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Abstract: In this paper, we look at the sector-level asymmetric effects of the monetary policy shocks on economic activity in Turkey. Using business cycles for the state of the economy, we find that monetary policy shocks have strong effects on both aggregate GDP, services and industrial production and sub-sectors during recessionary periods. The results are weaker for the expansionary periods. We further study whether the results depend on the state of the credit cycles. Similar results emerge in that the monetary policy is more effective during credit slowdowns with economically more feasible quantitative effects compared to the business cycles.

JEL classification: E32, E44, E52

Keywords: Monetary Policy Transmission, Markov Switching Models, Business Cycles, Credit Cycles.

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1 Introduction

The effects of monetary policy on economic activity constitute an important part of the research agenda on monetary policy and macroeconomics. Many empirical studies show that the effects of monetary policy shocks on real economy activity are stronger in slowdowns than in expansions (Garcia and Schaller (2002) and Lo and Piger (2005) for the U.S., Dolado and Maria-Doleros (2000) for Spain, and Peersman and Smets (2005) and Karras (1996) for the Euro Area). This asymmetry can work from different channels. One channel is based on credit market imperfections. According to this channel, during expansionary times, firms can finance themselves with retained earnings and external finance premium is likely to be relatively low because of strong balance sheets. However during slowdowns, firms find it hard to finance themselves with retained earnings since cash flows are low. Higher dependence on external financing makes them more sensitive to changes in the monetary policy stance. Hence, an unanticipated change in the interest rate leads to significant effect on economic activity in slowdown periods (Bernanke and Gertler (1989), Bernanke and Gertler (1995) and Bernanke et al. (1996)). Another channel works through convex short-run aggregate supply curve. In the presence of this type of supply curves, during slowdowns, a shift in aggregate demand stemming from a monetary policy shock would have a stronger effect on output than on prices. However, during expansions the same shift in aggregate demand would have stronger effect on prices than on output. As a results, the effects of monetary policy changes on demand and therefore on production would be stronger during slowdowns (Laxton et al. (1995), Peltzman (2000), Ball and Mankiw (1994), and Senda (2001)).

This paper analyzes the effects of the monetary policy shocks on the real economic activity in Turkey during 2006-2014 period. We use sectoral data in this analysis as the impact of such shocks could vary considerably across sectors. We initially do not make a distinction between different states of the economy in analyzing the output effect of monetary policy shocks. Then, we study if there exist any asymmetric effect of such shocks across different economic states. More specifically, we investigate whether monetary policy shocks have differential effects on the real economic activity during economic expansions and slowdowns, and during different phases of credit cycles. We employ Markov Switching Model (MSM) of Hamilton (1989) to endogenously determine the probability of moving from one state

to the other one for each point in time.

Normally, the state of the economy is measured from the production variables like gross domestic product or industrial production. However, especially in emerging economy countries like Turkey, the state of the economy could be also affected by the global/domestic financial conditions heavily. There are studies showing that financial cycles and business cycles could exhibit important differences (Borio (2012)). Therefore, to see the possible differences coming from the use of different state variables and also as a robustness check, we directly estimate economic states from both the GDP and credit cycles separately.

One important point in the analysis is the true identification of monetary policy shocks. If monetary policy shocks are not properly identified, then the effects of such shocks could be misleading. Direct use of interest rate as the monetary policy indicator could be inappropriate as interest rates are endogenous. In this paper, we rely on the monetary policy shocks generated from Kilinc and Tunc (2014), which use a rich structural VAR model with block exogeneity assumption for proper identification of monetary policy shocks in small open economies. Then, we use these shocks in our model to investigate whether monetary policy shocks have different effects on real economic activity.

In the first part of the analysis, in which no asymmetry is considered, the results suggest no significant effects of the monetary policy shocks on the GDP, services, and the industrial growth and very limited effect on a few sectors of industries. In the second part of the analysis, in which we examine the asymmetric effects of such shocks, the results show the presence of strong asymmetric effect of these shocks on the GDP, services, and the industrial growth both at the aggregate level and at the disaggregated sector level. Therefore the effects of the monetary policy shocks on the economic activity depend on expansionary and slowdown periods and on credit cycles. More importantly, we show that using credit cycles, we obtain economically more feasible asymmetric quantitative effects of the monetary policy shocks on the real economic activity than using expansionary and slowdown periods.

This study is related to the literature on the effects of monetary policy shocks on real economic activity in different aspects. Garcia and Schaller (2002) use MSM to examine the asymmetry of the monetary policy on the real economic activity in the U.S. between 1953-93 time period. They find that interest rate changes have stronger effect on output during slowdowns than during expansions. Us-

ing quarterly data of Spain over the period 1977-97, Dolado and Maria-Doleros (2000) also find that monetary policy shocks have larger effects in slowdowns. Peersman and Smets (2005, 2002) estimate the effects of a euro area-wide monetary policy shock on output growth in eleven industries of seven European countries. Their results suggest that the negative effect of an increase in the interest rate on output is significantly greater in slowdowns than in expansions. Lo and Piger (2005) have investigated the asymmetric effects of the US monetary policy on the real economy in the US. They conclude that policy actions taken during slowdowns seem to have larger effects on the real economic activity than those taken during expansions.

There are also studies on the effects of monetary policy shocks on industrial heterogeneity. For instance, Ganley and Salmon (1997) and Hayo and Uhlenbrock (2000) find the effects of an unanticipated monetary shock to be unevenly distributed across sectors in the England and Germany. Dedola and Lippi (2005) have systematically analyzed some industries for five OECD countries. Their analysis reveals that the monetary policy is stronger for industries that (1) produce durable goods, (2) have greater financing requirement, and (3) have smaller borrowing capacity. For the US manufacturing industries, Barth and Ramey (2002) find significant differential effects of monetary policy shocks across industries.

An important contribution of this paper to the existing literature is that it investigates the asymmetric effects of monetary policy shocks on the real economic activity not only in the aspect of commonly used economic expansions and recessions but also in the aspects of credit cycles. While these economic cycles can have similar patterns for some periods, they can also diverge in some other periods. The results also support the view that the output effects of monetary policy shocks on the real economic activity diverge to some extent depending on the definition of economic cycles.

Another important contribution of this paper to this literature is that to the best of our knowledge, it is the first paper examining the asymmetric effects of the monetary policy shocks on the sectoral growth in Turkey. A recent study (Ozlu and Yalcin (2012)) investigates the trade credit channel of the monetary policy transmission in Turkey using a panel data of large sample of firms. They find that firms more aggressively substitute trade credits for bank loans in recessionary periods. This also suggests the possible asymmetric effects of the monetary policy shocks on the real economic activity in Turkey. A recent study by Altunok and Fendoglu (2015) on Turkish firms shows that the cost of financing is more

sensitive to firms' indebtedness level during contractionary periods than during expansionary periods.

The results of the paper have some implications for macroeconomic and monetary policies as well. The effect of interest rate changes is limited during periods of strong economic activity or fast credit growth compared to periods of weak economic activity or slow credit growth, where the effect is stronger. As a result, supporting the interest rate policy with other policies would be important for demand management especially during expansionary times. Moreover, using the interest rates as the main policy instrument in this case can generate some financial stability trade-offs in small open economies. For example increasing interest rates during a demand boom can attract short-term capital inflows into the country, thereby appreciating the domestic currency, possibly worsening current account balance and supporting the domestic demand and therefore weakening the monetary policy effectiveness. To tackle these demand management and financial stability issues together, using additional policy instruments would increase the effectiveness of overall policy framework.[1]

The rest of the paper is organized as follows. In section 2, we describe the model in detail and introduce the monetary policy shocks and the data. In the following section, we present the estimation results of different specifications of the models and discuss their results. The final section concludes.

2 Model and Data

2.1 Empirical Model

In this section, we layout the specifications of the empirical models employed for the analysis. In the first model, we assume a very simple structure in which no regime switching features are included. We use seemingly unrelated regression (SUR) method as there might be correlation between shocks affecting different sectors.

$$\Delta y_{i,t} = \alpha_i + \phi_{i,1}\Delta y_{i,t-1} + \phi_{i,2}\Delta y_{i,t-2} + \beta_i MP_{t-1} + \varepsilon_{i,t}, \tag{1}$$

[1] See Aysan et al. (2015) for an overview of macroprudential policies in Turkey.

where $\Delta y_{i,t}$ is the quarterly growth rate of sector i at time t and MP_{t-1} is the monetary policy shock at time t-1. This model assumes that a monetary policy shock at time t would affect the real economy in the following quarter to account for possible lags in the monetary transmission process.

Following Peersman and Smets (2005), we then incorporate regime switching probabilities into the model in order to examine possible asymmetric effect of the monetary policy shocks on the sectoral growth.

$$\begin{aligned} \Delta y_{i,t} &= (\alpha_{i,0}\rho_{g,t} + \alpha_{i,1}\rho_{b,t}) + \phi_{i,1}\Delta y_{i,t-1} + \phi_{i,2}\Delta y_{i,t-2} + \\ &\quad \beta_{i,g}\rho_{g,t-1}MP_{t-1} + \beta_{i,b}\rho_{b,t-1}MP_{t-1} + \varepsilon_{i,t}, \qquad (2) \\ \rho_{g,t} + \rho_{b,t} &= 1. \qquad (3) \end{aligned}$$

where $\rho_{g,t}$ and $\rho_{b,t}$ are the probabilities of being in states g and b at time t and $\beta_{i,g}$ and $\beta_{i,b}$ stand for the short-run coefficients for being in states g and b, respectively. In the case of economic activity, states g and b correspond to economic expansions and slowdowns and in the case of credit cycles, they correspond to strong credit growth and slow credit growth periods respectively.

