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ABSTRACT

Using the theoretical predictions of the Bernanke-Blinder (1988) model, we seek to examine the existence of a bank lending channel through the empirical identification of a loan supply function and to assess the impact of differential bank characteristics on banks' ability to supply loans. To this end, we estimate a loan supply model and test for the restrictions implied by perfect substitutability between loans and bonds in bank portfolios. Estimations are carried out on bank panel data for 16 OECD countries, the results showing that a bank lending channel is at work in only two of them. Moreover, and contrary to standard accounts, we find that the relevance of bank characteristics is hardly a decisive factor in the identification of a loan supply function.

Keywords: Bank lending channel; financial structure; dynamic panels
JEL classification: C23; C52; E44; E52

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1. Introduction

The monetary transmission mechanism holds a central position in monetary analysis and has quite justifiably attracted a large amount of research. A still controversial issue in this respect is the relative importance of the "money" and "credit" channels of monetary transmission. Supporters of the traditional money view argue that the focus on interest rates or monetary aggregates is sufficient for understanding the transmission of monetary policy. The explanation runs as follows: in a world of two assets, money and bonds, a decline in bank reserves causes the real interest rate to rise. Investment demand and (interest-sensitive) consumer demand start to fall and, ultimately, real output decreases. Policymakers have followed this conventional view for many decades. However, some relatively recent events (for instance, the credit crunch during the 1990-91 recession in the United States)[1] have shown that the interest rate channel alone may not explain the monetary transmission mechanism.

While agreeing with the broad outlines of standard theory, Bernanke and Blinder (1988) and Bernanke and Gertler (1995), among other proponents of the credit view, emphasize the role of financial intermediaries and agency costs in monetary transmission. In particular, they suggest that output changes cannot be solely explained by changes in interest rates, which are small and, in any case, transitory. They therefore add a "balance sheet" channel and a "bank lending" channel to the theoretical discussion. The former suggests that the rise in interest rates following a contractionary monetary policy causes a deterioration in borrowers' balance sheets, which in turn raises the cost of credit intermediation and the requirement of additional collateral. The underlying theory of the bank lending channel suggests that firms have few substitute sources of funds beyond bank borrowing. Since during periods of monetary contraction the liabilities of banking institutions decrease, borrowers bear a large portion of the contraction. As noted by Bernanke (1993), the basic assumption needed for the existence of a bank lending channel is that, due to financial market imperfections, bonds and loans are imperfect substitutes for firms and banks do not consider loans as perfect substitutes for securities

[1] Peek and Rosengren (1995) point out that the slower than expected US recovery from the 1990-91 recession was accompanied by slow growth in bank lending.

in their portfolios. If this holds, central bank actions might affect the supply of loans from banks and, in turn, real spending in the economy.

While the balance sheet channel appears reasonably well established, the existence of a bank lending channel is still debated. Bernanke and Blinder (1988) developed a simple model (BB model hereafter) for the bank lending channel, which became the benchmark for future studies – and is practically the only structural framework available. They expanded the conventional IS-LM model to include the loan market, dropping the assumption of perfect substitutability between bank loans and securities (bonds). In this framework, loan supply shifts play a key role in the propagation of monetary impulses, amplifying the effect that works through the interest rate channel. Yet, observed changes in the quantity of loans after a monetary policy movement need not be related only to loan supply shifts but can also be interpreted differently. Thus, a monetary contraction may depress aggregate demand through the interest rate channel, thereby decreasing the demand for bank loans. The difficulties in distinguishing shifts in loan demand from shifts in loan supply (identification or simultaneity problem) have prompted researchers to focus on cross section (bank-level) data and try to capture asymmetries in loan supply behavior by examining reduced-form equations linking bank loans to monetary policy measures (see for example Kashyap and Stein, 2000). Implicit in this approach is the assumption that when asymmetries are present, loan supply shifts – a necessary condition for the operation of the lending channel – may be identified.

In this paper we focus on the loan market in the BB model and propose the direct identification of the loan supply function from bank-level data, while in a second step we assess the impact of differential balance sheet characteristics on banks' ability to supply loans. To this end, we test appropriate restrictions that are valid when perfect substitutability exists between loans and bonds in bank portfolios. This novel empirical test of the BB model is applied to a number of panel datasets corresponding to 16 OECD countries for the years 1996 to 2003. In the empirical analysis we deal with a number of econometric problems posed by the use of bank-level data, and this helps us to increase the robustness of the results pertaining to the existence of the bank lending channel.

Our paper proceeds as follows. Section 2 summarizes some previous empirical studies on the bank lending channel. The model specification is described in Section 3, and in Section 4 we present the empirical methodology and results. Our paper is concluded in Section 5.

2. Brief literature review

The Bernanke-Blinder (1988) model introduces a separate channel of monetary transmission, the bank lending channel, whose operation enhances the interest-rate-induced effect of monetary policy on aggregate demand. In this model, the bank lending channel is not operative when both loan demand and loan supply are perfectly elastic with respect to the loan rate and output demand is not responsive to changes in the loan rate; if these conditions hold, the demand for (supply of) loans cannot be defined separately from the demand for (supply of) securities.

To test for the existence of a bank lending channel, Bernanke and Blinder (1992) applied VAR analysis to US data to examine impulse responses of loans, deposits, securities and unemployment following a contractionary monetary policy. Their results showed that in the short run the volume of securities and deposits declines, while the effect on loans is not as important. Over a longer period of time, however, bank loans are substantially reduced, as banks are reluctant to make new contracts when the old ones expire. The effect on unemployment was found to be very similar to the effect on loans and therefore Bernanke and Blinder suggested that their analysis provides evidence for both a bank lending and an interest rate channel.

There has been a number of further attempts to test the implications of the Bernanke-Blinder model. Kashyap et al. (1993) examined changes in the mix between bank loans and commercial paper following monetary policy shocks. They asserted that if a bank lending channel exists, a monetary contraction will reduce the supply of bank credit. Therefore, an increase in non-bank debt could be expected due to the ability of some firms to substitute between the two sources of funds, leading to a decrease in the share of bank loans in total external finance. Their empirical results based on US manufacturing data over the period 1963 to 1989 confirm this, indicating that a contractionary policy can reduce loan supply.

Oliner and Rudebusch (1995) pointed out that Kashyap et al. (1993) used a narrow measure of the finance mix, which may exclude important shifts in financing patterns after a change in monetary policy. Thus, they adopted a broader definition of non-bank debt to analyze the response of the debt mix to monetary shocks. Their empirical results, once again based on US manufacturing data, provide no evidence for a bank lending channel. However, Oliner and Rudebusch identified important differences in the behavior of small and large firms.

