Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
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1. Introduction

The question of monetary policy transmission has always been of key interest for monetary policy, but most of the research in this area, by nature of the topic, has been concentrating on the aggregate level of the economy[1]. This view, however, ignores possible asymmetries on more disaggregate levels of the economy, which could in turn lead to asymmetric effects of monetary policy across economic entities, such as sectors of the economy, or regions.

For instance, one proposition in international finance which has been argued especially by Krugman and Venables (1996) is that a common currency will promote regional specialization patterns[2]. This argument is of particular relevance in the debate on European Monetary Union (EMU), as it implies that industry shocks will translate into regional shocks. Thus, if monetary policy would affect different industries asymmetrically, this could lead to noticeable regional effects of monetary policy[3]. A similar reasoning is suggested by the findings of Carlino and DeFina (1998), who look at the effects of monetary policy shocks at regional - read state - output variations for US states and find that these variations are, amongst others, significantly related to sectoral structure variables.

Our focus in this paper is on disaggregate monetary policy transmission in Germany, in particular the industry impact of monetary policy. Specifically, we want to shed more light on the question whether there are significant differences in the reactions of (West) German industries to monetary policy shocks. As regional output data for Germany are available only at a yearly frequency, but an investigation of monetary policy transmission clearly requires a higher frequency, we have chosen to concentrate on the question whether there are asymmetries in the reactions of the industries in the manufacturing and mining sector, for which data are available on a monthly basis.

In contrast to Ganley and Salmon (1997), who present the stylized facts of monetary policy transmission across industrial sectors for the UK including service sectors, due to availability of data we focus exclusively on the sub-sectors (two-digit level of classification) of the manufacturing and mining sector. Using the reactions of the manufacturing and mining sector as our benchmark, we investigate how the individual industry reacts in comparison by using relative output and producer prices` reactions in our VAR analysis[4].

After a short overview on the relative importance of these industries for the whole of West Germany and on

[1] For a comparative study on the monetary transmission mechanism in the G-7 countries see e.g. Gerlach and Smets (1995).

[2] This view is not uncontested in literature, see e.g. Frankel and Rose (1998).

[3] See e.g. Dornbusch et al. (1998, p.29), who also argue that due to regionally clustered industries monetary policy will have asymmetric effects across regions. On a national level, however, they think that EMU member countries are relatively similar in terms of industrial structure.

[4] Ganley and Salmon (1997) employ absolute data for their research.

regional structures in section 2, we present the setup of the model and empirical results in section 3. We then investigate whether our findings concerning which industries exhibit significantly stronger or weaker relative effects can be related to certain characteristics of the industries, and we will try to draw some conclusions as to which regions might be particularly affected based on "regional industry portfolios", before concluding the paper in section 4.

In accordance with a large share of the literature on monetary policy transmission, we will use the so-called VAR (Vector Autoregression) approach. It is particularly helpful to analyze dynamic interactions within a system through the impulse response functions. As the econometric concepts behind VARs can be considered well-known (see e.g. Lütkepohl (1993)), only a few comments about the specific econometric methodology used in this paper will be made in section 3, where we describe the concrete setup of the model.

2. Industries of the manufacturing and mining sector and regional structures

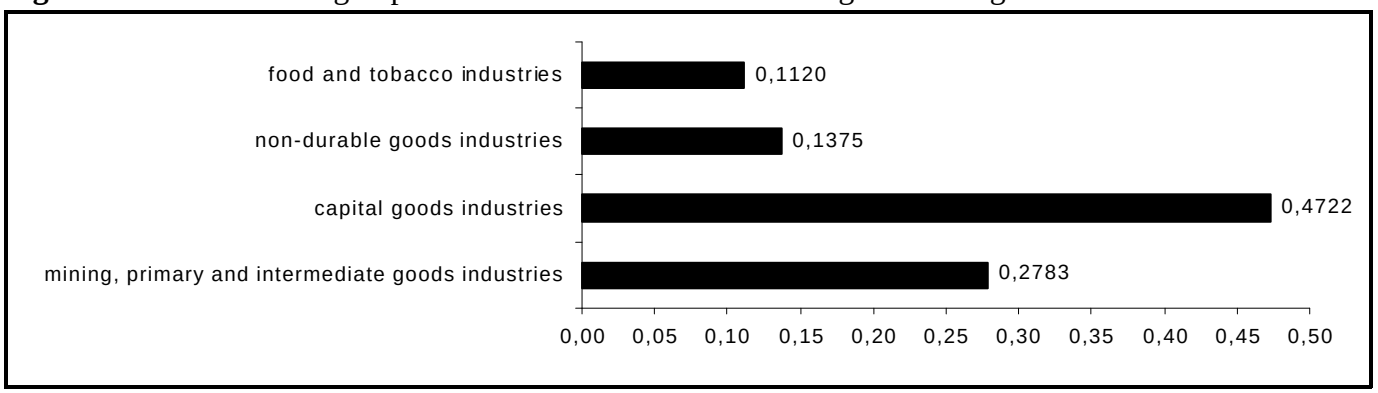
The production sector is considered as a 'central pillar of the national economy'[5], even as the service sector has gained in importance over the last decades. For example, according to the *Bundesverband der Deutschen Industrie (BDI)*, in 1997 more than 6.3 million were employed in firms of the manufacturing sector having more than 20 employees, and 4 of 5 employees of the manufacturing sector work in the primary and intermediate goods or the capital goods sector and produce roughly three quarters of industrial production, showing the special importance of these industries with regard to employment.

To evaluate the overall implications of asymmetric industry reactions to monetary policy shocks, it is necessary to look at the importance of specific industries within the manufacturing and mining sector. Figure 1 presents shares in sales revenue for West Germany in 1990[6], grouping the industries in the sub-sectors 'mining, primary and intermediate goods industries', 'capital goods industries', 'non-durable goods industries', and 'food and tobacco industries'. Under this sectoral grouping based on the SYPRO classification employed up to 1994 - which we have chosen because it gives the longest available time series - the sectors of mining and primary and intermediate goods and capital goods come up with 75% of the sales revenue of the manufacturing and mining sector.

[5] See Federal Statistical Office of Germany (homepage address: http://www.statistik-bund.de).

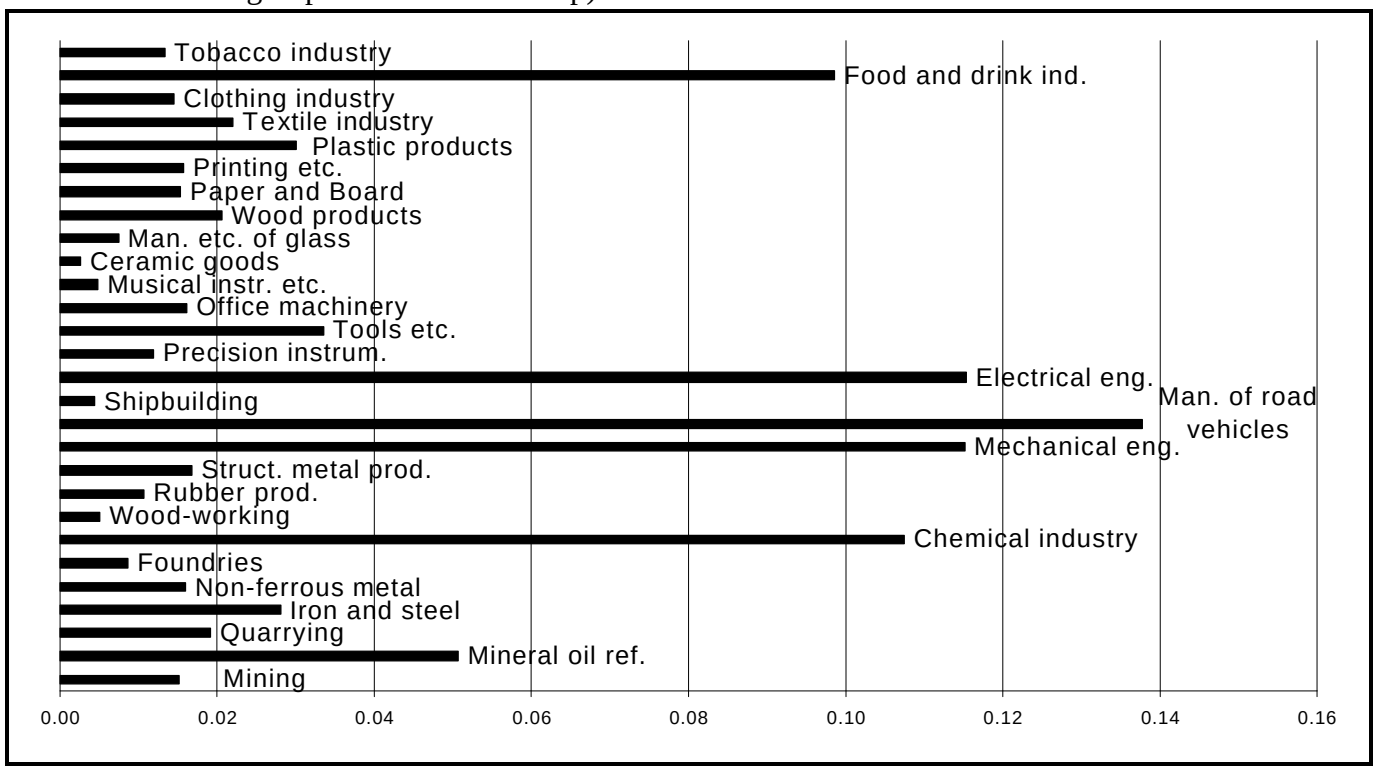
[6] Using the same Industrial Classification of Economic Activities, edition 1979 (*SYPRO)*, the relevant 1990 data for the industries of the manufacturing and mining sector are cited from the series 4.2.1 of the Federal Statistical Office of Germany. Included in the publication are data (numbers of firms/comp., employees, sales revenue and investment) for the industries, using reports of firms and companies with at least 20 employees.