We use the following Markov Switching Method (MSM) equation to estimate the probabilities of regime switches between states (i.e. ρ_g and ρ_b) for each time period.

$$g_t - \mu_{s_t} = \rho_{s_t}(g_{t-1} - \mu_{s_{t-1}}) + \epsilon_t, \qquad (4)$$

where g_t is the quarterly growth rate of the GDP at time t in the case of economic activity, and the yearly change in the stock of of business credits as a ratio to GDP in the case of credit cycles while μ_{s_t} represents the mean growth rate of GDP being in state s_t for the case of GDP and the mean of the net business credits to GDP ratio being in state s_t for the case of credit cycles.

2.2 Monetary Policy Shocks

We cannot use the changes in the short-term interest rate for the monetary policy shocks because of the endogeneity issue between the interest rate and the economic activity. Therefore, we use the monetary

policy shocks estimated by Kilinc and Tunc (2014) for Turkey for the 2006Q1-2014Q4 period. They employ a structural VAR (SVAR) model which uses world energy price, world industrial production, and the federal funds rate as external variables and gross domestic product, the consumer price index, monetary aggregate, the real effective exchange rate, country risk premium, and the short-term interest rate as domestic variables. The model incorporates block exogeneity assumption, which implies that the shocks to the domestic variables of small open economies have no impact on the external variables neither contemporaneously nor in lag form but the shocks to the external variables could have even contemporaneous impact on the domestic variables of such economies.[2] The impulse responses of shocks to the interest rate, country risk premium, world energy price, and world industrial production show that the model can successfully represent the dynamics of the Turkish economy.

We display in Figure 1 the monthly changes in the interest rate and the monetary policy shocks generated from the SVAR model for 2006-2014 period. In some periods, the whole changes in the interest rate are fully shocks while in some other periods shocks can only partly explain the changes in the interest rate. We take the sum of 3-month shocks for this analysis as we are using quarterly data.

2.3 Data

This study uses Turkish data at quarterly frequency from 2006Q1 to 2014Q4. Table 1 displays the data, their sources, and necessary transformations for this analysis. The seasonally-adjusted data of the aggregate and sector-level services, industrial production indices, and the GDP are provided by the Turkstat. Monetary policy shocks are obtained from Kilinc and Tunc (2014). Business credit data are from the Banking Regulation and Supervision Agency (BRSA) and are adjusted for the exchange rate movements. We use the yearly change in the stock of business credits as a ratio to GDP as the variable of interest for the credit cycles.

[2] See Cushman and Zha (1997) for the importance of this assumption in analyzing small open economies.

3 Results

3.1 The Simple Analysis

Table 2 and 3 display the estimation results for Equation 1, where different states of the economy are not taken into account. **Panel A displays the results for the aggregate GDP while in Panel B we estimate the model for the four main components of GDP (agriculture, industry, construction, and services). Finally, we perform the estimation for the sub-categories of services in Panel C.** In this first exercise, we aim to analyze if we can observe any effect of the monetary policy shocks on the economic activity in a simple model. The fourth column of the Table 2 shows the effects of the monetary policy shocks on the GDP and its sub-components. The results reveal that an unanticipated 100 basis points change in the interest rate has no impact on the GDP growth or the main production sectors of agriculture, industry, services and construction. In Panel C of Table 2, we look at the 14 sub-sectors of services as a system and again find no significant effects of the monetary policy shocks.

In Table 3 we repeat the same exercise for industry sector and its sub-sectors **where the data comes solely from the industrial production index. Panel A of the table displays the results for the aggregate industry while in panel B we perform the estimation for the manufacturing sector separately. In Panel C we split the industry into its three main sub-categories (energy, mining and quarrying, and manufacturing). In Panel D we split the manufacturing into four main sub-categories (intermediate goods, durable goods, non-durable goods, and capital goods. Finally, in Panel E, we further split the manufacturing sector into more disaggregated 22 sub-categories. We find no clear effect of the monetary policy shocks on either total industry (Panel A) or manufacturing sector (Panel B).** For the main sub-sectors of energy, manufacturing and mining-quarrying, only some limited effect is found for mining-quarrying. **Furthermore, no significant effect is observed for the main sub-sectors of the manufacturing in Panel D.** Then in the last part of Table 3, we look at the 22 sub-sectors of manufacturing as a system, and find significant effects only on three sectors, namely tobacco, paper and non-metallic products.[3] Therefore, these results suggest no significant effects of the

[3]In many specifications, we find strong positive effect of the monetary policy shocks on the manufacturing of tobacco products. As the tobacco market is very strictly administered and prices in this market are set by law, we do not interpret the effects of the monetary policy shocks on this particular market.

monetary policy shocks on the economic activity in Turkey when no asymmetric effect is taken into account.

3.2 Asymmetric Effects: Business Cycles

As the effects of the monetary policy shocks on the economic activity are found to be asymmetric in various studies, in the following part, we estimate Equation 2, in which the asymmetric effects are included. In the first asymmetric analysis, we make a distinction between economic expansions and recessions. We estimate the probabilities of being in each state through using GDP in Equation 4. The quarterly growth rate of the GDP and the state switching probabilities obtained from the GDP are displayed in Figure 2. This model chooses the global financial crisis period as the main recession period. There are also small probabilities of being in recession in 2013 and end-2014 where growth rates slow down. However, from the perspective of the GDP, crisis period dominates.

Having estimated the probabilities of expansions and recessions for each quarter, then we feed these probabilities into Equation 2 to estimate the asymmetric effect of the monetary policy shocks according to these states. The results are reported in Table 4 for the GDP, the main sub-sectors of the GDP and then for sub-sectors of services and in Table 5 for sub-sectors of industry. Columns 5 and 6 (i.e. β_g and β_b) capture the effects of monetary policy shocks on economic activity for expansion and recession periods, respectively. The results indicate strong asymmetric effects of the monetary policy shocks on the economic activity. According to Table 4, an unexpected decrease in the interest rate by 100 bps during contractionary times supports the quarterly growth rate by 6.3% for the GDP while the same size shock has no effect during the expansionary times. Looking at the main sectors, we find that industry and services are affected significantly from the monetary policy shocks during contractionary times while no effect is found on agriculture and construction activities. Another finding is that the effect on industry is much larger compared to the effect on services. In the last part of Table 4, we look at the sub-sectors of services as a system and find that wholesale and retail trade, transportation and storage, and administrative-support-technical activities are the sectors that monetary policy has significant effects on during contractionary times. The first two of these are large services sectors and constitute around 50% percent of aggregate services. From the Table 4, we further see that none of main sub-sectors of the

GDP or services are affected during expansionary times.

Then in Table 5, we check the sub-sectors of industry. We find that an unexpected decrease in the interest rate by 100 bps during contractionary times supports the quarterly growth rate by 8.1% for aggregate industry and by 9.7% for manufacturing while the same size shock has no effect during the expansionary times. The same asymmetry is observed for many manufacturing sub-sectors with different magnitudes. From a basic classification of manufacturing as intermediate goods, durable and nondurable consumptions goods, and capital goods, we see that the monetary policy shocks have strong effects on durable consumption goods and capital goods. This is an expected result, similar to the literature, since these goods involve significant intertemporal shifts in the demand (durables in the consumption basket of households and capital goods in the investment basket of firms) and also they are likelier to be financed by credit. Therefore, through their effect on intertemporal behavior and credit demand, interest rate changes might have strong effects on durables and capital goods, as found in our results.

When we look at the sub-sectors of the manufacturing, we find that during expansionary period, one sectors is significantly affected by interest rate shock but the size of the impact is very small. On the other hand, during contractionary periods, ten sectors are significantly affected by an interest rate shock. Furthermore, the sizes of the impacts are quite large compared to expansionary periods. Motor vehicles sector is the most sensitive sector followed by paper and wood products, electrical equipment, leather and rubber products, and textiles and furniture. This result is in line with the literature that the output effect of the monetary policy is most strongly observable in the heavy industries as in Hayo and Uhlenbrock (2000), Dedola and Lippi (2005), and Peersman and Smets (2005). In contrast, sectors of food products and beverages, which produce perishable goods, are not found to be sensitive to interest rate shocks both in expansionary and contractionary periods. Dedola and Lippi (2005) and Peersman and Smets (2005) have also find that these sectors are the least sensitive to the stance of the monetary policy than the other sectors. We also test if the $\beta_{i,g}$ and $\beta_{i,g}$ coefficients across these two states are the same in order to check if the difference between these parameters are significant and find that most the coefficients are statistically different from each other. Therefore, the results in Table 5 are in line with the findings of Garcia and Schaller (2002), Dolado and Maria-Doleros (2000), and Peersman and Smets (2005) and suggest strong asymmetric effect of the monetary policy shocks on the real economic

activity.

These consistently found asymmetries in Tables 4 and 5 help us understand why we observe no real effect of the monetary policy shocks when we employ a simple regression model. If we do not control for the state of the economy, then the weak effects of the monetary policy shocks during more prevalent expansionary periods suppress the strong effects during less common contractionary periods and we get spurious conclusion that the monetary policy shocks have no significant real effect on the economic activity. This analysis and the related results show the importance of controlling for the state of the economy for proper identification of the effects of monetary policy shocks.

