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A roadmap of actions aiming at ensuring furniture industry production growth: panel analysis

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This paper investigates European Commission necessary conditions for competitive industry in the context of furniture manufacturing. Namely, in the Industrial Strategy of the Republic of Croatia 2014–2020, the manufacture of furniture was assigned a strategic role. However, Croatia continues to underperform in comparison with the European Union member states in terms of return to pre-crisis levels. Accordingly, using the system of generalised method of moments estimators in two steps with robust standard errors, the panel model was estimated. Econometric analysis indicates that a better access to markets, higher investment, and stable macroeconomic environment are significant conditions for achieving production growth. Moreover, the results suggest that a furniture manufacturing sector would profit from lower energy prices.

Keywords: furniture manufacturing; industrial strategy; European Commission; generalized method of moments; Croatia; economic crisis

JEL classification: C33; E23; L68

1. Introduction

The global economic and financial crisis, competitive pressures on industry from emerging markets, and reductions in the industrial capacity in many economies have all increased the interest in the industrial policy among policy makers (Warwick & Nolan, 2014). In addition to this, in some countries, there are concerns that the manufacturing production has declined too much, and that knowledge and capabilities have been irreversibly lost, so there is a call for industrial policies to strengthen specific sectors, or areas of economic activity, with the aim of fostering new sources of economic growth (Warwick, 2013).

The aforementioned is further evidenced by the European Commission's new approach to the industrial policy. Specifically, in the *Europe 2020* strategy (European Commission, 2010), the Commission put seven leading initiatives in the foreground, including the topic of developing a strong and sustainable globally competitive industrial base. Furthermore, with the revamped industrial strategy, the Commission seeks to reverse the declining role of industry in Europe, with a projected increase from about 16% of GDP (in 2012) to as much as 20% by 2020. Although the set objective seems ambitious, it also provides a clear direction for the future industrial policy of the

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European Union. The impact of the economic crisis in several member states, the subsequent economic stagnation and the worsening conditions for the global economy have lent new urgency to this midterm review of the industrial policy (European Commission, 2012). Therefore, in 2014 the European Commission published a new document entitled *For a European Industrial Renaissance*, in which the importance of a full and effective implementation of an industrial policy in the EU was emphasised.

Additionally, to shed light on the role of the industrial policy, the European Commission monitors member states' progress in improving competitiveness and defines the conditions that have been highlighted as the drivers of the manufacturing revival in the EU. In this regard, in this paper, we will empirically analyse the selected drivers identified in the Member States Competitiveness Report (European Commission, 2014b), in the context of the furniture manufacturing industry. In January 2014, the Croatian Ministry of Economy published the *Industrial Strategy of the Republic of Croatia 2014–2020* (hereinafter: the Strategy) in which the industry of furniture manufacture was assigned a strategic role, and the sub-areas of the wood sector C31.0 – Manufacture of Furniture, and C16.2 – Manufacture of Products of Wood, Cork, Straw and Plaiting Materials, were classified as key industrial sub-areas or *Initiators*. The empirical analysis was conducted on a sample of EU member states, including Croatia. More specifically, with the application of the system of the generalised method of moments estimators in two steps, with robust standard errors, the panel model for the period from 2000 to 2013 was estimated. Following a macroeconomic approach, it was found that a stable macroeconomic environment, improved access to markets, more investment and lower energy costs have a statistically significant and positive impact on the industrial production of the furniture industry.

The paper is divided into six sections, including an introduction and concluding remarks. In the following section we analyse the key sectoral facts related to the wood industry in the Republic of Croatia. The third section refers to the necessary conditions for a competitive industry per the European Commission. Section 4 is dedicated to describing the data used and the method applied, as well as the reasons behind the choice of a system GMM estimator. Section 5 contains the concrete results of the econometric analysis and their interpretation. Finally, Section 6 concludes and presents some limitations and possible paths of future research.

2. Key sectoral facts in the context of the wood industry in Croatia

As mentioned in the introduction, the Croatian Ministry of Economy published the *Industrial Strategy of the Republic of Croatia 2014–2020*¹ with the aim of repositioning the identified strategic activities in the global value chain towards the development of activities that create added value. In doing so, the Strategy divided and arranged sub-areas into five groups on the basis of valuation models and ranking. The valuation model was based on three criteria used for the evaluation of sub-areas, grouping the sub-areas and their ranking within the group: profitability (EBITDA per person employed), export orientation, and size of the sub-area (defined by the number of persons employed in a specific sub-area).