Figure 1: Shares of main groups in sales revenue of manufacturing and mining sector - 1990



As figure 2 demonstrates, among the first group, the chemical industry leads with 10.76% of sales revenue of the manufacturing and mining sector, and in the second group, the industries of mechanical engineering, manufacture of vehicles and electrical engineering are the major contributors with each having shares of more than 11%. The only other industry that approaches this share size with almost 10% is the food industry.

Figure 2: Industry shares in sales revenue of manufacturing and mining sector - 1990 (ordering according to main groups from bottom to top)

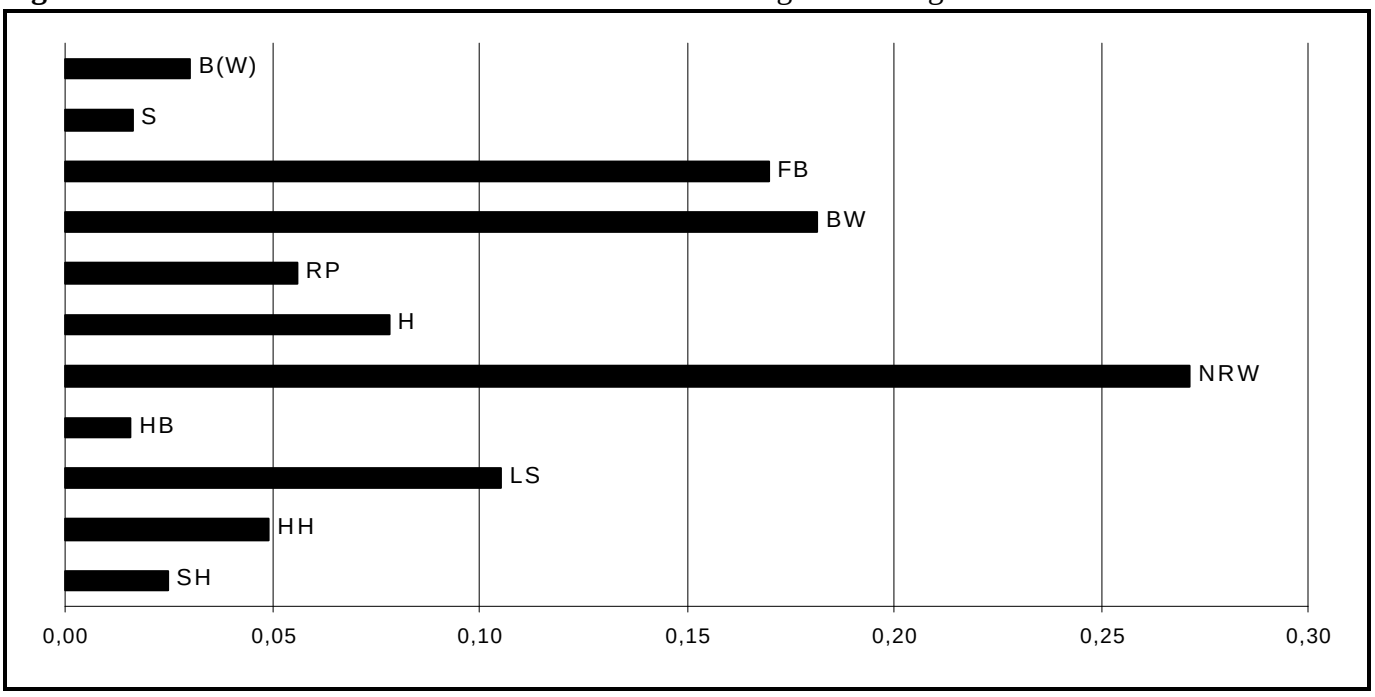


While these data are helpful for evaluating the economic significance on an aggregate scale, in order to

conclude on regional effects, one has to consider the specific industry portfolios of the Länder. Data for industries ordered by Länder are available based on firm reports of employment and sales revenue (series 4.1.4), but one has to make allowances for gaps in reporting as only firms with at least 20 employees are obliged to answer. From these data, industry portfolios (in those industries we consider in the empirical part) have been constructed for the 11 Länder of West Germany in 1990[7].

As these industry portfolios are relative figures, we have to look at the shares of the Länder in the manufacturing and mining sector as a whole (see figure 3) as well. Manufacturing and mining firms based in North Rhine-Westphalia have a share of 26% in the sales revenue, those of Bavaria and Baden-Württemberg have each at least 17% and of Lower Saxony 11%, which amounts to 71%.

Figure 3: Länder shares in sales revenue of the manufacturing and mining sector - 1990



Abbreviations (bottom to top):
SH Schleswig-Holstein, **HH** Hamburg, **LS** Lower Saxony, **HB** Bremen, **NRW** Nordrhine-Westphalia, **H** Hesse, **RP** Rhineland-Palatinate, **BW** Baden-Württemberg, **FB** Bavaria, **S** Saarland, **B(W)** Berlin(West)

Concerning the relative importance of industries in a Land, the following general observations can be made: In the industry portfolio of North Rhine-Westphalia, the two dominant industries are chemical and mechanical engineering, and in both of these industries it gets at least 30 % of total industry sales revenue. In the food

[7] The industry portfolio has been constructed for a Land based on the industry composition of sales revenue earned by the firms located in that Land.

industry, North Rhine-Westphalia's share with 42 % by far exceeds the second largest share, which belongs to Bavaria (30%). However, with regard to other industries important for North Rhine-Westphalia, electrical engineering and vehicle manufacturing, Bavaria and Baden-Württemberg get a larger share. Interestingly, the industry portfolio of Bavaria exhibits a clear concentration on all the five industries identified as the leaders in sales revenue, with mechanical engineering, vehicle manufacturing and electrical engineering on the top. The last three industries dominate the industry portfolio of Baden-Württemberg as well. Lower Saxony exhibits a more diversified portfolio in comparison.

This overview shows that the Länder of West Germany have varying degrees of diversification in their industry portfolios. Some industries are concentrated in specific regions, which induces some scope for asymmetric effects on regions if those industries show to be differently affected by monetary policy. This type of information will later be used to identify whether certain regions should be considered particularly vulnerable to asymmetric effects on specific industries. More details are available from the authors upon request.

3. Setup of the VAR

The well-known strength of VAR modeling lies in generating 'stylized facts' concerning the dynamic behavior of a set of variables to orthogonal innovations to the model. This makes it particularly well-suited for comparing the reactions of different sectors to a particular monetary policy shock over time, which is our primary objective. Since economic theory does not give useful identifying restrictions with respect to our research question, we use a lower-triangular Choleski-decomposition. This approach restricts the influence of economic theory to the choice of variables and, to a certain degree, their ordering in the VAR.

We specify a common structure and lag length for all VARs to avoid distortions of our conclusions due to different setups. Each VAR includes a constant per equation and a dummy for 1990:12 (the German reunification effect in the M1 aggregate). Due to the short time span of our sectoral data (monthly data for 1978:1-1994:12) the degrees of freedom problem is of particular concern to us, so we choose a lag length of $l = 5$ for our monthly data. While a higher lag length (see Sims (1992)) might seem more adequate with regard to the dynamics of the model, in our case higher lags seem to be of negligible importance. The findings of Diebold and Nerlove (1990), who suggested using $l = T^{1/4}$, with T the sample size, also support the chosen lag length.

Estimating a separate VAR for each sector, our choice of variables is determined by the consideration that individual sectors will be affected by the situation of the macro economy. Therefore a broader spectrum of influences connected to interactions between financial and real markets should be included in modeling the stylized facts of monetary policy transmission. Taking our lead from research on an aggregate level, the first

five variables model the macroeconomic environment. Ordered by their position in the VAR model, these are the exchange rate of the DM vs. the US dollar in price notation (**lex**), the world commodity price index (**lpcom**) to allow for influences via the world economy, the money market interest rate for daily funds (**r_short**), the rate of return on public bonds as a long-term interest rate (**r_long**), and the seasonally-adjusted monetary aggregate M1 (**lm1**) as a further possible transmission variable. Finally, the behavior of the production sector is modeled by its production index[8] and its producer price index.

As in a VAR all variables are a-priori endogenous, it can typically handle only a limited number of variables. Therefore, when analyzing the VARs for the individual sectors on the 2-digit aggregation level, the production and producer price indices consist of their relative values with regard to the whole manufacturing and mining sector, keeping the VAR down to 7 variables in all cases. For further details see the appendix.

While the short-term rate serves as the monetary policy indicator in our VAR, the long-term interest rate is meant to include effects from capital markets and inflation expectations. Considering the data frequency, the ordering of variables is based on the assumption that monetary policy might react to current changes in the exchange rate and the world commodity price index, but will react to the other variables of the system only with a lag.

All variables except for the interest rates enter in logarithmic form, but without prior differencing, to avoid the a-priori exclusion of long-run effects from the system. When testing for cointegration by means of the Johansen method to see whether estimating the regular VAR in levels seemed justified, based on the Trace statistic, the null hypothesis of no cointegration could be rejected in all cases at least at the 90% significance level[9]. However, as we are interested in the stylized facts only, we estimated the VAR and impulse response functions without the imposition of cointegration rank[10].

