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MONETARY POLICY, CHE COMPOSITION OF GDP AND CRISIS DURATION IN EUROPE

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MONETARY POLICY, THE COMPOSITION OF GDP, AND CRISIS DURATION IN EUROPE

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Abstract

This paper analyzes the effects of changes in interest rates on the composition of production in ten European countries during the boom period of the 2000s. We find that output elasticity differs across industries and across countries for similar industries. The paper suggests that in the run-up to the 2008 crisis, the ECB's low interest rate policy affected the allocation of resources across industries. This may explain the sluggish overall recovery from the crisis in Europe.

JEL: E32, E52, E58.

Keywords: Monetary Policy, Interest Rate Sensitivity, Crisis Duration, GDP Composition.

1. Introduction

Five years after the Lehman collapse, the US economy seems to have only begun recovering; Europe is still not back on the growth path. The depth and duration of the financial crisis raises questions as to why the recovery is so time-consuming and if there is a long-term effect of financial crises on trend growth (Cochrane 2012, DeLong 2009, 2011, Krugman 2009, and Mankiw 2009a, 2009b).[1]

Since the 2008 financial crisis, a growing number of papers have suggested that credit booms are determinants of subsequent crises. The larger a credit boom is, the greater is the following credit bust and associated financial crisis. Credit and asset market booms seem to be particularly associated with periods of low interest rates (Bordo and Meissner 2012, Jorda et al. 2011, Borio and Disyatat 2011, Schularick and Taylor 2012). John Taylor (2009) famously claimed that too-low interest rates fueled the US housing boom of the 2000s. In the EU, the period of low interest rates seems to have fueled housing and credit bubbles in the periphery economies of the euro area as well as in Central and Eastern Europe. Ahrend, Cournède, and Price (2008) have found that countries in which interest rates deviated strongly from the Taylor rule experienced the largest housing bubbles.

While previous research provides evidence that monetary policy affects the building of credit and asset booms in general, there is little research on the effects of monetary policy on the composition of the real economy. Such effects may be of interest to explain the duration of financial crises or to help determine over-expanded sectors. When sectors are more interest-rate sensitive and expand at the expense of others during an unsustainable

[1] Cushman (2012), Hosseinkouchack and Wolters (2013), and Perron and Wada (2005) summarize the results of the discussions and econometric findings.

credit boom, the crisis may make necessary an often painful reallocation of resources that goes along with rising unemployment and a depreciation of capital goods, particularly in overly expanded industries. For the boom period of the 1920s leading to the Great Depression, Eichengreen and Mitchener (2003) present some evidence of such sectoral booms fueled by low interest rates and credit expansion.

This paper studies the effects of the European Central Bank's (ECB) monetary policy at the industrial level in Europe during the boom period of the 2000s. The analysis, by and large, follows that of Cachanosky (2014) for Latin American emerging markets by analyzing the sensitivity of different industries to changes in short-term interest rates. We find that output elasticity in Europe differs across industries and across countries for similar industries. Therefore, the paper suggests that in the run-up to the recent financial crisis, the ECB's low interest-rate policy affected the allocation of resources across industries. This may explain the sluggish overall recovery of the euro area.

The paper proceeds as follows. Section 2 discusses the data used in the analysis. Section 3 explains the empirical approach to detecting uneven effects. Section 4 presents and comments on the results. Section 5 concludes briefly.

2. Data

To study the effects of monetary policy in Europe, we analyze whether industrial quarterly real Gross Value Added (GVA) reacts to changes in the short-term interest rate level in the following ten countries: (1) Belgium (BEL), (2) the Czech Republic (CZE), (3) Denmark (DEN), (4) France (FRA), (5) Germany (GER), (6) Italy (ITA), (7) Latvia (LAT), (8) the Netherlands (NET), (9) Poland (POL), and (10) Portugal (POR).

