FIRM SIZE AND MONETARY POLICY TRANSMISSION – EVIDENCE FROM GERMAN BUSINESS SURVEY DATA

MICHAEL EHRMANN

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Abstract

Using business survey data on German manufacturing firms, this paper provides tests for hypotheses formulated in capital market imperfection theories that predict distributional effects in the transmission of monetary policy. The business conditions of small firms are found to be somewhat more sensitive to monetary policy shocks than those of large firms, also when accounting for demand differences. These effects are reinforced in business cycle downturns.

JEL classification: E52, E32, C32.

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Michael Ehrmann
European Central Bank
DG Research
Kaiserstrasse 29
60311 Frankfurt/Main
Germany
michael.ehrmann@ecb.int

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1 Introduction

Numerous recent publications have been devoted to a theoretical analysis of the various channels of monetary policy transmission.[1] On the empirical side, the evidence is still far from complete. This paper aims to contribute further evidence on two channels of monetary policy transmission, namely the balance sheet and the bank lending channel.

The balance sheet channel is built on the argument that asymmetric information in the credit markets necessitates the use of collateral for borrowing. As a consequence, the availability of credit for firms is dependent on the value of their assets. If credit market conditions are tightened by rising interest rates, this will affect the balance sheet positions of firms: higher interest payments reduce cash flow and higher interest rates lower the market value of assets. A monetary policy tightening can thus possibly leave firms with a restricted access to credit. The firms which are more likely to be affected by this channel are small firms: due to higher informational asymmetries, the amount of collateral they have to pledge is relatively higher. A balance sheet weakening due to a monetary policy tightening can thus imply that they might become credit-constrained.

The bank lending channel comes into play if the central bank has leverage over the volume of intermediated credit in the economy and at least some firms depend on intermediated credit. If the first condition holds, a tighter monetary policy decreases the volume of credit available to borrowers. If the second condition holds, some borrowers cannot substitute intermediated credit with other forms of financing and will be left with a restricted access to finance their investment projects. It is typically assumed that it is easier for large firms to access other, non-intermediated forms of external finance, because the markets possess more information about these firms. Following monetary tightening, it is therefore relatively easy for large firms to substitute intermediated credit with other funds, whereas small firms are less flexible and hence face a restricted availability of funds.

Both channels are reflected in theories of credit market imperfections like those of Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). Several publications like Christiano, Eichenbaum, and Evans (1996) or Gertler and Gilchrist (1994) have provided supportive evidence for the US economy: using firm size as a proxy for capital market access, they do indeed find that small firms are affected more strongly by monetary policy.

The strength of both transmission channels depends on the phase of the business cycle: theory predicts that both are stronger in a downturn. The balance sheet channel becomes more potent because net worth of firms falls in downturns, with a corresponding deterioration of balance sheet positions; the bank lending channel is strengthened because default probabilities rise in

[1] For an overview of those channels see Cecchetti (1995).

a downturn, thus increasing the cost of intermediated credit and starting a flight to quality, which restricts small firms even more than in booms.

Gertler and Gilchrist (1994) show that, indeed, small firms' reactions to shocks to the federal funds rate are dependent on the business cycle position. Perez-Quiros and Timmermann (2000) confirm that the stock returns of small firms are affected more strongly by tightening monetary conditions than those of large firms and that these effects are reinforced if the economy is in a recession.

Whereas the evidence for the US is generally supportive of these effects, the picture for Germany (and other European countries) is much less clear. The recent constributions by Kalckreuth (2003) and Chatelain et al. (2003) conclude that there is some scope for these channels in Germany, but that they are of secondary importance. By splitting firms according to a rating variable that measures their credit worthiness, distributional effects of monetary policy can be identified, whereas the size of firms appears uninformative in this respect. This is in contrast with Audrestsch and Elston (2002), who find firm size to be important. Finally, Siegfried (2000) cannot identify credit channel effects at all in his study.

The data underlying most of the existing studies has two drawbacks. On the one hand, there is often a compositional bias towards large firms. On the other hand, annual balance sheet data, which are often available for small firms, do not allow inference at higher frequencies. The present paper exploits a data set that is not subject to those shortcomings; it includes very small firms (1–49 employees) and is available at a monthly frequency.

A large part of the literature follows Fazzari et al. (1988) by comparing the sensitivity of investment to cash flow across firms with differing degrees of informational asymmetries. However, Kaplan and Zingales (1997) and Kaplan and Zingales (2000) argue that such investment-cash flow sensitivities do not provide useful measures of financing constraints. Rather, the reaction need not be monotonic in the degree of financial constraints. This can be the case if the finance premium of a strongly financially constrained firm reacts less than for a firm which is relatively less constrained. The approach taken in this paper differs from this indirect testing by comparing cash flow sensitivities and thus not prone to the Kaplan and Zingales critique. Although I will follow the literature and classify firms a priori according to the degree of financial constraints (using a size criterion), I will conduct a direct test as to how the firm (namely, its business conditions) is affected by monetary policy.

The remainder of this paper is organized as follows. The data set will be described in Sect. 2. Section 3 explains the testing strategy applied. The subsequent Sect. 4 explores whether small firms are affected disproportionately by monetary tightenings. Section 5 investigates whether the asymmetry arises due to demand or supply side factors. In a further step, Sect. 6 checks for business cycle asymmetries of monetary policy effects. Section 7 concludes.

2 Data Description

Each month, the German Ifo-Institute for Economic Research conducts a business survey among more than 8,000 firms. Of these, approximately 3,000 belong to the West German manufacturing industry and form the subsample used in this paper. Firms are invited to answer questions on their business and demand conditions in the following ways:

- "At present, we consider our business conditions to be i) good, ii) satisfactory (usual for the season), iii) bad"
- "Our demand situation, compared to the last month, has i) improved, ii) remained unchanged, iii) deteriorated"

Boxes are provided next to each answer; the firms have to tick the box according to their choice. For each question, all answers are aggregated to an index variable by subtracting the share of "−"answers (third option) from the share of "+"answers (first option). The indices can therefore take any value between +1 and −1, with the extreme cases occurring when all firms answer with "+" or "−".

The data can be broken down according to firm size, with the classifications depicted in Tab. 1.

Table 1. Sample Breakdown

Size Class	1	2	3	4	5
Employees	1–49	50–199	200–499	500–999	≥1,000
% of Sample	16%	33%	23%	13%	15%

The size sorted data are available from July 1981. The latest observation included in the analysis here is 1998:12, to avoid the problem of a changing monetary policy regime with the introduction of the euro. As an illustration, Fig. 1 shows the business conditions for the largest and smallest firms. Apparently, there is quite some variation of the series across size groups.

Tables 2 to 4 provide some descriptive statistics of the series. They all exhibit a monotonic relationship between the size classes. This monotonicity will reappear in several results throughout the paper and suggests that size is an important factor in explaining firm behavior.

Table 2. Mean of Series

Size Class	1 (smallest)	2	3	4	5 (largest)
Business Conditions	-.118	-.064	-.048	-.020	-.006
Demand	-.091	-.050	-.019	-.013	.010

Table 3. Coefficient of Variation of Series

Size Class	1 (smallest)	2	3	4	5 (largest)
Business Conditions	-141	-323	-425	-1095	-3917
Demand	-109	-220	-568	-885	1240

Table 4. Correlation Coefficients for Different Size Classes

Business Conditions					Demand				
*sc*1	*sc*2	*sc*3	*sc*4	*sc*5	*sc*1	*sc*2	*sc*3	*sc*4	*sc*5
1					1				
97	1				.94	1			
.91	.96	1			.89	.92	1		
.90	.95	.98	1		.81	.86	.90	1	
.77	.84	.93	.94	1	.74	.79	.87	.87	1

A priori, it is not clear whether data series of this kind are actually suitable for an analysis of macroeconomic issues. Firstly, it can be argued that the access to relevant information differs across size classes, thus leading to different response patterns. Secondly, the series contain only perceptions of firms, rather than "hard" and quantifiable facts. Nothing guarantees that the perceptions of firms are, even when aggregated, on average correct. However, there is evidence that the data are free of such biases.

The business conditions index is used, together with a series on firms' business expectations, to construct the "Ifo Business Climate Index", an indicator which is widely used in German business cycle analysis because of its good quality as a leading indicator. Indeed, as is shown in Table 6 in the appendix, the correlations of the data with the business cycle is striking and clearly shows a leading pattern. Business conditions lead deviations from trend in industrial production by one quarter, and have a correlation coefficient of 0.85 for most size classes. The high correlation of all series with the business cycle suggests that they draw a rather accurate picture of the actual business conditions.

Another potential problem with this data could arise if size were correlated with other features, like e.g. the industry affiliation. In such a case, the regressions might reveal industry effects of monetary policy rather than size effects. Although it might be the case that the size distribution differs across industries, it is comforting to know that most industries cover all size classes. Exceptions are 6 out of 27 industries, namely the wood industry, which comprises size classes 1 to 3 only, car manufacturing (size classes 2 to 5 only), ceramics (1 to 4), paper (1 to 4), "other production goods" (3 to 5), and "other consumer goods" (1 to 3). Most of these industries (with the exception of car manufacturing) have a relatively small share in the aggregate industrial production.

