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Taming the herd? Foreign banks, the Vienna Initiative and crisis transmission [☆]



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ABSTRACT

We use detailed data on over 350 banks in emerging Europe to analyze how bank ownership and the Vienna Initiative impacted credit growth during the Great Recession. As part of the Vienna Initiative, western European banks signed country-specific commitment letters in which they pledged to maintain exposures and to support their subsidiaries in emerging Europe. We show that while both domestic and foreign banks sharply curtailed credit during the financial crisis, foreign banks that participated in the Vienna Initiative were relatively stable lenders. We find no evidence of negative spillovers from countries where banks signed commitment letters to countries where they did not.

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1. Introduction

The start of emerging Europe's transition from communism to capitalism in 1989 heralded the large-scale entry of foreign banks into the region. Western-European banks with saturated home markets were attracted to emerging Europe for its ample growth potential and scope for financial deepening. Policy makers and development institutions stimulated financial integration because of its presumed positive impact on the efficiency and stability of local banking sectors. The empirical evidence that has emerged over the last two decades suggests that foreign banks indeed stimulated competition (Havrylychuk and Jurzyk, 2011) and contributed to stability during local financial turmoil (De Haas and Van Lelyveld, 2006).

The global financial crisis put this model of intense cross-border banking to the test. The crisis was unique in that it emanated from the *home* markets of the banking groups operating in emerging Europe. Although few of these large banks had direct US sub-prime exposures, many of them were affected by the sharp reduction in interbank liquidity as of the second half of 2007. Banks started to deleverage both at home and abroad, a process that accelerated after the collapse of Lehman Brothers in September 2008 (Cetorelli and Goldberg, 2011/12; De Haas and Van Horen, 2013). It became increasingly uncertain whether multinational banks, now battered by problems elsewhere, would keep funding Eastern European customers through their local subsidiaries.

In response to these mounting pressures, Western governments supported various banks with guarantees, capital, and liquidity towards the end of 2008. This alleviated concerns about a credit crunch 'at home' but did not mitigate worries about a retrenchment of banks from emerging Europe. On the contrary, concerns were raised that government support came with strings attached. Anecdotal evidence suggests that banks were indeed asked to focus on domestic lending. For instance, French banks that received state support had to increase domestic credit by 3–4% annually and Dutch bank ING announced it would lend US\$ 32 billion to Dutch borrowers in return for government support (World Bank, 2009, p. 70).

Tightening funding constraints and biased government interventions raised concerns about the possibility of an uncoordinated rush of banks out of emerging Europe. Although many banks confirmed their commitment to the region during the early stage of the crisis, there was no formal policy framework or coordination mechanism in place to ensure these commitments were credible. The concern was that this lack of coordination could lead individual banks to withdraw, thus causing a 'run' on the region, even though it would be in their collective interest to roll over debt. The absence of agreements on how to share the burden of a defaulting subsidiary between the fiscal authorities in the home and host countries further exacerbated the risk of such a run. The accompanying reversal in financial flows could not only have had dire consequences for local firms and households but also have led to disruptive exchange-rate fluctuations and balance of payments problems.

In response to this emerging institutional vacuum, the Austrian government and various multinational banks with high exposures to emerging Europe started informal discussions towards the end of 2008. The goal of this 'Vienna Initiative' (VI)¹ was to avoid collective action problems (Pistor, 2012a) and to guarantee macroeconomic stability in emerging Europe. Soon the VI meetings also included the main International Financial Institutions (IFIs), the European Union, the European Central Bank, as well as the Ministries of Finance, central banks and bank regulators from multinational banks' home and host countries.

In February 2009, the European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), and the World Bank Group launched within the context of the VI a '*Joint IFI Action Plan in support of banking systems and lending to the real economy in Central and Eastern Europe*'. The goal was to mobilize resources from these institutions to avert a banking crisis and support bank lending in the region. This support was integrated with IMF and European Union macro-financial support programs to Bosnia and Herzegovina, Hungary, Latvia, Serbia, and Romania.

In return for financial support under the Joint IFI Action Plan and countries' commitment to keep their support programs on track, a number of multinational banks signed country-specific

¹ The name later changed to European Bank Coordination Initiative. Levinger (2010) provides a historical overview of the VI.

commitment letters in which they pledged to maintain exposures and to continue to provide credit to firms and households in a particular country. Parent banks confirmed that they would keep subsidiaries adequately capitalized and provide them with sufficient liquidity. The VI thus developed into a public–private partnership that combined macro-financial support by the IMF and the EU (a ‘bail-out’) with funding by development institutions and a coordinated ‘bail in’ of private lenders.

Although a large-scale, uncoordinated withdrawal of banks from emerging Europe did not materialize—and the VI can therefore be considered successful *stricto sensu*—to this date virtually no empirical analysis has been undertaken to assess its impact. No evidence is available on the role played by banks that were part of the VI versus those that were not. Likewise, for multinational banks that were part of the VI, no comparison has been made between their lending behavior in countries where they signed commitment letters and countries where they did not. It also remains unclear whether, as was feared at the time, signing commitment letters led to negative spillovers to other countries.

We employ a comprehensive bank-level dataset to fill these gaps in the literature. This is important as part of a thorough ex post evaluation of the VI and as a more general assessment of the effectiveness of private-sector ‘bail-ins’. Our findings also inform the policy debate on similar proposals (‘Vienna Initiative 2’) in the context of the European sovereign debt crisis.

To preview our results, we find that while overall both foreign and domestic banks sharply curbed credit growth during the crisis, banks that took part in the VI were relatively stable lenders. Moreover, VI banks did not retrench from non-VI countries to maintain exposures to countries where they signed commitment letters. If anything, participation in the VI led to positive rather than negative spillover effects to other countries.

These results allow us to contribute to three strands of the literature. First, we shed new light on the implications of foreign-bank entry for financial stability in emerging markets. An important difference between foreign-bank subsidiaries and domestic banks is that the former belong to a multinational bank with lending opportunities across various countries.² Morgan et al. (2004) present a model in which such multinational groups, by reallocating scarce capital across borders, absorb local shocks and transmit foreign shocks.

The empirical literature finds evidence for both these roles. As regards the former, De Haas and Van Lelyveld (2006) find for emerging Europe that during bouts of financial turmoil, lending by foreign banks was more stable than lending by domestic banks. De Haas and Van Lelyveld (2010) present similar results for a broader set of countries. In line with these findings, Dinger (2011) shows for emerging Europe that the presence of multinational bank subsidiaries eases aggregate liquidity shortages during local crises. As regards the role of multinational banks as foreign shock transmitters, Peek and Rosengren (1997) demonstrate how the drop in Japanese stock prices in 1990 induced Japanese bank branches in the United States to reduce lending. Schnabl (2012) analyzes spillovers of the 1998 Russian crisis to Peru, where banks – including multinational bank subsidiaries – saw their foreign funding decline and had to reduce local lending. Chava and Purnanandam (2011) and Aiyar (2012) find similar evidence for US and UK banks, respectively.

More recent studies ask whether multinational banks also transmitted the 2008–2009 crisis across borders. De Haas and Van Lelyveld (2014) use an international dataset and find that foreign-bank subsidiaries curtailed credit more aggressively than domestic banks. Domestic banks relied more on local deposits to fund credit growth and were better positioned to continue lending. In line with this evidence, Popov and Udell (2012) show how multinational banks transmitted the crisis to emerging Europe and that the severity of shock transmission depended on the strength of parent banks’ balance sheets. Ongena et al. (2012) also focus on emerging Europe and find that not only foreign banks but also domestic banks that borrowed in the international wholesale markets, had to cut back lending more during the crisis. Cull and Martínez Pería (2013) confirm that in Eastern Europe foreign bank lending declined more than lending by domestic private banks. In contrast, Barba Navaretti et al. (2010)

² A related difference is that the geographical and hierarchical distance between loan officers and headquarters is typically longer within foreign than domestic banks, so that intra-bank agency problems can thwart the effective screening and monitoring of local clients (Stein, 2002; Detragiache et al., 2008). As a result foreign banks may lend less to relatively opaque clients. Yet, Beck et al. (2013) find that foreign banks *can* actually lend to the same clients as domestic banks by applying transaction-based rather than relationship-based lending techniques.

stress that multinational banks were a stabilizing force in Europe as they displayed a relatively stable loan-to-deposit ratio. Their analysis focuses on the years 2007–2008 while, as we show in this paper, much of the reduction in lending took place in 2009 and after. More importantly, we are the first to differentiate among foreign banks on the basis of the level of government support they received during the crisis and their participation in the Vienna Initiative.

In doing so, we also add to the literature on the impact of state ownership and government support on credit growth. [Micco and Panizza \(2006\)](#) and [Mian \(2006\)](#) show that lending by state banks is less procyclical than lending by private banks as governments use banks to smooth credit over the business cycle. As regards government support, [Rose and Wieladek \(forthcoming\)](#) find for the recent crisis that foreign banks in the United Kingdom reduced lending and increased interest rates when they were nationalized in their home country. [Marques et al. \(2013\)](#) show that government support of banks is positively related to bank risk taking, providing support for the view that such policies reduce market discipline. [Brei et al. \(2011\)](#) provide evidence that recapitalizations during the global financial crisis did not boost bank lending except for banks with a capital ratio above a certain threshold. We compare foreign, private domestic, and state banks to separately assess the impact of state ownership and government support during the recent crisis.

Third, our results provide evidence on the possible catalytic effect of crisis funding by an international lender of last resort like the IMF. A theoretical literature has developed to understand the conditions under which (limited) IMF funding, by acting as a seal of approval of a country's reform efforts, may help close an external funding gap and prevent a balance of payments crisis. Such a catalytic effect materializes if an IMF program nudges private creditors to roll over their commitments. [Corsetti et al. \(2003\)](#) show how contingent support can reduce the range of economic fundamentals at which international investors find it optimal to withdraw from a country. In a similar vein, [Morris and Shin \(2006\)](#) demonstrate that catalytic finance works if it provides a country with incentives to keep up adjustment efforts without distorting creditors' roll-over decisions.

The empirical evidence on the effectiveness of contingent support is scarce. [Cottarelli and Giannini \(2002\)](#) conclude that IMF interventions result in only small increases in private capital. [Bird and Rowlands \(2008, 2009\)](#) even show that IMF-supported programs are typically *negatively* related to net private capital inflows. Yet, [Papi et al. \(2013\)](#) show for a large sample of developing countries that reverse causality may have plagued much of this previous research. Their results suggest that when dealing adequately with this endogeneity, IMF programs are actually associated with a lower probability of future banking crises. [Corsetti and Roubini \(2004\)](#) analyze a number of case studies and also draw a slightly more positive conclusion. They highlight two relative success stories, Korea (1997) and Brazil (1999), where IMF lending was accompanied by roll-overs of interbank credit lines (in Korea short-term interbank lines were converted into longer and government-guaranteed bonds). In both cases—similar to the Vienna Initiative—roll-overs were neither completely voluntary nor uncoordinated (as in a 'pure' catalytic approach) and systems were put in place to monitor roll-over rates. The official sector organized a concerted private sector involvement to resolve collective action problems.³ Our paper contributes to this literature by analyzing the impact of a combination of IMF funding and active creditor coordination on banks' willingness to roll over exposures.

We proceed as follows. Section 2 provides more details about the VI after which Section 3 describes our data. Section 4 then explains our empirical methodology and Section 5 presents the empirical results. Section 6 discusses the implications of our findings and concludes.

2. The Vienna Initiative

The VI came into being in the fall of 2008 when fears were growing about the vulnerability of emerging Europe to withdrawals by multinational banks.⁴ Rapid credit growth during the pre-crisis

³ In 1998, Brazil initially only collected data on rollover rates and shared these with the IMF, without encouraging banks to maintain cross-border lending. This soft monitoring without real 'bite' did not succeed in stemming a sharp reduction in international bank exposure to Brazil. A similarly soft arrangement in Turkey in 2002 proved to be a paper tiger as well ([Roubini and Setser, 2004, p. 150](#)).

⁴ Table A1 in Appendix A provides a timeline of the Vienna Initiative.