A common characteristic of these contributions is that they estimated time series relationships, concentrating on relatively short-term responses of loan supply, which may not be very informative in view of the fact that banks are prevented from quickly adjusting the stock of their loans following a monetary policy shock, due to loan commitments and other contractual agreements (Bernanke and Blinder, 1992). Also, observed responses may admit alternative interpretations, not necessarily restricted to loan supply shifts, but involving shifts in both loan demand and loan supply.

The difficulties in distinguishing shifts in loan demand from shifts in loan supply have prompted researchers to focus on panel data in order to indirectly test for the existence of a loan supply function by looking at the importance of bank characteristics for individual bank lending following a monetary policy change. Studies in this group include Kashyap and Stein (2000) and Kishan and Opiela (2000), both examining the US case. The former study uses liquidity and size to find evidence of a bank lending channel (which is stronger for smaller banks), while the latter uses an additional bank characteristic (namely bank capitalization) and suggests that the smaller and least capitalized banks are the most responsive to a monetary policy change. In contrast, large banks can partly, if not completely, insulate their loans from the effects of monetary policy, which implies that a bank lending channel may not hold in total, as these banks account for about 80% of all loans in the industry.

Studies that tested for the existence of a bank lending channel across European countries are Bondt (1999), Favero et al. (1999), Altunbas et al. (2002) and Ehrmann et al. (2003), while a number of studies examined the lending channel for individual countries (see for example the relevant studies in Angeloni et al. (2003) for euro area countries, Gambacorta (2005) for Italy and Kakes and Sturm (2002) for Germany). The results from these studies are rather inconclusive, generally suggesting that a bank lending channel is effective in countries with banking systems characterized by high dependency on small banks, weak capitalization and liquidity and limited non-bank sources of funds.

The panel studies mentioned above relied on reduced-form equations, linking bank loans to monetary policy measures. Even though this approach offers an insight into the effect of differential bank characteristics on bank lending, it appears to have basically two limitations. First, it does not allow the identification of the structural parameters that are relevant for the existence of a bank lending channel, in particular the interest rate elasticity of loan supply. Yet, identification of a loan supply function is critical to the empirical investigation, since in the absence of a bank lending channel, the loan supply function cannot be defined. Second, for the estimation of this type of models, simple panel data techniques, such as least squares or instrumental variables methods, are generally used, which produce significant biases in unknown magnitudes and directions.[2] The recent econometric literature (e.g. Arellano, 2003) proposes the application of certain techniques that overcome problems associated with the dynamic nature and/or the non-stationarity of the variables regularly used in these models. This issue will be further discussed in Section 4.

More recently, Brissimis and Magginas (2005), building on the Bernanke-Blinder model, proposed a new method for analyzing empirically the bank lending channel. In particular, they identified the equilibrium relationships included in the Bernanke-Blinder model from a Vector Error Correction Model and tested appropriate restrictions that hold under perfect asset substitutability. The use of time series data on six major industrial countries suggests that as financial systems move towards a more market-based structure,

[2] This might be especially true if the variables used are not stationary, which is usually the case with bank balance sheet variables, such as loans, liquid assets and deposits, or if the time dimension of the panels is small.

bank lending tends to play a less important role in the transmission of monetary policy.[3] What stands as a challenge is the direct estimation of the loan supply function using bank-level data, which has two main advantages: it overcomes the simultaneity problem and provides the basis for assessing whether differential bank characteristics are important for loan supply identification.

3. Theoretical framework

In this section, we try to make progress on the difficult identification problem discussed above, by examining loan supply behavior from bank-level data. The proposed specification of the loan supply function retains the basic features of the Bernanke-Blinder (1988) model as regards the loan market. As a supplementary specification test, we assess the impact of differential balance sheet characteristics on banks' ability to supply loans, an approach widely used in the empirical literature of the bank lending channel that focuses on bank-level data to identify loan supply shifts.

In the Bernanke-Blinder framework, bank credit has an independent effect on monetary transmission if loans and bonds are imperfect substitutes, due to financial market imperfections. Assuming, as in the BB model, a competitive market of loans, the aggregate loan demand and supply functions can be expressed as follows:

$$L_t^d = L(\underset{-}{\rho_t}, \underset{+}{i_t}, \underset{+}{y_t}) \tag{1}$$

$$L_t^s = L(\underset{+}{\rho_t}, \underset{-}{i_t}, \underset{+}{D_t}) \tag{2}$$

where L are loans, D are deposits, ρ is the bank lending rate, i is the bond rate, y is output, and the superscripts d and s refer to loan demand and supply, respectively; all variables are in real terms. Output and deposits are the scale variables in equations (1) and (2). The presence of the loan rate and the bond rate in both the loan demand and the loan supply functions reflects the assumption of imperfect substitutability between loans

[3] An important exception is Japan, for which the channel is operative.

and bonds in bank portfolios and as sources of external finance for firms. Equilibrium in the loan market requires $L^d = L^s$.

The use of bank-level data can offer a solution to the simultaneity problem inherent in eqs. (1) and (2). Indeed, once the aggregate market for loans, as described by these equations, has determined the interest rate for a given period, individual banks can be considered as price takers for this period, facing the following equilibrium loan supply function, assumed to be linear for analytical convenience:

$$L_{it}^s = \alpha + \beta(\rho_t - i_t) + \gamma D_{it} \tag{3}$$

where ρ is the loan rate as determined in the market for loans. The assumption underlying the inclusion of the spread in eq. (3) is that investment decisions of banks are characterized by rate of return homogeneity of degree zero, which implies that, when rates of return rise by the same amount for all assets, banks do not alter the structure of their balance sheets.

Identification of the loan supply function is a critical condition in the BB model that must be satisfied for a bank lending channel to exist (as mentioned in Section 2 above and in BB), because for an inoperative lending channel it is sufficient that loans and bonds are perfect substitutes for either borrowers or banks. If financial markets are characterized by asymmetric information, the effect of monetary policy through the interest rate channel can be amplified by changes in the availability of internal cash flow or of external finance. When banks are the main providers of funds for households or firms, monetary policy could affect the latters' spending via shifts in loan supply. A second argument favoring direct estimation of the bank loan supply function is that estimation of reduced-form equations linking bank loans to monetary policy variables does not allow identification of the parameters of the structural model. Since, due to data limitations, the observed asymmetries cannot be explicitly linked to the output responses of firms that borrow from a particular size category of banks, their implications for aggregate economic activity and the transmission mechanism are not clearly visible (see Kashyap and Stein, 2000).