Since the data are aggregated across firms, it is not possible to estimate the individual firms' thresholds at which they would have changed their assessment of business conditions sufficiently to also change their answer to the survey. Whereas the series of a single firm follows a step function over time, changing between the three possible answers, this would only be the case for the aggregated series if the thresholds were identical across firms. The smoothness of the series reveals that the thresholds are different for the individual firms, however. The aggregated series can therefore not be used to estimate the threshold value for firms, and whether this depends on firm size, but instead to estimate whether a larger share of small firms experiences a change in business conditions that leads them to change their assessment in the survey.

In any case, the survey data cannot give an estimate of how strongly a firm is affected once it has passed the threshold level. The estimates in this paper might therefore underestimate the potential asymmetries, if not only more small firms are led to report a worsening of their conditions, but their actual conditions also deteriorate by even more than the threshold value.

The data are not only aggregated across firms, but also across the type of answers, since the share of negative answers is subtracted from the share of positive answers. In order to analyze whether this affects the results, all regressions have been performed on the share of positive and negative answers separately, too. All results in the paper are unaffected by this robustness check.

The business survey series are transformed according to $y^* = \ln\left(\frac{1+y}{1-y}\right)$, a monotonically increasing transformation that maps the data from the $[-1,1]$-interval to $[-\infty,+\infty]$; a more detailed explanation is provided in appendix A.1.

3 Testing Strategy

Tests of the balance sheet and bank lending channel need to identify the reaction of credit supply to a monetary policy shock. In this paper, as in Gertler and Gilchrist (1994), we will employ the heterogeneity of firms to do so. The underlying assumption, as mentioned in the introduction, is that small firms are more prone to asymmetric information problems and more dependent on bank loans than large firms. A monetary-policy-induced decrease of credit supply should therefore lead to a worsening of business conditions that is larger for small firms than for large firms. The main difficulty, however, is to ensure that the bank lending channel is the only possible explanation for such a differential reaction.

Gertler and Gilchrist analyse the reaction of sales to a monetary policy shock. A larger drop of sales in small than in large firms, however could also be explained by subcontracting: if large firms contract out to small firms when demand is high, but maintain the whole business in times of weak demand, then this could also imply a stronger drop of sales for small firms after a monetary tightening. Similarly, business conditions for small firms would deteriorate by more than those for large firms in such a case. To overcome this identification problem, Gertler and Gilchrist analyze the reaction of inventories: if financial frictions exist, then small firms should face more difficulties in smoothing production when sales decline and as such should be forced to shed inventories. In this paper, a different strategy is used. Since firms reveal their demand situation, the effects of subcontracting should be reflected in the demand situation of small firms. Once demand is controlled for, any additional disproportionate decrease in business conditions cannot be explained by subcontracting.

A similar identification problem arises if small firms are concentrated in cyclical industries. Again, this possibility is accounted for by the demand variable. Having controlled for demand, the cyclicality of the industry has been corrected for.

A third issue mentioned by Gertler and Gilchrist could arise if small firms have more flexible technologies. For their sales and inventories data, this is potentially interesting, since a more flexible firm can adjust inventories to movements in sales more quickly. For the business conditions, this is not an issue, since this scenario would imply that a small firm, with a faster adjustment, reports depressed business conditions for a shorter period only. This effect would therefore counteract the expected stronger reaction of small firms' business conditions.

As an additional check, Gertler and Gilchrist suggest testing for asymmetries across the business cycle. This approach will be implemented here as well. The credit constraints should be more important in recessions than in booms, which would imply that the reaction of small firms' business conditions is larger during recessions than it is during booms.

Although the Ifo survey contains data on inventories, they will not be exploited here, because the actual level of inventories, as analyzed in Gertler and Gilchrist, is conceptually different from the according survey data. In the survey, firms are asked whether they consider their level of inventories too small, sufficient, or too big. If a firm accumulates inventories, this can be an active process because it perceives the present level of inventories as too low, or because inventories are treated as some sort of residual: with decreasing demand, a firm might want to smooth production and therefore accumulates inventories. Although we would see an accumulation of inventories in both cases, the answers in the business survey would be different.

The next sections will first estimate whether business conditions show a differential response according to size classes. Subsequently, the control for demand will be introduced. Eventually, it will be analyzed whether the effects of monetary policy on business conditions differ across business cycle phases.

4 Monetary Policy and Business Conditions

The effects of monetary policy will be analyzed with Structural Vector Autoregressions (SVARs). In particular, the identification approach suggested by King, Plosser, Stock, and Watson (1991) (KPSW) will be employed. In their framework, monetary policy can be modelled in terms of shocks to cointegration relations and as such need not be restricted to shocks to single variables. As a matter of fact, a monetary policy shock will be modelled as a shock to the interest rate and (with opposite sign) to the money growth rate. A more detailed discussion of both SVAR models and the KPSW procedure is provided in appendix A.2

4.1 The Baseline Model

The estimations start with a simple baseline model to understand how business conditions of firms are affected by monetary policy. Later on, the model will be extended to investigate the differential impact of monetary policy on firms of different size.

The baseline model consists of a four-variate VAR with

$$X_t = [Dm_t \quad bc_{i,t} \quad i_t \quad \pi_t]' ,$$

where X_t includes the growth rate of M3 (Dm_t), business conditions of size class i ($bc_{i,t}$), a three month's money market rate (i_t) and producer price inflation (π_t).[2] The data are monthly and range from 1981:7 to 1998:12, covering a sample of 210 observations. Since the aim of this paper is to identify effects over the business cycle, seasonality and long-run trends are eliminated by the inclusion of seasonal dummies and the use of detrended variables. The latter is achieved by simply regressing the data on a linear trend. Six lags are included in the models, which are estimated as Vector Error Correction models (VECMs) to allow for the possibility of cointegration. Stability tests on the VARs do not show any signs of structural breaks.

This model is estimated separately for the business conditions of each size class.[3] The cointegration analysis for this baseline model suggests the existence of cointegration relations (see Table 7 in the appendix). Three possible relations come to mind: the business conditions should be stationary, because they form a business cycle indicator and as such should be mean reverting;

[2] All variables, with the exception of interest rates, are in logarithms (the growth rates are annualized differences of the variables in logarithms). Producer price inflation was chosen because it is not affected by indirect tax increases. The consumer price index for Germany is greatly distorted by indirect tax increases and one-off effects of German unification, which would require the introduction of several dummy variables in a VAR.

[3] Although this could imply that each model estimates a different monetary policy shock, a direct comparison shows that they are nearly identically estimated.

economic theory suggests furthermore that real interest rates are stationary. The third cointegrating vector assumes that in the long run, money growth (possibly money growth exceeding some constant rate) equals inflation, which imposes superneutrality of money.[4] A cointegration rank of 3 seems plausible a priori, and the test statistics can be read in this way. In the following, the existence of 3 cointegration relations is therefore assumed, with the cointegrating vectors formulated as follows:

	Dm_t	$bc_{i,t}$	i_t	π_t
β_1' :	0	1	0	0
β_2' :	0	0	1	-1
β_3' :	1	0	0	-1

This hypothesis cannot be rejected in a corresponding test, as shown in Table 8 in the appendix. With this specification of the cointegrating vectors, the impulse response analysis of the system can now be performed. The monetary policy shock will be identified within the transitory subsystem, because after some time all variables should return to baseline (note that this already implies an identification restriction).[5] To identify the monetary policy shock within this subsystem, it is assumed that it affects neither business conditions nor inflation within the same month.

The resulting impulse responses, presented with 90% error bands, are provided in Fig. 2 in the appendix. The monetary policy shock is found to be a combination of a shock to the money growth rate and to interest rates: a decrease in money growth plus an increase in interest rates constitute a contractionary monetary policy shock. This shock decreases inflation and business conditions. All impulse responses are as expected a priori, which indicates that the baseline model has succeeded in identifying monetary policy innovations.[6] However, these models cannot estimate whether a monetary tightening might have asymmetric impacts on firms of different size. An extended model is therefore called for.

[4] This is derived and shown to be empirically relevant in Crowder (1997).

[5] Actually, the persistent shock is a nominal shock, too. It affects the nonstationary variables in the VAR, i.e. permanently alters the levels of inflation, money growth and/or interest rates. The interpretation of such a shock could be one of a changing inflation target of the Bundesbank. However, such a shock is difficult to reconcile with the actual pattern of the Bundesbank's monetary policy; I consider it more reasonable to assume that the nonstationarity of the series is a matter of the sample size rather than one of actual properties of the time series.

[6] The results throughout this paper are robust to a substitution of M3 with M2, or the inclusion of exchange rates.

4.2 Asymmetric Effects of a Monetary Tightening Across Size Classes

In order to test for possible asymmetries across size classes, the difference of responses is included as an additional variable. To give an example, the business conditions of the largest firms are subtracted from those of the smallest firms ($\Delta_{15,t} = bc_{1,t} - bc_{5,t}$). If both business conditions react in a parallel way to interest rate shocks, no significant response of the additional variable should be detectable. If relatively more small than large firms answer that their business conditions have deteriorated, $\Delta_{ij,t}$ should become negative.