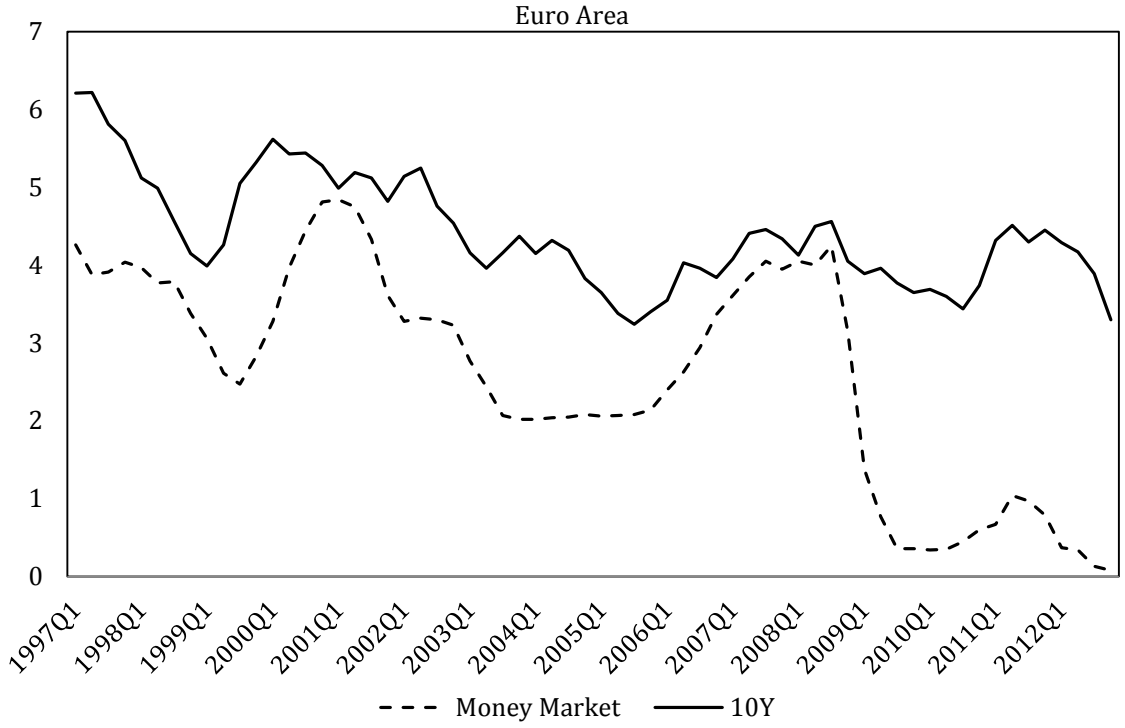
We take GVA and interest rate data for each country from Eurostat NACE Rev. 2. The exact industrial denomination of the GVA data is described as follows: (1) "Agriculture, forestry and fishing," (2) "Industry (except construction)," (3) "Manufacturing," (4) "Construction," (5) "Wholesale and retail trade, transport, accommodation, and food service activities," (6) "Information and communication," (7) "Financial and insurance activities," (8) "Real estate activities," (9) "Professional, scientific, and technical activities; administrative and support service activities," (10) "Public administration, defense, education, human health, and social work activities," and (11) "Arts, entertainment, and recreation; other service activities; activities of household and extra-territorial organizations and bodies."

The period of observation starts with the introduction of the euro in 1999 and ends with the 2008 financial crisis. Given the extent of the bust and policy reaction in the aftermath of the 2008 financial crisis, we consider the year 2009 to be the start of a structural break in the relationship between economic series. Even if not all the countries in the sample are part of the euro area, the ECB is the major central bank of the region, and as such, we take the euro area's money market rate as the benchmark of monetary policy that affects the new member states of the EU that are not part of the euro area.[2]

Figure 1 illustrates the development of short-term interest rates (money market rates) in the euro area. Previous research suggests that the ECB deviated from a Taylor Rule benchmark from 2001 to 2005 (Ahrend et al., 2008). In Figure 1, we see that from 2001 to 2005, long-term (10 year) interest rates also had a downward trend. We shall therefore concentrate on this period "period of low interest rates" in the following.

[2] See Hoffmann (2010).

Figure 1

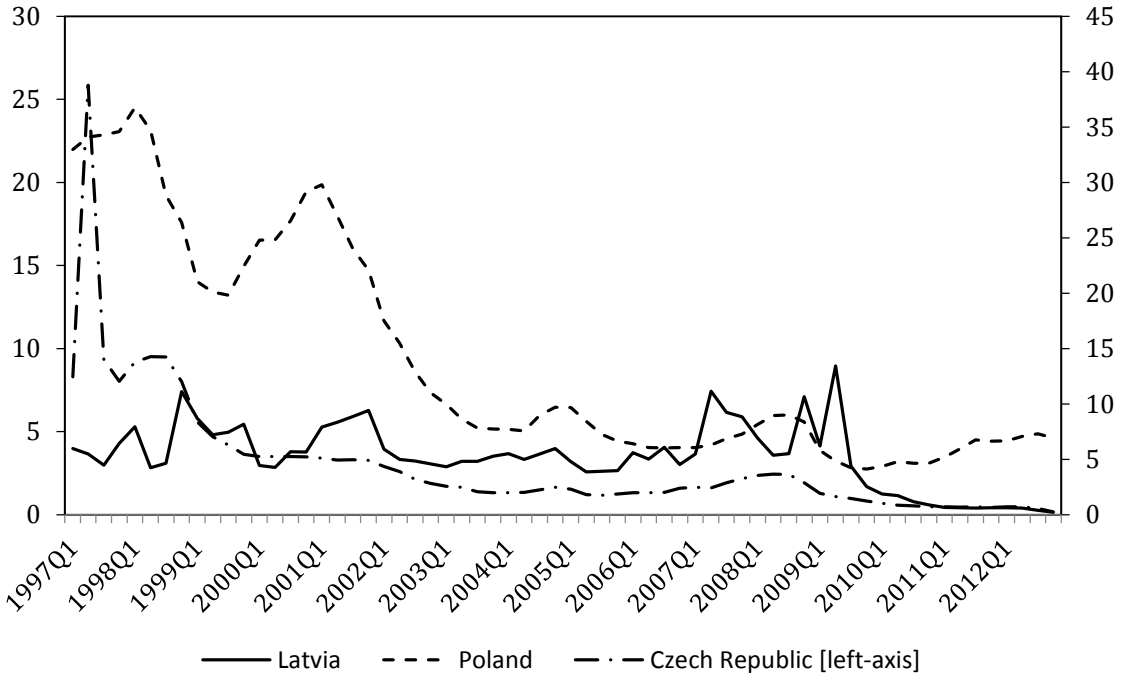


Source: Eurostat

All countries except the Czech Republic, Latvia, and Poland are regressed against the euro short-term rate. These three countries are regressed against domestic short-term interest rates. Figure 2 shows the short-term interest rates for the Czech Republic, Latvia, and Poland. We see that short-term interest rates fall toward the interest rate level of the euro area. Not surprisingly, from 2001 to 2005 interest rates dropped substantially.

