59,943	0.26
Cyprus	23,321	0.15
Czech Republic	237,753	0.47
Denmark	371,531	0.25
Estonia	18,116	0.43
Finland	287,803	0.22
France	2,920,571	0.21
Germany	4,731,014	0.24
Greece	191,855	0.15
Hungary	134,403	0.51
Ireland	441,863	0.31
Italy	2,326,296	0.19
Latvia	28,778	0.44
Lithuania	51,750	0.32
Luxemburg	70,025	0.52
Malta	15,191	0.26
Netherlands	888,776	0.38
Poland	434,512	0.39
Portugal	240,352	0.25
Romania	139,433	0.48
Slovakia	88,564	0.52
Slovenia	58,322	0.32
Spain	1,340,694	0.27
Sweden	565,959	0.32
United Kingdom	2,581,642	0.35
All EU28	19,449,862	0.28

Column 1 reports the total value of sales by firms in the business economy, excluding the financial sector, in million Euros. The business economy covers NACE Rev. 2 Sections B to N, excluding section K, plus division S95. Column 2 reports the share of sales in column 1 that is by foreign-owned affiliates. A firm is foreign-owned if a foreign entity controls - directly or indirectly - more than half of its shareholders' voting power or more than half of its shares. All data are for 2016. Data source: Eurostat (2019).

On aggregate, foreign affiliates are responsible for 28 percent of sales in the non-financial business economies of member states of the European Union. Their share in value added is similar, with around 25 percent of aggregate value added in the European Union. Only 1 percent of firms in European Union member states are foreign affiliates, which implies that the average foreign affiliate is significantly larger than the average domestic firm.

The Mediterranean countries of Greece (15 percent of sales), Cyprus (15 percent), and Italy (19 percent) have the lowest sales share of foreign affiliates. Countries in Eastern Europe, such as Slovakia (52 percent), Hungary (51 percent), Romania (48 percent), and the Czech Republic (47 percent) have the most sizable shares. The largest European economies all have shares in the middle of the distribution, for example Germany with 24 percent, France with 21 percent, and the United Kingdom with 35 percent. The correlation coefficient between total sales and the sales share of foreign affiliates is -0.33, indicating that foreign affiliates tend to be more important in smaller European economies.

Taken together, the data show that foreign affiliates play an important role in all countries of the European Union. Across all European economies, they account for at least one-seventh of total sales. In the three largest European economies, they account for at least one-fifth of sales, and in some economies for over half of sales. These numbers imply that shocks to foreign affiliates have the potential to drive aggregate outcomes. Since, by definition, foreign affiliates are connected to firms in other countries, their aggregate importance also raises the possibility that foreign affiliates import shocks from a foreign country to their country of residence.

V The Aggregate Impact: How Crisis Transmission Through Multinational Firms affects European Economies

The final step in our empirical analysis is to approximate how large the aggregate losses can be when multinational firms transmit a banking crisis from one country to another through their internal networks. We begin by analyzing a concrete event: the reduction in lending by banks in the United States during the financial crisis 2008/09. Ivashina and Scharfstein (2010) measure how the financial crisis in the United States affected loans to large corporate borrowers, such as multinational firms. They focus on syndicated loans, i.e. loans where a number of lenders

come together to originate a loan. Syndicated loans are a common way for banks to lend to large firms in the United States. Syndicated loans can take many forms, for example term loans, credit lines, loans for restructuring, working capital, and general purpose lending. This makes syndicated lending a relatively comprehensive measure of total lending to large US firms.

Ivashina and Scharfstein (2010) find that syndicated lending was much lower during the last quarter of 2008, relative to the previous quarter. They show that banks reduced lending by more if they were more reliant on non-deposit funding (i.e. funding that comes from other financial institutions, not from deposits by households). A two standard deviation increase in the ratio of non-deposit funding over assets was associated with a decrease in the number of loan originations by 28 percent. The freeze on non-deposit funding markets was a key feature of the financial crisis 2008/09, suggesting that the drop in syndicated lending was related to the crisis. Hence, we take the reduction in lending of 28 percent as approximate measure of the contraction in credit supply by banks to large US borrowers because of the crisis.

With this measure of the lending reduction in hand, we estimate by how much the sales of international affiliates of US multinationals decreased. As described above, Biermann and Huber (2019) find that a one percent decrease in bank loans held by a multinational firm lowered the average sales of its international affiliates by 0.25 percent. Hence, a 28 percent lending reduction would lead to a decrease of 28*0.25 = 7 percent in sales by the international affiliates of US multinationals.

