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ABSTRACT

The Monetary Transmission Mechanism: Evidence from the Industries of Five OECD Countries*

This Paper presents new evidence on the monetary transmission mechanism based on the effects that unexpected monetary policy shocks exert on the activity of 21 manufacturing industries in 5 OECD countries (France, Germany, Italy, UK and USA). The goal is twofold. First, documenting the cross-industry heterogeneity of monetary policy effects. Second, explaining this heterogeneity in terms of some microeconomic characteristics which are suggested by theory, using an original firm-level database. The results highlight the following empirical regularities: (i) a significant cross-industry heterogeneity of policy effects; (ii) a cross-industry distribution of policy effects similar across countries. These patterns are systematically related to the industry output durability and investment-intensity, and to measures of firms' borrowing capacity, size and interest payment burden. The 'credit channel' variables are quantitatively as significant as the traditional ones (durability, investment intensity) in explaining the differential impact of monetary policy.

JEL Classification: E32, E52 and G32
Keywords: balance sheet data, credit channel, interest rate channel and monetary policy transmission

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NON-TECHNICAL SUMMARY

This Paper reports new evidence on the monetary transmission mechanism. This evidence is obtained from the study of the impacts that unexpected monetary policy shocks have on the activity of 21 manufacturing sectors in 5 OECD countries (France, Germany, Italy, UK and USA). The goal is twofold. First, to document the cross-industry heterogeneity of the output effects of unanticipated monetary policy. Second, to explain these effects in terms of industry characteristics that are suggested by monetary transmission theories.

Our approach, based on a panel of disaggregated data, is motivated by the premise that the industry effects of monetary policy are more helpful in the understanding of the monetary transmission mechanism than their aggregate counterpart. This occurs because of two reasons. First, the features which are suggested by economic theory as the determinants of monetary policy effectiveness (e.g. interest-rate sensitivity of goods demand, capital intensity of the production process, firm size, firm access to financial markets, confusion of aggregate and idiosyncratic shocks) take on a wide range of values in microeconomic data. In particular, most features are more diverse across sectors within a country than across developed countries. The information provided by this heterogeneity, which may be useful to understand the monetary transmission mechanism, is lost with aggregation.

Second, panel data (across the industry and country dimensions) make it possible to analyse the role of microeconomic determinants of policy effects controlling for other time-invariant country-specific factors that also influence the effects of policy. This control cannot, by definition, be implemented with aggregate data. Time-invariant country fixed effect may be related to institutional/legal features, such as the workings of financial intermediaries or the judicial system (Cecchetti, 1999), and to the characteristics of the monetary regime, as suggested by several authors. When such country-specific effects are present, the role of the microeconomic determinants of monetary policy effects may be difficult to identify empirically. The use of cross-industry observations, drawn from a number of countries, allows this identification problem to be solved by controlling for country 'fixed' effects.

We begin by measuring the output effects of unanticipated monetary policy shocks by means of a structural VAR approach that is applied to 21 manufacturing industries in each of the 5 countries considered. By focusing on the effects of (unanticipated) policy shocks, the VAR approach is well suited to analyse the effects of monetary policy because it allows us to control for the systematic interactions between endogenous variable. Moreover, its widespread application in the literature makes our results directly comparable to previous studies. The analysis highlights two main empirical regularities: (i) a significant cross-industry heterogeneity of policy effects; (ii) a cross-industry distribution of policy effects similar across countries: some industries, e.g.

motorvehicles (food), show a systematic above (below) average response to a policy shock.

The second step of the analysis explains these regularities in terms of industry characteristics. In particular, we use two industry databases to construct a number of proxies for the determinants of monetary policy effects suggested by the ‘interest rate channel’ and the ‘broad credit channel’ views of the monetary transmission mechanism. Among the variables indicated by the former, we built a dummy for the industries producing durable goods, industry measures of capital intensity, financing requirements and of exchange rate sensitivity (openness to trade). In line with the suggestions of the ‘broad credit channel’, which emphasize the amplifier effect played by firms’ creditworthiness in the presence of capital market imperfections, we constructed a number of proxies for the firms’ borrowing capacity, such as the industry’s share of listed companies, mean and median firm size and financial leverage. To build several of these indicators we used an original firm-level database which contains balance sheet information from approximately 42,000 listed and non-listed firms. The resulting summary statistics are attached as a data appendix.

The study of the linkages between policy effects and industry features shows that, consistent with theoretical suggestions, monetary policy effects are stronger in the industries producing durable output, with a higher capital intensity of production and with smaller borrowing capacity (i.e. smaller size and/or leverage ratio). Moreover, the output effects of policy shocks appeared to be larger in the industries characterized by a greater interest rate burden (i.e. the ratio of interest payments to operating profit). No clear linkages emerged between the policy impacts and the degree of openness to trade, financial requirements and stock market access. Quantitatively, the economic significance of the credit channel variables (size and leverage) appeared of the same order of magnitude as that of the interest channel variables. This suggests that microeconomic industry features have a significant influence on macroeconomic outcomes.

Our exercise shows that the information contained in disaggregated data can be useful to understand the workings of the monetary transmission mechanism. Several extensions and applications are left for future research. Among the former, it would be of interest to analyse whether differential policy effects also arise with respect to pricing behaviour and to extend the analysis to the service industries. Deepening and widening the collection of disaggregated data is an important task for future empirical work. Future research might also be concerned with policy issues. In Europe, for instance, there are questions about the possible asymmetric effects that the ECB policy might cast on different countries. In particular, it would be interesting to understand to what extent differences documented from historic data are likely to change due to the common monetary policy of the ECB. Some of these issues have been recently addressed by Carlino and DeFina (1998a), Cecchetti (1999), Favero, Giavazzi and Flabbi (1999), Guiso et al. (1999). Disaggregated data appear to us a potentially promising way to tackle these questions because they allow aggregate policy effects to be decomposed into industry- and country-specific components and, eventually, to make some progress towards the identification of their microeconomic and macroeconomic determinants.

1. Introduction

This paper reports new evidence on the monetary transmission mechanism. This evidence is obtained from the study of the impacts that unexpected monetary policy shocks have on the activity of 21 manufacturing sectors in 5 OECD countries (France, Germany, Italy, UK and USA). The goal is twofold. First, to document the cross-industry heterogeneity of the output effects of unanticipated monetary policy. Second, to explain these effects in terms of industry characteristics which are suggested by monetary transmission theories.

Our approach, based on a panel of disaggregated data, is motivated by the premise that the industry effects of monetary policy are more helpful in the understanding of the monetary transmission mechanism than their aggregate counterpart. This occurs because of two reasons. First, the features which are suggested by economic theory as the determinants of monetary policy effectiveness (e.g. interest-rate sensitivity of goods demand, capital intensity of the production process, firm size, firm access to financial markets, confusion of aggregate and idiosyncratic shocks) take on a wide range of values in microeconomic data. In particular, most features are more diverse across sectors within a country than across developed countries. This can make disaggregated data more informative than aggregate ones.[1] The differential impact of policy on the spending components of output (e.g. durables versus non-durable consumption), documented for instance by Bernanke and Gertler (1995), provides indirect evidence of the heterogeneous industry effects of monetary policy. The information provided by this heterogeneity, which may be useful to understand the monetary transmission mechanism, is lost with aggregation.

[1] Sectoral studies have already proved very useful in the understanding of the business cycle determinants (e.g. Stockman, 1988; Basu and Fernald, 1995) and in the evaluation of the optimum currency area criteria (e.g Helg et al. 1995).

Second, panel data (across the industry and country dimensions) make it possible to analyze the role of microeconomic determinants of policy effects controlling for other time-invariant country specific factors that also influence the effects of policy. This control cannot, by definition, be implemented with aggregate data. Time-invariant country fixed effect may be related to institutional/legal features, such as the workings of financial intermediaries or the judicial system (Cecchetti, 1999), and to the characteristics of the monetary regime, as suggested by several authors.[2] When such country-specific effects are present, the role of the microeconomic determinants of monetary policy effects may be difficult to identify empirically. The use of cross-industry observations, drawn from a number of countries, allows this identification problem to be solved by controlling for country "fixed" effects.[3]

We begin by measuring the output effects of unanticipated monetary policy shocks by means of a structural VAR approach that is applied to 21 manufacturing industries in each of the 5 countries considered. By focusing on the effects of (unanticipated) policy shocks, the VAR approach is well suited to analyze the effects of monetary policy because it allows us to control for the systematic interactions between endogenous variable. Moreover, its widespread application in the literature makes our results directly comparable to previous studies. After documenting the industry effects of monetary policy, we use two industry databases, one of which contains firm-level information, to build a number of proxies for

[2] There is evidence, for instance, that monetary policy has smaller real effects under a more accommodative policy rule (Lucas 1973; Ball et al. 1988).

[3] Another desirable feature of disaggregated data, not exploited here, is that they make it possible to distinguish aggregate differences related to "behavior" from those due to "composition" effects. This point, which is key to identify the causes of cross-country "asymmetric" policy effects, is emphasized by Guiso, Kashyap, Panetta and Terlizzese (1999, p.61): "Relevant differences in the response to a monetary policy shock can be observed among different groups of agents in the same country, similar goups of agents in different countries, or both. However, the relative weights of these groups could differ across countries, in which case aggregation problems will confound attempts to make sense of the evidence."

the determinants of the monetary policy impacts as suggested by the "interest rate channel" and the "broad credit channel" views of the monetary transmission mechanism.[4] These proxies are used to explain the differential industry impacts of monetary policy, as measured by the estimated impulse response functions. The main findings of the analysis are summarized in the concluding section of the paper.

Our study is related to a recent paper by Carlino and DeFina (1998), where the differential effects of monetary policy shocks across US regions are analyzed. Following a structural VAR approach they show that output sensitiveness to monetary policy shocks varies significantly across regions. State-level data are then used to explain such differences in terms of the concentration of small firms (e.g. "credit channel") and the share of manufacturing in total production (e.g. "interest rate channel"). While the latter argument rests on the hypothesis of "differing interest rate elasticities of industries" (Carlino and DeFina 1998, p.572), the availability of industry-level data allows us to test hypotheses on the determinants of the policy effects in a more direct way. The paper also relates to a recent study by Hayo and Uhlenbrock (2000) where the industrial effects of monetary policy in Germany are measured and explained by indicators of industry investment intensity, trade openness and government subsidies. Our analysis extends this work by considering 5 OECD countries. Moreover, our database allows the industry effects of monetary policy to be related to firm-level balance sheet features which, according to the "credit view", should influence the intensity of policy effects. This may be interesting because, as pointed out by Bernanke (1993), it is not the existence of a credit channel effect which is in serious doubt but rather its *quantitative* relevance in the overall context of the policy transmission. In this respect, our paper provides some evidence showing that the policy determinants suggested by the

[4] This novel database, including information from the balance sheets of about 42,000 individual firms over a 5 year period, is attached as a data appendix.

credit view are as important as the traditional ones (e.g. durability, investment intensity) in explaining the differential effects of monetary policy.

The paper is organized as follows. In the next section the theoretical underpinnings of the industry effects of monetary policy are briefly spelt out. In Section 3 we present the methodology used in the identification of monetary policy shocks in the 5 countries at the aggregate level. In Section 4 the method is extended to study the industry response to policy shocks. The heterogeneity of industry responses is explained on the basis of structural features in Section 5, providing a first-round panel evidence on the significance of the different channels of monetary transmission. The main results and suggestions for future research are discussed in Section 6.

2. Why Focus on Industry Data?

Theoretical studies of the monetary transmission mechanism suggest several reasons why a policy induced rise in the short-term interest rate should entail differential effects on industry activity. Focusing on industry data is thus a natural way to utilize the information that such heterogeneity may provide. In the following, we briefly present some theoretical arguments underlying the view that the intensity of monetary policy effects may vary across industries.[5] These motivate our empirical investigation.