The extended VAR spans $X_t = [\Delta_{ij,t} \quad Dm_t \quad ip_t \quad i_t \quad \pi_t]'$.[7] $\Delta_{ij,t}$ as the difference of two stationary variables is by definition itself stationary, which implies a new cointegrating vector, namely the new variables themselves. As before, the model is estimated several times, with $\Delta_{ij,t}$ being substituted and the other variables held constant. Ten different combinations of $\Delta_{ij,t}$ are possible, all of which are in turn included in a VAR. The combinations are:

$$\left\{ \begin{array}{rrrr} bc_{4,t} - bc_{5,t} & bc_{3,t} - bc_{5,t} & bc_{2,t} - bc_{5,t} & bc_{1,t} - bc_{5,t} \\ & bc_{3,t} - bc_{4,t} & bc_{2,t} - bc_{4,t} & bc_{1,t} - bc_{4,t} \\ & & bc_{2,t} - bc_{3,t} & bc_{1,t} - bc_{3,t} \\ & & & bc_{1,t} - bc_{2,t} \end{array} \right\}$$

The results of this exercise are reported in Fig. 2 in the appendix. A tightening of monetary policy leads to distributional effects which are, however, estimated only at low levels of significance. The business conditions of all size classes worsen (see above), but those of smaller size classes deteriorate more after approximately 18 months. The point estimates of responses of $\Delta_{ij,t}$ are then negative for every single measure. This implies that the business conditions of smaller firms take longer to return to baseline than those of larger firms, which would mean that the transmission lags of the balance sheet and bank lending channel are relatively long. This is not implausible, however, since both channels operate through the banking system, which might add further reaction and transmission lags.

Additionally, the impulse responses evolve monotonically across size classes. Firms become more heterogeneous when moving from the left to the right in the matrix of responses, as well as when moving up from the bottom. In both directions, and for every single row and column, the point estimates of the impulse responses become more pronounced step by step.

[7] Detrended industrial production, ip_t, replaces the business conditions, $bc_{i,t}$, used so far for two reasons: first, to have an identical output variable across models and second, to avoid using the business conditions of a size class twice, in $bc_{i,t}$ as well as in $\Delta_{ij,t}$. The results go through with using a $bc_{i,t}$-variable instead, too.

5 Demand Side Effects

The original hypothesis that small firms are affected more strongly by monetary policy shocks stems from capital market imperfection theories and as such is concerned with financial factors. The evidence found in the preceding section supports this hypothesis, but cannot reveal whether the asymmetry indeed arises due to financial factors. If the business survey included questions on the financial situation of firms, the hypothesis could be tested directly. Unfortunately, this is not the case. The survey question on the current demand situation of firms can be helpful to single out other potential explanations, however.

Potentially, both the supply side as well as the demand side situation of firms should enter the evaluation of current business conditions. The business conditions of size class i can thus be described as a weighted sum of the two factors (possibly with some intercept α_i and some error term $\varepsilon_{i,t}$):

$$bc_{i,t} = \alpha_i + \omega_i dem_{i,t} + (1 - \omega_i) sup_{i,t} + \varepsilon_{i,t}$$

The constraints imposed by the data set are that $sup_{i,t}$ is not observable – whereas $dem_{i,t}$ is. Additionally, we do not know the weights ω_i. It is easy to see, however, that regardless of the weighting, responses of $bc_{i,t}$ to monetary policy shocks that exceed those of the responses of $dem_{i,t}$ must stem from supply side factors (since $0 \leq \omega_i \leq 1$). I will make use of this property as follows: the last model is extended to include the relative demand positions. The impulse responses of relative business conditions and demand situations are then compared: if the former are bigger than the latter, it can be concluded that supply-side issues create asymmetry, too.

A model specification with a demand variable is useful for yet another reason. The Ifo survey data have been criticized for a bias towards the demand side. A survey conducted by the Ifo Institute in 1976 found that the respondents often deal in their regular business with the firm's sales, and thus give a biased weight to demand factors. Financial factors, the focal point of this paper, are therefore somewhat underrepresented. By including a demand variable in the VAR, it is possible to check whether last section's findings are robust. Once demand asymmetries across size classes have been accounted for, any asymmetries on top of this make a strong case for supply-side and probably financial factors.

To check whether the demand variable itself responds as expected to a monetary policy shock, impulse responses are first calculated for the baseline VAR $X_t = [Dm_t \quad dem_{i,t} \quad i_t \quad \pi_t]'$. $dem_{i,t}$ denotes demand and is varied to cover all five size classes. The results of the cointegration analysis and the tests of the restrictions on the cointegrating vectors can be found in the appendix. A cointegration rank of $r = 3$ is maintained for all models, with the cointegrating vectors being the demand variable, the real interest rate and superneutrality of money (see Tables 9 and 10). Figure 4 plots the impulse responses of this baseline VAR. Following a contractionary monetary policy shock, demand declines for firms of all size classes, as expected.

In order to test for asymmetric effects, the relative demand situation is included in the model of the preceding section. The VAR now comprises $X_t = [\Delta_{ij,Dt} \quad \Delta_{ij,t} \quad Dm_t \quad ip_t \quad i_t \quad \pi_t]'$, where $\Delta_{ij,Dt}$ denotes the relative demand position of firms, in contrast to $\Delta_{ij,t}$ which represents the relative business conditions of firms. The model is again estimated for all ten possible combinations of the delta-variables. The corresponding impulse responses can be found in Figs. 5 and 6. The relative demand positions of firms deteriorate after a monetary policy tightening, which means that again there is a bias which is unfavorable for small firms, although this specification has not been able to improve the significance of the findings. Again, each point estimate becomes more pronounced moving up the columns or moving to the right in the rows of Fig. 5.

How does the picture on the relative positions of firms change with respect to their business conditions? Comparing Fig. 5 with Fig. 6, it turns out that, indeed, the responses of relative business conditions are indeed much stronger than those of demand positions. Interestingly, the responses of relative business conditions hardly change when the model is extended: Figs. 3 and 6 are nearly identical. The conclusion from this exercise is that demand also reacts more strongly for small firms; however, demand tells only part of the story. We are left with another cause of asymmetry that must stem from the supply side.

6 Business Cycle Asymmetry

As stated in the introduction, theories of the credit channel maintain the hypothesis that the distributional effects of monetary policy actions should be more pronounced in business cycle downturns. In the following, I will test for these effects, but two caveats should be mentioned beforehand.

Firstly, the data sample ranges from 1981:7 to 1998:12 and inspection of Fig. 1 reveals that over this sample period the German economy went through roughly 1.5 cycles. The evidence to be extracted from this small sample has to be taken with caution.

Secondly, the German economy is often referred to as a bank-based system. Small firms in particular often have a close link to one bank, their “Hausbank”. Theory suggests that small firms allow one single bank to gain such an influential position only because they expect advantages in other areas. For example, one of the possible gains a small firm might achieve in a close banking relationship is interest rate smoothing: a bank might be willing not to pass on a monetary-policy-induced interest rate increase to a close customer. This effect is probably strongest in times when the borrower would have difficulties with rising interest rates, i.e., in periods of low growth. Relationship lending can thus weaken the incidence of business cycle asymmetries to quite some extent.

6.1 Estimation Strategy: Regime-Dependent Impulse Responses in a Markov-Switching Model

In order to test for such business-cycle-related asymmetries, I will calculate regime-dependent impulse responses in a Markov-switching model.[8] This estimation procedure consists of two stages.

In the first stage, an unrestricted VAR is estimated that allows for Markov-switching regimes. Since the hypotheses to be tested are conditional on the business cycle, it is essential that the Markov-switching regimes capture the states of the business cycle. This first stage yields distinct parameter sets: one describes the economy in a business cycle expansion; the other set is valid if the economy is in a contractionary business cycle phase.

These two sets of parameters are then used in a second stage where structure is imposed by applying the usual identification restrictions, for each regime separately, and impulse response analysis is performed. The resulting impulse responses are conditional on the state of the economy, and as such disentangle the effects of monetary policy shocks for expansionary and contractionary business cycle phases.

The Markov-switching model employed in the first stage was originally introduced by Hamilton (1989) . To achieve distinctly shaped impulse responses for the two regimes, it is necessary to extend his specification beyond a mere mean-switching model. State-dependent autoregressive parameters will give rise to different shapes of the impulse responses, whereas a state-dependent variance–covariance matrix will lead to distinct impact effects of the shocks.

Impulse responses conditional on the state of the economy are of course a ceteris paribus experiment. The economy is in a given regime when the monetary policy shock hits the system, and the effects traced by looking at impulse responses assume that, throughout, the economy does not switch regimes.[9] In this way it is possible to test the theoretical predictions, which themselves are conditional: the transmission channels are claimed to be stronger during downturns than during expansions.

Of course, the analysis is a pure thought experiment. Given a probability of staying in one regime of, say, .95, the expected probability of still being in the same regime some 48 months later is merely .09 – so one would not really expect to stay in the same regime all the time for which the impulse responses are actually being calculated. The impulse responses are nonetheless a useful tool. As long as the economy stays in the same regime, they are valid – so even if the full trajectory is not being realized, the periods up to the change in regime are characterized by the conditional impulse responses.

[8] See Ehrmann et al. (2003) for a more detailed exposition of the estimation strategy.

[9] This excludes any analysis of how effective a monetary policy shock can be in moving the economy from one state to the other.

