Utjecaj makroekonomskih politika na prerađivačku industriju u Hrvatskoj

Tkalec, Marina; Vizek, Maruška

The Impact of Macroeconomic Policies on Manufacturing Production in Croatia

RESEARCH PAPER

Marina Tkalec*
Maruška Vizek**

Abstract

In this paper, we analyse the impact of macroeconomic policies on manufacturing production in Croatia. We use multiple regressions in order to assess how personal consumption, investments, interest rates, the real effective exchange rate, government consumption, fiscal deficit and foreign demand affect the output of 22 manufacturing sectors. The analysis is conducted on quarterly data from 1998:1q to 2008:3q. The results suggest that changes in fiscal conditions, the real effective exchange rate and personal consumption mostly affect low technological intensity industries. Production in high technological intensity industries is, in general, elastic to changes in investments, foreign demand and fiscal policy. Fiscal policy seems particularly important for manufacturing output, both in terms of the magnitude of fiscal elasticities and shorter time lags. Production in low technological intensity industries on average increases with the exchange rate depreciation, while in high and medium-high technological intensity industries it contracts as a result of depreciation.

Keywords: manufacturing, monetary policy, fiscal policy, regression analysis, Croatia

JEL classification: C22, E63, L16, L60

* *Marina Tkalec, Research Assistant, The Institute of Economics, Zagreb, e-mail: mtkalec@eizg.hr.*

** *Maruška Vizek, Research Associate, The Institute of Economics, Zagreb, e-mail: mvizek@eizg.hr.*

1 Introduction

Manufacturing is one of the most important sectors of every economy. In terms of size, the share of manufacturing in total value added in 2007 in EU-27 economies and in Croatia amounted to 17.1 and 15.1 percent respectively,[1] which suggests that manufacturing accounts for a significant portion of overall economic activity. Manufacturing is also the most important tradable sector of the economy, which in turn means that it is often the most competitive sector. The significance of manufacturing also stems from the fact that it is the carrier of innovation, research and development activities that eventually spill over to other sectors and result in an increased productivity.

Besides industry specific factors and industrial policy, macroeconomic conditions are the most influential drivers of manufacturing growth (European Commission, 2009a). The term "macroeconomic conditions" usually assumes domestic business cycle fluctuations, foreign demand, interest and exchange rates, taxes, government expenditure and relative prices. The empirical literature on the relationship between manufacturing and macroeconomic policies is very scarce, especially when looking at particular manufacturing industries. Moreover, there has been no empirical research on the effects of macroeconomic conditions on manufacturing output in Croatia. This is somewhat surprising given the fact that monetary policy (and the exchange rate in particular) is often considered to be the main reason for the weak performance of manufacturing.

The aim of this paper is to determine which macroeconomic factors drive output in the Croatian manufacturing. In order to detect the most important determinants, we take two approaches. First, we model the changes in 22 manufacturing industries as a function of changes in macroeconomic conditions. Then we aggregate manufacturing output in order to obtain the output of four groups of manufacturing industries classified according to their global technological intensity. This enables us to detect whether the responses to changes in macroeconomic conditions are related to

[1] *Eurostat, http://ec.europa.eu/eurostat/.*

technologies used by those industries. Besides filling the gap in the empirical literature on the macroeconomic determinants of manufacturing growth, we also want to address two specific questions that often arise, both in public and academic debates in Croatia. The first question relates to the influence of exchange rate changes on manufacturing output, i.e. we want to know whether the exchange rate depreciation can boost manufacturing output, as is often claimed. The second question addresses the effect of fiscal policy on manufacturing output. Namely, we suspect that excessive government spending might crowd out manufacturing production and that in some manufacturing industries government spending might actually boost output and demotivate these industries from finding other domestic or foreign markets.

The next section of the paper gives an overview of developments in the Croatian manufacturing. In the third section, we review the literature on the macroeconomic determinants of industrial growth. The fourth section presents the econometric analysis. It encompasses a brief description of variables and the modelling strategy and discusses the results of the econometric exercise. The remaining section summarises main findings and discusses policy implications.

2 Manufacturing Sector in Croatia

Structural changes in manufacturing industries in Croatia are best observed if one compares the Croatian manufacturing to that of the European Union. In order to understand the importance of each industry, we calculated the shares of manufacturing industries in total manufacturing gross value added in Croatia and EU-25 for years 1997 and 2007.[2] Moreover, we divided those industries according to their global technological intensity, which enabled us to obtain shares in the total value added of industries

[2] We must keep in mind that the manufacturing of the largest European economies (namely, Germany, France, Italy and Great Britain) has the largest share in the EU-25 manufacturing production, which in turn means that the data for EU-25 actually reflect changes in the manufacturing structure of these countries.

characterised by high and medium-high, medium-low and low level of technological intensity.

This kind of classification provides important insights into the structure of manufacturing regarding the application of technology and knowledge.[3] Finally, we calculated changes in industry shares in total value added that had occurred from 1997 to 2007 in order to grasp the sectoral dynamics and trends in the use of the technology. The results are presented in Table 1.

Table 1 shows that the structure of the Croatian manufacturing is a reversed image of the European manufacturing. While the industries that intensively use technology account for the largest portion of value added in the EU, the largest share of value added in Croatia relates to low technological intensity industries. For example, Croatian industries characterised by high and medium-high technological intensity in 2007 produced 23.7 percent of manufacturing total value added, while in EU-25 those industries produced 44.9 percent of value added. Moreover, the value added of high and medium-high technological intensity industries for Croatia is overestimated because industry D35 (production of other transport equipment) consists mostly of shipbuilding (D35.1), which is classified as a medium-low technological intensity industry, as opposed to EU-25 where D35 mostly encompasses production requiring high and medium-high level of technology (namely aerospace and train production). Unlike in EU-25, the industries characterised by a low level of technological intensity dominate the entire manufacturing sector in Croatia. In 2007, the share of those industries in value added reached 54.7 percent, while in EU-25 it stood at 30 percent. In 2007, the share of industries requiring a medium-low technological intensity in EU-25 and Croatia was similar, 25.1 and 21.6 percent respectively.

[3] *One must note that although the European Commission uses the same classification (European Commission, 2007) as in Table 1, it differs somewhat from the OECD classification of industries according to global technological intensity. Namely, the OECD classification requires a lower level of data aggregation, which is not provided by Eurostat or the Central Bureau of Statistics of the Republic of Croatia. For details on the OECD classification, see Appendix.*