A first set of hypotheses suggests that the interest rate impinges on sectorial output because it affects both the demand for the industry commodities and the firms' decision problem. We will call this channel, common to several models, the interest rate channel. It postulates that a monetary restriction, by raising

[5] A comprehensive survey on the monetary transmission mechanism is beyond the scope of this paper. An excellent survey is the symposium in the fall 1995 issue of the Journal of Economic Perspectives. Recent textbook presentations of the broad credit channel argument are given in Freixas and Rochet (chapter 6, 1997) and Walsh (chapter 7, 1998).

the expected real interest rate, triggers a decrease in the expenditure for investment and durable consumption goods, which materializes in lower output of the industries producing such commodities. In an open economy, an interest rate increase may also involve an exchange rate appreciation which causes an expenditure switching effect from domestic to foreign (traded) goods. Moreover, firms in sectors characterized by more capital-intensive production processes may display a higher sensitivity to interest rate changes. It is important to note that the above mentioned factors are more diverse across industries than across countries. For instance, several structural features such as capital-labor ratios, trade openness, GDP shares of investment and consumption durables, are more similar across most OECD countries than across the industries of a given nation.[6]

A second monetary transmission mechanism, the so-called credit channel, matters under frictions in financial markets. This channel is rather thought as an amplification mechanism of the former one than as an independent one (Bernanke and Gertler, 1995). In general terms, the "broad credit channel" posits that financial debt becomes relatively scarce under a monetary tightening; this amplifies the real effects of monetary policy. Intuitively, this view relies on the depressing effect of an interest rate rise on borrowers net-worth (e.g. on bonds that can be provided as collateral) and therefore on their borrowing capacity.[7] This should result in a more acute effect of monetary policy on firms impaired by a more difficult access to financial markets, by smaller collateral, and in general whose credit-worthiness is more susceptible to changes in interest rates.[8] As the broad credit channel

[6] A potentially important source of heterogeneity in the industry impacts of policy is the different speed of price adjustment (e.g. Blanchard and Kiyotaki (1987)). Unfortunately, lack of sufficiently detailed data on industry prices prevents the investigation of this issue.

[7] Various special forms of this general idea have been investigated. A well known one, called the "lending channel", focuses on the peculiarity of bank loans as an essential input of production (imperfectly substitutable by borrowers). A monetary tightening that entails a reduction in bank loans supply decreases the amount of outstanding bank credit and finally output.

[8] It is worthwhile to point out that the credit channel can impinge on sectoral output through both prices (as the spread between the interest rate on loans and the risk free one) and quantities

suggests several microeconomic factors determining the effect of monetary policy, it is natural to verify its empirical relevance using disaggregated data, as close as possible to those singled out by the theory. The considerable cross-industry heterogeneity which exists along these dimensions increases the potential fruitfulness of our exploration.[9]

3. Measuring the Effects of a Monetary Policy Shock

An important step in the analysis of the effects of monetary policy involves the distinction between its expected and unexpected components. The latter are particularly useful to isolate the effects of monetary policy *per se*, distinguishing them from those effects associated with interest rate changes that represent a systematic policy reaction to exogenous factors. Isolating the exogenous component of monetary policy from its endogenous response to the economy is crucial since the empirical correlation between interest rates, output and prices may be due to reverse causation.

The measurement of unexpected policy components, however, is a difficult task. Several approaches have been proposed in the literature, but no wide consensus has been reached yet.[10] Here we rely on the structural vector auto regression methodology (SVAR). The multivariate approach of SVARs allows us to estimate exogenous monetary policy shock controlling for the systematic feedback between monetary policy and the main macroeconomic variables. While the impulse response generated by the SVAR are not an estimate of the *total* effects of monetary policy (they neglect the effects due to the systematic policy component), their exogeneity makes them particularly appealing to test hypotheses on

(as a credit rationing effect).

[9] For example, in some countries the cross-industry variation in the percentage of listed firms ranges between 0 and 100%, larger than the one recorded across countries.

[10] See the exchange between Rudebusch (1998) and Sims (1998).

the monetary transmission mechanism.

The identification method used here relies on the recursiveness assumption presented in Christiano, Eichenbaum and Evans (1998) and briefly explained in Appendix A. A main reason for the adoption of this scheme lies in its simplicity, which makes it a natural starting point. Moreover, its widespread use makes the results comparable to several previous studies. Obviously, simplicity also raises the question of the robustness of our findings to alternative identification schemes. This issue is discussed in Section 5.[11]

In essence, the recursiveness assumption amounts to dividing the VAR variables in two sets: on the one hand those to which monetary policy reacts contemporaneously (but that respond to it with a delay); on the other hand those that the central bank observes with a lag (but are immediately affected by it). An appealing feature of the recursive approach is that the ordering of the variables preceding and following the monetary policy instrument does not influence the measurement of their response to the monetary policy shock (see Appendix A).

Our starting point is the estimation of 5 aggregate VARs (for France, Germany, Italy, the UK and the USA) using monthly data for the 1975-97 period and a 5 period lag length. For all countries, it is assumed that the operating instrument of monetary policy is a short-term interest rate, as is common in the literature.[12] We follow Christiano et al. (1998) in the specification of a parsimonious 5 variable VAR for the United States which includes industrial production, the consumer

[11] In a nutshell, we find that changing the identification scheme influences the absolute *size* of the policy effect on industrial output but that the *relative* intensity of policy shocks across industries (which is what we want to explain on the basis of industry features) is not significantly changed when a different identification scheme is applied.

[12] On the use of the short-term rate as the operating tool of the G7 central banks see Clarida et al. (1998). We use three-month interest rates for all European countries, and the Federal Fund rate for the US; all data were taken from the OECD database "Main Economic Indicators"; sectoral data on output are from the OECD database "Indicators of Industrial Activity". The sample period runs from January 1975 to March 1997; in a few industries data are only available since the early 80s.

price index, a commodity price index, a short-term rate and a monetary aggregate. The recursive ordering postulates that the first three variables enter the monetary authorities' reaction function simultaneously (but respond to it with a lag). The monetary policy shocks thus obtained are asymptotically equivalent to the regression residuals of the short-term rate on the contemporaneous values of the industrial production, inflation and a commodity price index and lagged values of all the VAR variables. The impulse response functions for the USA yielded by this identification scheme, reported in the first column of Figure 1, show that a monetary tightening is followed by a temporary reduction of industrial activity and of the money stock. These patterns are consistent with theoretical *a priori* about the long-run neutrality of money and short-run policy effectiveness. The VAR specification for the European countries includes the exchange rate after the short term rate (thus assuming that monetary policy does not respond contemporaneously to it).[13] This is done under the presumption that the exchange rate is a more relevant economic variable in European countries than in the USA, possibly because of the larger degree of openness of the former economies.

The specification adopted for every country and the ordering of variables used in the recursive identification of the monetary policy shock is presented in Table 1, together with some diagnostic statistics for the interest rate equation. The tests show that the estimated interest rate equations display no serial correlation and no parameter instability – when we split the sample in two – except for Germany and the United States. In the latter case it is well known that this is related to

[13] The inclusion of the exchange rate among the variables entering contemporaneously in the monetary authority information set (but responding with a lag) helps dealing with the so-called "price puzzle" (i.e. the fact that the price level increases after a restrictive monetary policy shock). This assumption neglects the simultaneous relation between the interest rate and the exchange rate, central to non-recursive identification schemes (e.g. Sims and Zha, 1995). The monthly data used in our analysis, however, may justify the assumption of a non-simultaneous policy reaction to the exchange rate, under the premise that policy reacts to reacts to low frequency movements of the exchange rate and does not immediately react to its monthly fluctuations.

the different operating procedures adopted in the early 80s.[14] As common in the VAR literature, the normality of the interest rate equation residuals is rejected.

Identification schemes were harmonized across countries to minimize differences in results originating from different specifications. An alternative identification procedure, based on country-specific schemes, leads to similar estimates of the industry effects and to almost identical conclusions about the relationships between these effects and their determinants (Section 5).[15]

Figure 1 illustrates the impulse responses of the main variables included in the VARs, along with 5 per cent confidence bands.[16] An unexpected increase of the short-term interest rate brings about effects on the other variables that are *qualitatively* similar across countries and broadly in line with previous studies (e.g. Sims, 1992). The policy shock is highly persistent: in all countries the interest rate is significantly larger than zero in the year after the shock. Industrial production falls after a few months, bottoming between 18 and 24 months after the shock; it eventually returns to the level prevailing before the shock after 3/4 years. Moreover, a higher interest rate leads to a reduction of monetary aggregates and, in the European countries, to an exchange rate appreciation.[17] The price level does not show clear signs of reduction, which is a common finding in the SVAR literature, usually taken to support the presence of nominal rigidities. Quantitatively, the effect on industrial production of a monetary policy shock varies across countries: the maximum impact of the monetary policy shock on

[14] Bernanke and Mihov (1998) show that the interest rate equation is only marginally affected by this instability.

[15] The results based on country specific identification schemes, which appeared in a previous version of the paper, are available from the authors upon request. The main difference between those identification schemes and the standardized ones used here is that in the former a long-term interest rate was included in the VAR for France, Germany and UK in order to "cure" the price and exchange rate puzzles; moreover, different lag lengths were used for each country.

[16] Confidence bands are computed with Monte Carlo simulations assuming that innovations are asymptotically normally distributed.

[17] The appreciation is not very significant in Germany and does not appear in Italy.

industrial production, measured by the output semi-elasticity to the interest rate shock[18], is about 1.6 per cent in Germany, 1.1 in Italy and around 0.7 in the other countries (see the last row of Table 3). Germany and Italy also show a slower output response to the interest rate shock (industrial production bottoms after 2 years in Italy and somewhat later in Germany), while the effect unfolds more quickly in France, the UK and the US.

4. Industry Effects of Monetary Policy

In this section we employ the recursive identification scheme presented above to measure the industry effects of monetary policy. This is done by estimating a VAR where the production index of industry j in country i is added as the *last* variable to the VAR of country i presented before (see Table 1). Lack of data forces confines our analysis to differences in the output effects, overlooking potential differences in pricing behavior. The index j spans 21 manufacturing industries, listed in Table 2 (according to a 3 or 4 digit ISIC code), where their percentage share in total manufacturing output is reported.[19]

This VAR specification implies that monetary policy does not respond simultaneously to industry-specific shocks while it does not constrain to zero the simultaneous response of industrial output to policy shocks. It is reasonable to consider whether allowing for a simultaneous industry response is consistent with the assumption, used in the identification of the aggregate VAR, that the con-

[18] The size of the shock is equal to one standard deviation of the structural innovation of the estimated reaction function, and therefore varies across countries. Hence, the output effect of policy is normalized by the shock to make it comparable across countries. In France, for example, industrial production shrinks by 0.2 per cent 24 months after a 40 basis point interest shock, which amounts to a (semi)elasticity of -0.5.

[19] The data are averages over the 1970-93 period. The industries for which data are available amount to about 90 per cent of total manufacturing output in each of the country considered. The monthly data used in the VAR are not available for all industries in some countries; these "missing" data are denoted by an asterisk in Table 2.

temporaneous aggregate output response is zero. A sufficient condition to show that there is no inconsistency is provided by the empirical observation that the estimated simultaneous industry responses are generally not significantly different from zero.[20]

The main output of our analysis is a set of 100 VARs with the associated impulse response functions, one for each of the 21 industries in each of the 5 countries (data from 5 industries are missing). Figure 2 shows, for each of the 5 countries considered, the effects of a 1 percentage point increase of the interest rate on the aggregate industrial production and on the output of 6 large industries – food, textiles, chemicals, iron, machinery, motorvehicles – representing about half of the total manufacturing output (5 industries for Italy). Most industries display a u-shaped response to the shock (the erratic behavior during the first 6 months is never statistically significant).[21] Within each country, the industry responses differ significantly both qualitatively and quantitatively: the impact on the production in the food and textiles industry is not larger (and most of the times smaller) than the one recorded at the aggregate level by industrial production. On the contrary, the heavy industry (iron, machinery and motorvehicles) shows a response to policy that is markedly larger than that recorded by the other industries.