The analysis will concentrate on the impulse responses to a contractionary monetary policy shock, which is taken to be a unit shock to the orthogonalized innovation of the short-term interest rate equation. Confidence intervals for the impulse response functions (1.44 S.E.) have been simulated[11] under RATS and are depicted

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[8] All production indices were seasonally-adjusted by means of the X-12-Arima program of the US Bureau of the Census (final version 0.1, 1998).

[9] A full rank for the system would indicate that the variables are stationary (see Lütkepohl (1993), p. 355). We do, however, find no such evidence.

[10] In the case of cointegration between the I(1) variables the unconstrained Least Squares (LS) estimator of the VAR process has the same asymptotic properties as the Maximum Likelihood (ML) estimator which observes the cointegration restriction (see Lütkepohl (1993), p. 369). While the recursion formulae for calculating the impulse response functions for the estimated VAR in the present case are equivalent to the case when the VAR process is stationary, the impulse responses will not necessarily converge to zero with time, see Lütkepohl (1993), p. 376.

[11] The results should be interpreted with some caution. Although vector tests on the residuals revealed problems of autocorrelation for only few cases (at the 5% significance level), normality of the residuals was rejected in all cases even at the 1% level. However, since the distribution was symmetric and single peaked, we proceeded in the estimation process under the assumption of

in the graphs[12].

4. Empirical Results

In this section, we will look at the actual results of our empirical analysis performed along the lines described in the previous section. To economise on space, results will in general be given in a very condensed, tabulated form[13], concentrating on the effects an increase of the short-term interest rate, taken as the major monetary policy instrument, has on the on the relative industry variables.

Applying our VAR model to the aggregate West German economy serves as our benchmark and leads to generally plausible results, which are similar to other studies in this area (see e.g. Sims (1992)). Focussing on reactions to a rise of the short-term interest rate (see figure 4), we observe an increase in the long-term interest rate, but this is not significant. The developments of the exchange rate and the commodity price index are characterised by cyclical behavior with alternating phases of increasing and decreasing values. None of these, except the first decrease in the commodity price index, are statistically significant. Money reacts instantly by contracting to a lower value and is showing persistence by staying there, even though the effect is not significant anymore after the course of 13 months. Our main variable of interest is the output reaction. Here we can see that after some stationary fluctuations output starts to drop significantly from month 12 onwards. The trough of industrial output is reached in month 22. Afterwards a recovery takes place, which causes the output value in month 32 to become insignificantly different from zero. Thus the contractionary phase spans about 21 months, which is more than one and a half year. Finally, we find that the price level exhibits a slight rise in the first months after the monetary policy shock, which however is not significant. From month 8 onwards, the impulse response function indicates that industrial producer prices start to fall below their starting values. Thus in contrast to many studies in this field, in this specification we do not really find a 'price puzzle'. The elimination of the 'price puzzle' in our system is due to the joint inclusion of a long-term interest rate and a commodity price index in the VAR. Using a smaller VAR without these variables, we would get a price puzzle as well. We think that this finding supports Sims' (1992) argument regarding the possible existence of inflationary expectations in the system, as both variables can be seen as conveying information about future developments of prices. Rising commodities prices will feed into the economy since commodities are important input factors and nominal long-term interest rates include inflation expectations based on a Fisher-effect.

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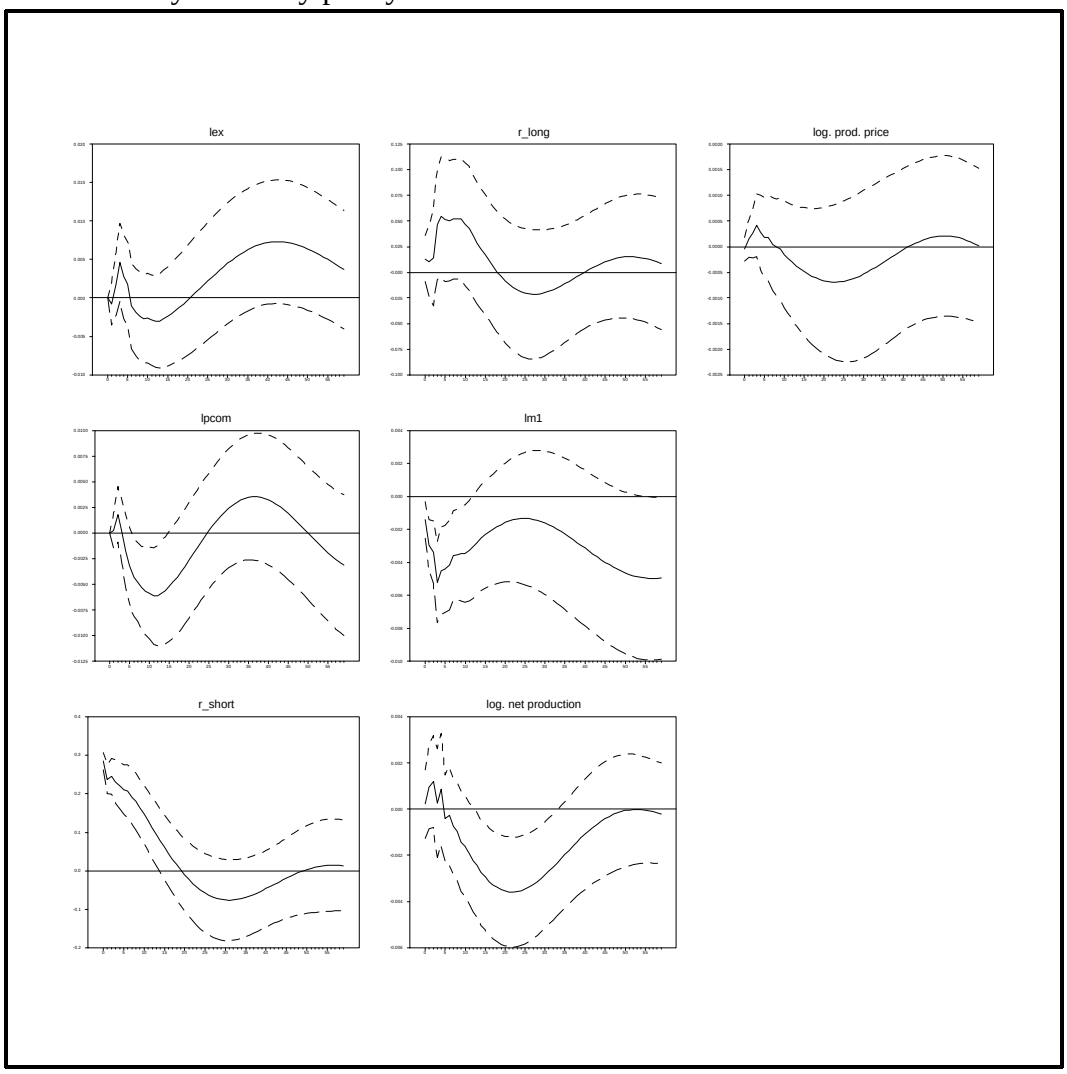
asymptotic normality, relying on the central limit theorem.

[12] The simulation (100 draws) is based on the programs Montevar.prg (as included in the RATS package) and the modified program Montevar.93 (available on the Estima webpage).

[13] Graphic representation will be limited to impulse response functions to monetary policy shocks for the five major industries and the aggregate manufacturing and mining sector. Additional graphs are available upon request.

Figure 4: Impulse response functions for the manufacturing and mining sector to a contractionary monetary policy shock



Industry effects:

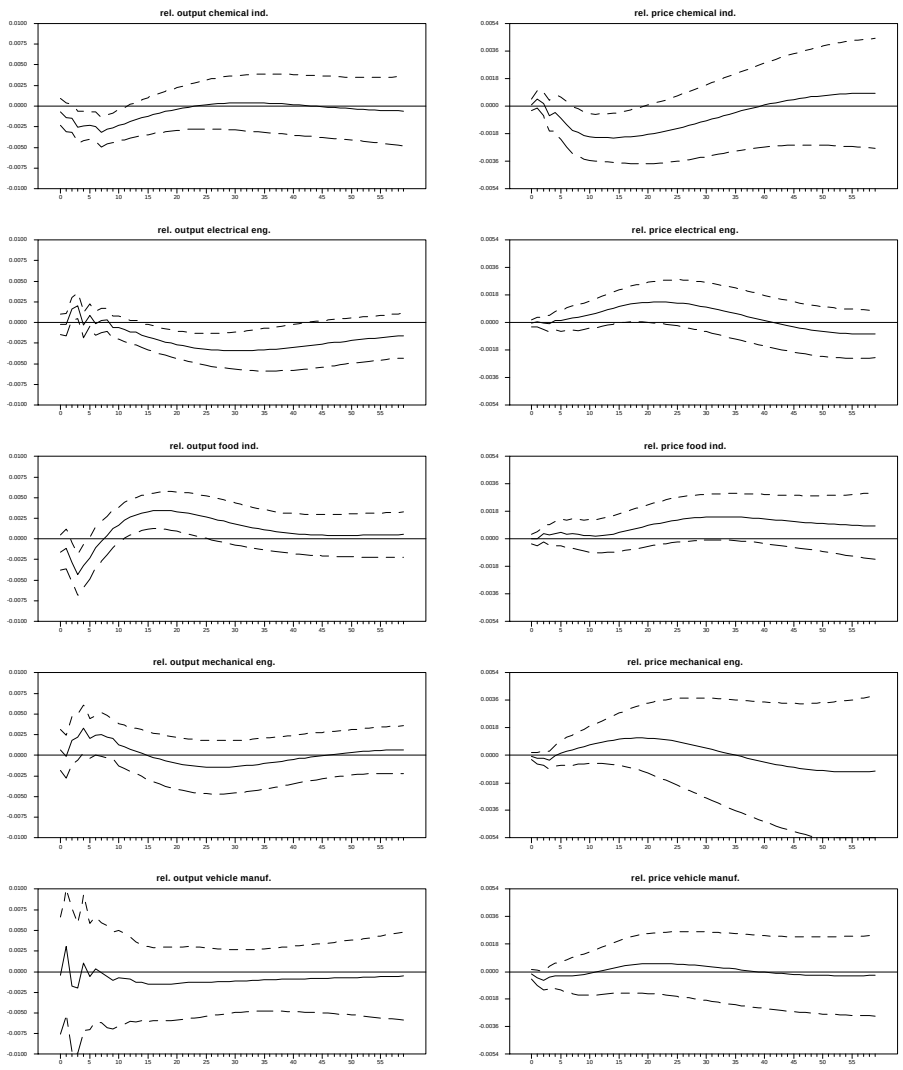
Now the ground is prepared for the analysis of the impact of monetary policy on specific industries. Preliminary estimations have shown that no sector exhibits an increase in absolute output after the monetary policy shock, which allows us to exclude the possibility that the negative output effect on the aggregate level is subject to some kind of averaging effect, i.e. some sector's production is decreasing while another sector's production is increasing. We find this reassuring. However, due to the focus of our analysis we report only results for industry systems including the *relative* production and producer price indices[14].

