BULGARIAN NATIONAL BANK

DISCUSSION PAPERS
DP/118/2021

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ISBN 978-619-7409-23-9 (online)

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Abstract: During the past 20 years Bulgaria's market shares in global and intra-EU trade have more than doubled. This process was accompanied by a significant appreciation of Bulgaria's real effective exchange rate, deflated with unit labour costs, which could be a sign of eroding export price competitiveness. In this paper we examine the caveats of using ULC-deflated REER as a sole indicator of export competitiveness in converging economies and we point to the importance of accounting for sectoral heterogeneity of export performance. The empirical analysis in the paper is based on the use of a state space model with which we estimate the relative importance of price and non-price competitiveness on export dynamics for the Bulgarian manufacturing subsectors. With the help of the Kalman filter we derive historical series for non-price competitiveness, which point to strong gains for most manufacturing subsectors, with the exception of textiles and base metals. We find that the exports dynamics of most manufacturing subsectors during the period 2000–2019 are driven predominantly by external demand and non-price competitiveness, while price competitiveness has contributed to a much lower extent.

Keywords: *Exports, Price Competitiveness, Non-Price Competitiveness, Bulgaria, State Space Models, Kalman Filter*

JEL classification: C32, D24, F14, F16

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Acknowledgment: We would like to thank the members of the Economic Research and Forecasting Directorate and the editorial board of the Bulgarian National Bank for their valuable contribution, comments and suggestions.

1. Introduction

The consistent growth in exports over the past 20 years has played a crucial role for the economic convergence of Bulgaria and most of the countries from Central, Eastern and South Eastern Europe[1] to the euro area (EA). A significant part of this export growth was generated by the increased trade integration of these countries in the European Union's (EU) value chains, as well as the offshoring of certain production activities from the core euro area countries to the New Member States (NMS) and Bulgaria (Ivanova and Ivanov, 2017). This is evident by the increasing trade openness, growing participation in Global Value Chains (GVCs) and gains in global trade market shares. Bulgaria stands out as one of the countries where trade openness and the participation in GVCs are higher compared to the average for the NMS and for the EU (Ivanova and Ivanov, 2017). The offshoring of production activities has been accompanied by significant foreign investments and inward technological and know-how transfers. As a result of these investments and transfers Bulgaria and the NMS have managed to increase their productivity levels, which in turn have stimulated exports and have facilitated the income and price convergence process towards euro area average levels.

As a result of these processes, certain economic sectors, such as the manufacturing, benefited disproportionately and managed to increase their production capacity well beyond the needs of their countries' domestic market. Empirical evidence suggests that in Bulgaria and the NMS on average around 53% of the turnover in the manufacturing sector is generated by exports, as opposed to 35% on average in the core euro area countries such as Germany, France and Italy.[2] As the production base in the NMS expanded in order to accommodate demand from external markets, the need for labour also increased proportionately. However, Bulgaria and the NMS are among the fastest aging nations, which, combined with the net migration outflows experienced in the period after their transition to market economies and their accession to the EU, has led to a steadily decreasing work force (European Commission, 2017).

[1] From here on the analysis will focus on a selected group of Central, Eastern and South Eastern European countries to which Bulgaria will be compared. In this group we include the countries that joined the EU after 2004 and that have experienced similar economic developments to Bulgaria. These countries are Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and Slovakia. We refer to this group of countries as NMS (New Member States of the EU) in the paper. For the sake of comparison the group excludes Bulgaria even though it has also joined the EU after 2004.

[2] The calculation is based on EUROSTAT data for the turnover in the manufacturing sector (million EUR) from the Structural Business Statistics and for the export of goods of the manufacturing sector (million EUR) from the Trade by Enterprise Characteristics (TEC) dataset. The available data that can be compared from both datasets covers only the period 2016–2018. The numbers cited in the calculation refer to the average for the three years.

The combination of increasing demand for their products and decreasing capacity to expand their available work forces has stimulated firms to increase remunerations. In more recent years and especially after 2018 unemployment in Bulgaria reached historically low levels. At the same time, firms have been reporting increasing labour shortages and difficulties in hiring new employees (BNB, 2019), which forced them to compete with other firms on the offered remunerations. As a result, the growth of compensation per employee has been outpacing that of productivity, leading to an increase in the unit labour costs (ULCs). The growth in ULCs in Bulgaria has generally been stronger than the one in peer NMS countries over the whole period from 2000 to 2019.