To quantify the output effects of monetary policy across industries (and countries) three summary measures of impact are constructed. These are the industry output elasticity to a 1 percentage point interest rate increase after 24 months, the maximum elasticity recorded between 12 and 36 months after the increase and the arithmetic average of the elasticities recorded between 18 and 24 months

[20]It is also important to note that the coefficient of the lagged industry output appearing in the policy equation (short rate) are never significantly different from zero. Therefore the policy shocks measured by the industry VAR are essentially identical to those obtained from the aggregate VAR.

[21]Standard error bands are not reported here to make the picture more readeable.

(so that single "peaks" have less influence on the impact measure). These three measures are highly correlated, suggesting that the policy effects identified by our analysis do not crucially hinge on the particular measure of impact that is used.[22] These measures are shown in Table 3.

The impact of policy on the industry output is usually negative in all countries and in several cases it is statistically different from zero (bold numbers). Visual inspection of Table 3 reveals that the largest (negative) impacts tend to be concentrated in the lower part of the table, where the "heavy" industries are located. In the United States, Italy and the UK the largest maximum impact is recorded by the motorvehicles industry (respectively -2.0, -2.5 and -2.4 per cent). The machinery (MH) and iron (IR) industries also record impacts which are clearly larger than the one recorded by the industrial production in four out of five countries (see last row of Table 3). At the other extreme, the maximum impact in the footwear (FT) and wearing apparel (CL) industries is almost never significantly different from zero; in Italy, where it is different from zero in the wearing apparel industry (-0.6), it is about half the maximum impact recorded by industrial production (-1.1).[23]

To analyze the extent to which the cross-industry effects of monetary policy are alike across countries, we measured the similarity of the ranking of impacts between pairs of countries using the Spearman index or rank correlation.[24] The results, presented in Table 4, are based on both the 24-month and the maximum elasticity (Panel A and B, respectively). The first thing which appears is that no

[22] In each country, the cross-industry correlation between the maximum and the 24 month elasticity is larger than 0.92, that between the maximum and the 18-24 month elasticity is above 0.95, that between the 24 month and the 18-24 month elasticity is larger than 0.98.

[23] The shipbuilding industry displays a positive response to the policy shock in three out of four countries (statistically significant in Germany); positive responses also appear in the Tobacco industry. Hayo and Uhlenbrock (2000) argue that government subsidies may help understanding the "unusual" output responses of some industries.

[24] The rank correlation index between country i and country j would be 1 if the rankings of the elasticity of table 3 were identical, -1 if they were reversed.

countries show an "inverse" correlation of rankings (the rank correlation index is never significantly smaller than zero). Rather, most correlation are significantly larger than zero, suggesting a certain degree of cross-country similarity in the cross-industry profile of policy effects.

We use a simple linear regression to decompose the impact of monetary policy in industry j of country i (call it η_{ij}) into country and industry specific components. To do this we run the regression (there are 100 η_{ij} estimates obtained from the industry VARs)

$$\eta_{ij} = \mu + \alpha_i + \delta_j + \varepsilon_{ij} \tag{4.1}$$

where i is a country index ($i = 1, 2, ..., 5$) and j is an industry index ($j = 1, 2, ..., 21$). The constant term μ measures the average policy impact across all sectors and countries, the α_i's coefficients measure the average deviation of the sectors of country i's from μ; the δ_j's coefficients measure the average (cross-country) deviation of industry j from μ. Obviously, the α_i's and the δ_j's coefficients cannot be estimated independently, as the linear dependency between the explanatory variables implies that both the industry effects and the country effects sum to zero (i.e. $\sum_i \alpha_i = \sum_j \delta_j = 0$). Therefore equation (4.1) is estimated under the constraints

$$\alpha_5 = -\sum_{i \neq 5} \alpha_i, \qquad \delta_{21} = -\sum_{j \neq 21} \delta_j. \tag{4.2}$$

The α_i's measure how much heterogeneity of responses can be attributed to country specific factors, once industry differences (identical across countries) are controlled for. Similarly, the δ_j's measure the heterogeneity of responses related to industry specific factors, after controlling for country effects (identical across industries).

The estimates of equation (4.1) are reported in Table 5, where both the 24-month and the maximum elasticity are used as impact measures (estimated with GLS assuming the error terms ε_{ij} have country-specific variances and are correlated across countries). The estimated constant μ from the 24-month elasticity equation (first column) indicates that an unexpected interest rate increase of 1 percentage point reduces the level of industrial activity by 0.6 per cent, in the average industry of the average country. A lower than average response for US industries appears (a positive and significant country effect), while no "structural" differences emerge between France, Italy and Germany, where the average (cross-industry) policy effect does not reveal a statistically significant country component.[25] Significant differences appear across industries, confirming that industries producing non-durable consumption goods experience a smaller fall in activity than the industries producing durable-consumption or investment goods (those appearing in the lower part of Table 5). Note, moreover, that the cross-industry variability is larger than the cross-country variability (differences across industries can be as large as 2 percentage points, more than twice the maximum difference recorded across country).

5. The Determinants of the Monetary Policy Effects

The heterogeneity of industry responses appearing in all countries raises the natural question of what explains such differences. The "interest rate channel" and the "broad credit channel" views of monetary transmission suggest several features that might help answering this question. The purpose of this section is to build proxies for some of these features and to use them to explain the differential

[25] Previous estimates, using impact measures derived from country specific VAR schemes (see footnote 14), revealed more heterogeneity in the country fixed effects than what appears from Table 5(which is based on the harmonized VAR scheme of Table 1). The industry effects, however, are only marginally affected by the VAR scheme.

industry impacts documented before.

5.1. The database

To construct these proxies, we use information drawn from two databases. The first one, STAN (from the OECD), contains industry data on value added, investment, exports and employment at a level of disaggregation that is analogous to the one we used before (ISIC 3/4 digits).[26] The second database, Amadeus, is an original firm-level database where balance sheet information is collected from about 150,000 major public and private companies from 26 European countries, from all branches of manufacturing considered before, over the period 1993-1997.[27] The firms considered show marked differences in terms of size (value added, employees) and access to capital markets (both listed and non-listed companies appear). Unfortunately, when using Amadeus we are forced to exclude the US from the analysis.

To measure the interest rate sensitivity of each industry we use the following variables: a *dummy durability* for the industries producing durable goods;[28] measures of *short-term debt* (industry mean and median ratio of short-term debt to total debt); measures of capital intensity (the ratio of an industry's *investment to value added*); measures of financing needs (industry mean and median of firm

[26] Data are available for most OECD countries over the 1970-93 period.

[27] The data in Amadeus provide information on the entire distribution of the industry features considered, such as mean and median, which are not available in the STAN database. For the 21 industries of the 4 European countries studied here the database has observations on about 42,000 firms. The data are likely to be biased toawards medium-large firms, as companies surveyed in Amadeus must comply with at least one of the following criteria: (a) turnover greater than 12 million USD; (b) number of employees greater than 150; (c) total assets greater than 12 million USD.

[28] The industries are grouped on the basis of the economic destination of production used in the national accounts statistics. According to this criterion, the industries producing "durable" output are denoted by the ISIC codes beginning with digits: 33, 36, 37, 38 (cf. Table 2). An alternative measure, which includes industries 34 and 35 (paper and chemicals) among the durable output producers, does not change the results.

working capital per employee[29]); measures of trade *openness* (ratio of exports - and of imports plus exports - to the industry value added). We expect a stronger output effect of monetary policy in the industries where larger values of each of the above variables appear.[30]

According to the suggestions of the broad credit channel, the following indicators are constructed: *firm size* (mean and median number of employees per firm in each sector); the industry share of *listed companies* (the ratio of the number of employees of listed companies, including their subsidiaries, to the total number of employees in the industry); measures of financial *leverage* (mean and median ratio of total debt to shareholders' capital). We interpret these variables as proxies for the indebtness capacity of firms. For instance, larger firms are expected to have easier access to the bond market; similarly, the leverage ratio is taken as an indicator of borrowing ability, consistently with the findings of Giannetti (2000) that more leveraged firms tend to get loans at better terms (both maturity and interest rate).[31] Therefore, on the basis of the broad credit channel hypothesis, an inverse relationship between the effectiveness of monetary policy and the level of these variables is expected (i.e. a positive partial correlation coefficient).

Finally, we construct an indicator to measure the incidence of interest rate expenditures on profits, called *interest burden* (mean and median ratio of interest rate payments to operating profits). This variable may affect firms' responsiveness to policy shocks either directly, as suggested by "limited participation models"

[29] Working capital is defined in Amadeus as the sum of the asset items "stocks" and "debtors" minus the liability item "creditors". This variable proxies the short term financial requirement of a firm business associated with its operating activity.

[30] In the case of an interest rate increase, a larger output reduction. Therefore, the expected sign of the partial correlation coefficient between the estimated elasticities (Table 3) and each of these indicators is negative.

[31] Using information from the Amadeus database Giannetti shows that "the cost of debt is lower for more levered firms" and that "more levered firms are the ones with higher share of long term debt to total debt". Both findings lead her to conclude that high leverage is a signal of the ability to get loans at better terms.

(e.g. Christiano and Eichenbaum, 1992; Fuerst, 1992; Lucas, 1990), or through a worsening of their creditworthiness. It is expected that a higher interest rate burden raises the impact of monetary policy.[32]

Sources and definitions of all the variables used in the analysis are detailed in Appendix B and summarized in Table A1: the interest rate channel variables appear in the shaded area of the right column; below them the broad credit channel variables are listed in a white box.

5.2. Regression analysis

The industry effects that we want to explain are measured by the elasticities to monetary policy shocks reported in Table 3. Since these elasticities are averages of the industry behavior over the estimation period, the explanatory variables are also measured as averages over the available period.[33] The use of averages, moreover, reduces the possibility that the results depend on a particular realization of the data in a given year.

Table 6 reports the results of a regression analysis where the 24-month elasticity is used as dependent variable.[34] All estimates include country fixed effects to control for unobserved industry-invariant factors which may affect the policy impact in a given country[35] and common (across country) coefficients on the industry explanatory variables (durability, investment/value added, openness, leverage,

[32] The interest rate burden indicator differs from the leverage indicator discussed before, which is a proxy for indebtness capacity. Conceptually, the independence of the two concepts obtains if operating profits are independent of leverage. In our sample, the correlation coefficient between the leverage and the interest rate burden is 0.5.

[33] The indicators are averages over the available period: 1993-97 for Amadeus and 1970-93 for STAN variables.

[34] Similar results are obtained when the other elasticity measures are used (cf. equation 5 and 6 in Table 6).

[35] The estimates are based on the White heteroschedasticity consistent estimator (Greene, 2000, p.463) which allows us to take account of the non-spherical disturbances typical of cross-section data.

size, interest-burden, etc..).[36] The analysis is based on two different data samples: the first one uses the proxies constructed from the STAN database, which includes the United States (equations 1 and 2). The second is based on Amadeus and is confined to European countries (equations 3 to 7).

Equation 1 is estimated using the durability dummy, the investment intensity and the trade openness as explanatory variables. Since neither openness measure is statistically significant,[37] equation 2 presents results where this variable is omitted. It appears that industries producing durable output and where production is more capital-intensive tend to show a more intense reaction to policy shocks. This finding, also highlighted in single-country studies by Hayo and Uhlenbrock (2000) and Ganley and Salmon (1997), confirms the relevance of the traditional interest rate channel of monetary transmission. Unlike Hayo and Uhlenbrock, however, no significant role for the degree of trade openness is detected.

