Monetary transmission and bank lending in the Netherlands

Jan Kakes*
June 1998

Abstract

This paper investigates the role of bank lending in the monetary transmission process in the Netherlands. We observe significant differences between the responses of corporate and household lending following a monetary shock. We also find that banks hold a buffer stock of securities which they use to offset monetary shocks. The main implication of our study is that a bank lending channel is not likely to be an important transmission mechanism of monetary policy.

1 Introduction

In recent years, a large body of literature has developed that emphasizes the role of credit market imperfections in the monetary transmission process, known as the ‘credit view’ (see, for instance, Bernanke and Gertler [1995]). Part of this literature focuses on the existence and the importance of a bank lending channel. According to this transmission mechanism, banks respond to a monetary contraction by reducing the supply of bank loans, which has a negative impact on real activity. The relevance of a bank lending channel follows from the specific function of private banks as financial intermediaries, which is in contrast with their purely passive role in conventional theory, as represented by e.g. the IS-LM model. A bank lending channel operates on top of the standard interest rate channel. If part of the borrowers are bank dependent—i.e. they cannot switch to alternative forms of external financing—and banks consider bank loans as imperfect substitutes for other assets on their balance sheets, monetary policy may be effective through a bank lending channel.

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Although the importance of financial market imperfections in the monetary transmission process—as predicted by the credit view—has been established by a large number of studies, the empirical evidence for the existence of a bank lending channel has been much less conclusive. To a large extent, this is due to the fact that most studies based on aggregate data, following Bernanke and Blinder [1992], suffer from a severe identification problem: the inability to establish whether the decrease in credit that is observed after a monetary contraction is induced by bank supply or driven by a fall in borrowers’ demand. In the latter case, a lending channel would be irrelevant. In this respect, recent studies based on disaggregate data are more informative. The advantage of disaggregate data is that the response of credit variables can be analyzed in combination with other hypotheses that follow from the theoretical literature underlying the credit view. Information problems, for instance, are presumably more relevant for particular categories of borrowers. Gertler and Gilchrist [1993,1994], Oliner and Rudebusch [1996], and Gilchrist and Zakrajsek [1998] use quarterly panel data of a large number of nonfinancial firms in the US, taking heterogeneity among borrowers into account. It appears from this research that, following a monetary contraction, small firms reduce their amount of bank credit while large firms initially attract more credit. Although this is obviously consistent with the credit view in the sense that credit is ‘special’, there is no general agreement to what extent these findings should be interpreted as support for a bank lending channel. Kashyap and Stein [1997b] analyze quarterly data at the individual bank level. These authors find that monetary policy has in particular an impact on lending behaviour of relatively small banks with less liquid balance sheets, which they interpret as support for a bank lending channel.

Unfortunately, detailed time series at the individual firm or bank level are not available for most countries. Empirical research may still yield valuable insights, though, even if based on aggregate data. Garretsen and Swank [1998] observe that a monetary contraction in the Netherlands is immediately followed by a substantial reduction in banks’ bond holdings, which they interpret as a buffer stock that banks use to shield their lending activity from monetary policy shocks. The subsequent decrease in bank credit may possibly be attributed to demand effects, which suggests that a bank lending channel is not important.

The purpose of this paper is to provide more evidence on the role of banks in the transmission of monetary policy in the Netherlands, using vector autoregression (VAR) analysis. We use bank balance sheet data on bank credit, split into loans to the household sector and to the corporate sector. In this way, we separate different classes of borrowers, although not as rigorous as in the aforementioned studies based on US data. Our analysis is similar to Dale and Haldane [1995], who also distinguish

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these two sectors in a study of monetary transmission in the UK. Our results show that, especially for short-term credit, the sectoral differences are striking. Firms react to a negative monetary impulse by demanding more short-term credit, while total credit to the household sector is reduced. This response of firms may be interpreted as buffer stock behaviour: following a monetary contraction, firms demand more short-term loans to compensate for declining cash flows. Furthermore, we find strong evidence consistent with the idea that banks use their bond holdings as a buffer against monetary shocks. The main implication of our results is that a bank lending channel is not likely to be an important monetary transmission mechanism in the Netherlands.

The paper is organized as follows. The next section offers a highly stylized model that illustrates under what circumstances banks are likely to hold a large buffer stock of securities. Section 3 presents our results, based on VAR analysis. Section 4 concludes.