In this way, the wood sector sub-areas C31.0 – Manufacture of Furniture, and C16.2 – Manufacture of Products of Wood, Cork, Straw and Plaiting Materials, were classified as key industrial sub-areas or *Initiators*. According to the Strategy (Official Gazette, 126/15), 'Initiators' are large export-oriented sub-areas that generate a positive EBITDA (Earnings before Interest, Taxes, Depreciation and Amortisation) and employ a

significant number of workers. These sub-areas are expected to achieve higher growth rates and employment trends compared with the movement in GDP, or more than 5%, which is based primarily on increasing exports. Category C31.0 is the 15th, and category C16.2 is the 19th out of the 22 selected sub-areas.

Furthermore, the integration of model results in the Strategy led to the conclusion that nine industrial activities had the greatest potential, and thus the 'responsibility' for the growth and development of the industry. This group included C31 and assigned it a strategic role. Furniture manufacturing bases its position as an important industrial activity on sufficient availability and high quality of natural resources, and, unlike the food industry, the furniture manufacturing industry has not yet made sufficient use of the specific competitive advantage of the quality raw material base and still has to deal with repositioning in the global value chain, from the position of the manufacturer of semi-finished and low value-added products to the supplier of classy end products with high added value (Official Gazette, 126/15).

In addition to the above, the Strategy (Official Gazette, 126/15) lists the factors for the development of the wood sector, and highlights C16's high export, growth and employment potential. It also highlights its low import dependency due to the availability and quality of natural resources, i.e. domestic raw materials, and high inter-industry trade. On the other hand, it lists insufficient technological equipment, negligible investment in research and development, the lack of long-term contracts for the supply of raw materials, unavailability of capital, small domestic market (hence the necessary orientation to the foreign market, with a much stronger competition), developed informal economy (the grey economy), weak links between educational institutions and the economy, low level of product processing and completion, large differences between regions, and the necessity of introducing product standardisation as the main problems.

Furthermore, according to the Strategy (Official Gazette, 126/15), the growth potential of the Manufacture of Furniture (C31) is also reflected in the high export potential and low import dependence. However, the introduction of foreign retail chains to the Croatian market, non-specialisation of manufacturers, large logistic costs, inadequate distribution channels, failure to follow trends, grey economy, negligible investment in product development, and poor technological equipment are the main problems of this industrial activity (Official Gazette, 126/15).

The fact that these are the industries of particular macroeconomic importance is further evidenced by the following data: in 2013, C16 and C31 participated with 8.3% in the total manufacturing exports, and the sector achieved exports of over HRK5 billion and an international trade surplus of HRK2.5 billion.² However, a detailed analysis of sectoral data points to a significant lag.

More precisely, according to the analysis of sectoral data for activities C16 (Manufacture of Wood and of Products of Wood and Cork) and C31 (Manufacture of Furniture), calculated based on the movement of the index of industrial production in 2013 compared with 2007, we can conclude that neither of these two industries has begun with the recovery, nor reached the pre-crisis level of industrial production. Despite the modest growth in 2011, the production still contracts (–15% in 2012 and –4% in 2013 for C16; –6% in 2012 and –1% in 2013 for C31) on a yearly basis.

Furthermore, according to the Eurostat data, on the basis of the EU manufacturing production change by Member State, the production of wood processing has demonstrated negative growth since 2007 in 18 out of 23 member states. If we undertake this same analysis from the perspective of the furniture industry, the production is in an even worse condition: negative growth since 2007 in almost all member states (21 out of 23).

In Croatia's case, both sectors record a double digit negative change (−30% for C16; −20% for C31), where C16 records the worse condition of the industrial output.