The use of balance sheet indicators from Amadeus allows us to go one step further in the analysis and to test the significance of credit channel variables. Equation 3, where all explanatory variables constructed from Amadeus are used (i.e. working capital, short-term debt, size, leverage, listed companies, interest burden), shows that the impact of monetary policy is not significantly related to measures of short-term debt, financing needs (*working capital*) and listed companies (these variables do not pass a joint test of redundancy). After removing redundant variables from the estimation, the significant role of durability is confirmed and evidence appears in support of the broad credit channel hypothesis (equation 4): two of the variables measuring firms' borrowing capacity, namely leverage and firm size, are significant and have the expected (positive) sign. This is consistent with the hypothesis that a higher borrowing capacity reduces the potency of monetary policy. We also find that the interest-burden variable is

[36] The hypothesis of equal (across country) coefficients is not rejected at the 5 per cent level.
[37] The results in equation 1 are based on the (imports+exports)/(value added) indicator.

significant and has the expected (negative) sign.

Quantitatively, the economic significance of the credit channel variables (size and leverage) appears as relevant as that of the interest channel variables. The estimated marginal effect of increasing the typical firm size by two hundred employees is to reduce the policy impact by about 0.6 percentage points. To get a feel of magnitudes, note that such an effect is sufficiently large to offset the differential negative effect experienced by durable producing industries. Considering that the range of variation of the (median) firm size in our sample ranges from 0.5 to 5 hundred employees (this interval contains approximately 90% of the observations), the size variable appears capable of inducing differential impacts in the range of 1.5 percentage points, quite a large number if judged in comparison to the range of variation of the policy impacts (Table 3).[38]

The results are reasonably robust. They are essentially analogous to the ones obtained in a previous version of the paper, where the industry impacts were measured using country-specific identification schemes. The main difference between the previous estimates and the current ones is the cross-country heterogeneity of the country fixed effects, which was previously more apparent.[39] However the cross-industry variability and, quite importantly, its relation to the industry features are not affected by the choice of the identification scheme: even under the country specific schemes the durability, leverage, firm-size and interest-burden variables were significantly related to the industrial impact of policy. The use of alternative impact measures (maximum or 18-24 month elasticity) weakens somewhat the significance of the leverage variable (see equations 5 and 6), with no

[38] Similarly, the leverage variable is capable to explain about 1 percentage point of the differential policy effects.

[39] Country specific effects are quite similar in Table 6. In equation 2 it is not possible to reject the hypothesis (at the 10 per cent level) that France, Germany, Italy and the USA have identical fixed effects; a stronger than average policy effect is detected for the UK. When the European sample is used (equation 4) it is not possible to reject the hypothesis of equal coefficients (at the 10 per cent level) between Germany, Italy and the UK.

major consequence for the other variables. This also happens when instrumental variable estimation is performed (equation 7), to control for the biases possibly related to measurement errors in the indicators.[40] Overall, the point estimates of all variables (except leverage) remain significant and their value does not change much across equations. In particular, the coefficients of durability and firm size are almost identical across equations, suggesting that their quantitative significance remains strong.

6. Concluding Remarks

This paper investigated the differential output effects of unanticipated monetary policy shocks using industry data from 5 OECD countries. The first step of the analysis documented such differences, highlighting two main empirical regularities: (i) a significant cross-industry heterogeneity of policy effects; (ii) a cross-industry distribution of policy effects similar across countries: some industries, e.g. motorvehicles (food), show a systematic above (below) average response to a policy shock.

The second step of the analysis attempted to explain these regularities in terms of industry characteristics. In particular, we used two industry databases to construct a number of proxies for the determinants of monetary policy effects suggested by the "interest rate channel" and the "broad credit channel" views of the monetary transmission mechanism. Among the variables indicated by the former, we built a dummy for the industries producing durable goods, industry measures of capital intensity, financing requirements and of exchange rate sensitivity (openness to trade). In line with the suggestions of the "broad credit channel",

[40] We instrumented the size, leverage and interest burden variables of equation 4 with their ranks across countries and industries. For instance, we ranked all the industries in all countries according to the median number of Employees per firm (size), and used this ranking as an instrument for that variable.

which emphasize the amplifier effect played by firms' creditworthiness in the presence of capital market imperfections, we constructed a number of proxies for the firms' borrowing capacity, such as the industry's share of listed companies, mean and median firm size and financial leverage. To build several of these indicators we used an original firm level database which contains balance sheet information from approximately 42,000 listed and non-listed firms. The resulting summary statistics are attached as a data appendix.

The study of the linkages between policy effects and industry features showed that, consistently with theoretical suggestions, monetary policy effects are stronger in the industries producing durable output, with a higher capital intensity of production and with smaller borrowing capacity (i.e. smaller size and/or leverage ratio). Moreover, the output effects of policy shocks appeared to be larger in the industries characterized by a greater interest rate burden (i.e. the ratio of interest payments to operating profit). No clear linkages emerged between the policy impacts and the degree of openness to trade, financial requirements and stock market access. Quantitatively, the economic significance of the credit channel variables (size and leverage) appeared of the same order of magnitude as that of the interest channel variables. This suggests that microeconomic industry features have a significant influence on macroeconomic outcomes.

Our exercise shows that the information contained in disaggregated data can be useful to understand the workings of the monetary transmission mechanism. Several extensions and applications are left for future research. Among the former, it would be of interest to analyze whether differential policy effects also arise with respect to pricing behavior and to extend the analysis to the service industries. Deepening and widening the collection of disaggregated data is an important task for future empirical work. Future research might also be concerned with policy issues. In Europe, for instance, there are questions about the possible asymmetric effects that the ECB policy might cast on different countries. In particular, it would be interesting to understand to what extent differences documented from historic data are likely to change due to the common monetary policy of the ECB. Some of these issues have been recently addressed by Carlino and DeFina (1998a), Cecchetti (1999), Favero, Giavazzi and Flabbi (1999), Guiso et al. (1999). Disaggregated data appear to us a potentially promising way to tackle these questions because they allow aggregate policy effects to be decomposed into industry and country specific components and, eventually, to make some progress towards the identification of their microeconomic and macroeconomic determinants.

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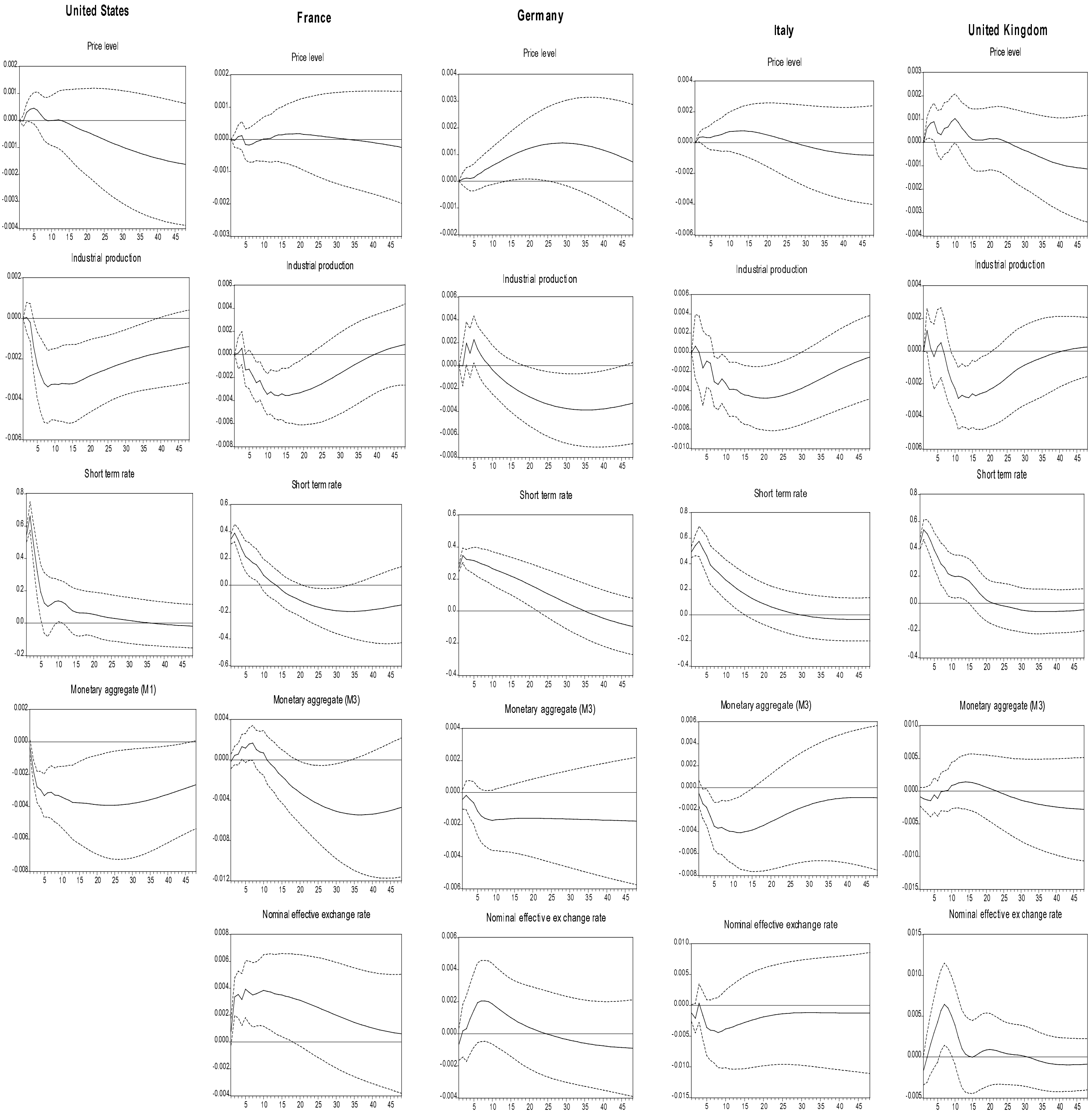
Figure 1

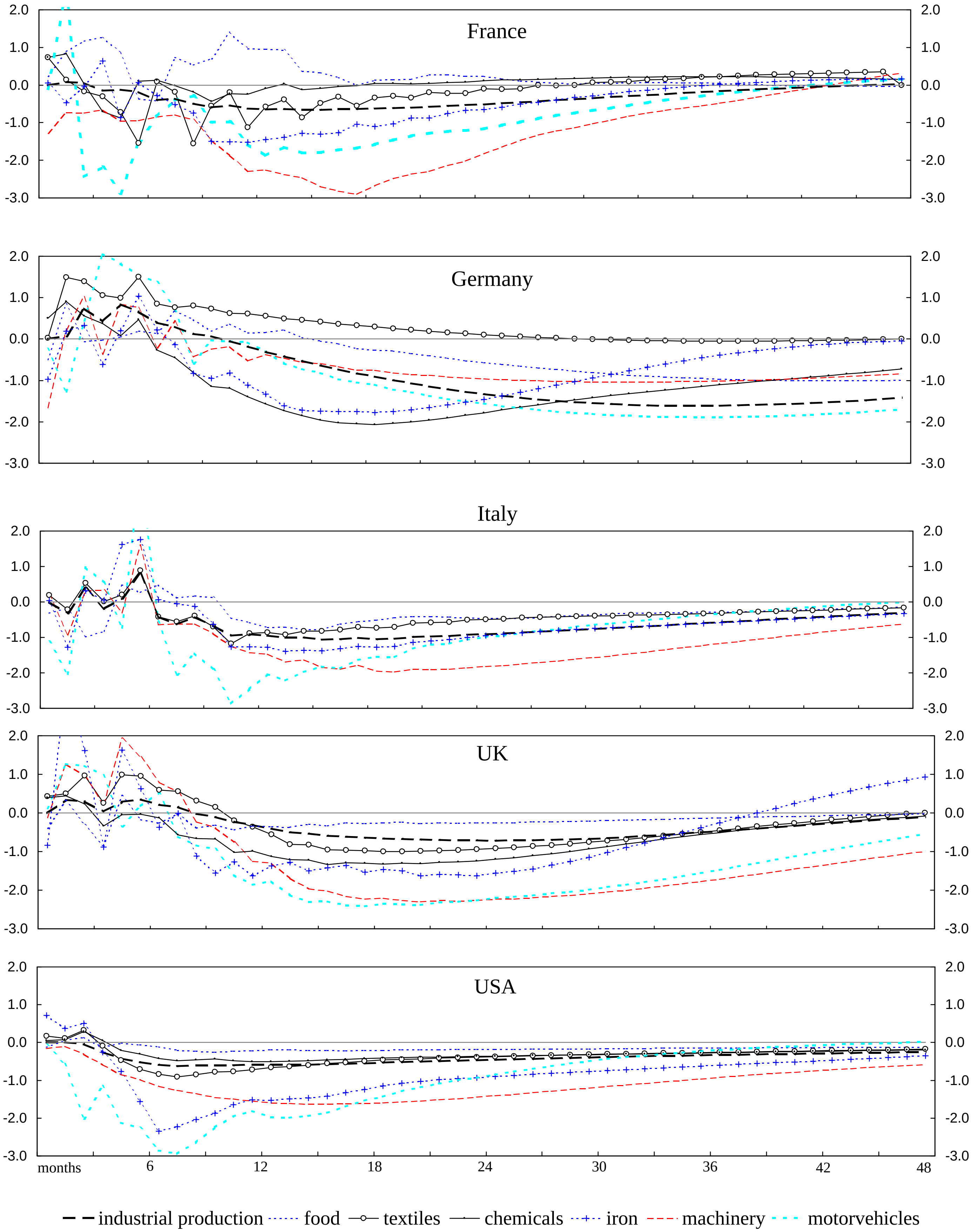
Responses of the main macro variables to a monetary policy shock