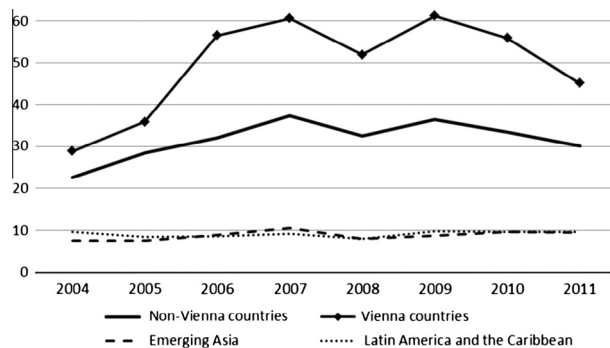


Fig. 1. International claims as a percentage of GDP (2004–2011). *Note:* This figure shows total international claims to various geographical regions as a percentage of regional GDP at end year. International claims contain the consolidated claims of banks headquartered in BIS reporting countries, including claims of their own foreign affiliates but excluding positions between related offices. International claims capture the sum of cross-border lending and local claims extended in foreign currency. Vienna countries: Bosnia and Herzegovina, Hungary, Latvia, Serbia, and Romania. Non-Vienna countries in emerging Europe: Albania, Bulgaria, Croatia, Czech Republic, Estonia, Lithuania, Macedonia, Montenegro, Poland, Slovak Republic and Slovenia. Source: BIS Consolidated International Banking Statistics (immediate borrower basis) and IMF World Economic Outlook.

period had left the private sector in many countries highly leveraged. A sharp reduction in multinational banks' funding to their subsidiaries would not only have caused a reduction in lending and asset prices but most likely also have resulted in severe macroeconomic destabilization. By way of background, Fig. 1 illustrates the importance of international bank lending to emerging Europe. We show total international claims, as taken from the BIS Consolidated International Banking Statistics, as a percentage of regional GDP.⁵ The figure indicates that compared to Emerging Asia and Latin America, international banks' exposure to emerging Europe is significantly higher. This holds in particular for the five countries that in 2009 became part of the VI. In these countries, international claims peaked at just above 60% of GDP right before the onset of the crisis. In the rest of emerging Europe this number was never higher than 37%, while in the other two regions international bank lending has typically only been around 10% of GDP. This very high dependence of local borrowers on foreign funding explains why concerns about a possible retrenchment in such funding concentrated on emerging Europe in general and the five VI countries in particular.

In November 2008, a number of pan-European banks with a large presence in emerging Europe sent a letter to the European Commission to call for a quick and coordinated response to the problems in emerging Europe and, more specifically, to ensure sufficient funding for banks in the region. In response the VI was created as a coordination platform for multinational banks, their home and host country supervisors, fiscal authorities, the IMF, and development institutions to safeguard a continued commitment of parent banks to their subsidiaries.⁶ In addition, the European Commission ensured that banks benefiting from state support would not be forced to downsize their presence in emerging Europe. In March 2009, an Emergency Summit of EU leaders confirmed that home-country bank support should not come with any restrictions on supported banks' eastern European subsidiaries.

On February 27th 2009 the EBRD, EIB, and the World Bank Group launched the 'Joint IFI Action Plan in support of banking systems and lending to the real economy in Central and Eastern Europe' with the objective "to support banking sector stability and lending to the real economy in crisis-hit Central and

⁵ These statistics capture banks' risk exposure to a region and contain the consolidated claims of banks headquartered in BIS reporting countries, including claims of their own foreign affiliates but excluding positions between related offices. International claims capture the sum of cross-border lending and local claims extended in foreign currency.

⁶ Impromptu coordination was necessary since burden sharing in the case of a failing European cross-border bank effectively depends on ex post negotiations between countries. Such improvised cooperation (Freixas, 2003) or ex post bargaining is prone to coordination failures.

Eastern Europe". During spring 2009 these institutions met several times with 17 banking groups that covered about 60% of all banking assets in the region. The meetings led to a 'joint needs assessment' that resulted in financial support for individual banking groups. In aggregate, the institutions committed to a funding package of EUR 24.5 billion to support cross-border banks. By end-September 2009, banks had received EUR 16.3 billion in the form of senior loans, tier 1 and 2 capital, trade finance, facilities for small business loans, and syndicated loans.⁷

The Joint IFI Action Plan was embedded in a broader policy framework by linking it to the IMF and EU stabilization programs. IMF programs were introduced in various countries when substantial amounts of foreign currency debt matured and external financing gaps opened up. Part of this debt was issued by multinational banks and insufficient roll-overs would have compromised the success of IMF–EU balance of payments programs. The authorities were wary not to substitute commercial funding with public sector money: the goal was to keep commercial banks 'bailed in' rather than bailed out. Bank commitments to roll over debt consisted of strong mutual agreements that were nevertheless voluntary and not an explicit pre-condition for balance of payments support.

In five countries – Bosnia and Herzegovina, Hungary, Latvia, Romania, and Serbia – a total of 17 parent banks pledged, via so-called 'commitment letters', to maintain their exposures and to recapitalize subsidiaries for the duration of the IMF/EU programs.⁸ On average the banks that signed up had a joint market share in the host country of about 63%. Importantly, the banks that signed differed by country as did the exact nature of the commitments. In the case of Latvia, the assumption was that foreign banks would roll over at least 80% of their lending to the country, the majority of which was to their own subsidiaries. In the case of Hungary, banks promised to ensure a "prudent capitalization of their subsidiaries" and to maintain at least 95% of their September 2008 exposure. In Romania, the pledges were most concrete as banks promised to "increase the minimum capital adequacy ratio for each subsidiary from 8% to 10%" and to fully maintain their March 2009 exposure for the time of the IMF program. Also in Bosnia and Herzegovina and in Serbia, banks committed to rollover 100% of their exposure (as of December 2008) and to recapitalize subsidiaries if and when needed. Some of these commitments were reaffirmed later on in 2009.⁹ As the crisis subsided, pressure to maintain cross-border exposures was reduced and in some cases roll-over commitments were lowered by early 2010.

At the time concerns were expressed that the focus of the commitment letters on five specific countries could tempt multinational banks to support their subsidiaries in these countries by withdrawing funds from countries without exposure commitments, such as Poland or the Czech Republic. Such negative spillovers could have contributed to the further cross-border transmission of the crisis (Keller, 2009; Mitra et al., 2010). These concerns were only partially alleviated by a number of so-called 'horizontal meetings' with multinational banks and the relevant national and international authorities that were held in September 2009 and March 2010 (see Table A6 in Appendix A). The focus of these meetings was on lending to the region as a whole rather than the five countries with an IMF/EU program and explicit exposure commitments.

3. Data and descriptive statistics

3.1. Data sources and construction

Our main data consists of a panel of balance sheet and income statement data for over 350 banks in emerging Europe during 1999–2011.¹⁰ This time window includes the global financial crisis as well as the – partially overlapping – eurozone crisis of 2009–2011. The source is Bureau van Dijk's BankScope

⁷ Progress Report 2009 (p. 4) and Final Report 2011 (p. 5). By end-December 2010, EUR 33.2 billion had been made available.

⁸ Commitment letters were signed for Romania and Serbia in March 2009, Hungary in May 2009, Bosnia and Herzegovina in June 2009, and Latvia in September 2009. Belarus and the Ukraine had an IMF program but no commitment letters were signed.

⁹ In Romania, parent banks ultimately did not maintain full exposures. With the exception of three banking groups, parent bank financing declined before the commitments were reaffirmed (see IMF, Romania: Letter of Intent and Technical Memorandum of Understanding, February 2010).

¹⁰ Our definition of emerging Europe comprises Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, FYR of Macedonia, Montenegro, Poland, Romania, Serbia, Slovak Republic, and Slovenia.

database and all data are denominated in US dollars to ensure comparability across banks. We disregard banks for which we have less than three consecutive years of data.¹¹ The panel is unbalanced as we do not have information for each bank in each year. We combine these data with macroeconomic information from the IMF International Financial Statistics.

In addition, we hand-collect information on crisis-related government support to banks in home countries. We take this information from publications by the European Commission¹² and IMF, Reuters news service, and bank websites. We capture support in the form of capital injections, bank-specific guarantees, and asset sales to the government.

We also gather information about the ownership structure of each bank over time. In line with the extant literature we consider a bank foreign-owned if 50% or more of its shares are owned by foreigners (e.g. Claessens and Van Horen, 2014). Time-varying information on ownership is important as the process of foreign-bank entry differed across countries in terms of intensity and timing. We manually pull information from bank websites and annual reports. For foreign-bank subsidiaries we trace back in which year t they became part of a group. For newly established subsidiaries by parent banks, we then use data from year t onwards. For subsidiaries that are the result of a takeover, we only use data from year $t + 1$ onwards. In this way we take into account that after a take-over the influence of the new parent bank is not immediate but only noticeable when the integration process is well under way.

A number of parent banks merged or acquired another bank during our sample period and such M&As may lead to artificial jumps in total lending in the merger or acquisition year. To correct for this, we perform a backward adjustment by synthetically merging the two banks into one entity in the years before the M&A took place. In addition, to rule out remaining M&A effects we drop bank-year observations where the annual growth rate of total gross loans exceeds 200%.

Finally, for each foreign-bank subsidiary (level 1) we check whether it owns sub-subsidiaries (level 2) that are larger than 0.5% of the ultimate bank holding company (level 0). If not, we include consolidated data for the level 1 subsidiaries. If it does, we include unconsolidated data for the level 1 subsidiary and include the sub-subsidiary as a separate entity (using consolidated data) of the parent bank.

Our main dependent variable is annual gross nominal credit growth. We assess growth rates because level variables tend to be integrated of order one and this may lead to spurious correlation.¹³ We define gross nominal credit as net loans plus loan loss reserves. Thus, our dependent variable reflects changes in banks' output of new loans but not loan loss provisions and write-offs.¹⁴ If certain banks provisioned more during the crisis than others, this should therefore not bias our dependent variable.

3.2. Descriptive statistics

Table 1 summarizes the development of credit growth in emerging Europe over the past decade. We distinguish between, on the one hand, the five countries – Bosnia and Herzegovina, Hungary, Latvia, Romania, and Serbia – that in 2009 would become part of the Vienna Initiative and, on the other hand, the non-participant countries. Within the first group we separate foreign-bank subsidiaries for which the parent bank signed a commitment letter from subsidiaries for which parents did not sign such a letter.

Before the outbreak of the crisis (1999–2007) both domestic and foreign banks grew rapidly at an average pace of just over 40% per year. Credit growth was even somewhat higher among foreign banks,

¹¹ We did not need to exclude any significant banks during the crisis period as there were only seven banks without three consecutive years of data in the period 2008–2010. These banks had an average market share of just 2.3% and none of them exited the region. More generally, we checked whether major banks left the region during the crisis as this could have biased our results upwards (survivorship bias). Yet, only very few banks were closed or sold to other strategic investors during 2008–2011, mainly as a result of a dearth of potential buyers.

¹² In particular European Commission memorandum No. 10/284, *State aid: Overview of national measures adopted as a response to the financial/economic crisis*, Brussels, 29 June 2010.

¹³ We perform a Phillips–Perron unit-root test (which allows for unbalanced panels) on gross credit and cannot reject the null hypothesis of a unit root and non-stationary data. When performed on credit growth, the null hypothesis can be rejected as the differenced data are stationary.

¹⁴ Our results continue to hold when we use net loans as our dependent variable (see Table 4).

Table 1
Credit growth across emerging Europe. Source: BankScope.

Bank ownership	Avg. no. banks 1999–2011 (1)	Average annual credit growth				
		1999–2007 (2)	2008 (3)	2009 (4)	2010 (5)	2011 (6)
<i>Vienna countries</i>						
Domestic state	12	0.40	0.13	0.15	0.00	0.03
Domestic private	32	0.42	0.19	0.31	0.03	0.00
Foreign						
Vienna	24	0.57	0.15	0.01	−0.05	−0.04
Non-Vienna	30	0.43	0.26	0.01	0.00	−0.01
Total	99					
<i>Non-Vienna countries</i>						
Domestic state	14	0.26	0.07	0.21	0.09	0.07
Domestic private	57	0.44	0.22	0.20	0.11	0.10
Foreign	97	0.43	0.16	0.10	−0.05	0.01
Total	168					

Note: This table shows the average number and the weighted average annual credit growth of banks in emerging Europe (Central Europe, the Baltic States, and South-Eastern Europe). Countries are split according to whether they participated in the Vienna Initiative or not. Banks are classified based on their ownership and participation in the Initiative. State banks are more than 30% owned by the state and/or local governments. Domestic private banks are majority owned by domestic private shareholders. Foreign banks are majority foreign owned. The average number of banks is computed as the average of the number of banks in each ownership category over all years in the sample. Credit growth rates are averaged over banks and weighted by total assets (weights reflect the within-country relative size in each ownership category).

in particular among subsidiaries whose parent banks would sign VI commitment letters in 2009 (the difference between signers and non-signers is statistically significant at the 1% level). Foreign-bank subsidiaries typically had easier access to foreign funding – either from international capital markets or from their parent banks – and were less constrained by the availability of local funding.