We also display in Figure 3 the distribution of the coefficients that measure the impact of monetary policy shocks for 22 sub-sectors of the industry during expansionary and recessionary periods ($\beta_{i,g}$ and $\beta_{i,b}$). The comparison between Panel A, which displays the parameters for the expansionary times and Panel B, which displays the parameters for the contractionary times shows the asymmetry in another form. The distribution of the coefficients for the expansionary times is compressed around zero and their sizes are very small. However, the coefficients for the contractionary times are relatively more dispersed and are quite larger than the coefficients of expansionary times. The figure further shows that there are more statistically-significant coefficients for the contractionary periods than the expansionary periods.

When estimating states of the economy from the GDP data, MSM captures the deep global financial crisis almost as the only contractionary period and assigns small probabilities of being in recession to the other periods. Therefore, the crisis period of 2009 might be dominating the results for some sectors like motor vehicles. One way of handling this shortcoming would be to extend the data to earlier periods and as a result include other contractionary times. We have the GDP and the industry data going back enough periods but the main constraint comes from estimating the interest rate shocks. Between 2001 and 2006, strong disinflationary dynamics and fiscal consolidation make it difficult to estimate the monetary policy shocks and before 2001 different monetary policy regimes make it challenging to fit a standard monetary model as explained by Kilinc and Tunc (2014). Another way of trying to handle this shortcoming would be to check the robustness of results with different cycle definitions for the same time period as we do next.

3.3 Asymmetric Effects: Credit Cycles

In this part we look at the effects of the monetary policy shocks for different states of credit cycles. Defining the state of economy with respect to credit cycle could be informative as well. First, it serves as a robustness check of the asymmetrical results coming from the economic expansions and slowdowns above. Second, estimating states from credit could be valuable on its own. In emerging countries like Turkey, global and domestic financial conditions are very important for economic activity and financial cycles could differ from standard business cycles significantly as mentioned in Borio (2012). Also, firms could be credit constrained and sensitive to credit conditions affecting their economic activity. Households could be similarly credit constrained so affecting the demand for sectors. Furthermore, using the credit cycles could be considered as a more direct way of looking at the asymmetry of financial accelerator effects.

In order to obtain the probabilities of being in the credit expansions and slowdowns, again we use Equation 4. However, this time our variable of interest, Δg_t, is the yearly change in the stock of business credits (net credit) corrected for the exchange rate volatility as a ratio to the GDP.[4] Figure 4 displays the net credit and the probabilities of being in credit slowdowns. Contrary to Figure 2, where only during 2009 the probability of contractionary states hits the probability of 1, in Figure 4 we observe quite high probabilities for the state of weak credit growth during end-2006 and 2012 in addition to the one observed in 2009. During these periods, the net credit decreases and the probability of being in credit slowdowns increases.

By incorporating the probabilities of being in the credit expansions and slowdowns, we estimate Equation 2 and display the results in Table 6 and 7. Similar to the previous case, we observe asymmetric effects of the monetary policy shocks on the economic activity. According to Table 6, an unexpected decrease in the interest rate by 100 bps during credit slowdowns supports the quarterly growth rate of the GDP by 1.9% while the same shock has no effect during the credit expansions. In the second panel of Table 6, we look at the main sub-sectors of the GDP and again find that monetary policy shocks affect industry and services while no effect is found on agriculture and construction. These results from

[4]We conduct the same analysis with the total credits and report the results in the Appendix. We find very similar and asymmetric impact of the monetary policy shocks on the real economic activity when the state of the economy is determined by total credits.

the credit cycles are totally with the results from business cycles with only difference being the smaller coefficients. For the sub-sectors of services, we again find that negative monetary policy surprises increase the quarterly growth of transportation and storage and administrative-support-technical activities. Then in Table 7, we repeat the same analysis for industry and its sub-sectors. According to the table, an unexpected decrease in the interest rate by 100 bps during credit slowdowns supports the quarterly growth rate by 2.6% for the aggregate industry and by 2.8% for manufacturing while the same size shock has no effect during the credit expansions. Among the 22 sub-sectors, a negative interest rate shock affect four sectors positively in slowdowns while they affect only one sector positively in expansionary times. Motor vehicles, wood, paper and rubber products, and pharmaceutical products are the sectors that monetary policy could significantly affect similar to the results from states being determined by the GDP.

We also show in Figure 5 the distribution of the coefficients for effect of the monetary policy shocks on the industrial growth rate. Similar to Figure 3, the magnitude of the coefficients are greater for the slowdowns and they are relatively less compressed around zero. One important difference between Panel B of Figures 3 and 5, however, is the size of coefficients. With credit cycles we get much smaller coefficients. For example, an unexpected decrease in the interest rate by 100 bps supports the quarterly growth rate of GDP by 6.3% and industrial production by 9.7% during recessions measured by GDP and by 1.9% and 2.8%, respectively during credit slowdowns . For the motor vehicles, these coefficients are 41.3% and 10.7%, respectively. Overall, estimation through credit cycles also finds that monetary policy has asymmetric effects on industrial production; however, magnitudes of responses are economically more feasible with this approach. Therefore, using credit cycles provide valuable information for the effects of monetary policy shocks.

There are important policy implications of these results as well. Interest rates are the main policy instrument of central banks for conducting monetary policy. However, the effect of interest rate changes can be limited during expansionary times according to our results. Therefore, to manage demand more effectively especially during boom times, policy toolkit of monetary policy could be extended. Another important implication comes from the small open economy aspect. Using the interest rates as the only tool during expansionary periods can lead to significant financial stability trade-offs. For example, in an

environment where credit and aggregate demand are growing strongly, the standard policy response for a central bank is to increase the interest rates to control inflationary pressures. However, with open capital accounts higher interest rates can attract short-term capital flows from the rest of the world, possibly leading to appreciation in domestic currency and worsening in current account balance. These kinds of policy trade-offs were very dominant for emerging countries after the global financial crisis, especially when central banks of advanced countries implemented quantitative easing policies, leading to abundant global liquidity. Many emerging market central banks employed macroprudential policies to tackle these issues. Our results also put evidence that supporting interest rate policy with non-interest rate policies could increase the effectiveness of overall policy framework.

4 Conclusion

This paper investigates the asymmetric effects of the monetary policy shocks on the real economic activity in Turkey between 2006Q1 to 2014Q4 by employing Markov Regime Switching Model. It considers asymmetries related to the economic expansions and recessions measured by the GDP and related to the credit cycles. The results show that the effects of the monetary policy shocks on the GDP, industrial production and services are not observable if any of these asymmetries are disregarded. When we take asymmetrical effects of the monetary policy shocks into consideration where the asymmetry depends on the state of the economy, then the effects of the monetary policy shocks become visible. Economic activity responds to the monetary policy actions more strongly during economic contraction periods and during weak credit growths. These effects are stronger for industrial production compared to services. Among the sub-sectors of industry, the effects are stronger for durable consumption goods and capital goods, while the effects are not significant for the sectors that produce nondurable consumption goods and intermediate goods. Both estimations for the state of the economy give the same results that monetary policy is more effective in slowdowns, while using credit cycles we find economically more feasible quantitative effects.

Expanding the analysis for a sufficiently long time period would allow for more robust analysis. However, we cannot not expand the data because it is difficult to obtain plausible monetary policy shocks

in Turkey for the time period before the explicit implementation of inflation targeting. Having said this, this study can be extended by investigating the contribution of sectoral heterogeneity on the effects of policy shocks by using firm level data. For instance, a distinction between durable good production sectors versus non-durable goods production sectors, foreign market oriented sectors versus domestic market oriented sectors, or small or large firms could provide different patterns for the asymmetric effects of the monetary policy shocks.

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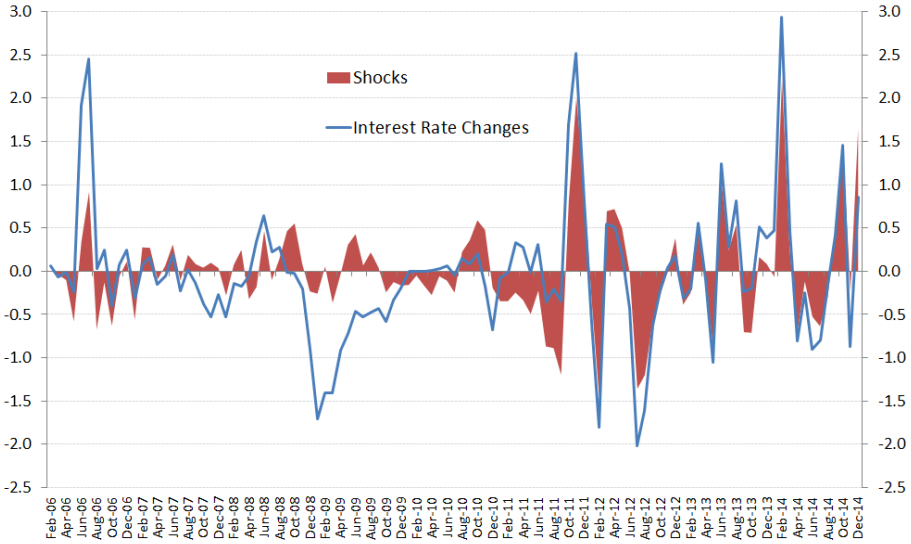
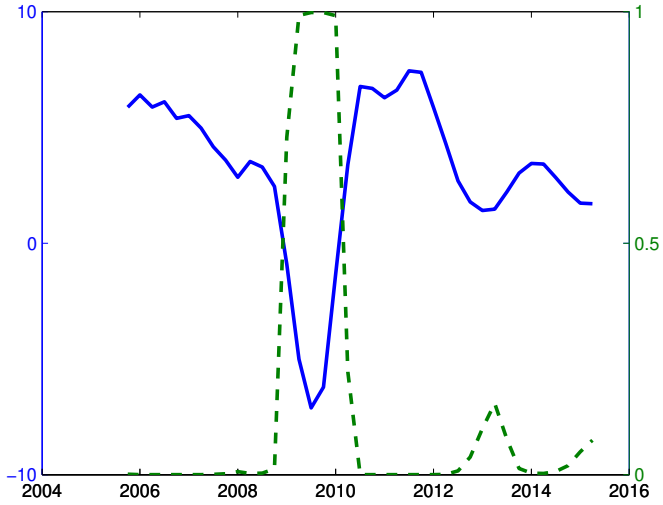
Figure 1: Interest Rate Changes from the Data and the Monetary Policy Shocks Generated from SVAR Model