(±2 standard error bands)



Note: The boxes in each column show the response of the VAR variables to a shock to the short term interest rate (equal to one standard deviation) yielded by the SVAR estimates of Table 1. The error bands were computed with Monte Carlo simulations. The horizontal axis reports the months elapsed since the interest rate shock.

Industry impact of a contractionary monetary policy shock



Note: The industry impact is measured by the percent output reduction after an unanticipated interest rate increase (1 percentage point).

Table 1

Aggregate and industry VARs: ordering of variables

FRA	***GER***	***ITA***	***UK***	***USA***
Industrial Production	Industrial Production	Industrial Production	Industrial Production	Industrial Production
Consumer price Index	Consumer price index	Consumer price index	Consumer price Index	Consumer price index
Commodity price index	Commodity price index	Commodity price index	Commodity price index	Commodity price index
Short term rate (3 month)	Short term rate (3 month)	Short term rate (3 month)	Short term rate (3 month)	Short term rate (FF rate)
Money (M3)	Money (M3)	Money (M3)	Money (M3)	Money (M1)
Exchange rate	Exchange rate	Exchange rate	Exchange rate	
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Production index of i-th industry	Production index of i-th industry	Production index of i-th industry	Production index of i-th industry	Production index of i-th industry

Note: Estimated on monthly data (taken from the OECD: "Main Economic Indicators") with a 5-lag specification over the sample period 1975.1-1997.3 and monthly dummies (all data, except the short-term rate, are in log(levels) not seasonally adjusted). Data for France begin in 1980.1; in a few industries of the other countries observations begin around 1980.

Diagnostics of the VAR interest rate equation

		France	Germany	Italy	UK	USA
	# lags					
Serial correlation						
Breusch-Godfrey	*6*	4.4	5.9	5.6	5.1	9.8
(LM test)	*1*	2.8	0.2	1.8	0.2	0.3
Parameter stability						
(loglikelihood ratio)	*mid-sample break*	38.4	47.9*	36.5	34.4	80.0*
Normality						
(Jarque Bera)		rejected	rejected	rejected	rejected	rejected

Note: An asterisk indicates that the null hypothesis of, respectively, "no-serial correlation" and "no structural break" is rejected at the 10 per cent level. # *lags* shows the order of lagged residuals which are used in the serial correlation test.

Table 2

Manufacturing Industries (shares in total IP)

ISIC CODE	***INDUSTRIES***	***FRANCE***	***GERMANY***	***ITALY***	***UK***	***USA***
311	Food (FD)	10.3	5.6	7.8	9.6	7.8
313	Beverages (BV)	2.1	2.8	2.5	3.0	1.4
314	Tobacco (TB)	0.9	2.8	0.5	1.1	1.5
321	Textiles (TX)	3.5	2.7	8.9	3.7	3.0
322	Wearing apparel (CL)	2.6	1.4	4.4	2.2	2.3
323	Leather (LT)	0.5	0.3	1.0	0.3	0.2
324	Footwear (FT)	0.7	0.3	2.0	0.7	0.3
33	Wood and furniture (WD)	3.2	3.3	5.5	3.0	4.7
3411	Paper (PP)	2.5	2.4	2.3	3.2	4.2
342	Printing and publishing (PR)	4.7	2.0	3.5	7.1	6.4
351+352	Industrial chemicals (CH)	8.5	10.9	7.5*	11.3	10.0
353	Petroleum refineries (PT)	6.5	3.5	0.9	1.5*	1.7
36	Non-metallic mineral (NM)	4.3	4.2	7.2*	3.8	2.8
362	Glass (GL)	1.2	1.0	1.4	0.7	0.8*
371	Iron and steel (IR)	3.6	5.8	3.8	3.6	3.7
372	Non ferrous metals (NF)	1.9	1.8	0.8	1.3	1.7
381	Fabricated metal products (MP)	7.3	9.4	9.7	6.0	7.1
382	Machinery and equipment (MH)	9.7	11.3	9.6	11.8	11.4
383	Electrical machinery (EM)	9.6	11.2	7.3	9.1	8.6
3841	Ship building (SH)	0.5	0.4	0.4*	1.2	0.7
3843	Motor vehicles (MV)	6.9	9.3	4.9	5.5	6.1

Source: OECD-STAN database; Averages of yearly data over the 1970-1993 period.
An asterisk indicates that monthly industrial production data are not available. That industry is thus excluded from VAR analysis of the corresponding country.

Elasticity of industrial output to a monetary policy shock

Industry	France			Germany			Italy			UK			USA		
	24-month elasticity	maximum elasticity	18-24 month elasticity	24-month elasticity	maximum elasticity	18-24 month elasticity	24-month elasticity	maximum elasticity	18-24 month elasticity	24-month elasticity	maximum elasticity	18-24 month elasticity	24-month elasticity	maximum elasticity	18-24 month elasticity
Food (FD)	0.24	-0.01	0.17	-0.53	-0.94	-0.36	**-0.46**	**-0.78**	-0.46	**-0.26**	**-0.38**	-0.26	**-0.19**	**-0.22**	-0.20
Beverages (BV)	-0.53	-1.28	-0.66	-0.33	-0.74	-0.22	**-0.67**	**-1.16**	-0.82	**-0.64**	**-0.68**	-0.55	**-0.26**	**-0.29**	-0.25
Tobacco (TB)	-0.24	-0.27	-0.13	0.75	-0.21	1.00	**1.56**	0.82	1.49	-0.60	-1.21	-0.58	0.15	-0.10	0.25
Textiles (TX)	-0.22	-1.13	-0.31	0.47	0.42	0.46	**-0.51**	**-0.93**	-0.63	**-0.94**	**-1.00**	-0.98	-0.39	**-0.72**	-0.43
Wearing apparel (CL)	-0.50	-1.10	-0.72	-0.22	-0.27	0.05	-0.24	**-0.58**	-0.28	-0.33	-0.36	-0.33	0.03	-0.22	-0.02
Leather (LT)	-1.11	**-2.40**	-1.21	0.72	0.39	0.85	0.42	-0.45	0.29	-1.39	-1.77	-1.45	0.09	-0.34	-0.01
Footwear (FT)	-0.07	-0.13	0.07	2.94	2.23	3.15	0.05	-0.10	0.21	-0.75	-0.96	-0.84	0.48	0.35	0.48
Paper (PP)	-0.16	-0.32	-0.12	**-2.13**	**-2.19**	-2.14	**-1.36**	**-1.97**	-1.50	**-0.76**	**-0.88**	-0.68	**-0.28**	**-0.36**	-0.31
Printing and publishing (PR)	-0.68	**-1.04**	-0.82	-0.03	-0.96	0.25	**-1.76**	**-2.03**	-1.87	-0.58	-0.76	-0.49	-0.27	-0.48	-0.31
Industrial chemicals (CH)	0.08	-0.24	0.04	**-1.84**	**-2.06**	-1.98	n.a.	n.a.	n.a.	**-1.24**	**-1.34**	-1.29	**-0.37**	**-0.51**	-0.39
Petroleum refineries (PT)	-0.02	-0.20	0.08	**-3.08**	-3.15	-2.95	**-1.28**	**-1.29**	-1.23	n.a.	n.a.	n.a.	**-0.54**	**-0.66**	-0.57
Wood and furniture (WD)	**-1.27**	**-1.33**	-1.23	-2.18	-2.95	-1.91	**-1.46**	**-1.46**	-1.43	**-1.17**	**-1.17**	-1.14	**-0.38**	**-0.62**	-0.46
Non-metallic mineral (NM)	**-0.88**	**-1.21**	-1.01	-1.20	-1.80	-0.92	n.a.	n.a.	n.a.	**-0.95**	**-0.97**	-0.86	**-0.52**	**-0.72**	-0.58
Glass (GL)	-0.21	-0.37	-0.30	**-2.51**	**-2.60**	-2.36	**-0.59**	**-0.74**	-0.65	**-0.89**	**-0.93**	-0.77	na	na	na
Iron and steel (IR)	-0.68	**-1.52**	-0.91	-1.53	-1.77	-1.68	**-1.00**	**-1.39**	-1.16	-1.63	-1.63	-1.57	**-0.93**	**-1.53**	-1.05
Non-ferrous metals (NF)	-0.45	-0.63	-0.49	-1.84	-1.85	-1.80	**-1.24**	**-1.83**	-1.41	**-0.81**	**-0.93**	-0.67	**-0.62**	**-0.91**	-0.73
Fabricated metal products (MP)	**-0.99**	**-1.48**	-1.19	**-1.94**	**-2.16**	-1.79	-0.12	-0.14	-0.07	-0.23	-0.68	-0.34	**-0.55**	**-0.70**	-0.60
Machinery and equipment (MH)	-2.00	**-2.90**	-2.41	-0.94	-1.04	-0.85	**-1.86**	**-1.97**	-1.90	**-2.26**	**-2.31**	-2.26	**-1.45**	**-1.63**	-1.54
Electrical machinery (EM)	-0.20	-0.35	-0.23	-0.47	-0.65	-0.32	**-0.59**	**-0.84**	-0.65	-1.83	-1.83	-1.74	-0.43	-0.65	-0.49
Shipbuilding (SH)	-0.15	-0.70	0.12	**3.24**	2.56	3.36	n.a.	n.a.	n.a.	0.93	0.30	0.94	0.11	0.00	0.16
Motorvehicles (MV)	-1.21	**-1.88**	-1.40	-1.50	-1.89	-1.28	-1.06	**-2.46**	-1.35	**-2.27**	**-2.42**	-2.34	-0.93	**-1.99**	-1.21
Industrial Production (IP)	-0.53	**-0.66**	-0.59	**-1.27**	**-1.61**	-1.06	**-0.93**	**-1.07**	-0.99	-0.71	**-0.72**	-0.68	**-0.47**	**-0.59**	-0.51

Note: The *24-month* elasticity indicates the percentage output change that occurs 24 months after a 1 percentage point increase of the short-term rate.
The *maximum-elasticity* is the smallest output value recorded between 12 and 36 months after a 1 percentage point increase of the short-term rate.
The 18-24 month elasticity is the average elasticity recorded between 18 and 24 months after a 1 percentage point increase of the short-term rate.
Numbers in bold appearing in the first two columns of each country indicate that the point estimate of the output effect is significantly different from zero at the 5 per cent level.