Table 1 **Gross Value Added of Manufacturing Industries**

Level of technological intensity	Sector		EU-25			CROATIA		
			Share in TVA 1997 (in %)	Share in TVA 2007 (in %)	Change 1997-2007 (in p.p)	Share in TVA 1997 (in %)	Share in TVA 2007 (in %)	Change 1997-2007 (in p.p)
High and medium-high	D24	Production of chemicals and chemical products	10. 3	10. 5	0. 1	10. 1	6. 0	-4.2
	D29	Production of machinery and equipment	10. 7	11. 4	0. 7	3. 4	4. 7	1. 3
	D30, D31, D32,D33	Production of electrical and optical products	12. 0	12. 1	0. 2	8. 5	7. 7	-0.8
	D34, D35	Production of transport vehicles	9. 9	11. 0	1. 0	6. 5	5. 3	-1.2
		High and medium-high level of technological intensity	**42. 9**	**44. 9**	**2.0**	**28. 5**	**23. 7**	**-4.8**
Medium-low	D23	Production of coke and refined petroleum products	1. 6	2. 2	0. 5	3. 8	1. 1	-2.8
	D25	Production of rubber and plastic products	4. 7	4. 5	-0.2	3. 2	2. 7	-0.5
	D26	Production of other non-metallic mineral products	4. 7	4. 5	-0.2	5. 2	7. 6	2. 5
	D27, D28	Production of basic metals and fabricated metal products	13. 3	14. 0	0. 7	7. 0	10. 2	3. 3
		Medium-low level of technological intensity	**24. 3**	**25. 1**	**0. 8**	**19. 2**	**21. 6**	**2. 4**
Low	D15, D16	Production of food and tobacco	11. 7	11. 8	0. 1	25. 5	26. 2	0. 7
	D17, D18	Production of textiles and clothing	4. 8	3. 3	-1.5	7. 4	4. 9	-2.5
	D19	Production of leather products	1. 0	0. 7	-0.3	1. 6	1. 5	-0.1
	D20	Production of wood, wood products and cork	2. 3	2. 1	-0.2	2. 2	3. 4	1. 2
	D21, D22	Production of paper and paper products, publishing	9. 0	8. 2	-0.8	10. 7	15. 0	4. 3
	D36,D37	Production of furniture, other manufacturing	4. 0	3. 9	-0.1	4. 9	3. 7	-1.2
		Low level of technological intensity	**32. 8**	**30. 0**	**-2.8**	**52. 3**	**54. 7**	**2. 4**

Source for original data: Eurostat and Central Bureau of Statistics of the Republic of Croatia.

Changes in value added shares from 1997 to 2007 also suggest that the structure of the Croatian manufacturing industry is rapidly deteriorating. The deterioration is even more worrisome if one takes into account that the European manufacturing is actually losing pace with other developed economies, notably the USA and Japan (European Commission, 2007). Namely, industries requiring a high technological intensity are on average growing twice as fast in the USA and Japan than in EU-25.

Compared to 1997, industries of high and medium-high technological intensity in Croatia decreased their share in value added by 4.8 percentage points in 2007. At the same time, those industries in EU-25 increased its share in value added by 2.0 percentage points. When one observes the industries characterised by low technological intensity, the opposite is true. Croatian industries increased their share by 2.4 percentage points in ten years, while the share of low technological intensity industries in European countries declined by 2.8 percentage points.

When analysing particular industries of high and medium-high technological intensity, one notices that in EU-25 all industries have increased their share in manufacturing value added. However, in the case of Croatia that has occurred only in the case of D29 (production of machinery and equipment). One reason for the success is the fact that this industry consists of a significant number of foreign-owned enterprises that engage intensively in exports. All other industries requiring a high and medium-high technological intensity decreased their share, with D24 (production of chemicals and chemical products) being the most notable example.[4] Industries that have increased their share in value added in Croatia are concentrated in a low and medium-low technological section. The most propulsive industries have been D21-D22 (production of paper, paper products and publishing) and D27-D28 (production of metal and fabricated metal products).

This analysis suggests that the Croatian manufacturing is lagging behind global trends. Therefore, in this paper we will assess whether macroeconomic

[4] *Unfavourable developments in this industry are mostly due to bad performance of the largest companies within the industry; namely Pliva, Petrokemija and Dioki.*

policies have contributed to such adverse developments. Moreover, we will explore whether macroeconomic policies can be used in order to boost activity in the manufacturing sector and increase its competitiveness. We put a special emphasis on the impact of the exchange rate on industrial activity because exchange rate developments are often held responsible for manufacturing sector deficiencies. However, this paper does not explore the effects of microeconomic policies (such as industrial policy or policies directed to research, development and innovation) on manufacturing output.[5]

3 Literature Review

Since macroeconomic policies are important determinants of economic growth, economists have become interested in studying the relationship between output and macroeconomic policies. In order to detect what drives output growth, researchers have tested how different macroeconomic policy proxies, such as interest rates, fiscal deficits, investment and exchange rates, affect output. One must note that the majority of empirical research is focused on the macroeconomic determinants of overall output and not on manufacturing output in particular. However, since the manufacturing represents a significant portion of economic activity and the growth of manufacturing output is closely correlated to overall output growth, results of the empirical research on the macroeconomic determinants of overall output can also be applied on manufacturing output.

Kormendi and Meguire (1985) examine which macroeconomic variables are related to economic growth, using observations for forty-seven countries over forty-year period. They find a negative correlation between economic growth and money supply. On the other hand, investment-to-income ratio exhibits positive correlation with output. Using a cross-country analysis, Levine and Renelt (1992) confirm that investments greatly affect output growth. As for fiscal indicators, they find no correlation with output growth. Fischer (1993) applies cross-sectional and panel regressions trying to prove

[5] *For example, Aralica (2007) addresses these issues.*

that inflation, large budget deficits and distorted foreign exchange markets hamper output growth. The results imply that inflation reduces growth by reducing investment; larger budget surpluses are associated with faster economic growth; undistorted foreign exchange market is convenient for growth. Bruce and Turnovsky (1999) design a simple endogenous growth model using fiscal indicators like tax rates and government consumption. They conclude that a reduction in government involvement on the market (by cutting taxes or lowering consumption) boosts output growth. Adam and Bevan (2001) take a step further and construct an overlapping generation model using a panel of 45 developing countries over the period 1970-1999. By examining the relation between fiscal deficits and growth, they find a specific budget deficit threshold of 1.5 percent of GDP. Their recommendation for conducting fiscal policy is thus to reduce deficits to this level in order to exhaust a potential growth pay-off.

Instead of constructing growth models for output and macroeconomic variables, we can look at the effect of the same macroeconomic variables on manufacturing output. We can construct a model for each specific industrial sector in order to analyse manufacturing production on a more disaggregated level. European Commission (2009a; 2009b) conducted such an analysis for twenty-five EU countries. In that study, fluctuations in GDP and employment, interest rates, exchange rates, government spending, corporate tax rates, the change in relative prices, consumption, investment, exports, imports and intermediate demand are used to construct a model for each industrial sector. The findings imply that real interest rates have a robust negative correlation with manufacturing output growth.[6] Exchange rate fluctuations are important only for exporting sectors, with appreciation having a dampening effect on output. As for the demand side variables, exports and intermediate demand are the two most important manufacturing output drivers, while imports and government expenditure have very little impact on growth in manufacturing. The results for New Member States are somewhat different when it comes to the effect of fiscal

[6] *The study explores all sectors (not just the manufacturing), but we only present the results for manufacturing.*

policy on output. Namely, fiscal deficits reduce output growth in a number of industries.

In Croatia, empirical literature does not offer such detailed evidence on the interrelation between manufacturing production and macroeconomic conditions. Nevertheless, in a more aggregate setting, Erjavec, Cota and Bahovec (1999) analyse the impact of monetary-credit aggregates on the real sector applying vector autoregression. Instead of GDP (available only on a quarterly basis), they use aggregated industrial output as a proxy for real economic activity. The VAR incorporates the following variables: money supply, consumer prices, domestic credit and unemployment. Their findings show that money supply does not affect industrial output, while the domestic credit effect fades after one year. Vizek (2006) analyses monetary transmission in Croatia using the Granger causality test and error correction model and concludes that monetary policy affects industrial output through changes in the exchange rate and money supply, while interest rate changes do not have any influence.