2 Bank behaviour and buffer stocks: a stylized model

The working of a bank lending channel, from a bank’s perspective, can be illustrated within a simple two-period framework, based on Kashyap and Stein [1995]. The model presented here is limited in many respects: it is a partial equilibrium model which only specifies the supply side of the credit market. Stein [1995] provides a more rigorous microfoundation of a similar type of model, and suggests several extensions in order to arrive at a complete macroeconomic model that specifies the entire monetary transmission process. Developing a suchlike model is beyond the scope of this paper: our only purpose is to capture the idea that banks may invest in a buffer stock of marketable securities which enables them to offset monetary shocks.

Consider a simplified bank balance sheet:

<table>
<thead>
<tr>
<th>assets</th>
<th>liabilities</th>
</tr>
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<tbody>
<tr>
<td>$L$</td>
<td>$M$</td>
</tr>
<tr>
<td>$B$</td>
<td>$N$</td>
</tr>
</tbody>
</table>

In the first period, the bank has to specify an investment portfolio of two types of assets: loans $L$ and securities (‘bonds’) $B$. Loans are an attractive investment because they yield a higher return than bonds, equal to $r$ over both periods together, which is exogenous to the bank. The return on bonds is normalized to zero, so $r$ can be interpreted as the spread between lending and investing in bonds. A disadvantage of loans, however, is that they cannot be costlessly liquidated in period two. We simply assume that liquidation costs are infinite or, alternatively, that loans cannot be liquidated. By contrast, bonds can be liquidated without any costs, which makes them suited to serve as a buffer stock.
In order to finance its assets, the bank can use two types of liabilities. First, the public holds demand deposits $M$ with the bank, which are fixed by the central bank at $M_1$ in period one and $M_2$ in period two. In the first period, the bank faces uncertainty with respect to the amount of deposits in period two: given $M_1$, $M_2$ is uniformly distributed on the interval $[\rho M_1 + (1 - \rho) M^* - \gamma, \rho M_1 + (1 - \rho) M^* + \gamma]$, with a mean of $\rho M_1 + (1 - \rho) M^*$, where $M^*$ can be interpreted as an equilibrium value of monetary stance. Hence, $\rho$ can be seen as a measure of persistence of a monetary policy disturbance in period one, and $\gamma$ as a measure of its standard deviation. As an alternative to demand deposits, a bank can raise non-deposit external financing $N$ in both periods: these are $N_1$ in period 1 and $N_1 + N_2$ in period 2. Non-deposit finance is characterized by increasing marginal costs, which we assume to be equal to $\alpha_1 N_1^2$ and $\alpha_2 N_2^2$, where $\alpha_1, \alpha_2 \geq 0$. The relevance of a convex increasing cost function, which is essential for this model, can be explained by the fact that the bank’s creditors are likely to demand a higher return when external finance increases, since they become exposed to higher risk. This does not hold for demand deposits, which are protected by deposit insurance. The bank balance sheets in period one and two, respectively, look as follows:

<table>
<thead>
<tr>
<th>assets</th>
<th>liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L$</td>
<td>$M_1$</td>
</tr>
<tr>
<td>$B_1$</td>
<td>$N_1$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>assets</th>
<th>liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L$</td>
<td>$M_2$</td>
</tr>
<tr>
<td>$B_2$</td>
<td>$N_1 + N_2$</td>
</tr>
</tbody>
</table>

Given these assumptions, it is easy to understand why banks are likely to invest in a buffer stock of liquid assets $B$ in the first period. In order to see this, consider the situation in period two. There exist two possibilities. First, if $N_1 + M_2 > L$, the loan portfolio can be financed without any new external finance: $N_2$ will be zero in this case since it is always cheaper to reduce bond holdings (unless $\alpha_2 = 0$). Alternatively, if $N_1 + M_2 < L$, the bank needs to attract new external finance: $N_2 = L - N_1 - M_2$. When the bank takes its portfolio decisions in period one, it has to take into account that it cannot run the risk that loans have to be liquidated, and that $M_2$ may become $\rho M_1 + (1 - \rho) M^* - \gamma$. Hence, if the bank comes in a situation that it needs to raise non-deposit finance, i.e. $N_2 > 0$, the expected costs of this external funding,