Figure 2

Short-term interest rates



Source: Eurostat

3. The VAR model

The analysis of monetary policy's effects at the industry level proceeds in two steps. First, to analyze whether industrial GVA is associated with changes in short-term interest rates, we estimate a VAR for each country where the industrial GVA are the endogenous variables and the short-term interest rate plus other controls (discussed below) are exogenous variables. In a second step, we estimate new output levels by deviating the short-run interest rate 1% downward for the period of low interest rates to calculate sensitivity of components of output.

Because a VAR regression consumes a large number of degrees of freedom in the process of estimating the coefficients, we restrict our analysis to the use of the four industries with the largest participation in total GVA for each country (rather than the 10 sectors

available in the dataset). Another reason for dropping sectors with small participation is that they may be subject to significant changes in output. These changes may be due to shocks at the industrial level that are independent of monetary policy, and this can have a potential effect on the coefficient estimation. Large sectors are more robust against random effects that can affect the value of their output. We also drop the public sector. It is our aim to observe how the actors in the market react to a change in monetary policy. Government activities and programs may not be used while applying the same economic rationale as private programs. For instance, when interest rates fall and output thrives, the government may restrict spending even though it is easier to finance new debt.

The remaining four largest industries represent more than 55% of total GVA and more than 65% of private GVA. Table 1 and Table 2 provide an overview of real GVA output for the period 2001-2005 for ten different economic activities and the share of the top four industries together.

Table 1

	BEL	CZE	DEN	FRA	GER
Agriculture	1.2%	2.7%	2.1%	2.0%	1.0%
Industry (except construction)	21.1%	25.3%	17.6%	15.4%	20.5%
Manufacturing	N/A	21.7%	12.7%	12.9%	18.2%
Construction	5.2%	4.7%	4.4%	4.3%	3.7%
Wholesale and retail trade	19.6%	18.4%	17.4%	15.8%	13.6%
Information and communication	4.4%	3.6%	4.5%	5.0%	3.6%
Financial and insurance	6.2%	1.9%	5.1%	3.9%	3.1%
Real estate	9.4%	4.7%	8.4%	10.2%	9.6%
Professional	11.4%	4.8%	5.7%	9.6%	9.0%
Public administration	19.6%	10.4%	19.2%	17.9%	14.1%
Art	1.9%	1.8%	2.8%	2.9%	3.5%
All	100.0%	100.0%	100.0%	100.0%	100.0%
Top 4 industries (total GVA)	61.5%	70.3%	56.1%	54.3%	62.0%
Top 4 industries (private GVA)	76.5%	78.4%	69.4%	66.2%	72.2%

Table 2

	ITA	LAT	NET	POL	POR
Agriculture	2.2%	3.6%	2.1%	4.4%	2.9%
Industry (except construction)	18.1%	15.9%	16.6%	20.2%	17.1%
Manufacturing	16.0%	12.5%	12.5%	15.7%	14.2%
Construction	4.6%	6.5%	4.6%	5.6%	6.3%
Wholesale and retail trade	17.9%	26.8%	18.4%	21.4%	19.5%
Information and communication	4.2%	4.7%	4.7%	3.6%	3.5%
Financial and insurance	4.0%	2.6%	5.6%	4.4%	6.0%
Real estate	9.4%	7.7%	7.2%	5.3%	6.6%
Professional	7.5%	4.7%	9.4%	5.2%	5.0%
Public administration	13.5%	12.7%	16.8%	11.4%	17.1%
Art	2.7%	2.3%	2.1%	2.8%	1.8%
All	100.0%	100.0%	100.0%	100.0%	100.0%
Top 4 industries (total GVA)	61.4%	62.9%	56.9%	62.8%	57.4%
Top 4 industries (private GVA)	71.0%	72.1%	68.4%	70.9%	69.2%

The VAR model for each country is specified as follows. The differences of the log of GVA of the four top industries in each country are the endogenous variables. The exogenous variables are (1) short-term interest rates (money market rates) in euros or in domestic currency when available (Czech Republic, Latvia, and Poland); (2) difference in the real exchange rate (RER); (3) difference of exports over imports (X/M); (4) difference of the log of US GDP; (5) difference of a composite of commodity prices;[3] and (6) quarterly dummies. Variables 2 and 3 control for international competitiveness and changes in terms of trade, while Variables 4 and 5 control for international market conditions.

Lag selection optimization is constrained to a model that has all inverse roots inside the unit circle. This is because once the model is calculated, new GVA values will be estimated from deviations in the interest rate. Therefore, the model needs to be stable to produce

[3] The composite is the average of the price index for Energy, non-Energy, and Precious Metals from World Bank's Pink Sheet.

reliable estimations.[4] Also, one lag of the short-term interest rate variable is added to the model. The estimation of industrial GVA output reaction to changes in short-term interest rates follows two steps: (1) estimate VAR Model 1 for each country and (2) use Model 2 to produce hypothetical GVA values when the interest rate is 1% lower for the period of 2001-2005. Models 1 and 2 are specified as follows:

Model 1 $$[y_t] = C + A_1 y_{t-1} + \cdots + A_p y_{t-p} + B_1 INT + B_2 INT_{t-1} + EX_t + e_t$$

Model 2 $$[\hat{y}_t] = C + A_1 y_{t-1} + \cdots + A_p y_{t-p} + B_1 (INT_t - 1) + B_2 (INT_{t-1} - 1) + EX_t + e_t$$

Where y_t is the difference of the log of GVA of the top four industries in each country; INT is the short-term interest rate, and X contains the other control variables. A, B, and E are the coefficients of each variable, and C is the constant of the model.