4 Empirical Analysis

In order to assess how macroeconomic conditions affect the activity of the manufacturing sector, we use a multiple regression approach. We estimate separate multivariate models for each manufacturing industry applying ordinary least squares. Manufacturing activity is proxied by the industrial production index. We use individual indices representing all manufacturing industries, except D37 (recycling). Altogether, we estimate 22 regressions, with the industrial production index for 22 industries ranging from D15 (production of food and beverage) to D36 (production of furniture, other manufacturing) as dependant variables. As explanatory variables we use proxies for domestic demand (personal consumption and investments), foreign demand (GDP of five countries to which Croatia exports most of its products), monetary policy (real short- and long-term rates), fiscal policy (deficit and government consumption) and the real effective exchange rate. At the initial stage of empirical analysis, we also incorporated relative prices for individual manufacturing industries as an explanatory variable. However, this variable did not appear significant, so it was excluded from the estimation.

We expect to find that an expansive monetary policy increases manufacturing output, while an expansive fiscal policy decreases it. Moreover, a pick-up in domestic and foreign demand should boost output. Regarding the exchange rate, both outcomes are possible. Namely, one should expect that the real effective exchange rate depreciation should increase output, especially in exporting industries. But given the fact that Croatia is a highly euroised economy, with manufacturing enterprises borrowing with a foreign currency clause and having a large import component in manufacturing goods, exchange rate depreciation may also have a contractionary effect on manufacturing output.

Data used in the analysis range from the first quarter 1998 to the third quarter 2008, providing altogether 43 observations. We could not include the latest data for two reasons. Firstly, the methodology for calculating GDP and its components was revised in the last quarter 2008 in order to include the shadow economy. Since the new GDP series includes only observations starting from the year 2000, we use the old series with data available from 1997. Secondly, at the beginning of 2009 the Central Bureau of Statistics changed the classification of manufacturing industries to NACE Revision 2, but it did not publish individual manufacturing industry series for the period prior to 2009. For this reason, we use the series applying the old NACE Revision 1.1 classification, for which data are available from 1992 to the end of 2008. Interest rates, personal consumption, investments, government consumption and the fiscal deficit are expressed in first differences, while the other series (real effective exchange rate, manufacturing production and the GDP of top five export partners) are in log-differences. Instead of prior seasonal adjustment, seasonal dummies are used in the regression analysis to control for seasonal oscillations.

As far as our modelling strategy is concerned, we apply a general-to-specific approach. At the beginning, we estimate a general unrestricted model, in which we regress the production volume index of a given manufacturing industry on five lags of variables representing domestic demand, long-run interest rate, real effective exchange rate, fiscal deficit and foreign demand variables.[7] A more detailed description of the variables can be found in Appendix. The next step is to eliminate statistically insignificant variables from the model, which leads to the derivation of the final model. If the final model does not incorporate the long-run interest rate, we reestimate the final model by adding five lags of the short-run interest rate in order to verify whether another proxy for monetary policy is relevant for manufacturing activity. Furthermore, if the final model does not include the fiscal deficit, we reestimate the final model by adding five lags of government spending. We could not include both variables in our general unrestricted model due to a lack of observations.

The summary of results (i.e. statistically significant coefficients) is given in Table 2. Detailed results for all 22 regressions can be found in Appendix. Before turning to the discussion of the results, we must note that most of the models satisfied all diagnostic tests, including tests for stability. Some models, however, had either heteroscedastic or autocorrelated residuals, which in turn led to the application of White's or Newey-West's corrections in order to account for the potential problems with the variance of OLS estimator.

Most of the coefficients displayed in Table 2 have the expected sign. Namely, both short-run and long-run interest rates have negative coefficients, suggesting that an increase in interest rates caused by a more restrictive monetary policy leads to the contraction of manufacturing output. Interest rate elasticities range from -0.33 in the case of D17 (production of textile) to -1.65 in the case of D29 (production of machinery). Furthermore, the results indicate that manufacturing production is more elastic to long-run rates. They also suggest that it takes at least two quarters for the changes in interest rates to transmit to manufacturing production.[8] However, in most cases the monetary policy lags are even longer (from 3 to 5 quarters).

[7] *We must note that we did not use both proxies for personal demand (personal consumption and investments) in the same equation. Instead, we used the data on the structure of domestic demand for the products from manufacturing industries from 2004 (Lovrinčević, 2009) in order to determine which of the two domestic components is more dominant in particular industries. The one that dominates is used as a proxy for domestic demand in a given regression.*

[8] *Please refer to Table A4 in Appendix.*

As far as fiscal policy is concerned, the regression results suggest that fiscal policy proxied either by the changes in government spending or the fiscal deficit is crowding out manufacturing industries. That is in line with European Commission (2009b), which found that an expansionary fiscal policy in ten New Member States reduces manufacturing output. However, we must note that, when fiscal policy is proxied by government consumption, crowding out is more prevalent in industries requiring low and medium-low technological intensity like D16 (production of tobacco), D17 (production of textiles), D18 (production of clothes), D19 (production of leather and footwear), D20 (production of wood), D21 (production of paper) and D25 (production of rubber and plastic products). Overall, the magnitude of government consumption elasticities is rather large (ranging from -0.59 in the case of D20 to -2.94 in the case of D16). In other three industries (D24 - production of chemicals, D31 - production of electrical machinery and apparatus, D32 - production of radio, television and communication equipment and apparatus), the government consumption coefficient is positive, implying that government consumption actually boosts output. When compared to government spending, fiscal deficit elasticities are relatively low in the absolute term, but in most cases they also suggest that fiscal policy expansion leads to manufacturing output contraction. The results also indicate that fiscal policy lags are on average somewhat shorter than monetary policy lags. In most cases, fiscal policy changes affect manufacturing output in two quarters.[9]

The impact of personal consumption on manufacturing output is almost entirely limited to industries characterised by low technological efficiency. This should not come as a surprise given the fact that these industries make products for final consumption. An increase in personal consumption leads to the expansion of output in D15 (food production), D18 (production of clothes), D20 (production of wood) and D22 (publishing). These coefficients are quite similar across industries and range from 0.22 in D20 to 0.67 in D15. Personal consumption also influences output in D25 (production of rubber and plastic products), which is an industry requiring a medium low technological intensity. On the other hand, investments explain the

[9] *Please refer to Table A4 in Appendix.*

manufacturing output dynamics in industries such as D26 (production of other non-metallic mineral products), D27 (production of basic metals), D32 (production of radio, television and communication equipment and apparatus), D33 (production of medical, precision and optical instruments) and D35 (production of other transport equipment). In this case, coefficients vary significantly across sectors and range from 0.38 in the case of D35 to 3.14 in the case of D32.

The regression results related to foreign demand suggest that sectors with more intensive export activities are generally affected by changes in foreign demand. However, one must notice that these coefficients are relatively small for all sectors except D30 (production of office machinery and computers), where the foreign demand elasticity amounts to 1.24. In other sectors, it varies from 0.23 in the case of D28 (production of fabricated metal products) to 0.46 in the case of D18 (production of clothes). In general, it takes four or even five quarters for manufacturing output to react to changes in foreign demand.[10]

The most interesting result of our econometric analysis relates to exchange rate elasticities. At first glance, one can notice that the magnitudes of those elasticities are quite large. Moreover, in terms of the magnitudes, exchange rate elasticities can only be compared to government spending elasticities. Further, the sign of elasticities varies across industries. In industries characterised by low and medium technological intensity like D16 (production of tobacco), D17 (production of textiles), D18 (production of clothes), D19 (production of leather and footwear), D20 (production of wood), D26 (production of other non-metallic mineral products) and D36 (production of furniture), the real effective exchange rate depreciation boosts output. The opposite is true for industries requiring a high or medium-high level of technological intensity like D29 (production of machinery), D31 (production of electrical machinery and apparatus) and D33 (production of medical, precision and optical instruments), where depreciation leads to manufacturing output contraction.