6.2 Model Set-up

To keep the model as parsimonious as possible, the number of regimes chosen is two. In addition, the number of variables in the VAR is reduced. It is not feasible in this context to estimate large-dimensional systems as in the preceding sections. The reduction is carried out in two steps. Firstly, it turns out that a cointegrated VAR with $X_t = [bc_{i,t} \quad i_t \quad \pi_t]'$ with the KPSW identification scheme gives reasonable impulse responses, too: business conditions deteriorate after a shock to the interest rate, and inflation falls. The informational content has decreased of course, because now it is no longer possible to identify the liquidity effects of monetary policy.

A second reduction is possible because in the very special case analyzed here, where the variables of interest are stationary, the model specification can be reduced from a full-blown VECM with KPSW's identification scheme to a simple VAR with stationary variables only, where the identification scheme follows a Choleski decomposition. The two models simulate the same shocks in this case: A KPSW model simulates shocks to the cointegration relations

$$\beta' X_t = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & \text{-}1 \end{pmatrix} \begin{pmatrix} bc_{i,t} \\ i_t \\ \pi_t \end{pmatrix}$$

where the monetary policy shock is a shock to the second cointegrating vector, i.e., to the real interest rate. An equivalent shock can be modelled in a VAR which includes $bc_{i,t}$ and the real interest rate r_t directly.

Both in KPSW with two cointegration relations and in the stationary VAR, one identification restriction has to be imposed. The restriction that a monetary policy shock cannot affect business conditions contemporaneously is imposed in a VAR with a Choleski decomposition by ordering real interest rates last.

The business conditions of firms define the business cycle; if they fall, the economy is in a contraction; if they rise, the business cycle position is expansionary. This implies that models for the different size classes would define a different business cycle. To ensure some stability, each model therefore includes the business conditions of the largest firms and additionally those of firms of a different size class. This leads to the model set-up

$$\begin{pmatrix} bc_{i,t} \\ bc_{5,t} \\ r_t \end{pmatrix} = \begin{pmatrix} \beta_1(s_t) \\ \beta_2(s_t) \\ \beta_3(s_t) \end{pmatrix} + B_1(s_t) \begin{pmatrix} bc_{i,t-1} \\ bc_{5,t-1} \\ r_{t-1} \end{pmatrix} + B_2(s_t) \begin{pmatrix} bc_{i,t-2} \\ bc_{5,t-2} \\ r_{t-2} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{pmatrix} \quad (1)$$

where $\varepsilon_t \backsim iid \quad N(0, \Sigma)$. The state transition probabilities are assumed to follow a first-order Markov chain:

$$p_{ij} = \Pr(s_{t+1} = j | s_t = i), \quad \sum_{j=1}^{2} p_{ij} = 1 \quad \forall i, j \in \{1, 2\} \quad (2)$$

Some restrictions are imposed to decrease the number of switching parameters: none of the autoregressive parameters in the interest rate equation is switching, and the variance–covariance matrix is not state-dependent.

6.3 Empirical Results

In such a set-up, it is a priori not sure whether the regimes picked by the algorithm are actually related to the business cycle. Any kind of regime that shows best fit, be it characterized by distinct intercepts, autoregressive parameters, or some combination, can emerge. Nonetheless, the regimes picked can indeed be characterized as business cycle downturns and expansions. To take an example, in the model with $bc_{2,t}$ and $bc_{5,t}$ the estimated mean for $bc_{5,t}$ is $-.23$ in regime one, and .09 in regime two ($-.21$ and .04 for $bc_{2,t}$). Figure 7 in the appendix reports the according regime probabilities and compares them with the business conditions variable $bc_{5,t}$. The fit of regimes to expansions and contractions is relatively close: regime 1 spans from peaks to troughs and therefore indicates a business cycle contraction, whilst regime 2 is well characterized as an economic expansion. The characterization of business cycle regimes is very close to those found in other, univariate Markov-switching models, e.g. in Krolzig and Toro (2000). The matrix of switching probabilities is

$$P = \begin{pmatrix} 0.92 \; 0.08 \\ 0.04 \; 0.96 \end{pmatrix}$$

Two lags prove to be sufficient to achieve a well-specified VAR. This shows that the fit of the models is much better in a Markov-switching framework than when neglecting it; in the standard VAR models, a lag length of six was needed. The results of mis-specification tests following Hamilton (1996) can be found in the appendix. The restrictions imposed on the autoregressive parameters of the interest rate equation are accepted with a p-level of 0.65.

In the second stage of the procedure, structure is given to the unrestricted MS-VAR. Figure 8 graphs the impulse responses to a monetary policy shock conditional on the state of the economy. In both regimes, a tightening of monetary policy leads to a deterioration of business conditions for firms of all size classes. Not unexpectedly, the impulse response functions are estimated rather imprecisely. This is especially the case for regime 1, which is estimated on very few observations. When interpreting the point estimates, however, it is interesting to compare the responses for a given size class across the two regimes. For some size classes, there does not seem to be any difference, whereas firms of size class one face a stronger deterioration of business conditions when the economy is in a downturn. The magnitude of the maximum effects more than doubles: from -3.5 to -7.7. A direct comparison across size classes is provided in the Table 5, which calculates the amplification of responses in contractions relative to expansions (in the example of size class one: $\frac{-7.7}{-3.5} = 2.2$). As predicted by theory, the effect of an interest rate shock on business conditions of the smallest firms is stronger in a downturn than in an expansion, although this finding is subject to a caveat regarding its statistical significance.

Table 5. Amplification of Responses in Business Cycle Downturns

Size Class	1	2	3	4	5
Amplification Factor	2.2	0.7	1.0	1.7	1.0

7 Conclusion

This paper has provided empirical tests for hypotheses formulated in capital market imperfection theories, claiming a higher exposure of small firms to monetary policy tightenings when compared to large firms. The data set analyzed consists of firms' aggregated answers from a business survey. The data is sorted into size classes, ranging from firms with 1–49 employees to firms with more than 1,000 employees. Thus, a sample bias towards large firms which is present in many data sets is avoided. The business survey is conducted on a monthly basis, which allows for an analysis at a much higher frequency than the usual data sets on small firms (mostly annual balance sheet data or quarterly financial reports). The downside of the data set is possible ambiguities, because the survey questions concern non-quantifiable items such as the general assessment of business conditions. It has been shown, however, that the series possess good leading indicator qualities and correlate closely with the business cycle components of industrial production. Therefore, the data quality can be considered as adequate for research on macroeconomic issues.

The empirical results support theories of asymmetric monetary policy effects. The business conditions of all firms deteriorate after a monetary tightening, but those of small firms do so relatively more. As a consequence, small firms are hit disproportionately strongly by interest rate increases; this shift in their relative position causes distributional effects of monetary policy in that the burden of adjustments is unevenly shared between firms of different size. Although at modest levels of significance, it has furthermore been shown that these asymmetries are augmented in business cycle downturns. Compared to expansions, the distributional effects are more pronounced.

An analysis of demand-side factors has been performed in order to distinguish supply-side from demand-side effects. After accounting for differences in the relative demand situations of small vs. large firms, there are still distributional effects of monetary policy detectable. Demand-side factors can thus tell only part of the story, with the bulk being left for supply-side factors. Even though it was not possible to test the importance of financial issues with the available data, this is the main criterion that comes to mind when thinking about uneven effects of interest rate changes. The empirical findings of this paper therefore support theories which predict asymmetric effects of monetary policy and cannot reject theories that attribute such effects to financial factors.

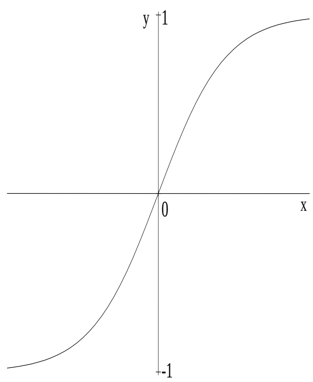
A Appendix

A.1 Transformation of Business Survey Data for the Empirical Analysis

The transformation applied to the business survey data series is based on the assumption that the data follows a logistic model. Most of the time, it can be expected that the variables cluster around medium values in the range, say, of $[-.5, .5]$. Only if the macroeconomic conditions become very (un-)favourable can it be expected that the series come close to their extreme values of ± 1. In order to make 100% of all firms answer that times are worse/better, the conditions must be very severe, especially because the data are not disaggregated according to industry. Indeed, the actual range of the series is far from hitting the borderline cases. This means, however, that the trajectories of the business survey series follow the model

$$y_t = 2\frac{e^{x_t'\beta+\varepsilon_t}}{1+e^{x_t'\beta+\varepsilon_t}} - 1, \tag{3}$$

where the x_t are the usual explanatory variables of a regression model. The multiplication by factor 2 and the subtraction of 1 ensure that the data actually lie in the range $[-1, 1]$ (for $x_t'\beta + \varepsilon_t \to \infty$, $y_t \to 1$; for $x_t'\beta + \varepsilon_t \to -\infty$, $y_t \to -1$). Graphically, the model assumed for the business survey data looks as follows:



Let $a_t = e^{x'_t\beta+\varepsilon_t}$. Thus (3) simplifies to

$$y_t = \tfrac{2a_t}{1+a_t} - 1$$
$$y_t + y_t a_t = 2a_t - 1 - a_t$$
$$a_t(1 - y_t) = 1 + y_t$$
$$a_t = \tfrac{1+y_t}{1-y_t}$$
$$e^{x'_t\beta+\varepsilon_t} = \tfrac{1+y_t}{1-y_t}$$

