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ABSTRACT

In this paper we develop a method for testing the implications of the Bernanke-Blinder model for monetary policy transmission. Multivariate cointegration techniques are used in a sample that includes six major industrial countries with data covering the last 25 years. Moreover, we examine whether changes in financial markets affected the degree of asset substitutability and thus the potency of the lending channel. We find that in the US and the UK, representing the "Anglo-Saxon type" of financial market structure, the lending channel is inoperative, while in Japan it is still important for monetary transmission. The other three European countries examined – Germany, France, Italy – are in between, with the lending channel losing its potency in the last decade.

Keywords: Monetary transmission mechanism; bank lending channel; financial structure; multivariate cointegration
JEL classification: C32; C52; E44; E52

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1. Introduction

The traditional view of monetary transmission relies on the effects monetary impulses may have on equilibrium in financial asset markets and, through these effects, on the real economy. Thus in the "money" view, exemplified by the simple IS-LM model, there are only two financial assets, money and bonds. When the monetary authorities engineer a change in the supply of money, equilibrium is restored by changes in the interest rate for bonds that will ultimately have an effect on real variables. An appeal to Walras' Law allows us to ignore the bond market. In this framework, monetary policy operates through the liabilities side of bank balance sheets, while the presence of bank loans is in no way necessary for the monetary transmission mechanism (Miron *et al*., 1993) as loans are perfect substitutes for bonds on the asset side of bank balance sheets. Thus, a loan supply function cannot be defined.

An alternative view of monetary transmission, usually called the "credit" view or "lending" view of monetary policy, builds on the assumption of incomplete markets characterized by imperfect information, which may cause imperfect substitution between loans and bonds both in bank portfolios and as means of borrowing for firms. Banks would then play a special role because they offer a third distinct asset in addition to money and bonds, namely credit. The credit channel that has been more frequently analyzed in the recent literature is referred to as the bank lending channel[1]. As noted by Bernanke (1993), the basic assumption needed for bank credit to have an independent effect in monetary transmission is that loans and bond issues are not perfect substitutes for firms and that banks do not consider loans as perfect substitutes for securities due to financial market imperfections.

Moving away from conventional models of the transmission process which analyze the interest rate channel, and focusing on channels based on financial market imperfections, may be necessary to explain the apparent strength of monetary policy effects on the economy. Bernanke and Blinder (1988) propose a stylized model for analyzing the bank lending channel that departs from the IS-LM framework by taking into account the loan market. A key result of their model is that the existence of imperfect substitutability between bank loans and bonds provides a separate channel of monetary transmission, enhancing the effect of monetary policy on aggregate demand.

[1] Another part of the credit channel, also based on financial market imperfections, is the balance-sheet or net-worth channel (Brunner and Meltzer, 1998; Bernanke and Gertler, 1989). The central idea here is that reductions in borrowers' net worth associated with a rise in interest rates increase agency and information costs for lenders.

The implications of the Bernanke-Blinder model are not easy to test empirically and thus obtaining a "sharp measurement of the channel's potency is a challenging task" (Bernanke and Gertler, 1995, p.42). A number of studies over the last decade have indirectly tested for the existence of the bank lending channel by examining timing relationships between quantity or price variables and measures of the monetary policy stance. A common limitation of these studies is that they analyze short-run responses that may admit alternative interpretations not necessarily restricted to loan supply shifts which play a central role in the propagation of monetary impulses in the lending channel. In this paper we propose a new method for analyzing empirically the bank lending channel. In particular, we identify the equilibrium relationships included in the Bernanke-Blinder model from a Vector Error Correction Model (VECM) and test appropriate restrictions that pertain to the existence of perfect asset substitutability. The implications of the model are tested for six major industrial countries (USA, Germany, Japan, France, UK and Italy) by using multivariate cointegration techniques.

A further contribution of this paper is that it offers an assessment of whether the changes in financial markets observed over the last two decades have weakened the lending channel's effectiveness by reducing asymmetric information problems. As Bernanke (1995, p.130) notes, "the making of monetary policy in an environment of ongoing institutional change and financial innovation requires a sophisticated appreciation of how these changes affected the potency of monetary policy". The structural change findings of this study indeed help us attain that appreciation.

Our empirical results indicate that, consistent with existing theoretical priors, in the market-based financial systems of the US and the UK there is no evidence of lending channel effectiveness in a sample that begins in the mid-1970s and runs through to the late 1990s. By contrast, we find that in Japan the lending channel does matter for monetary transmission over the entire sample period, although financial developments in Japan during the 1990s may have worsened information asymmetries, holding in check the tendency towards market-based financing. The remaining three euro area countries (Germany, France and Italy) are somewhere in between. The results for these countries are indicative of a regime shift with respect to the degree of asset price substitutability implying that in the 1990s bank lending no longer plays a role in the transmission of monetary policy impulses.

The rest of the paper is structured as follows. Section 2 provides an overview of the bank lending channel by outlining the implications of the Bernanke-Blinder model and reviewing briefly empirical work on the lending channel. Section 3 analyses and reformulates the Bernanke-Blinder model, making it suitable for empirical testing. Section 4 discusses several stylized facts on evolving financial structures over the past two decades relating them to monetary policy transmission. Section 5 contains the empirical evidence on the operation of the lending channel and on regime shifts regarding the degree of asset substitutability. Finally, Section 6 summarizes and concludes.

2. Overview of the bank lending channel

As already mentioned, the bank lending channel is a separate channel which is supposed to operate in addition to the conventional interest rate channel for monetary policy transmission. Its existence is based on credit market imperfections caused *inter alia* by asymmetric information. If some borrowers are bank dependent, i.e. they can not easily switch to alternative forms of external financing, and banks consider their loans as imperfect substitutes for securities in their portfolios, monetary policy can influence aggregate demand not only through interest rates as in the traditional interest rate channel, but also through its impact on the supply of bank loans. When monetary policy tightens, bank deposits fall and the loan supply schedule shifts up and to the left which complements the interest rate-induced effect on aggregate demand[2]. This effect on loan supply should clearly be distinguished from loan demand contraction and the inward shift in the loan demand schedule that higher interest rates and the resulting fall in output would bring about.

The Bernanke-Blinder model is a convenient framework for analyzing the bank lending channel. In this model, equilibrium conditions for the output and loan markets are combined to produce the so called CC curve, while the LM curve remains as in the standard IS-LM model. Loans and bonds are assumed to be imperfect substitutes both for banks and borrowers. This implies that, along with the bond rate, the bank lending rate is also a determinant of loan demand and supply and output demand. A key result of the Bernanke-Blinder model is that the bank lending channel does not work when: (a) the elasticity of loan

[2] This result does not depend on the use of reserve requirements as an instrument of monetary control; monetary policy could have tightened through an open market operation reducing the reserve base, with increased leverage in the presence of a bank lending channel.

supply with respect to the loan rate is infinite, i.e. banks consider loans and bonds as perfect substitutes in their balance sheets *or* (b) loan demand is perfectly elastic with respect to the loan rate and output demand is not responsive to changes in the loan rate, both conditions implying that Modigliani and Miller's "financial irrelevance" proposition applies to borrowers. Note that when the above conditions hold, the demand for (supply of) loans cannot be defined separately from the demand for (supply of) bonds.

A number of primarily US-oriented studies over the last decade have tested for the existence of the lending channel by examining timing relationships either between quantity variables (output, loans, money and other bank or firm balance sheet items) or price variables (interest rates or interest rate differentials) and monetary policy variables. Following the first alternative, Bernanke and Blinder (1992) apply VAR analysis to US data to examine the impulse response functions of bank loans, securities, deposits and unemployment to a positive innovation in the Federal funds rate. Their results showed: (i) an immediate decline in the volume of securities and deposits and a delayed decline in the volume of bank loans and (ii) over a somewhat longer time period, a rebuilding of bank securities holdings and a further decline in loans, essentially matching the decline in deposits. Their results were felt to be consistent with a bank lending channel, but also with an interest rate channel, since loans responded with the same lag as unemployment to the policy shock.

In an attempt to separate the effect of loan demand from loan supply, Kashyap, Stein and Wilcox (KSW, 1993) examine movements in the mix between bank loans and commercial paper, a close substitute for bank finance to firms, following monetary policy changes. They expect that, if there is a bank lending channel, a tightening of monetary policy would cause the supply of bank loans to fall by more than the supply of commercial paper, whereas the composition of external finance would not be affected if monetary policy operated only through the interest rate channel. KSW report evidence that tight monetary policy leads to an increase in commercial paper issuance while bank loans slowly decline. Oliner and Rudebusch (1995, 1996) question the usefulness of changes in the aggregate financing mix as an indicator of the operation of a bank lending channel. They instead propose an alternative explanation: the tightening of policy reduces the demand for all types of external finance but it is also redirects all types of credit from small to large firms, which rely more heavily on commercial paper financing. In this case, commercial paper issuance may rise relative to bank loans even when the supply of bank loans remains unchanged,

implying that heterogeneity in loan demand rather than shifts in loan supply would explain a change in the mix between bank and non-bank financing. In response to this criticism, Kashyap, Stein and Wilcox (1996) report that even among large firms there appears to be a substitution away from bank loans to commercial paper after a monetary contraction. Their statistical results, however, are not very robust; when the Federal funds rate replaces the variable constructed on the basis of the dates of monetary contraction selected by Romer and Romer (1994) as the monetary policy variable, they do not support the existence of the bank lending channel. This is also the case with Oliner and Rudebusch's (1995) paper.