[10] *Please refer to Table A4 in Appendix.*

Table 2 **Elasticities of Production in Manufacturing Industries**

	Domestic demand		Monetary policy		Exchange rate#	Fiscal policy		Foreign demand
	Personal consumption (% of GDP)	Investments (% of GDP)	Real short-run interest rate (in %)	Real long-run interest rate (in %)	Real effective exchange rate	Government consumption (% of GDP)	Fiscal deficit (% of GDP)	GDP of top five export partners
D15	0.675* -	-	-	-0.767*	-	-	-	-
D16	0.507*	-	-	-	3.025**	-2.349** -2.940**	-	-
D17	-	-	-0.33**	-	1.348*	-1.069*	-	-
D18	0.606*	-	-	-	2.091*	-1.890*	-	0.462*
D19	-	-	-	-1.317*	2.147*	-0.887*	-	-
D20	0.217*	-	-0.636*	-	2.650*	-0.591*	-	-
D21	-	-	-	-	-	-0.933*	-	-
D22	0.542** 0.475*	-	-	-1.543*	-	-	0.209*	-
D23	-	-	-	-	-	-	0.383**	-
D24	-	-	-	-	-	3.115*	-	-
D25	0.241*	-	-	-	-	-1.812*	-	0.257*
D26	-	0.906*	-	-0.79**	1.571*	-	-0.21*	-
D27	-	0.702*	-	-	-1.931**	-	-	-
D28	-	-	-	-	-	-	0.193**	0.226*
D29	-	-	-	-1.652*	-3.393*	-2.061*	-	-
D30	-	-	-	-	-	-	-	1.239*
D31	-	-	-0.497**	-	-2.871*	2.279*	-	0.366*
D32	-	3.138**	-	-	-	5.266*	-	-
D33	-	1.810*	-1.477*	-	-4.00**	-	-0.571*	-
D34	-	-	-	-	2.705**	-	-	0.244**
D35	-	0.385**	-	-	-	-	-	0.313*
D36	-	-	-	-	1.688*	-	-	-

*Notes: # - an increase signifies depreciation; * p-value less than 0.05; ** p-value less than 0.1.*
Please note that numbers represent elasticities and not coefficients. To calculate coefficients for variables expressed as percentages, divide elasticities by 100 or see Appendix.
Source: Authors' calculation.

Since the results displayed in Table 2 suggest that industries of the same level of technological intensity react to macroeconomic conditions in a similar fashion, we aggregated the industrial production indices in order to obtain output produced in industries requiring low, medium-low, medium-high and high level of technological intensity.[11] Then we used the same modelling approach as in the first part of the analysis in order to detect how manufacturing production at different levels of technological intensity reacts to changes in macroeconomic conditions. The results of the exercise are presented in Table 3.

Table 3 clearly shows that in all four industry groups output reacts to changes in government spending. Government spending decreases output in industries characterised by low, medium-low and high level of technological intensity. The opposite is true in medium-high technological intensity industries, where an increase in public spending boosts production. Two out of four industry groups also react to changes in the exchange rate. Industries of a low technological level increase production after depreciation, while medium-high industries reduce production. Only high technological intensity industries seem elastic to changes in foreign demand. As far as domestic demand is concerned, low technological intensity industries are somewhat elastic to changes in personal consumption, while high technological intensity industries strongly react to changes in investments.

[11] *We must note that due to the fact that data on industrial production are not sufficiently disaggregated, we had to adjust the OECD classification of industries according to the level of technological intensity. Details are explained in Table A2 in Appendix.*

Table 3 **Elasticities of Production in Industries Aggregated According to the Level of Technological Intensity**

Technological intensity of manufacturing industries	Domestic demand		Monetary policy		Exchange rate#	Fiscal policy		Foreign demand
	Personal consumption (% of GDP)	Investments (% of GDP)	Real short-run interest rate (in %)	Real long-run interest rate (in %)	Real effective exchange rate	Government consumption (% of GDP)	Fiscal deficit (% of GDP)	GDP of top five export partners
Low	0.273*	-	-	-	0.871**	-1.208*	-	-
Medium-low	-	-	-	-0.659*	-	-0.422*	-	-
Medium-high	-	-	-	-	-4.318*	1.550**	-	-
High	-	1.652**	-	-	-	-1.613**	-	0.436**

*Notes: # - an increase signifies depreciation; * p-value less than 0.05; ** p-value less than 0.1.*
Please note that numbers represent elasticities and not coefficients. To calculate coefficients for variables expressed in percentages, divide elasticities by 100 or see Appendix.
Source: Authors' calculations..

5 Concluding Remarks

The aim of this paper was to explore how macroeconomic conditions affect production in manufacturing industries. By macroeconomic conditions we assume monetary and fiscal policy as well as domestic and foreign demand. Due to the fact that public attention is focused on the potential effects of the exchange rate depreciation on industrial production and exports, we also included the real effective exchange rate into the analysis.

The results of the empirical analysis suggest that manufacturing industries in general react most to changes in fiscal policy, proxied by government spending and the fiscal deficit. Besides the fact that the magnitude of fiscal policy elasticities is quite large, an increase in government spending crowds out manufacturing output in the majority of industries. Such a result should not come as a surprise considering the fact that the crowding out effect is also present in New Member States (European Commission, 2009b). The policy recommendation regarding fiscal policy is therefore straightforward: in order to increase manufacturing output, governments should in general spend less and restructure spending in such a way to promote manufacturing growth.

In comparison to fiscal policy, monetary policy seems to be less important in terms of interest rate changes and domestic demand for explaining changes in manufacturing changes. Namely, only few industries react to changes in interest rates and domestic demand when compared to fiscal policy. When they do react, the magnitude of reaction (i.e. elasticities) is smaller and lags are longer.

The reaction of manufacturing output to changes in the real effective exchange rate is not uniform across industries and depends considerably on their level of technological intensity. In industries characterised by low and medium technological intensity, the depreciation of the real exchange rate in general boosts output. The opposite is true for industries requiring a medium-high level of technological intensity, where depreciation leads to manufacturing output contraction. In terms of magnitude, exchange rate elasticities can only be compared to government spending elasticities, which indicates that fiscal policy and exchange rate developments are probably two most important factors driving output in manufacturing sector.

If the aim of policy-makers is to boost manufacturing output in Croatia, from the macroeconomic perspective it would be more advisable to reduce the role of the Government than to use the exchange rate. Namely, since the nominal exchange rate is relatively fixed due to a large exchange rate risk inherent to the Croatian economy and because different manufacturing industries react differently to the real effective exchange rate developments, the exchange rate policy would probably not be an effective tool for boosting manufacturing output. However, any macroeconomic policy or even a mix of macroeconomic policies will most likely not be enough to tackle issues related to manufacturing production. Instead, if one wants to permanently increase manufacturing output and enhance the industrial structure in order to increase the value added of industries characterised by high and medium-high technological intensity, a shift in fiscal policy must be accomponied by other measures. Namely, various horizontal measures removing entry and exit barriers and promoting innovation, transfer of technologies, foreign direct investments and competition in the manufacturing sector should go along with a different strategy for subsidy allocation and changes in educational system, agricultural and energy policy.