Table 4

Rank Correlation of Industry Effects

A - Rank correlation of industries' *24-month* elasticity to policy

	FRA	GER	ITA	UK
GER	0.30			
ITA	0.39	0.59		
UK	0.39	0.16	0.39	
USA	0.47	0.66	0.64	0.56

B - Rank correlation of industries' *maximum* elasticity to policy

	FRA	GER	ITA	UK
GER	0.27			
ITA	0.35	0.61		
UK	0.46	-0.01	0.26	
USA	0.66	0.52	0.66	0.51

Note: Correlation is measured by the Spearman rank correlation index for the 16 industries where data are available for all countries. The index is distributed with zero mean and standard deviation 1/(n-1) (i.e. 0.07 in our sample).

Table 5

Decomposition of industry responses into country and industry effects

	Dependent Variable					
	24-month elasticity			Maximum elasticity		
	Coefficient	Standard error		Coefficient	Standard error	
Constant	-0.63	0.01	***	-0.95	0.01	***
Dummies:						
- Country						
France	0.13	0.13		0.00	0.12	
Germany	-0.12	0.23		-0.15	0.15	
Italy	0.00	0.12		-0.09	0.23	
UK	-0.30	0.11	***	-0.12	0.11	
US	0.29	0.08	***	0.36	0.07	***
- Industry						
Food (FD)	0.40	0.04	***	0.49	0.04	***
Beverages (BV)	0.15	0.04	***	0.12	0.04	***
Tobacco (TB)	0.94	0.04	***	0.74	0.04	***
Textiles (TX)	0.32	0.04	***	0.28	0.04	***
Wearing apparel (CL)	0.38	0.04	***	0.44	0.04	***
Leather (LT)	0.36	0.04	***	0.03	0.04	
Footwear (FT)	1.18	0.04	***	1.24	0.04	***
Paper (PP)	-0.30	0.04	***	-0.18	0.04	***
Printing and publishing (PR)	-0.01	0.04		-0.09	0.04	**
Industrial chemicals (CH)	-0.21	0.06	***	-0.10	0.06	*
Petroleum refineries (PT)	-0.66	0.06	***	-0.40	0.06	***
Wood and furniture (WD)	-0.66	0.04	***	-0.56	0.04	***
Non-metallic mineral (NM)	-0.26	0.06	***	-0.25	0.06	***
Glass (GL)	-0.34	0.06	***	-0.12	0.06	**
Iron and steel (IR)	-0.52	0.06	***	-0.62	0.04	***
Non-ferrous metals (NF)	-0.36	0.04	***	-0.27	0.04	***
Fabricated metal products (MP)	-0.15	0.04	***	-0.11	0.04	**
Machinery and equipment (MH)	-1.07	0.04	***	-1.02	0.04	***
Electrical machinery (EM)	-0.07	0.04		0.09	0.04	**
Shipbuilding (SH)	1.66	0.06	***	1.46	0.06	***
Motorvehicles (MV)	-0.77	0.04	***	-1.17	0.04	***

No. Observations: 100

SUR Estimation; *, **, *** indicate rejection of the null hp. of zero coefficients at the 10, 5, 1 per cent level, respectively.

Table 6

Industry determinants of monetary policy effects

Explanatory Variable	Dependent Variable						
	24-month elasticity				maximum elasticity	18-24 month elasticity	24-month elasticity
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7 (IV estimation)
Dummy Durability	-0.60 *0.16*	-0.58 *0.15*	-0.59 *0.19*	-0.67 *0.18*	-0.62 *0.18*	-0.69 *0.19*	-0.61 *0.19*
Investment/Value added°	-1.80 *1.06*	-2.08 *1.04*					
Openness°	0.58 *0.43*						
Working capital per employee*			0.002 *0.006*				
Short-term debt*			2.36 *2.26*				
Firm size* (hundred employees per firm)			0.32 *0.12*	0.28 *0.10*	0.26 *0.10*	0.29 *0.10*	0.19 *0.10*
Leverage*			0.28 *0.20*	0.36 *0.18*	0.24 *0.18*	0.35 *0.18*	0.08 *0.27*
Listed companies*			-0.73 *0.57*				
Interest burden*			-0.28 *0.11*	-0.30 *0.11*	-0.21 *0.12*	-0.29 *0.12*	-0.26 *0.17*
Country fixed effect:							
France	-0.32 *0.26*	-0.01 *0.17*	-2.62 *1.92*	-1.01 *0.40*	-1.30 *0.45*	-1.08 *0.41*	-0.42 *0.56*
Germany	-0.67 *0.37*	-0.37 *0.37*	-3.52 *1.50*	-2.47 *0.71*	-2.52 *0.73*	-2.35 *0.73*	-1.37 *0.82*
Italy	-0.38 *0.36*	-0.09 *0.29*	-3.15 *1.78*	-1.52 *0.74*	-1.59 *0.82*	-1.59 *0.77*	-0.44 *1.11*
UK	-0.76 *0.27*	-0.45 *0.16*	-3.20 *2.10*	-1.69 *0.44*	-1.68 *0.46*	-1.67 *0.45*	-1.04 *0.58*
US	-0.03 *0.20*	0.15 *0.16*					
No. Observations:	91	91	80	80	80	80	80
$\bar{R}^2$ **- Adj:**	0.19	0.16	0.33	0.33	0.24	0.31	0.27

Note: Pooled (cross-section cross-country) least squares; White Heteroskedasticity-Consistent standard errors (in italics).
* Industry's median firm (mean firm for the interest burden indicator); Data constructed from the Amadeus database.
° Industry averages; data constructed from the the OECD STAN database.

A. Appendix: The VAR recursive identification scheme

VARs focus on cross-correlations among a limited number of variables. The estimated (reduced form) VAR equation can be written as

$$C(L)y_t = u_t \tag{A.1}$$

where $C(L)$ is a matrix-polynomial in the lag operator ($C_0 = I$), y_t is a $(n \times 1)$ vector of endogenous variables and u_t is the vector of reduced form errors with covariance matrix $cov(u_t) = \Sigma$. Equation (A.1) can be seen as the reduced form of the structural model

$$A_0 y_t = \sum_{i=1}^{n} A_i y_{t-i} + \varepsilon_t \tag{A.2}$$

where

$$\varepsilon_t \equiv A_0 u_t \tag{A.3}$$

These three equations make it possible to derive the moving average representation

$$y_t = [A_0 C(L)]^{-1} \varepsilon_t \tag{A.4}$$

from which the "impulse response functions", showing the dynamic response of each endogenous variable to the structural innovations (ε), are derived. To derive the impulse response functions the A_0 matrix must be identified, given the estimates of $C(L)$, u_t and Σ. To this end restrictions must be imposed. A standard set of restriction involves assuming that the covariance matrix of the structural innovations is the identity matrix

$$E(\varepsilon_t \varepsilon_t^{'}) = A_0 E(u_t u_t^{'}) A_0^{'} = A_0 \Sigma A_0^{'} = I \tag{A.5}$$

which amounts to assume that the structural innovations of the endogenous variables are uncorrelated. Condition (A.5) imposes at most $n(n+1)/2$ constraints on the n^2 unknown coefficients of A_0. There are $n(n-1)/2$ additional restrictions that are needed to identify *all* the elements of A_0 (this is a necessary but not a sufficient condition). One particular way this can be achieved is to assume that the A_0 matrix is lower triangular (i.e. setting the $n(n-1)/2$ off diagonal elements of A_0 equal to zero, also known as Choleski decomposition).

The identification of *policy* effects based on the *recursiveness* assumption relies on a partition of the endogenous variables (y_t) into three groups: the policy variable y_{pt}; n_1 variables responding contemporaneously to monetary policy (y_{1t}); n_2 variables not responding contemporaneously to policy (y_{2t}; with $n_1+n_2+1 = n$). The A_0 matrix can then be written as

$$
y_t = \begin{bmatrix} y_{1t} \\ (n_1 \times 1) \\ y_{pt} \\ (1 \times 1) \\ y_{2t} \\ (n_2 \times 1) \end{bmatrix}; \qquad A_0 = \begin{bmatrix} a_{11} & 0 & 0 \\ (n_1 \times n_1) & (n_1 \times 1) & (n_1 \times n_1) \\ a_{21} & a_{22} & 0 \\ (1 \times n_1) & (1 \times 1) & (1 \times n_2) \\ a_{31} & a_{32} & a_{33} \\ (n_2 \times n_1) & (n_2 \times 1) & (n_2 \times n_2) \end{bmatrix} \tag{A.6}
$$

An important property of the recursiveness assumption shown by Christiano, Eichenbaum and Evans (1998; proposition 4.1) is that the impulse response of *all* variables in y_t to a shock in the policy variable y_p is identified by the partition of y_t (i.e. y_{1t}; y_{pt}; y_{2t}). Note that the recursiveness assumption is *not* sufficient to identify all the elements of A_0 (hence the impulse response functions to shocks in variables other than y_p are not identified). In synthesis, the recursiveness result shows that if the variables in y can be partitioned in accord with (A.6), then such partition is sufficient to determine the effects of a shock to the variable y_p; moreover it says that these effects do not depend on the ordering of the variables within the y_{1t} and the y_{2t} vectors.[41] Hence all that is required to identify the effects of a shock to $y_p$is the definition of the variables entering the policy reaction function simultaneously (y_{1t}). From a practical point of view, the recursiveness assumption justifies measuring the impulse responses to a policy shock by assuming a lower triangular A_0 matrix (Choleski decomposition) which is consistent with the partition in (A.6).

B. Appendix: Data Sources and Definitions

The following data are used in the VARs estimates:

- Industrial production: monthly indices from OECD Main Economic Indicators (1975:1 - 1997:4);
- Industrial sectors production (ISIC 3/4 digits): monthly indices from OECD Indicators of Industrial Activity;
- CPI: monthly data from OECD Main Economic Indicators (1975:1-1997:4);
- Interest Rates: monthly averages of Federal Fund Rate (US), three month interbank rate for all other countries; from BIS Data Bank (1980:1 - 1997:4).

[41] Note for instance that the recursive scheme is not applicable if the variable y_p simultaneously affects, and is affected by, another variable in the y vector.

For Italy, three month interbank rate from domestic screen-based market (MID);

- Exchange rates: monthly averages of the real effective (trade weighted) exchange rate from IFS ("rec" line) (1980:1 - 1997:4);

- Money stock: M1 and M3 monetary aggregates, national definitions, monthly data from BIS Data Bank (1980:1 - 1997:4).

A synopsis of definitions and sources of the variables used in the regressions of Table 6 appears in Table A1. The left column lists countries and industries upon which the analysis is based. The right column lists the variables that are used in the regressions. The dependent variables appear in the upper panel of this column, they are given by the (semi)elasticity of industrial output to an interest rate structural innovation, 24 months after the shock, at its maximum between 12 to 36 months or as the average impact between 18 and 24 months.

Explanatory variables used in the regressions are listed in this column below the dependent variables. The first variable is a durability dummy, which takes the value of 1 if the industry produces durable goods. The economic destination of production is taken from the national accounts statistics: according to this criterion, the "durable" output industries are denoted by the ISIC codes beginning with: 33, 36, 37, 38. An alternative measure, which includes industries 34 and 35 (paper and chemicals) among the durable output producers, does not affect results in Table 6.

The next three variables are constructed from the STAN-OECD database, which records yearly data aggregated at the industry level; the variables we use are averages over the 1970-93 period; they are:

- the industry "investment intensity" ratio: (investment) / (value added)

- the industry openness ratio: (exports+imports) / (value added)

- the industry export ratio: (exports) / (value added)

The other explanatory variables are constructed from yearly balance sheet data of individual firms contained in Amadeus. First, average firm level data are calculated over the available period (1993-97); second, the industry mean and median value of each variable is calculated from the firm level data (the exception is the *listed companies* variable). The variables are defined as follows:

- working capital per employee: sum of the asset items "stocks" and "debtors" minus the liability item "creditors" over the firm's employment (data are in thousand euro per employee).