Furthermore, according to the International Trade Centre database, on the basis of growth in the international supply and demand for the products exported from Croatia in 2013, the indicators suggest a disappointing performance. Specifically, the wood processing industry³ is located in the quadrant of winners in the declining sector. The products in this quadrant are characterised by growing shares of the country's exports in the markets that are declining or growing below the world average rate (International Trade Centre, 2014). From a trade promotion perspective, niche-marketing strategies might help pinpoint those products that demonstrated a positive trade performance in spite of an overall market decline (International Trade Centre, 2014). On the other hand, the furniture industry is situated in the quadrant of losers in the declining sector. The products in this quadrant are characterised by a declining share of the country's exports in the world import markets that are growing below the world average rate (International Trade Centre, 2014). The trade promotion efforts for product groups in this category face an uphill struggle. They need to make an integrated plan of attack that will take into account the bottlenecks on the end of both the supply and demand (International Trade Centre, 2014).

Looking ahead, it is important that the potential and strengths of the Croatian wood processing and furniture manufacturing industries is recognised on the national level, but they cannot rely solely on the existing competences. It is clear from the production and trade performance indicators that they point to a relatively bleak future of growth in the wood-based output. At the same time, these pressing issues, together with the dangers related to a permanent loss of industrial capacity, have furthered the need of strengthening competitiveness, since it is definitely possible to reverse the downward trend. Hence, in the next chapter we analyse the European Commission's necessary conditions for a competitive industry.

3. European Commission's Necessary Conditions for Competitive Industry

Faster growth is a necessary condition to reverse the downward trend in the wood processing and furniture industry. However, it is only one of the factors making it possible. In order to close the gap, considerable changes and stimuli are required. In particular, the European Commission identified key indicators for recovery. In addition to the implementation of sectoral strategies, the European Commission provides country-specific recommendations. More precisely, to shed light on the role of the industrial policy, the European Commission monitors member states' progress in improving competitiveness as part of the contribution of the Commission to the European Semester process.

Their analysis is based on three indicators of output in the last five years (2007–2012): labour productivity, exports and innovation. Based on the outcomes of the analysis, the members are grouped into four groups, where Croatia is categorised as a member state with modest and stagnating or declining competitiveness.⁴ Member states in this group should focus on restoring the cost and non-cost competitiveness of their economies, as they combine a relatively low performance level with limited improvement (European Commission, 2014b). They are not closing the gap between themselves and the strong performers, and are in danger of losing competitiveness (European Commission, 2014b). The three output indicators (labour productivity, exports and innovation) are defined by a series of input indicators or conditions that have been

reviewed and highlighted as the drivers of the EU manufacturing revival. These include the following:

- Additional investments,
- Improving access to finance,
- Access to markets and integration into global value chains, and
- The importance of energy costs.

To enable the EU economy to fully recover, improvements in these common fields are necessary. These drivers are the essential components of competitiveness across all sectors and currently at the centre of the EU policy debate. Hence, their importance for the furniture industry is measured through a panel regression since, despite substantial divergences on the policies and performance of member states, they are at the forefront of policy-making in most member states. We use new data and employ empirical methods to provide new evidence for policy-making. The results confirm the relevance of the current policy priorities, and reveal new opportunities.

4. Econometric analysis

In this section we will explain the way of obtaining the variables included in the econometric analysis in great detail, and will also highlight the specific characteristics of individual time series.

4.1. Data description and sources

The industrial production data (manufacture of furniture) of 23 European Union member states were originally gathered using the Eurostat database.

Furthermore, access to finance was approximated with the use of loans to non-financial corporations. Non-financial corporations consist of institutional units whose distributive and financial transactions are distinct from those of their owners, and which are market producers, whose principal activity is the production of goods and non-financial services (European Commission, 2014b). The values were taken from the European Central Bank. Next, we used the SME Access to Finance (SMAF) index in order to run a robustness test. The European Commission developed the SMAF index to provide an indication of the changing conditions of the SME's access to finance over time for the EU and its member states. The index comprises access to debt finance and access to equity finance. The values were taken from the Eurostat website. In so doing, the assumption is that the algebraic sign of both indicators will be in line with economic theory, and that its increase will have a stimulating effect on the production of the furniture industry.

The next determinant to be addressed is the impact of the total investment. This variable is expressed as a gross capital formation. Eurostat served as a source of the variable of investment. We expect a positive connection because an increase in gross capital formation and manufacturing will augment the productive capacity, thus enabling producers to develop their output.

Further, the integration of countries in a single market is measured by the average ratio of total exports and imports over GDP, expressed as a percentage. The increase in trade openness entails the movement of goods produced in one country for consumption or for further processing into another country (Shahbaz, Nasreen, Hui Ling, & Sbia,

2014), which is expected to have a positive impact on production. The values were taken from the United Nations Economic Commission for Europe (UNECE).