Appendix

Table A1	**Data Sources and Description**
D15	Production of food products and beverages; source: CBS.
D16	Production of tobacco products; source: CBS.
D17	Production of textiles; source: CBS.
D18	Production of wearing apparel; dressing and dyeing of fur; source: CBS.
D19	Production of tanning and dressing of leather, manufacture of luggage, handbags, saddlery, harness and footwear; source: CBS.
D20	Production of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; source: CBS.
D21	Production of pulp, paper and paper products; source: CBS.
D22	Production of publishing, printing and reproduction of recorded media; source: CBS.
D23	Production of coke, refined petroleum products and nuclear fuel; source: CBS.
D24	Production of chemicals and chemical products; source: CBS.
D25	Production of rubber and plastic products; source: CBS.
D26	Production of other non-metallic mineral products; source: CBS.
D27	Production of basic metals; source: CBS.
D28	Production of fabricated metal products, except machinery and equipment; source: CBS.
D29	Production of machinery and equipment n.e.c.; source: CBS.
D30	Production of office machinery and computers; source: CBS.
D31	Production of electrical machinery and apparatus n.e.c.; source: CBS.
D32	Production of radio, television and communication equipment and apparatus; source: CBS.
D33	Production of medical, precision and optical instruments, watches and clocks; source: CBS.
D34	Production of motor vehicles, trailers and semi-trailers; source: CBS.
D35	Production of other transport equipment; source: CBS.
D36	Production of furniture; manufacturing n.e.c.; source: CBS.
pc	Personal consumption, in constant 1997 prices - as a share of GDP; source for original data: CBS.
i	Investment, in constant 1997 prices - as a share of GDP; source for original data: CBS.
ir _ sr	Real money market interest rates on overnight credits: real interest rates are calculated by subtracting monthly year-on-year consumer inflation from the short-term interest rates; source for original data: CNB and CBS.
ir _ lr	Real interest rates on kuna long-term credits indexed to foreign currency and granted to enterprises: real interest rates are calculated by subtracting monthly year-on-year consumer inflation from the long-term interest rates; source for original data: CNB and CBS.
reer	Real effective exchange rate; source for original data: CNB, CBS and the OECD Main Economic Indicators database.
g	Government consumption – in constant (1997) prices - as a share of GDP; source for original data: CBS.
def	Budget deficit – consolidated general government deficit as a share of GDP; source: Ministry of Finance of the Republic of Croatia and CBS.
gdpf	Weighted average of GDP, (chain linked, reference year 2000) of Croatia's main export partners expressed in EUR: Germany, Italy, Slovenia, USA and Austria (Bosnia and Herzegovina and Serbia are excluded due to the lack of data). Weights are determined on the basis of destination structure of Croatian merchandise exports for each year. The composite GDP is expressed in EUR; source for original data: CBS, Eurostat and the IMF International Financial Statistics.
l	Production of manufacturing goods requiring low technological intensity. Weighted average of D15, D16, D17, D19, D20, D21, D22 and D36. Weights determined according to the share of a respective industry in manufacturing value added; source for original data: CBS.
ml	Production of manufacturing goods requiring a medium-low technological intensity. Weighted average of D23, D25, D26, D27, D28 and D35. Weights determined according to the share of a respective industry in manufacturing value added; source for original data: CBS.

mh	Production of manufacturing goods requiring a medium-high technological intensity. Weighted average of D29, D31 and D34. Weights determined according to the share of a respective industry in manufacturing value added; source for original data: CBS.
h	Production of manufacturing goods requiring a high technological intensity. Weighted average of D24, D30, D32 and D33. Weights determined according to the share of a respective industry in manufacturing value added; source for original data: CBS.
Dummies	Dummies are used in order to capture seasonal effects.

Data sources: CBS – http://www.dzs.hr; CNB – http://www.hnb.hr; Eurostat – http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/; IMF - http://www.imfstatistics.org/imf/; Ministry of Finance of the Republic of Croatia – http://www.mfin.hr; OECD – http://stats.oecd.org/mei/.
Note: CBS – Central Bureau of Statistics of the Republic of Croatia; CNB – Croatian National Bank.

Table A2 **Manufacturing Industries Classfied According to Their Global Technological Intensity (NACE Revision 1.1)**

	OECD classification	Modified classification
D15	LTI	LTI
D16	LTI	LTI
D17	LTI	LTI
D18	LTI	LTI
D19	LTI	LTI
D20	LTI	LTI
D21	LTI	LTI
D22	LTI	LTI
D23	MLTI	MLTI
D24*	24.4 (pharmaceuticals) - HTI the rest - MHTI	HTI
D25	MLTI	MLTI
D26	MLTI	MLTI
D27	MLTI	MLTI
D28	MLTI	MLTI
D29	MHTI	MHTI
D30	HTI	HTI
D31	MHTI	MHTI
D32	HTI	HTI
D33	HTI	HTI
D34	MHTI	MHTI
D35**	35.1 (shipbuilding) – MLTI 35.3 (aerospace) – HTI the rest - MHTI	MLTI
D36***	36.1 (furniture) – LTI the rest - MLTI	LTI

*Note: HTI – high technological intensity, MHTI – medium-high technological intensity, MLTI – medium-low technological intensity, LTI – low-technological intensity; * In 2007 pharmaceutical companies had in Croatia the highest share in total revenues of D24, hence we have classified D24 as HTI industry; ** In 2007 shipbuilding companies in Croatia had the highest share in total revenues of D35, hence we classified D35 as MLI industry; *** In 2007 companies producing furniture in Croatia had the highest share in total revenues of D36, hence we classified D36 as LTI industry.*
Source: Eurostat, http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/reg_hrst_base_an3.pdf.

Table A3 **Regression Results**

Table A3.1 **D15 Production of Food Products and Beverages**

Δ Contribution	Coefficient	Standard error	t-value	p-value
Constant	0.00808	0.00580	1.393	0.1736
pc _ 2	0.00675***	0.00044	15.486	0.0000
pc _ 5	0.00263***	0.00060	4.409	0.0001
ir _ lr _ 3	-0.00767***	0.00269	-2.854	0.0076
S _ dummy1	-0.05476***	0.01554	-3.524	0.0013
S _ dummy3	0.03608***	0.00746	4.837	0.0000
Adjusted R-squared = 0.95758		F-statistic = 137.6926***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 7.3472 [0.4997]		
LL = 162.82464		Portmanteau(6): Chi^2(5) = 0.4583 [0.7655]		
sigma = 0.01340		Jarque-Bera test = 3.1054 [0.2117]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.2 **D16 Production of Tobacco Products**

Δ Contribution	Coefficient	Standard error	t-value	p-value
Constant	0.056350***	0.018817	2.994553	0.0055
pc _ 5	0.005073**	0.001935	2.621928	0.0136
reer _ 5	3.025327*	1.594363	1.897514	0.0674
g _ 1	-0.023492*	0.012153	-1.932995	0.0627
g _ 5	-0.029404*	0.016635	-1.767656	0.0873
S _ dummy2	-0.121143***	0.038050	-3.183749	0.0034
S _ dummy3	-0.136310***	0.041553	-3.280411	0.0026
Adjusted R-squared = 0.179298		F-statistic = 2.310818***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 21.0957 [0.0490]		
LL = 68.95192		Portmanteau(6): Chi^2(5) = 0.5849 [0.6770]		
sigma = 0.041684		Jarque-Bera test = 1.3297 [0.5143]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance. Due to heteroscedasticity, White's correction has been applied.*