A common shortcoming of all studies estimating timing relationships in order to identify a bank lending channel is that they focus on short-run responses, which may not be very informative in view of the fact that banks are prevented from adjusting the stock of their loans quickly after a monetary policy change, due to loan commitments and other contractual agreements (Bernanke and Blinder, 1992) and that observed responses may admit alternative interpretations not necessarily restricted to loan supply shifts[3].

The difficulties in distinguishing shifts in loan demand from shifts in loan supply have prompted researchers to focus on cross-section data to explore some of the distributional consequences of the lending view, namely that the responses of banks to changes in monetary policy may differ depending on their characteristics – see, among others, Kashyap and Stein (1995, 2000) and Kishan and Opiela (2000). All these studies try to capture asymmetries in loan supply behavior by examining reduced form equations on the basis of bank level data. 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 - can be identified[4]. However, since, due to data limitations, the observed asymmetries cannot be directly linked to the output responses of firms that borrow from a particular size category of banks, their

[3] An exception to the above type of analysis has been Kakes` (2000) work who addresses the specification issue by estimating a vector error correction model (VECM) for the Netherlands and identifying credit demand and credit supply functions as cointegrating equations from it. His results however, implying that a bank lending channel is not an important element of the transmission mechanism in the Netherlands, are not linked to the predictions of the Bernanke-Blinder model, since the successful estimation and identification of a loan demand and a loan supply relationship in this model, is in itself an indication of the operation of the bank lending channel.

[4] The study of Brissimis *et al.* (2001) proposes estimating a loan supply function directly from bank level data and combines some of the features of the Bernanke-Blinder model with a specification appropriate for assessing the impact of differential balance sheet characteristics on banks' ability to supply loans. Ehrmann *et al*. (2001), on the other hand, attempt to relate a reduced form incorporating bank heterogeneity to a structure analogous to the Bernanke – Blinder model.

implications for aggregate economic activity and the transmission mechanism are not clearly visible (Kashyap and Stein, 2000).

3. The model

Our model is a version of the Bernanke-Blinder model, assumed to be linear for analytical convenience. The loan market is described by the following equations

$$L^d = a_0 - a_1(\rho - i) + a_2 y \qquad a_1, a_2 > 0 \qquad (1)$$

$$L^s = b_0 + b_1(\rho - i) + b_2 D \qquad b_1, b_2 > 0 \qquad (2)$$

$$L^d = L^s = L \qquad (3)$$

where L, D and y are real loans, deposits and output, ρ-i is the spread between the bank lending rate (ρ) and the bond rate (i) and superscripts d and s refer to loan demand and supply respectively. Equation (1) is a loan demand function, in which the quantity of loans demanded is negatively related to the interest rate spread ρ-i and positively to the scale variable y. The assumption underlying the inclusion of the spread is that financing decisions of borrowers are characterized by rate of return homogeneity, which implies that when financing costs rise by the same amount for all forms of borrowing, firms do not alter the structure of their liabilities. Since bank loans and bonds are assumed to be imperfect substitutes, a higher spread results in a finite decline in loan demand. Similarly, loan supply is specified as a positive function of both the interest rate spread and deposits[5]. The existence of the spread in (2) is based on the same principle as in loan demand, namely that bank portfolio decisions
are subject to rate of return homogeneity and thus banks` willingness to supply loans depends on the relative return on loans. Deposits are the scale variable in (2), as we have assumed for simplicity that there are no reserve requirements, an assumption that, as explained above, is not crucial to developing our test. Finally, equation (3) is the clearing condition for the loan market.

The money market is described by a conventional LM curve

$$D = c_0 - c_1 i + c_2 y \qquad c_1, c_2 > 0 \qquad (4)$$

[5] A loan supply function of this kind can be derived from the solution of the profit maximization problem for a representative bank, assuming that its cost function is convex, i.e. costs rise as lending increases (see Keeton, 1992). The latter reflects the fact that the bank progressively lends to borrowers with increasingly severe information problems.

The demand for deposits (money) is a function of the opportunity cost of holding deposits, i.e. the bond rate, and income. Total wealth is assumed to be constant and is not included among the determinants. Also, the rate of return on deposits is assumed to be exogenously fixed and is normalized to zero.

The last building block of the model is the output market. Output is assumed to be demand determined and aggregate demand to be related negatively both to the interest rate and the spread:

$$y = d_0 - d_1 i - d_2(\rho - i) \qquad d_1 > d_2 > 0 \qquad (5)$$

The traditional IS curve is nested in equation (5) and the two coincide when there is perfect substitutability between loans and bonds for borrowers, as suggested by the financial irrelevance proposition of Modigliani and Miller (1958).

The system of equations (1) to (5) can be reduced, as in Bernanke and Blinder, to a set of two equations, one describing equilibrium in the money market (LM curve) and one representing the equilibrium condition for the goods and loan markets jointly (CC curve). Solving equations (1) to (3) for the spread ρ-i and substituting into the output equation, we derive the CC curve as

$$i = e_0 - e_1 y + e_2 D \qquad \text{CC curve} \qquad (6)$$

where $e_0 = d_0/d_1 - d_2(a_0 - b_0)/d_1(a_1 + b_1)$

$e_1 = 1/d_1 + d_2 a_2/d_1(a_1 + b_1)$

and $e_2 = d_2 b_2/d_1(a_1 + b_1)$

The LM curve is simply the demand for deposits equation, assuming that the supply of deposits is determined exogenously by the monetary authorities.

$$i = c_0/c_1 + (c_2/c_1)y - (1/c_1)D \qquad \text{LM curve} \qquad (7)$$

Two conditions must be satisfied for a bank-lending channel to exist:

(a) Borrowers are not able to fully insulate their real spending from a decline in the availability of bank loans, i.e. loans are imperfect substitutes for other sources of finance *and*,

(b) banks are not able to fully insulate their loan supply from a monetary policy-induced change in their reserves, i.e. there are no perfect substitutes for loans in bank portfolios. In the context of equation (6) imperfect substitutability means that the derivatives of loan demand and loan supply with respect to the spread (coefficients a_1 and b_1 respectively) are finite and moreover that output demand responds to the spread as well as to the interest rate

(d_2>0). A monetary policy change shifts the CC curve downwards, while also affecting the LM curve. As a result, the effect on output is magnified compared to the case where only the interest rate channel exists.

When loan demand or supply are perfectly elastic with respect to the spread (a_1=b_1→∞) and/or the spread does not affect the demand for output (d_2=0), loans and bonds are perfect substitutes and neither the loan demand nor the loan supply functions can be defined separately, so that there is no distinct bank lending channel. It should be noted here that the existence of perfect substitutability between loans and bonds for *either* borrowers *or* banks is sufficient to ensure the irrelevance of the lending channel for monetary transmission.

As can been seen from equation (6), monetary policy actions, assuming that there is imperfect substitutability, shift the CC curve through movements in deposits, the size of this shift, and thus the effect on output, depending on the parameter b_2, namely the elasticity of loan supply with respect to deposits. The importance of this parameter for determining how large the effect of monetary policy on output will be would seem to warrant the efforts to identify loan supply shifts as a critical factor in the operation of the credit channel. Moreover all three parameters on the spread (a_1, b_1, d_2) are the key parameters for assessing the existence of a bank lending channel; if any one of them assumes the extreme values indicated above (a_1=b_1→∞ and d_2=0), bank loans and bonds are perfect substitutes from the point of view of banks and/or borrowers and the lending channel loses its potency.

The two equilibrium conditions as represented by the CC and LM curves are not suitable for empirically testing the existence of a bank lending channel, since it is not possible to identify from the CC curve, loan supply shifts which are mixed with other factors affecting the joint equilibrium of the loan and output markets – loan and output demand shifts. To cope with this difficulty, we rearrange equations (1) to (5) of our model, so that it becomes appropriate for empirical testing. Combining the loan demand equation with the equilibrium conditions in the money and output markets we arrive at the following quasi-reduced form.

$$y = g_0 + g_1 D + g_2 L \qquad g_1, g_2 > 0 \qquad (8)$$

where $g_0 = \left(d_0 - d_1 c_0 / c_1 - d_2 a_0 / a_1\right) / \left(1 + d_1 c_2 / c_1 + d_2 / a_1\right)$

$g_1 = \left(d_1 / c_1\right) / \left(1 + d_1 c_2 / c_1 + d_2 / a_1\right)$

and $g_2 = \left(d_2 / a_1\right) / \left(1 + d_1 c_2 / c_1 + d_2 / a_1\right)$

In (8) output is a positive function of the volume of both deposits and loans. When there is perfect substitutability of loans and bonds for borrowers (d_2=0, $a_1 \rightarrow \infty$), the loan variable drops from the equation which is thus reduced to a relationship between output and real deposits.