When banks view loans and bonds as perfect substitutes $(\beta \rightarrow \infty)$, the loan and bond rates are equalized and L_{it}^{s} is not defined. Given that we cannot directly test that $\beta \rightarrow \infty$, we invert eq. (3) to obtain:

$$\rho_t - i_t = -\alpha / \beta + (1/\beta) L_{it} - (\gamma / \beta) D_{it} \tag{4}$$

This specification allows for the identification of the parameters of the loan supply function. Rejection of the joint significance of the variables in the right-hand side would provide evidence against the existence of a bank lending channel, since loan supply would be perfectly elastic with respect to the interest rate spread.

Implications of the bank lending channel are, *inter alia*, that monetary policy has distributional effects for banks. Monetary policy is thus expected to have a differentiated impact on the loans of individual banks, depending on certain bank characteristics. If we assume that loan demand is homogeneous across banks with respect to these characteristics, the differentiated loan responsiveness to monetary policy impulses would help identify loan supply movements. We introduce the effect of bank characteristics via the coefficient on deposits, which implies that

$$\gamma = \gamma_0 + \gamma_1 Z_{it} \tag{5}$$

where Z_{it} is a bank-specific characteristic.[4] Substituting (5) into (4) yields:

$$\rho_t - i_t = -\alpha / \beta + (1/\beta) L_{it} - (\gamma_0 / \beta) D_{it} - (\gamma_1 / \beta) D_{it} Z_{it} \tag{6}$$

In line with previous studies, the bank-specific characteristics used here are size, capitalization and liquidity, each expected to have a negative effect on the supply of loans ($\gamma_1 < 0$). Well-capitalized and liquid banks should be able to better shield their loans from monetary policy changes by resorting to the higher amount of stockholders' funds available and by using their buffer of liquid assets. Also, larger banks tend to raise less expensive capital, which may lead to a better lending position. If these effects are significant, the shift parameter γ would be smaller and, as a result, the lending channel would be less important. Again in eq. (6) testing for the joint significance of the right-

[4] This is equivalent to including as regressors both the level of deposits and an interaction term between

hand side variables gives an indication of the importance of the lending channel. In the following section, we provide estimates of eqs. (4) and (6) for a sample of OECD countries.

4. Empirical evidence

4.1 Data and econometric methodology

In this section we investigate the existence of a loan supply function, which in the BB model is a prerequisite for the operation of a bank lending channel, by using panel data on banks for 16 OECD countries. The panels for individual countries are unbalanced and include yearly observations for the period 1996-2003. All bank balance sheet variables are obtained from the BankScope database and deflated by the consumer price index. Loans and deposits are expressed in logs. The lending rate and the bond rate are drawn from the IFS database.[5] Bank size (*S*) is measured by the logarithm of total assets, liquidity (*LQA*) by the ratio of liquid assets (cash, deposits held with other banks and short-term securities) to total assets and capitalization (*CAP*) by the ratio of capital and reserves to total assets. In order to get indicators that sum to zero over all observations, the bank-characteristic variables are defined as deviations from their cross-sectional mean at each time period in the case of the size variable, so as to remove its trend, or the overall mean in the case of the liquidity and capitalization variables, which do not have a trend:

$$S_{it} = \ln A_{it} - \frac{\sum_{i=1}^{N} \ln A_{it}}{N_{it}}, \; LQA_{it} = \frac{LQ_{it}}{A_{it}} - \left(\sum_{t=1}^{T} \frac{\sum_{i=1}^{N} LQ_{it} / A_{it}}{N_t} \right) / T, \qquad (7)$$

$$CAP_{it} = \frac{C_{it}}{A_{it}} - \left(\sum_{t=1}^{T} \frac{\sum_{i=1}^{N} C_{it} / A_{it}}{N_t} \right) / T$$

this variable and the bank-specific characteristic.

[5] These are nominal interest rates, since the spread between the two is equal to the real rate spread appearing in the theoretical model.

In Table 1 we present the number of banks by country and the respective means of the variables used.

We consider the following empirical formulation of eq. (6):

$$\left.\begin{aligned} &R_t = b_0 + b_1 L_{it} + b_2 D_{it} + b_3 D_{it} Z_{it} + \eta_t + \varepsilon_{it} \\ &\varepsilon_{it} = \mu_i + u_{it} + v_{it} \\ &u_{it} = \lambda u_{i,t-1} + e_{it} \quad |\lambda| < 1 \\ &e_{it}, v_{it} \sim MA(0) \end{aligned}\right\} \qquad (8)$$

where R_t is the spread between the lending and the bond rate at time *t* and η_t is a year-specific intercept reflecting shocks (e.g. a technology shock) that are common to all banks. Of the error components, μ_i is an unobservable bank-specific effect, u_{it} is a possibly autoregressive shock and v_{it} is a serially uncorrelated error component.

In the literature, estimation of lending equations (either reduced-form or structural) presents considerable robustness problems due to the non-stationarity of the variables involved and the possible existence of cointegrating relationships between them.[6] Moreover, in model (8) loans and deposits are likely to be correlated with μ_i, e_{it} and v_{it}, in which case there are no valid moment conditions if the disturbances u_{it} are autoregressive (Bond, 2002).

To overcome these problems we consider a dynamic autoregressive model of the kind described in Blundell and Bond (1998) and Arellano (2003):

$$R_t = d_0 + d_1 R_{t-1} + d_2 L_{it} + d_3 L_{i,t-1} + d_4 D_{it} + d_5 D_{i,t-1} + d_6 D_{it} Z_{it} + d_7 D_{i,t-1} Z_{i,t-1} + \eta_t^{/} + \varepsilon_{it}^{/} \qquad (9)$$

System GMM can be applied, which does not break down in the presence of unit roots (for a proof see Binder et al., 2003). We choose the two-step estimator, since it is asymptotically more efficient than the respective one-step estimator, and we account for its downward bias by using the finite-sample correction to the two-step covariance matrix derived by Windmeijer (2000). The maximum number of instruments that can be used are

[6] Binder et al. (2003) and Baltagi (2001), among others, suggest that in panels with a small time dimension and a larger cross-sectional dimension (which is usually the case in the relevant literature), instrumental variables and GMM estimators based only on standard orthogonality conditions break down if the underlying time series contain unit roots.