By applying the transformation $y_t^* = \ln\left(\frac{1+y_t}{1-y_t}\right)$ it is possible to estimate a linear regression model

$$y_t^* = x'_t\beta + \varepsilon_t \tag{4}$$

A.2 The KPSW-Approach to Identification in Structural Vector Autoregressions

Structural Vector Autoregressions (SVARs) go back to the seminal article by Sims (1980). They assume that the economy can be described by a dynamic, stochastic, linear model of the form:

$$A_0X_t = A_1X_{t-1} + ... + A_kX_{t-k} + \mu_t = A(L)X_{t-1} + \mu_t \tag{5}$$

with $\mu_t \sim iid \quad N(0, \Sigma_\mu)$, where X_t represents an $nx1$-vector of endogenous variables, including one or several instrument variables, and L denotes the lag operator. The estimation proceeds with the reduced form

$$X_t = C_1X_{t-1} + ... + C_kX_{t-k} + \varepsilon_t = C(L)X_{t-1} + \varepsilon_t \tag{6}$$

with $C_i = A_0^{-1}A_i$ and $\varepsilon_t = A_0^{-1}\mu_t$. Estimates can be found for the coefficient matrices C_i and the variance–covariance matrix of the disturbances ε_t, Σ_ε. However, of interest are the parameters in the matrices A_i and Σ_μ, which are exactly identified if n^2 parameters are restricted. A first set of restrictions is found by the assumption of uncorrelated structural errors (i.e., Σ_μ diagonal) and by normalising the diagonal elements to unity, yielding $\Sigma_\mu = E(\mu_t\mu_t^{'}) = I_n$, which imposes $n(n{+}1)/2$ restrictions. Hence, further $n(n{-}1)/2$ restrictions are needed. Sims (1980) used a recursive structure to achieve identification, whereas subsequent contributions extended the range of identification schemes by restricting parameters in various matrices of the system. Amongst these are King, Plosser, Stock, and Watson (1991). They have shown that cointegration properties of the data can be used for identification purposes. A cointegrated VAR model, which is in its Vector Error Correction format (See Johansen (1995), pp. 45–49):

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \varepsilon_t \tag{7}$$

has the Granger representation

$$X_t = C \sum_{i=1}^{t} \varepsilon_i + C^*(L)\varepsilon_t + A \tag{8}$$

where A depends on initial values, $\beta' A = 0$, and $C = \beta_\perp(\alpha_\perp^{'} \Gamma \beta_\perp)^{-1} \alpha_\perp^{'}$ with $\Gamma = I - \sum_{i=1}^{k-1} \Gamma_i$. Equation (8) shows that the representation in levels is composed of two parts, the non-stationary common trends $\alpha_\perp^{'} \sum_{i=1}^{t} \varepsilon_i$ and the stationary part of $C^*(L)\varepsilon_t$.

The idea behind KPSW is to decompose the shocks ε into r shocks that have only transitory effects (on the levels of the variables), and $n - r$ shocks with permanent effects (with r denoting the number of cointegration relations). This is achieved by rotating the system by premultiplying certain matrices. The new set of variables Y is

$$Y_t = \begin{pmatrix} SX_t \\ \beta' X_t \end{pmatrix}. \tag{9}$$

The matrix S has to satisfy $SC \neq 0$. It follows that the new set of variables consists of $n - r$ non-stationary and r stationary variables. The stationary variables are identical to the cointegrating vectors; their stationarity follows because $\beta' C = 0$ and $\beta' A = 0$:

$$\beta' X_t = \beta' \beta_\perp (\alpha_\perp^{'} \Gamma(1) \beta_\perp)^{-1} \alpha_\perp^{'} \sum_{i=1}^{t} \varepsilon_i + \beta' C^*(L)\varepsilon_t + \beta' A = \beta' C^*(L)\varepsilon_t. \tag{10}$$

This system need not be identified fully; partial identification of either the transitory or the persistent shocks is also possible. This amounts to the imposition of $r(n - r)$ identification restrictions by setting the according covariances of the shocks to zero. These restrictions have been tested for by the test for the cointegrating rank. Instead, however, a different kind of identification restriction is needed, namely a decision as to which part of the system the supposed shock is to be found (like in the context of the present paper, where the monetary policy shock is identified in the transitory subsystem). This restriction cannot be tested and has to be justified by economic theory.

To identify the subsystems, additional untested identification restrictions are necessary. If only the shocks with permanent effects are of interest, then $(n - r)(n - r - 1)/2$ additional identification restrictions are needed. In particular, where there are $r = n - 1$ cointegration relations, no additional identification restrictions have to be imposed. Should the shocks of interest be the transitory ones, then $r(r - 1)/2$ additional restrictions are sufficient.

A.3 Test Statistics

Table 6. Cross-Correlation of Business Conditions with Industrial Production, Quarterly Bandpass-Filtered Variables

	-6	*-5*	*-4*	*-3*	*-2*	*-1*	*0*	*1*	*2*	*3*	*4*	*5*	*6*
bc1	-.69	-.66	-.52	-.26	.08	.42	.67	**.78**	.74	.60	.43	.27	.15
bc2	-.46	-.30	-.08	.20	.48	.70	.83	**.85**	.76	.61	.43	.24	.08
bc3	-.51	-.36	-.13	.15	.44	.68	.82	**.85**	.78	.64	.47	.30	.16
bc4	-.56	-.42	-.19	.10	.41	.67	.82	**.85**	.78	.64	.47	.30	.14
bc5	-.58	-.45	-.22	.08	.40	.67	.83	**.85**	.76	.61	.43	.26	.11

For lag k, the correlations are defined between output$_t$ and business conditions$_{t-k}$. Hence, a positive k indicates the lead of a variable with respect to the business cycle. The variables are: business conditions for firms of size class 1 (bc1) to 5 (bc5), where 1=smallest, 5=largest.

Table 7. Trace Statistics for the Test of Cointegration Rank of the Baseline Model

Model	$bc_{1,t}$	$bc_{2,t}$	$bc_{3,t}$	$bc_{4,t}$	$bc_{5,t}$
$r = 0^a$	92.14	90.61	97.30	94.73	99.08
$r = 1^b$	50.87	48.08	51.12	49.84	56.60
$r = 2^c$	21.70	20.66	24.72	23.07	27.22
$r = 3^d$	4.37*	4.83*	5.70*	7.30*	6.19*

^{a} critical values 95%: 53.42; ^{b} 34.80; ^{c} 19.99; ^{d} 9.13

Table 8. Test for Three Cointegrating Vectors in the Baseline Model: $bc_{i,t}$, Real Interest Rates and Superneutrality of Money

Model	$bc_{1,t}$	$bc_{2,t}$	$bc_{3,t}$	$bc_{4,t}$	$bc_{5,t}$
$\chi^2(3)$	6.80	5.81	4.52	3.49	5.83
p-value	0.08	0.12	0.21	0.32	0.12

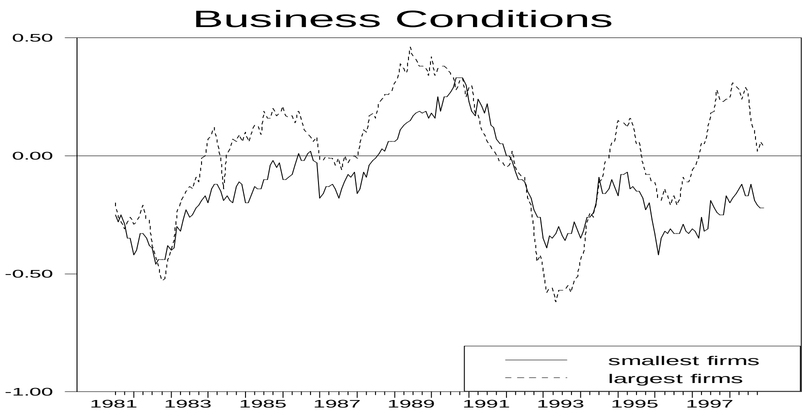


Fig. 1. Business Conditions of Firms of Size Class 1 (Smallest) and 5 (Largest)