The model is closed with the loan supply function normalized on the interest rate spread:

$$\rho - i = -b_0/b_1 + (1/b_1)L - (b_2/b_1)D \qquad (9)$$

This specification allows us to identify the structural parameters of the loan supply function that would enable an assessment of the importance of the lending channel. When banks view loans and bonds as perfect substitutes in their portfolios ($b_1 \rightarrow \infty$), the loan and bond rates are equalized and the supply of loans function is not defined.

The system of equations (8) and (9) forms the theoretical basis for a direct test of the bank-lending channel. Indeed, under imperfect substitutability, we expect to be able to identify the loan supply function (i.e. a structural relationship) which, together with the reduced form (8) that incorporates the demand side of all markets[6]- loan, deposit and output markets - provides a simplified framework for the analysis of monetary policy transmission. In Section 5, we empirically test the implications of the model described above for six major industrial countries (USA, Germany, Japan, France, UK, Italy), using multivariate cointegration techniques.

4. Changing financial structures: some stylized facts

Having presented the theoretical model on the bank lending channel, in this section we discuss developments in financial markets over the past two decades with a view to facilitating the assessment of the empirical tests of this channel which are presented in the next section. During this period, financial markets have witnessed profound changes in their structure. These changes, driven by advances in information technology, have led *inter alia* to a reduction in transaction costs and information asymmetries (Mishkin and Strahan, 1999) and have altered the way in which monetary policy is transmitted to the real economy. The net impact of developments in financial markets on the effectiveness of monetary policy is, however, uncertain (Mylonas *et al.*, 2000): monetary policy may have become more powerful

[6] It is reminded that the supply of deposits in our model is exogenous and output is demand-determined.

through its effects on financial asset prices (wealth effects) which reinforce the traditional direct impact of interest rates on demand, but the transmission of monetary policy through bank balance sheets and/or the supply of credit may have weakened as these developments have accelerated the pace of financial sector consolidation and provided alternative non-bank sources of finance to firms and households.

Financial markets have grown over the last couple of decades and have undergone substantial changes in the scope of their activities, even though the pace at which these changes occurred in national financial systems was not identical for all major industrial countries. Table 1, adopted from Mylonas *et al.* (2000), shows that, as a ratio to GDP, the total value of outstanding bank credit to the (non-bank) private sector, privately-issued bonds and stock market capitalization rose for the countries in our sample by about 80 percentage points between 1985 and 1998, reaching 220 percent of GDP at the end of this period. The growth of financial markets implied an expansion in the role of market-based financing as evidenced by the shift in borrowing from bank loans to securities.

Although bank loans play a relatively small role in the financing of (non-financial) firms in the US (and to a lesser extent in the UK), they have traditionally been the dominant source of debt financing in almost all European countries and Japan[7]. The high degree of dependence on bank lending in the countries of Continental Europe has begun to be eroded during the past decade. Indeed, private bond markets in these countries grew considerably during the 1990s, although their size remains significantly smaller (as a percentage of GDP) compared to the US[8], more so if one considers that the major part of European bond market activity is accounted for by financial institutions[9]. The growth of European corporate bond markets accelerated significantly after the advent of EMU and this pace is expected to be sustained in view of the increasing integration of financial markets and the reduced crowding out of private bond issuance by government bonds (de Bandt and Davis, 1999). In Japan, even though large firms have increasingly substituted bond issuance for bank finance in the last 15

[7] Danthine *et al.* (2000) report that in 1993 the share of bank debt of all non-financial firms to total debt in Germany, France and Italy ranged between 80 and 95 percent, while it was 32 and 49 percent in the US and the UK respectively.

[8] A particular development in the US was the growth of high-yield bond markets, which allowed more firms to access credit markets sidestepping bank intermediation. This financial innovation was slow to spread in Europe.

[9] According to the data presented by Danthine *et al.* (2000), the euro area's private bond market was around 42 percent the size of the respective US market just before the introduction of the euro and this proportion falls to less than one third in the case of the non-financial corporate bond market.

years, banks remain the dominant source of corporate finance[10]. Similar trends to those observed in the bond market characterize the market for short-term corporate debt[11].

Finally, Table 1 shows a spectacular increase in stock market capitalization during the last fifteen years. Although part of the increase represents valuation effects, there is also a marked rise in the number of listed companies. In the case of Continental European and Japanese equity markets the rise exceeded 50 percent during the 1990-2000 period (Galati and Tsatsaronis, 2001). The rapid growth of equity markets allowed an increasing number of small and medium-sized companies to access equity finance.

The move towards market-based financing was facilitated by changes in corporate governance. A more active market for corporate control increased the attractiveness of equity capital for investors (Jensen, 1988). This effect was more important in Europe, which, in the past, lagged behind the US in developing an active mergers and acquisitions market. At the same time, bond financing came to be seen as a management-constraining device as it reduced the free cash flow available to management (Jensen,1986). This was especially important in the US market, where the issuance of bonds was seen as a positive sign given by management regarding future cash flows that they would be used to repay interest on bonds and not invested in value-reducing projects.

The trend towards market-based financing was reinforced by the growing process of securitization. By transforming non-marketable assets (such as loans) appearing in their balance sheets into marketable securities, banks and other financial institutions enhanced their ability to improve the quality and liquidity of their assets by flexibly managing their risks, and to undertake other risks. At the same time, market financing has become a feasible option for smaller businesses, given that technologies have made loans more standardized, lowering the transaction costs of their securitization, and more transparent, as a result of the decline in the costs of asymmetric information in financial markets (Mishkin and Strahan, 1999).

Securitization took hold initially in the US home mortgage markets in the 1970s. The pace of securitization continued with new entrants to the securitization market and a greater variety of assets in other credit markets being securitized. The growth of securitization was particularly vigorous in the US in the second half of the 1990s and seems to have gained

[10] Levy (1999) notes that the share of market instruments (bonds and commercial paper) in the liabilities of firms is higher than 40 percent in the six largest economic groups in Japan.
[11] In the US the commercial paper market grew steadily over the past 20 years accounting for about 5 percent of total non-financial corporate borrowing at the end of the 1990s.

importance in European countries and Japan. As argued by Estrella (2001), if securitization has transformed credit markets over the last decades, it may have had important effects on the monetary transmission mechanism, and in particular the bank lending channel, by weakening the impact of monetary policy moves.

The above financial market developments appear to have changed the role of banks as the most important player in the financial system. Faced with the new financial market conditions which involve intensified competition, easier access by borrowers to market forms of finance and higher substitutability among financial assets, banks had to adjust their strategy and business mix, to preserve their position in the system. Thus banks engaged in a wide range of new financial activities and this in turn contributed to the further development of market-based financial instruments and sectors of the capital market, and thus to the greater fungibility of bank loans. Securitization, which we mentioned above, is just one example of this re-oriented strategy.

Banks have also increased impressively the extent to which they do business off the balance sheet. Boyd and Gertler (1994) argue that, if account is taken of the relative movement of bank accounts from on to off the balance sheet, the widely acknowledged decline in the share of bank intermediation by traditional figures is turned to a moderate increase. A (non-exhaustive) list of off-balance sheet activities includes asset management, underwriting and other forms of investment banking, provision of back-up lines of credit or guaranties for commercial paper issuance, and provision of derivative instruments.

The greater use of derivatives by banks and other financial institutions has also raised asset price substitutability across financial markets. The existence of these new financial instruments increases the supply and dissemination of information about the quality of the issuer of the underlying assets and lowers the cost of incorporating new information into prices (BIS, 1994). By permitting lenders and investors to unbundle and hedge the various risk components of their assets and by allowing firms to manage the business risk arising from their operations, derivatives can contribute to a widened firms` access to alternative funding sources, thus weakening the bank lending channel[12].

[12] On the other hand, by raising financial asset substitutability across financial markets, derivatives markets may strengthen the interest rate channel of monetary transmission, as a change in the policy controllable interest rate is transmitted more rapidly through the prices of a wide range of financial assets of different maturities.

Derivatives markets emerged in the seventies in the US and began to grow in the eighties, especially the OTC markets (Mishkin and Strahan, *op. cit.*). These markets became very large during the last decade, with notional amounts for all OTC derivatives contracts reaching $95.2 trillion in December 2000 as against $3.5 trillion (interest rate and currency swaps only) in December 1990.