Table A3.3 **D17 Production of Textiles**

Δ Contribution	Coefficient	Standard error	t-value	p-value
Constant	0.020578***	0.002710	7.594513	0.0000
ir _ sr _ 5	-0.003298*	0.001806	-1.826194	0.0772
reer _ 5	1.347809**	0.533556	2.526089	0.0167
g _ 5	-0.010688***	0.002773	-3.854970	0.0005
S _ dummy2	-0.090771***	0.010156	-8.937913	0.0000
Adjusted R-squared = 0.754613		F-statistic = 28.67678***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 1.1671 [0.9917]		
LL = 92.74082		Portmanteau(6): Chi^2(5) = 3.7762 [0.0141]		
sigma = 0.021219		Jarque-Bera test = 1.8841 [0.3898]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance. Due to autocorrelation, Newey-West's correction has been applied.*

Table A3.4 **D18 Production of Wearing Apparel; Dressing and Dyeing of Fur**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	-0.06316***	0.01187	-5.322	0.0000
pc _ 4	0.00606***	0.00139	4.344	0.0001
reer _ 2	2.09063**	0.88929	2.351	0.0255
g _ 1	-0.01890**	0.00768	-2.463	0.0197
gdpf _ 4	0.46202***	0.16207	2.851	0.0078
S _ dummy1	0.14420***	0.03015	4.783	0.0000
S _ dummy3	0.05447**	0.02284	2.385	0.0236
Adjusted R-squared = 0.52611		F-statistic = 3.880594***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 13.6226 [0.1909]		
LL = 134.41342		Portmanteau(6): Chi^2(5) = 0.0613 [0.9926]		
sigma = 0.02937		Jarque-Bera test = 0.5628 [0.7547]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.5 **D19 Production of Tanning and Dressing of Leather, Manufacture of Luggage, Handbags, Saddlery, Harness and Footwear**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.02245***	0.00594	3.780	0.0006
ir _ lr _ 2	-0.01317**	0.00614	-2.144	0.0397
reer _ 2	2.14742**	0.84093	2.554	0.0156
g _ 3	-0.00887***	0.00304	-2.914	0.0065
S _ dummy2	-0.07901***	0.01361	-5.804	0.0000
Adjusted R-squared = 0.49147		F-statistic = 9.303752***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 5.1748 [0.6386]		
LL = 134.21014		Portmanteau(6): Chi^2(5) = 0.4247 [0.7895]		
sigma = 0.02859		Jarque-Bera test = 3.8070 [0.1490]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.6 **D20 Production of Wood and of Products of Wood and Cork, Except Furniture; Manufacture of Articles of Straw and Plaiting Materials**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.023069***	0.005221	4.418823	0.0001
pc _ 4	0.002174***	0.000605	3.591190	0.0011
ir _ sr _ 1	-0.006359***	0.001750	-3.634263	0.0010
reer _ 2	2.649806***	0.826844	3.204721	0.0031
g _ 2	-0.005907***	0.002023	-2.919125	0.0065
S _ dummy2	-0.068275***	0.010029	-6.807763	0.0000
Adjusted R-squared = 0.792027		F-statistic = 28.41988***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 17.4193 [0.0425]		
LL = 91.71268		Portmanteau(6): Chi^2(5) = 1.8677 [0.1451]		
sigma = 0.022166		Jarque-Bera test = 1.4675 [0.4801]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance. Due to heteroscedasticity, White's correction has been applied.*

Table A3.7 **D21 Production of Pulp, Paper and Paper Products**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.010273*	0.006119	1.678914	0.1023
g _ 4	-0.009328***	0.002635	-3.539863	0.0012
S _ dummy2	-0.026943***	0.009647	-2.792934	0.0085
Adjusted R-squared = 0.130791		F-statistic = 3.708494***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 11.2065 [0.0474]		
LL = 77.28062		Portmanteau(6): Chi^2(5) = 1.2073 [0.3325]		
sigma = 0.031263		Jarque-Bera test = 20.9835 [0.0000]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance. Due to heteroscedasticity, White's correction has been applied.*

Table A3.8 **D22 Production of Publishing, Printing and Reproduction of Recorded Media**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	-0.01732	0.02059	-0.841	0.4070
pc _ 3	0.00542*	0.00288	1.884	0.0693
pc _ 4	0.00475**	0.00214	2.219	0.0342
ir _ lr _ 4	-0.01543**	0.00568	-2.716	0.0109
def _ 5	0.00209**	0.00098	2.139	0.0407
S _ dummy1	-0.01348	0.03114	-0.433	0.6682
S _ dummy2	0.12809**	0.05000	2.562	0.0157
Adjusted R-squared = 0.72880		F-statistic = 17.07054***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 5.9801 [0.8169[		
LL = 138.93837		Portmanteau(6): Chi^2(5) = 0.3328 [0.8529]		
sigma = 0.02599		Jarque-Bera test = 5.6858 [0.0583]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.9 **D23 Production of Coke, Refined Petroleum Products and Nuclear Fuel**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	-0.033273***	0.007602	-4.377033	0.0001
def _ 5	0.003827*	0.002250	1.700633	0.0984
S _ dummy1	0.006063	0.021078	0.287658	0.7754
S _ dummy2	0.117226***	0.022284	5.260644	0.0000
Adjusted R-squared = 0.475754		F-statistic = 11.89003***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 1.6157 [0.8060]		
LL = 58.41658		Portmanteau(6): Chi^2(5) = 2.9665 [0.0360]		
sigma = 0.052836		Jarque-Bera test = 1.0000 [0.6065]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance. Due to autocorrelation, Newey-West's correction has been applied.*

Table A3.10 **D24 Production of Chemicals and Chemical Products**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.052823**	0.021697	2.434538	0.0207
g _ 3	0.031145***	0.010680	2.916273	0.0064
S _ dummy1	0.029200	0.031013	0.941564	0.3535
S _ dummy2	-0.177757***	0.044338	-4.009142	0.0003
S _ dummy3	-0.038209	0.032610	-1.171697	0.2500
Adjusted R-squared = 0.392207		F-statistic = 6.807663***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 7.5322 [0.1840]		
LL = 63.47527		Portmanteau(6): Chi^2(5) = 4.5935 [0.0056]		
sigma = 0.046799		Jarque-Bera test = 0.1372 [0.9337]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance. Due to autocorrelation, Newey-West's correction has been applied.*