Electricity prices were used as a proxy for energy prices. More precisely, the average half-yearly national electricity price in euro per kWh excluding taxes and levies, is applicable for medium-sized industrial consumers (annual consumption between 500 and 2000 MWh). The indicator does not cover small enterprises for reasons of data availability, nor large enterprises, since the latter often have individual contracts with energy providers, as suggested in European Commission (2014b). The prices refer to the second half of the year and are taken from the Eurostat website. We expect a negative algebraic sign.

Finally, since the research in this paper also focuses on the analysis of production performance in the context of the economic crisis, we need to define the term ‘crisis’. Therefore, we considered a possible definition of a crisis (for annual data) according to which the period of crisis happens when the output gap is negative and greater than 4%. A dummy variable representing the economic crisis takes the value 1 in the crisis year and value 0 in all others. The values were taken from the Annual macro-economic database (AMECO).

All variables are logarithmically transformed (except for the dummy variable and trade openness, which is expressed in percentages). The lagged value (one-period lag) of the dependent variable will be used as an instrumental variable.

4.2. Dynamic linear panel data model

The concrete analysis spans the 14-year period from 2000 to 2013, and was conducted in 23 EU member states, including Croatia. The members of Cyprus, Luxembourg, Hungary, Slovenia and Slovakia are not included in the analysis due to the lack of disaggregated sectoral data.

Thus, for the uses of empirical testing, the dynamic panel data models are estimated. Furthermore, since there are no available data for all countries and all years of interest, an unbalanced panel model will be used to evaluate the appropriate models. The dynamic panel specification estimated is as follows:

$$y_{it} = \mu + \delta y_{i,t-1} + \beta' x_{itK} + v_i + u_{it}, i = 1, \dots, N, t = 1, \dots, T_i \quad (1)$$

where N is the number of the units of observation, T is the number of periods, y_{it} stands for the value of the dependent variable (in this case, the value of the EU member states’ production of furniture) i in the period t , the parameter μ is the constant, δ is the scalar, $y_{i,t-1}$ is the one-period-lagged (one year) dependent variable (for the same country), x_{it1}, \dots, x_{itK} are the K of independent variables (i) for the member state i during the period t (i.e. x'_{it} is $1 \times K$ and β is $K \times 1$), v_i is the fixed element or random error for the unit of observation, and u_{it} the error term in the model. It is assumed that all variables x_{it} are strictly exogenous and uncorrelated with any u_{it} . However, with the inclusion of the lagged dependent variable $y_{i,t-1}$ in the model, it becomes correlated with v_i . Due to the observed correlation, the difference GMM estimator proposed by Arellano and Bond (1991) and the system GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998) are commonly employed estimation procedures. Both estimators are designed for situations with a small T , large N panels, meaning few time periods and many individuals; a linear functional relationship; a single left-hand-side variable that is dynamic, depending on its own past realisations; independent variables that are not strictly exogenous, meaning correlated with past and possibly current realisations of

the error; fixed individual effects; and heteroscedasticity and autocorrelation within, but not across, individuals (Roodman, 2009a).

However, building on the work of Arellano and Bover (1995), Blundell and Bond (1998) argue that the difference GMM estimator can have very poor finite sample properties in terms of bias and precision when the series are persistent, as the instruments are then weak predictors of endogenous changes (Bun & Windmeijer, 2010). Hence, Blundell and Bond (1998) proposed incorporating additional moment conditions. When these conditions are satisfied, the resulting system GMM estimator has been shown in the Monte Carlo studies by, for example, Blundell and Bond (1998), and Blundell, Bond, and Windmeijer (2000) to have much better finite sample properties in terms of bias and the root mean squared error (rmse) than that of the difference GMM estimator (Bun & Windmeijer, 2010; Hayakawa, 2007). Blundell and Bond (1998) use moment conditions for the model in the first differences with moment conditions for the model in levels. Furthermore, Blundell and Bond (1998) argued that the system GMM estimator performs better than the difference GMM estimator because the instruments in the levels model remain good predictors for the endogenous variables in this model even when the series are very persistent (Bun & Windmeijer, 2010).