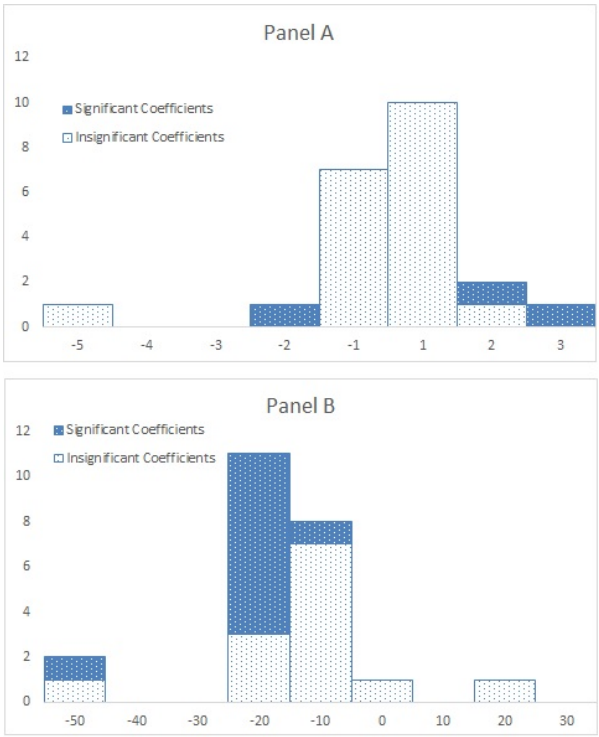
This figure displays the changes in the monthly-averaged interbank over-night interest rate (solid line) and the monetary policy shocks (shaded-area) generated for Turkey by Kilinc and Tunc (2014) for 2006-2014 time period.

Figure 2



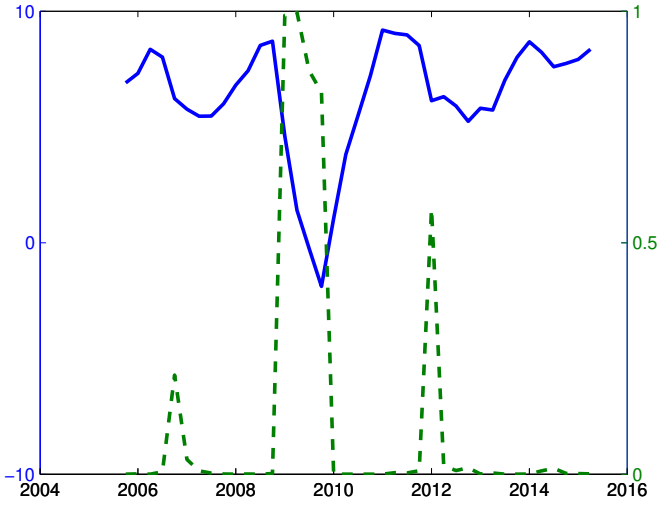
The solid blue line is the growth rate of GDP and the dashed line is the probabilities of recessions obtained through Equation 4 using the GDP.

Figure 3: The Distribution of the Beta Coefficients (Expansionary vs Contractionary Periods)



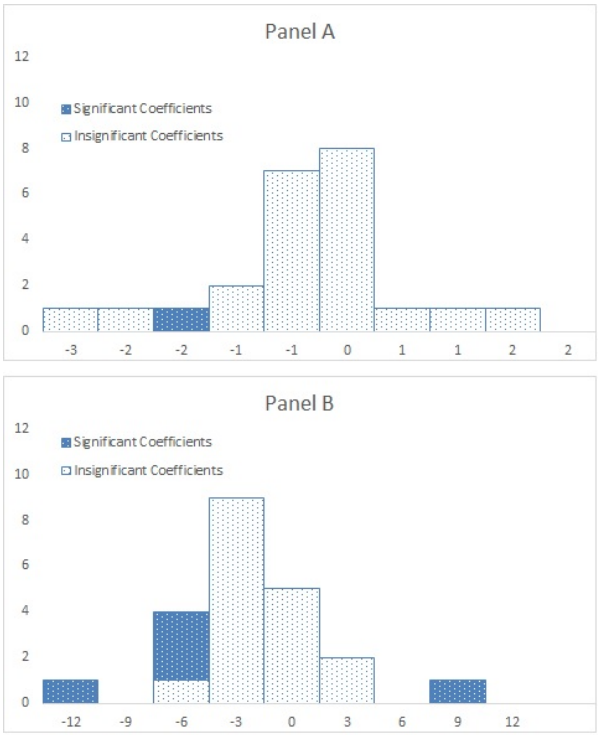
Panel A displays the distribution of the coefficients of the effect of monetary policy shocks on the industrial growth rate for 22 sub-sectors during expansionary periods, where the probabilities of regime switches are obtained through GDP. Panel B displays the distribution for the same parameters for contractionary periods.

Figure 4



The solid blue line is the ratio of net business credit to GDP and the dashed line is the probabilities of recessions obtained through Equation 4 using the business credits.

Figure 5: The Distribution of the Beta Coefficients (Strong Credit Growth vs Weak Credit Growth)



Panel A displays the distribution of the coefficients of the effect of monetary policy shocks on the industrial growth rate for 22 sub-sectors during strong credit growth periods where the probabilities of regime switches are obtained through the ratio of business credits to GDP. Panel B displays the distribution for the same parameters for the weak credit growth periods.

Table 1: Data Definitions and Sources

Data	Source	Transformation
GDP and Sub-components	Turkstat	Seasonally adjusted
Monetary Policy Shocks	Kilinc and Tunc (2014)	3-month moving sum
Business Credits	BRSA	Adjusted for the exchange rate movements

Table 2: The Effects of the Monetary Policy Shocks on the GDP: Simple Model

	Industry	α	ϕ_1	ϕ_2	β
Panel A	GDP	0.772**	0.353**	-0.187	-0.17
		(0.379)	(0.164)	(0.162)	(0.263)
Panel B	Agriculture	0.803*	-0.131	-0.168	0.153
		(0.442)	(0.174)	(0.174)	(0.341)
	Industry	1.074**	0.293***	-0.335***	-0.336
		(0.514)	(0.104)	(0.103)	(0.388)
	Construction	0.169	1.209***	-0.492***	-0.106
		(0.253)	(0.138)	(0.137)	(0.189)
	Services	0.926***	0.199*	-0.183	-0.075
		(0.31)	(0.111)	(0.11)	(0.217)
Panel C	Wholesale and Retail Trade	0.885	0.369***	-0.438***	-0.075
		(0.581)	(0.083)	(0.09)	(0.447)
	Transportation and Storage	1.081**	-0.067	-0.083	-0.161
		(0.526)	(0.082)	(0.08)	(0.4)
	Accommodation and Food Services	1.298***	-0.272**	-0.058	-0.138
		(0.419)	(0.112)	(0.114)	(0.304)
	Information and Communication	0.574**	0.313**	0.267*	-0.022
		(0.248)	(0.14)	(0.143)	(0.149)
	Financial and Insurance Activities	2.393***	-0.091	-0.09	0.011
		(0.438)	(0.118)	(0.109)	(0.24)
	Real Estate Activities	0.503***	-0.179	0.367**	-0.008
		(0.142)	(0.124)	(0.154)	(0.045)
	Professional, Scientific and Technical Activities	2.908***	-0.132*	-0.234***	0.099
		(0.423)	(0.072)	(0.07)	(0.283)
	Administrative and Support and Technical Activities	1.678***	-0.01	-0.145**	-0.001
		(0.396)	(0.07)	(0.068)	(0.287)
	Public Administration and Defense	1.04***	-0.554***	-0.265***	0.051
		(0.234)	(0.085)	(0.081)	(0.174)
	Education	0.801***	-0.139	0.329***	0.051
		(0.244)	(0.107)	(0.105)	(0.136)
	Human Health and Social Work Activities	0.99***	-0.096	0.034	0.067
		(0.206)	(0.105)	(0.104)	(0.114)
	Art, Entertainment and Recreation	0.462*	0.213***	0.115*	-0.002
		(0.253)	(0.072)	(0.064)	(0.191)
	Other Service Activities	0.44***	0.037	0.104	-0.013
		(0.138)	(0.083)	(0.082)	(0.092)
	Activities of households as Employers	1.628***	-0.095	-0.055	-0.218
		(0.391)	(0.097)	(0.1)	(0.249)

Standard errors are reported in the parenthesis where (*), (**), and (***) indicates significance at 10%, 5%, and 1% levels, respectively. β is the short-run coefficient of monetary policy shocks. Panel A display the results for the aggregate GDP while in Panel B, we split GDP into its four main components. In Panel C, we further split the services sector into its 14 sub-categories. For each panel, seemingly unrelated regression the estimation is performed separately.