As of 2008 bank lending started to slow markedly and this was the case for both domestic and foreign banks. Relative to banks that would not end up in the VI, VI banks reduced their lending growth significantly more in 2008. However, in 2009 – once the VI had come into force – the two groups of foreign banks displayed a similar nominal growth rate of about 1%. In the same year foreign subsidiaries in the less-affected countries outside of the VI still grew on average by 10%. While credit growth decelerated substantially during the period 2008–2009, persistent negative growth only started occurring in 2010–2011 when the Eurozone crisis intensified (see also Fig. 1).

Appendix Tables A2–A4 provides variable definitions, descriptive statistics, and a correlation matrix. 58% of the banks in our sample are foreign owned, 35% are domestic private banks, and 8% are state-owned. About 58% of all foreign-bank subsidiaries are owned by a parent bank that received some form of government support (excluding VI-related support) during 2008–2009. Banks' loan-to-deposit ratio, an indicator of their use of wholesale funding, was on average 72.2%. However, variation is large with some banks operating at considerably higher ratios, in particular at the height of the pre-crisis credit boom. Loan quality varies significantly, with the ratio of loan loss reserves to gross loans lower among foreign banks (4.9%) and higher among state banks (8.1%).

Tables A5 and A6 in Appendix A provide an overview of the banks that participated in the VI and the specific countries in which they signed commitment letters. Importantly, in each of the five VI countries there were two groups of foreign-bank subsidiaries: those with parent banks that signed a VI commitment letter in that country and those with parents that did not. For instance, in Hungary Uni-Credit and Raiffeisen Bank signed a commitment letter whereas Commerzbank and Deutsche Bank did not.

The table also shows variation among foreign-bank subsidiaries according to whether their parent banks received government support or not. For instance, Commerzbank received capital support from the German government whereas Deutsche Bank did not. Moreover, note that parent banks signed commitment letters in some countries but not in others. Erste Bank signed a letter in Hungary but

not in Serbia. Similarly, NLB Bank committed to rollovers in Bosnia & Herzegovina but not in Serbia. These are the precisely the sources of within-country and within-bank variation that we will exploit in this paper.

4. Empirical methodology

We first exploit the time dimension of our data set by running a number of panel regressions, while also presenting a difference-in-differences exercise based on a collapsed version of these data. We then use a cross-sectional approach to focus on the period during which the Vienna Initiative was in place. Finally, we present the results of a propensity-score matching exercise combined with a difference-in-differences procedure.

4.1. Panel regressions

We start by reporting a set of panel regressions for the period 1999–2011 to analyze whether foreign-bank subsidiaries continued to be relatively stable lenders, as they had been during earlier local crises, or whether they were more fickle during the recent crisis. We include our time-varying ownership dummies – Own_{ijt} (see Section 3.1) – to distinguish between domestic private banks (the benchmark group), state banks, and foreign banks.¹⁵ We also create yearly crisis dummy variables – $Crisis_t$ – that are ‘1’ in either 2008, 2009, 2010, or 2011 and interact these with the ownership dummies to analyze whether, all else equal, banks with different ownership structures behaved differently during the crisis.

Next, we use our panel data to zoom in on the sub-sample of foreign banks and to differentiate these by VI participation status. We construct four time-invariant *Vienna* dummy variables that we now include instead of the ownership dummies. The first one, *Vienna country_j*, indicates whether a country was one of the five VI countries or not. Second, *Vienna parent_{ij}*, specifies whether the parent bank of subsidiary i in country j signed one or more VI commitment letters (in country j or elsewhere). Third, *Parent signed here_{ij}* indicates whether the parent bank of subsidiary i in country j signed a VI commitment letter in country j . Fourth, *Parent signed elsewhere_{ij}* indicates whether the parent of subsidiary i in country j signed a VI commitment letter though not in country j .

All panel regressions contain on the right-hand side macroeconomic conditions in the host country and a matrix of bank-specific, time-varying control variables – X_{ijt} – that measure financial characteristics of the banks. The latter are all one period lagged and include *Profitability* (return on equity); *Bank size* (log total assets); *Loan-to-deposit* ratio as a measure of wholesale funding; *Solvency* (equity to net loans); *Liquidity* (liquid assets to deposits and short-term funding); and *Loan quality* (loan loss reserves to gross loans).

At the macro-level we include host-country *GDP growth*, a proxy for credit demand, and the change in CPI *Inflation*. We expect a positive link between GDP growth and credit expansion as banks expand credit in a procyclical way. We anticipate a negative impact of inflation on credit growth as rapid price increases worsen market frictions, forcing banks to ration credit (Boyd et al., 2001). To the extent that local inflation increases the nominal value of loan portfolios there may also be some positive mechanical impact of inflation on credit growth. Yet, as we convert our data to US dollars, such an effect should disappear to the extent that PPP holds.¹⁶ Summarizing, our baseline panel specification is:

$$\Delta L_{ijt} = \alpha_1 + \gamma_1 Own_{ijt} + \gamma_2 Crisis_t + \gamma_3 Own_{ijt} \cdot Crisis_t + \gamma_4 X_{ijt} + \eta_{ij} + \varepsilon_{ijt} \quad (1)$$

¹⁵ We also try specifications where we split foreign banks into greenfields, established by the parent bank from scratch, and subsidiaries resulting from a take-over. We do not find any differences in the lending behavior of both bank types and hence do not distinguish between them in our analysis.

¹⁶ If foreign and domestic banks denominate different portions of their lending in local versus foreign currency (FX) then this could confound our results. However, Brown and De Haas (2012) use data from the first Banking Environment and Performance Survey (BEPS I) to show that the proportion of FX lending is not strongly correlated with bank ownership. We replicate this exercise using data from the more recent BEPS II survey in which a larger group of banks participated. We find a correlation between bank ownership and the portion of FX lending of –0.01 in 2007 (p -value: 0.93); 0.15 in 2009 (p -value: 0.11); and 0.09 in 2011 (p -value: 0.29).

where ΔL_{ijt} is the percentage gross credit growth of bank i in country j in year t ; α_1 is an intercept term and γ are coefficients or coefficient vectors; Own_{ijt} is a matrix of time-varying dummy variables that distinguish between domestic private banks (control group), state banks, and foreign banks in country j ; $Crisis_i$ is a dummy variable that identifies 2008, 2009, 2010, or 2011 as a crisis year; X_{ijt} is a matrix of characteristics of bank i itself, host country macroeconomic variables, and characteristics related to the parent bank of subsidiary banks i ; η_{ij} are bank fixed effects and ε_{ijt} is the idiosyncratic error, $\varepsilon_{ijt} \sim IID(0, \sigma_\varepsilon^2)$; $i = 1, \dots, N$ where N is the number of banks in the sample; $j = 1, \dots, K$ where K is the number of countries in the sample; $t = 1, \dots, T_i$ where T_i is the number of years in the sample for bank i .

We estimate this specification using OLS with bank-specific fixed effects as Hausman tests indicate that the bank individual effects are significantly correlated with the explanatory variables. Standard errors are clustered by host country (Moulton, 1990) and robust in order to correct for heteroskedasticity.

Because VI participation was not randomly allocated over the banking population it is important to control for other bank characteristics (X_{ijt}). Our dataset allows us to do so, reducing concerns about omitted variable bias. Moreover, we use the methodology developed by Altonji et al. (2005) and Bellows and Miguel (2009) to quantify the relative importance of any remaining omitted variable bias (cf. Section 5.2).

We also collapse our panel data to estimate difference-in-differences regressions for the effect of foreign ownership and participation in the Vienna Initiative on average credit growth. Here the dependent variable is a bank's average credit growth during a three-year pre-crisis window (2005–2007) and during the three-year crisis period (2009–2011). On the right-hand side we include a dummy variable that distinguishes the *Crisis period* (“after”) from the pre-crisis (“before”) observations. We also include either *Foreign*, *Vienna parent*, or *Parent signed here* as dummy variables to distinguish between treatment and control banks. We then use an interaction term between the before/after and treatment dummies to identify the impact of treatment on credit growth during the crisis. To increase precision we include the same bank-level controls as before but now as pre-treatment averages (2005–2007).

4.2. Cross-sectional regressions

We then proceed by running a set of cross-sectional regressions where the dependent variable is either bank-specific credit growth in 2009; average credit growth in 2009–2011; or a dummy variable that is ‘1’ in case of non-negative credit growth in 2009 and zero otherwise. We now limit the sample to the five countries that participated in the VI and focus on foreign-bank subsidiaries. Since each of these countries contains several subsidiaries, we can include country fixed effects to control for credit demand at the country level. The crisis affected countries to a different extent and with a different lag; firms' credit demand may consequently have been impacted to varying degrees. Country fixed effects allow us to compare, within the same country, how lending by banks that signed a commitment letter differed from banks that did not sign a letter. To the extent that we adequately control for confounding factors, we expect that banks that signed a letter in a country, were relatively stable credit sources compared to other foreign banks. Our cross-sectional specification thus looks as follows:

$$\Delta L_{ij} = \alpha_1 + \gamma_1 VI_{ij} + \gamma_2 \Delta L_{ij,2005-07} + \gamma_3 X_{ij} + \eta_j + \varepsilon_{ij} \quad (2)$$

where ΔL_{ij} is the percentage gross credit growth of bank i in country j in 2009 (2009–2011); α_1 is an intercept term and γ are coefficients or coefficient vectors; VI_{ij} is a dummy that either indicates whether the parent bank of subsidiary i signed a commitment letter in country j (*Parent signed here* _{ij}) or whether the parent bank signed a commitment letter in any country (*Vienna parent* _{ij}); $\Delta L_{ij,2005-07}$ is the average annual percentage gross credit growth of bank i in country j during the pre-crisis period 2005–2007; X_{ij} is a matrix of control variables for the (parent bank of) subsidiary i ; η_j are country fixed effects and ε_{ij} is the idiosyncratic error, $\varepsilon_{ij} \sim IID(0, \sigma_\varepsilon^2)$.

We also include *Support* _{ij} , a dummy variable that identifies whether the parent bank of subsidiary i in country j received home-country government support during the crisis. Our priors about the impact of government support versus VI participation on credit growth differ. In the case of government

support, we expect a negative relationship to the extent that such support came with ‘protectionist’ strings attached. Only if government support had a strong positive impact on banks’ financial positions this may have outweighed the impact of a shift towards home-country lending. In the case of VI participation we expect the impact to be positive as this intervention was explicitly targeted at maintaining exposures abroad. As government support and VI participation only partially overlapped (Appendix Table A5) we can disentangle the impact of these two forms of government intervention.

While we control for an extensive set of bank-level characteristics one may still worry about omitted covariates that are correlated with both credit growth and the selection of a bank into the VI. In our cross-sectional framework we therefore also follow an instrumental variables (IV) approach where our instrument in the first-stage regression uses the behavior of other foreign-bank subsidiaries in the same country as a source of exogenous variation. More specifically, we calculate the market share (in terms of gross loans in 2008) of all *other* foreign banks that signed a VI letter in a specific country. For banks that decided not to participate, this variable equals the market share of all banks that signed, while for a bank that decided to participate it excludes its own market share. We also include the square of this measure as a second instrument. Our reasoning is that a bank was more likely to sign a VI letter when other banks were signing up too because scale effects are necessary to affect aggregate outcomes. However, if enough banks – with a sufficiently large joint market share – have already committed, the benefits from signing become lower relative to the costs of commitment. We thus expect a concave relationship between the aggregate market share of all other foreign banks that sign a letter and the likelihood that a foreign subsidiary committed to roll over exposures itself.

5. Empirical results

5.1. Foreign-bank ownership and credit growth during the crisis

Table 2 shows a first set of panel regressions to analyze the relationship between bank ownership and credit growth during the crisis. The regressions are based on the full bank sample in columns 1a/b and on a sub-sample of private domestic, state, and foreign-owned banks in columns 2, 3, and 4, respectively. In each case average pre-crisis credit growth serves as the baseline to which we compare lending during the four consecutive crisis years. We explain about 30% of the variation in banks’ annual credit growth.