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3This implies that monetary policy stance is measured by the volume of deposits, which is clearly an oversimplification compared to actual policy practice. Nevertheless, we believe that the main characteristics of the model in this section remain useful in a more realistic setting. Changes in $M$ that are analyzed in this model can be considered as monetary disturbances in general, rather than just due to monetary policy. In most economies, the central bank is only able to control the amount of base money: short-run changes in broad monetary aggregates are dominated by demand or—particularly in the case of the Netherlands—reflecting international capital flows. Moreover, the monetary authorities use the short-term interest rate, rather than base money, as their main policy target. Hence, as we focus on monetary policy shocks in this paper, we use a short-term interbank interest rate as the policy variable in our estimations.
formulated in period one, are:

\[ E[\alpha_2 N_2^2] = \frac{\alpha_2}{3} (L - N_1 - \rho M_1 - (1 - \rho)M^* + \gamma)^2 \]  

(1)

The bank’s portfolio choice of \( L \) and \( N_1 \) in the first period, and hence \( B \), can be derived from the following maximization problem:

\[
\max_{N_1, L} rL - \alpha_1 N_1^2 - \frac{\alpha_2}{3} (L - N_1 - \rho M_1 - (1 - \rho)M^* + \gamma)^2 
\]

(2)

which yields the following solution:

\[
N_1 = \frac{1}{2\alpha_1} r 
\]

(3)

\[
L = \left( \frac{1}{2\alpha_1} + \frac{3}{2\alpha_2} \right) r + \rho M_1 + (1 - \rho)M^* - \gamma 
\]

(4)

\[
B = M_1 + N_1 - L = -\frac{3}{2\alpha_2} r + (1 - \rho)(M_1 - M^*) + \gamma 
\]

(5)

These three outcomes can be given an intuitive interpretation. According to Equation (3), the bank will raise non-deposit finance in the first period up to the point where the marginal costs of this funding are equal to the marginal return of lending: \( 2\alpha_1 N_1 = r \). Second, Equation (4) shows that the supply of bank loans is a positive function of its return \( r \) and the amount of deposits in the first period and a negative function of the variability of the money stock in the second period, indicated by \( \gamma \). Equation (5), finally, implies that banks will hold a large buffer stock of bonds \( B \) if there is a lot of uncertainty \( \gamma \) with respect to monetary stance—i.e. if the maximum possible fall in deposits is large—while \( B \) further depends on the return \( r \) on loans and the degree of persistence \( \rho \) of monetary disturbances.

The parameters \( \alpha_1 \) and \( \alpha_2 \) indicate the cost of non-deposit funding for a bank. According to Kashyap and Stein [1995], these parameters are likely to be higher for smaller banks, which implies according to (5) that smaller banks hold a larger buffer stock of securities \( B \). If \( \alpha_1 \) and \( \alpha_2 \) are zero, this would imply that external funding is

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4This equation can be derived as follows. First, from the definition of the variance it follows that \( E[N_2^2] = \text{var}(N_2) + N_2^2 \). Second, the variance of a variable that is uniformly distributed on the interval \([a, b]\) is equal to \( \frac{(b-a)^2}{12} \). Hence, our interval of \([0, L - N_1 - \rho M_1 - (1 - \rho)M^* + \gamma]\) implies:

\[
\text{var}(N_2) = \frac{(L - N_1 - \rho M_1 - (1 - \rho)M^* + \gamma)^2}{12} 
\]

\[
\frac{N_2^2}{\text{var}(N_2)} = \left( \frac{L - N_1 - \rho M_1 - (1 - \rho)M^* + \gamma}{2} \right)^2 
\]

Summation of these two expressions, and premultiplying by \( \alpha_2 \), yields Equation (1).
costless: in that case, a bank would always be able to offset any unanticipated deposit withdrawal, which makes a bank lending channel impotent.

What are the implications of this model for the Netherlands? Two aspects may be relevant here. First, given the fact that large banks dominate the domestic credit market and Dutch banks have high creditworthiness ratings, one would expect that these banks can attract non-deposit funding at relatively low costs: in terms of the model, \( \alpha_1 \) and \( \alpha_2 \) are likely to be low.\(^5\) This would reduce the impact of a bank lending channel of monetary transmission.

Second, as a small, open economy with a fixed exchange rate and a high degree of capital mobility, the Netherlands are subject to external monetary shocks. Monetary policy measures, which are in this paper summarized by innovations in the short-term interest rate, are for the most part indirectly determined by the German Bundesbank. Moreover, monetary aggregates have a relatively large foreign component due to the impact of foreign capital flows. Hence, monetary shocks are likely to have a high variability which, according to (5), induces banks to hold a large buffer stock of bonds.