Table 3: The Effects of the Monetary Policy Shocks on the Industrial Sectors: Simple Model

	Industry	α	ϕ_1	ϕ_2	β
Panel A	Total Industry	0.006	0.498***	-0.203	-0.004
		(0.005)	(0.161)	(0.161)	(0.003)
Panel B	Manufacturing	0.006	0.465***	-0.16	-0.004
		(0.005)	(0.163)	(0.162)	(0.004)
Panel C	Energy	0.01**	-0.19	0.022	0.003
		(0.004)	(0.146)	(0.159)	(0.003)
	Mining and Quarrying	0.013**	0.063	-0.343**	-0.009*
		(0.006)	(0.133)	(0.127)	(0.005)
	Manufacturing	0.007	0.3*	-0.083	-0.004
		(0.005)	(0.148)	(0.149)	(0.004)
Panel D	Intermediate Goods	0.007	0.221*	-0.122	-0.004
		(0.005)	(0.121)	(0.122)	(0.004)
	Durable Consumer Goods	0.025***	-0.488***	-0.482***	-0.004
		(0.008)	(0.103)	(0.102)	(0.006)
	Nondurable Consumer goods	0.008*	-0.154	0.09	0
		(0.004)	(0.147)	(0.142)	(0.003)
	Capital Goods	0.016	-0.105	-0.024	-0.011
		(0.012)	(0.107)	(0.105)	(0.009)
Panel E	Man. of Food Products	0.016**	-0.259**	-0.186*	0.001
		(0.006)	(0.104)	(0.102)	(0.005)
	Man. of Beverages	0.011**	-0.106	-0.111	0.001
		(0.005)	(0.082)	(0.081)	(0.003)
	Man. of Tobacco Products	0.025**	-0.489***	-0.597***	0.025**
		(0.012)	(0.075)	(0.076)	(0.009)
	Man. of Textiles	-0.002	0.148*	-0.193**	-0.007
		(0.006)	(0.074)	(0.071)	(0.005)
	Man. of Wearing Apparel	0.001	0.195***	0.045	0.001
		(0.005)	(0.065)	(0.063)	(0.004)
	Man. of Leather and Related Products	-0.002	-0.099	0.019	0.008
		(0.009)	(0.082)	(0.075)	(0.007)
	Man. of Wood and Products of Wood and Cork	0.009*	0.462***	-0.056	-0.004
		(0.005)	(0.078)	(0.079)	(0.004)
	Man. of Paper and Paper Products	0.014***	0.1	-0.182**	-0.007**
		(0.004)	(0.076)	(0.075)	(0.003)
	Man. of Coke and Refined Petroleum Products	0.009	-0.257***	-0.288***	0.013
		(0.013)	(0.09)	(0.094)	(0.01)
	Man. of Chemicals and Chemical Products	0.011	0.042	-0.19***	-0.001
		(0.007)	(0.069)	(0.068)	(0.005)
	Man. of Pharmaceutical Products	0.025**	0.06	-0.258***	-0.009
		(0.011)	(0.068)	(0.067)	(0.009)
	Man. of Rubber and Plastic Products	0.01	0.158**	-0.107*	-0.004
		(0.006)	(0.061)	(0.059)	(0.005)
	Man. of Other Non-Metallic Mineral Products	0.003	0.236***	-0.079	-0.012***
		(0.006)	(0.062)	(0.059)	(0.004)
	Man. of Basic Metals	0.01	0.071	-0.157*	0.001
		(0.008)	(0.079)	(0.083)	(0.006)
	Man. of Fabricated Metal Products	0.01	0.203***	-0.033	-0.001
		(0.009)	(0.068)	(0.064)	(0.007)
	Man. of Computer	-0.001	-0.013	-0.034	-0.013
		(0.019)	(0.081)	(0.081)	(0.015)
	Man. of Electrical Equipment	0.016**	0.12	-0.161**	-0.002
		(0.008)	(0.077)	(0.075)	(0.006)
	Man. of Machinery and Equipment	0.009	0.376***	-0.088	-0.004
		(0.009)	(0.077)	(0.076)	(0.007)
	Man. of Motor Vehicles	0.02	0.292***	-0.394***	-0.011
		(0.017)	(0.065)	(0.063)	(0.013)
	Man. of Other Transport Equipment	0.041	-0.318***	-0.071	-0.032
		(0.039)	(0.071)	(0.074)	(0.03)
	Man. of Furniture	0.028**	-0.171**	-0.128*	-0.007
		(0.012)	(0.066)	(0.065)	(0.01)
	Electricity Steam and Air Conditioning Supply	0.011**	0.033	-0.049	0.003
		(0.004)	(0.08)	(0.082)	(0.003)

Standard errors are reported in the parenthesis where (*), (**) and (***) indicate significance at 10%, 5%, and 1% levels, respectively. β is the short-run coefficient of monetary policy shocks. Panel A display the results for the total industrial production while Panel B shows the results of the manufacturing sector only. We display three main sub-sectors of the industrial production in a system in Panel C. In the last two panels (D and E), we split the manufacturing sector into 4 main and 22 detailed sub-sectors, respectively. For each panel, the seemingly unrelated regression estimation is performed separately.

Table 4: The Effects of the Monetary Policy Shocks on the GDP: Using Business Cycles

	Industry	α_1	α_2	ϕ_1	ϕ_2	β_g	β_b
Panel A	GDP	0.624	0.722	0.557***	-0.189	0.12	-6.333***
		(0.413)	(0.868)	(0.153)	(0.152)	(0.232)	(1.665)
Panel B	Agriculture	0.718	1.299	-0.117	-0.17	0.224	-1.305
		(0.475)	(1.251)	(0.178)	(0.174)	(0.356)	(2.288)
	Industry	1.025**	0.843	0.42***	-0.321***	0.078	-8.717***
		(0.499)	(1.211)	(0.098)	(0.097)	(0.34)	(2.309)
	Construction	-0.176	1.245	1.18***	-0.347**	-0.153	0.772
		(0.346)	(0.901)	(0.129)	(0.159)	(0.193)	(1.245)
	Services	1.005***	0.4	0.273**	-0.209*	0.125	-3.86***
		(0.341)	(0.722)	(0.114)	(0.113)	(0.202)	(1.361)
Panel C	Wholesale and Retail Trade	0.885	0.275	0.543***	-0.412***	0.389	-9.077***
		(0.553)	(1.415)	(0.077)	(0.087)	(0.395)	(2.599)
	Transportation and Storage	1.288**	-0.068	0.03	-0.128	0.082	-5.537**
		(0.562)	(1.372)	(0.096)	(0.09)	(0.387)	(2.6)
	Accommodation and Food Services	1.141**	1.532	-0.255**	0.004	-0.296	3.115
		(0.446)	(1.075)	(0.116)	(0.121)	(0.307)	(2.051)
	Information and Communication	0.788**	0.097	0.223	0.265*	-0.047	0.351
		(0.314)	(0.538)	(0.139)	(0.142)	(0.158)	(0.987)
	Financial and Insurance Activities	2.446***	1.913**	-0.048	-0.125	-0.09	2.385
		(0.452)	(0.878)	(0.121)	(0.103)	(0.244)	(1.579)
	Real Estate Activities	0.502***	0.481**	-0.204	0.401**	-0.009	0
		(0.147)	(0.228)	(0.133)	(0.164)	(0.048)	(0.303)
	Professional, Scientific and Technical Activities	3.101***	2.301**	-0.138*	-0.257***	0.165	-1.001
		(0.47)	(1.028)	(0.08)	(0.071)	(0.296)	(1.946)
	Administrative and Support and Technical Activities	1.811***	0.712	0.116	-0.221***	0.198	-4.222**
		(0.421)	(0.943)	(0.081)	(0.073)	(0.272)	(1.82)
	Public Administration and Defence	0.967***	1.261*	-0.515***	-0.255***	0.039	0.288
		(0.255)	(0.645)	(0.085)	(0.079)	(0.185)	(1.197)
	Education	0.937***	0.554	-0.194*	0.301**	0.015	0.865
		(0.273)	(0.5)	(0.11)	(0.113)	(0.143)	(0.944)
	Human Health and Social Work Activities	0.967***	0.98**	-0.004	-0.028	0.122	-0.807
		(0.211)	(0.427)	(0.103)	(0.099)	(0.12)	(0.777)
	Art, Entertainment and Recreation	0.607**	-0.079	0.235***	0.056	0.023	-0.519
		(0.284)	(0.697)	(0.073)	(0.067)	(0.201)	(1.293)
	Other Service Activities	0.44**	0.416	0.008	0.14	-0.004	-0.13
		(0.16)	(0.337)	(0.084)	(0.095)	(0.098)	(0.646)
	Activities of households as Employers	1.619***	1.446	-0.077	-0.042	-0.132	-1.808
		(0.44)	(0.898)	(0.099)	(0.104)	(0.262)	(1.685)

Standard errors are reported in the parenthesis where (*), (**), and (***) indicates significance at 10%, 5%, and 1% levels, respectively. β_g and β_b are the short-run coefficient of monetary policy shocks during expansionary and recessionary periods, respectively. Panel A display the results for the aggregate GDP while in Panel B, we split GDP into its four main components. In Panel C, we further split the services sector into its 14 sub-categories. For each panel, the seemingly unrelated regression estimation is performed separately.