The results in column 1a show that foreign banks reduced credit growth significantly more than private domestic banks during the whole crisis period. For instance, compared to average annual pre-crisis growth of 41.0%, private domestic banks in 2010 reduced credit growth by 21.1% points (to an average of 19.9%) whereas foreign banks shrank lending by an additional 14.7% points (to 5.2%) during that year. This holds when controlling for a battery of other (lagged) bank characteristics. In line with our expectations, these controls show that large banks, banks with an already high loan-to-deposit ratio, and banks with high loan loss reserves (i.e. worse loan quality) grew slower on average. More liquid and profitable banks expanded credit more quickly. As expected, credit growth was positively correlated with the business cycle – a proxy for local credit demand.

We also find weak evidence – at the 10% level – that state banks reduced credit growth less in 2009. This may reflect that in some countries governments used state-owned banks to smooth aggregate lending when privately owned banks started to deleverage.

Column 1a also includes (unreported) bank-ownership dummy variables. One might worry that bank fixed effects and these ownership dummies are collinear, leaving the identification of the coefficients of the latter dependent on banks that changed ownership.¹⁷ We therefore also present results of a random effects model in column 1b (while continuing to control for time-varying bank-level covariates). These results are similar but the estimated negative impact of foreign ownership on credit growth is now slightly smaller in terms of economic magnitude while the baseline crisis impact on private domestic banks is somewhat larger.

¹⁷ Of the 363 banks on which the estimates in column 1 are based, 79 banks (22%) changed ownership during 1999–2011.

Table 2

Bank ownership and credit growth during the crisis. Source: BankScope, IMF IFS, authors' calculations.

	All		Private domestic (2)	State (3)	Foreign (4)
	(1a)	(1b)			
Year 2008	-9.407 [*] (0.069)	-14.570 ^{***} (0.000)	-19.662 ^{**} (0.011)	-6.250 (0.132)	-14.641 ^{***} (0.006)
Year 2009	-4.627 (0.651)	-1.704 (0.791)	-18.006 (0.237)	-3.545 (0.705)	-10.960 (0.260)
Year 2010	-21.126 ^{**} (0.017)	-21.668 ^{***} (0.000)	-28.603 ^{**} (0.018)	-25.521 ^{***} (0.001)	-28.746 ^{***} (0.000)
Year 2011	-20.312 ^{**} (0.031)	-22.482 ^{***} (0.000)	-25.806 ^{**} (0.032)	-22.128 ^{***} (0.003)	-24.380 ^{***} (0.003)
State * Year 2008	-0.920 (0.846)	1.583 (0.774)			
State * Year 2009	9.077 [*] (0.058)	9.243 ^{**} (0.050)			
State * Year 2010	0.203 (0.975)	3.097 (0.499)			
State * Year 2011	1.694 (0.839)	2.207 (0.690)			
Foreign * Year 2008	-8.743 ^{**} (0.016)	-6.835 (0.064)			
Foreign * Year 2009	-15.716 ^{***} (0.001)	-15.239 ^{***} (0.000)			
Foreign * Year 2010	-14.720 ^{***} (0.000)	-12.890 ^{***} (0.000)			
Foreign * Year 2011	-10.796 ^{**} (0.048)	-8.885 ^{**} (0.037)			
GDP growth	1.488 ^{***} (0.009)	1.820 ^{***} (0.000)	0.782 (0.320)	0.878 (0.300)	1.957 ^{***} (0.003)
Inflation	-1.347 ^{***} (0.001)	-0.433 ^{**} (0.001)	-1.291 ^{**} (0.013)	-2.686 ^{***} (0.000)	-1.158 ^{**} (0.015)
Profitability (lag)	0.029 (0.151)	0.038 [*] (0.049)	0.046 [*] (0.094)	0.008 (0.828)	-0.023 (0.681)
Bank size (lag)	-6.262 ^{**} (0.042)	-3.096 ^{***} (0.000)	1.138 (0.786)	-11.292 ^{**} (0.042)	-9.560 ^{***} (0.004)
Loan/deposit ratio (lag)	-0.077 ^{**} (0.012)	-0.033 (0.112)	-0.111 (0.149)	0.017 (0.651)	-0.081 ^{**} (0.022)
Solvency (lag)	0.058 (0.258)	0.033 (0.329)	0.130 (0.136)	0.072 ^{**} (0.020)	0.074 (0.286)
Liquidity (lag)	0.078 ^{**} (0.008)	0.058 ^{**} (0.003)	0.379 ^{***} (0.000)	-0.002 (0.930)	0.131 ^{**} (0.055)
Loan quality (lag)	-0.956 ^{***} (0.000)	-0.781 ^{***} (0.000)	-1.083 ^{***} (0.003)	-0.333 (0.172)	-1.365 ^{***} (0.001)
Constant	119.982 ^{***} (0.006)	71.724 ^{***} (0.000)	18.848 (0.708)	193.309 ^{**} (0.020)	175.730 ^{***} (0.000)
No. of observations	2461	2461	844	214	1,403
No. of banks	363	363	156	38	223
R-squared	0.319	0.283	0.261	0.308	0.393
Bank FE	Yes	No	Yes	Yes	Yes

Note: This table shows panel regressions to estimate the impact of bank ownership on credit growth before and during the crisis. The samples include all banks in emerging Europe (column 1a/b), private domestic banks (column 2), state banks (column 3), and foreign banks (column 4), respectively. The dependent variable is yearly credit growth (%). All independent variables are defined in Table A2. Year 2008, 2009, 2010 and 2011 are dummies that are "1" in the respective year, "0" otherwise. State and Foreign are ownership dummies equal to "1" if the bank is state-owned or foreign-owned, respectively, "0" otherwise. Standard errors are clustered at the country level and p-values appear in brackets.

* Corresponds to the 10% level of significance.

** Corresponds to the 5% level of significance.

*** Corresponds to the 1% level of significance.

Columns 2–4 show that across different bank-ownership types credit growth declined most, relative to pre-crisis growth rates, in 2008, 2010, and 2011. During 2009 – the year of the Vienna Initiative – the decline in lending appears to have halted temporarily (cf. Fig. 1).

5.2. The Vienna Initiative and credit growth during the crisis

In Table 3 we start our investigation of the impact of the Vienna Initiative on bank lending. We use the same panel data as in Table 2 but limit ourselves to foreign banks. To keep the table concise, we only report the interaction terms between the crisis years and the VI variables. However, all specifications include time-varying macroeconomic and bank controls (the same as in Table 2) as well as bank fixed effects. We also include the following (one period lagged) time-varying parent-bank covariates: *Profitability* (return on assets), *Total assets*, *Solvency* (equity to net loans), *Home country GDP growth*, and *Regional exposure* (the number of emerging European subsidiaries of the parent bank).

We show separate regressions for a sample consisting of all of emerging Europe (columns 1 and 4), the non-VI countries (columns 2 and 5), and the five VI countries (columns 3 and 6). In the first three columns we focus on the growth of gross credit while in the last three columns we analyze the VI impact on banks' asset growth. We consider both because when banks signed VI letters they committed to roll over their total *exposure* in a country not just their outstanding loan portfolio.

The first column shows that overall – when compared to pre-crisis rates of expansion – the reduction in foreign-bank lending during 2008–2011 was not different in VI versus non-VI countries. Column 4 indicates, however, that asset growth was reduced significantly more by banks in those countries that would need to be supported by the IMF and EU.

The interaction term between *Vienna parent* and the 2008 crisis dummy shows that in the year *before* the VI was put in place, there were no significant differences in credit growth adjustments between subsidiaries of parent banks that would become part of the VI and subsidiaries of parent banks that would stay out of the VI. However, once the VI was in place in 2009, we start to observe differences between these two groups of foreign-bank subsidiaries. On average, subsidiaries of VI parent banks now grow about 15% points faster compared to subsidiaries of non-participant banks.

Interestingly, this positive relationship between VI status and credit growth during 2009–2011 appears to extend to non-VI countries (column 2). That is, we find that participation in the VI did not lead to negative spill-over effects. VI banks did not prop up their lending in VI countries – as per the signed commitment letters – by reducing their lending elsewhere in emerging Europe. If anything, there are *positive* externalities involved as subsidiaries of VI parent banks also grew faster in non-VI countries, i.e. in those countries where their parent banks faced no commitment to maintain exposures. We find similar but somewhat less precisely estimated results for asset growth (column 5).

In columns 3 and 6 we focus on VI countries only and this allows us to differentiate between three types of foreign banks in these countries. As a benchmark group we consider the subsidiaries of parent banks that were nowhere involved in the VI. We compare this group to two types of VI subsidiaries: those for whom the parent bank signed a letter in the country of the subsidiary itself (*Parent signed here*) and those with a parent bank that signed a letter in *another* country (*Parent signed elsewhere*).

We find a positive VI impact in 2009 of local signings on credit and asset growth of about 10.1% and 15.0% points, respectively, when compared to non-VI banks. We do not, however, find evidence of additional positive effects of VI parents that signed elsewhere.¹⁸ For example, Raiffeisen Bank signed commitment letters in Bosnia and Herzegovina, Hungary, Romania and Serbia, but did not commit in Latvia. Our results suggest that participation by Raiffeisen in the VI stabilized lending by its subsidiaries in those countries where it signed (*Parent signed here*; such as Hungary and Romania) but not in those VI countries where it did not sign (*Parent signed elsewhere*; Latvia). Importantly, spillover effects to 'third' countries – such as Raiffeisen Poland – were *positive* in nature. Column 6 confirms these results for asset growth. This suggests that the VI – and in particular the Joint IFI Action Plan that focused on bank lending

¹⁸ In 2008, subsidiaries in the *Parent signed elsewhere* category grew faster than subsidiaries of non-participating parents. This partly explains why parents did not sign in these VI countries in 2009 and also suggests that any bias in estimating the local impact of *Parent signed here* would be negative.

Table 3

The Vienna Initiative and credit growth during the crisis. Source: BankScope, IMF IFS, authors' calculations.

	Credit growth			Asset growth		
	All countries (1)	Non-Vienna countries (2)	Vienna countries (3)	All countries (4)	Non-Vienna countries (5)	Vienna countries (6)
Vienna country * 2008	-7.390 (0.322)			-14.658** (0.017)		
Vienna country * 2009	-11.069 (0.210)			-16.087* (0.081)		
Vienna country * 2010	0.144 (0.984)			-12.272* (0.057)		
Vienna country * 2011	-5.899 (0.367)			-15.613** (0.014)		
Vienna parent * 2008	6.336 (0.122)	3.122 (0.547)		3.809 (0.141)	1.196 (0.652)	
Vienna parent * 2009	15.350** (0.008)	15.117** (0.014)		12.409** (0.016)	11.594** (0.048)	
Vienna parent * 2010	15.465*** (0.004)	15.173** (0.025)		4.931 (0.228)	5.447 (0.126)	
Vienna parent * 2011	14.599** (0.018)	18.616** (0.046)		7.874* (0.080)	10.028* (0.082)	
Parent signed here * 2008			1.919 (0.838)			2.333 (0.816)
Parent signed here * 2009			10.061** (0.035)			15.010** (0.016)
Parent signed here * 2010			9.380 (0.148)			4.359 (0.526)
Parent signed here * 2011			-5.336 (0.246)			-1.609 (0.831)
Parent signed elsewhere * 2008			37.187 (0.078)			15.796*** (0.007)
Parent signed elsewhere * 2009			19.856 (0.276)			1.683 (0.915)
Parent signed elsewhere * 2010			24.885 (0.183)			0.332 (0.986)
Parent signed elsewhere * 2011			2.454 (0.912)			-7.121 (0.775)
No. observations	794	524	270	794	524	270
No. banks	148	94	54	148	94	54
R-squared	0.655	0.671	0.723	0.643	0.643	0.772
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Parent bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
$R = \beta^F / (\beta^R - \beta^F)$	3.380	2.507	1.296	27.885	9.884	2.389

Note: This table shows panel regressions to estimate the impact of the Vienna Initiative on credit and asset growth. The sample period is 1999–2011. All regressions include foreign banks only. The regressions in columns 1 and 4 include banks in all emerging European countries while columns 2 and 5 (3 and 6) only include banks in non-Vienna countries (Vienna countries). The dependent variable is yearly credit (asset) growth in columns 1–3 (4–6). All regressions include bank and macroeconomic controls as specified in Table 2. In addition the following lagged time-varying parent-bank covariates are included: return on average assets, log total assets, equity to net loans, and home country GDP growth (all defined in Table A2). Standard errors are clustered at the country level and *p*-values are shown in brackets. The constant is not reported. *R* is a ratio that indicates how influential omitted variable bias would need to be relative to the importance of observed covariates to explain the full effect found for *Vienna parent* (columns 1–2, 4–5) or *Parent signed here* (columns 3, 6).