In sum, applying the model of this section to the Dutch situation suggests that banks can relatively easily fund themselves with non-deposit finance while, in addition, they may hold a large buffer stock of marketable securities. Although these two aspects are not independent—actually, the first somewhat weakens the second because of the low value of \( \alpha_2 \) in Equation (5)—one would a priori expect that bank lending is not an important transmission channel of monetary policy. Rather, the opposite seems more plausible: by insulating their lending activity from monetary impulses, banks may substantially reduce the real impact of monetary policy. This is consistent with recent empirical research on bank behaviour. Swank [1994] concludes from an interview study among Dutch banks that banks attach much value to bank-client relationships, which implies that the credit market can be characterized as a customer market, rather than an auction market. In addition, banks indicate that they are more inclined to sell securities following a monetary contraction than to reduce loans supply.

3 Results

We analyze monthly and quarterly data over a sample that runs from March 1983 up to and including December 1996. The starting date coincides with the implicit decision of the Dutch monetary authorities to fix the guilder to the German Dmark. Since 1983, the guilder-Dmark spot rate has been stable around a constant central parity while the Dutch short-term interest rate has been virtually equal to its German counterpart most of the time. Hence, we should interpret monetary policy, which is

\(^5\)Kashyap and Stein [1997a] conclude, on the basis of these factors, that in the Netherlands banks are better able to offset monetary disturbances than those in most other European countries.
measured as innovations in the short-term interest rate, as being largely determined by the German Bundesbank. We have not included the turbulent first years of the EMS period, during which the guilder was devaluated two times against the Dmark while the short-term interest rate spread vis-a-vis Germany was relatively volatile, in order to obtain a homogeneous period without shifts in policy regime.

In the first subsection we briefly discuss the data we used and report the results of pre-testing. Next, we present our main empirical findings, which consist of variance decompositions and impulse-responses. We consider several VAR specifications. First, we present a VAR based on aggregate data. Since we include GDP as a measure of aggregate activity, which is only available at a quarterly frequency, we have to use quarterly data here. Subsequently, we analyze more disaggregate VAR models which focus on the two sectors. As we use monthly series now, we can include more variables while retaining sufficient degrees of freedom.

3.1 Data and pre-testing

The data we use can be divided into three subsets:

- **Bank balance sheet data.** We include two bank assets, bond holdings and bank loans. We take sectoral differences into account by distinguishing a corporate sector and a household sector. In our estimates based on monthly data, loans are further disaggregated into short-term and long-term credit supplied to each sector. The series we use are shown, at an annual frequency, in Figure 1. It appears that, for both sectors, long-term credit has more than doubled over our sample period, while short-term credit has shown a more modest growth. Furthermore, the lion’s share of short-term loans is supplied to firms, while long-term credit is more equally distributed between both sectors. The strong increase in long-term credit to households during the last two years of our sample reflects a rising supply of mortgage loans due to a boom in the housing market. Compared to total bank credit, the volume of bond holdings is relatively modest, although the ratio bonds/total credit has increased over our sample from 11% to about 20%. The volume of other securities, mainly shares, is negligible. The only liability we include is a broad money aggregate (M3). Most of M3 is in the hands of the household sector, but the main part of this difference consists of short-term saving deposits. Without short-term savings, money holdings—M2, in fact—of both sectors are about the same.

- **Key macroeconomic variables.** We include real activity and prices, since these are the main variables that reflect the ultimate effects of monetary policy. We use GDP and the GDP deflator in our aggregate model, and corresponding alternatives in our two sectoral specifications (see data appendix). We also include a real effective exchange rate, in order to account for the openness of
the Dutch economy. In our estimations based on monthly data, finally, we include a long-term interest rate.

- Policy variable. Following Bernanke and Blinder [1992] and most of the subsequent VAR-based literature on monetary policy transmission, we include a three-month interest rate as our monetary policy variable. This is consistent with the fact that this variable can be considered as the Dutch central bank’s main short-run target. As already mentioned, we should interpret this policy variable as being largely indirectly determined by the German Bundesbank, given the Dutch fixed exchange rate policy vis-à-vis the Dmark.6

For all series, we performed augmented Dickey-Fuller tests in order to investigate stationarity. The results are reported in Table 1. It can be concluded that all series can be considered as I(1) variables, with the possible exception of long-term bank