Table 5: The Effects of the Monetary Policy Shocks on the Industrial Sectors: Using Business Cycles

	Industry	α_1	α_2	ϕ_1	ϕ_2	β_g	β_b
Panel A	Total Industry	0.395	1.142	0.673***	-0.188	0.019	-8.149***
		(0.524)	(1.243)	(0.151)	(0.159)	(0.299)	(2.119)
Panel B	Manufacturing	0.296	1.466	0.678***	-0.155	0	-9.741***
		(0.567)	(1.407)	(0.153)	(0.157)	(0.336)	(2.383)
Panel C	Energy	2.009***	-1.881	-0.365**	-0.263	0.497	0.835
		(0.538)	(1.122)	(0.148)	(0.175)	(0.314)	(2.081)
	Mining and Quarrying	1.456**	0.81	0.039	-0.367***	-0.833	-2.048
		(0.691)	(1.661)	(0.136)	(0.133)	(0.494)	(3.27)
	Manufacturing	0.395	1.276	0.532***	-0.085	-0.001	-8.932***
		(0.558)	(1.391)	(0.142)	(0.146)	(0.34)	(2.379)
Panel D	Intermediate Goods	0.679	0.411	0.27**	-0.116	-0.296	-3.207
		(0.589)	(1.449)	(0.13)	(0.15)	(0.393)	(2.544)
	Durable Consumer Goods	2.485***	1.312	-0.302**	-0.449***	0.155	-10.409**
		(0.87)	(2.11)	(0.133)	(0.114)	(0.621)	(4.502)
	Nondurable Consumer goods	0.802	0.577	-0.127	0.093	0.094	-1.221
		(0.507)	(1.139)	(0.163)	(0.157)	(0.318)	(2.103)
	Capital Goods	1.217	1.615	0.318**	-0.048	0.058	-23.605***
		(1.073)	(2.831)	(0.118)	(0.107)	(0.724)	(5.143)
Panel E	Man. of Food Products	1.343*	2.461	-0.267**	-0.091	-0.093	2.657
		(0.721)	(1.743)	(0.109)	(0.105)	(0.506)	(3.22)
	Man. of Beverages	1.308**	0.191	-0.091	-0.16**	0.251	-2.634
		(0.488)	(1.222)	(0.073)	(0.073)	(0.354)	(2.265)
	Man. of Tobacco Products	3.441**	-2.537	-0.491***	-0.68***	2.501**	5.755
		(1.301)	(3.335)	(0.055)	(0.055)	(0.968)	(6.187)
	Man. of Textiles	-0.272	0.655	0.321***	-0.233***	-0.354	-10.472***
		(0.621)	(1.633)	(0.076)	(0.072)	(0.465)	(3.018)
	Man. of Wearing Apparel	0.09	0.466	0.237***	-0.001	0.337	-4.438
		(0.572)	(1.486)	(0.069)	(0.068)	(0.427)	(2.744)
	Man. of Leather and Related Products	-0.381	1.575	0.131	0.022	1.352**	-12.8***
		(0.86)	(2.229)	(0.086)	(0.075)	(0.643)	(4.194)
	Man. of Wood and Products of Wood and Cork	0.164	2.438**	0.575***	0.008	-0.039	-8.124***
		(0.471)	(1.113)	(0.06)	(0.06)	(0.323)	(2.071)
	Man. of Paper and Paper Products	1.465***	1.018	0.082	-0.162**	-0.481	-3.819*
		(0.437)	(1.024)	(0.073)	(0.076)	(0.3)	(1.899)
	Man. of Coke and Refined Petroleum Products	2.354*	-7.08**	-0.22**	-0.283**	1.568	-2.206
		(1.293)	(3.45)	(0.09)	(0.109)	(0.961)	(6.518)
	Man. of Chemicals and Chemical Products	0.523	3.712*	0.065	-0.089	0.248	-7.216**
		(0.718)	(1.829)	(0.07)	(0.069)	(0.529)	(3.4)
	Man. of Pharmaceutical Products	2.627**	1.434	0.087	-0.252***	-0.584	-6.666
		(1.198)	(3.065)	(0.057)	(0.056)	(0.89)	(5.672)
	Man. of Rubber and Plastic Products	0.507	2.109	0.319***	0.006	0.109	-10.27***
		(0.59)	(1.497)	(0.068)	(0.068)	(0.429)	(2.776)
	Man. of Other Non-Metallic Mineral Products	0.318	0.13	0.213***	-0.021	-1.039**	-3.684
		(0.616)	(1.595)	(0.053)	(0.051)	(0.458)	(2.914)
	Man. of Basic Metals	1.669*	-2.359	-0.088	-0.046	0.342	-6.592
		(0.872)	(2.248)	(0.084)	(0.109)	(0.621)	(4.397)
	Man. of Fabricated Metal Products	1.127	0.765	0.192***	-0.065	0.007	-2.136
		(0.992)	(2.538)	(0.069)	(0.07)	(0.72)	(4.616)
	Man. of Computer	0.118	-0.766	-0.011	-0.056	-0.957	-6.977
		(2.062)	(5.358)	(0.079)	(0.08)	(1.547)	(9.895)
	Man. of Electrical Equipment	0.642	4.143**	0.414***	-0.16**	0.488	-14.175***
		(0.705)	(1.743)	(0.077)	(0.071)	(0.505)	(3.319)
	Man. of Machinery and Equipment	1.104	0.18	0.587***	-0.266***	0.354	-10.756**
		(0.927)	(2.388)	(0.086)	(0.087)	(0.66)	(4.292)
	Man. of Motor Vehicles	0.771	6.316*	0.547***	-0.258***	0.99	-41.304***
		(1.274)	(3.275)	(0.056)	(0.053)	(0.94)	(6.14)
	Man. of Other Transport Equipment	9.46**	-24.929**	-0.379***	-0.122	-4.463	23.341
		(3.899)	(10.038)	(0.07)	(0.072)	(2.898)	(18.679)
	Man. of Furniture	3.078**	0.884	-0.107	-0.122*	-0.075	-11.203*
		(1.312)	(3.328)	(0.069)	(0.067)	(0.966)	(6.23)
	Electricity Steam and Air Conditioning Supply	1.662***	-0.165	-0.076	-0.142	0.369	-0.005
		(0.478)	(1.103)	(0.082)	(0.091)	(0.32)	(2.04)

Standard errors are reported in the parenthesis where (*), (**), and (***) indicate significance at 10%, 5%, and 1% levels, respectively. β_g and β_b are the short-run coefficient of monetary policy shocks during expansionary and recessionary periods, respectively. Panel A display the results for the total industrial production while Panel B shows the results of the manufacturing sector only. We display three main sub-sectors of the industrial production in a system in Panel C. In the last two panels (D and E), we split the manufacturing sector into 4 main and 22 detailed sub-sectors, respectively. For each panel, the seemingly unrelated regression estimation is performed separately.

Table 6: The Effects of the Monetary Policy Shocks on the GDP: Using Business Credits for Cycles

	Industry	α_1	α_2	ϕ_1	ϕ_2	β_g	β_b
Panel A	GDP	1.746***	-2.735**	0.213	-0.548***	-0.002	-1.932**
		(0.452)	(1.081)	(0.146)	(0.177)	(0.249)	(0.844)
Panel B	Agriculture	0.692	1.516	-0.172	-0.169	0.299	-0.625
		(0.469)	(1.359)	(0.178)	(0.174)	(0.379)	(1.268)
	Industry	1.909***	-3.413**	0.213**	-0.491***	-0.036	-3.08**
		(0.526)	(1.442)	(0.097)	(0.106)	(0.372)	(1.271)
	Construction	0.261	-0.384	1.143***	-0.447***	-0.129	-0.079
		(0.31)	(0.911)	(0.144)	(0.133)	(0.214)	(0.737)
	Services	1.592***	-1.705**	0.093	-0.377***	0.039	-1.347*
		(0.348)	(0.82)	(0.109)	(0.12)	(0.21)	(0.719)
Panel C	Wholesale and Retail Trade	2.221***	-6.33***	0.291***	-0.728***	0.052	-2.308
		(0.573)	(1.661)	(0.077)	(0.093)	(0.427)	(1.458)
	Transportation and Storage	1.988***	-3.404**	-0.185**	-0.283***	0.135	-3**
		(0.53)	(1.458)	(0.077)	(0.081)	(0.392)	(1.345)
	Accommodation and Food Services	1.209**	1.978	-0.253**	-0.039	-0.285	1.124
		(0.443)	(1.179)	(0.11)	(0.115)	(0.331)	(1.158)
	Information and Communication	0.563*	-0.103	0.383**	0.279**	-0.035	0.001
		(0.299)	(0.575)	(0.16)	(0.136)	(0.165)	(0.645)
	Financial and Insurance Activities	2.484***	2.031**	-0.012	-0.145	-0.248	2.168**
		(0.411)	(0.922)	(0.111)	(0.1)	(0.241)	(0.846)
	Real Estate Activities	0.493***	0.49**	-0.206	0.411**	-0.005	-0.037
		(0.14)	(0.24)	(0.123)	(0.152)	(0.05)	(0.17)
	Professional, Scientific and Technical Activities	3.331***	1.377	-0.179**	-0.283***	0.172	-0.633
		(0.461)	(1.083)	(0.075)	(0.073)	(0.305)	(1.044)
	Administrative and Support and Technical Activities	2.651***	-1.663*	-0.143**	-0.347***	0.171	-1.713*
		(0.388)	(0.979)	(0.065)	(0.065)	(0.272)	(0.931)
	Public Administration and Defence	0.975***	1.547**	-0.578***	-0.265***	0.075	-0.049
		(0.251)	(0.695)	(0.085)	(0.08)	(0.195)	(0.671)
	Education	0.83***	1.047*	-0.154	0.296***	0.024	0.29
		(0.264)	(0.547)	(0.104)	(0.107)	(0.153)	(0.528)
	Human Health and Social Work Activities	0.954***	1.159**	-0.12	0.044	0.158	-0.569
		(0.216)	(0.453)	(0.102)	(0.104)	(0.124)	(0.426)
	Art, Entertainment and Recreation	0.598**	-0.236	0.219***	0.086	-0.049	0.187
		(0.277)	(0.756)	(0.071)	(0.065)	(0.212)	(0.725)
	Other Service Activities	0.398**	0.452	0.037	0.176**	-0.035	0.189
		(0.156)	(0.368)	(0.078)	(0.084)	(0.103)	(0.356)
	Activities of households as Employers	1.931***	0.745	-0.142	-0.108	-0.197	-0.472
		(0.436)	(0.977)	(0.096)	(0.102)	(0.275)	(0.94)

Standard errors are reported in the parenthesis where (*), (**), and (***) indicates significance at 10%, 5%, and 1% levels, respectively. β_g and β_b are the short-run coefficient of monetary policy shocks during credit expansions and slowdowns, respectively. Panel A display the results for the aggregate GDP while in Panel B, we split GDP into its four main components. In Panel C, we further split the services sector into its 14 sub-categories. For each panel, the seemingly unrelated regression estimation is performed separately.