[14] The relative production index is defined as the ratio of the industry production index divided by the aggregate industrial production index, to measure the production of a specific industry in relation to overall production. The same procedure is applied to prices.

Looking at relative industry effects has a number of advantages for our analysis. First, due to data availability problems, our sample is rather short for a VAR analysis. Computing relative values reduces the number of variables that we have to include in our system. Second, since the overall development of industrial production is negative over a longer time period, it simplifies the comparison of single industries if one eliminates the average overall development. Third, and most importantly, using relative values provides us with the opportunity to apply statistical tests of the null hypothesis that a certain industry behaves in the same way as the average of all industries.

Even though the effects on all variables are influenced by the industry considered in the system, the macro effects are quite robust over all industries. As we are interested in the effects of contractionary monetary policy shocks on relative production and price indices, figure 5 gives the impulse response functions of the relevant variables for the five major industries.

Figure 5: Impulse response functions for the five largest industries (relative production, relative producer prices) to a contractionary monetary policy shock



To economise on space and achieve better comparability, the information pertaining to the relevant impulse response functions will be represented in tabulated form for all (other) industries. Table 1 contains the significant relative output[15] and table 2 the significant relative price responses of the 28 industries[16] in our sample caused by an increase in the short-term interest rate.

Starting the interpretation of the results by looking at the relative output effects, we find that in 13 cases out of 28 industries there is a relatively positive reaction in the impulse response function, for 10 cases there is a

[15] Based on the confidence intervals of 1.44 * S.E..

[16] Additional information on the industries can be found in the appendix.

relatively negative and for 5 cases there appears to be no clear visible difference to the average development. With respect to statistical significance we can state that 13 of these industries experience developments which are also significantly different to the average. This leaves 8 industries with positive output effects and 5 with negative ones.

Table 1: Significant Relative Output Effects of a Contractionary Monetary Policy Shock

Industries	Relative Output Effect	Period of Effect (Months)	Length of Effect (Months)	Min or Max Effect is in Month	
Chemical industry	-	3-12	10	7	Min
Clothing industry	+	8-25	18	22	Max
Electrical engineering etc.	-	14-43	30	30	Min
Food and drink industries	+	11-26	16	18	Max
Iron and steel industry	-	8-17	10	12	Min
Mining	+	6-16	11	15	Max
Non-ferrous metal industry etc.	-	7-20	14	11	Min
Manufacture of office machinery etc.	(-)	10-15	6	14	Min
Mineral oil refining	+	21-40	20	39	Max
Printing and duplicating	+	16-28	13	22	Max
Shipbuilding	+	7-28	22	17	Max
Manufac. of structural metal products etc.	+	12-21	10	18	Max
Manufacture of tools etc.	+	3-5	3	4	Max

Notes: +/- indicates a relative positive/negative effect. Only significant observations (based on the confidence intervals (1.44 * S.E.)) are given. (+ /-) signals only marginally significant effects.

The largest absolute deviations from the average are observed for shipbuilding, iron and steel industry and mineral oil refining. Since industries differ in importance with respect to their sales for the German economy, it is interesting to know the relative importance of sales related to industries showing significant positive or negative effects. Adding up the respective shares of industry sales shows that about 30% of overall sales are made in industries suffering relative output losses and 26% in industries characterised by relative output gains. In other words, more than 50% of sales fall upon industries significantly differently affected than the national average. Thus, these numbers underline the observation that asymmetry of monetary policy is important.

More detailed information on the disaggregated output responses is included in the last three columns. In columns three and four, information about the actual period of the significant effect and its length is given[17].

[17] Erratic fluctuations during the first months after the shock are typical for many impulse response functions. As we do not put much trust in these effects, they are not listed but available upon request.

The occurrence of the maximal absolute positive or negative effect is noted in column five.

The significant effects are concentrated in an interval from months 3 to 43. As the interval for the overall negative effect of an interest rate shock on industrial production was noted to be between 12 and 32 months, we can infer that some industries react earlier than the average or continue to be affected at a time when the aggregate is already back at its pre-shock value. Distinct negative reactions occur relatively early in chemical industry and late in the electrical engineering industry. Interpreting this finding from the point of view of early business cycle indicators, it is arguably the case that the observation of negative output developments in chemical industry could indicate the begin of a cyclical downturn of overall industrial production and the recovery in electrical engineering industry the end of a slump.

The length of significant output reactions varies from 3 to 30 months. A short-term influence of monetary policy shocks is observed for manufacture of tools with a duration of a quarter of a year and a long-term effect for electrical engineering with two and a half years. Moreover, the extremal points are to be found in the range of 4 to 39 months. In other words, the maximal deviation of one industry relative to the average occurs in a period of half a year to over three years. However, in more than half of the cases do we see an extremal point occurring in the months 14 to 22. An early relative minimum is experienced by the chemical industry, which can be viewed as supporting the interpretation of this industry's output as a leading business cycle indicator, while especially the mineral oil refining and electrical engineering industries exhibit their extremal reactions at a much later state.

Another interesting issue is related to the relative price effects of monetary policy shocks. Regarding the results for producer prices, we find 13 cases with relatively rising prices, of which 11 cases are statistically significant, and 8 with falling prices, 4 of which are significant. Thus the number of significantly negative relative price reactions is lower compared to the relative positive reactions.

Some of the price reactions are only marginally significant and in general, the output reactions are comparatively higher. For both output and prices it is the case that about one half of the industries show a behavior that statistically differs from the industry aggregate. In absolute terms, the greatest deviations from the aggregate price development are observed for non-ferrous metal industry, iron and steel industry and wood-working.

Considering the results in terms of relative industry shares of sales revenue, we find that industries showing a significantly negative effect are responsible for ca. 20% and those showing a relative positive effect for about 23% of total aggregate sales revenue. Together these 43% are less than the 56% in the case of output, but certainly not negligible. Moreover, this result implies that monetary policy, which many economists believe to

cause only price *level* effects, can be responsible for relative price changes - at least in the short-run - as well.

Table 2: Significant Relative Price Effects of a Contractionary Monetary Policy Shock

Industries	Relative Price Effect	Period of Effect (Months)	Length of Effect (Months)	Min or Max Effect is in Month	
Manufacture of ceramic goods	+	13-23	11	23	Max
Chemical industry	-	7-20	14	13	Min
Electrical engineering etc.	(+)	16-21	5	21	Max
Manufacture and processing of glass	+	4-26	23	13	Max
Iron and steel industry	-	14-28	15	27	Min
Manufacture of musical instruments etc.	+	1-16	17	9	Max
Non-ferrous metal industry etc.	-	5-23	19	14	Min
Processing of paper and board	(-)	19-28	10	27	Min
Manufacture of plastic products	+	0-6	7	4	Max
Manufacture of precision instruments etc.	(+)	12-21	12	21	Max
Quarrying etc.	+	13-21	9	21	Max
Manufacture of rubber products	+	0-18	19	13	Max
Manufac. of structural metal products etc.	(+)	13-18	6	16	Max
Manufacture of wood products	+	10-27	18	27	Max
Wood-working	+	0-16	17	9	Max

Notes: +/- indicates a relative positive/negative effect. Only significant observations (based on the confidence intervals (1.44 * S.E.)) are given. (+ /-) signals only marginally significant effects.

The overall period of individual prices showing a significantly different behavior from the aggregate prices ranges from the moment after the monetary shock up to 28 months. The manufacturers of musical instruments and toys, rubber products, plastic products and the wood working industry show an (almost) instantaneous reaction of relative prices. Moreover, for 13 out of 15 cases we have to note that industries exhibit significant price reactions within the first 14 months after the interest rate rise. Extremal relative price effects happen for most industries within a span from 13 to 27 months, i.e. they, approximately, take place within year two after the shock. An observation in comparison with the output effects is that the maximum length is only 23 months for relative prices while it is 30 for output. Additionally, relative output effects prevail longer than three years after the shock, while all relative price movements are gone just after the course of two years.