* Corresponds to the 10% level of significance.

** Corresponds to the 5% level of significance.

*** Corresponds to the 1% level of significance.

to firms and households – did not push banks to continue lending while shortening their local balance sheets in other ways.

In our regressions we control for a rich set of observable bank-level, parent-bank level, and country-level covariates that, if omitted, could confound our estimates of the impact of the Vienna Initiative. After all, such covariates may also affect the decision of a parent bank to participate in the VI and more specifically to sign a commitment letter in a country. Yet, it is possible that other, unobservable factors still confound the main VI effects we aim to identify. We therefore follow [Altonji et al. \(2005\)](#) and [Bellows and Miguel \(2009\)](#) and quantify the relative importance of omitted variable bias in [Table 3](#). Intuitively, what we do is to analyze how the coefficients of interest change when we include our (rich) set of covariates. If this change is substantial then it is more likely that adding more (currently unobservable) covariates would further reduce the estimated impacts. In contrast, if coefficients turn out to be stable when adding controls, then we can be more confident when interpreting our VI coefficients in a causal sense.

The R ratio reported at the bottom of [Table 3](#) equals the absolute value of the coefficient in the regression including controls (β^F : full) divided by the difference between this coefficient and the one derived from a regression without covariates (β^R : restricted). The ratio shows how strong the covariance between the unobserved factors explaining credit growth and the VI treatment variable needs to be relative to the covariance between observable factors and treatment, to explain the entire effect that we find. The reported R refers to the coefficient of *Vienna parent * 2009* in columns 1–2 and 4–5 and to the coefficient for *Parent signed here * 2009* in columns 3 and 6.

The R ratios suggest that to explain the full Vienna effects we find, the covariance between unobserved factors and the *Vienna parent* variable needs to be at least 2.5 times as high as the covariance of the included controls (columns 1–2). For asset growth the ratio lies even between 10 (non-VI countries) and 30 (all countries). We therefore conclude that it is unlikely that unobserved heterogeneity can completely explain away the VI impacts we document. The ratio is lower for the *Parent signed here * 2009* treatment – 1.3 and 2.4 – implying that unobserved factors are more likely to explain part of this effect. By way of comparison, [Altonji et al. \(2005\)](#) estimate a ratio of 3.55 which they interpret as evidence that unobservables are unlikely to explain the entire effect they document.

5.3. Robustness tests

[Table 4](#) provides a number of robustness tests of the results of column 3 in [Table 3](#), which we reproduce in column 1 here. In the second column we only include banks for which we have at least seven years of subsequent observations to make sure our results are not driven by banks with just a few data points. Our results on the stabilizing effect of Vienna participation continue to hold.

In column 3 we apply a system GMM estimator where we use forward orthogonal deviations instead of first differencing ([Arellano and Bover, 1995](#)). This transformation removes panel fixed effects and has the added benefit of better preserving sample size in our unbalanced panel. We collapse the data and thus create one instrument for each variable and lag distance as this helps avoid bias due to too many instruments in a relatively small sample. We report the outcomes of the Arellano and Bond test for autocorrelation of order 1 and 2. The p -value of 0.90 shows that we cannot reject the null hypothesis of no second-order autocorrelation (first-order autocorrelation does not imply inconsistent estimates). To test whether the instruments are valid, we perform Hansen's J test for overidentifying restrictions. We cannot reject the null (p -value: 0.59) and conclude that the model is supported. Our results continue to hold in this GMM approach.

In column 4 we report estimates with panel-corrected standard errors ([Beck and Katz, 1995](#)). This allows us to correct for bank-level heteroscedasticity and an AR(1) process in the error structure. Our results do not change materially. Finally, in column 5 we replace gross loan growth with net loan growth by adjusting for provisioning. Our results hold here as well.

5.4. The Vienna Initiative and credit growth: a difference-in-differences approach

[Table 5](#) presents our difference-in-differences (DID) results for the effect of foreign ownership (columns 1–3) and participation in the Vienna Initiative (columns 4–6) on credit growth during

Table 4

Robustness. Source: BankScope, IMF IFS, and authors' calculations.

	Base (1)	7 + years (2)	GMM (3)	PCSE (4)	Net loan growth (5)
Parent signed here * 2008	1.919 (0.838)	0.591 (0.954)	8.578 (0.361)	8.876 (0.326)	-0.713 (0.947)
Parent signed here * 2009	10.061** (0.035)	7.909** (0.050)	16.530* (0.084)	17.978** (0.018)	9.025** (0.015)
Parent signed here * 2010	9.380 (0.148)	6.367 (0.411)	14.820* (0.060)	12.837* (0.090)	6.608 (0.171)
Parent signed here * 2011	-5.336 (0.246)	-4.637 (0.433)	11.388 (0.137)	8.047 (0.315)	-6.001 (0.180)
Parent signed elsewhere * 2008	37.187* (0.078)	34.241* (0.083)	23.548 (0.328)	29.199*** (0.008)	35.730* (0.078)
Parent signed elsewhere * 2009	19.856 (0.276)	19.661 (0.288)	8.423 (0.445)	2.524 (0.792)	17.256 (0.404)
Parent signed elsewhere * 2010	24.885 (0.183)	25.156 (0.239)	13.847 (0.443)	14.581 (0.133)	26.698 (0.196)
Parent signed elsewhere * 2011	2.454 (0.912)	7.474 (0.726)	-2.781 (0.764)	-8.974 (0.398)	3.285 (0.891)
No. observations	270	249	268	270	264
No. banks	54	49	54	54	54
AB test AR(1)	-	-	0.00	-	-
AB test AR(2)	-	-	0.90	-	-
Hansen J	-	-	0.59	-	-
R-squared	0.723	0.736	-	0.715	0.725
Bank controls	Yes	Yes	Yes	Yes	Yes
Parent bank controls	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	No	No	Yes

Note: This table shows robustness tests of column (3b) in Table 3 (here repeated in column 1). Column 2 shows a specification that only includes observations where we have at least seven years of data for a bank. Column 3 shows a specification using the Blundell and Bond (1998) system GMM estimator. AB test AR1(2) shows the p -value of the Arellano–Bond test that average autocovariance in residuals of order 1 (order 2) is 0. Hansen J shows the p -value of the Hansen J test for overidentifying restrictions, which is asymptotically distributed as χ^2 under the null of instrument validity. Column 4 shows a specification with panel-corrected standard errors which combines bank-level heteroscedasticity with a panel-specific AR(1) process. Column 5 shows a regression where the dependent variable is growth of net loans. Country dummy variables and the constant are not shown. Standard errors are clustered at the country level. All independent variables are defined in Table A2. p -Values appear in brackets.

* Corresponds to the 10% level of significance.

** Corresponds to the 5% level of significance.

*** Corresponds to the 1% level of significance.

2009–2011 (the year in which the VI started and the two consecutive years).¹⁹ In these regressions the dependent variable is average annual credit growth during 2005–2007 (pre-treatment) or 2009–2011 (treatment).²⁰ The dummy variable *Crisis period* distinguishes between observations in either period. *Foreign*, *Vienna parent* and *Parent signed here* are dummy treatment variables as previously defined.

The results in the first three columns confirm that while both domestic and foreign banks significantly reduced credit growth during the crisis, the average annual adjustment was almost 10% points

¹⁹ We do not calculate the R ratio to quantify omitted variables bias in Table 5 because our controls are time invariant here. Omitting them does therefore not change the coefficient of *Crisis period*. Given that a treatment dummy (*Foreign*, *Vienna parent*, *Parent signed here*) is included, the variation in the interaction term comes from its time-varying component only. Yet, this component also has a zero correlation with the time-invariant controls. In other words, even though the interaction term and the controls are correlated, given that the treatment variable is included their conditional correlation is zero. Omitting controls does therefore not affect the interaction term's coefficient (only the precision with which it is estimated).

²⁰ We thus leave out the early-crisis year 2008 when Lehman Brothers had not yet collapsed and the VI was not yet in place. This allows for a clean comparison between the most severe part of the crisis and the pre-crisis period. Including 2008 – and separately interacting it with the treatment variable – yields very similar (and slightly more significant) results for the 2009–2011 treatment effect.

Table 5

The Vienna Initiative and bank lending: a difference-in-differences approach.

Bank sample Country sample	Foreign and domestic banks			Foreign banks		
	Emerging Europe (1)	VI countries (2)	Non-VI countries (3)	VI countries (4) (5)		Non-VI countries (6)
Crisis period	−38.852 ^{***} (0.000)	−44.605 ^{***} (0.005)	−35.521 ^{***} (0.001)	−73.011 ^{***} (0.003)	−73.011 ^{***} (0.003)	−45.041 ^{***} (0.001)
Foreign	2.665 (0.525)	6.964 [*] (0.054)	0.600 (0.923)			
Crisis period * Foreign	−8.927 [*] (0.090)	−13.482 ^{**} (0.049)	−6.245 (0.398)			
Vienna parent				−4.163 (0.469)		3.583 (0.464)
Crisis period * Vienna parent				19.698 ^{**} (0.049)		3.363 (0.686)
Parent signed here					1.848 (0.759)	
Crisis period * Parent signed here					18.591 [*] (0.060)	
Number of observations	484	178	306	90	80	160
R-squared	0.543	0.594	0.534	0.756	0.758	0.613
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Parent bank controls	No	No	No	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents difference-in-differences regressions to estimate the impact of foreign ownership (columns 1–3) and participation in the Vienna Initiative (columns 4–6) on average credit growth during 2009–2011. The results are based on a country sample of emerging Europe (column 1), VI countries (columns 2, 4, 5), or non-VI countries (column 3 and 6) and a bank sample of all banks (columns 1–3) or foreign banks only (columns 4–6). The dependent variable is average credit growth in the pre-crisis period (2005–2007) or in the crisis period (2009–2011). All regressions include bank-level pre-treatment controls averaged over 2005–2007. Columns 4–6 also include parent-bank level pre-treatment controls averaged over this period. *Crisis period* is a dummy variable equal to “1” in the treatment period, “0” otherwise. *Foreign bank*, *Vienna parent*, and *Parent signed here* are dummy variables as previously defined. All regressions include country fixed effects. Standard errors are clustered at the country level. Source: BankScope, IMF IFS, authors’ calculations.

^{*} Corresponds to the 10% level of significance.

^{**} Corresponds to the 5% level of significance.

^{***} Corresponds to the 1% level of significance.

stronger for foreign banks.²¹ Columns 2 and 3 show that this effect is driven by the VI countries. The last three columns, in which we focus on foreign banks only, show that in these five VI countries, subsidiaries of VI parent banks were relatively stable lenders (column 4). This effect is driven – in line with our results in Table 3 (columns 3 and 6) – by those subsidiaries for whom a letter was actually signed. Finally, in column 6 we find no statistically significant evidence for spill-over effects to non-VI countries, although the coefficients are positive (in line with column 2, Table 3). We conclude that any cross-country spill-overs that may have occurred were positive rather than negative.

5.5. The Vienna Initiative and credit growth: cross-sectional results

Table 6 reports cross-sectional regressions for the sample of foreign-bank subsidiaries in VI countries. As in Table 5 we include host-country fixed effects to control for local demand conditions. This allows us to compare, within the same host country, subsidiaries of banks that signed a commitment letter in that country versus those that did not. Columns 1–4 (5–8) show regressions with credit

²¹ This number is close to the average coefficient of −12.3 for the three interaction terms between *Foreign* and the three consecutive crisis year dummies in column 1b of Table 2.

Table 6

The Vienna Initiative and bank lending: a cross-sectional analysis. Source: BankScope, IMF IFS, authors' calculations.