The final step in the calculation is to relate the 7 percent decrease in sales of affiliates of US multinationals to the aggregate importance of US affiliates in foreign economies. Data for the total sales share of US affiliates are not available for all countries. Instead, we focus on Germany, the largest European economy, where the aggregate importance of international affiliates is approximately in the middle of the distribution of European economies. Affiliates of US multinationals account for 4.91 percent of total sales by firms in the German business economy, excluding the financial sector. If all of them decrease their sales by 7 percent, total non-financial business sales in Germany would fall by 0.07*4.91=0.34 percent or 21 billion euros. To put this number into perspective, real non-financial business sales in Germany fell by 4.33 percent from 2008 to 2009. This suggests that the shock transmission through multinationals can have

quantitatively important effects on aggregate outcomes.

The calculation above has relied on several simplifying assumptions. We have assumed that: changes in the sales of US affiliates did not have general equilibrium effects on other firms in Germany; government policy did not endogenously respond to the decrease in US affiliate sales; and the exchange rate did not adjust. These assumptions are unlikely to hold in practice. This will introduce some error into the analysis. For example, the calculation might understate the true aggregate impact if input-output linkages between US affiliates and German firms are important. In the opposite direction, the calculation might exaggerate the aggregate effect if US affiliates lost customers to German firms or if the Dollar depreciated relative to the Euro. Despite these sources of potential error, the calculation allows us to at least gauge the aggregate impact of the transmission through multinational firms' internal networks.

We carry out thought experiments for six additional countries: the United Kingdom, Italy, Spain, Ireland, Portugal, and Greece. For each country, we assume that its banks face a crisis of similar magnitude to the financial crisis 2008/09 in the United States. That amounts to assuming that the average multinational corporation resident in that country suffers a decrease in its bank loans of 28 percent. As described above, this will result in a decrease of 7 percent in the sales of the international affiliates with parents in that country, according to the estimates in Biermann and Huber (2019). We then calculate by how much sales in the German non-financial business economy would decline because of the decrease in sales by international affiliates resident in Germany. We use the German economy as illustrative example because consistent data are available for Germany. But, as Table I shows, international affiliates play an important role in all European economies. Hence, the economic mechanisms we consider apply to European countries more generally.

Table II presents the results. Differences in the estimated sales decrease across the six countries are entirely driven by differences in the importance of affiliates from these countries to the German economy. Affiliates controlled by entities in the United Kingdom account for 3.09 percent of sales in the German non-financial business economy. So, when a banking crisis hits multinationals in the United Kingdom, the shock transmission to affiliates resident in Germany could have significant effects on the performance of the aggregate German economy.

The estimate suggests that sales in the German non-financial business economy could drop by 0.22 percent or 14 billion euros. This scenario is of interest given the current discussions about the economic repercussions of the United Kingdom's exit from the European Union. Some observers, including the Bank of England, have warned that the exit could harm financial stability (Partington 2018). If indeed the banking sector in the United Kingdom is negatively affected, the activities of multinational firms may transmit the effects of the UK banking shock to Germany and other European countries.

In recent years, there has been much discussion about the health of the banking system in Italy, Spain, Ireland, Portugal, and Greece. Table II lists how banking crises in these countries could affect the German economy if multinationals transmit the banking shock to their German affiliates. Affiliates controlled by entities in Italy, Spain, and Ireland are responsible for between 0.3 and 0.45 percent of sales in the German non-financial business economy. Accordingly, shocks to these affiliates have the potential to affect aggregate outcomes in Germany. Sales in the German non-financial business economy could fall between 0.021 and 0.031 percent. Entities resident in Portugal and Greece control only a small share of sales. Therefore, it is less likely that a banking crisis in Portugal and Greece would have large effects on the German business economy through multinational firms' networks. Notably, a banking crisis in Italy, currently under close watch by the EU Commission's fiscal rules framework, could translate into a sales loss of about 0.031% (or 2 billion euros) in Germany. A banking crisis in Spain would exhibit an impact on sales in the German business economy of about 0.024% or 1.5 billion euros in losses. But overall, the effects stemming from these countries are relatively moderate compared to the larger or more open economies listed in Table II.