In addition, the system GMM should be preferred over the difference GMM when the number of individuals is small, i.e. the number of countries typically available in panel studies, characteristic to the data-set in this paper. Although previous research by Blundell and Bond (1998), and Blundell et al. (2000) has already shown the superiority of the system GMM estimator over other estimators, Soto (2009) explained that the system GMM estimator has a lower bias and higher efficiency than all the other estimators analysed, including the difference GMM estimator.

Further, we use the two-step instead of the one-step estimator, with robust standard errors in all specifications. Two-step estimators use a weighting matrix that makes the two-step GMM asymptotically efficient (Roodman, 2009b). Historically, researchers often reported one-step results in addition to two-step results because of the downward bias in the computed standard errors in two-step results (Roodman, 2009a). However, when the Windmeijer (2005) correction became available, the problem was greatly reduced (Roodman, 2009b).

Further, the models are tested using the Sargan test and the Arellano-Bond test for zero autocorrelation in first-differenced errors. Next, due to the unbalanced nature of our panel and the short time series dimension, we cannot apply standard panel unit root tests to check whether the export is stationary.

5. Econometric results

To investigate the impact of the selected drivers of the EU furniture manufacturing revival, the regression analyses using panel estimation models, discussed in the previous section, were undertaken using the sample of 23 European Union member states, including Croatia. The model is estimated using a two-step system GMM estimator with robust standard errors.

Table 1 contains the results of the impact assessment of the selected macroeconomic variables on the production of furniture in the EU member states. More precisely, the model includes a persistence element (the lagged dependent variable), loans to non-financial corporations (access to finance), trade openness (access to markets), investment, electricity prices (energy prices) and the dummy variable for the economic crisis. The results indicate the significant impact of all variables (except access to finance) on

Table 1. The results of the dynamic linear panel model – dependent variable: production of furniture manufacturing.

| | (1) | (2) |
|---|-------------------|-------------------|
| Lagged dependent variable | 0.935*** (0.000) | 0.763*** (0.000) |
| Access to finance | 0.006 (0.685) | -1.114 (0.576) |
| Access to markets | 0.002*** (0.001) | 0.003*** (0.002) |
| Investment | 0.003*** (0.004) | 0.002*** (0.003) |
| Energy prices | -0.134*** (0.008) | -0.365*** (0.000) |
| Economic crisis - dummy | -0.082*** (0.000) | -0.069*** (0.000) |
| Constant term | -0.309 (0.438) | 3.433 (0.214) |
| Sargan test of over-identifying restrictions (<i>p</i> -value) | 0.8540 | 0.5488 |
| Arellano-Bond test for AR(2) in differences (<i>p</i> -value) | 0.1097 | 0.1606 |
| Number of observations | 204 | 135 |
| Number of groups | 23 | 23 |

Note: ***, **, * indicate statistical significance at 1%, 5% and 10%; *p*-values in parenthesis. Two-step system GMM estimator with robust standard errors is applied.

Source: Authors' calculations.

the success of the furniture manufacturing sector (Column 1). Specifically, better access to markets, integration into global value chains and higher capital formation lead to a small but significant increase in furniture manufacturing. Thus, our empirical findings support the widespread belief that increased levels of investment positively influence furniture production. Hence, the estimated coefficients have signs in line with economic theory. Furthermore, the coefficient of electricity prices is negative and significant in the model specification, suggesting a negative energy cost-production nexus, so the findings of this study suggest that energy is an important factor influencing the furniture manufacturing production. We also consider the dummy variable for the economic crisis as an explanatory variable. By examining the results of the evaluated panel model, it could be concluded that the dummy variable is negatively related to furniture manufacturing, indicating that the financial crisis has had a negative impact on the sector observed. This empirical evidence is consistent with the previous findings of the European Commission (2014a). On the other hand, the loans to non-financial corporations variable is not statistically significant in the model. The aforementioned is in accordance with the results of the BACH database (a database managed by the European Committee of Central Balance-Sheet Data Offices, ECCBSO). According to their research, furniture is an externally independent sector for the analysed countries for the period from 2000 to 2004 (European Commission, 2013). This means that growth has been hit more severely by the global financial crisis in sectors more dependent on external finance.