Table 7: The Effects of the Monetary Policy Shocks on the Industrial Sectors: Using Business Credits for Cycles

	Industry	α_1	α_2	ϕ_1	ϕ_2	β_g	β_b
Panel A	Total Industry	0.241	2.79*	0.617***	-0.072	-0.059	-2.619**
		(0.558)	(1.599)	(0.164)	(0.181)	(0.377)	(1.164)
Panel B	Manufacturing	0.214	2.995	0.577***	-0.033	-0.114	-2.847**
		(0.616)	(1.844)	(0.167)	(0.182)	(0.431)	(1.317)
Panel C	Energy	1.327**	-0.304	-0.347**	-0.083	0.174	1.685
		(0.544)	(1.361)	(0.155)	(0.174)	(0.401)	(1.092)
	Mining and Quarrying	1.043	2.821	0.056	-0.309**	-0.938*	-1.106
		(0.681)	(1.883)	(0.13)	(0.128)	(0.551)	(1.541)
	Manufacturing	0.423	2.395	0.389**	-0.005	-0.108	-2.4*
		(0.606)	(1.806)	(0.15)	(0.163)	(0.438)	(1.318)
Panel D	Intermediate Goods	0.241	2.724	0.254**	0.012	-0.385	-1.12
		(0.568)	(1.657)	(0.119)	(0.137)	(0.442)	(1.265)
	Durable Consumer Goods	2.728***	1.774	-0.477***	-0.479***	-0.063	-1.708
		(0.918)	(2.616)	(0.11)	(0.11)	(0.76)	(2.182)
	Nondurable Consumer goods	0.822	0.517	-0.162	0.092	0.045	0.058
		(0.502)	(1.322)	(0.165)	(0.153)	(0.36)	(1.039)
	Capital Goods	2.041	0.64	-0.036	-0.03	-0.18	-5.015
		(1.329)	(4.052)	(0.114)	(0.121)	(1.069)	(3.143)
Panel E	Man. of Food Products	1.46*	1.99	-0.254**	-0.155	-0.133	0.883
		(0.725)	(1.998)	(0.111)	(0.11)	(0.576)	(1.615)
	Man. of Beverages	1.388***	-0.6	-0.132*	-0.119	0.235	-0.104
		(0.485)	(1.39)	(0.073)	(0.072)	(0.402)	(1.134)
	Man. of Tobacco Products	2.047	-0.867	-0.413***	-0.54***	1.114	9.898***
		(1.21)	(3.511)	(0.06)	(0.054)	(1.016)	(2.879)
	Man. of Textiles	-0.421	1.218	0.098	-0.158**	-0.697	-0.882
		(0.706)	(2.104)	(0.074)	(0.069)	(0.6)	(1.712)
	Man. of Wearing Apparel	-0.053	0.731	0.193***	0.078	-0.043	0.724
		(0.583)	(1.729)	(0.067)	(0.064)	(0.495)	(1.391)
	Man. of Leather and Related Products	-0.684	1.214	-0.041	0.169**	0.108	3.163
		(0.961)	(2.824)	(0.075)	(0.076)	(0.822)	(2.316)
	Man. of Wood and Products of Wood and Cork	0.586	3.294**	0.45***	0.013	-0.015	-3.023**
		(0.512)	(1.366)	(0.073)	(0.073)	(0.396)	(1.111)
	Man. of Paper and Paper Products	1.429***	1.803	0.064	-0.171**	-0.492	-1.471
		(0.441)	(1.2)	(0.071)	(0.075)	(0.351)	(0.98)
	Man. of Coke and Refined Petroleum Products	1.677	-4.296	-0.295***	-0.265**	1.595	1.334
		(1.388)	(4.199)	(0.092)	(0.098)	(1.18)	(3.328)
	Man. of Chemicals and Chemical Products	0.364	6.002***	0.086	-0.095	-0.008	-2.077
		(0.698)	(2.024)	(0.067)	(0.068)	(0.584)	(1.652)
	Man. of Pharmaceutical Products	2.921**	2.308	0.037	-0.252***	0.021	-4.852*
		(1.166)	(3.394)	(0.06)	(0.06)	(0.983)	(2.763)
	Man. of Rubber and Plastic Products	0.556	3.877**	0.261***	0.006	0.061	-3.444**
		(0.623)	(1.82)	(0.057)	(0.057)	(0.522)	(1.474)
	Man. of Other Non-Metallic Mineral Products	0.233	1.006	0.235***	-0.05	-1.103**	-1.925
		(0.616)	(1.829)	(0.065)	(0.063)	(0.521)	(1.451)
	Man. of Basic Metals	0.604	2.13	0.139*	-0.037	0.064	-0.223
		(0.893)	(2.649)	(0.076)	(0.096)	(0.732)	(2.102)
	Man. of Fabricated Metal Products	0.725	2.857	0.202***	0	-0.099	-0.634
		(0.969)	(2.846)	(0.069)	(0.069)	(0.805)	(2.289)
	Man. of Computer	-0.976	2.777	-0.06	-0.089	-2.362	3.602
		(2.003)	(5.945)	(0.077)	(0.08)	(1.704)	(4.859)
	Man. of Electrical Equipment	1.087	5.234**	0.129*	-0.088	0.094	-2.514
		(0.794)	(2.276)	(0.068)	(0.066)	(0.657)	(1.854)
	Man. of Machinery and Equipment	0.951	1.6	0.386***	-0.094	-0.092	-1.819
		(0.995)	(2.953)	(0.078)	(0.084)	(0.819)	(2.322)
	Man. of Motor Vehicles	1.925	7.521	0.323***	-0.317***	0.648	-10.658**
		(1.699)	(5.017)	(0.063)	(0.064)	(1.431)	(4.052)
	Man. of Other Transport Equipment	9.644**	-32.902***	-0.375***	-0.105	-1.697	0.203
		(3.735)	(10.975)	(0.067)	(0.068)	(3.156)	(8.95)
	Man. of Furniture	3.285**	1.276	-0.137**	-0.158**	0.031	-3.489
		(1.331)	(3.865)	(0.061)	(0.062)	(1.117)	(3.142)
	Electricity Steam and Air Conditioning Supply	1.178**	1.281	-0.046	-0.031	0.251	0.352
		(0.485)	(1.262)	(0.084)	(0.085)	(0.374)	(1.043)

Standard errors are reported in the parenthesis where (*), (**), and (***) indicate significance at 10%, 5%, and 1% levels, respectively. β_g and β_b are the short-run coefficient of monetary policy shocks during credit expansions and slowdowns, respectively. Panel A display the results for the total industrial production while Panel B shows the results of the manufacturing sector only. We display three main sub-sectors of the industrial production in a system in Panel C. In the last two panels (D and E), we split the manufacturing sector into 4 main and 22 detailed sub-sectors, respectively. For each panel, the seemingly unrelated regression estimation is performed separately.

5 Appendix

Table 8: The Effects of the Monetary Policy Shocks on the GDP: Using Total Credits for Cycles