- short term debt (ratio): (short term debt) / (total debt)
- firm size: number of employees per firm (in units)
- leverage (ratio): (total debt) / (shareholders funds)
- listed companies: employment ratio of firms (including subsidiaries) listed in the stock market to total industry employment (the latter variable is taken from STAN).
- interest burden: ratio of interest rate payments to operating profits.

The variables are reported in the country Tables A2-A6.

Table A1

Country
France
Germany
Italy
United Kingdom
United States

Industry

ISIC	Acronym	
311	FD	Food
313	BV	Beverages
314	TB	Tobacco
321	TX	Textiles
322	CL	Wearing apparel
323	LT	Leather
324	FT	Footwear
341.1	PP	Paper
342	PR	Printing and publishing
351	CH	Industrial chemicals
353	PT	Petroleum refineries
330	WD	Wood and furniture
360	NM	Non-metallic mineral
362	GL	Glass
371	IR	Iron and steel
372	NF	Non ferrous metals
381	MP	Fabricated metal product
382	MH	Machinery and equipment
383	EM	Electrical machinery
384.1	SH	Shipbuilding
384.3	MV	Motorvehicles

Variables	Source	
Elasticity: maximum; 24 month; 18-24 month		DEPENDENT
Durability Dummy (1 if ISIC code equals 33, 36, 37, 38)		EXPLANATORY
Investment/(value added)	STAN 1970-1993	EXPLANATORY
Openness: (a) (exp.+imp)/value added; (b) exp./value added	STAN 1970-1993	EXPLANATORY
Working capital per employee (1000 euros): mean; median	AMADEUS 1993-1997	EXPLANATORY
Short term debt: (ratio to total debt): mean; median	AMADEUS 1993-1997	EXPLANATORY
Employees per firm: mean; median	AMADEUS 1993-1997	EXPLANATORY
Leverage: (total debt) / (own capital): mean; median	AMADEUS 1993-1997	EXPLANATORY
Listed companies (employment share)	AMADEUS 1993-1997	EXPLANATORY
Interest burden: (i-payments)/profit: mean; median	AMADEUS 1993-1997	EXPLANATORY

France

Isic Code	Industry (acronym)	Elasticity			Durability Dummy	Invest-ment / Value added	Openness	Export	Working capital per employee		Short term debt		Employees per firm		Leverage		Listed companies	Interest burden		# of firms
		maximum	24 month	18-24 month					mean firm	median firm	mean	median	mean firm	median firm	mean	median	(employment share)	mean firm	median firm	surveyed in Amadeus
311	Food (FD)	-0.01	0.24	0.17	0	n.a.	0.27	0.13	41.0	18.5	0.81	0.83	221	93	16.94	2.41	0.09	1.01	0.35	1253
313	Beverages (BV)	-1.28	-0.53	-0.66	0	n.a.	0.62	0.52	265.9	82.0	0.75	0.79	210	80	11.44	1.48	0.33	1.01	0.36	232
314	Tobacco (TB)	-0.27	-0.24	-0.13	0	n.a.	0.36	0.05	112.4	75.8	0.86	0.90	1266	142	0.89	0.64	0.90	0.08	0.09	5
321	Textiles (TX)	-1.13	-0.22	-0.31	0	0.15	0.63	0.28	130.4	33.4	0.79	0.83	224	146	4.38	1.53	0.09	2.22	0.34	405
322	Wearing apparel (CL)	-1.10	-0.50	-0.72	0	n.a.	0.53	0.23	45.3	32.4	0.83	0.86	203	113	3.25	1.73	0.08	0.85	0.42	292
323	Leather (LT)	-2.40	-1.11	-1.21	0	0.18	0.84	0.39	101.6	26.3	0.80	0.85	267	167	2.12	1.31	0.12	0.54	0.44	43
324	Footwear (FT)	-0.13	-0.07	0.07	0	n.a.	0.75	0.24	38.2	18.0	0.76	0.78	283	230	6.75	1.48	0.07	0.57	0.17	86
3411	Paper (PP)	-0.32	-0.16	-0.12	0	0.13	0.27	0.11	43.7	28.2	0.77	0.81	288	174	10.72	1.57	0.21	1.62	0.27	306
342	Printing and publishing (PR)	-1.04	-0.68	-0.82	0	0.11	0.12	0.06	42.5	17.9	0.83	0.88	191	104	6.53	2.23	0.07	1.17	0.21	483
351	Industrial chemicals (CH)	-0.24	0.08	0.04	0	0.16	0.53	0.27	79.0	41.1	0.78	0.83	358	128	3.21	1.58	0.50	0.59	0.19	922
353	Petroleum refineries (PT)	-0.20	-0.02	0.08	0	0.15	0.21	0.08	126.6	62.4	0.78	0.85	941	226	6.28	1.94	0.84	0.45	0.23	42
330	Wood and furniture (WD)	-1.33	-1.27	-1.23	1	0.18	0.29	0.11	49.1	25.7	0.79	0.82	207	137	4.48	1.91	0.08	0.85	0.33	394
360	Non-metallic mineral (NM)	-1.21	-0.88	-1.01	1	0.18	0.32	0.17	60.6	26.0	0.75	0.78	322	145	13.29	1.67	0.29	0.76	0.24	365
362	Glass (GL)	-0.37	-0.21	-0.30	1	0.13	0.60	0.36	40.6	24.1	0.76	0.80	395	161	30.79	1.72	0.28	0.98	0.36	117
371	Iron and steel (IR)	-1.52	-0.68	-0.91	1	0.11	0.54	0.31	52.4	24.1	0.77	0.80	406	214	6.93	1.88	0.18	1.14	0.41	211
372	Non-ferrous metals (NF)	-0.63	-0.45	-0.49	1	0.41	0.58	0.23	54.6	39.7	0.74	0.79	451	153	4.61	1.73	0.49	0.71	0.36	94
381	Fabricated metal products (MP)	-1.48	-0.99	-1.19	1	n.a.	n.a.	n.a.	50.1	26.2	0.81	0.83	272	156	4.17	2.14	0.16	0.65	0.28	660
382	Machinery and equipment (MH)	-2.64	-1.31	-1.20	1	0.04	0.65	0.33	67.3	32.8	0.76	0.84	384	154	5.29	2.35	0.25	0.98	0.24	1059
383	Electrical machinery (EM)	-0.35	-0.20	-0.23	1	0.15	0.54	0.28	79.8	31.8	0.82	0.85	576	193	6.28	2.07	0.31	1.33	0.22	629
3841	Shipbuilding (SH)	-0.70	-0.15	0.12	1	0.02	0.46	0.32	102.7	26.6	0.83	0.88	330	137	14.90	2.65	0.52	1.16	0.15	47
3843	Motorvehicles (MV)	-1.88	-1.21	-1.40	1	0.17	0.71	0.42	66.7	21.2	0.80	0.83	1106	226	8.31	2.22	0.35	2.33	0.30	255
						Source: database STAN			*Source: database AMADEUS*											*Total* 7900

Germany

Isic Code	Industry (acronym)	Elasticity			Durability Dummy	Invest-ment / Value added	Openness	Export	Working capital per employee		Short term debt		Employees per firm		Leverage		Listed companies (employment share)	Interest burden		# of firms surveyed in Amadeus
		maximum	24 month	18-24 month					mean firm	median firm	mean	median	mean firm	median firm	mean	median		mean firm	median firm	
311	Food (FD)	-0.94	-0.53	-0.36	0	0.13	0.29	0.12	109.9	55.2	0.59	0.59	1450	338	52.89	2.30	0.12	2.09	0.51	1567
313	Beverages (BV)	-0.74	-0.33	-0.22	0	0.16	0.14	0.05	236.1	37.9	0.46	0.44	359	219	2.66	2.00	0.12	0.50	0.19	488
314	Tobacco (TB)	-0.21	0.75	1.00	0	0.02	0.09	0.05	220.8	127.8	0.55	0.66	1064	469	3.09	2.99	n.a.	0.02	0.01	31
321	Textiles (TX)	0.42	0.47	0.46	0	0.11	0.85	0.36	165.6	47.0	0.59	0.59	764	348	2.38	1.71	0.12	0.83	0.42	623
322	Wearing apparel (CL)	-0.27	-0.22	0.05	0	0.04	1.02	0.29	570.1	74.3	0.65	0.71	476	189	6.00	1.72	0.05	0.59	0.38	442
323	Leather (LT)	0.39	0.72	0.85	0	0.06	1.12	0.45	64.7	65.6	0.37	0.32	2300	1275	1.77	1.70	0.08	1.69	1.69	71
324	Footwear (FT)	2.23	2.94	3.15	0	0.06	0.97	0.21	86.0	75.0	0.49	0.48	1787	1173	1.89	1.52	0.27	0.96	0.63	57
341.1	Paper (PP)	-2.19	-2.13	-2.14	0	0.15	0.39	0.19	353.6	51.5	0.50	0.43	1457	458	4.57	2.67	0.29	0.98	0.74	534
342	Printing and publishing (PR)	-0.96	-0.03	0.25	0	0.13	0.20	0.14	92.1	25.7	0.49	0.44	909	363	14.13	2.29	0.05	0.40	0.17	955
351	Industrial chemicals (CH)	-2.06	-1.84	-1.98	0	0.12	0.47	0.26	194.0	64.7	0.50	0.48	1756	383	19.63	2.01	0.67	0.57	0.23	1245
353	Petroleum refineries (PT)	-3.15	-3.08	-2.95	0	0.07	0.26	0.05	340.8	91.1	0.56	0.58	696	238	20.69	2.59	0.57	0.68	0.20	101
330	Wood and furniture (WD)	-2.95	-2.18	-1.91	1	0.11	0.32	0.10	56.6	32.5	0.62	0.57	637	443	8.17	2.46	0.04	0.98	0.42	1029
360	Non-metallic mineral (NM)	-1.80	-1.20	-0.92	1	0.14	0.25	0.14	195.6	43.7	0.51	0.47	695	374	6.71	1.72	0.14	0.80	0.36	1020
362	Glass (GL)	-2.60	-2.51	-2.36	1	0.15	0.36	0.21	240.1	41.2	0.47	0.42	918	569	2.47	1.59	0.21	1.75	0.93	193
371	Iron and steel (IR)	-1.77	-1.53	-1.68	1	0.13	0.42	0.26	173.5	50.5	0.54	0.52	1750	475	4.73	2.60	0.18	0.66	0.52	582
372	Non-ferrous metals (NF)	-1.85	-1.84	-1.80	1	0.13	0.55	0.24	70.6	65.9	0.50	0.49	1597	565	2.11	1.62	0.13	0.56	0.39	131
381	Fabricated metal products (MP)	-2.16	-1.94	-1.79	1	0.09	0.32	0.21	162.7	42.8	0.54	0.53	889	466	4.94	2.30	0.06	1.25	0.38	1460
382	Machinery and equipment (MH)	-1.04	-0.94	-0.85	1	0.08	0.54	0.42	245.5	56.2	0.53	0.53	1638	472	9.57	2.62	0.26	1.07	0.39	3098
383	Electrical machinery (EM)	-0.65	-0.47	-0.32	1	0.10	0.43	0.26	206.5	56.6	0.55	0.56	2205	478	12.08	2.68	0.25	0.86	0.46	1158
384.1	Shipbuilding (SH)	2.56	3.24	3.36	1	n.a.	n.a.	n.a.	100.2	60.7	0.53	0.54	3538	1257	6.31	3.90	0.84	1.32	0.55	65
384.3	Motorvehicles (MV)	-1.89	-1.50	-1.28	1	n.a.	n.a.	n.a.	71.5	38.2	0.51	0.49	6786	1181	5.76	2.34	0.37	1.12	0.45	461
						Source: database STAN			*Source: database AMADEUS*											*Total* 15311