6Garretsen and Swank [1998] go one step further by including the German short-term interest rate as the policy variable.
<table>
<thead>
<tr>
<th>Series</th>
<th>Levels</th>
<th>First differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Trend</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lags</td>
</tr>
<tr>
<td>short-term interest</td>
<td>10</td>
<td>-1.65</td>
</tr>
<tr>
<td>real effective exchange rate</td>
<td>6</td>
<td>-2.36</td>
</tr>
<tr>
<td>gross domestic product</td>
<td>0</td>
<td>-2.75</td>
</tr>
<tr>
<td>GDP deflator</td>
<td>4</td>
<td>-1.91</td>
</tr>
<tr>
<td>industrial production</td>
<td>9</td>
<td>-2.20</td>
</tr>
<tr>
<td>producer price index</td>
<td>7</td>
<td>-2.59</td>
</tr>
<tr>
<td>household expenditures</td>
<td>12</td>
<td>-2.76</td>
</tr>
<tr>
<td>household expenditures deflator</td>
<td>3</td>
<td>-1.54</td>
</tr>
<tr>
<td>M3</td>
<td>6</td>
<td>-1.32</td>
</tr>
<tr>
<td>M3 corporate sector</td>
<td>3</td>
<td>-1.08</td>
</tr>
<tr>
<td>M3 household sector</td>
<td>12</td>
<td>-1.63</td>
</tr>
<tr>
<td>total loans</td>
<td>10</td>
<td>-2.63</td>
</tr>
<tr>
<td>total loans corporate sector</td>
<td>12</td>
<td>-1.56</td>
</tr>
<tr>
<td>long-term loans</td>
<td>9</td>
<td>-3.16</td>
</tr>
<tr>
<td>total loans corporate sector</td>
<td>12</td>
<td>-2.03</td>
</tr>
<tr>
<td>s-t loans corporate sector</td>
<td>12</td>
<td>-1.47</td>
</tr>
<tr>
<td>l-t loans corporate sector</td>
<td>5</td>
<td>-3.06</td>
</tr>
<tr>
<td>total loans household sector</td>
<td>6</td>
<td>-1.41</td>
</tr>
<tr>
<td>s-t loans household sector</td>
<td>6</td>
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</tr>
<tr>
<td>l-t loans household sector</td>
<td>6</td>
<td>-1.22</td>
</tr>
<tr>
<td>banks’ bond holdings</td>
<td>10</td>
<td>-2.27</td>
</tr>
</tbody>
</table>

Test statistics; all variables are in real terms (except interest rates and price indices) and in logs (except interest rates). All specifications include a constant term and up to twelve lags, except for GDP and the GDP deflator where a maximum of four lags have been included; *, ** and *** denote rejection of nonstationarity at the 10%, 5% and 1% significance level, respectively, based on critical values computed by MacKinnon [1991].

Table 1: Augmented Dickey-Fuller tests
loans, although the evidence in some cases depends on the specification (including a trend or not). It may seem somewhat strange to find that prices are I(1), whereas in many studies these are found to be I(2), but this may be attributed to the fact that inflation has been relatively low, even sometimes negative, in our sample period.

Akaike’s Information Criterion and a Likelihood Ratio test have been carried out to determine the optimal number of lags. Since these tests led to very different outcomes, we simply impose four lags in the case of quarterly data and twelve lags in the case of monthly data. In the latter case, we reduced the number of parameters to be estimated by imposing a lag structure of \(\{1,2,3,6,9,12\}\), in order to conserve degrees of freedom. Our results are robust to slightly different lag structures.

We applied the Johansen [1991] procedure to investigate cointegration, using the Pantula principle to jointly determine the cointegration rank and the specification of the cointegration space. Table 2 reports, for each VAR specification of Section 3.2, the number of cointegration relationships. Since cointegration can be established in all cases, while the cointegration rank is close to the number of variables included, we estimate our models as unrestricted VARs in which each variable is included in levels.

<table>
<thead>
<tr>
<th>model</th>
<th># variables</th>
<th>cointegration rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 3: aggregate model</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Figure 4: corporate sector</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Figure 4: household sector</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Figure 5: corporate sector</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Figure 5: household sector</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2: Cointegration

Our results are based on innovations analysis (impulse-response analysis and variance decompositions) which can be performed with an estimated VAR model, transformed into its moving average representation. Each time, we use a simulation period of three years (i.e. 12 quarters or 36 months). Innovations are identified by imposing a Wold causal chain in which the policy variable is ordered first, and the other variables in the order presented in the impulse-response graphs. By ordering the short-term interest rate first we capture the idea that it is the ‘least endogenous’ variable, which reflects both the fact that it is largely determined indirectly by German policymakers, and the fact that in reality information on prices and real activity are available with a lag of at least a month. We also investigated alternative orderings, but these hardly affect the outcomes and do not lead to different conclusions.
The graphs indicate for each variable the part of the forecast error variance that can be attributed, from top to bottom, to bond holdings, bank loans, money, the effective exchange rate, real activity, the price level and the short-term interest rate.