Tables III and IV run the same analyses for sales reductions in two other countries, the UK and Italy. The UK is an open economy with a relatively high share of foreign affiliates, as shown in Table I. In addition, its economy quite heavily relies on banking. Consequently, the UK's real economy could be particularly vulnerable to banking crises in other economies. The estimates suggest that a banking crisis in large economies like Germany (about 0.3% or 11 billion euros) and France (about 0.2% or 7 billion euros) could severely hit the UK economy, which is already struggling with worries about Brexit and the implications for the UK banking

sector. Entities resident in countries like Portugal and Greece control few firms in the UK, leading to a rather small impact on the UK economy as a result of potential crises in these countries. In Italy, there are worries about a potential sovereign debt crisis given the country's high debt-to-GDP ratio, low growth prospects, and its struggle over the budget with the EU Commission. Banking crises in the US and the France would have a notable negative impact on sales in Italy of about 0.22% and 0.28% or 6 to 8 billion euros, respectively. Again, Portugal and Greece have few entities controlling firms in Italy, so that Portuguese and Greek banking crises would have little impact on Italy through the channel of foreign affiliates.

Table II: Estimated sales reduction in Germany due to banking crisis in another country

Country with a (hypothetical) banking crisis	Resulting decrease in sales in the German business economy (in %)	Resulting decrease in sales in the German business economy (in million euros)
United States	0.344	21,284
United Kingdom	0.216	13,393
Netherlands	0.160	9,906
Switzerland	0.131	8,108
France	0.119	7,358
Luxembourg	0.087	5,396
Italy	0.031	1,947
Spain	0.024	1,480
Ireland	0.021	1,323
Portugal	0.002	106
Greece	0.000	7

The right-hand column reports the estimated decrease in the total value of sales by firms in the German business economy (excluding the financial sector) that is due to the transmission of a banking crisis in the given country through the internal networks of multinational firms. The values in the left-hand column are in percent. The business economy covers NACE Rev. 2 Sections B to N, excluding section K, plus division S95. The calculation is explained in Section V.

Table III: Estimated sales reduction in the UK due to banking crisis in another country

Country with a (hypothetical) banking crisis	Resulting decrease in sales in the UK business economy (in %)	Resulting decrease in sales in the UK business economy (in million euros)
United States	0.757	30,106
Germany	0.270	10,736
France	0.167	6,650
Japan	0.166	6,611
China (without Hongkong)	0.119	4,731
Netherlands	0.090	3,571
Spain	0.072	2,871
Ireland	0.066	2,615
Italy	0.018	728
Greece	0.001	26
Portugal	0.001	23

The right-hand column reports the estimated decrease in the total value of sales by firms in the UK business economy (excluding the financial sector) that is due to the transmission of a banking crisis in the given country through the internal networks of multinational firms. The values in the left-hand column are in percent. The business economy covers NACE Rev. 2 Sections B to N, excluding section K, plus division S95. The calculation is explained in Section V.

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Table IV: Estimated sales reduction in Italy due to banking crisis in another country

Country with a (hypothetical) banking crisis	Resulting decrease in sales in the Italian business economy (in %)	Resulting decrease in sales in the Italian business economy (in million euros)
United States	0.278	7,936
France	0.224	6,402
Germany	0.189	5,388
Switzerland	0.091	2,598
United Kingdom	0.087	2,478
Netherlands	0.057	1,626
Spain	0.025	710
Ireland	0.012	334
Portugal	0.001	38
Greece	0.001	17

The right-hand column reports the estimated decrease in the total value of sales by firms in the Italian business economy (excluding the financial sector) that is due to the transmission of a banking crisis in the given country through the internal networks of multinational firms. The values in the left-hand column are in percent. The business economy covers NACE Rev. 2 Sections B to N, excluding section K, plus division S95. The calculation is explained in Section V.

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VI Conclusion

This study builds on current research on banking crises to argue that multinational firms can transmit banking crises across countries, potentially leading to sizable aggregate losses in the Eurozone. We document that a banking crisis in major economies could severely affect aggregate outcomes in the German economy. For instance, we show that a banking crisis in the US could lead to a decrease in sales in the German economy (excluding the financial sector) of 0.3%. The extent to which a banking crisis affects other countries through multinational firms depends on the origin of a hypothetical banking crisis. The sales loss in Germany could be as high as 0.2% in case of a banking crisis in the UK and 0.031% in Italy. But the sales losses would amount to just 0.002% in the case of a banking crisis originating in Portugal.

We base these results on two factors documented in recent research. First, firms exposed to a banking crisis in their home country grow more slowly. Second, novel research shows that foreign affiliates grow more slowly if their parent company is hit by a banking crisis abroad. Thus, domestic crises can spread through internal networks within multinational firms and thereby become international crises.

We also report that foreign affiliates are of significant importance in EU economies. The share of sales by foreign affiliates is particularly high in small, open Western European economies (like the Netherlands with a sales share of 0.38%). Also, foreign affiliates matter in Eastern European economies such as Poland (0.39%), Romania (0.48%) and Slovakia (0.52%) – clearly reflecting the nature of value chains across the EU, for example, in the automotive industry.