4. Results

Looking at the behavior of the GVA output ratios, we can see structural changes in the economy of the observed countries between 2001 and 2005. Table 3 shows the count of how many output ratios changed more than a threshold level of 2.5%, 5%, 7.5%, and 10% for each country and the total count of changes and no-changes. Each country has a total of six output ratios between the four largest industries. For instance, five output ratios changed more than 2.5% and one output ratio did not change more than 2.5% between 2001 and 2005 in Belgium.[5]

[4] The lags for the VAR of each country are as follows: BEL = 1, CZE = 3, DEN = 3, FRA = 1, GER = 1, ITA = 2, LAT = 3, NET = 2, POL = 3, and POR = 2.

[5] See the appendix for the detailed tables.

Table 3

GVA ratio change count for each country at threshold levels of 2.5%, 5%, 7.5%, and 10% between 2001 and 2005

Threshold level	2.5%		5%		7.5%		10%	
	Change	No change	Change	No change	Change	No change	Change	No change
Belgium	5	1	3	3	3	3	3	3
Czech Republic	6	0	6	0	4	2	3	3
Denmark	3	3	2	4	0	6	0	6
France	0	6	0	6	0	6	0	6
Germany	3	3	0	6	0	6	0	6
Italy	3	3	2	4	0	6	0	6
Latvia	5	1	3	3	3	3	3	3
Netherlands	5	1	3	3	3	3	1	5
Poland	6	0	6	0	6	0	4	2
Portugal	3	3	0	6	0	6	0	6
Total	39	21	25	35	19	41	14	46

The change in GVA ratios does not, in itself, denote the presence of economic imbalances, but it does point to the possibility of such problems. If it is the case that monetary policy has uneven effects at the industrial level, then the elasticity of GVA output to short-term interest rate changes would differ across industries. We take the hypothetical GVA output values from Model 2 and calculate the GVA/short-term elasticities for the four industries observed in each country.[6] If these elasticities differ with each other, then monetary policy is associated with uneven effects at the industrial level.

Table 4 shows the elasticity for each observed industry in each country.

[6] The elasticity is calculated with the percent change of GVA by the end of the 2001-2005 period and the percent change of the average short-term interest rate during the 2001-2005 period.

Table 4

GVA/short-term interest rate elasticities

	IND	MAN	WHO	REA	PRO	CON
BEL	-0.02	-	0.13	0.07	-0.20	-
CZE	-0.36	-	-0.47	-0.15	0.03	-
DEN	0.10	-0.02	-0.03	0.20	-	-
FRA	0.09	-0.01	0.01	-0.19	-	-
GER	-0.11	-0.12	-0.08	0.09	-	-
ITA	-0.07	-0.09	-0.09	0.13	-	-
LAT	-0.24	-0.29	-0.10	0.10	-	-
NET	0.02	-0.43	-0.55	-	-1.16	-
POL	-0.63	-1.00	-0.20	-	-	-1.12
POR	-0.03	-0.03	-0.11	0.04	-	-

There are two things to notice. First, elasticities differ among industries in any given country. Second, the same industry has different elasticity values in different countries. This suggests that there is a reallocation of resources domestically across industries and, with a different pattern, across countries as well.Table 5 shows how many of the elasticities between industries differ by more than a threshold level of 2.5%, 7.5%, 12.5%, and 20%. For instance, all six possible elasticity comparisons between the four industries observed in Belgium differ with each other by more than 2.5%; five do so for Portugal at the 20% threshold level.