	Credit growth				Asset growth				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Vienna parent	-15.086 [*] (0.079)	-23.769 [*] (0.061)	-10.783 ^{**} (0.014)	-0.152 (0.596)	-12.249 (0.344)	-19.331 [*] (0.077)	-4.773 (0.439)	0.063 (0.872)	
Parent signed here	23.746 [*] (0.056)	38.143 ^{**} (0.029)	15.272 ^{**} (0.018)	0.574 (0.100)	21.015 ^{**} (0.016)	32.592 ^{**} (0.043)	12.120 ^{**} (0.037)	0.157 (0.516)	
Average pre-crisis annual growth	-0.356 ^{**} (0.013)	-0.401 ^{***} (0.000)	-0.310 ^{***} (0.006)	-0.010 ^{**} (0.020)	-0.231 (0.265)	-0.232 ^{**} (0.017)	-0.280 ^{**} (0.045)	-0.010 [*] (0.080)	
Support	7.787 (0.335)	7.710 (0.212)	8.674 (0.314)	0.119 (0.396)	2.192 (0.682)	2.247 (0.729)	7.595 (0.174)	-0.091 (0.644)	
No. of observations	54	54	54	54	51	51	51	51	
R-squared	0.603	0.574	0.646	0.511	0.701	0.678	0.732	0.522	
Estimator	OLS	IV	OLS	LPM	OLS	IV	OLS	LPM	
Period	2009	2009	2009– 2011	2009	2009	2009	2009– 2011	2009	
F-test (p-values)	(0.129)	(0.090)	(0.019)	(0.189)	(0.032)	(0.112)	(0.067)	(0.787)	
$R = \beta^C / (\beta^{R^*} - \beta^A) $	1.069	1.042	0.861	1.179	2.317	1.579	1.019	–	
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Parent bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
		1st stage IV				1st stage IV			
Market share other Vienna letter		0.091 [*] (0.054)				0.087 [*] (0.093)			
Market share other Vienna letter ²		-0.001 ^{**} (0.026)				-0.001 ^{**} (0.044)			
F-stats for instrument relevance		4.680				4.280			
F-test (p-value)		(0.016)				(0.023)			
Hansen test (p-value)		(0.745)				(0.578)			

Note: This table shows cross-sectional regressions to estimate the impact of participating in the VI on credit and asset growth. The sample includes foreign bank subsidiaries in the five Vienna countries. Columns 1, 3, 5 and 7 report OLS results; columns 2 and 6 IV results; and columns 4 and 8 the results of a linear probability model (LPM). The dependent variables are credit (asset) growth in 2009 in column 1–2 (5–6); average credit (asset) growth in 2009–2011 in column 3 (7); and a dummy equal to “1” for positive credit (asset) growth in column 4 (8). Pre-crisis average growth is computed for the period 2005–2007. *Support* is a dummy variable equal to “1” if the parent bank received state support in 2008–2009, “0” otherwise. All unreported bank level and parent level controls are defined in Table A2. Standard errors are either clustered at the country level (columns 1, 3, 4, 5, 7 and 8) or robust (columns 2 and 6). *p*-Values appear in brackets. The constant is not reported.

^{*} Corresponds to the 10% level of significance.

^{**} Corresponds to the 5% level of significance.

^{***} Corresponds to the 1% level of significance.

(asset) growth on the left-hand side. We control for average pre-crisis growth, government support, and our standard battery of other bank and parent-bank covariates. Note that, different from Tables 3 and 4, we now include *Vienna parent* and *Parent signed here* at the same time. The benchmark group consists of foreign-bank subsidiaries whose parent bank stayed completely outside of the VI. The variable *Parent signed here* thus measures the incremental impact of signing a letter in a particular country *over and above* the general effect of having a parent bank that participated in the VI.

The results in columns 1 and 5 suggest that among foreign banks in VI countries signing a commitment letter had a positive incremental effect on bank-level growth.²² The magnitude of this effect is 23.7% and 21.0% for credit and asset growth, respectively. Relative to subsidiaries of non-VI parent banks the effect is also positive but less pronounced: around 9% for both credit and asset growth. We note that the magnitude of this 2009 effect is in line with the one documented in column 3 of Table 3 (10.1%).

²² While the *Vienna letter* dummy is significant at the 5% level in most specifications, the *Vienna parent* one is not. The *p*-value of an *F*-test for joint significance of the two treatment variables is reported for each of the eight regressions.

In columns 3 and 7 we then test whether the VI impact persisted in 2010 and 2011. In both cases we indeed find a positive average impact during the years 2009–2011. When we next estimate a linear probability model to predict the likelihood that a subsidiary fully rolled over its 2008 exposure in 2009 (implying a credit growth rate of at least zero per cent) we find that this probability is 42.2% higher for subsidiaries for whom the parent bank had signed a commitment letter as compared to subsidiaries of non-participating parents (column 4).²³

The specifications in columns 2 and 6 show our cross-sectional IV results (first-stage results are reported in the lower part of the panel). As discussed in Section 4.2, our instrument is the market share (and market share squared) of all other foreign banks that signed a VI letter in a country. In light with our prior, we find a concave relationship between total market share of other VI-signing banks and the participation decision of a particular bank.²⁴ The maximum participation probability is reached at an aggregate market share of around 55%. An *F*-test for instrument relevance confirms that the market share of Vienna participant subsidiaries and its second power are jointly significant at the 5% level. We note, however, that the first stage *F*-statistic is below the often used rule-of-thumb of ten, casting some doubt on the strength of the instruments. The soundness of our identification strategy is also grounded in the validity of the instrument set. A Hansen over-identification test shows that the null hypothesis of valid instruments cannot be rejected (*p*-value: 0.75).

Relative to the OLS results, the IV regressions indicate a somewhat larger impact of signing a commitment letter in a particular country relative to other subsidiaries of Vienna parent banks. Relative to subsidiaries of non-VI parents, *Parent signed here* subsidiaries had about 14.4% higher credit growth (compared to almost 9% in the OLS regressions). This suggests that the OLS results are somewhat biased downwards. This might reflect unobservable differences in loan quality that are positively correlated with the treatment variable but negatively with a bank's credit growth rate. Yet, the Altonji *R* ratio suggests that the covariance between unobservables and the *Vienna letter* variable needs to be at least as strong as the covariance with the included controls to explain away the full effect.

The specifications in Table 6 do not point towards a separate, general impact of government support – in the form of capital injections, bank-specific guarantees, or asset sales – on either credit or asset growth. In Appendix Table A7, we analyze government support in more detail by replicating the IV results of column 2, Table 6 while including *separate* dummy variables for the three types of support. Although we continue to find no apparent effect of either guarantees or asset sales, we do detect a positive effect of capital injections when we include this dummy variable by itself (column 1) or together with the other two support dummies (column 4). This result, and the fact that the other (imprecisely estimated) government support coefficients are positive too, suggests that government support did not come with strong 'protectionist' strings attached that would have caused a significant shift towards home-country lending. Finally, note that in all these alternative specifications the impact of the VI variable *Parent signed here* remains virtually unchanged.

5.6. Propensity-score matching

We conclude our analysis by combining a propensity-score matching exercise (Rosenbaum and Rubin, 1983) with a difference-in-difference procedure. As a first step, we run probit regressions that yield for each bank a propensity score: the conditional probability of being foreign or participating in the Vienna Initiative. In a second step we then use these propensity scores to match foreign to non-foreign banks (and VI to non-VI subsidiaries) that are closest in terms of their propensity score. Third, we use a difference-in-differences framework to compare the difference between credit growth in 2009 (or 2009–2011 average) and credit growth in 2008 for both the treatment and the control group.

Table 7a summarizes the first-stage results. We run probit regressions to analyze what determines being foreign owned (columns 1–3) and a parent bank's decision to participate in the VI (columns 4–6). As explanatory variables we employ our regular set of lagged (parent) bank and macroeconomic controls.

²³ This effect is not significant for asset growth (column 8).

²⁴ An *F*-test for instrument redundancy confirms that the second power of the market share is not redundant (the null hypothesis of redundancy is rejected with a *p*-value of 0.034).

The objective of the first set of regressions is not so much to explain why a particular bank is foreign owned, but rather to help us subsequently match banks of different ownership that are comparable across observable characteristics. The results indicate that foreign-owned banks are on average larger, more solvent, and less liquid. There is some evidence that they also have a lower loan quality, in particular in Vienna countries.

In columns 4–6 we then analyze the determinants of VI participation. We use explanatory variables at the subsidiary level when the dependent variable is a *Parent signed here* dummy (column 4) and at the parent level when the dependent variable is a *Vienna Parent* dummy (columns 5 and 6). The difference between columns 4 and 5 is that column 4 not only limits the sample to foreign banks in Vienna countries, but also excludes subsidiaries whose parent banks signed elsewhere. In column 4 we thus compare subsidiaries of non-participating parents to subsidiaries whose parent banks signed a commitment letter in a country. We find that the subsidiaries for which the parent bank signed are larger and more profitable. From the instrumental variables results in Table 6 we already knew that a parent bank was also more likely to sign a VI letter when *other* banks were signing up too.

In addition, we performed an additional (unreported) comparison between subsidiaries for which the parent bank signed a commitment letter and those for which the parent did not sign (but could have signed). Here we limit ourselves to subsidiaries in VI countries whose parent banks participated in the VI in at least one country. This analysis shows that the probability of a VI parent bank signing a letter for a particular subsidiary is higher if that subsidiary was larger in absolute terms (confirming the results in Table 7a) and if the subsidiary was large relative to the combined size of all the parent bank's subsidiaries in VI countries. To sum up, we find that a parent bank was more likely to sign for a subsidiary if that subsidiary was large (in absolute terms and relative to other subsidiaries of the same parent), if it was profitable, and if many other subsidiaries in the same country were also part of the VI. Lastly, at the *parent* level, VI participation was correlated with a higher regional exposure and a lower equity to net loans ratio (columns 5 and 6).

Table 7b then summarizes our second-stage diff-in-diff results.²⁵ The results in columns 1–3 confirm our earlier findings of Tables 2 and 5: foreign banks, and in particular those located in Vienna countries, had a significantly lower credit growth in 2009 and the period 2009–2011 as a whole. The estimates for 2009–2011 in particular are almost identical in magnitude to the ones found in the first three columns of Table 5. These results are also robust to the different matching procedures we apply.

When it comes to the effect of VI participation, the results suggest a positive impact on credit growth of a parent bank signing a commitment letter in a specific country. In terms of economic significance the effect is stronger in 2009 (upper panel) than in the whole 2009–2011 period (lower panel). In magnitude the 2009–2011 impact is even somewhat stronger than the one in column 5 of Table 3. Similar to the results in Table 5, there is again no evidence of negative spillovers to countries where the initiative was not implemented. The coefficients are positive in all specifications though imprecisely estimated.

We end our analysis with a concise counterfactual exercise to assess what aggregate credit growth would have been if – in the five VI countries – the foreign bank subsidiaries that signed commitment letters had not signed. Such a counterfactual calculation is a useful back-of-the-envelope assessment of the overall magnitude of the VI impact. An important assumption is that the VI did not impact the credit growth of other types of banks (domestic banks and foreign banks outside the VI) so that we can keep their growth rates constant.

We base our calculations on columns 1 (OLS) and 2 (IV) in Table 6. The sum of the first two coefficients in each of these columns indicates the total effect of VI participation on subsidiary credit growth. These effects imply that in the absence of the VI, credit growth of these subsidiaries would on average have been lower by between 7% (OLS) and 12% (IV) points (in reality these subsidiaries grew by 2% on an unweighted basis). Since these VI banks were relatively large players in their

²⁵ Common support is imposed in all specifications except column 5. Imposing common support in this specification yields positive results of the same statistical significance but would significantly limit the sample that we use to compute the average treatment effect.

Table 7aPropensity-score matching: first-stage probit regression estimates. *Source:* BankScope, IMF IFS, and authors' calculations.

Sample →	Banks in emerging Europe	Banks in VI countries	Banks in non-VI countries	Foreign banks in VI countries ^a	Foreign banks in non-VI countries	
Treatment →	Foreign			Parent signed here	Vienna Parent	
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidiary profitability 2008	−0.003 (0.513)	−0.004 (0.645)	−0.002 (0.731)	0.036 [*] (0.098)		
Subsidiary size 2008	0.217 ^{***} (0.001)	0.220 [*] (0.059)	0.199 ^{**} (0.017)	0.578 ⁺ (0.026)		
Subsidiary loan to deposit ratio 2008	0.003 [*] (0.092)	0.009 (0.223)	0.004 (0.109)	−0.003 (0.515)		
Subsidiary solvency 2008	0.009 ⁺ (0.043)	0.007 (0.225)	0.011 [*] (0.085)	−0.007 (0.444)		
Subsidiary liquidity 2008	−0.009 ^{**} (0.013)	−0.008 ⁺ (0.080)	−0.010 ^{**} (0.022)	−0.002 (0.928)		
Subsidiary loan quality 2008	−0.043 ⁺ (0.080)	−0.061 (0.104)	−0.039 (0.307)	0.096 (0.279)		
Parent size 2008					0.095 (0.712)	0.040 (0.785)
Parent solvency 2008					−0.231 ^{**} (0.022)	−0.102 ^{**} (0.045)
Parent regional exposure 2008					0.748 ^{***} (0.002)	0.317 ^{***} (0.000)
GDP growth 2008	0.101 ^{***} (0.003)	0.089 (0.158)	0.149 ^{***} (0.007)	0.063 (0.556)	0.008 (0.955)	−0.020 (0.805)
Inflation 2008	0.006 (0.843)	0.007 (0.925)	−0.046 (0.282)	0.142 (0.250)	0.212 (0.212)	0.136 [*] (0.069)
Constant	−3.050 ^{***} (0.004)	−3.218 (0.146)	−2.758 ^{**} (0.043)	−9.534 ^{**} (0.037)	−4.122 (0.481)	−2.100 (0.515)
No. of observations	250	90	160	46	52	91
Pseudo R-squared	0.132	0.170	0.140	0.386	0.684	0.472

Note: This table shows probit regressions to determine, as part of the first stage of a propensity-score matching exercise, the probability of a bank being foreign-owned (columns 1–3) and the probability of VI participation (columns 4–6). The sample is specified in the first row of the table. Treatment determinants include subsidiary, parent, and macroeconomic covariates, as specified above and defined in [Table A2](#). *p*-Values appear in brackets.