Figure 2: Aggregate model: variance decompositions (quarterly data)

3.2 Innovation analysis

We first analyze a VAR that consists of only aggregate data, including the short-term interest rate, price level, GDP, effective exchange rate, money (M3), total bank loans and banks’ bond holdings. All variables are in real terms (except the short-term interest rate and prices) and in logs (except the short-term interest rate). We also experimented with VAR systems that include German variables (real activity and prices), following Garretsen and Swank [1998], in order to obtain a better mean-reversion of the short-term interest rate. Since this hardly affect our results, we decided to leave them out, in order to conserve degrees of freedom.

Figure 2 presents a forecast error variance decomposition for each variable. It appears that short-term interest rate innovations, indicated by the black part of each bar, immediately have a substantial effect on banks’ bond holdings, while the impact on the other variables is very limited in the first simulation periods. Apparently, bonds are very sensitive to monetary policy shocks. This is confirmed by Figure 3, which plots the dynamic response of each variable following an unanticipated monetary contraction.7 These findings corroborate the results of Garretsen and Swank

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7Dotted lines are 95% confidence bounds that are calculated using Monte Carlo integration (see
[1998], even though their specification and estimation period are slightly different. After the initial shock of about 25 basis points, the policy variable returns to a level not significantly different from zero within two quarters. Real activity, money and bank loans show a negative reaction, which is consistent with the interpretation of a monetary tightening, although the responses are not immediately significant. Prices do not seem to respond at all, which suggests that nominal rigidities are important. The real effective exchange rate appreciates, and returns to its base level after a year. Banks’ bond holdings, finally, show an immediate and highly significant negative response. Furthermore, looking only at the point estimates, it appears that the response of bond holdings is about four times as large as the responses of loans and money. Together with the evidence of the variance decomposition in Figure 2, this can be interpreted as strong evidence that banks, rather than to adjust their loans portfolio, prefer to use their bond holdings as a buffer stock to offset monetary shocks.

The next relevant question is how to explain the subsequent decrease in bank loans, which becomes significant after a year. Given our observation that the most important reaction of banks after a monetary tightening is to adjust bond holdings, the response of bank loans is likely to be the result of a decrease in demand. In this respect, it is worth to notice that the decrease in aggregate bank loans coincides with the fall in real activity, which also becomes more or less significant after a year.

Doan [1995]), based on 100 draws.
From the bank’s perspective, and consistent with our theoretical framework in Section 2, the response of credit may be attributed to the fact that existing loan contracts cannot be liquidated, or at a high cost. Hence, banks can only reduce the supply of *new* loans, which presumably does not immediately lead to a substantial fall in aggregate loans. Of course, this holds in particular for the banks’ response to a monetary contraction. It should be noticed, though, that our analysis is symmetric with respect to the direction of monetary policy measures, which implies that banks’ response to a monetary expansion mirrors the results presented here.\(^8\)

A disaggregation of total bank loans into corporate lending and household lending, however, suggests that the insignificant response of aggregate lending in the first quarters is the net result of significant responses of these two different types of borrowers in opposite directions (see Figure 4). This may be explained by what is known as the ‘flight to quality’ hypothesis (Bernanke *et al.* [1994]). Two basic ingredients of this hypothesis are (1) heterogeneity among borrowers and (2) increasing demand for short-term credit following a monetary tightening, to compensate for declining cash flows. Since only high quality borrowers will be able to obtain additional credit, while loans supplied to low quality borrowers is reduced, there will be a shift in the quality mix of bank loans. Insofar as our distinction between firms and households matches the difference between high and low quality borrowers, this is consistent with our results. It seems plausible that information asymmetries between banks and households may be greater than between banks and firms or, alternatively, that households are more like small firms in this respect. The latter would be consistent with the findings of Gertler and Gilchrist [1993], who consider the responses of lending to different types of firms as well as households in the US, and conclude that the responses of bank lending to households and small firms following a monetary policy shock are very similar. Like bank loans, M3 shows a different response for both sectors, albeit less pronounced. To some extent, this follows directly from the balance sheet identity which implies that money and credit are positively correlated for each sector. The fact that most of M3 is in the hands of households explains that aggregate M3 eventually shows a negative response.