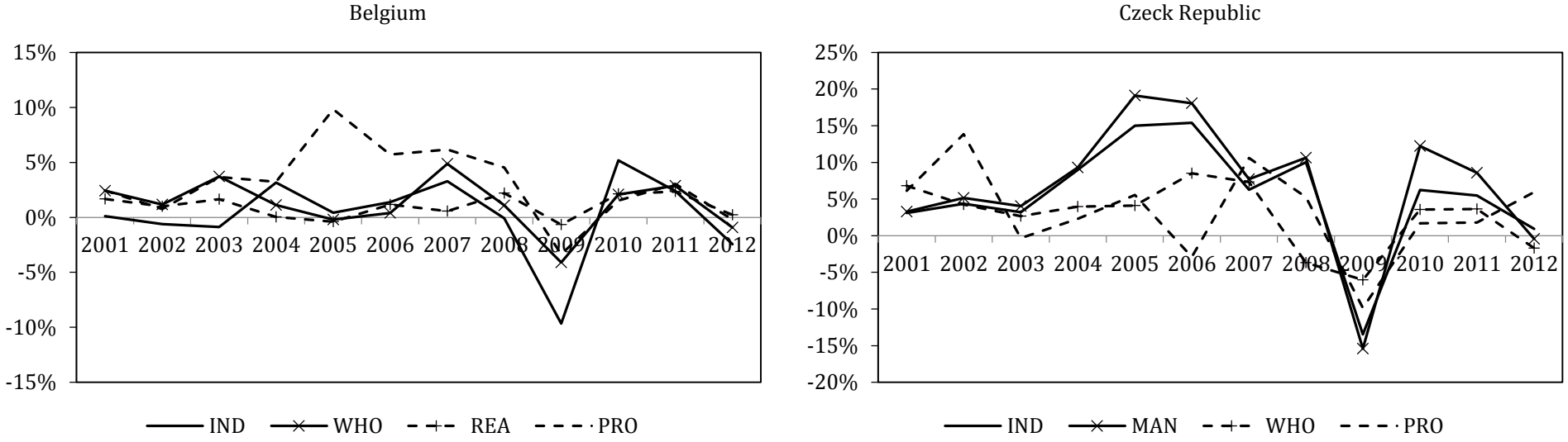
Table 5

GVA/short-term elasticities change at the threshold level of 2.5%, 7.5%, 12.5%, and 20% between 2001 and 2005 when short-term interest rate decreases 1%								
	2.5%		7.5%		12.5%		20%	
	Differ	Similar	Differ	Similar	Differ	Similar	Differ	Similar
Belgium	6	0	6	0	6	0	6	0
Czech Republic	6	0	6	0	6	0	6	0
Denmark	6	0	6	0	6	0	6	0
France	6	0	6	0	6	0	6	0
Germany	6	0	6	0	5	1	5	1
Italy	6	0	5	1	5	1	5	1
Latvia	6	0	6	0	6	0	5	1
Netherlands	6	0	6	0	6	0	6	0
Poland	6	0	6	0	5	1	5	1
Portugal	6	0	5	1	5	1	5	1
Total	60	0	58	2	56	4	55	5

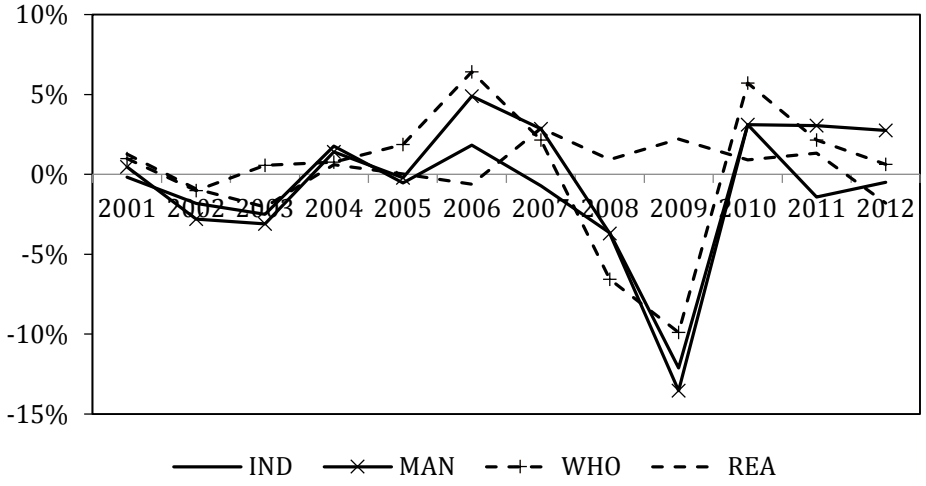
Different elasticity values point to the problem that changes in interest rates may have non-neutral effects at the industrial level. Therefore, deviations in monetary policy from equilibrium produce distortions across the market by allocating specific capital goods and resources to some industries more than others. A later correction of the monetary policy that moves interest rates upward, by producing the opposite effect, puts into motion a costly reallocation of resources. The longer the monetary policy remains "out of track," the larger the weight of economic imbalances that are accumulated in the economy and the more costly it becomes to return to equilibrium after a crisis.