$R_{t-2},...,R_1,\Delta R_{t-1}$; $L_{i,t-2},...,L_{i1},\Delta L_{i,t-1}$; $D_{i,t-2},...,D_{i1},\Delta D_{i,t-1}$ and, when bank characteristics are included in the specification, $D_{i,t-2}Z_{i,t-2},...,D_{i1}Z_{i1},\Delta D_{i,t-1}\Delta Z_{i,t-1}$ too. The choice of the lagged levels and lagged first-differences as instruments is made in a way that guarantees validity of the resulting overidentifying restrictions, a hypothesis tested using the Hansen test, which is the minimized value of the two-step GMM criterion function and – unlike the Sargan test in the two-step case – is robust to heteroskedasticity and autocorrelation.[7]

The estimation results are shown in Table 2. We present estimates of the inverted loan supply function (eq. 4) and an augmented version (eq. 6) that includes the capitalization variable. We also estimated equations that include the size and liquidity variables separately, as well as equations that include all three bank-characteristic variables. However, the results were similar and thus are not reported here.[8]

There are three key considerations in the analysis of our results. First, the Hansen test should accept the validity of the lagged levels and lagged first differences as instruments. If not, the results are consistent with the presence of measurement errors, since the instruments used would be weak. Second, AR(1) could be expected in the first differences of the errors because by construction $\Delta v_{it} = v_{it} - v_{i,t-1}$ should correlate with $\Delta v_{i,t-1} = v_{i,t-1} - v_{i,t-2}$, as they share the first lag of the error term. However, higher order autocorrelation would indicate that some lags of the dependent variable are in fact endogenous, thus bad instruments. Therefore, the relevant test statistic should reject the presence of AR(2). Third, as noted earlier, the existence of a bank lending channel in the BB model presumes that the loan supply function can be defined. To examine this hypothesis we use a simple Wald test, which is reported in the last column of Table 2. Rejection of the null hypothesis of the joint non-significance of all the right-hand side variables of eq. 4 (or eq. 6) would imply perfect substitutability between loans and bonds in bank portfolios, in which case eq. 4 (or eq. 6) reduces to $\rho = i$.

[7] In order to ensure robustness - in the spirit of Bond (2002) - we compared the various consistent GMM estimators (differenced GMM and system GMM) to simpler estimators like OLS levels, Within Groups and first-differenced Two Stage Least Squares estimators, which are likely to be biased in opposite directions as regards the lagged dependent variables in panels with a small time dimension.

4.2 Results

Backed by Wald test values that strongly reject the hypothesis of zero coefficients in the estimation of the inverted loan supply function, the results show that Japan and Greece are the only countries, among the 16 included in the sample, that are clearly identified as having an operative bank lending channel. For Japan the results are not surprising given the prolonged recession and the accompanying banking crisis that characterized the 1990s, and the exposure to the Asian financial crisis in 1997. The real value of bank assets fell, making banks more reluctant to grant new loans for investment. This development forced Japanese banks to re-balance their portfolios by shifting from loans to bonds. Yet, the nature and depth of the crisis made this adjustment slow, reflecting imperfect asset substitutability. Moreover, the importance of financial intermediaries in Japan remains high as the share of private sector holdings of financial assets in banks accounted in 2000 for 85% of total intermediated financial assets in Japan, compared to 63% in the euro area and only 48% in the US (ECB, 2002).

The case of Greece is slightly different, as its financial system has only recently been fully deregulated and banks during most of the sample period were not able to flexibly adjust their portfolios.[9] The results of the present paper are similar to the empirical findings of Brissimis et al. (2003) and in line with the conclusions of Kashyap and Stein (1997). In the latter study, Greece is classified as a country where the bank lending channel is more likely to work, mainly because of the relatively small size of Greek banks and the limited availability of non-bank finance. The liberalization of the financial system in Greece started much later compared to the rest of EU-15 countries, therefore Greece provides an interesting case study for the years ahead.

For three countries, namely Spain, Italy and France, our evidence for a bank lending channel is weak, since for all of them the restrictions are rejected at the 5 percent but not at the 10 percent level of significance. A number of studies that employ reduced-form equations have examined the French case, their evidence being rather inconclusive.

[8] These results are available upon request.

[9] This was mainly due to the high reserve requirement ratio in place until June 2000 when it was harmonized with that of the Eurosystem. Notably, the bulk of deposits in foreign currencies were subject to a reserve requirement which was effectively 100 per cent.

Ehrmann et al. (2003) and Altunbas et al. (2002) suggest that a bank lending channel is not operative in general, while Loupias et al. (2003) indicate that its operation is found to be conditional on the inclusion in their model of the bank characteristic of liquidity. Here, we confirm the results of Brissimis and Magginas (2005), suggesting that overall the lending channel in France has recently lost its potency. However, as the relevant equations show, inclusion of a bank-characteristic variable significantly reduces the p-value of the Wald test, bringing it closer to the 5 percent level of significance. This is possibly due to the relatively low level of bank health in the late 1990s (see Kashyap and Stein, 1997).

Many studies have examined the bank lending channel in Italy, too, a recent one being Gambacorta (2005). Although we share some of the conclusions of this study (especially those regarding comparisons with estimates derived from BankScope data), our results are more in line with Altunbas et al. (2002), Favero et al. (1999), Bondt (1999) and Brissimis and Magginas (2005), where only weak evidence is found for a lending channel.[10] Weak evidence (though stronger compared to France and Italy) is also found for a lending channel in Spain.[11] Spain, managed to liberalize its banking sector sooner than other Southern European countries, mainly owing to the fact that the Bank of Spain has been independent since the late 1970s. In the years to come, one would expect the impact of a lending channel to be further weakened as a result of the ongoing financial integration with the EU, the latter resulting in increased availability of market-based finance. An interesting question regarding the French, Italian and Spanish cases (which cannot be addressed here due to data limitations) is whether (or to what extent) there has been a change in the effectiveness of the bank lending channel during the last 10 to 15 years.

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[10] In particular the profitability of the Italian banks, as proxied by the return on equity, seems to be the lowest among EU countries. Also, Italian banks, through their group structure, control a large share of mutual funds, engage in the provision of services otherwise offered by other financial institutions and are the major financiers of long-term investments (ECB, 2002).

[11] Hernando and Martinez-Pages (2003), using reduced-form equations, also found weak evidence for an operative bank lending channel in the 1990s, claiming that the high levels of liquid asset holdings of Spanish banks allowed them to absorb even very significant monetary shocks. Other studies like Altunbas et al. (2002) and Favero et al. (1999) suggest that a bank lending channel was at work in Spain during the 1990s.