Hence, the results were tested against a robustness check (Column 2). When access to finance is recalculated based on the SME Access to Finance (SMAF) index, the results remain the same (the indicator is statistically insignificant). Moreover, this result is robust in both estimated specifications (1 and 2) confirming that better access to markets, higher investment, lower energy prices and a stable macroeconomic environment are important conditions for achieving and maintaining production growth in the furniture manufacturing industry.

In both models there was no autocorrelation between the residuals of the second order. Furthermore, based on the Sargan test, the hypothesis that there is no correlation between the residuals and the instruments was accepted. The dependent lagged variable was statistically significant and had a positive algebraic sign.

6. Concluding remarks

The Croatian Ministry of Economy published the *Industrial Strategy of the Republic of Croatia 2014–2020* in which the industry of furniture manufacture was assigned a strategic role, and the sub-areas of the wood sector C31.0 – Manufacture of Furniture, and C16.2 – Manufacture of Products of Wood, Cork, Straw and Plaiting Materials, were classified as key industrial sub-areas or *Initiators*. However, although it is important that the potential and strengths of Croatian wood processing and furniture manufacturing industries are recognised on the national level, they cannot rely solely on the existing competences. It is clear from the analysis of production and trade performance indicators that they point to a relatively bleak future of growth in the wood-based output. Hence, in this paper, we empirically analysed the selected drivers identified in the Member States Competitiveness report, in the context of the furniture manufacturing industry. The empirical analysis was conducted on a sample of 23 EU member states, including Croatia. More specifically, the panel model was estimated for the period from 2000 to 2013, by applying the system of the generalised method of moments estimators in two steps, with robust standard errors. Following a macroeconometric approach, it was found that over the analysed period (which includes the recent economic crisis), a stable macroeconomic environment, improved access to markets, more investment and lower energy costs have a statistically significant and positive impact on the industrial production of the furniture industry. These results largely confirm the findings of the European Commission to foster growth by promoting conditions that have been highlighted as the drivers of the EU manufacturing revival, and signal the importance of this policy during the crisis. Additionally, the results obtained in this paper are consistent with the previous researches which point out that supportive macroeconomic policies are the key near-term priorities. Namely, access to energy inputs, at affordable prices that reflect international costs, is key to promoting investment in EU industry (European Commission, 2014c). Further, helping companies go beyond borders helps European firms to integrate into global value chains (Dobbs, Manyika, & Woetzel, 2015). In the aftermath of the crisis, investment must be at the core of any strategy to revive growth in Europe (Baldi, Fichtner, Michelsen, & Rieth, 2014; Buti & Mohl, 2014; European Commission, 2015). On the other hand, an insignificance of access to the finance variable confirms that ‘manufacturing is a diverse sector, not subject to simple, one-size-fits-all approaches’ (McKinsey Global Institute, 2012), suggesting that sector analysis provides key insight into how to form and deliver a policy. At the same time, the major variation between members and industrial sectors should not be ignored.

Overall, for post-crisis, sustainable growth of furniture manufacturing it is necessary to encourage investment, and ensure access to global markets on more favourable competitive conditions and, in particular, energy prices, at affordable prices that reflect international cost conditions. This can serve as a base for considering the role of industrial strategy in creating concrete economic policy measures, and might also have significant implications for Croatia.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. However, even before the Strategy itself, some strategic documents had already been adopted.
2. The Croatian Bureau of Statistics.

3. The exports of section 16 (according to NACE Rev. 2, it is the section of the Manufacture of Wood and of Products of Wood and Cork), fall in category 44 according to the HS classification (Wood and Articles of Wood, Wood Charcoal). Furthermore, the exports of section 31 (according to NACE Rev. 2, it is the section of Furniture Manufacturing), fall in category 94 according to the HS classification (Furniture, Lighting, Signs, Prefabricated Buildings).
4. Slovenia, Bulgaria, Malta and Cyprus also belong to this group. The remaining three groups are member states with strong and improving competitiveness in all three dimensions (Denmark, Germany, Ireland and the Netherlands), member states with strong but declining competitiveness (Belgium, France, Italy, Luxembourg, Austria, Finland, Sweden and the United Kingdom) and member states with modest but improving competitiveness (Czech Republic, Greece, Spain, Estonia, Latvia, Lithuania, Hungary, Poland, Portugal, Romania and Slovakia).

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