The findings on shock transmission in this paper have a number of implications relevant for policy making. The first relates to EU reform initiatives, such as the banking union. The unified set of rules for standards and supervision of banks is meant to contribute to preventing (or better managing) banking crises. Similarly, the proposed capital markets union could reduce home bias in the investment of banks, firms, and households, which – in turn – may well be conducive to stabilizing the banking system. The findings of this paper show that banking crises in one EU member state can have effects across the whole EU because of multinational firms. This strengthens the case for coordinated reforms across countries that could reduce the probability

of banking crises in the EU, such as the banking union and the capital market union.

Second, the results also have implications for the current debate on the UK's exit from the European Union (Brexit). Some observers argue that a hard Brexit could increase the likelihood of a banking crisis in the UK. Our analysis indicates that, given the importance of affiliates controlled by UK multinationals in EU economies, a UK banking crisis could have severe consequences in large EU economies, such as Germany. Such effects are not discussed to a great extent in current analyses of consequences of Brexit on other EU economies, as these analyses mainly focus on effects from increased trading costs for bilateral trade flows with the UK.

The findings of this paper should be seen as a rough estimate of how multinational firms could transmit negative effects of banking crises across countries – and thereby affect aggregate economies. It is important to point out that our analysis does not account for cross-country and within-country general equilibrium effects and policy responses that could mitigate any sales reduction. But it should also be noted that general equilibrium effects of banking crises could reinforce the sales reduction. Our simplified assumptions are helpful to gauge the extent to which multinational firms could matter for crises transmission. Future research could focus on a theoretical framework to analyze general equilibrium effects of crisis transmission via multinational firms.

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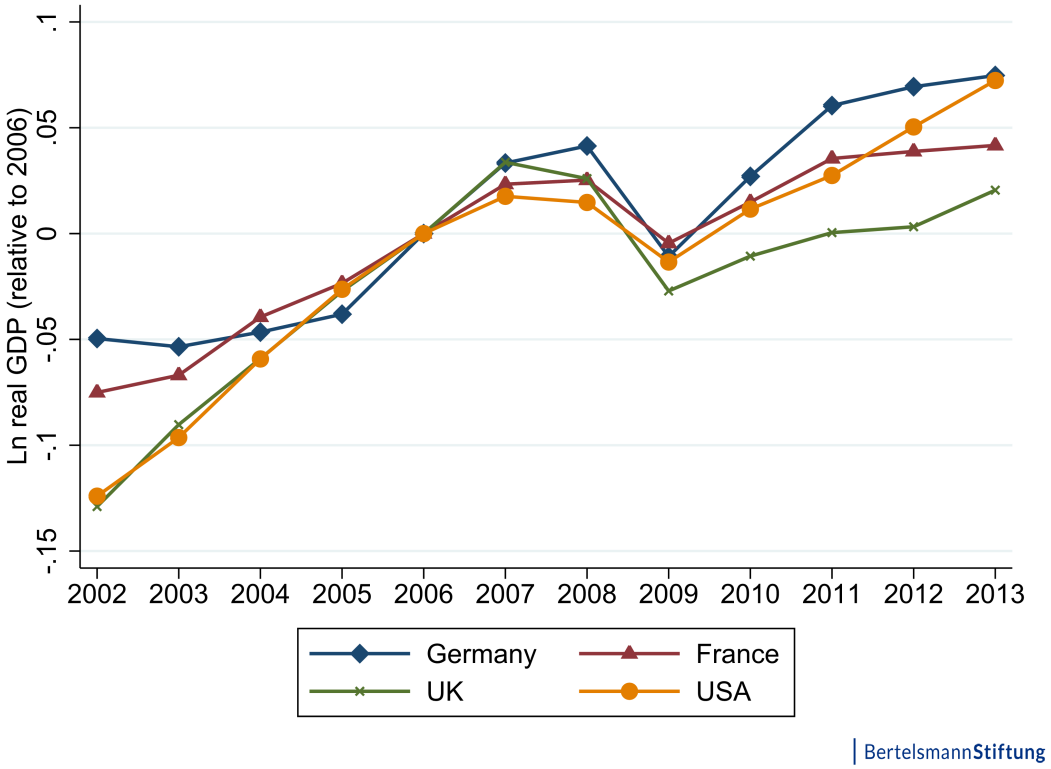
Appendix

Figure III: Real GDP in advanced economies



Notes: The figure shows real GDP (in logs, relative to 2006) in France, Germany, the United Kingdom, and the United States. Source: Huber (2018) using data from the IMF.

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