The moves towards "Anglo-Saxon" type of financial systems, characterized by higher levels of transparency and informational symmetry, has led to a decrease in the potency of the bank lending channel in the rest of the EU countries. From these, the lower Wald test value is found for Denmark, possibly due to low levels of liquidity and capitalization, along with the fact that the Danish banking sector consists of a large number of relatively small banks (see Kashyap and Stein, 1997). These effects are probably more than offset by the extensive availability of non-bank sources of finance to Danish firms, mainly due to the financial integration with the EU and the high level of liberalization of the Danish economy.

In Austria, even though the financial system is primarily bank-based,[12] the remarkable internationalization that occurred in the second half of the 1990s, as Austrian banks increased their foreign assets and liabilities and vigorously expanded into neighboring Central and Eastern Europe, has become a key catalyst for their consolidation efforts in order to become more competitive. Owing to the sharp increase in other types of business, such as international lending and securitization, the share of loans to non-bank residents on banks' balance sheets has shrunk.

Although the Dutch and Belgian financial systems are more concentrated than those discussed above (something that may signify a departure from competitive behavior),[13] the results are not dissimilar. The relevant Wald tests indicate strong rejection of the hypothesis of a lending channel, regardless of the inclusion of bank-characteristic variables.[14] Profitability ratios and bank health indicators are high in both countries,[15] while the reduced importance of deposit funding made banks less sensitive to the impact of monetary policy. Furthermore, Dutch and Belgian banks have increased

[12] This is also the suggestion of Kaufmann (2003) who finds weak evidence for a bank lending channel in Austria, using a reduced-form equation and quarterly data for the period 1990-1998.

[13] Various approaches to measuring competition in banking have been proposed, the most recent literature favoring the method developed by Panzar and Rosse (1987). Yet, all these approaches provide estimates of banking industry market power and not market power exercised by individual banks, as would be appropriate when bank-level data are used. This line of investigation is however beyond the scope of this study.

[14] For the Dutch case, De Haan (2003) distinguishes between secured and unsecured bank debt to find evidence that the lending channel is operative only for unsecured lending. Garretsen and Swank (1998), Van Ees et al. (1999) and Kakes (2000) conclude that the bank lending channel is ineffective in general. In Belgium, banks have traditionally held a relatively small percentage of their assets in loans and a large percentage in government securities.

their activities outside the euro area, which is also likely to have made them less sensitive to monetary policy impulses.

In contrast to other euro area countries, the German financial system has not changed dramatically over the past few decades, mainly because financial liberalization in Germany took place very early. Also, the degree of banking competition is strong, with a large number of banks facing comparatively low levels of profitability. Moreover, the fact that the vast majority of the banks are either savings or co-operative allows them to indirectly access the interbank market through their respective large central institutions, something that creates sufficient flexibility in times of scarce liquidity (ECB, 2002). This favors the argument that a bank lending channel is not at work in Germany, as is clearly reflected in the relevant Wald tests.[16]

Luxembourg and Switzerland provide two distinct cases, due to their unique tax, legal and structural conditions. The financial sectors in these countries hold a very large portion of total GNP, with banks being capitalized and liquid well above international standards. The liberalization reforms in these countries were mainly society-driven (originating from both domestic and foreign interest groups) and hence more effective. Also, the fact that their financial systems are bank-based does not suggest an important role for monetary policy transmission through bank assets, since these economies are very open to foreign financial flows.

In Canada, the banking system is concentrated to the top 6 banks that operate nationally, and therefore testing an equilibrium relationship with banks behaving as price takers should be treated with caution. Recently, Atta-Mensah and Dib (2003) used a dynamic general equilibrium model on time series data to examine the role of bank lending in the Canadian monetary transmission mechanism. They found that the response of output to monetary policy shocks is amplified when the model incorporates credit frictions, thus ruling in favor of the channel's existence. However, our results are in contrast. The high level of liberalization of the Canadian banking system and its proximity to the US financial sector, which makes plenty of alternative fund sources

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[15] Also the increase in banks' loan portfolios was accompanied by an even larger increase in liquid assets.
[16] Brissimis and Magginas (2005), Altunbas et al. (2002) and Favero et al. (1999) also find no evidence of an operative bank lending channel in Germany.

available, indicates that to the extent that loan and deposit prices are competitive, no lending channel is at work.

In Sweden, too, the evidence strongly rejects the hypothesis of the existence of a loan supply function. In the late 1990s there were a number of regulatory changes in the Swedish banking system, aiming at the abolition of reserve requirements and the strengthening of its market orientation. Furthermore, the system is characterized by transparency and informational symmetry; hence the non-identification of a loan supply function does not come as a surprise.

We kept the discussion of the UK and US cases last, since their financial market structures are the most representative of the Anglo-Saxon type. Their banking systems are characterized by low concentration and high efficiency, liberalization, globalization and transparency. In a recent paper, Huang (2003) uses a reduced-form equation and a panel dataset of UK firms to suggest that a bank lending channel is operative.[17] However, the development of market financing and the extensive deregulation of the country's banking system that was completed as early as the 1980s seem to support our finding about the non-existence of a bank lending channel. Our results for the UK are backed by Wald tests strongly suggesting against the identifiability of a loan supply function.

The US financial system is probably the most market-oriented among those studied in this paper. As noted previously, with regard to the relative size of traditional bank intermediation, as measured by the ratio of holdings of bank-related assets to other intermediated assets, the US is below the euro area and Japan. At the same time, loans and deposits as a percentage of GDP are twice as high in the euro area relative to the US (see Maddaloni and Sorensen, 2005). These figures indicate the importance of banking intermediation in the euro area compared with the US. One would therefore expect that no bank lending channel is operative in the US, since in most EU countries already examined, the evidence is either weak or not present at all. We have already mentioned the main findings of the literature on the US bank lending channel (which uses reduced-

[17] This study employs the Arellano-Bond GMM estimator, which has been found to break down in the presence of unit roots, likely to be present in bank-level or firm-level balance sheet data. Estimation of the present model using the Arellano-Bond method produces large differences in the results, very similar to those found by the Monte Carlo experiments of Blundell and Bond (1998).

form equations for loan supply identification), our results being similar to those of Kishan and Opiela (2000). Our US dataset includes banks that account for about 80% of the total industry's share, admittedly corresponding to large financial intermediaries. Inclusion of any of the bank-characteristic variables does not alter the results, which strongly reject the existence of a lending channel.

As a final step, we have estimated the same loan supply model for the panel of EMU countries included in the present analysis. There is no uniformity regarding the nature and importance of financial intermediaries across EMU member states. We capture this heterogeneity by including country dummies in the regressions, which are found to be statistically significant. Unsurprisingly, given the individual country results, the estimations show that the lending channel is not operative in the unified panel of EMU countries. This has clear and direct implications for ECB's monetary policy, since there seems to be no amplification effects of monetary policy changes due to a bank lending channel.