Figure 3

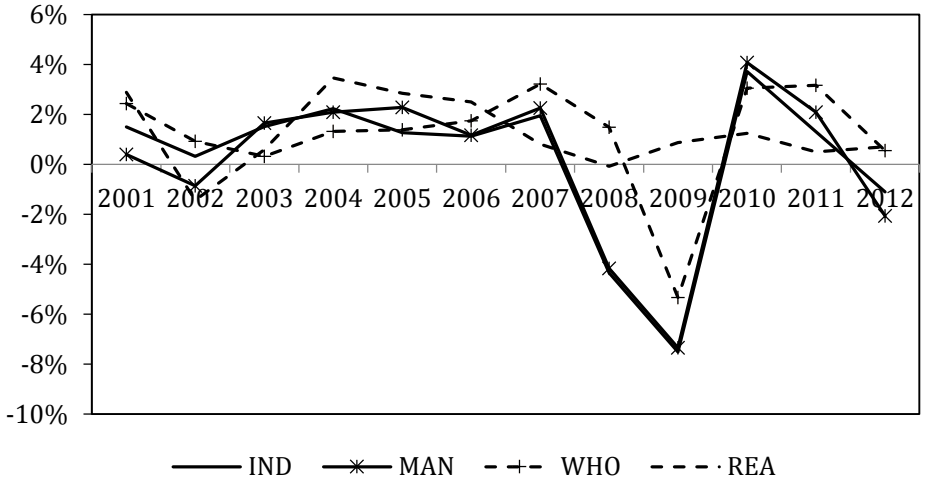
Real GVA growth rates



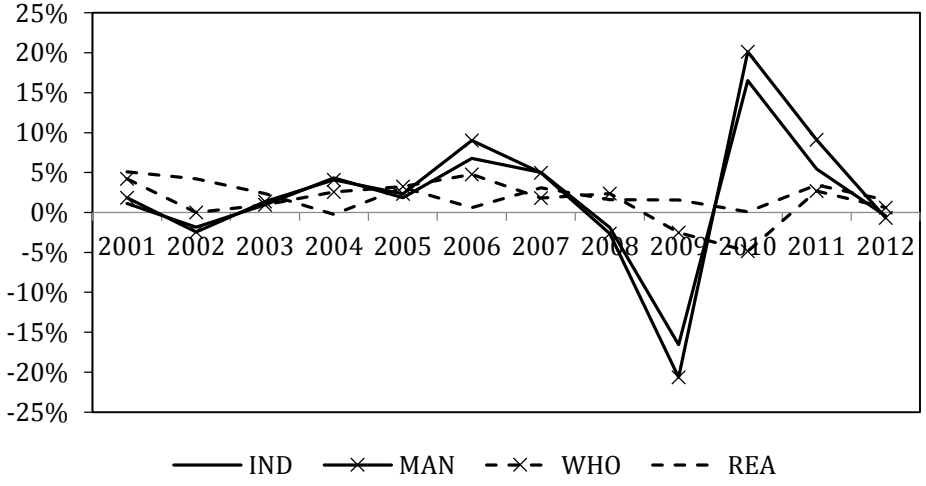
Denmark



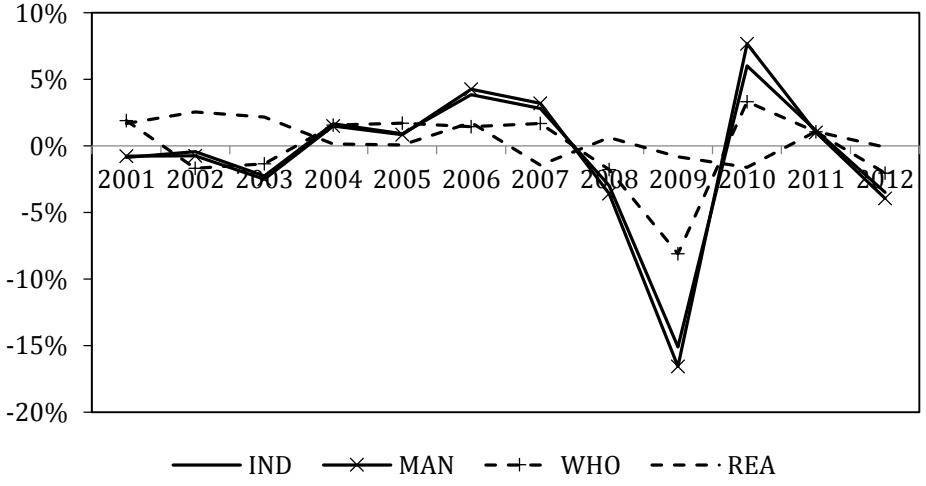
France



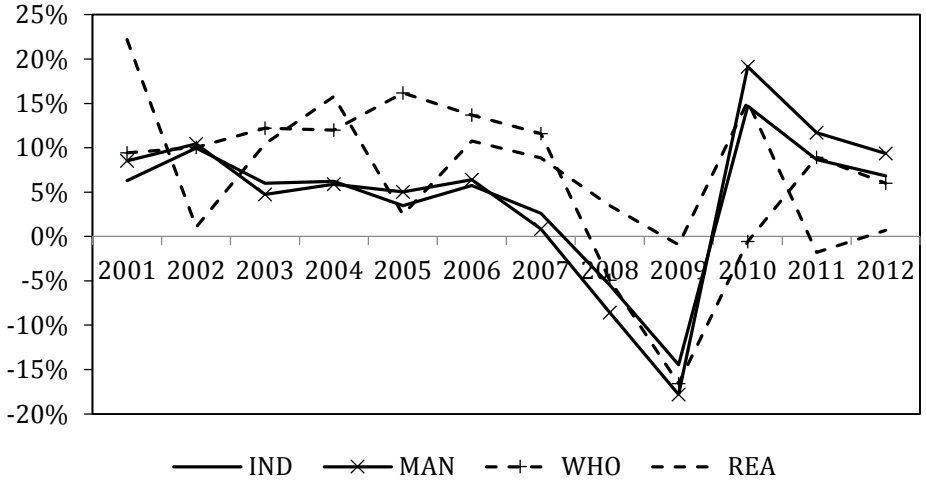
Germany



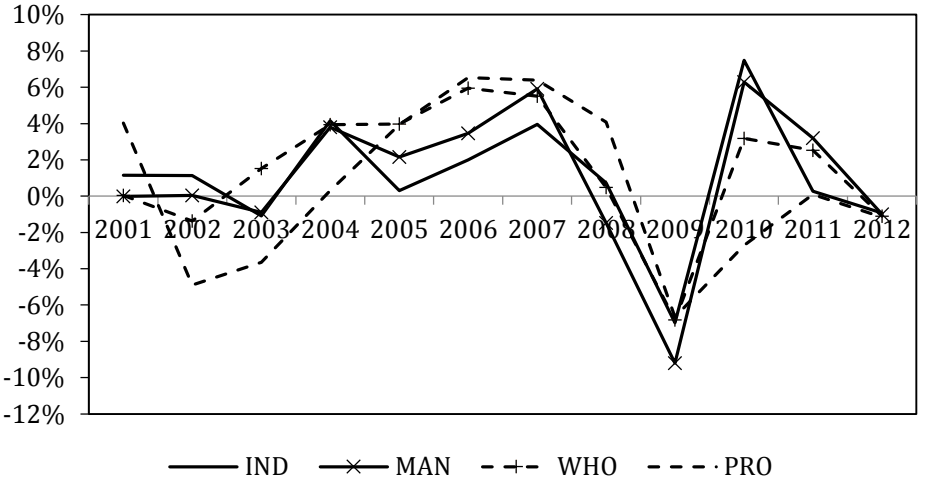
Italy



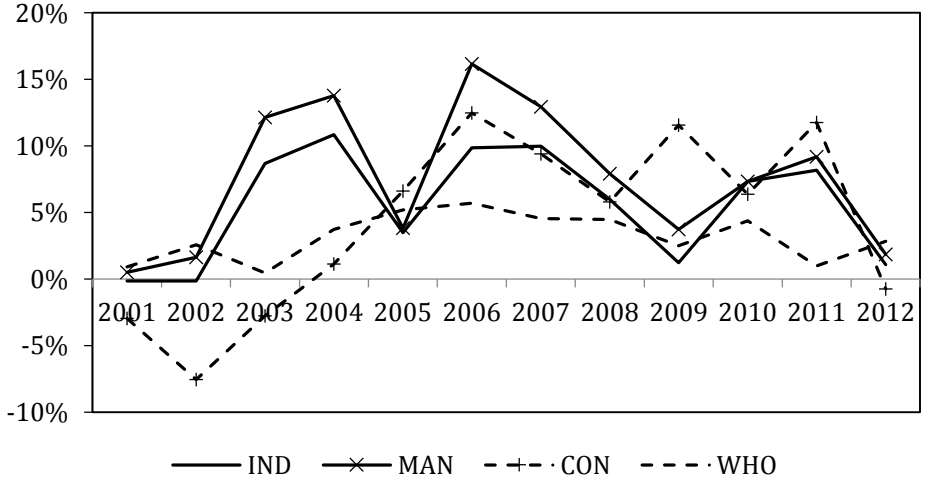
Latvia



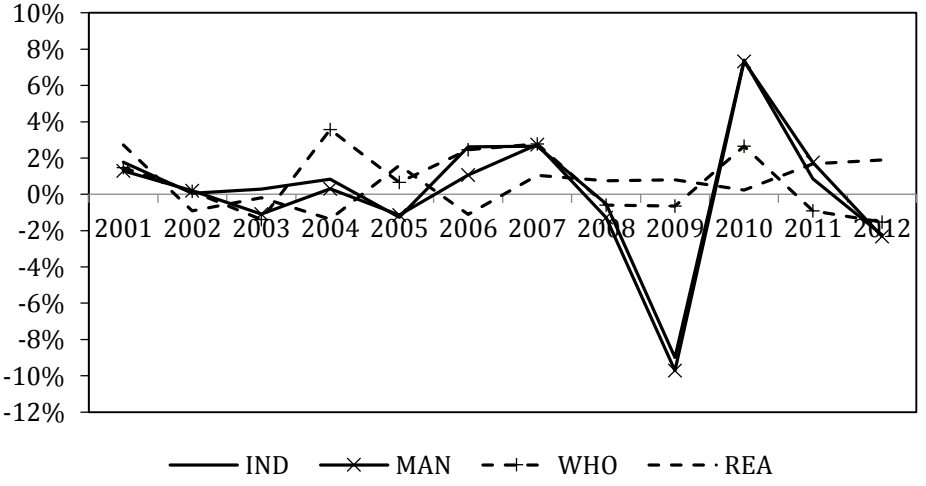
Netherlands



Poland



Portugal



5. Conclusions

We have studied the effects of monetary policy at the industrial level in ten European countries during a period of relatively loose monetary policy. We have found that output/short-term elasticities differ across industries and across countries for similar industries. The uneven effects on the composition of GDP signal that the low interest rate environment of the 2000s may have caused substantial microeconomic distortions in the run-up to the recent crisis that may help explain the sluggish return to growth in Europe.

In line with recent research on credit booms, our study suggests that a monetary policy that focuses on price stability may not necessarily provide economic and financial stability in the long run. In fact, we may experience periods of low inflation during which too-low interest rates contribute to investment distortions fed by swelling credit or asset booms. Bursting bubbles will eventually set a troublesome end to such a financial cycle.