Table A3.11 **D25 Production of Rubber and Plastic Products**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.00842*	0.00446	1.888	0.0681
pc _ 4	0.00241***	0.00070	3.452	0.0016
g _ 4	-0.01812***	0.00441	-4.104	0.0003
gdpf _ 4	0.25710**	0.10620	2.421	0.0213
S _ dummy3	-0.04484***	0.01137	-3.945	0.0004
Adjusted R-squared = 0.71838		F-statistic = 10.76546***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 6.7704 [0.4532]		
LL = 146.64199		Portmanteau(6): Chi^2(5) = 0.4725 [0.7554]		
sigma = 0.02043		Jarque-Bera test = 2.0897 [0.3517]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.12 **D26 Production of Other Non-metallic Mineral Products**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	-0.04523***	0.00988	-4.576	0.0001
i _ 4	0.00906**	0.00394	2.299	0.0289
ir _ lr _ 3	-0.00790*	0.00475	-1.664	0.1070
reer _ 2	1.57074**	0.76376	2.057	0.0488
def _ 1	-0.00210**	0.00089	-2.357	0.0254
S _ dummy1	-0.03994***	0.01429	-2.795	0.0091
S _ dummy2	0.16490***	0.01629	10.120	0.0000
S _ dummy3	0.08080***	0.02159	3.742	0.0008
Adjusted R-squared = 0.94646		F-statistic = 101.6175***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 12.5084 [0.3267]		
LL = 145.00655		Portmanteau(6): Chi^2(5) = 0.8713 [0.4975]		
sigma = 0.02243		Jarque-Bera test = 2.8120 [0.2451]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.13 **D27 Production of Basic Metals**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	-0.02168***	0.00764	-2.836	0.0078
i _ 3	0.00702***	0.00254	2.762	0.0093
reer _ 1	-1.93131*	1.00586	-1.920	0.0635
S _ dummy2	0.08358***	0.01722	4.853	0.0000
Adjusted R-squared = 0.38166		F-statistic = 9.503774***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 4.4020 [0.4931]		
LL = 129.34375		Portmanteau(6): Chi^2(5) = 1.8144 [0.1576]		
sigma = 0.03211		Jarque-Bera test = 0.2553 [0.8802]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.14 **D28 Production of Fabricated Metal Products, Except Machinery and Equipment**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.03983***	0.00666	5.980	0.0000
def _ 3	0.00193*	0.00115	1.683	0.1021
gdpf _ 4	0.22591**	0.08428	2.680	0.0115
S _ dummy1	-0.08237***	0.01164	-7.076	0.0000
S _ dummy3	-0.04646***	0.01125	-4.129	0.0002
Adjusted R-squared = 0.65294		F-statistic = 14.73951***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 8.9480 [0.1765]		
LL = 134.81674		Portmanteau(6): Chi^2(5) = 1.0918 [0.3830]		
sigma = 0.02812		Jarque-Bera test = 1.6491[0.4384]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.15 **D29 Production of Machinery and Equipment n.e.c.**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.07379***	0.02623	2.813	0.0087
d29 _ 1	-0.52942***	0.13421	-3.945	0.0005
ir _ lr _ 5	-0.01652**	0.00786	-2.102	0.0444
reer _ 1	-3.39323**	1.31970	-2.571	0.0155
g _ 4	-0.02061*	0.01052	-1.959	0.0598
S _ dummy1	-0.10289***	0.02478	-4.153	0.0003
S _ dummy2	-0.05887	0.04418	-1.333	0.1931
S _ dummy3	-0.11678**	0.05183	-2.253	0.0320
Adjusted R-squared = 0.510809		F-statistic = 13.53027***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 0.2682 [0.9844]		
LL = 125.95559		Portmanteau(6): Chi^2(5) = 0.5426 [0.7062]		
sigma = 0.03754		Jarque-Bera test = 1.9096 [0.3849]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.16 **D30 Production of Office Machinery and Computers**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.09150**	0.03468	2.638	0.0126
gdpf _ 5	2.01541***	0.53614	3.759	0.0007
S _ dummy2	-0.13768**	0.05838	-2.358	0.0244
S _ dummy3	-0.29881***	0.07223	-4.137	0.0002
Adjusted R-squared = 0.34772		F-statistic = 7.397128***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 4.0773 [0.3956]		
LL = 74.07903		Portmanteau(6): Chi^2(5) = 0.6951 [0.6024]		
sigma = 0.14300		Jarque-Bera test = 10.3180 [0.0057]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.17 **D31 Production of Electrical Machinery and Apparatus n.e.c.**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.06854***	0.00858	7.992	0.0000
ir _ lr _ 3	-0.00497*	0.00291	-1.711	0.0975
reer _ 5	-2.87056***	1.01799	-2.820	0.0084
g _ 3	0.02279***	0.00702	3.248	0.0029
gdpf _ 4	0.36600**	0.14645	2.499	0.0182
S _ dummy1	-0.08546***	0.01696	-5.039	0.0000
S _ dummy3	-0.18241***	0.02514	-7.255	0.0000
Adjusted R-squared = 0.76436		F-statistic = 13.34216***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 12.0128 [0.2842]		
LL = 130.28720		Portmanteau(6): Chi^2(5) = 1.3618 [0.2793]		
sigma = 0.03283		Jarque-Bera test = 0.0274 [0.9864]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.18 **D32 Production of Radio, Television and Communication Equipment and Apparatus**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.14168***	0.05131	2.761	0.0095
i _ 3	0.03138*	0.01687	1.860	0.0721
g _ 5	0.05266***	0.01822	2.890	0.0069
S _ dummy1	-0.46420***	0.14863	-3.123	0.0038
S _ dummy3	-0.06805	0.06201	-1.097	0.2807
Adjusted R-squared = 0.23180		F-statistic = 1.430972		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 6.8645 [0.3336]		
LL = 83.64470		Portmanteau(6): Chi^2(5) = 1.6776 [0.1880]		
sigma = 0.11213		Jarque-Bera test = 0.1967 [0.9063]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance*

Table A3.19 **D33 Production of Medical, Precision and Optical Instruments, Watches and Clocks**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.02535*	0.01356	1.869	0.0710
i _ 4	0.01810***	0.00590	3.068	0.0044
ir _ sr _ 2	-0.01477***	0.00522	-2.832	0.0081
reer _ 4	-4.00007*	2.03010	-1.970	0.0578
def _ 2	-0.00571**	0.00242	-2.355	0.0250
S _ dummy2	-0.13479***	0.04156	-3.243	0.0028
Adjusted R-squared = 0.35795		F-statistic = 2.129455**		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 6.9776 [0.6394]		
LL = 106.43444		Portmanteau(6): Chi^2(5) = 0.2952 [0.8781]		
sigma = 0.06154		Jarque-Bera test = 1.1521 [0.5621]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.20 **D34 Production of Motor Vehicles, Trailers and Semi-trailers**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.05169***	0.01012	5.108	0.0000
reer _ 3	2.70483*	1.37327	1.970	0.0576
gdpf _ 2	0.24395*	0.12441	1.961	0.0587
S _ dummy1	-0.02028	0.01929	-1.052	0.3008
S _ dummy3	-0.13030***	0.01706	-7.638	0.0000
Adjusted R-squared = 0.66582		F-statistic = 11.28253***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 7.7494 [0.2570]		
LL = 119.27949		Portmanteau(6): Chi^2(5) = 0.5106 [0.7285]		
sigma = 0.04280		Jarque-Bera test = 2.5546 [0.2788]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.21 **D35 Production of Other Transport Equipment**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.01291**	0.00582	2.219	0.0335
i _ 4	0.00385*	0.00198	1.945	0.0604
gdpf _ 5	0.31270***	0.09664	3.236	0.0028
S _ dummy3	-0.04792***	0.01551	-3.090	0.0040
Adjusted R-squared = 0.44099		F-statistic = 8.684783***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 7.9698 [0.1579]		
LL = 137.56768		Portmanteau(6): Chi^2(5) = 1.3002 [0.2969]		
sigma = 0.02571		Jarque-Bera test = 2.3070 [0.3155]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.22 **D36 Production of Furniture; Manufacturing n.e.c.**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.04214***	0.00995	4.235	0.0002
reer _ 2	1.68835**	0.80061	2.109	0.0429
S _ dummy1	-0.04270***	0.01304	-3.275	0.0025
S _ dummy2	-0.02609*	0.01306	-1.998	0.0543
S _ dummy3	-0.07066***	0.01318	-5.363	0.0000
Adjusted R-squared = 0.42691		F-statistic = 6.162026***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 5.7385 [0.3325]		
LL = 136.41884		Portmanteau(6): Chi^2(5) = 0.5045 [0.7328]		
sigma = 0.02693		Jarque-Bera test = 0.8551 [0.6521]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.23 **Low Technological Intensity**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	-0.040979***	0.009874	-4.150120	0.0003
pc _ 4	0.002732**	0.001315	2.078152	0.0463
pc _ 5	0.002384*	0.001219	1.955291	0.0599
reer _ 4	0.871131*	0.429419	2.028626	0.0515
g _ 5	-0.012082***	0.002180	-5.542368	0.0000
S _ dummy1	0.119067***	0.016722	7.120236	0.0000
S _ dummy2	0.057934**	0.022085	2.623170	0.0136
Adjusted R-squared = 0.896518		F-statistic = 52.98108***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 16.1011 [0.0968]		
LL = 115.5935		Portmanteau(6): Chi^2(5) = 1.3451 [0.2849]		
sigma = 0.011817		Jarque-Bera test = 0.8447 [0.6555]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance. Due to heteroscedasticity, White's correction has been applied.*