In the field of the deregulation of financial markets, significant advances have taken place that have increased the degree of integration of these markets, by improving investors` scope for international portfolio diversification and, at the same time, providing borrowers with alternative sources of finance. Thus, the ratio of gross foreign portfolio liabilities (equity and debt) to GDP has risen in all major countries. In the United States and Germany in particular, this ratio has risen by 30 percentage points of GDP between 1985 and 1998 (Mylonas *et al*., 2000). In European Union countries some of the progress in deregulating financial markets can be attributed to the adoption of the Second Banking and the Financial Services Directives in the early 1990s, aimed at opening up and homogenizing the fragmented national financial markets. These developments have enhanced cross-border competition between financial institutions and promoted the internationalization of their activities, thereby increasing the degree of asset substitutability.

It should be noted that the factors discussed above which accounted for the rapid pace of financial developments in the last two decades are not sufficient to ensure in every case a continuous decline in transaction costs and informational asymmetries. During periods of economic stress - such periods were in general absent during the ’90s, with the possible exception of Japan- the influence of some of these factors may exacerbate short-run asset price volatility. This could lead to financial distress and increase the complexity of the monetary policy framework and the severity of the restrictions monetary authorities have to cope with in their attempt to stabilize the economy, but it would also enhance the leverage of monetary policy on the economy.

5. Empirical evidence

To test the empirical relevance of the theoretical relationships underlying the Bernanke-Blinder model and their possible changes in an evolving financial environment, we use multivariate cointegration analysis along the lines of Johansen and Juselius (1990), Johansen (1991) and Phillips (1991). In this context, testing for the existence of a bank

lending channel can be shown to imply testing for restrictions on estimated cointegrating vectors. If a lending channel exists, we can identify the two theoretical relationships (8) and (9) derived in Section 3, which are repeated here for convenience:

$$y = g_0 + g_1 D + g_2 L \qquad g_1, g_2 > 0 \qquad (8)$$

and $$\rho - i = h_0 + h_1 D + h_2 L \qquad h_1 < 0, h_2 > 0 \qquad (9)$$

where (8) represents the combined demand side of the loan, deposit and output markets under the assumption that deposits and output are demand determined, and (9) is a structural loan supply equation.

In the absence of informational asymmetries, loans and bonds are perfect substitutes in bank portfolios and ρ=i. In this case, the identification of a distinct loan supply function is not possible as loan supply is perfectly elastic with respect to the interest rate spread i.e. ($b_1 \to \infty$). Similarly, with no informational asymmetries, bonds are perfect substitutes for bank loans from the borrowers point of view (loan demand is perfectly elastic with respect to the spread and output demand is not responsive to changes in the spread, i.e. $\alpha_1 \to \infty$, and $d_2=0$). Hence equation (9) is reduces to:

$$y = g_0' + g_1' D \qquad (10)$$

where $g_0' = (d_0 - d_1 c_0 / c_1) / (1 + d_1 c_2 / c_1)$

and $g_1' = (d_1 / c_1) / (1 + d_1 c_2 / c_1)$

We once again emphasize that for the bank lending channel to be ineffective, it is sufficient that loans and bonds are perfect substitutes for *either* borrowers *or* banks and not necessarily for both.

The economies studied in this paper have experienced profound changes in their financial markets in the last decades which, as we have seen in Section 3, are likely to have reduced information asymmetries, increasing asset price substitutability. We examine how these developments manifest themselves as changes in the underlying equilibrium relationships (eqs 8 and 9) which can take the form of changes in the number of equilibria and/or in the parameters of the cointegrating vectors.

To investigate the presence of cointegrating relationships among the variables of the Bernanke-Blinder model we use the cointegrating VAR framework of Johansen (1988) and estimate unrestricted VAR models over the entire sample period as well as over two subperiods in the case of those countries for which recursive techniques indicated structural

instability. The starting point of our empirical analysis is an augmented VAR of the following form:

$$z_t = \sum_{j=1}^{p} D_j z_{t-j} + \Phi x_t + \varepsilon_t \qquad \text{with} \quad \varepsilon_t \sim Niid(0,\Sigma) \qquad (11)$$

where z_t is a n×1 vector of jointly determined dependent variables, x_t is a q×1 vector of deterministic and/or exogenous variables, D_j and Φ are the n×n and n×q coefficient matrices respectively and ε_t is a vector of n unobserved errors, which have zero mean and constant covariance matrix Σ. The VAR in (11) can be re-parameterized as a VECM (Hendry,1995):

$$\Delta z_t = \sum_{j=1}^{p-1} \Gamma_j \Delta z_{t-j} + \Pi z_{t-j} + \Phi x_t + \varepsilon_t \qquad (12)$$

where Δ is the first-difference operator, Γ_j is the matrix of short-run adjustment parameters and Π is the matrix of equilibrium parameters. If Π has reduced rank r<n and the variables being modeled are I(1), there must be r cointegrating relationships among the variables under consideration that are stationary. In that case Π can be factorized as $\Pi=\alpha\beta'$, where α is the matrix of equilibrium adjustment parameters and β is the matrix of r cointegrating vectors.

The Johansen procedure produces unique estimates of α and β satisfying $\Pi=\alpha\beta'$ by imposing an orthogonality condition on β. This estimate of β does not have a direct economic interpretation, unless theory-based restrictions are imposed and tested. Economic theory is in general very informative about the nature of the equilibrium relationships (embodied in β) whereas it is usually much less precise concerning the time profile of responses to shocks and the speed of adjustment towards equilibrium (embodied in α).

Identification of the equilibrium structure can be attempted without imposing restrictions on the model's dynamic structure (restrictions on α and/or Γ_j). In this respect, Pesaran and Shin (2001) developed a formal theory of the identification of the equilibrium structure in isolation from the dynamic adjustment path implied by the model. The exact identification of the equilibrium parameters requires (as a necessary and sufficient condition) the imposition of r^2 restrictions (including r normalization restrictions). Further economically meaningful hypotheses can be tested in the form of overidentifying restrictions[13].

The economic framework discussed above will be used to investigate the existence of a bank lending channel in six of the major industrial counties-USA, Germany, Japan, France,

UK and Italy- over the period 1977-1999. For the three European countries that have been members of the European Monetary Union since its inception (1 January 1999), the sample period ends in 1998 Q4. Quarterly observations are used for the following variables: real gross domestic product (Y) ; real bank loans to the private sector (L) derived by deflating nominal values with the consumer price index; real deposits (D) calculated as the difference between the M3 monetary aggregate and currency in circulation deflated by the CPI; and the interest rate differential (ρ-i) between the bank lending rate and the government bond rate. The definitions and sources of the variables are given in the Appendix. All data are in logs except for the interest rates, and seasonally adjusted.

Before proceeding to cointegration analysis, we estimate unrestricted VARs for all the countries for the full sample. The order of the VAR is set on the basis of lag selection criteria (Akaike Information Criterion and Schwartz Bayesian Criterion) with a view to ensuring statistical adequacy of the model[14]. Standard unit root tests (ADF and Phillips-Perron tests) are performed to investigate the existence of unit roots in the variables in levels as well as in their first differences. All variables are found to be I(1).

In the next step, we test for the number of cointegrating relationships in the system using the Johansen procedure. This procedure provides two separate test statistics for the determination of the number of cointegrating vectors: the trace statistic and the maximum eigenvalue statistic. The two tests indicate the existence of either one or two vectors in all cases[15]. Recursive estimation of the trace statistic showed that in several cases there were changes in the number of estimated vectors. This instability is also reflected in the tests for structural stability of the cointegrating vectors estimated after imposing just-identifying restrictions. The recursively estimated tests for the stability of the parameters of the cointegrating vectors as well as the recursive one-step and break-point Chow tests for each equation and the system as a whole presented in Figure 1 indicated the possibility of a structural break in all but two countries (Japan and UK). We chose to localize the break point on the basis of the Chow test so that parameter estimates within each of the two subperiods

[13] The standard likelihood ratio test of the overidentifying restrictions follows asymptotically a χ^2(k-r) distribution, where k is the number of restrictions.

[14] In terms of departures from the Gaussian framework regarding serial correlation of the residuals, lack of normality, heteroscedasticity and ARCH errors.

[15] In general both tests for the determination of the cointegration rank gave identical results at the 95 per cent level of significance. In the few instances of diverging results, we set the number of vectors on the basis of the

are relatively constant. It must be noted that localizing a point in time which indicates a structural break oversimplifies a significantly more complex process of structural economic change that takes place gradually.

The observed temporal instability can be seen as an indication of a change in the underlying economic structure. In three out of the four countries for which instability was found (Germany, France, Italy) this change indicates a transition to a new regime of increased asset substitutability and a loss of the bank lending channel's potency. Only in the case of the United States was instability not related to a switch in the monetary transmission process away from the bank lending channel, since there was no evidence of the existence of this channel in the first place in either of the two subperiods. Misspecification and unit root tests as well as tests for determining the cointegration rank and evaluating the stability of the cointegrating relationships (see Table 2 and Figure 2) were carried out for each subsample as a basis for selecting the appropriate specification in each subperiod. Moreover, the recursive stability tests presented in Figure 3 indicate relative parameter constancy in the two subperiods.