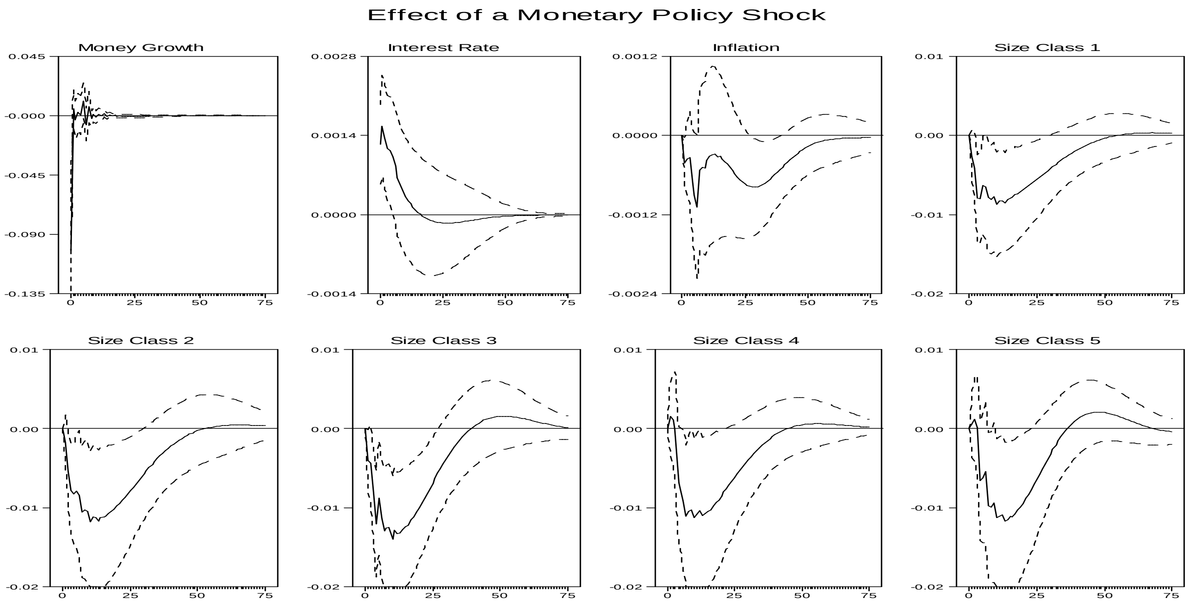


Fig. 2. Responses to a Monetary Policy Shock, Baseline Model

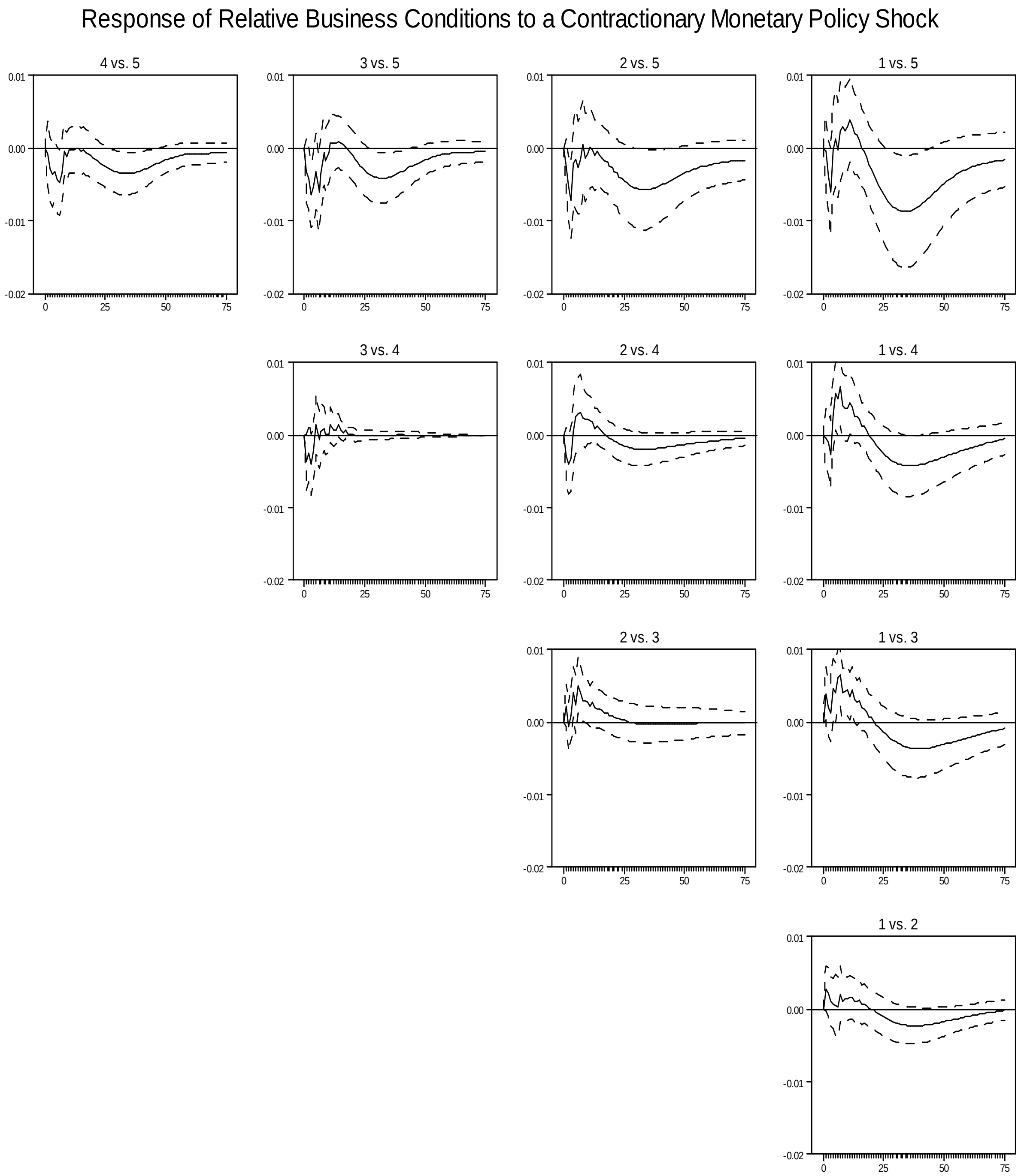


Fig. 3. Responses of the Relative Business Conditions of Firms ($\Delta_{ij,t}$) to a Contractionary Monetary Policy Shock