Classification according to relative producer price and production reactions to a contractionary monetary policy shock

Some industries behave like the aggregate in both price and output reactions, while others exhibit significant reactions in prices and/or output. This suggests a grouping as follows (see table 3):

Table 3: Grouping according to relative price and output reactions

Relative output:	Relative price: lower	constant	higher
lower	chemical industry, iron and steel industry, non-ferrous metal industry	manuf. of office machinery	electrical engineering
constant	processing of paper and board	foundries, mechanical engineering, textile industry, tobacco industry, manuf. of road vehicles	manuf. of ceramic goods, manuf. and processing of glass, manuf. of musical instruments, manuf. of plastic products, manuf. of precision instruments, quarrying, manuf. of rubber products, manuf. of wood products, wood-working
higher		clothing industry, food and drink industry, mining, mineral oil refining, printing and duplicating, shipbuilding, manuf. of tools	manuf. of structural metal products

In the interpretation of these results, one needs to be very careful not to simply equate the industry reactions with different managerial strategies to cope with the shock. What we observe as quantity and price reactions are complex outcomes of market processes.

As can be seen from the middle cell, only five industries show effects very similar to the national aggregate. The largest group with nine cases are industries experiencing positive relative price movements accompanied

by constant relative output. For another large group of industries we observe constant relative prices and higher relative output. All other combinations are less frequently encountered. The situation of three industries is characterized by lower relative output and lower relative prices. No industry appears in the cell indicating lower price and higher output. In the remaining four cells only one entry can be found.

According to the results in table 3, the manufacturers of structural metal products - ignoring possible cost effects - seem to be less negatively affected by the monetary policy shock than all other industries. The opposite cases are chemical, iron and steel, and the non-ferrous metal (including semi-finished products) industries. All these industries belong to the same main sector group named 'mining, primary and intermediate goods industries' (see the appendix). Another cell of table 3 collects industries with higher relative prices and constant relative output. Five of these nine cases are part of main group 'non-durable goods'. These industries are somewhat nearer to final demand, and this position in the value-added chain might enable them to keep prices relatively higher than the industry aggregate. However, in view of the slim evidence, this interpretation is more suggestive than compelling.

Undoubtedly, an important problem in the attempt to attribute labels to the different industries is the heterogeneity of firms within the industry classifications. Ganley and Salmon (1997), for example, claim that they can cluster UK industries according to the respective output reactions. But looking closely at the classifications of industries employed by them lays open similar contradictions to the ones that can be found in our results. In any case, one of their basic conclusions, namely that industries closer to final demand seem to be hit less, appears to be roughly similar to ours. However, in their model this conclusion is reached by looking only at output effects, but based on our results, we think that relative price reactions are important as well and must be accounted for.

In the next section, we want to investigate the asymmetric output and price reactions of industries to monetary shocks in somewhat more detail with the help of a number of proxy variables for important industry characteristics.

Industry characteristics and monetary policy effects

In the preceding section we have shown that there are certain industries that show significantly different output and price reactions after a monetary shock than the aggregate. Now we would like to explore some of the characteristics of these industries. Again, to sharpen the differences between groups in the analysis, we concentrate on those industries that showed a significant deviation from the industry aggregate.

Obviously, industries can be described using a wide variety of different variables. But since we have to face data limitations, only a small number of variables has actually been used. Basically, we look at four groups of

variables that can be considered as proxies for the underlying economic structure. These variables are related to capital stock, investment behavior, external dependence and receipt of government subsidies of industries. We employ several proxies for the dependence of an industry on capital goods. These are intended to capture the direct effect of an increase in interest rates as the use of capital would become more expensive[18]. Consequently, we would expect that industries which depend relatively more on capital will react more negatively than the aggregate and vice versa. We make use of the sample average of the following variables which are available at a classification very close to the one used in the impulse response analysis. The first variable is the productivity of capital, i.e. output divided by the capital stock (**CAPRO**). Ceteris paribus, the lower CAPRO the higher is the capital stock in relation to output and the more dependent is the industry with respect to an increase in the costs of capital. Thus our prior would be that industries which are characterized by relatively low values of CAPRO will be hit relatively hard by a negative monetary shock. A related variable is capital intensity (**CAPINT**), which is the ratio of capital and labor. Applying the same type of argument leads us to expect a negative association of this variable with industries that do relatively well after a negative shock. Similar reasoning also applies to the second group of variables, which are related to industry investments. It may well be the case - due to numerous problems connected with using capital stock based proxies - that the sensitivity of industries with respect to monetary shocks is better captured by the relative importance of investments. Again we compute two variables: One is the ratio of investments to employees (**INVEMP**) and the other variables is investments divided by gross value added (**INVVAL**).

The third group of proxy variables attempts to capture another important transmission channel of monetary policy: the external link via the exchange rate. An increase in interest rates will ceteris paribus lead to an appreciation of the exchange rate and industries that earn a large share of their revenues by exports are relatively more vulnerable. To capture these considerations, the variable **EXTREV** is computed as the ratio of external to internal sales revenue. Our prior would be that in general export-oriented industries will react more negatively after a contractionary monetary shock.

The fourth and final group of proxies is based on the fact that industries in Germany are receiving different amount of subsidies by the government. These subsidies are often paid to less competitive industries and can affect price or quantity reactions if they help to insure firms against demand related price or output fluctuations. To capture these effects, a variable is computed, which we name **SUBVAL**, as industry subsidies divided by

[18] There is the possibility that the capital stock is financed by borrowing under conditions of fixed interest rates, which would not lead to a direct transmission of negative monetary shocks to higher costs of financing. But this need not imply that there are no adverse effects. First, there is an opportunity cost argument in the sense that rising interest rates have a negative effect on economic measures of profit. Another argument is based on the idea that if costs are fixed then profits can still be negatively affected by the general economic downturn caused by contractionary monetary policy through a decline in revenues.

gross value added. Based on the idea that subsidies are being paid to secure jobs, we would expect that - if this "insurance" concept works - heavily subsidized industries do not experience high output losses relative to the manufacturing and mining sector as a whole.

In a first step, it is interesting to look at the bivariate association between these variables and monetary policy effects. To get a variable capturing differences in impulse response functions, we create dummy variables that take the value one (zero) if the relative output (**YIRF**) or price (**PIRF**) reaction of an industry to a negative monetary policy shock is positive (negative). Table 4 shows Pearson's correlation coefficients.

Table 4: Pearson's correlation coefficients

	Cases	CAPIN	CAPRO	INVEMP	INVVAL	ESTREV	SUBVAL
YIRF	13	.004	.44	-.04	-.37	-.56*	.27
PIRF	15	-.65**	.53	-.57*	-.27	-.38	-.69**

Notes: * (**) indicates significance at a 5% (1%) level.

We find that capital intensity (CAPIN) and the investment-gross-value-added ratio (INVVAL) are not correlated with the relative output reaction of industries (YIRF). Capital productivity (CAPRO) and subsidies in relation to gross value added (SUBVAL) are displaying a positive sign and fairly large correlation coefficients. This implies that industries characterized by relatively high capital productivity and subsidies fare better than the industry aggregate after a monetary contraction. These findings are in accordance with our expectations given above, but they are not statistically significant. Negative associations are recorded for investments per employee (INVEMP) and the ratio of foreign to domestically earned revenues (ESTREV). Again these results are consistent with our priors, and at least the correlation coefficient for ESTREV is statistically significant.

Next we investigate the relationship between these industry characteristics and the relative price reactions. Except for CAPRO, all of the coefficients are negative, and three of those - CAPIN, INVEMP and SUBVAL - are statistically significant and most of the signs are in line with our expectations. Industries characterized by a high ratio of subsidies in relation to gross value added (SUBVAL) show more often a negative relative price effect, which is a conclusion based on a statistically significant coefficient, and also a higher - but non-significant - relative output effect. These results are in accordance with the hypothesis of subsidies as output-stabilisers put forward above. In this framework, subsidies allow firms to cut prices relatively more compared to the manufacturing and mining sector as a whole, in order to avoid major output reductions.

So far we have only looked at bivariate correlations and this does not say a lot about how an individual variable behaves in a multivariate setting. Therefore, we present the outcome of estimating a logit model for YIRF in table 5. As it was not possible to conduct a serious testing down procedure due to degrees of freedom

problems, and a powerful statistical analysis was therefore impossible, this model is basically the outcome of including and excluding groups of variables.

Table 5: Logit model for YIRF

	Coefficient	Odds ratio	SE	Robust SE	p-values	p-values (robust SE)
CAPRO	0.004	1.004	0.002	0.002	0.08	0.05
EXTREV	-3.17	0.042	1.94	2.41	0.10	0.19

Pseudo R^2 (Cox & Snell)	Pseudo R^2 (Nagelkerke)	$Chi^2(2)$ p-value	Goodness-of-fit test p-value	Classification (overall)
0.37	0.50	0.05	0.17	84.6%

The fit is reasonably high, variables are jointly significant, and the Hosmer and Lemeshow goodness-of-fit test cannot reject the model. In terms of classification, using a cut-off point of 0.5, only two wrong predictions are being made by the model (implies 84.6% correct predictions). Looking at the significant variables, only CAPRO and EXTREV remain in the equation at a 10% significance level. We check the robustness of test results using White's robust standard errors. While CAPRO is now significant at a 5% level, the p-value of EXTREV goes up to almost 20%. In view of the small sample size, however, it is far from clear whether the robust standard errors are superior.

The interpretation of the remaining regressors of the model is straightforward. CAPRO is a proxy for the capital dependency of an industry. Consequently, we see that firms producing their output with relatively less capital do not suffer as much from a negative monetary policy shock than the industry aggregate. With respect to EXTREV it can be concluded that the export dependency forces industries to lower output more than the manufacturing and mining sector as a whole when faced with an adverse monetary policy shock.

There is an additional model for YIRF which may be of interest. If INVVAL is added to the equation, we get a clear improvement in fit and its coefficient - displaying a negative sign - is significant at a level of 11% when using robust standard errors. This may indicate that not only capital stock but also investment behavior helps to explain the different reactions of industries to monetary shocks. However, since the share of correct predictions drops to 69%, and the coefficient of INVVAL is only marginally significant, we have preferred the model presented in table 5.