Having determined the number of cointegrating relationships in each subperiod, it is important to consider what these relationships can tell us about the operation of the bank lending channel as outlined in Section 3 above. Therefore, it is necessary to impose and test overidentifying restrictions in order to assess the predictions of the Bernanke–Blinder model under an imperfect/perfect asset substitutability regime. The economic assumptions underlying the relations in equations (8) and (9) can provide the necessary restrictions in order to identify unique cointegrating vectors. These overidentifying restrictions (on each of the cointegrating relationships) are tested against the exactly identified model using the likelihood ratio test of Johansen and Juselius (1994). As already indicated, equation (8) follows from the equilibrium conditions in the money and output markets and the loan demand relationship and should be one of the cointegrating vectors of the model in the presence of a bank lending channel. Under imperfect asset substitutability, the model should give rise to a second cointegrating vector representing a loan supply function (equation 5). The inability to find a significant coefficient on the loan variable in the first cointegrating vector and/or to identify

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trace statistic which according to findings of the empirical literature is more robust in the presence of either skewness or excess kurtosis.

the second cointegrating vector as a loan supply equation would imply that the lending channel does not exist.

Table 2 reports the maximum likelihood estimates for the equilibrium overidentified model for each of the six countries under consideration. For the United States we find one cointegrating vector corresponding to equation (10) in each of the two subperiods (1977.Q1-1988.Q4 and 1989.Q1-1999.Q4) selected on the basis of the break-point Chow test for the entire system. In this vector the zero restriction on the coefficient of the loan variable cannot be rejected in either subperiod indicating that there is perfect asset substitutability for borrowers and banks and thus the lending channel should not be considered as part of the US monetary transmission process. The instability of the cointegrating vector is reflected in the decline of the coefficient on money which can be the result of a rise in one (or more) of the following parameters: the income elasticity of money demand (c_2), the bond rate elasticity of the demand for deposits (c_1), or the bond rate elasticity of the demand for output (d_1). The empirical literature confirms that the interest rate elasticity of money demand has increased over time reflecting financial innovation and the proliferation of money substitutes (Carlson *et al.,* 2000). An increase in the income elasticity of money demand is also apparent due to a rising financial wealth to income ratio (Maki and Palumbo, 2001) and the fact that money holdings reflect portfolio decisions in addition to transaction motives. Finally, the interest rate elasticity of output demand, and hence the effectiveness of the interest rate channel of monetary transmission, seems to have increased as developments in financial markets gave monetary authorities an enhanced leverage over a wider range of financial asset prices (Mylonas *et al*., 2000) and through these on aggregate economic activity.

For Germany, it appears that the bank lending channel played an important role in monetary policy transmission through the mid-1980s, as we are able to identify two cointegrating vectors that correspond to the reduced form (8) and the loan supply function (9) (see Table 1). All the parameters of these two vectors are significant and correctly signed. A zero restriction on the coefficient of the loan variable in the first equilibrium relationship (eq. 8) was easily rejected at the 95 per cent level of significance. In the second subperiod (starting in 1987) there is a unique cointegrating vector identified as the reduced form equation (8), while it is not possible to identify a loan supply equation. Moreover, the acceptance of a zero overidentifying restriction on the coefficient of the loan variable in equation (8) indicates a switch to a perfect substitutability regime in the second half of the sample period. Worms

(2001) observes a declining share of bank loans in external financing during the 1990s, attributing this to the ongoing securitization and, to some extent, to disintermediation[16]. It should be noted that the structural break coincides with the shift in Bundesbank's strategy from targeting central bank money (the adjusted monetary base) to M3 targeting that could be seen as the central bank's response to financial markets changes.

Japan is, as already indicated, the only country in which the lending channel is relevant for monetary transmission in the entire sample period. The relative stability of equilibrium relationships (eqs 8 and 9) in the 1990s, despite the gradual incorporation in Japanese financial markets of the advances that took place in international financial markets, can be seen as a result of the countervailing influence of the slump in economic activity and the accompanying banking crisis that characterizes this period. As banks play such an important role in financial intermediation in Japan, the problems in the banking sector combined with widespread corporate losses, which have resulted in an erosion of the traditional sources of mutual support among corporations and the deterioration of the credit rating of the Japanese corporate sector (Levy, 1999), preserved the dependence of borrowers on bank lending.

In line with the results obtained for Germany and Italy, the bank lending channel in France seems to have lost its potency since the early 1990s, as indicated by our inability to find a second cointegrating vector (a loan supply equation) and the non rejection of an exclusion restriction as regards the loan variable in the first. To understand properly the observed patterns we should take into account that this period was characterized by rapid financial liberalization. The latter was boosted by legislative measures (as the Banking System Law and the suppression of direct controls over credit provision in 1984), the consequences of which became more visible at the end of the 1980s. The rationalization of the structure of the French banking industry and the accompanying intensification of competition have resulted in a higher degree of concentration of this industry (Loupias *et al*., 2001). This fact, in conjunction with the relatively high holdings of liquid assets by the French banking sector since the early 1990s has increased the degree of asset substitutability from the banks' point of view and, thus, their ability to shield the supply of loans from monetary policy movements. At the same time, the increasing use by firms of internal financing and the

[16] This trend was found to be almost exclusively the result of the financing behavior of the very large firms in Germany.

enhanced role of equity financing (Cobham and Serre, 2000), appear to have contributed to a rising trend of asset substitutability making the bank lending channel inoperative.

In the UK – which represents, together with the US, the "Anglo-Saxon type" of financial market structure (Schmidt, 2001) – we, unsurprisingly, find only one vector linking output to money, with an overidentifying exclusion restriction on the loan variable coefficient not being rejected. This result can be seen as a consequence of the development of market financing and the deregulation of the country's banking system that was completed in the early 1980s.

Finally, the transmission mechanism in Italy also seems to have been affected by a similar process of structural change in the financial system. This process is characterized by the abolition, between the mid-1980s and the early 1990s, of all major legislative restrictions in financial markets (Gambacorta, 2001) that could hinder the restructuring of Italy's financial system. Since 1989, a regime in which the bank lending channel was ineffective (since only one equilibrium relationship linking output to money can be identified), succeeded the previous regime in which monetary policy had a leverage on the supply of bank loans. Indeed, for the period 1977 through 1989 we identified two equilibrium relationships such as those derived in the theoretical section of the paper, although our coefficient estimates are at the limit of statistical significance, given the small sample size for this period.

6. Conclusions

The existence of a bank lending channel has important implications for the transmission of monetary policy as it enhances its effect on real economic activity over and above the effect from the conventional interest rate channel. Previous empirical work on the lending channel using aggregate data concentrated on the examination of timing relationships between quantity or price variables and monetary policy measures. Unfortunately, much of this evidence admits other interpretations due mainly to the difficulties in distinguishing shifts in loan supply from shifts in loan demand. The evidence from studies using aggregate data was supplemented in the literature by an analysis of the distributional effects of monetary policy changes, by using bank level data, in an attempt to identify empirically loan supply shifts. This approach also has its limitations in that it is hard to assess from estimated cross-sectional patterns the importance of the lending channel for aggregate economic activity.

In this paper, we look at the importance of the lending channel at the aggregate level by building on the theoretical framework proposed by Bernanke and Blinder for the analysis of monetary transmission in the presence of imperfect substitutability among financial assets. We bring the Bernanke-Blinder model to a form suitable for empirical testing by reformulating it so that the identification of a loan supply function becomes possible. Our framework provides us with a number of testable restrictions related to the degree of asset substitutability and, thus, to the effectiveness of the lending channel. These restrictions are tested in the context of a VECM which is applied to data for six major industrial countries (USA, Germany, Japan, France, UK and Italy) that cover the period from the mid-1970s to the late 1990s.

In view of the substantial changes that took place in financial markets during the above period, we would expect the degree of asset substitutability to have increased over time, thus weakening the potency of the lending channel. This issue is investigated by looking for evidence of structural change in the empirically identified equilibrium relationships derived from the model. Our findings lead to different conclusions with regard to the operation of the lending channel in individual countries. Importantly, however, they suggest that changing financial structures matter for monetary policy transmission. In the US and the UK, where financial systems are predominantly market-based, the lending channel does not seem to be a part of the transmission mechanism. On the other hand, the lending channel plays a significant role in Japan, although this may partly reflect the conditions of financial distress experienced by Japan since the late 1980s. The other three European countries examined are somewhere in between, in the sense that temporal instability appears to be a feature of their empirical record as these countries switched from a regime of imperfect asset substitutability to one (starting in the late 1980s / early 1990s) in which the lending channel is inoperative.

The finding that the bank lending may not be important for monetary transmission does not necessarily imply that information asymmetries are no longer relevant in financial markets. In order to form a complete picture of the role of informational asymmetries in monetary transmission, the other part of the credit channel, namely the balance sheet channel, also has to be considered.

References

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

Bernanke, B.S. (1995), "A Conference Panel Discussion: What Do We Know About How Monetary Policy Affects Economy?", *Federal Reserve Bank of St. Louis Review*, May/June, 127-30.