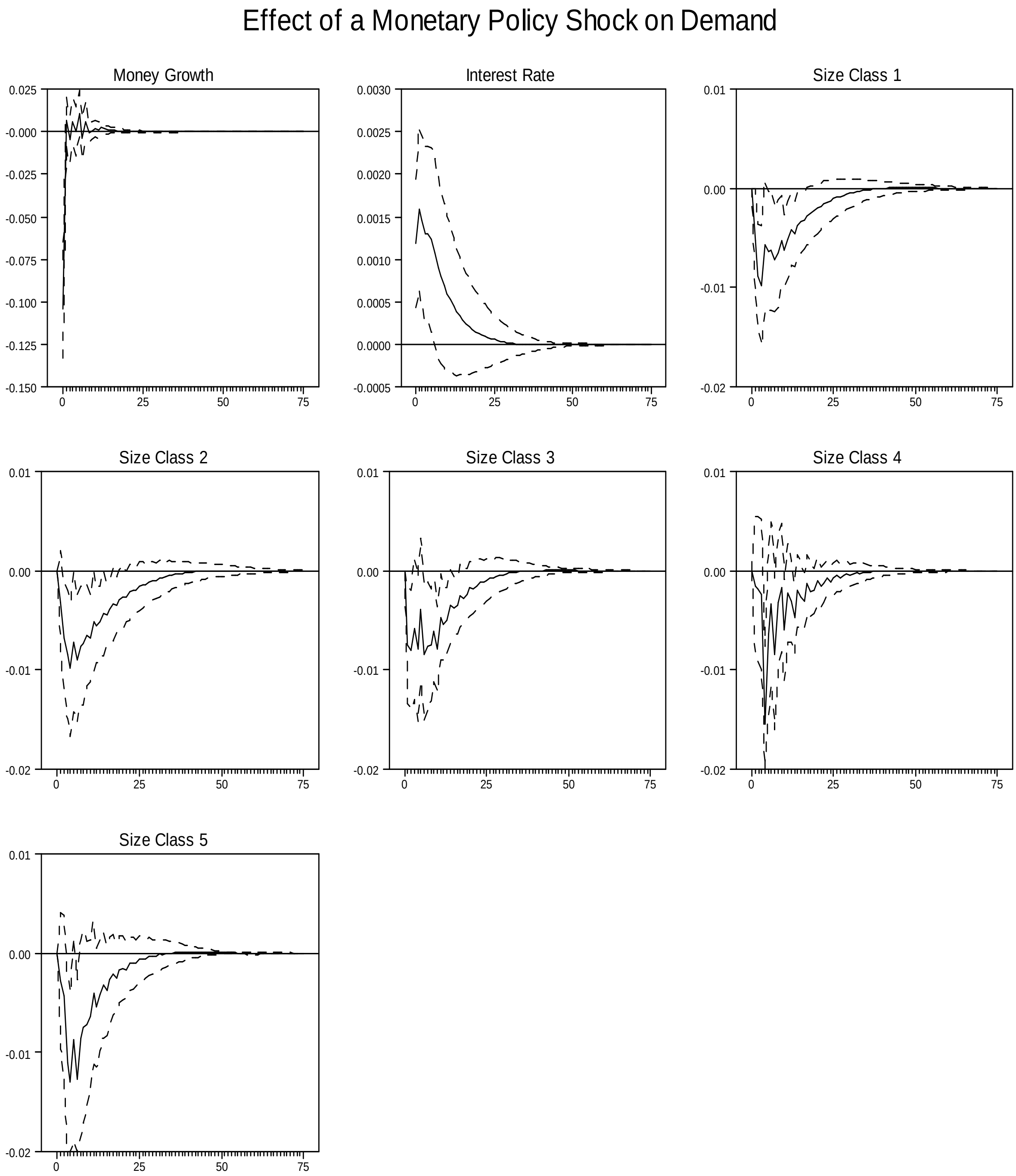


Fig. 4. Responses of Demand to a Monetary Policy Shock

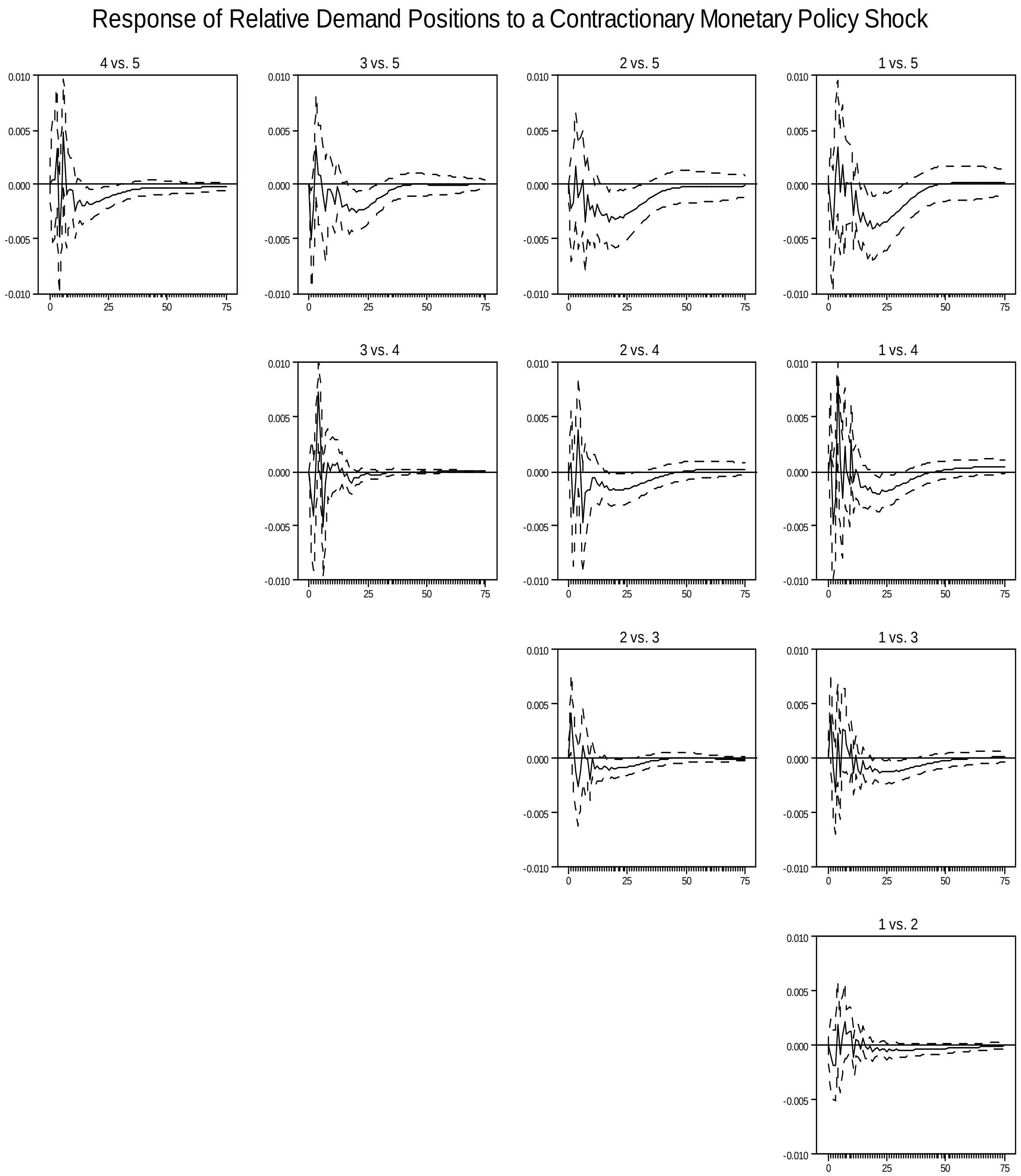


Fig. 5. Responses of the Relative Demand Positions of Firms ($\Delta_{ij,Dt}$) to a Contractionary Monetary Policy Shock

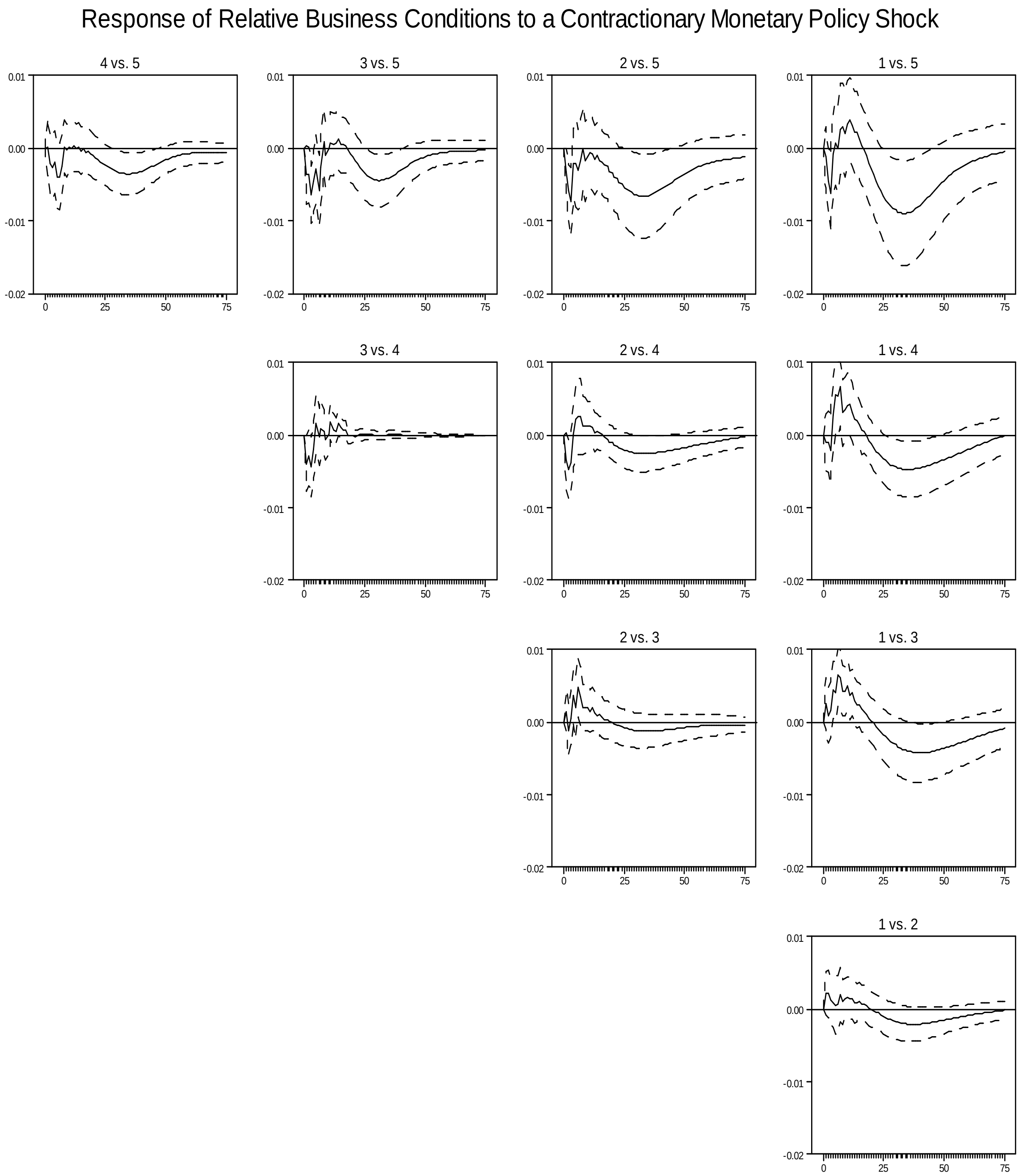


Fig. 6. Responses of the Relative Business Conditions of Firms ($\Delta_{ij,t}$) to a Contractionary Monetary Policy Shock in a Model with Demand