A similar approach is applied to PIRF, i.e. to the relative price effects of a contractionary monetary policy. Here the results are shown in Table 6.

Table 6: Logit model for PIRF

	Coefficient	Odds ratio	SE	Robust SE	p-values	p-values (robust SE)
CAPRO	0.009	1.004	0.005	0.003	0.06	0.01
SUBVAL	-410.7	0.000	259.6	237.8	0.11	0.08

Pseudo R^2 (Cox & Snell)	Pseudo R^2 (Nagelkerke)	$Chi^2(2)$ p-value	Goodness-of-fit test p-value	Classification (overall)
0.58	0.77	0.002	0.96	86.7%

The diagnostics are generally better for the PIRF estimates than for the preceding YIRF model. Again we find that CAPRO appears to be a significant influence, and since the sign is positive, a similar reasoning applies. As a second variable there is SUBVAL present in the chosen model, the coefficient of which shows a negative sign. An interpretation of this finding is that subsidies are given to certain industries with the intention to stabilize their output and thereby employment. Relatively higher subsidies might allow these industries to lower prices more than other industries in order to avoid excessive output reductions, and this adjustment may be captured by our logit model.

Referring back to Table 4 containing the bivariate correlation coefficients, we find that CAPIN or INVEMP, which are significant there, do not appear in the model here. This is due to the fact that simple correlations can be misleading as indicators of the unique effects of a variable and that there is no intercept term in the logit model, as it turned out to be not significant. Once more we want to mention that there exists another plausible model (results not displayed here) which contains EXTREV instead of SUBVAL. Even though the latter is more significant when both variables are put together into one equation and leads to a better fit - that is why it is the preferred model presented in table 6-, the model consisting of EXTREV (with a negative coefficient) and CAPRO has a better classification record (93.3% of observations are correctly classified).

To summarize our findings, the relationship between capital and output seems to help explain different industry responses to monetary shocks. The higher the ratio of capital to output, the higher is the probability that an industry's relative output and price "performance" is worse than that of the aggregate of all industries. Important for - at least - the output reactions is also the relation of foreign sales to domestic sales revenue. The more dependent industries are with respect to exports the greater seems to be the likelihood that they will suffer relatively larger output losses. Finally, in terms of price effects, there is evidence that industries that receive a relatively high amount of subsidies in terms of their gross value added do experience a stronger decline in prices. This can be interpreted in the sense that subsidies allow firms to avoid large output reductions by lowering relative prices without having to face unsustainable losses in revenues.

Regional effects of monetary policy

As indicated in the introduction, it is an interesting issue whether monetary policy has regional effects. Within our framework, we can address this question indirectly by looking at "industry portfolios" of regions. Concentrating on the 11 West German Länder as suitable regional entities, we think that two aspects are particularly relevant: First, whether a certain industry exhibits strong regional concentration. As appropriately disaggregated regional industry net production data are not available, we make use of industrial sales revenue data, as argued above, and try to identify whether certain Länder (read: firms located in certain Länder) earn a large share of an industry´s overall sales revenue (see column four of table 7)[19]. Second, it will matter more for a certain Land whether an industry is more or less affected by a contractionary monetary policy shock if that industry plays a larger role in this Land´s industry portfolio. We try to identify this aspect by looking at relative sales revenue data as well (column five)[20]. In addition, we look at employment data; in particular, in column six those Länder are indicated for which the share of industry i´s employment in the employment of all industries in a Land is larger than the national average[21]; if it is larger by at least 5 percentage points than the national average, this is indicated by italics. If all aspects are fulfilled for a Land, we consider it to be particularly affected (indicated by bold typeface). Complete information in how far these aspects are fulfilled for those industries that react significantly different from overall manufacturing and mining with regard to relative output and price effects are given in the appendix (table 10). Table 7 concentrates on those industries for which all three criteria are fulfilled in certain Länder and which we therefore consider of specific regional importance.

We start off the analysis by investigating how the industries showing negative relative output reactions are distributed across the Länder. Concerning the last two criteria, the chemical industry is important for five Länder, Schleswig-Holstein (SH), Hamburg (HH), North Rhine-Westphalia (NRW), Hesse (H), and Rhineland-Palatinate (RP). Considering where the main shares of sales revenue are earned, the last three Länder seem - ceteris paribus - to be particularly affected by a contractionary monetary policy shock. Considering next the electrical engineering industry, it is important with regard to employment and industry composition of sales revenue for six Länder, and of these Bavaria (FB), Baden-Württemberg (BW) and again North Rhine-Westphalia are the primary recipients of that industry`s sales revenue. Taking all three criteria into account, Bavaria and Baden-Württemberg are the primary locations of electrical engineering firms and - ceteris paribus - especially hit by the negative impact of the monetary policy shock on the electrical engineering industry. For

[19] The criterion is a share of at least 10% in the overall sales revenue of that industry across West Germany, 1990.

[20] The criterion is that in Land i the industry has a share of at least 5% in the sales revenue of all industries considered in our analysis.

[21] "All industries" refers to the set of industries from the manufacturing and mining sector considered in our empirical analysis.

the iron and steel industry, which is important for the Saarland (S) and North Rhine-Westphalia (NRW), the main share of sales revenue is earned in the latter Land.

Table 7: Regional impact of a contractionary monetary policy shock (condensed overview for industries with significant effects)

Industries	Rel. Output effect	Rel. Price effect	Large shares of industry sales revenue accrue to firms in Land:	Important for Land w.r.t. sales revenue:	Important for Land w.r.t. employment share:
Chemical industry	-	-	**NRW, H, RP**, BW	SH, **NRW, H, RP**, HH, BW, FB, B(W)	***RP, H***, *HH*, SH, **NRW**
Electrical engineering etc.	-	+	**FB, BW**, NRW	SH, LS, HB, **BW, FB**, HH, NRW, H, S, B(W)	*B(W)*, *HB*, *HH*, **FB**, LS, SH, **BW**
Food and drink industries	+	0	**NRW, FB**	B(W), **NRW**, H, **FB**, S	*B(W)*, **FB**, S, **NRW**, H
Iron and steel industry	-	-	**NRW**	**NRW**, S	*S*, **NRW**
Manufacture of tools etc.	+	0	**NRW**, BW, FB	**NRW**	RP, **NRW**, SH, HB
Mineral oil refining	+	0	**HH**, NRW	SH, **HH**	***HH***, SH, NRW
Mining	+	0	NRW, LS, **S**	**S**	***S***, NRW, LS
Shipbuilding	+	0	**HB**, LS, SH	**HB**	***HB***, *SH*, LS

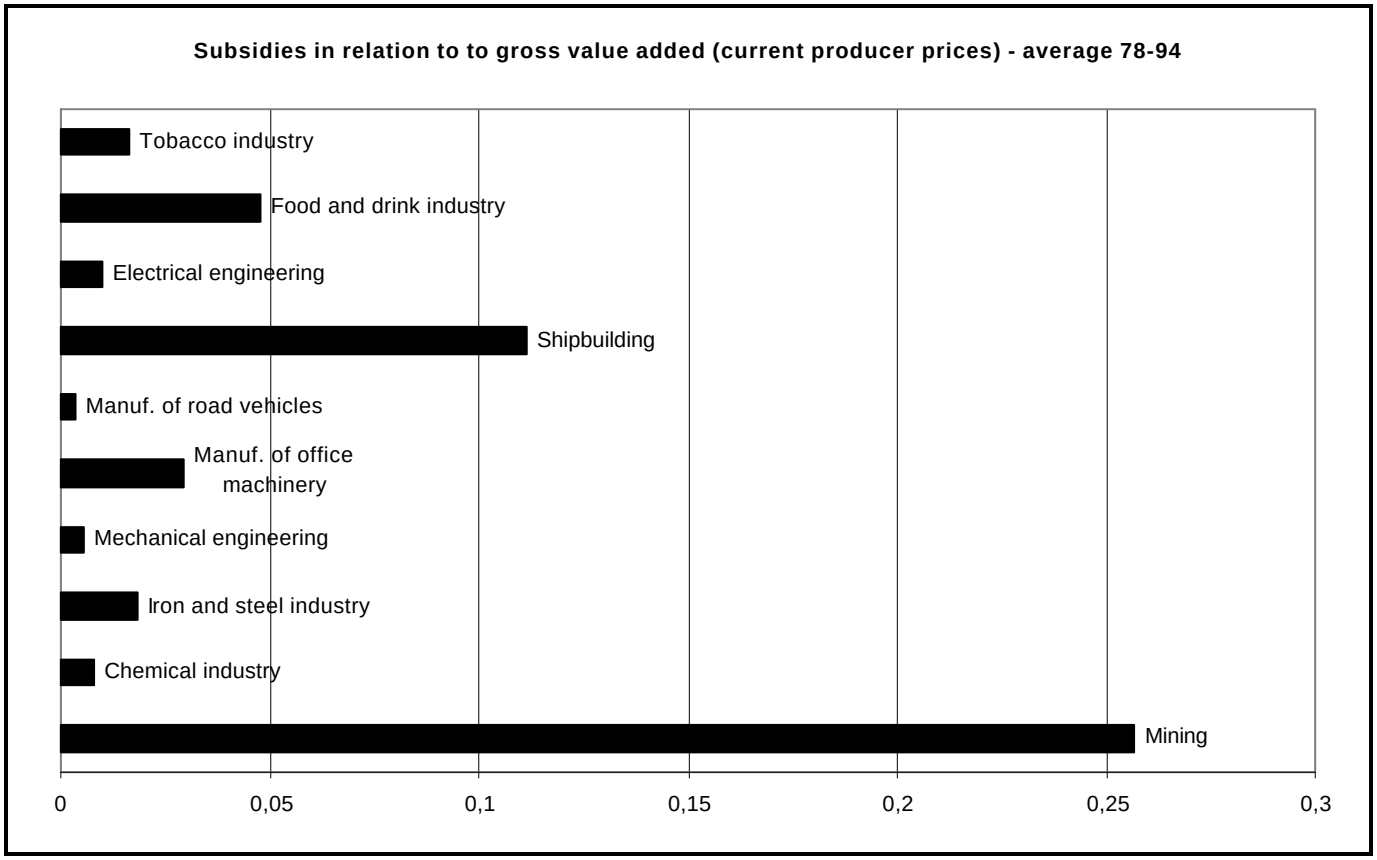
Coming now to positive relative output reactions, the food industry, another very large industry is especially important for North Rhine-Westphalia (NRW), Bavaria (FB) and with regard to the third criterion also for Berlin (B(W)), however, in absolute terms the share of Berlin-based firms in industry's revenues is not very high. For Hamburg (HH) and Schleswig-Holstein (SH), the mineral oil refining industry plays a special role, though only for Hamburg does this amount to a significant share of total industry revenues. The print industry is important for Schleswig-Holstein (SH), but again the absolute amount of revenues of firms located there is not large (see table 10). Finally, ship building is a major industry for Bremen (HB) and firms operating in this Land are responsible for a large share of industry's sales.