Bernanke, B.S. and A.S. Blinder (1988), "Credit, Money and Aggregate Demand", *American Economic Review Papers and Proceedings*, 78, 435-9.

Bernanke, B.S. and A.S. Blinder (1992), "The Federal Funds Rate and the Channels of Monetary Transmission", *American Economic Review*, 82, 901-21.

Bernanke, B. S. and M. Gertler (1989), " Agency Costs, Net Worth, and Business Fluctuations", *American Economic Review*, 79, 14-31.

Bernanke, B.S. and M. Gertler (1995), "Inside the Black Box: The Credit Channel of Monetary Policy Transmission ", *Journal of Economic Perspectives*, 9, 27-48.

BIS (1994), "Macroeconomic and Monetary Policy Issues Raised by the Growth of Derivative Markets", Report prepared by a Working Group established by the Euro-currency Standing Committee of the Central Banks of the Group of Ten Countries, November.

Boyd, J. H. and M. Gertler (1994),"Are Banks Dead? Or Are the Reports Greatly Exaggerated?", *Federal Reserve Bank of Minneapolis Quarterly Review*, Summer, 2-23.

Brissimis, S. N., N.C. Kamberoglou and G.T. Simigiannis (2001), "Is There a Bank Lending Channel of Monetary Policy in Greece?: Evidence from Bank Level Data", ECB Working Paper No. 104, December.

Brunner, K. and A. H. Meltzer (1998), "Money and Credit in the Transmission Process", *American Economic Review Papers and Proceedings*, 78, 446-51.

Carlson, J. B., D. L. Hoffman, B. D. Keen and R. H. Rasche (2000), "Results of a Study of the Stability of Cointegrating Relations Comprised of Broad Monetary Aggregates", *Journal of Monetary Economics* , 46, 345-83.

Cobham, D. and J.-M. Serre (2000), "A Characterization of the French Financial System", *Manchester School,* 68, 44-67.

Danthine, J.-P., F. Giavazzi and E.-L. von Thadden (2000), "European Financial Markets after EMU: A First Assessment", NBER Working Paper No. 8044, December.

De Bandt, O. and E.P. Davis (1999), "A Cross-Country Comparison of Market Structures in European Banking", ECB Working Paper No. 7, September.

Ehrmann, M. L. Gambacorta, J. M. Pages, P. Sevestre and A. Worms (2001), "Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area", ECB Working Paper No. 105, December.

Estrella, A. (2001), "Securitization and the Efficacy of Monetary Policy", mimeo.

Galati, G. and K. Tsatsaronis (2001), "The Impact of the Euro in Europe's Financial Markets", BIS Working Paper No. 100, July.

Gambacorta, L. (2001), "Bank-Specific Characteristics and Monetary Policy Transmission: The Case of Italy ", ECB Working Paper No. 103, December.

Hendry, D. F. (1995*), Dynamic Econometrics*. Oxford: Oxford University Press.

Jensen, M. C. (1986), "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers", *American Economic Review*, 76, 323-9.

Jensen, M.C. (1988), "Takeovers: Their Causes and Consequences*", Journal of Economic Perspectives*, 2 , 21-48.

Johansen, S. (1988), "Statistical Analysis of Cointegration Vectors", *Journal of Economic Dynamics and Control*, 12, 231-54.

Johansen, S. (1991), "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", *Econometrica* , 59, 1551-80.

Johansen, S. and K. Juselius (1990), " Maximum Likelihood Estimation and Inference on Cointegration - With Applications to the Demand for Money", *Oxford Bulletin of Economics and Statistics*, 52, 169-210.

Johansen, S. and K. Juselius (1994), "Identification of the Long-Run and Short-Run Structure: An Application to the IS – LM Model", *Journal of Econometrics*, 63, 7-36.

Kakes, J. (2000), "Identifying the Mechanism: Is There a Bank Lending Channel of Monetary Transmission in the Netherlands?", *Applied Economics Letters*,7, 63-7.

Kashyap, A.K. and J.C. Stein (1995), "The Impact of Monetary Policy on Bank Balance Sheets", *Carnegie Rochester Conference Series on Public Policy*, 42,151-95.

Kashyap, A.K. and J.C. Stein (2000), "What Do a Million Observations on Banks Say About the Transmission of Monetary Policy?", *American Economic Review*, 90, 407-28.

Kashyap, A.K., J.C. Stein and D.W. Wilcox (1993), " Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance", *American Economic Review*, 83, 78-98.

Kashyap, A.K., J.C. Stein and D.W. Wilcox (1996), " Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance: A Reply", *American Economic Review*, 86, 310-4.

Keeton, W. R. (1992), "Monetary Policy Implications of Bank Security Holdings and Large CDs", Federal Reserve Bank of Kansas City, Research Working Paper No. 8, December.

Kishan, R. P. and T. P. Opiela (2000), "Bank Size, Bank Capital and the Bank Lending Channel", *Journal of Money, Credit, and Banking*, 32, 121-41.

Levy, J. (1999), "Financial Reorganization and Corporate Restructuring in Japan", Japan-Selected Issues, IMF SM/99/181, Suppl.1, July, 97-128.

Loupias, C., F. Savignac, O. and P. Sevestre (2001), "Monetary Policy and Bank Lending in France: Are There Asymmetries?", ECB Working Paper No. 101, December.

Maki, D. M. and M.G. Palumpo (2001), "Disentangling the Wealth Effect: A Cohort Analysis of Household Saving in the 1990s", Federal Reserve Board, Finance and Economics Discussion Series No. 21.

Miron, J.A., C.D. Romer and D. N. Weil (1993), "Historical Perspectives on the Monetary Transmission Mechanism", NBER Working Paper No. 4326, April.

Mishkin, F. S. and P. E. Strahan (1999), "What Will Technology Do to the Financial Structure?", NBER Working Paper No. 6892, January.

Modigliani, F. and M.H. Miller (1958), "The Cost of Capital, Corporate Finance and the Theory of Investment", *American Economic Review*, 48, 261-97.

Mylonas, P., S. Schich and G. Wehinger (2000), "A Changing Financial Environment and the Implications for Monetary Policy", OECD Working Paper No. 243, May.

Oliner, S. D. and G. D. Rudebusch (1995), "Is There a Bank Lending Channel for Monetary Policy ?", *Federal Reserve Bank of San Francisco Economic Review*, No. 2, 3-20.

Oliner, S. D. and G. D. Rudebusch (1996), "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance: Comment", *American Economic Review*, 86, 300-9.

Pesaran, M. H. and Y. Shin (2001), "Long-Run Structural Modelling", University of Cambridge, mimeo.

Phillips, P. C. B. (1991), "Optimal Inference in Cointegrated Systems", *Econometrica*, 59, 283-306.

Romer, C. D. and D.H. Romer (1994), "Monetary Policy Matters", *Journal of Monetary Economics*, 34, 75-88.

Schmidt, R. H. (2001), "Differences Between Financial Systems in European Countries: Consequences for EMU", Deutsche Bundesbank, ed*., The Monetary Transmission Process: Recent Developments and Lessons for Europe*. New York: Palgrave, 208-40.

Worms, A. (2001), "The Effects of Monetary Policy on Bank Loans in Germany", ECB Working Paper No. 96, December.

Data Appendix

All data are quarterly. The data set begins in 1977.Q1 and ends in 1999.Q4. The GDP, credit, currency in circulation, price and interest rates data are all from IMF `s International Financial Statistics (IFS) data bank. The deposit variable is M3 minus currency in circulation, where M3 is defined according to national definitions and is drawn from the following sources: for Germany and France: IFS, line 39mc; for the US: Federal Reserve System`s data base; for Japan: Bank of Japan's data base; for the UK: Datastream; and for Italy: Banca d`Italia, Financial Statistics.

The other variables are as follows:

GDP: Real gross domestic product (IFS, line 99b.c)

Prices: Consumer prices (IFS, line 64)

Currency: Currency in circulation (IFS, 34a.u)

Loans: Claims of banking institutions on other resident sectors (IFS, line 22d.u)

Lending rate: Prime lending rate (IFS, line 60p)

Bond rate: Government bond yield (IFS, line 61)

TABLE 1 - SOURCES OF FINANCE
(end-year figures in per cent of GDP)

	Bank credit to the non-bank private sector				Private sector domestic debt securities[a]				*Of which* Corporate issuers	Market capitalisation of equity markets[b]			
	1985	1990	1995	1998	1985	1990	1995	1998	1998	1985	1990	1995	1998
United States	68	70	64	69	na	50	56	71	27	52	58	82	123
Germany	93	98	103	118	na	39	42	53	0,5	21	24	22	48
Japan	99	122	118	118	na	33	30	40	18	58	125	72	57
France	76	96	87	80	na	41	29	33	6	12	29	32	65
United Kingdom	47	116	116	120	na	16	17	28	8	62	86	119	169
Italy	51	56	58	60	na	26	32	31	1	10	15	18	46

a) Amounts outstanding by country of issuer.

b) Data refer only to listed companies.