Table A3.24 **Medium-low Technological Intensity**				
∆ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.00045	0.00446	0.101	0.9201
ir _ lr _ 3	-0.00659*	0.00365	-1.805	0.0805
g _ 4	-0.00422**	0.00199	-2.121	0.0417
S _ dummy1	-0.03355***	0.00796	-4.214	0.0002
S _ dummy2	0.04586***	0.00842	5.444	0.0000
Adjusted R-squared = 0.74755		F-statistic = 32.42482***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 5.9123 [0.4331]		
LL = 148.87154		Portmanteau(6): Chi^2(5) = 0.6989 [0.6002]		
sigma = 0.01924		Jarque-Bera test = 1.0724 [0.5850]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.25 **Medium-high Technological Intensity**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	0.13007***	0.03026	4.298	0.0002
reer _ 5	-4.31807***	1.00660	-4.290	0.0002
g _ 2	0.01550*	0.00783	1.979	0.0570
g _ 5	0.02262**	0.00964	2.346	0.0258
S _ dummy1	-0.18878***	0.04192	-4.503	0.0001
S _ dummy2	-0.12324**	0.05218	-2.362	0.0249
S _ dummy3	-0.15580***	0.02535	-6.145	0.0000
Adjusted R-squared = 0.79223		F-statistic = 23.87819***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 6.9796 [0.6392]		
LL = 139.07028		Portmanteau(6): Chi^2(5) = 0.2100 [0.9301]		
sigma = 0.02589		Jarque-Bera test = 0.0117[0.9942]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. The number following the name of seasonal dummy indicates the quarter. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A3.26 **High Technological Intensity**				
Δ Contribution	**Coefficient**	**Standard error**	**t-value**	**p-value**
Constant	-0.01066	0.00718	-1.485	0.1471
i _ 4	0.01652***	0.00322	5.127	0.0000
g _ 2	-0.01613***	0.00464	-3.478	0.0014
gdpf _ 5	0.43606***	0.15110	2.886	0.0068
Adjusted R-squared = 0.48876		F-statistic = 8.895149***		
Number of obs. = 37		ARCH 1-1 test: F(1,22) = 4.9704 [0.5476]		
LL = 119.36570		Portmanteau(6): Chi^2(5) = 0.5424 [0.7060]		
sigma = 0.04205		Jarque-Bera test = 3.2026 [0.2016]		

Source: Authors' calculations.
*Notes: p-values are given in brackets. The number of time lags follows the variable name. ***1 percent significance, **5 percent significance and *10 percent significance.*

Table A.4 **Number of Lags in Each Regression**

	Domestic demand		Monetary policy		Exchange rate	Fiscal policy		Foreign demand
	Personal consumption (% of GDP)	Investments (% of GDP)	Real short-run interest rate (in %)	Real long-run interest rate (in %)	Real effective exchange rate	Government consumption (% of GDP)	Fiscal deficit (% of GDP)	GDP of top five export partners
D15	2 5	-	-	3	-	-	-	-
D16	5	-	-	-	5	1 5	-	-
D17	-	-	5	-	5	5	-	-
D18	4	-	-	-	2	1	-	4
D19	-	-	-	2	2	3	-	-
D20	4	-	1	-	2	2	-	-
D21	-	-	-	-	-	4	-	-
D22	3 4	-	-	4	-	-	5	-
D23	-	-	-	-	-	-	1	-
D24	-	-	-	-	-	3	-	-
D25	4	-	-	-	-	4	-	4
D26	-	4	-	3	2	-	1	-
D27	-	3	-	-	1	-	-	-
D28	-	-	-	-	-	-	3	4
D29	-	-	-	5	1	4	-	-
D30	-	-	-	-	-	-	-	5
D31	-	-	3	-	5	3	-	4
D32	-	3	-	-	-	5	-	-
D33	-	4	2	-	4	-	2	-
D34	-	-	-	-	3	-	-	2
D35	-	4	-	-	-	-	-	5
D36	-	-	-	-	2	-	-	-

Source: Authors' calculations.

Literature

Adam, Christopher S. and David L. Bevan, 2001, "Fiscal Deficits and Growth in Developing Countries", University of Oxford Economic Series Working Paper, No. 120, Oxford: University of Oxford.

Aralica, Zoran, 2007, "Utjecaj tehnologije na izvoznu konkurentnost Republike Hrvatske", PhD thesis, Zagreb: Ekonomski fakultet, Zagreb.

Bruce, Neil and Stephen J. Turnovsky, 1999, "Budget balance, welfare, and the growth rate: 'dynamic scoring' of the long-run government budget", *Journal of Money, Credit and Banking*, 31(2), pp. 162-186.

Erjavec, Nataša, Boris Cota and Vlasta Bahovec, 1999, "Monetarno-kreditna i realna privredna aktivnost u Republici Hrvatskoj: VAR model", *Ekonomski pregled*, 50(11), pp. 1488-1504.

European Commission, 2007, *EU industrial structure 2007: Challenges and opportunities*, Luxembourg: European Commission.

European Commission, 2009a, *European Competitiveness Report 2008*, Luxembourg: European Commission.

European Commission, 2009b, *Sectoral Growth Drivers and Competitiveness in the European Union*, Luxembourg: European Commission.

Fischer, Stanley, 1993, "The Role of Macroeconomic Factors in Growth", NBER Working Paper, No. 4565, Cambridge, MA: National Bureau of Economic Research.

Kormendi, Roger and Philip G. Meguire, 1985, "Macroeconomic Determinants of Growth: Cross-Country Evidence", *Journal of Monetary Economics*, 16(2), pp. 141-163.

Levine, Ross and David Renelt, 1992, "A Sensitivity Analysis of Cross-Country Growth Regressions", *The American Economic Review*, 82(4), pp. 942-963.

Lovrinčević, Željko, 2009, "Tehnološka složenost i struktura ponude i potražnje industrijskih proizvoda u Hrvatskoj", *Ekonomski pregled*, 60(11), pp. 535-569.

Vizek, Maruška, 2006, "Econometric Analysis of Monetary Transmission Channels in Croatia", *Privredna kretanja i ekonomska politika*, 109(16), pp. 28-61.