Appendix: Change in observed output ratios [1]

Belgium										2.5%		5%		7.5%		10%	
2001	IND	WHO	REA	PRO	2005	IND	WHO	REA	PRO	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.90	0.44	0.51	IND	1	0.93	0.44	0.59	2	1	1	2	1	2	1	2
WHO	-	1	0.49	0.57	WHO	-	1	0.47	0.64	2	0	1	1	1	1	1	1
REA	-	-	1	1.16	REA	-	-	1	1.35	1	0	1	0	1	0	1	0
PRO	-	-	-	1	PRO	-	-	-	1								
Czech Republic										2.5%		5%		7.5%		10%	
2001	IND	MAN	WHO	PRO	2005	IND	MAN	WHO	PRO	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.84	0.76	0.19	IND	1	0.88	0.65	0.17	3	0	3	0	2	1	1	2
MAN	-	1	0.91	0.23	MAN	-	1	0.74	0.20	2	0	2	0	2	0	2	0
WHO	-	-	1	0.25	WHO	-	-	1	0.26	1	0	1	0	0	1	0	1
PRO	-	-	-	1	PRO	-	-	-	1								

[1] The ratios are read as the industry on the top over the industry on the left. For instance, in Belgium, the first value of 0.90 is the GVA ratio of WHO/IND in 2001. The shortened label for the economic activites are as follows. IND: "Industry (except construction)"; MAN: "Manufacturing"; CON: "Construction"; WHO: "Wholesale and retail trade"; REA: "Real estate"; and PRO: "Professional."

Denmark										2.5%		5%		7.5%		10%	
2001	IND	MAN	WHO	REA	2005	IND	MAN	WHO	REA	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.73	0.97	0.47	IND	1	0.72	1.02	0.48	1	2	1	2	0	3	0	3
MAN	-	1	1.32	0.65	MAN	-	1	1.41	0.66	1	1	1	1	0	2	0	2
WHO	-	-	1	0.49	WHO	-	-	1	0.47	1	0	0	1	0	1	0	1
REA	-	-	-	1	REA	-	-	-	1								
France										2.5%		5%		7.5%		10%	
2001	IND	MAN	WHO	REA	2005	IND	MAN	WHO	REA	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.84	1.03	0.67	IND	1	0.84	1.01	0.67	0	3	0	3	0	3	0	3
MAN	-	1	1.22	0.79	MAN	-	1	1.20	0.79	0	2	0	2	0	2	0	2
WHO	-	-	1	0.65	WHO	-	-	1	0.66	0	1	0	1	0	1	0	1
REA	-	-	-	1	REA	-	-	-	1								
Germany										2.5%		5%		7.5%		10%	
2001	IND	MAN	WHO	REA	2005	IND	MAN	WHO	REA	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.89	0.66	0.45	IND	1	0.89	0.67	0.47	1	2	0	3	0	3	0	3
MAN	-	1	0.74	0.51	MAN	-	1	0.75	0.53	1	1	0	2	0	2	0	2
WHO	-	-	1	0.68	WHO	-	-	1	0.70	1	0	0	1	0	1	0	1
REA	-	-	-	1	REA	-	-	-	1								
Italy										2.5%		5%		7.5%		10%	
2001	IND	MAN	WHO	REA	2005	IND	MAN	WHO	REA	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.89	0.99	0.49	IND	1	0.88	1.00	0.52	1	2	1	2	0	3	0	3
MAN	-	1	1.12	0.56	MAN	-	1	1.13	0.59	1	1	1	1	0	2	0	2
WHO	-	-	1	0.50	WHO	-	-	1	0.52	1	0	0	1	0	1	0	1
REA	-	-	-	1	REA	-	-	-	1								

Latvia										2.5%		5%		7.5%		10%	
2001	IND	MAN	WHO	REA	2005	IND	MAN	WHO	REA	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.79	1.54	0.49	IND	1	0.79	1.94	0.51	2	1	1	2	1	2	1	2
MAN	-	1	1.95	0.62	MAN	-	1	2.44	0.64	2	0	1	1	1	1	1	1
WHO	-	-	1	0.32	WHO	-	-	1	0.26	1	0	1	0	1	0	1	0
REA	-	-	-	1	REA	-	-	-	1								
Netherlands										2.5%		5%		7.5%		10%	
2001	IND	MAN	WHO	PRO	2005	IND	MAN	WHO	PRO	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.76	1.10	0.61	IND	1	0.76	1.14	0.56	2	1	1	2	1	2	0	3
MAN	-	1	1.46	0.80	MAN	-	1	1.50	0.73	2	0	1	1	1	1	0	2
WHO	-	-	1	0.55	WHO	-	-	1	0.49	1	0	1	0	1	0	1	0
PRO	-	-	-	1	PRO	-	-	-	1								
Poland										2.5%		5%		7.5%		10%	
2001	IND	MAN	CON	WHO	2005	IND	MAN	CON	WHO	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.74	0.33	1.12	IND	1	0.80	0.25	1.01	3	0	3	0	3	0	1	2
MAN	-	1	0.44	1.50	MAN	-	1	0.32	1.26	2	0	2	0	2	0	2	0
CON	-	-	1	3.43	CON	-	-	1	3.98	1	0	1	0	1	0	1	0
WHO	-	-	-	1	WHO	-	-	-	1								
Portugal										2.5%		5%		7.5%		10%	
2001	IND	MAN	WHO	REA	2005	IND	MAN	WHO	REA	Change	No change	Change	No change	Change	No change	Change	No change
IND	1	0.84	1.14	0.39	IND	1	0.82	1.17	0.39	1	2	0	3	0	3	0	3
MAN	-	1	1.36	0.46	MAN	-	1	1.42	0.47	1	1	0	2	0	2	0	2
WHO	-	-	1	0.34	WHO	-	-	1	0.33	1	0	0	1	0	1	0	1
REA	-	-	-	1	REA	-	-	-	1								

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