Source: Mylonas *et al.* (2000).

TABLE 2 - TEST OF THE BANK LENDING CHANNEL

	United States		Germany			Japan	
Period	1977.Q1 - 1988. Q3	1988.Q4 - 1999.Q4	1977.Q1 - 1986.Q1		1986.Q2 - 1998.Q4	1977.Q1 - 1999.Q4	
A.Number of coIntegrating vectors[1]	1	1	2		1	2	
Trace test	56.40 (42.34)	78.56 (63.02)	33.23 (31.54)		66.84 (48.88)	44.82 (42.34)	
Maximum eigenvalue test	28.08 (25.42)	39.05 (31.07)	24.83 (21.12)		34.12 (27.42)	24.58 (25.42)	
B.Coefficients on cointegrating vector variables[2]							
	Vector 1	Vector 1	Vector 1	Vector 2	Vector 1	Vector 1	Vector 2
L	0	0	-0.172 (0.003)	-0.358 (0.058)	0	-0.235 (0.083)	-0.220 (0.046)
D	-0.406 (0.109)	-0.323 (0.098)	-0.332 (0.063)	0.695 (0.120)	-0.822 (0.114)	-0.345 (0.080)	0.458 (0.050)
y	1.000	1.000	1.000	0	1.000	1.000	0
ρ-i.	0	0	0	1.000	0	0	1.000
L-R test of exclusion restrictions on cointegrating vector coefficients[3]	$a_1=a_4=0$ $\chi^2(2)=2.77$ [0.258]	$a_1=a_4=0$ $\chi^2(2)=4.78$ [0.091]			$a_1=a_4=0$ $\chi^2(2)=1.05$ [0.305]		

TABLE 2 -*Continued*

	France			UK	Italy		
Period	1977.Q1-1991.Q4		1992.Q1-1998.Q4	1985.Q1 - 1999.Q4	1983.Q3 - 1989.Q1		1989.Q2 - 1998.Q4
A.Number of coIntegrating vectors[1]	2		1	1	2		1
Trace test	36.18 (31.54)		71.64 (48.88)	91.3 (39.81)	35.14 (24.05)		53.71 (48.88)
Maximum eigenvalue test	21.35 (21.12)		46.42 (27.42)	64.04 (23.92)	19.85 (17.68)		31.81 (27.42)
B.Coefficients on cointegrating vector variables[2]							
	Vector 1	Vector 2	Vector 1	Vector 1	Vector 1	Vector 2	Vector 1
L	-0.288	-0.159	0	0	-0.542	-0.187	0
	(0.032)	(0.040)			(0.067)	(0.070)	
D	-0.125	0.147	-0.894	-0.509	-0.362	0.622	-0.527
	(0.020)	(0.024)	(0.181)	(0.134)	(0.129)	(0.135)	(0.008)
y	1.000	0	1.000	1.000	1.000	0	1.000
ρ-i.	0	1.000	0	0	0	1.000	0
L-R test of exclusion restrictions on cointegrating vector coefficients[3]			$a_1=a_4=0$ $\chi^2(2)=5.79$ [0.055]	$a_1=a_4=0$ $\chi^2(2)=0.01$ [0.997]			$a_1=a_4=0$ $\chi^2(2)=2.84$ [0.241]

Notes:

1. Numbers in parenthesis are critical values at the 5% significance level
2. Numbers in parenthesis are asymptotic standard errors
3. Numbers in brackets are probabilities to accept the overidentifying restrictions