5. Conclusions

Using bank-level data, this paper attempted the identification of a loan supply function as this has important implications in the context of the BB model for the existence of a bank lending channel. Previous empirical work on the lending channel used either (*i*) time series data and the theoretical predictions of the Bernanke-Blinder (1988) model (but faced a problem of simultaneity between loan supply and loan demand), or (*ii*) panel data on banks and indirectly tested for loan supply shifts through estimation of reduced-form equations that examine the relationship between bank lending, a monetary policy variable and bank characteristics. Implicit in this latter approach is the assumption that when heterogeneity in bank characteristics is present, loan supply shifts can be identified.

Given the limitations of this approach, we focused here on the direct identification of the loan supply function from bank data, adopting the assumptions of the Bernanke-Blinder model as regards the loan market. Thus, we derived, at the individual bank level, a loan supply function that is free of the simultaneity problem and offers testable hypotheses pertaining to imperfect substitutability between loans and bonds in bank portfolios. In this context, perfect substitutability implies that a loan supply function cannot be defined. In a second step, we assessed the impact of individual bank characteristics on banks' ability to supply loans by augmenting the above model to include a number of bank-characteristic variables (capitalization, liquidity and size) and examining whether these can modify the test results obtained prior to their inclusion.

The proposed methodology was applied to a number of panel datasets corresponding to 16 OECD countries for the years 1996 to 2003. Among, the countries examined the lending channel clearly plays a significant role only in Japan and Greece. In the former case this is mainly attributed to the financial distress of the 1990s, while in the latter some recent financial deregulations have not been fully absorbed by banking institutions during the sample period. A second group of countries, where only weak evidence is found for a lending channel, includes France, Italy and Spain. It would be interesting to analyze the case of these countries further by investigating whether the potency of the bank lending channel has gradually weakened in the last two decades. The apparent absence of a bank lending channel in the rest of the countries in our sample suggests that the tendency towards increased market-based finance has strengthened the degree of asset substitutability. For countries like the US and the UK, where financial systems have been predominantly market-based for a relatively long time, the tests strongly rejected the hypothesis of an operative lending channel. Finally, heterogeneity in bank characteristics was found to be useful in accounting for loan supply shifts only in the case of France, suggesting that it represents a less important element on which the search for a bank lending channel could be based.

We conclude that future research regarding loan supply identification may benefit from focusing on the structure, performance and risks facing the banking industry or individual banks. This would require a different theoretical framework with microeconomic underpinnings to account for possibly inefficient, imperfectly competitive, or incomplete banking systems.

References

Altunbas, Y., Fazylow, O., Molyneux, P. (2002). Evidence on the bank lending channel in Europe. Journal of Banking and Finance 26, 2093-2110.

Angeloni, I., Kashyap, A.K., Mojon, B. (2003). Monetary Policy Transmission in the Euro Area. Cambridge University Press, Cambridge.

Arellano, M. 2003. Panel Data Econometrics. Oxford University Press, New York.

Baltagi, B.H. (2001). Econometric Analysis of Panel Data. John Wiley & Sons, New York.

Bernanke, B.S. (1993). Credit in the macroeconomy. Federal Reserve Bank of New York Quarterly Review, Spring, 50-70.

Bernanke, B.S., Blinder, A.S. (1988). Is it money or credit or both or neither? Credit, money, and aggregate demand. American Economic Review 78, 435-459.

Bernanke, B.S., Blinder, A.S. (1992). The federal funds rate and the channels of monetary transmission. American Economic Review 82, 901-921.

Bernanke, B.S., Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. Journal of Economic Perspectives 9, 27-48.

Binder, M., Hsiao, C., Pesaran, M.H. (2003). Estimation and inference in short panel vector autoregressions with unit roots and cointegration. Cambridge Working Papers in Economics, No. 0003.

Blundell, R., Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics 87, 115-143.

Bond, S. (2002). Dynamic panel data models: A guide to micro data methods and practice. CeMMAP working paper CWP09/02.

Bondt, G. de (1999). Banks and monetary transmission in Europe: Empirical evidence. BNL Quarterly Review 52, 149-168.

Brissimis, S.N., Kamberoglou, N.C., Simigiannis, G.T. (2003). Is there a bank lending channel for monetary policy in Greece? Evidence from bank level data. In: Angeloni et al. (Eds.), Monetary Policy Transmission in the Euro Area. Cambridge University Press, Cambridge, 309-322.

Brissimis, S.N., Magginas, N.S. (2005). Changes in financial structure and asset price substitutability: A test of the bank lending channel. Economic Modelling 22, 879-904.

De Haan, L. (2003). The impact of monetary policy on bank lending in the Netherlands. In: Angeloni et al. (Eds.), Monetary Policy Transmission in the Euro Area. Cambridge University Press, Cambridge, 335-346.

Ehrmann, M., Gambacorta, L., Martinez-Pages, J., Sevestre, P., Worms, A. (2001). Financial systems and the role of banks in monetary policy transmission in the euro area. Banca d'Italia temi di discussione, No. 432.

Ehrmann, M., Gambacorta, L., Martinez-Pages, J., Sevestre, P., Worms, A. (2003). Financial systems and the role of banks in monetary policy transmission in the euro area. In: Angeloni et al. (Eds.), Monetary Policy Transmission in the Euro Area. Cambridge University Press, Cambridge, 235-269.

European Central Bank (2002). Report on Financial Structures, October.

Favero, C.A., Flabbi, L., Giavazzi, F. (1999). The transmission mechanism of monetary policy in Europe: Evidence from banks' balance sheets. CEPR Discussion Paper, No. 2303.

Gambacorta, L. (2005). Inside the bank lending channel. European Economic Review 49, 1737-1759.

Garretsen, H., Swank, J. (1998). The transmission of interest changes and the role of bank balance sheets: A VAR analysis for the Netherlands. Journal of Macroeconomics 20, 235-339.

Hernando, I., Martinez-Pages, J. (2003). Is there a bank-lending channel of monetary policy in Spain? In: Angeloni et al. (Eds.), Monetary Policy Transmission in the Euro Area. Cambridge University Press, Cambridge, 284-296.

Huang, Z. (2003). Evidence of a bank lending channel in the UK. Journal of Banking and Finance 27, 491-510.

Kakes, J. (2000). Identifying the mechanism: Is there a bank lending channel for monetary transmission in the Netherlands? Applied Economics Letters 7, 63-67

Kakes, J., Sturm, J. (2002). Monetary policy and bank lending: Evidence from German banking groups. Journal of Banking and Finance 26, 2072-2092.