At this point one has to keep in mind the relationship between the regional importance of industries and the incentive for subsidization. Ranking the complete set of our 28 industries by the amount of subsidies received in 1990, almost all industries that are in the top-ten positions fall into the category of "regionally important" industries (based on the three criteria introduced above)[22]. The only slight exception, the manufacture of office

[22] Table 11 in the appendix gives the top-ten ranks, including those industries that show no significant relative output or price effects to a negative monetary policy shock.

machinery, does however fulfill criteria one and three for Bavaria and Baden-Württemberg and can insofar be considered as having regional importance in a broader sense. For these "top-ten" industries, the West German 1978-1994 industry averages of subsidies in relation to gross value added at current producer prices are depicted in figure 6. Within this group of highly subsidized industries, those with a positive relative output reaction to the contractionary monetary policy shock, namely mining, shipbuilding and the food and drink industry, also exhibit the highest relative values for subsidization vs. gross value added, for shipbuilding above 10% and for mining even above 25%. This suggests that using subsidies in an effort to stabilize industry output will inevitably impose a heavy burden on public budgets. A further word of caution regarding the use of subsidies might be added to this in light of the interpretations of the logit estimates for the whole spectrum of industries considered in our analysis.

Figure 6: Industry subsidies in relation to industry gross value added - average value 1978-1994



However, another aspect which we have not addressed so far is that by diversifying over many industries, Länder can under certain conditions insure themselves against industry specific shocks. And, since according to our analysis interest rate changes have asymmetric effects, a well-diversified industry portfolio protects to some extent also against the effects of monetary policy shocks. For instance, a large number of firms from almost every industry are located in North Rhine-Westphalia and thus negative effects might be compensated

by industries reacting relatively positively. Unfortunately, we cannot say anything specific in terms of absolute values, as only index data are available for industry output and prices.

5. Conclusion

The main objective of this paper was to investigate possible asymmetric effects of monetary policy transmission in Germany on the industries of the manufacturing and mining sector. Since we did not intend to model individual industry behavior in detail, the relevant stylized facts were analyzed in a macroeconomic setting by means of a common VAR model.

After looking at the production sector as a whole, we concentrated our analysis on the question of the relative effect of a monetary policy shock on the individual industries (at the 2-digit level of aggregation). To answer that question, we compared relative output and producer price responses. The resulting 'stylized facts' of our industrial VAR analysis are the following: Almost half of the industries show an output reaction that is significantly different from that of the aggregate manufacturing and mining sector. In more than half of the cases do we observe significant price reactions that differ from the aggregate. Five industries out of 28 exhibit significantly negative relative production movements in response to a contractionary monetary policy shock: non-ferrous metal industry, chemical industry, iron and steel industry, electrical engineering industry and manufacturers of office machinery. Interestingly, apart from iron and steel industry, all those industries are chosen as business cycle indicators[23] in the Bundesbank's 'Seasonally adjusted business statistics'. The two remaining industries selected by the Bundesbank as business cycle indicators, mechanical engineering and vehicle production, do not display a significant deviation from the manufacturing and mining industry as a whole[24].

Eight industries exhibit a significantly positive relative output reaction, namely clothing industry, food industry, mining industry, oil refining industry, printing industry, ship building, manufacturers of tools, and manufacturers of structural metal products.

Regarding relative prices, we find significantly negative price effects in four cases, chemical, iron and steel, non-ferrous metal industries and processing of paper. Positive relative price effects appear to be more common, we encounter those in eleven industries.

In a logit analysis we discovered that certain characteristics of industries might help in explaining why monetary policy has asymmetric effects. In particular, use of capital, export orientation, and receipt of subsidies turned

[23] See Deutsche Bundesbank, 'Seasonally adjusted business statistics', section III.(economic indicators) position 10. (output in selected branches of the manufacturing sector).

[24] However, there are differing definitions of industrial sectors in the Bundesbank's series and our data set.

out to be significant for the reactions of industries to monetary policy shocks.

With respect to regional effects of monetary policy it was shown that the German Länder are also likely to be affected asymmetrically by monetary shocks since there are large differences in the respective "regional industry portfolios". Projecting this finding to the European level leads to the conclusion that the ECB's monetary policy might well create asymmetric regional effects as long as European regions have different industry portfolios. Considering the argument mentioned in the introduction, structural adjustments to be expected after the introduction of EMU may exacerbate (Krugman and Venables (1996)) or lessen (Frankel and Rose (1998)) that problem.

Finally, in view of the growing importance of the service sector it would have been very interesting to see how the stylized facts for 'service sub-sectors' compare to the results derived for the manufacturing and mining sector. Such comparative results can be found in Ganley and Salmon (1997) for the UK, but due to lacking data we could not investigate this issue for Germany.

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Appendix

A. Data for Manufacturing and Mining

The two-digit level disaggregated industry **production and producer price indices** as well as the data for the overall manufacturing and mining sector were taken from the Time Series Service of the Statistical Office of the Federal Republic of Germany. The monthly *net production indices* (adjusted for working days; 1985=100) for the former area of the Federal Republic of Germany, published in segment 2705, are based on the industrial classification SYPRO[25] and are provided as monthly data from 1978:1 to 1994:12. The switch to a different industrial classification standard in 1995 limited our analysis to the given time period. The *producer price indices*[26] (1991=100, monthly data from 1950 onwards) for the former area of the Federal Republic of Germany are included in segment 3362[27] and measure the average development of the prices at which goods produced in Germany are sold in the country (Laspeyres index); quality changes are being considered in the calculation. Table 8 (following page) gives the names and the classification code of the selected industries used in the empirical research under SYPRO, ordered under main groups of the manufacturing and mining sector; for the industries, this classification code is sufficient to identify the production and producer price series, therefore their numbers are in general omitted.

Yearly data (area of the former Federal Republic of Germany) for **overall sales revenue of the industries** have been taken from the publication "Statistisches Bundesamt, Fachserie 4, Reihe 4.2.1: Beschäftigte, Umsatz und Investitionen der Unternehmen und Betriebe im Bergbau und im Verarbeitenden Gewerbe (1990)" (Federal Statistical Office of Germany, Series 4.2.1: Employees, Sales revenue and investment of companies and firms in the manufacturing and mining sector, edition 1990) , and for the **sales revenue and employment ordered by Länder** from "Statistisches Bundesamt, Fachserie 4, Reihe 4.1.4, Beschäftigung und Umsatz der Betriebe im Bergbau und im Verarbeitenden Gewerbe nach Bundesländern (1990)" (Federal Statistical Office of Germany, Series 4.1.4: Employment and Sales revenue of firms in the manufacturing and mining sector, ordered by Länder, edition 1990).

From the Time Series Service we have obtained additional **sales revenue data (internal, external)** for the SYPRO industries from segment 2314 (monthly data, in 1000 DM), which have been transformed to yearly data and then used to construct the average quotient of external vs. internal sales revenue.

From the same source, yearly data on **subsidies** (in Billion DM, segment 1660), **capital productivity** (segment 4378), **capital intensity** (segment 4382), **capital goods investment** (in Billion DM, 1991 prices, segment 1503), **gross value added** (in Billion DM, 1991 prices, segment 1496) and **employment** (yearly average, segment 917) have been obtained for the industries, to construct additional data for the research. The data follow a slightly different classification (WZ,

[25] SYPRO is the 'Systematik der Wirtschaftszweige, Ausgabe 1979, Fassung für die Statistik im Produzierenden Gewerbe' - 'Industrial Classification of Economic Activities, Edition 1979, Version for Statistics of Production Industries'.

[26] While the reporting of the producer price indices follows the 'Nomenclature of Goods for Production Statistics' - 'Güterverzeichnis für Produktionsstatistiken' (GP), with very few exceptions, the two-digit codes of the SYPRO corresponds to those of GP (see Industrial Classification of Economic Activities, Edition 1979, Version for Statistics of Production Industries).

[27] This segment includes the 'Index der Erzeugerpreise gewerblicher Produkte(Inlandsabsatz)'.

edition 1979), forcing us in some cases to approximations; table 8 gives the corresponding WZ classification codes used for the individual SYPRO industries. Additional information on the data is available upon request.