Figure 5 plots impulse-responses of more detailed VAR specifications for each sector. We use monthly data now, which allows us to include more variables. Again, we looked at systems in which we included German variables as well, but this hardly influenced our results, so we left them out. In addition to the variables in Figures 3 and 4, we also include the long-term interest rate and we split bank loans for each sector into long-term and short-term credit. In order to take the interdependence between the two sectors into account, we include industrial production as well as household expenditures in both sectoral VARs.

\(^8\)Using a very different methodology and sample, Van Ees *et al.* [1998a] find some evidence for asymmetric responses of credit aggregates following expansionary or contractionary monetary policy
Money M3

Bank loans

The first column is copied from Figure 3. The second and third columns plot the responses of similar VARs for the corporate sector and the household sector, in which prices, activity, money and loans are replaced by the corresponding variables of these sectors (see appendix).

Figure 4: Disaggregate data: responses of money and credit (quarterly data)

In both models, the long-term interest rate follows the same pattern as the short-term rate, although its initial response is much smaller. Variance decompositions, which are not reported, show that innovations in the long-term interest have a marked impact on the corporate sector variables, while the influence on household sector variables is negligible, which implies that the open capital market is a relevant factor only for firms.

Prices show initially a positive response, which is in contradiction with the expected result of a monetary contraction, and also with our aggregate model in which prices did not react at all. This perverse response of prices shows up in many VAR-based studies and may be an indication that an important variable is omitted. Including the oil price or a commodity price index, as Sims [1992] suggests, in order to take supply effects into account, did not resolve this price puzzle. Dale and Haldane [1995] suggest that the positive response of prices after a monetary tightening may be explained by increasing variable costs which initially translate into higher prices due to cost mark-up pricing. Whereas the decrease in the real activity measure for our corporate model—industrial production—becomes borderline-significant after more than a year, which is in line with the response of GDP in Figure 3, household expenditures do not seem to respond at all. Apparently, the eventual real effects of monetary impulses are small or insignificant. The fact that households are a net

shocks.
Figure 5: Impulse-responses per sector (monthly data)
receiver of interest payments in the Netherlands (see, for instance, BIS [1995], p. 19) may be responsible for the absence of real effects in the household sector. The corporate sector, by contrast, is a net payer of interest.

The bank balance sheet variables show striking differences between both sectors. First, with respect to long-term loans, the corporate sector does not respond, while loans to households initially fall; the subsequent rise of the latter is insignificant. The results for short-term credit are also quite different: in this case, firms respond by increasing their volume of loans, while the response of households is insignificant, which is in line with the ‘flight to quality’ hypothesis. The explanation of this result may be that declining cash flows induce firms to demand short-term credit. The latter is less relevant for households, who hold only a small part of short-term loans (see Figure 1). The net result is consistent with our earlier observation that during a year after the monetary impulse aggregate credit does not respond significantly, which masks the fact that the loans portfolio of the banking sector shows a shift from households to the corporate sector. Second, money holdings also show a different result for both sectors. For firms, there is no significant response, which implies that they prefer to attract short-term credit rather than to reduce their money holdings. For households, there is a short, negative response. Again, it can be noticed that, according to the balance sheet restriction, bank lending should to some extent mirror money holdings for each sector. The response of firms following a monetary contraction may be interpreted as buffer stock behaviour, which is consistent with the conclusions of De Haan et al. [1992,1994]. Finally, banks’ bond holdings show a clear negative response, which is consistent with our earlier observation that bonds are used as a buffer stock against monetary shocks.

In general, we can conclude that, although banks play a relevant role in the transmission process, bank lending is not likely to be important as a transmission channel of monetary policy. For the corporate sector, short-run credit supply increases after a monetary contraction, which implies that monetary shocks are, at least partly, offset. The fact that we observe a negative, although not very significant, response of real activity implies that monetary policy may operate through the standard interest rate channel. For households, the story is slightly different. We do observe a fall in bank lending following a monetary contraction, but this does not lead to a decrease in real expenditures. Hence, although there may be some scope for a bank lending channel here, it is presumably not an important transmission mechanism.

We performed several robustness checks. We repeated the analysis for a shorter sample, up to 1994, since the last years have seen a large credit expansion in the housing market in combination with easy monetary policy, which may be largely responsible for the observed negative relationship between monetary stance and long-term personal credit. This hardly changed the results, however, and did not affect our conclusions. Further, we experimented with alternative variables. We replaced
M3 by M2 and included several components of consumer expenditures instead of aggregate consumer expenditures. As we reported earlier, we also looked at specifications in which we included German variables in order to obtain a better mean reversion mechanism of the policy variable. Neither of these alternative specifications had much impact on our results. Finally, we included the German short-term interest rate, rather than its Dutch counterpart, as the policy variable, following Garretsen and Swank [1998]. In this case, we found a significant positive response of long-term credit to the corporate sector, instead of no response. However, this does not affect our overall conclusions; it rather strengthens the ‘flight to quality’ interpretation of our results.