Kashyap, A.K., Stein, J.C. (2000). What do a million observations on banks say about the transmission of monetary policy? American Economic Review 90, 407-428.

Kashyap, A.K., Stein, J.C. (1997). The role of banks in monetary policy: A survey with implications for the European Monetary Union. Federal Reserve Bank of Chicago Economic Perspectives, September/October, 2-18.

Kashyap, A.K., Stein, J.C., Wilcox, D.W. (1993). Monetary policy and credit conditions: Evidence from the composition of external finance. American Economic Review 83, 78-98.

Kaufman, S. (2003). The cross-sectional and the time dimension of the bank-lending channel: The Austrian case. In: Angeloni et al. (Eds.), Monetary Policy Transmission in the Euro Area. Cambridge University Press, Cambridge, 347-358.

Kishan, R.P., Opiela, T.P. (2000). Bank size, bank capital and the bank lending channel. Journal of Money, Credit, and Banking 32, 121-141.

Loupias, C., Savignac, F., Sevestre, P. (2003). Monetary policy and bank lending in France: Are there asymmetries? In: Angeloni et al. (Eds.), Monetary Policy Transmission in the Euro Area. Cambridge University Press, Cambridge, 297-308.

Maddaloni, A., Sorensen, C.K. (2005). How are euro area financial structures changing? In: Berg, J., Grande, M., Mongelli, F.P. (Eds.), Elements of the Euro Area:

Integrating Financial Markets. Ashgate, Aldershot, 85-116.

Oliner, S.D., Rudebusch, G.D. (1995). Is there a bank lending channel for monetary policy? Federal Reserve Bank of San Francisco Economic Review 2, 3-20.

Panzar, J.C., Rosse, J.N. (1987). Testing for monopoly equilibrium. Journal of Industrial Economics 35, 443-456.

Peek, J., Rosengren, E.S. (1995). Bank lending and the transmission of monetary policy. In: Peek, J., Rosengren, E.S. (Eds.), Is Bank Lending Important for the Transmission of Monetary Policy? Federal Reserve Bank of Boston Conference Series, No. 39, 47-68.

Van Ees, H., Garretsen, H., Sterken, E. (1999). Some evidence on the relevance of bank behavior for the lending channel in the Netherlands. De Economist 147, 19-37.

Windmeijer, F. (2000). A finite sample correction of the variance of linear two-step GMM estimators. Working Paper 00/19. Institute for Fiscal Studies, London.

Table 1
Descriptive statistics of the variables

Country	Number of banks [a]	Mean assets [b]	Mean loans [c]	Mean deposits [d]	Mean liquidity [e]	Mean capitalization [f]
Austria	138	2055.6	981.6	1451.4	13.9	7.8
Belgium	80	15525.3	6166.9	12917.8	18.4	8.9
Canada	69	20375.6	10874.5	16869.4	5.8	11.9
Denmark	77	428.3	283.0	176.4	24.0	14.5
France	213	4163.1	1480.7	3362.5	16.5	12.2
Germany	765	4753.0	2408.9	3307.5	28.4	6.7
Greece	27	7111.5	3070.5	6253.3	29.3	10.4
Italy	266	9413.8	5242.2	6285.7	25.0	11.6
Japan	154	485.4	314.0	408.3	13.8	5.2
Luxembourg	138	4520.6	1010.7	3680.2	44.5	6.2
Netherlands	64	26793.4	16715.3	19436.7	34.1	9.6
Spain	159	7247.1	3887.9	5841.5	11.5	12.3
Sweden	100	8388.6	5468.2	5282.5	13.3	12.1
Switzerland	413	536.6	328.7	408.5	19.1	13.8
UK	134	10124.1	3756.1	6923.3	53.3	15.6
USA	560	12946.9	7655.2	10390.7	7.2	9.1
EMU countries	2094	6310.7	3045.5	4588.9	27.0	9.3

Notes:

a. The number of banks that operated in each country during the sample period (whether in operation throughout the whole period or not).
b. The overall mean assets for each country's panel in million euros.
c. The overall mean loans for each country's panel in million euros.
d. The overall mean deposits for each country's panel in million euros.
e. The overall mean liquidity in percentages (liquid assets to total assets ratio) for each country's panel.
f. The overall mean capitalization in percentages (equity to total assets ratio) for each country's panel.

Table 2
Estimation results

Country	Obs.	R_{t-1}	L_{it}	$L_{i,t-1}$	D_{it}	$D_{i,t-1}$	$(ZD)_{it}$	$(ZD)_{i,t-1}$	Hansen [b]	AR(1) [b]	AR(2) [b]	Wald [b]
Austria	634	0.933	6.561	-6.996	-8.433	8.582			0.622	0.024	0.280	0.405
		(1.53)	(1.33)	(-1.39)	(-1.99)**	(1.97)**						
	634	0.929	6.394	-6.930	-8.719	8.940	-0.103	-0.037	0.438	0.022	0.279	0.659
		(1.52)	(1.24)	(-1.32)	(-1.90)*	(1.89)*	(-0.06)	(-0.02)				
Belgium	275	0.473	-0.276	0.046	1.094	-1.049			0.076	0.000	0.176	0.396
		(4.18)***	(-0.53)	(0.11)	(1.21)	(-1.25)						
	275	0.504	-0.033	-0.223	-0.066	0.155	1.623	-1.595	0.137	0.001	0.190	0.547
		(4.16)***	(-0.06)	(-0.40)	(-0.06)	(0.15)	(1.28)	(-1.26)				
Canada	269	0.277	0.116	0.704	0.593	-1.890			0.230	0.012	0.605	0.163
		(1.60)	(0.24)	(0.81)	(0.97)	(-1.49)						
	269	0.173	1.305	0.291	-1.091	-1.581	0.617	-3.074	0.451	0.060	0.221	0.118
		(0.79)	(1.68)	(0.31)	(-1.52)	(-1.39)	(0.57)	(-2.73)***				
Denmark	398	-0.099	3.103	-2.724	3.363	-4.425			0.899	0.071	0.073	0.130
		(-0.32)	(0.85)	(-1.07)	(1.12)	(-2.05)**						
	398	-0.271	2.008	-1.610	0.488	-1.327	2.001	2.219	0.935	0.154	0.675	0.103
		(-1.13)	(0.89)	(-0.88)	(0.21)	(-0.71)	(1.99)**	(2.06)**				
France	955	0.076	0.755	0.514	-1.277	0.571			0.112	0.127	0.981	0.154
		(0.28)	(1.28)	(0.79)	(-1.48)	(0.62)						
	955	-0.152	0.160	0.602	-1.085	1.663	-0.714	1.927	0.907	0.023	0.425	0.064
		(-0.40)	(0.22)	(0.75)	(-0.91)	(1.25)	(-0.93)	(2.38)**				
Germany	3501	0.011	4.407	-4.562	1.205	-1.812			0.467	0.283	0.994	0.684
		(0.05)	(0.80)	(-0.70)	(0.38)	(-0.33)						
	3500	-0.039	2.821	-1.987	-0.071	-4.325	-0.537	-2.590	0.439	0.123	0.571	0.779
		(-0.18)	(0.69)	(-0.53)	(-0.03)	(-1.05)	(-0.29)	(-0.93)				