	Industry	α_1	α_2	ϕ_1	ϕ_2	β_g	β_b
Panel A	GDP	1.725***	-2.396**	0.238	-0.514***	0.188	-2.659**
		(0.47)	(1.119)	(0.145)	(0.18)	(0.264)	(1.084)
Panel B	Agriculture	0.718	1.452	-0.166	-0.176	0.384	-1.339
		(0.473)	(1.368)	(0.177)	(0.174)	(0.406)	(1.613)
	Industry	1.907***	-2.88*	0.237**	-0.472***	0.249	-4.363**
		(0.532)	(1.458)	(0.097)	(0.106)	(0.394)	(1.614)
	Construction	0.261	-0.353	1.151***	-0.455***	-0.112	-0.111
		(0.319)	(0.928)	(0.144)	(0.133)	(0.231)	(0.938)
	Services	1.609***	-1.52*	0.108	-0.37***	0.186	-1.924**
		(0.358)	(0.836)	(0.109)	(0.122)	(0.225)	(0.915)
Panel C	Wholesale and Retail Trade	2.3***	-6.046***	0.307***	-0.722***	0.296	-2.867
		(0.588)	(1.716)	(0.078)	(0.098)	(0.461)	(1.877)
	Transportation and Storage	2.056***	-3.128**	-0.154*	-0.288***	0.387	-4.105**
		(0.531)	(1.457)	(0.078)	(0.081)	(0.413)	(1.694)
	Accommodation and Food Services	1.217**	1.763	-0.271**	-0.045	-0.319	1.17
		(0.451)	(1.206)	(0.109)	(0.112)	(0.36)	(1.486)
	Information and Communication	0.537*	-0.079	0.426***	0.254*	-0.021	0.05
		(0.295)	(0.583)	(0.155)	(0.135)	(0.179)	(0.789)
	Financial and Insurance Activities	2.464***	1.752*	0.019	-0.176*	-0.262	2.416**
		(0.428)	(0.966)	(0.118)	(0.102)	(0.268)	(1.142)
	Real Estate Activities	0.51***	0.51**	-0.22*	0.398**	-0.001	-0.058
		(0.139)	(0.241)	(0.122)	(0.152)	(0.054)	(0.217)
	Professional, Scientific and Technical Activities	3.297***	1.534	-0.167**	-0.274***	0.292	-1.22
		(0.465)	(1.094)	(0.074)	(0.072)	(0.328)	(1.337)
	Administrative and Support and Technical Activities	2.68***	-1.485	-0.118*	-0.351***	0.363	-2.494**
		(0.388)	(0.975)	(0.064)	(0.065)	(0.287)	(1.172)
	Public Administration and Defence	0.976***	1.509**	-0.565***	-0.271***	0.061	-0.016
		(0.255)	(0.708)	(0.084)	(0.079)	(0.211)	(0.863)
	Education	0.825***	1.008*	-0.15	0.293***	0.018	0.295
		(0.266)	(0.557)	(0.103)	(0.106)	(0.167)	(0.677)
	Human Health and Social Work Activities	0.947***	1.196**	-0.102	0.044	0.191	-0.798
		(0.215)	(0.457)	(0.1)	(0.101)	(0.134)	(0.543)
	Art, Entertainment and Recreation	0.597**	-0.235	0.216***	0.086	0.022	-0.205
		(0.281)	(0.767)	(0.07)	(0.064)	(0.23)	(0.93)
	Other Service Activities	0.393**	0.457	0.03	0.176**	-0.022	0.087
		(0.157)	(0.374)	(0.077)	(0.083)	(0.112)	(0.456)
	Activities of households as Employers	1.882***	0.892	-0.131	-0.095	-0.153	-0.634
		(0.443)	(0.994)	(0.096)	(0.102)	(0.298)	(1.208)

Standard errors are reported in the parenthesis where (*), (**), and (***) indicates significance at 10%, 5%, and 1% levels, respectively. β_g and β_b are the short-run coefficient of monetary policy shocks during credit expansions and slowdowns, respectively. Panel A display the results for the aggregate GDP while in Panel B, we split GDP into its four main components. In Panel C, we further split the services sector into its 14 sub-categories. For each panel, the seemingly unrelated regression estimation is performed separately.

Table 9: The Effects of the Monetary Policy Shocks on the Industrial Sectors: Using Total Credits for Cycles

Industry	α_1	α_2	ϕ_1	ϕ_2	β_g	β_b	
Panel A	Total Industry	0.15	3.079*	0.664***	-0.057	0.125	-4.161***
		(0.545)	(1.516)	(0.159)	(0.172)	(0.375)	(1.47)
Panel B	Manufacturing	0.114	3.381*	0.628***	-0.015	0.099	-4.608***
		(0.604)	(1.751)	(0.162)	(0.174)	(0.428)	(1.665)
Panel C	Energy	1.344**	-0.252	-0.332**	-0.082	0.181	1.816
		(0.549)	(1.344)	(0.152)	(0.171)	(0.408)	(1.407)
	Mining and Quarrying	1.016	2.918	0.059	-0.311**	-0.907	-1.227
		(0.688)	(1.876)	(0.13)	(0.128)	(0.567)	(2.031)
	Manufacturing	0.317	2.823	0.447***	0.01	0.075	-3.984**
		(0.593)	(1.72)	(0.146)	(0.157)	(0.436)	(1.666)
Panel D	Intermediate Goods	0.184	2.884*	0.254**	0.019	-0.346	-1.328
		(0.576)	(1.644)	(0.118)	(0.138)	(0.456)	(1.657)
	Durable Consumer Goods	2.723***	1.747	-0.451***	-0.456***	0.103	-3.115
		(0.921)	(2.582)	(0.113)	(0.111)	(0.78)	(2.872)
	Nondurable Consumer goods	0.74	0.928	-0.131	0.114	0.084	-0.337
		(0.511)	(1.316)	(0.167)	(0.154)	(0.371)	(1.372)
	Capital Goods	1.835	1.909	0.061	0.001	0.278	-9.34**
		(1.275)	(3.803)	(0.113)	(0.116)	(1.042)	(3.913)
Panel E	Man. of Food Products	1.374*	2.274	-0.253**	-0.147	-0.225	1.591
		(0.737)	(1.989)	(0.112)	(0.111)	(0.592)	(2.112)
	Man. of Beverages	1.409***	-0.484	-0.121*	-0.121*	0.291	-0.676
		(0.492)	(1.387)	(0.071)	(0.07)	(0.415)	(1.49)
	Man. of Tobacco Products	2.003	-0.199	-0.397***	-0.548***	0.978	12.218***
		(1.239)	(3.53)	(0.061)	(0.056)	(1.057)	(3.831)
	Man. of Textiles	-0.418	1.464	0.119	-0.16**	-0.565	-1.754
		(0.711)	(2.08)	(0.076)	(0.069)	(0.613)	(2.238)
	Man. of Wearing Apparel	-0.098	1.205	0.198***	0.099	0.041	0.387
		(0.593)	(1.725)	(0.067)	(0.064)	(0.511)	(1.829)
	Man. of Leather and Related Products	-0.509	0.79	-0.061	0.125	0.371	2.593
		(0.991)	(2.867)	(0.078)	(0.077)	(0.859)	(3.084)
	Man. of Wood and Products of Wood and Cork	0.536	3.322**	0.467***	0.003	0.075	-3.986***
		(0.511)	(1.343)	(0.071)	(0.071)	(0.402)	(1.437)
	Man. of Paper and Paper Products	1.417***	1.828	0.064	-0.167**	-0.461	-1.82
		(0.446)	(1.195)	(0.071)	(0.075)	(0.361)	(1.283)
	Man. of Coke and Refined Petroleum Products	1.786	-4.284	-0.283***	-0.243**	1.655	0.238
		(1.405)	(4.171)	(0.093)	(0.099)	(1.209)	(4.362)
	Man. of Chemicals and Chemical Products	0.27	6.106***	0.082	-0.083	0.064	-2.495
		(0.706)	(2.013)	(0.068)	(0.069)	(0.601)	(2.166)
	Man. of Pharmaceutical Products	2.922**	2.935	0.036	-0.261***	0.307	-7.696**
		(1.164)	(3.334)	(0.056)	(0.057)	(0.996)	(3.568)
	Man. of Rubber and Plastic Products	0.461	4.048**	0.29***	0.024	0.23	-4.942**
		(0.618)	(1.773)	(0.058)	(0.057)	(0.526)	(1.892)
	Man. of Other Non-Metallic Mineral Products	0.171	1.35	0.25***	-0.043	-1.06*	-2.437
		(0.624)	(1.818)	(0.064)	(0.062)	(0.533)	(1.895)
	Man. of Basic Metals	0.56	2.181	0.147*	-0.029	0.077	-0.276
		(0.907)	(2.637)	(0.074)	(0.096)	(0.754)	(2.774)
	Man. of Fabricated Metal Products	0.667	3.089	0.21***	0.004	-0.029	-1.052
		(0.983)	(2.833)	(0.07)	(0.069)	(0.829)	(3)
	Man. of Computer	-0.902	2.964	-0.069	-0.088	-2.119	3.722
		(2.057)	(5.993)	(0.078)	(0.081)	(1.776)	(6.447)
	Man. of Electrical Equipment	1.044	5.228**	0.164**	-0.096	0.316	-4.076*
		(0.792)	(2.235)	(0.067)	(0.064)	(0.667)	(2.399)
	Man. of Machinery and Equipment	0.975	1.594	0.414***	-0.109	0.094	-3.114
		(1.005)	(2.925)	(0.081)	(0.087)	(0.838)	(3.019)
	Man. of Motor Vehicles	1.858	7.71	0.352***	-0.293***	1.319	-16.492***
		(1.657)	(4.804)	(0.062)	(0.062)	(1.418)	(5.12)
	Man. of Other Transport Equipment	10.057**	-30.601**	-0.368***	-0.117*	-1.407	-5.105
		(3.858)	(11.136)	(0.065)	(0.066)	(3.311)	(11.953)
	Man. of Furniture	3.358**	1.238	-0.12*	-0.156**	0.343	-6.116
		(1.336)	(3.813)	(0.061)	(0.062)	(1.138)	(4.078)
	Electricity Steam and Air Conditioning Supply	1.194**	1.274	-0.057	-0.036	0.236	0.465
		(0.469)	(1.258)	(0.079)	(0.082)	(0.383)	(1.359)

Standard errors are reported in the parenthesis where (*), (**), and (***) indicate significance at 10%, 5%, and 1% levels, respectively. β_g and β_b are the short-run coefficient of monetary policy shocks during credit expansions and slowdowns, respectively. Panel A display the results for the total industrial production while Panel B shows the results of the manufacturing sector only. We display three main sub-sectors of the industrial production in a system in Panel C. In the last two panels (D and E), we split the manufacturing sector into 4 main and 22 detailed sub-sectors, respectively. For each panel, the seemingly unrelated regression estimation is performed separately.