Table 8: Manufacturing and Mining Sector: Main groups and Industries

Full name	Class. code under SYPRO	Class. code under WZ,79
Production industries of the Manufacturing &Mining sector (excl. construction) [net production: 2705002, producer price: 3362006[28]]		
Mining, primary and intermediate goods industries		
Mining	21	11
Mineral oil refining	22	205
Quarrying, extraction and working up of stone and earths	25	221..223;226
Iron and steel industry	27	230..232
Non-ferrous metal industry, non-ferrous metal semi-finished products industries	28	233
Foundries	29	234..236
Chemical industry	40	200..201
Wood-working	53	260
Manufacture of rubber products	59	213..216
Capital goods industries		
Manufacture of structural metal products, rolling stock	31	240..241;247
Mechanical engineering	32	242
Manufacture of road vehicles; repair of motor vehicles etc.	33	244..245;2491
Shipbuilding [net production: 2705103, producer price: 3362031[29]]	34	246
Electrical engineering; repair of electrical household goods	36	250;2591[30]
Manufacture of precision and optical instruments, clocks, and watches	37	252..254
Manufacture of tools and finished metal goods (excl. electrical equipment)	38	256
Manufacture of office machinery and data processing equipment	50	243
Non-durable goods industries		
Manufacture of musical instruments, toys and games, articles of jewelry, fountain pens; working up of natural carving ad molding materials; photographic and cinematographic laboratories	39	257..258
Manufacture of ceramic goods	51	224

[28] For 'gewerbliche Erzeugnisse insgesamt (ohne Elektrizität, Erdgas, Fernwärme und Wasser)', that is excluding the costs of electricity, earth gas, and water.

[29] While the production index refers to classification no. 34, the producer price index is for the sub-class 345 (Boats and Yachts). However, no closer match was available.

[30] Corresponds to combined SYPRO industries no. 36 and 65 (repair of household goods).

Full name	Class. code under SYPRO	Class. code under WZ,79
Manufacture and processing of glass	52	227
Manufacture of wood products	54	261
Processing of paper and board	56	265
Printing and duplicating	57	268
Manufacture of plastic products	58	210
Textile industry	63	275
Clothing industry	64	276
Food and tobacco industries		
Food and drink industries	68	28/29[31]
Tobacco industry	69	299

B. Other data sources (monthly data for the time period 1978:1-1994:12*)*

Time Series Data Base of the Deutsche Bundesbank

r_short: Money market rates for daily funds reported by Frankfurt banks: monthly averages, % p.a. (Monthly Report: chapter VI. Interest rates, 4. Money market rates, by month); time series code: su0101; **r_long**: Yields on outstanding public bonds, listed as Federal securities, total, % p.a. (Monthly Report: chapter VII. Capital markets, 5. Yields and indices on domestic securities); time series code: wu0115.

International Financial Statistics of the IMF (cd-rom edition 1/98):

lm1: logarithmic monetary aggregate M1, s.a., Country: Germany, Bil. of (n.c. units), time series key in IFS: 13439MACZF...; **lpcom**: logarithmic world export commodity price index: world, all exports, international trade, index number, time series key: 00176AXDZF...; and as in Sims (1992), the logarithmic DM-US dollar exchange rate (**lex**) was constructed as the quotient of the **market rate, (n.c. units) per SDR, Country: Germany**, Time Series Key: 134..AA.ZF... and the **US dollars per SDR**, (n.c. units) per SDR, Country: United States, Time Series Key: 111..SA.ZF... .

[31] incl. 293..295, excl. 9.039.

C. Relative Output and Price Effects of a Contractionary Monetary Policy Shock

Table 9: Relative Output and Price Effects of Contractionary Monetary Policy Shock

Industries	Effect			
	Rel. Output	Significant	Rel. Price	Significant
Manufac. of ceramic goods	+	No	+	Yes
Chemical industry	-	Yes	-	Yes
Clothing industry	+	Yes	+	No
Electrical engineering etc.	-	Yes	+	(Yes)
Food and drink industries	+	Yes	+	No
Foundries	-	No	-	No
Manufac. and processing of glass	-	No	+	Yes
Iron and steel industry	-	Yes	-	Yes
Mechanical engineering	+/-	No	+/-	No
Mining	+	Yes	-	No
Manufact. of musical instruments etc.	-	No	+	Yes
Non-ferrous metal industry etc.	-	Yes	-	Yes
Manufac. of office machinery etc.	-	(Yes)	+/-	No
Mineral oil refining	+	Yes	-/+	No
Processing of paper and board	0	No	-	(Yes)
Manufac. of plastic products	-	No	+	Yes
Manufac. of precision instruments etc.	+	No	+	(Yes)
Printing and duplicating	+	Yes	+/-	No
Quarrying etc.	+	No	+	Yes
Manufac. of rubber products	-	No	+	Yes
Shipbuilding	+	Yes	-	No
Manufac. of structural metal products etc.	+	Yes	+	(Yes)
Textile industry	+	No	0	No
Tobacco industry	+	No	-	No
Manufac. of tools etc.	+	Yes	+/-	No
Manufac. of road vehicles etc.	0	No	0	No
Manufac. of wood products	-/+	No	+	Yes
Wood-working	-/+	No	+	Yes

Notes: A '+' ('-') indicates a relative positive (negative) effect, and a combination like '-/+' a fluctuation of the impulse response function from negative to positive. 'Yes' indicates that the observations are significant based on the confidence intervals (1.44 * S.E.), and '(Yes)' signals only marginal significance.

D. Regional Impact of a Contractionary Monetary Policy Shock (complete overview)

Table 10: Regional Impact of a Contractionary Monetary Policy Shock (overview for industries with significant effects)

Industries	Rel. Output effect	Rel. Price effect	Large shares of industry sales revenue accrue to firms in Land:	Important for Land w.r.t. sales revenue:	Important for Land w.r.t. employment share:
Chemical industry	-	-	**NRW, H, RP**, BW	SH, **NRW, H, RP**, HH, BW, FB, B(W)	***RP, H***, *HH*, SH, **NRW**
Clothing industry	+	0	NRW, FB, BW		FB, LS, HB
Electrical engineering etc.	-	+	**FB, BW**, NRW	SH, LS, HB, **BW, FB**, HH, NRW, H, S, B(W)	*B(W)*, *HB*, *HH*, **FB**, LS, SH, **BW**
Food and drink industries	+	0	**NRW, FB**	B(W), **NRW**, H, **FB**, S	*B(W)*, **FB**, S, **NRW**, H
Iron and steel industry	-	-	**NRW**	**NRW**, S	*S*, **NRW**
Manufac. of ceramic goods	0	+	FB, RP		FB, RP
Manufac. and proc.of glass	0	+	NRW, FB, RP, BW, LS		RP, LS, FB, NRW
Manufac. of rubber prod.	0	+	BW, H, LS, NRW		HH, LS, S, H, RP, SH
Manufac. of musical instr..	0	+	BW, FB		HH, BW, FB, LS
Manufac. of tools etc.	+	0	**NRW**, BW, FB	**NRW**	RP, **NRW**, SH, HB
Manufac. of office machin.	-	0	BW, FB, NRW		FB, B(W), BW
Manufac. of wood products	0	+	NRW, FB, BW		LS, RP, FB, NRW, SH
Manufac. of structural metal products etc.	+	+	NRW, BW, FB		HB, S, LS, SH, NRW, HH
Manufac. of plastic prod.	0	+	NRW, BW, FB, LS		LS, SH, RP, FB
Manufac. of precision instruments etc.	0	+	BW, FB, H, NRW		*SH*, HB, BW, LS, H, HH
Mineral oil refining	+	0	**HH**, NRW	SH, **HH**	***HH***, SH, NRW
Mining	+	0	NRW, LS, **S**	**S**	***S***, NRW, LS
Non-ferrous metal industry	-	-	NRW, BW, LS, FB		LS, NRW
Printing and duplicating	+	0	FB, NRW, BW	SH	*SH*, HH, HB, B(W), LS, H, FB
Processing of paper and board	0	-	NRW, BW, FB		B(W), SH, LS, RP, NRW
Quarrying etc.	0	+	FB, NRW, BW, LS		LS, RP, SH, FB
Shipbuilding	+	0	**HB**, LS, SH	**HB**	***HB***, *SH*, LS
Wood-working	0	+	NRW, FB, BW, LS		LS, RP, FB, S

E. Industry subsidies: top-ten ranks

Table 11: Top-ten ranks by amount of industry subsidies in 1990

Industry	Rang 1990	rel. output effect	rel. price effect	regionally important by crit. 1-3	Criteria fulfilled (for industries not included in table 10)		
					crit. 1	crit. 2	crit. 3
Mining	1	+	0	yes			
Food and drink industries	2	+	0	yes			
Electrical engineering	3	-	+	yes			
Chemical industry	4	-	-	yes			
Mechanical engineering	5	0	0	yes	**NRW,** **BW**, FB	LS,**NRW**, H, **BW**, FB, S, B(W)	*HB*, **BW**, HH, LS, **NRW**
Manufacture of office machinery etc.	6	-	0	(yes, crit. 1 and 3)			
Shipbuilding	7	+	0	yes			
Tobacco industry	8	0	0	yes	**B(W)**, FB	**B(W)**	**B(W)**, FB
Iron and steel industry	9	-	-	yes			
Manuf. of road vehicles etc.	10	0	0	yes	**BW, FB**, NRW	NRW, H, RP, **BW, FB**, S	*RP*, *S*, ***BW***, H, **FB**

Notes: +/- indicates significantly positive/negative relative industry reactions to a contractionary monetary policy shock; ranks are ordered by decreasing absolute amounts of subsidies received.

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