^a Sample in column 4 excludes *Parent signed elsewhere* banks.

^{*} Corresponds to the 10% level of significance.

^{**} Corresponds to the 5% level of significance.

^{***} Corresponds to the 1% level of significance.

Table 7bPropensity-score matching results. *Source:* BankScope, IMF IFS, and authors' calculations.

Treatment period	Matching method	Sample →	Banks in emerging Europe	Banks in VI countries	Banks in non-VI countries	Foreign banks in VI countries ^a	Foreign banks in non-VI countries	
			Treatment → Foreign ownership	Parent signed here	Vienna Parent			
			(1)	(2)	(3)	(4)	(5)	(6)
2009	Nearest neighbor matching (n = 1)	ATT	−14.823**	−32.490**	−5.879	26.125*	26.205**	6.026
		t-Value	(2.200)	(2.470)	(1.230)	(1.870)	(2.320)	(0.320)
		N	250	90	159	46	52	91
	Kernel matching Bootstrap	ATT	−11.637*	−28.524**	−5.101	25.678**	16.581	8.857
		z-Statistic	(1.900)	(2.460)	(1.310)	(1.980)	(1.360)	(0.550)
		N	250	90	159	46	52	91
Average 2009–2011	Nearest neighbor matching (n = 1)	ATT	−10.846**	−11.742	−6.023	22.476**	18.133	5.052
		t-Value	(2.370)	(1.550)	(1.270)	(2.210)	(1.310)	(0.300)
		N	250	90	159	46	52	91
	Kernel matching Bootstrap	ATT	−8.279**	−13.083**	−5.250	22.748**	8.892	6.890
		z-Statistic	(2.080)	(1.980)	(1.150)	(2.430)	(0.640)	(0.460)
		N	250	90	159	46	52	91

Note: This table presents the results of a propensity-score matching procedure combined with difference-in-difference estimation. The sample and treatment are specified in the first and second row, respectively. The outcome variable is credit growth in 2009 in the upper panel and average credit growth in 2009–2011 in the panel below. Treatment determinants are as specified in Table 7. The matching methods are specified in the second column of the table. Common support is imposed in all columns but column 5.

^a Sample in column 4 excludes *Parent signed elsewhere* banks.

* Corresponds to the 10% level of significance.

** Corresponds to the 5% level of significance.

*** Corresponds to the 1% level of significance.

respective host countries, their lower credit growth would have translated into substantial *aggregate* impacts. Instead of an aggregate nominal credit growth rate of 7% in 2009, lending would have grown by only 2% (OLS) or even have shrunk by 1% (IV). Such a more severe credit crunch would have entailed a significantly more negative impact on firms and households too.

6. Conclusions

The strong and manifold linkages that developed between Western banking groups and their emerging European subsidiaries, have not been accompanied by equally intense supervisory cooperation and integration. One may even argue that emerging Europe is characterized by a “governance void” (Pistor, 2012b): neither host-country nor home-country supervisors take full responsibility for foreign-bank subsidiaries. When the parent banks of these subsidiaries were increasingly affected by the global crisis, this governance void had to be filled by an ad hoc coordination mechanism: the Vienna Initiative.

The bank-level evidence that we present in this paper suggests that, by and large, the VI has been successful. In particular, subsidiaries of parent banks that signed commitment letters were significantly more stable sources of credit than subsidiaries of banks that did not sign such letters *in the same country*. We also find no evidence of VI banks withdrawing from non-VI countries in order to maintain exposures to countries where they signed commitment letters. If anything, VI participation had positive rather than negative spillover effects. These results hold up well when we deal with possible selection bias through an instrumental variables approach or propensity-score matching. Moreover, we show that the estimated effects are relatively insensitive to adding covariates and this further mitigates concerns about possible omitted variables bias.

A potential limitation of our analysis is that we focus on lending by foreign bank subsidiaries and disregard direct cross-border lending by parent banks to companies in Emerging Europe. There are two justifications for this focus. First, the Vienna Initiative itself – in particular the Joint IFI Action Plan – focused on local lending through foreign bank subsidiaries. This emphasis reflected policy makers’ concern about a sharp reduction in the credit supply to small and medium-sized firms. These are borrowers that are typically served through local affiliates rather than cross-border lending by parent banks. Because the policy efforts were concentrated on local subsidiaries, it makes sense to look for first-order policy impacts here. Nevertheless, an interesting area for future research is to analyze in more detail whether and how the Vienna Initiative affected cross-border parent bank lending into Emerging Europe.

The implications of our findings go beyond emerging Europe and the latest financial crisis. They reinforce recent evidence to suggest that IMF support and public bail-outs may be successful in particular when private sector resources are effectively crowded in (Papi et al., 2013). In the case of the Vienna Initiative, such a coordinated (but non-coercive) bail-in of private lenders not only helped countries to close external funding gaps but also to soften and delay the inevitable deleveraging process.

A more sustainable solution to the current governance void in emerging Europe may lie in a better coordination and cooperation between home and host country supervisors. This is not only necessary to prevent spillovers of financial shocks, but also because the alternative – forcing highly integrated pan-European banking groups to hold more capital and liquidity in each individual subsidiary – could be costly. Effectively cutting up multinational banks into strings of independent banks (‘ring-fencing’) would be a second-best option that reflects the inability of national supervisors to reach a satisfactory level of cross-border cooperation and burden sharing.

Appendix A

Tables A1–A7.

Table A1

A timeline of the Vienna Initiative.

October 26th 2008	– IMF approves US\$16.5 billion Stand-By Agreement for Ukraine
November 6th 2008	– IMF approves €12.3 billion Stand-By Arrangement for Hungary
November 27th 2008	– Six bank groups (Raiffeisen, Erste, Intesa SP, Société Générale, KBC, Unicredit) write a letter to the EC on financial stability concerns in emerging Europe and urge action by host governments. Start of work on a joint action plan, which culminates in a joint declaration on February 27 (see below)
December 23rd 2008	– IMF announces €1.7 billion Stand-By Agreement for Latvia, coordinated with the European Commission
December 17th 2008	– The six multinational bank groups meet in Vienna to discuss next steps by the industry. International Financial Institutions are invited
January 16th 2009	– IMF approves €402.5 million Stand-By Arrangement for Serbia
January 23rd 2009	– First “Vienna Initiative” meeting at the Austrian Ministry of Finance. It is agreed that the IMF will develop principles of burden sharing between home and host-country authorities and banks
End-January and early February 2009	– Country meetings for coordinated action in Ukraine and Romania, bringing together the key subsidiaries of bank groups with the IMF and other IFIs and, in Ukraine, the government
February 27th 2009	– As part of the VI framework, the Joint IFI Action Plan is launched, offering up to €24.5 billion of support to banks in the region for lending to the real economy
March 17th 2009	– Second VI meeting. IMF presents a distribution of burden sharing rules between home and host country authorities which is broadly agreed on and to be used during the crisis. Host country responsibilities: prudent macroeconomic policies, support of deposit insurance schemes, and the supply of local currency liquidity irrespective of bank ownership. Parent banks and home country responsibilities: rollover/maintain exposures to the extent possible, recapitalize subsidiaries following stress tests; home country national bank support packages can be used for supporting subsidiaries
March 15th–June 15th 2009	– Under the Joint IFI Action Plan the International Financial Institutions meet with 17 multinational bank groups to assess their needs
March 26th–27th 2009	– First set of parent bank commitment letters signed for Romania and Serbia, at the Joint Vienna Institute, Vienna
April 25th 2009	– Meeting of IFIs and home and host governments during the IMF-World Bank Spring meetings, Washington, DC, to take stock and agree on next steps under the VI
May 4th 2009	– IMF approves €12.9 billion Stand-By Arrangement for Romania as part of a EUR 20 billion package of balance of payments support approved by the European Commission
May 15th 2009	– Joint IFI Action Plan: Meeting of key parent banks, home and host governments and IFIs in London
May 20th 2009	– Commitment letter signed for Hungary and Romania in Brussels
June 22nd 2009	– Commitment letter signed for Bosnia and Herzegovina in Vienna
July 8th 2009	– IMF €1.52 billion Stand-By Agreement for Bosnia and Herzegovina
September 14th 2009	– Parent bank commitment letter signed for Latvia in Stockholm
September 24th 2009	– First ‘horizontal’ Full-Forum meeting of the Vienna Initiative in Brussels. Discussion of deleveraging and recapitalization needs – first signal of moving out of the systemic risk phase. Participants: 17 parent bank groups, their home and host supervisors and fiscal authorities, IMF, EC, EBRD, EIB, WB, ECB, CEBS
October 5th 2009	– Meeting with CEOs of parent bank groups, home and host governments and heads of IFIs at the IMF-World Bank Annual Meetings, Istanbul. Joint Progress Report issued by the Joint IFI Action Plan participants
November 18–19th 2009	– Follow-up meetings with parent banks for Romania and Hungary in Brussels. Start of discussions with banks on addressing the vulnerability of foreign exchange (FX) exposures
January 18th 2010	– Coordination meeting with the IMF, World Bank, EIB, EC in Vienna. Shift from crisis management to addressing the region’s vulnerabilities (lack of local capital markets, FX exposures) and the legacy of the crisis (balance sheet clean-up, distressed asset management)
February 26th 2010	– Follow-up meetings on Serbia (with exposure commitments relaxed on the back of good macroeconomic adjustment and recovery) and Bosnia in Vienna
March 18–19th 2010	– Second ‘horizontal’ Full-forum VI meeting in Athens. Agreement to set up working groups on local currency market development and on the absorption of EU funds. Participants: 20 bank groups, their home and host supervisors and fiscal authorities, IMF, EC, EBRD, EIB, WB, ECB, and CEBS
May 9th 2010	– IMF approves €30 billion Stand-By Arrangement for Greece
June 17th 2010	– Information session and meeting on the absorption of EU funds in Sofia
July 22nd 2010	– Follow-up Vienna parent bank meeting on Romania and Hungary
July 26th–August 4th	– Joint Commission-IMF-WB mission to Romania to discuss measures to accelerate the absorption of EU structural funds
October 6th 2010	– Progress Report on implementation of the Joint IFI Action Plan
End-2010	– Expiry of the Vienna Initiative Joint IFI Action Plan
March 2011	– Final Report on implementation of the Joint IFI Action Plan
March 17th–18th 2011	– Third ‘horizontal’ full forum meeting under the VI in Brussels to evaluate and consider recommendations of the two working groups
March 17th 2011	– Follow-up meetings in Brussels with parent banks on Romania

Table A2
Variable descriptions.