FIGURE 1

PLOTS OF THE RESTRICTED COINTEGRATING VECTORS

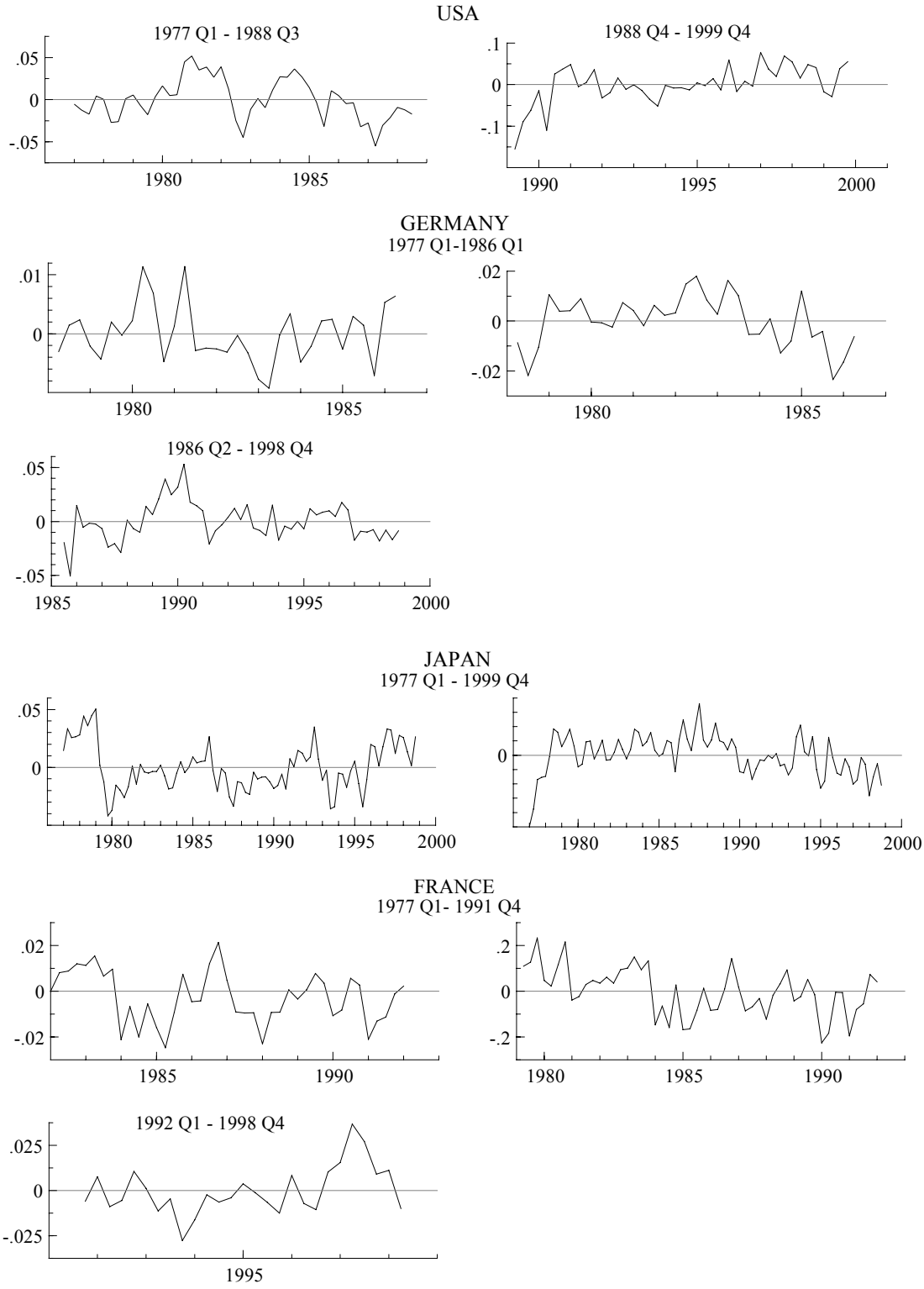


FIGURE 1 - *Continued*

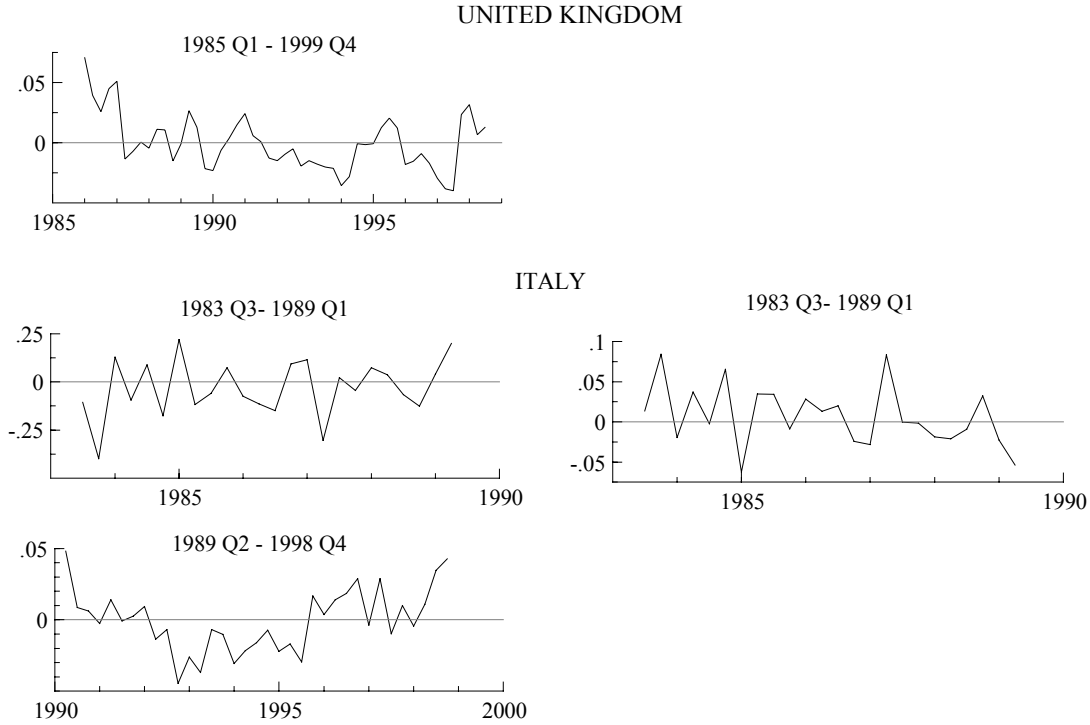


FIGURE 2

RECURSIVE ESTIMATES OF LONG-RUN COEFFICIENTS

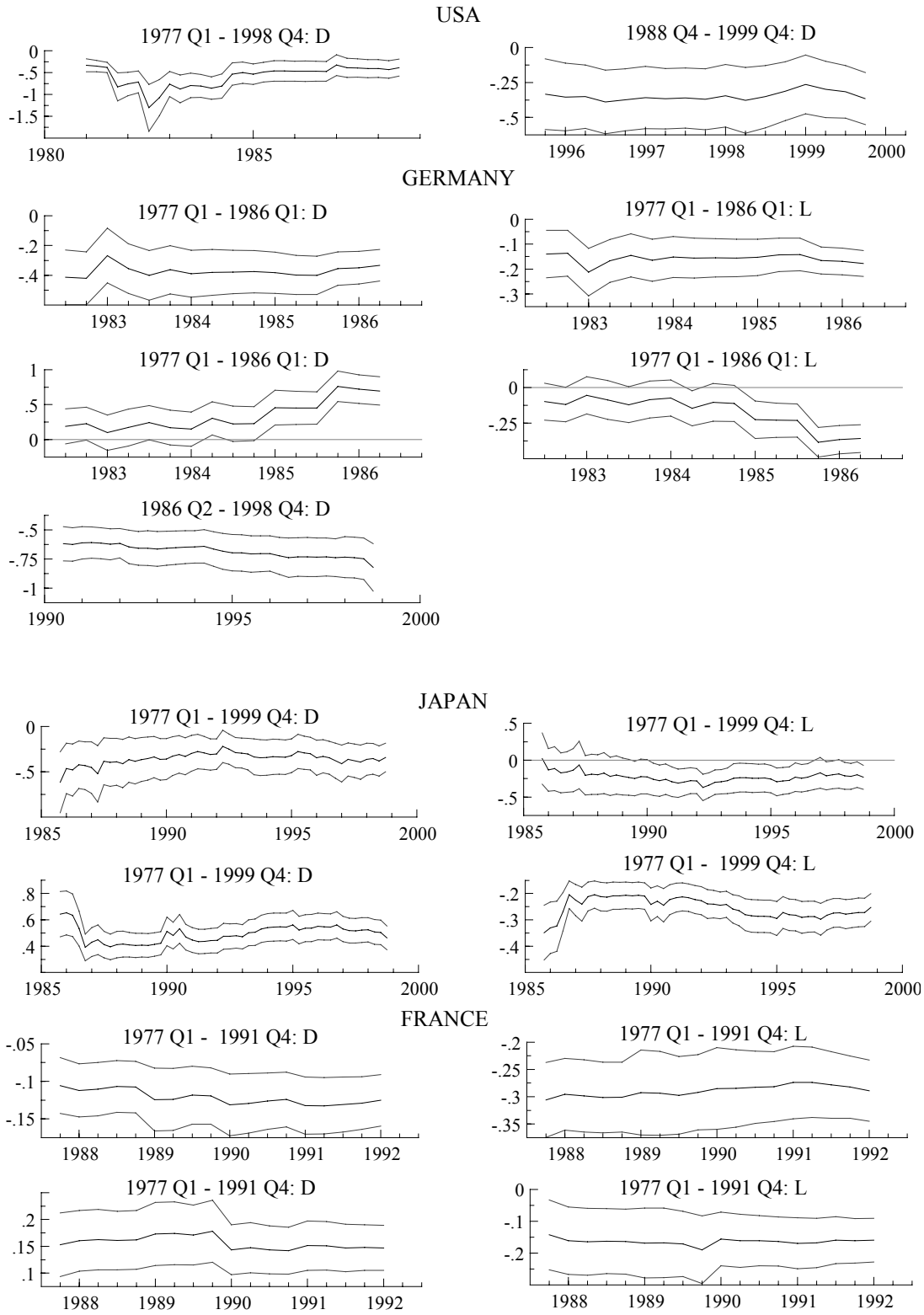
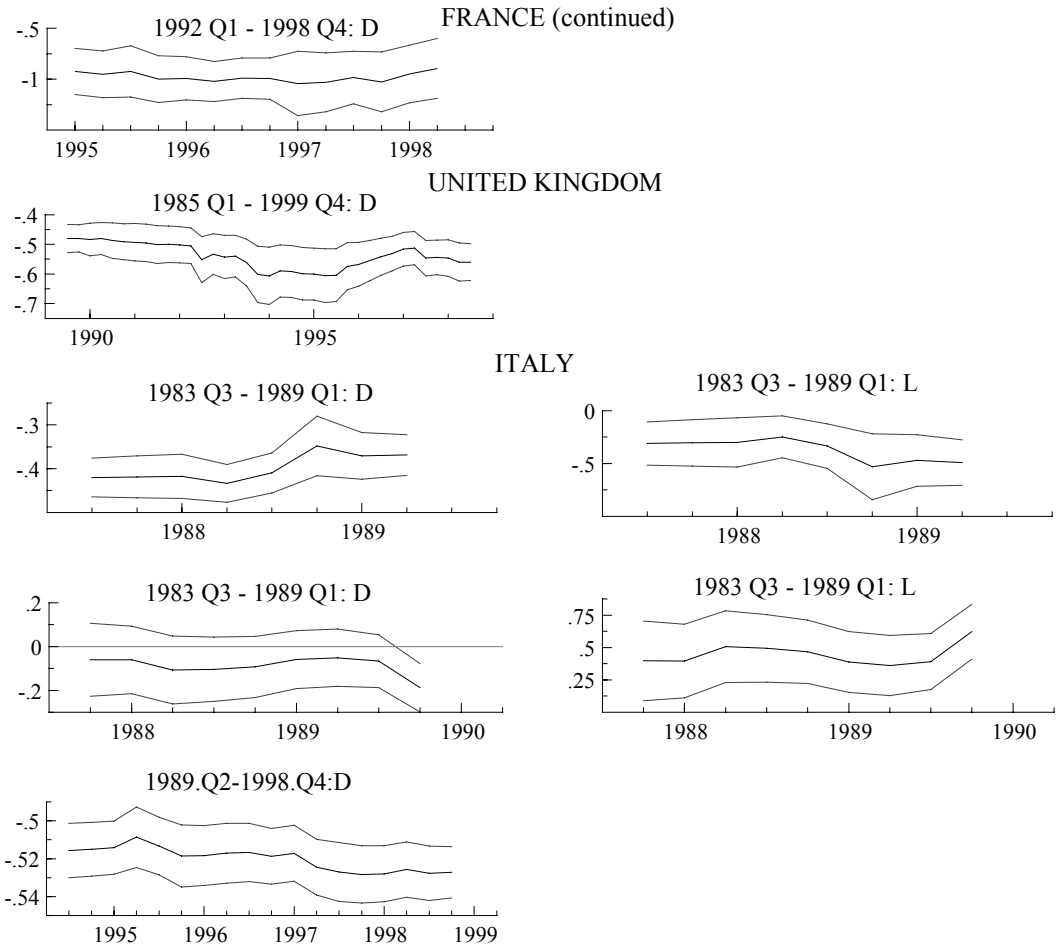


FIGURE 2 - *Continued*



Note: Estimated coefficients of CVs are presented in the same order as they appear in Table 2.

BANK OF GREECE WORKING PAPERS

1. Brissimis, S. N., G. Hondroyiannis, P.A.V.B. Swamy and G. S. Tavlas, "Empirical Modelling of Money Demand in Periods of Structural Change: The Case of Greece", February 2003.

2. Lazaretou, S., "Greek Monetary Economics in Retrospect: The Adventures of the Drachma", April 2003.

3. Papazoglou, C. and E. J. Pentecost, "The Dynamic Adjustment of a Transition Economy in the Early Stages of Transformation", May 2003.

4. Hall, S. G. and N. G. Zonzilos, "An Indicator Measuring Underlying Economic Activity in Greece", August 2003.