Italy

Isic Code	Industry (acronym)	Elasticity			Durability Dummy	Invest-ment / Value added	Openness	Export	Working capital per employee		Short term debt		Employees per firm		Leverage		Listed companies	Interest burden		# of firms
		maximum	24 month	18-24 month					mean firm	median firm	mean	median	mean firm	median firm	mean	median	(employment share)	mean firm	median firm	surveyed in Amadeus
311	Food (FD)	-0.78	-0.46	-0.46	0	0.14	0.27	0.08	106.5	62.8	0.20	0.20	147	53	16.76	3.82	0.08	3.72	0.88	1141
313	Beverages (BV)	-1.16	-0.67	-0.82	0	0.12	0.25	0.18	144.4	93.1	0.14	0.14	105	41	9.99	3.38	0.05	1.63	0.78	229
314	Tobacco (TB)	0.82	1.56	1.49	0	0.12	0.23	0.02	65.9	60.7	n.a.	n.a.	132	100	6.90	6.90	n.a.	1.19	0.99	12
321	Textiles (TX)	-0.93	-0.51	-0.63	0	0.16	0.35	0.23	77.5	46.6	0.14	0.14	176	88	7.33	3.19	0.03	1.63	0.76	696
322	Wearing apparel (CL)	-0.58	-0.24	-0.28	0	n.a.	n.a.	n.a.	72.6	50.9	0.14	0.14	172	79	6.99	4.13	0.02	1.58	0.66	454
323	Leather (LT)	-0.45	0.42	0.29	0	0.12	0.51	0.33	124.6	71.6	n.a.	n.a.	87	48	8.17	4.24	n.a.	0.88	0.73	197
324	Footwear (FT)	-0.10	0.05	0.21	0	0.08	0.54	0.50	78.4	29.0	n.a.	n.a.	130	81	10.13	4.82	n.a.	0.80	0.62	226
3411	Paper (PP)	-1.97	-1.36	-1.50	0	0.17	0.20	0.08	53.7	42.8	0.19	0.19	162	82	8.65	3.27	0.06	0.76	0.50	292
342	Printing and publishing (PR)	-2.03	-1.76	-1.87	0	0.12	0.09	0.06	63.1	29.0	0.37	0.37	321	97	11.77	3.83	0.17	2.12	0.65	321
351	Industrial chemicals (CH)	n.a.	n.a.	n.a.	0	0.07	0.31	0.25	97.9	58.8	0.19	0.19	197	85	6.07	2.99	0.18	1.14	0.54	1062
353	Petroleum refineries (PT)	-1.29	-1.28	-1.23	0	0.35	0.62	0.30	152.5	78.6	0.02	0.02	487	64	24.85	3.45	0.02	1.76	0.88	73
330	Wood and furniture (WD)	-1.46	-1.46	-1.43	1	0.14	0.25	0.06	55.6	36.2	0.02	0.02	119	85	6.26	3.85	n.a.	4.34	0.73	443
360	Non-metallic mineral (NM)	n.a.	n.a.	n.a.	1	n.a.	n.a.	n.a.	83.7	46.2	0.18	0.18	191	105	6.56	2.73	0.04	1.29	0.62	529
362	Glass (GL)	-0.74	-0.59	-0.65	1	0.18	0.32	0.19	60.6	38.1	0.16	0.16	263	114	3.32	2.15	0.04	0.72	0.40	94
371	Iron and steel (IR)	-1.39	-1.00	-1.16	1	0.24	0.33	0.18	110.8	48.6	0.12	0.12	201	82	6.94	3.66	0.08	1.23	0.72	523
372	Non-ferrous metals (NF)	-1.83	-1.24	-1.41	1	n.a.	n.a.	n.a.	101.6	55.6	0.15	0.15	138	81	9.49	4.52	0.05	0.94	0.72	104
381	Fabricated metal products (MP)	-0.14	-0.12	-0.07	1	0.18	0.60	0.29	60.8	38.9	0.07	0.07	128	86	6.16	3.41	0.01	0.90	0.58	621
382	Machinery and equipment (MH)	-1.97	-1.86	-1.90	1	0.11	0.64	0.45	86.1	47.6	0.11	0.11	234	97	11.10	4.04	0.08	3.14	0.61	1697
383	Electrical machinery (EM)	-0.84	-0.59	-0.65	1	0.05	0.70	0.27	95.0	46.6	0.12	0.12	1241	109	10.48	3.79	0.12	0.94	0.58	757
3841	Shipbuilding (SH)	n.a.	n.a.	n.a.	1	n.a.	n.a.	n.a.	166.8	71.3	n.a.	n.a.	429	93	21.16	6.53	n.a.	5.03	1.32	52
3843	Motorvehicles (MV)	-2.46	-1.06	-1.35	1	0.19	0.97	0.25	50.3	33.7	0.67	0.67	621	107	6.78	3.73	0.45	1.03	0.63	287

Source: database STAN (Investment / Value added, Openness, Export)

Source: database AMADEUS (Working capital per employee through Interest burden)

Total 9810

Table A5

United Kingdom

Isic Code	Industry (acronym)	Elasticity maximum	Elasticity 24 month	Elasticity 18-24 month	Durability Dummy	Investment / Value added	Openness	Export	Working capital per employee: mean firm	Working capital per employee: median firm	Short term debt: mean	Short term debt: median	Employees per firm: mean firm	Employees per firm: median firm	Leverage: mean	Leverage: median	Listed companies (employment share)	Interest burden: mean firm	Interest burden: median firm	# of firms surveyed in Amadeus
311	Food (FD)	-0.38	-0.26	-0.26	0	0.12	0.29	0.08	38.0	12.4	0.78	0.82	1836	232	5.36	1.76	0.76	0.83	0.21	904
313	Beverages (BV)	-0.68	-0.64	-0.55	0	0.14	0.27	0.16	109.4	21.4	0.74	0.80	3159	279	6.48	1.06	0.92	0.70	0.26	226
314	Tobacco (TB)	-1.21	-0.60	-0.58	0	0.05	0.13	0.07	142.8	51.4	0.81	0.97	13515	301	4.84	2.74	0.99	0.18	0.09	21
321	Textiles (TX)	-1.00	-0.94	-0.98	0	0.08	0.68	0.26	35.0	18.0	0.80	0.85	946	275	8.06	1.30	0.75	0.96	0.21	432
322	Wearing apparel (CL)	-0.36	-0.33	-0.33	0	0.04	0.65	0.22	25.2	12.9	0.85	0.92	985	260	7.04	1.63	0.74	0.52	0.18	311
323	Leather (LT)	-1.77	-1.39	-1.45	0	0.05	0.84	0.37	44.2	24.6	0.87	0.93	366	178	3.97	1.34	0.48	0.39	0.34	52
324	Footwear (FT)	-0.96	-0.75	-0.84	0	0.03	0.68	0.15	55.1	15.0	0.85	0.90	1459	308	10.81	1.31	0.71	0.52	0.19	77
3411	Paper (PP)	-0.88	-0.76	-0.68	0	0.10	0.28	0.09	34.0	20.6	0.75	0.79	1131	231	3.78	1.82	0.76	0.49	0.17	381
342	Printing and publishing (PR)	-0.76	-0.58	-0.49	0	0.08	0.12	0.07	23.5	10.8	0.78	0.85	803	188	77.35	2.11	0.73	0.80	0.18	878
351	Industrial chemicals (CH)	-1.34	-1.24	-1.29	0	0.20	0.71	0.38	48.3	30.9	0.78	0.84	1799	211	3.71	1.57	0.81	0.60	0.17	867
353	Petroleum refineries (PT)	n.a.	n.a.	n.a.	0	n.a.	n.a.	n.a.	111.8	43.6	0.71	0.75	4465	249	4.31	1.89	0.88	0.53	0.16	70
330	Wood and furniture (WD)	-1.17	-1.17	-1.14	1	0.09	0.47	0.03	22.9	12.6	0.85	0.91	720	207	16.47	1.90	0.74	0.36	0.15	462
360	Non-metallic mineral (NM)	-0.97	-0.95	-0.86	1	n.a.	n.a.	n.a.	24.4	18.4	0.72	0.79	1469	269	7.42	1.47	0.85	0.52	0.18	428
362	Glass (GL)	-0.93	-0.89	-0.77	1	0.18	0.46	0.19	21.2	15.9	0.74	0.78	1187	272	2.47	1.59	0.75	0.80	0.27	120
371	Iron and steel (IR)	-1.63	-1.63	-1.57	1	0.15	0.39	0.20	44.7	18.6	0.78	0.83	819	219	10.04	1.87	0.75	0.48	0.22	325
372	Non-ferrous metals (NF)	-0.93	-0.81	-0.67	1	0.10	0.88	0.35	67.7	30.9	0.77	0.82	539	160	7.19	1.73	0.63	0.90	0.18	139
381	Fabricated metal products (MP)	-0.68	-0.23	-0.34	1	0.08	0.32	0.17	43.5	14.6	0.81	0.86	706	204	4.54	1.81	0.70	0.61	0.17	803
382	Machinery and equipment (MH)	-2.31	-2.26	-2.26	1	n.a.	n.a.	n.a.	34.9	21.2	0.82	0.88	850	222	11.72	1.88	0.64	1.41	0.16	1424
383	Electrical machinery (EM)	-1.83	-1.83	-1.74	1	0.10	0.63	0.29	39.7	19.8	0.81	0.87	986	225	8.22	1.80	0.83	0.87	0.16	1001
3841	Shipbuilding (SH)	0.30	0.93	0.94	1	n.a.	n.a.	n.a.	29.7	11.4	0.78	0.87	579	270	11.68	1.68	0.32	0.50	0.16	101
3843	Motorvehicles (MV)	-2.42	-2.27	-2.34	1	n.a.	n.a.	n.a.	19.6	13.2	0.82	0.88	1498	289	4.44	1.91	0.69	0.60	0.16	326
						Source: database STAN			*Source: database AMADEUS*											*Total* 9348

United States

Isic Code	Industry (acronym)	Elasticity		Durability Dummy	Invest-ment / Value added	Openness	Export
		maximum	24 month				
311	Food (FD)	-0.24	-0.18	0	0.11	0.09	0.05
313	Beverages (BV)	-0.59	-0.12	0	0.15	0.10	0.02
314	Tobacco (TB)	-1.21	0.13	0	0.05	0.12	0.11
321	Textiles (TX)	-1.17	-0.45	0	0.10	0.19	0.07
322	Wearing apparel (CL)	-0.25	0.22	0	0.03	0.31	0.03
323	Leather (LT)	-0.73	0.19	0	0.05	0.62	0.14
324	Footwear (FT)	-1.90	-0.84	0	0.03	1.16	0.06
3411	Paper (PP)	-0.68	-0.24	0	0.20	0.14	0.06
342	Printing and publishing (PR)	-0.66	0.01	0	0.08	0.03	0.02
351	Industrial chemicals (CH)	-0.60	-0.33	0	0.18	0.17	0.08
353	Petroleum refineries (PT)	-0.74	-0.48	0	0.35	0.13	0.03
330	Wood and furniture (WD)	-0.44	-0.20	1	0.08	0.12	0.03
360	Non-metallic mineral (NM)	-1.06	-0.33	1	0.13	0.11	0.04
362	Glass (GL)	n.a.	n.a.	1	n.a.	n.a.	n.a.
371	Iron and steel (IR)	-3.50	-0.73	1	0.14	0.16	0.03
372	Non-ferrous metals (NF)	-0.89	-0.59	1	0.14	0.23	0.07
381	Fabricated metal products (MP)	-1.01	-0.91	1	0.08	0.10	0.04
382	Machinery and equipment (MH)	-1.50	-1.39	1	0.10	0.38	0.22
383	Electrical machinery (EM)	-0.56	-0.04	1	0.12	0.41	0.17
3841	Shipbuilding (SH)	-0.43	0.05	1	0.08	0.14	0.09
3843	Motorvehicles (MV)	-2.06	-1.46	1	0.15	0.42	0.13

Source: database STAN