Variable name	Periodicity	Description	Source
<i>Bank-level data</i>			
Private domestic bank	1999–2009	1 = bank is privately domestically owned	BankScope, websites
State bank	1999–2009	1 = bank is >30% owned by the state	BankScope, websites
Foreign bank	1999–2009	1 = bank is foreign bank (50% or more)	BankScope, websites
Support	2008–2009	1 = bank received government support (asset sale, capital injection, and/or guarantee)	Websites
Vienna country	2009	1 = subsidiary is based in a country part of the Vienna Initiative	EBRD
Vienna parent	2009	1 = subsidiary is owned by a parent bank that signed up to the Vienna Initiative	EBRD
Non-Vienna parent	2009	1 = subsidiary is owned by a parent bank that did not sign up to the Vienna Initiative	EBRD
Parent signed here	2009	1 = parent bank signed a commitment letter in the subsidiary's host country	EBRD
Parent signed elsewhere	2009	1 = parent bank signed a commitment letter in another but not in the subsidiary's country	EBRD
Regional exposure	1999–2009	Number of subsidiaries that a parent bank owns in Emerging Europe	BankScope
Credit growth	2000–2009	Annual percentage growth in gross loans (= net loans plus loan loss reserves)	BankScope
Asset growth	2000–2009	Annual percentage growth in total assets	BankScope
Pre-crisis average credit (asset) growth	2005–2007	Average credit (asset) growth for the period 2005–2007	BankScope
Profitability	1999–2009	Return on average equity (in %)	BankScope
Bank size	1999–2009	Log total assets in thousands of US\$	BankScope
Loan/deposit ratio	1999–2009	Net loans/short term funding (in %)	BankScope
Solvency	1999–2009	Equity/net loans (in %)	BankScope
Liquidity	1999–2009	Liquid assets/deposits and short-term funding (in %)	BankScope
Loan quality	1999–2009	Loan loss reserves/gross loans (in %)	BankScope
ROAA	1999–2009	Return on average assets (in %)	BankScope
<i>Country-level data</i>			
GDP growth	1999–2009	Real GDP growth (in %)	IFS
Inflation	1999–2009	Change in CPI inflation, end of period (in %)	IFS

This table presents definitions and sources of all variables used in our empirical analysis. BankScope is Bureau van Dijk's BankScope database. IFS are the International Financial Statistics provided by the International Monetary Fund.

Table A3

Descriptive statistics. Source: BankScope and IMF IFS.

	Mean	Std. dev.	Min	Max	Means by bank-ownership			
					Foreign Vienna	Foreign non-Vienna	Private domestic	State
<i>Panel A. Bank-level variables (1999–2009)</i>								
Foreign	0.58	0.49	0	1	–	–	–	–
Private domestic	0.35	0.48	0	1	–	–	–	–
State bank	0.08	0.26	0	1	–	–	–	–
Support ^a	0.58	0.49	0	1	0.86	0.52	–	–
Credit growth	30.46	38.43	–47.40	197.62	34.44	28.93	32.24	26.13
Profitability	7.46	12.39	–57.73	37.09	8.98	7.68	7.28	4.80
Bank size	2.15	3.41	0.03	20.13	3.59	2.74	0.97	1.89
Loan/deposit ratio	72.17	26.39	16.71	198.81	79.49	75.46	66.80	65.50
Solvency	26.45	18.42	7.06	119.50	20.39	23.26	29.95	38.37
Liquidity	36.65	20.98	3.56	94.71	32.82	33.13	40.44	47.00
Loan quality	5.60	4.53	0.25	22.47	4.86	4.81	6.33	8.06
		Mean			Std. dev.		Min	Max
<i>Panel B. Country-level variables (1999–2009)</i>								
GDP growth		3.75			4.32		–17.73	11.15
Inflation		4.99			5.20		–1.22	45.67

Note: This table provides summary statistics for all the bank-level and country-level variables. Table A2 provides variable definitions and sources. Bank size shown here in US\$ billions while $\log(\text{Bank size})$ is included in regressions. Panel A contains summary statistics for the full sample as well as conditional means for sub-samples by bank ownership.

^a Support indicates the proportion of foreign banks with a parent bank that received state support in 2008–09. Panel B contains summary statistics for the country-level variables.

Table A4

Pairwise correlations of bank level variables. Source: BankScope and IMF IFS.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
[1] Foreign	1									
[2] Private domestic	–	1								
[3] State	–	–	1							
[4] Credit growth	–0.01	0.02	–0.02	1						
[5] Profitability	–0.04	0.06	–0.02	0.12	1					
[6] Bank size	0.38	–0.45	0.17	–0.03	0.03	1				
[7] Loan/deposit ratio	–0.11	0.09	0.02	0.00	–0.02	–0.16	1			
[8] Solvency	–0.10	0.07	0.02	–0.12	–0.02	–0.31	–0.04	1		
[9] Liquidity	–0.17	0.12	0.08	–0.06	0.00	–0.32	0.23	0.48	1	
[10] Loan quality	–0.13	0.10	0.04	–0.28	–0.19	–0.07	–0.01	0.26	0.11	1

Note: This table provides pairwise correlations for our bank-level variables. Tables A2 and A3 provide variable definitions and sources.

Table A5Overview of government support to parent banks and participation in the Vienna Initiative. *Source:* EBRD, banks' websites.

Bosnia–Herzegovina Bank name	Support	Hungary Bank name	Support	Latvia Bank name	Support	Romania Bank name	Support	Serbia Bank name	Support
<i>Parent signed VI letter</i>									
Raiffeisen Bank	Y	UniCredit Bank	Y	DnB Nord Bank	N	Alpha Bank Romania	Y	Société Générale Bank Serbia	Y
Intesa SanPaolo Bank	Y	Raiffeisen Bank	Y	SEB Bank	N	Banc Post	Y	UniCredit Bank	Y
UniCredit Bank	Y	Erste Bank Hungary	Y	Swedbank	Y	Banca Romaneasca	Y	Piraeus Bank Beograd	Y
HypoAlpe-Adria-Bank	Y	K&H Bank	Y			Piraeus Bank Romania	Y	Eurobank EFG	Y
ZepsterKomerckBank BanjaLuka	Y	CIB Bank	Y			Volksbank Romania	Y	Volksbank Serbia	Y
		MKB Bank	Y						
Volksbank BH	Y					Banca Comerciala Romana	Y	Alpha Bank Serbia	Y
NLB Bank	N					UniCredit Tiriack Bank	Y	Vojvodjanska Bank	Y
						BRD - Groupe Societe Generale	Y	Banca Intesa	Y
						Raiffeisen Bank	Y	HypoAple-Adria Bank Raiffeisen Bank	Y
<i>Parent did not sign VI letter</i>									
Turkish Ziraat Bank Bosnia	N	KDB Bank	Y	HVB Bank Latvia	Y	Egnatia Bank	N	NLB Bank	N
ProCredit Bank	N	Volksbank	Y	Regional Investment Bank	N	ProCredit Bank	N	ProCredit Bank	N
Bosna Bank International Komerckijalna Banka BanjaLuka	N	Commerzbank	Y	Privat Bank	N	ABN Amro Bank	Y	Erste Bank	Y
	N	Banco Popolare	Y	SMP Bank	N	OTP Bank	N	OTP Bank	N
		Deutsche Bank	N			San Paolo IMI Bank	Y	Marfin Bank	N
		Fundamenta-Lakaskassza	N			Banca de Creditsi Dezvoltare Romexterra	Y	Moskovska Bank	N
		Allianz Bank	N			Emporiki Bank	N	Credit Agricole	Y
		Budapest Hitel- ésFejlesztési Bank	Y			ATE Bank	Y	Findomestic Bank	Y
								KBC Bank	Y

Note: This table provides information for the five VI countries on whether foreign banks signed commitment letters in each of these countries and on whether they received government support. “Y” (“N”) indicate that the subsidiary’s parent bank received (did not receive) government support in 2008–2009.

Table A6

Banks participating in the Vienna Initiative and horizontal meetings. Source: Commitment letters and concluding statements with the IMF and European Commission.

VI country	Commitment letter	Parent banks	Subsidiaries	Participation September 2009 Brussels	Participation March 2010 Athens
Hungary	Signed May 20, 2009 http://www.imf.org/external/np/cm/2009/052009.htm	Bayerische Landesbank	MKB Bank	x	x
		Erste Group	Erste Bank Hungary	x	x
		Intesa SanPaolo	CIB Bank	x	x
		KBC Group	K&H Bank	x	x
		Raiffeisen International	Raiffeisen Bank	x	x
		UniCredit Group	UniCredit Bank Hungary	x	x
		Romania	Signed March 26, 2009 Reaffirmed November 18, 2009 http://www.imf.org/external/np/cm/2009/032609.htm	Erste Group	Banca Comercială Română
Raiffeisen International	Raiffeisen Bank			x	x
Eurobank EFG	Banc Post			x	x
National Bank of Greece	Banca Romaneasca			x	x
UniCredit Group	UniCredit Tiriac Bank			x	x
Société Générale	BRD			x	x
Alpha Bank	Alpha Bank Romania			x	x
Volksbank International	Volksbank Romania			x	x
Piraeus Bank	Piraeus Bank Romania			x	x
Bosnia and Herzegovina	Signed June 22, 2009 http://www.imf.org/external/np/cm/2009/062209.htm			Raiffeisen International	Raiffeisen Bank
		Hypo Alpe-Adria	Hypo Alpe-Adria Bank	x	x
		UniCredit Group	UniCredit Bank	x	x
		Volksbank International	Volksbank Bosnia	x	x
		Intesa SanPaolo	Intesa Sanpaolo Bank	x	x
		NLB Group	NLB Bank		
		Serbia	Signed March 27 2009 Reaffirmed Feb 26 2010 http://www.imf.org/external/np/cm/2009/032709.htm	Eurobank EFG	Eurobank EFG
Intesa SanPaolo	Bank Intesa			x	x
Raiffeisen International	Raiffeisen Bank			x	x
Hypo Alpe-Adria	Hypo Alpe-Adria Bank				x
National Bank of Greece	Vojvodjanska Bank			x	x
UniCredit Group	UniCredit Bank Serbia			x	x

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Table A6 (continued)

VI country	Commitment letter	Parent banks	Subsidiaries	Participation September 2009 Brussels	Participation March 2010 Athens
		Société Générale Alpha Bank	Société Générale Bank Alpha Bank Beograd	x x	x x
		Volksbank International Piraeus Bank	Volksbank Beograd Piraeus Bank Beograd	x x x	x x x
Latvia	Signed September 11, 2009 http://www.imf.org/external/np/country/2009/091409.htm	Bank DnB NORD Nordea Bank	AS DnB NORD Bank Nordea branch	x x x	x x x
		Swedbank	Swedbank, Latvia	x	x
		SEB	SEBBank Latvia		x
Other banks		ING Bank OTP Bank			x x

Note: This table lists all banks that participated in the horizontal meetings of the Vienna Initiative.

Table A7

The Vienna Initiative and government support: a cross-sectional IV analysis. Source: BankScope, IMF IFS, authors' calculations.

	Credit growth			
	(1)	(2)	(3)	(4)
Vienna parent	-28.300** (0.024)	-19.642 (0.125)	-20.697* (0.097)	-29.144** (0.020)
Parent signed here	34.871** (0.031)	39.584** (0.038)	39.228** (0.023)	39.784** (0.023)
Average pre-crisis annual growth	-0.382*** (0.000)	-0.390*** (0.000)	-0.413*** (0.000)	-0.400*** (0.000)
Capital injection	15.367*** (0.002)			14.011*** (0.002)
Liquidity support		14.965 (0.125)		10.999 (0.212)
Guarantee support			7.199 (0.151)	6.057 (0.230)
No. of observations	54	54	54	54
R-squared	0.617	0.570	0.573	0.617
Estimator	IV	IV	IV	IV
Period	2009	2009	2009	2009
F-test (p-values)	(0.070)	(0.109)	(0.070)	(0.054)
$R = \beta F / (\beta R^- \beta F)$	1.046	1.040	1.041	1.040
Bank controls	Yes	Yes	Yes	Yes
Parent bank controls	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
1st stage IV				
Market share other Vienna letter	0.095** (0.046)	0.082* (0.063)	0.096** (0.049)	0.081 (0.125)

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Table A7 (continued)

	Credit growth			
	(1)	(2)	(3)	(4)
Market share other Vienna letter ²	−0.001** (0.023)	−0.001** (0.032)	−0.001** (0.027)	−0.001* (0.071)
F-stats for instrument relevance	4.690	4.450	4.310	3.880
F-test (p-value)	(0.016)	(0.019)	(0.022)	(0.031)
Hansen test (p-value)	(0.365)	(0.627)	(0.790)	(0.601)

Note: This table shows cross-sectional regressions to estimate the impact of participating in the VI and of government support on credit growth. The sample includes foreign bank subsidiaries in the five Vienna countries. The dependent variable is credit growth in 2009. Pre-crisis average growth is computed for the period 2005–2007. *Capital injection*, *Liquidity support*, and *Guarantee support* are dummy variables equal to “1” if the parent bank received this type of government support in 2008–2009, “0” otherwise. All unreported bank level and parent level controls are defined in Table A2. Standard errors are robust and p-values appear in brackets. The constant is not reported.

* Corresponds 10% level of significance.

** Corresponds to the 5% level of significance.

*** Corresponds to the 1% level of significance.

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