3.3 Related literature

Our findings extend the analysis of Garretsen and Swank [1998], which is based on purely aggregate data, by taking differences between types of borrowers into account. Their results can be replicated in a richer setting. Our sectoral approach follows Dale and Haldane [1995] who perform a comparable analysis for the UK. These authors find similar differences in responses of firms and households, but do not address buffer stock behaviour of banks. Further, in contrast to our results, they find significant responses of real activity following a monetary shock, for both sectors as well as GDP.

Our results can be interpreted along the lines of a number of studies on the US (e.g. Gertler and Gilchrist [1993,1994], Oliner and Rudebusch [1996]). The conclusions of these studies are probably more robust than ours since they are based on large sets of individual firm data, whereas we employ a relatively crude distinction between two sectors. Van Ees et al. [1998] investigate financial constraints using a panel of Dutch firm level data, and conclude that these are in particular relevant for certain types of firms, which suggests that a more disaggregated approach may be useful. A possible shortcoming of most of these micro-based studies, however, is that they focus on firms while, at least in the Netherlands, a substantial part of credit is supplied to households.

4 Concluding remarks

In this paper we have analyzed the role of bank behaviour in the transmission of unanticipated monetary policy shocks in the Netherlands. Using VAR analysis, we investigated aggregate effects as well as possible differences between sectors. An important conclusion, which has also been found by Garretsen and Swank [1998], is that banks use their bond holdings as a buffer stock to offset monetary impulses. Credit aggregates show a positive response of short-term loans to the corporate sector.

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9Similar studies on the Netherlands, based on aggregate data, are Kroes [1996], Smant [1997] and Van Ees et al. [1998].
while long-term credit to households falls. To the extent that firms can be considered as high quality borrowers and households as low quality borrowers, this result is consistent with the ‘flight to quality’ hypothesis, which predicts a shift in the quality mix of banks’ loan portfolio. The main implication of our findings is that monetary policy in the Netherlands does not work via a bank lending channel, which is consistent with our \textit{a priori} expectations based on a stylized model of bank behaviour. On the contrary: rather than providing an important transmission channel, banks in the Netherlands are more likely to \textit{reduce} the macroeconomic impact of monetary policy, by insulating their lending activity from monetary shocks. This may partly explain why we hardly find significant real effects of monetary disturbances.

It may be interesting to estimate richer specifications of the banking sector’s balance sheet, for instance by including banks’ non-deposit funding in the analysis. Like bond holdings, banks may use this instrument to offset monetary policy shocks. According to Swank [1994], banks indicate that they will indeed try to attract domestic long-term liabilities following a monetary contraction. Another extension may be to investigate differences between several types of banks, in the spirit of Kashyap and Stein [1997b]. Finally, it would be useful to investigate more explicitly to what extent the Dutch credit market is demand-determined, which is an implication of our findings that is not directly tested.

A Data appendix

All our data are seasonally adjusted except interest rates and the effective exchange rate. Most of the series are taken from the source in seasonally adjusted form, some have been seasonally adjusted by ourself.

- \textit{Bank balance sheet variables}. Source: Dutch central bank (DNB). M3 and bank credit have been disaggregated for firms and households: the sectoral models include the corresponding component of that sector. All series have been corrected for breaks.

- \textit{Real activity, prices}. For the aggregate model, we include real GDP as a measure of real activity, and the implicit GDP deflator as the price index. Both are taken from the IFS database. For the corporate sector, we use industrial production and the producer price index from the IFS. For the household sector, we use the volume of total household expenditures and its corresponding deflator, both taken from Datastream and seasonally corrected with the Census X-11 adjustment routine. In order to compare the magnitude of the responses of these variables among the models, we normalized all activity and price indices by dividing them by their 1990:01 observation.
• Exchange rate, interest rates. In each model, we include the real effective exchange rate, based on unit labour costs, taken from the IFS database. An increase in this variable reflects an appreciation of the Dutch guilder. The short-term interest rate is the three month interbank rate, and the long-term interest rate is the government bond yield, taken from the IFS.

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