Table 2 (continued)

Country	Obs.	R_{t-1}	L_{it}	$L_{i,t-1}$	D_{it}	$D_{i,t-1}$	$(ZD)_{it}$	$(ZD)_{i,t-1}$	Hansen [b]	AR(1) [b]	AR(2) [b]	Wald [b]
Greece	102	0.775	6.904	-7.883	-8.610	8.647			0.694	0.666	0.033	0.000
		(7.18)***	(2.20)**	(-3.36)***	(-2.24)**	(3.10)***						
	91	1.120	12.178	-13.582	-14.588	14.786	-0.087	0.668	0.750	0.110	0.308	0.008
		(5.43)***	(3.34)***	(-2.15)**	(-3.45)***	(1.89)*	(-0.13)	(2.96)**				
Italy	882	0.315	0.595	-0.624	-2.741	-0.482			0.082	0.161	0.076	0.078
		(2.19)**	(0.36)	(-0.43)	(-1.66)	(-0.40)						
	882	0.281	1.077	0.819	-2.459	0.136	0.710	-0.143	0.931	0.768	0.111	0.143
		(1.27)	(0.73)	(0.45)	(-1.44)	(0.05)	(1.96)**	(-0.33)				
Japan	702	-0.082	1.553	-2.188	-0.675	0.295			0.315	0.030	0.621	0.000
		(-1.44)	(8.75)***	(-5.33)***	(-3.43)***	(0.70)						
	702	-0.100	1.424	-1.957	-0.85	0.39	0.107	0.026	0.965	0.037	0.929	0.000
		(-1.63)	(3.78)***	(-4.48)***	(-2.32)**	(1.19)	(1.93)**	(0.20)				
Luxembourg	528	-0.272	0.217	-0.269	0.240	-0.313			0.696	0.624	0.329	0.532
		(-5.52)***	(1.40)	(-1.45)	(0.71)	(-0.78)						
	528	-0.317	-0.021	-0.092	1.739	0.554	0.855	0.158	0.962	0.006	0.913	0.252
		(-1.65)	(-0.05)	(-0.19)	(1.69)	(0.29)	(0.88)	(0.15)				
Netherlands	217	0.571	-0.096	0.125	0.236	-0.313			0.252	0.000	0.186	0.916
		(4.42)***	(-0.29)	(0.38)	(0.40)	(-0.56)						
	217	0.596	-0.042	0.092	1.239	-1.341	1.011	-1.177	0.829	0.000	0.166	0.875
		(4.37)***	(-0.13)	(0.28)	(1.34)	(-1.47)	(1.22)	(-1.40)				
Spain	613	-0.574	0.483	-0.740	-0.023	-0.103			0.126	0.005	0.574	0.073
		(-3.36)***	(1.31)	(-2.52)**	(-0.04)	(-0.15)						
	613	-0.656	0.454	-0.890	0.385	-0.615	0.365	-1.442	0.147	0.096	0.626	0.081
		(-2.77)***	(0.94)	(-2.19)**	(0.43)	(-0.58)	(0.43)	(-1.40)				

Table 2 (continued)

Country	Obs.	R_{t-1}	L_{it}	$L_{i,t-1}$	D_{it}	$D_{i,t-1}$	$(ZD)_{it}$	$(ZD)_{i,t-1}$	Hansen [b]	AR(1) [b]	AR(2) [b]	Wald [b]
Sweden	232	1.825	-0.255	0.152	0.130	-0.016			0.999	0.568	0.111	0.685
		(5.28)***	(-0.85)	(0.52)	(0.15)	(-0.02)						
	232	1.921	-0.218	0.110	0.350	-0.221	0.401	-0.340	1.000	0.578	0.158	0.939
		(3.99)***	(-0.69)	(0.35)	(0.48)	(-0.29)	(0.32)	(-0.28)				
Switzerland	890	-1.075	-0.716	-1.046	-0.993	1.864			0.260	0.821	0.633	0.403
		(-3.69)***	(-0.51)	(-0.70)	(-0.54)	(1.17)						
	866	-1.253	-1.887	-0.155	0.077	1.437	-0.155	0.219	0.148	0.195	0.202	0.170
		(-5.07)***	(-1.64)	(-0.16)	(0.05)	(1.08)	(-1.53)	(2.10)**				
UK	509	0.488	-0.050	-0.976	-1.327	0.423			0.393	0.092	0.342	0.742
		(1.32)	(-0.05)	(-0.82)	(-0.75)	(0.31)						
	449	0.443	1.445	-2.230	-1.016	0.080	-0.030	-0.042	0.551	0.052	0.569	0.875
		(1.36)	(0.60)	(-0.98)	(-0.44)	(0.04)	(-0.26)	(-0.33)				
USA	2040	0.700	1.264	0.600	-2.237	-4.072			0.310	0.525	0.864	0.833
		(1.03)	(0.51)	(0.80)	(-0.51)	(-0.50)						
	2034	0.211	0.772	0.778	4.135	-5.301	-0.059	0.110	0.984	0.487	0.782	0.634
		(0.66)	(0.28)	(0.37)	(1.38)	(-1.17)	(-0.77)	(1.12)				
EU	6280	0.743	2.760	-0.739	-4.619	5.107			0.193	0.180	0.250	0.138
		(1.25)	(0.95)	(-0.42)	(-1.48)	(1.55)						
	6279	0.125	2.716	-0.397	-3.146	1.354	-0.692	3.731	0.293	0.652	0.024	0.165
		(0.48)	(1.48)	(-0.30)	(-1.61)	(0.76)	(-0.69)	(1.35)				

Notes:

a. *** denotes coefficient significantly different from zero at the 1% significance level, ** denotes significance at the 5% level and * significance at the 10% level.

b. P-values.

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