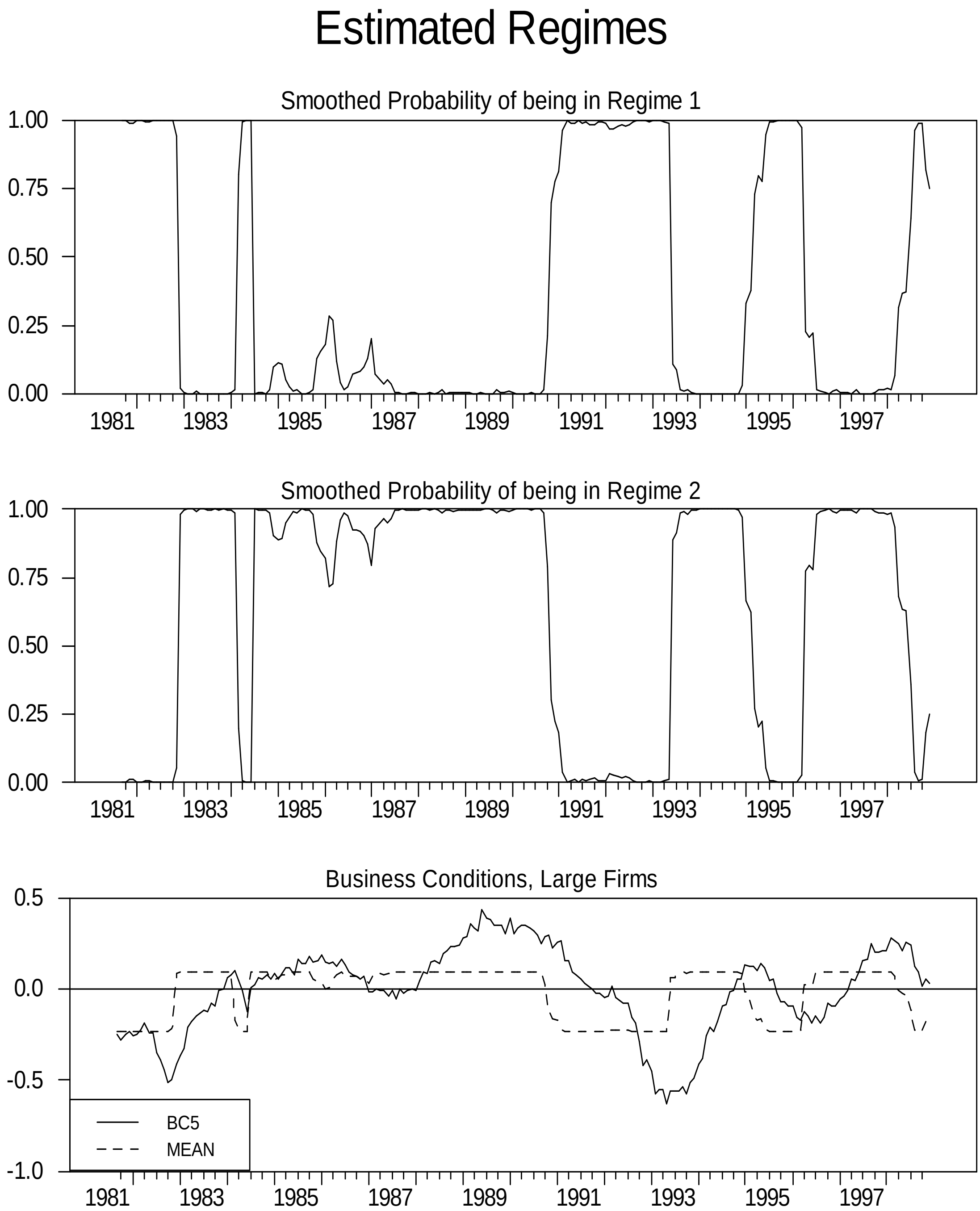


Fig. 7. Regime Probabilities for the Markov-Switching VAR with Business Conditions

Table 9. Trace Statistics for the Test of Cointegration Rank of the Baseline Model with Demand Variables

Model	$dem_{1,t}$	$dem_{2,t}$	$dem_{3,t}$	$dem_{4,t}$	$dem_{5,t}$
$r = 0^a$	87.18	85.89	93.72	89.81	85.40
$r = 1^b$	45.87	42.28	50.30	47.03	43.72
$r = 2^c$	22.04	21.91	23.39	22.23	22.57
$r = 3^d$	4.09*	4.56*	6.69*	5.93*	5.97*

[a] critical values 95%: 53.42; [b] 34.80; [c] 19.99; [d] 9.13

Table 10. Test for Three Cointegrating Vectors in the Baseline Model with Demand Variables: Demand, Real Interest Rates and Superneutrality of Money

Model	$dem_{1,t}$	$dem_{2,t}$	$dem_{3,t}$	$dem_{4,t}$	$dem_{5,t}$
$\chi^2(3)$	8.48	7.01	6.05	6.45	6.13
p-value	0.04	0.07	0.11	0.09	0.11

Table 11. Mis-Specification Tests for the MS-VAR Model on Business Conditions: $bc_{2,t}, bc_{5,t}, r_t$

	Autocorrelation	ARCH	Markov chain
Equation 1	1.20 (0.31)	0.02 (0.89)	1.41 (0.23)
Equation 2	2.09 (0.08)	3.22 (0.07)	0.03 (1.00)
Equation 3	0.37 (0.83)	1.50 (0.22)	3.03 (0.02)*
System	1.03 (0.42)	1.32 (0.12)	2.01 (0.05)

Tests are for omitted autocorrelation, omitted ARCH and mis-specification of the Markovian dynamics. Numbers in brackets are p-values.

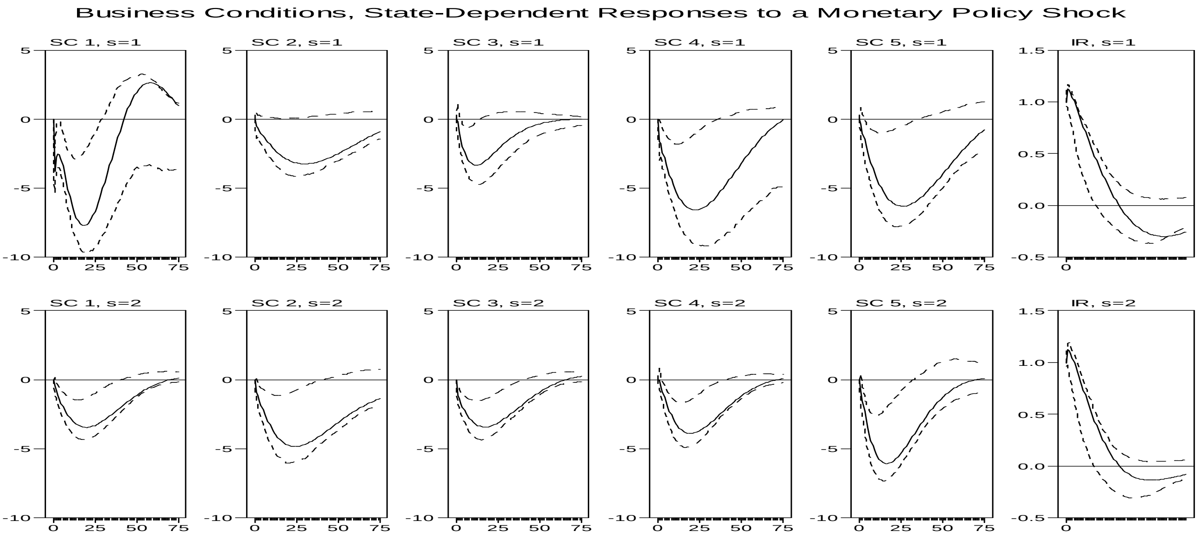


Fig. 8. State-Dependent Responses to a Monetary Policy Shock

References

Audrestsch, D., and J. Elston (2002): "Does Firm Size Matter? Evidence on the Impact of Liquidity Constraints on Firm Investment Behavior in Germany," *International Journal of Industrial Organization*, 20, 1–17.

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

Cecchetti, S. (1995): "Distinguishing Theories of the Monetary Transmission Mechanism," *Federal Reserve Bank of St. Louis Review*, 77, 83–97.

Chatelain, J., et al. (2003): "Firm Investment and Monetary Policy Transmission in the Euro Area," in *Monetary Policy Transmission in the Euro Area*, ed. by K. A. Angeloni, I., and B. Mojon, pp. 133–161. Cambridge University Press.

Christiano, L., M. Eichenbaum, and C. Evans (1996): "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds," *Review of Economics and Statistics*, 78, 16–34.

Crowder, W. (1997): *The Liquidity Effect: Identifying Permanent and Transitory Components of Money Growth.* mimeo, University of Texas at Arlington.

Ehrmann, M., et al. (2003): "Regime-Dependent Impulse Response Functions in a Markov-Switching Vector Autoregression Model," *Economics Letters*, 78, 295–299.

Fazzari, S., et al. (1988): "Financing Constraints and Corporate Investment," *Brookings Papers on Economic Activity*, pp. 141–195.

Gertler, M., and S. Gilchrist (1994): "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms," *Quarterly Journal of Economics*, 109, 309–340.

Hamilton, J. (1989): "A New Approach to the Economic Analysis of Non-Stationary Time Series and the Business Cycle," *Econometrica*, 57, 357–384.

——— (1996): "Specification Testing in Markov-Switching Time-Series Models," *Journal of Econometrics*, 70, 127–157.

Johansen, S. (1995): *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models.* Oxford University Press, Oxford.

Kalckreuth, U. V. (2003): "Investment and Monetary Transmission in Germany: A Microeconometric Investigation," in *Monetary Policy Transmission in the Euro Area*, ed. by K. A. Angeloni, I., and B. Mojon, pp. 133–161. Cambridge University Press.

Kaplan, S., and L. Zingales (1997): "Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?," *Quarterly Journal of Economics*, 112, 169–215.

——— (2000): "Investment-Cash Flow Sensitivities Are Not Valid Measures of Financing Constraints?," *Quarterly Journal of Economics*, 115, 707–712.

King, R., C. Plosser, J. Stock, and M. Watson (1991): "Stochastic Trends and Economic Fluctuations," *American Economic Review*, 81, 819–840.

Kiyotaki, N., and J. Moore (1997): "Credit Cycles," *Journal of Political Economy*, 105, 211–248.

Krolzig, H., and J. Toro (2000): "Classical and Modern Business Cycle Measurement: The European Case," Economic Discussion Paper No. 60, University of Oxford.

Perez-Quiros, G., and A. Timmermann (2000): "Firm Size and Cyclical Variations in Stock Returns," *Journal of Finance*, 55, 1229–1262.

Siegfried, N. (2000): "Microeconometric Evidence for a German Credit Channel," Macroeconomics Working Paper No. 1/2000, University of Hamburg.

Sims, C. (1980): "Macroeconomics and Reality," *Econometrica*, 48, 1–48.

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