The standard claim that is typically put forward in the analyses of the export performance in Bulgaria and the rest of the NMS, is that export competitiveness in these countries could be eroding due to the appreciation of the real effective exchange rate (REER) and the increase in ULCs (IMF, 2019; EC, 2020). However, the data on export dynamics shows that over the past 20 years the growth in ULCs and/or REERs across the region has been accompanied by simultaneous gains in global trade shares. This suggests that there are other factors apart from labour cost changes that are at play when it comes to explaining export performance. Moreover, the appreciation of REERs in countries like Bulgaria and the NMS could be seen as an equilibrium process reflecting ongoing real and nominal convergence.

The aim of this paper is to study in detail and assess quantitatively the drivers behind export dynamics in Bulgaria. Particular emphasis is placed on the analyses of the relative importance of price and non-price competitiveness for the export performance of the different manufacturing subsectors over time. The main contribution of this paper to the existing literature lies in linking directly sectoral labour cost developments to developments in sectoral exports of goods, thanks to the usage of EUROSTAT's recently published Trade by Enterprise Characteristics (TEC) database, as well as in complementing these analyses with firm-level data from the AMADEUS database. The paper also offers a systematic approach for quantitative assessment of the relative importance of price and non-price competitiveness in determining export performance by economic sector and a setup in which future export performance can be assessed. To the best of our knowledge this is the first attempt in existing literature to apply such type of analysis.

The structure of the paper is as follows: Section 2 contains a review of the existing literature on the measurement of competitiveness; Section 3 presents a descriptive analysis of the link between price competitiveness and export performance; Section 4 describes how the gap between external trade data and ULC statistics is bridged; Section 5 contains quantitative estimations of the relative importance of price and non-price competitiveness on exports dynamics in Bulgaria, using a state space framework; Section 6 summarises the findings in the paper and concludes it.

The analyses in the paper cover the time period up to the end of 2019. Therefore, it does not cover the effects of the COVID-19 pandemic on the export performance and competitiveness, which are likely to be quite significant and potentially, long-lasting. The pandemic has severely disrupted global supply chains and international trade and because of it a number of exporting firms would likely be forced to shut down their activities permanently. The firms that manage to overcome the negative effects of the COVID-19 pandemic would face a prolonged period of reduced demand for their products while the expected disruption of global supply chains and the expected re-centralization of some of the production would lead to lower productivity, especially for firms whose competitive advantage is heavily related to sourcing cheaper inputs through global supply chains. The potential lay-off of workers, related to the economic effects of the pandemic, on the other hand, could partially alleviate the labour shortages for the firms that overcome the COVID-19 pandemic.

2. Literature Review on Measuring Competitiveness

The literature on competitiveness is vast. However, there is no single definition of what competitiveness encompasses. Competitiveness is a multifaceted and relative concept and as such the analytical approaches towards the subject tend to be quite diverse. It is our understanding that competitiveness cannot mean simply having lower wages than other countries. It is better defined as the ability to achieve high levels of productivity, enabling a country to pay high wages while still maintaining adequate levels of exports for ensuring external balance (World Economic Forum, 2015). In this section we outline the key approaches on measuring competitiveness in the existing literature. Some of the more prominent research on the topic of competitiveness over the past 10 years, especially for EU countries, has been conducted by the Competitiveness Research Network[3].

[3] For more information, please refer to: https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_compnet.en.html.

2.1. Real Effective Exchange Rate and Unit Labour Costs

The most commonly used indicators for external competitiveness are the real effective exchange rate (REER) and the growth of unit labour costs (ULCs), relative to competitor countries. Major international organizations such as the International Monetary Fund (in their "Competitiveness and External Sector Assessment" exercise) and the European Commission (in their "Macroeconomic Imbalances Procedure" exercise) analyse the growth rate in ULCs and other metrics derived from it (such as the ULC-deflated REER), to assess the sustainability of export competitiveness of countries (IMF, 2019; EC, 2020).

The notion of the REER was first introduced by the theoretical framework of Armington (1969) and further developed by McGuirk (1987). REER can be derived as the deviation from multilateral purchasing power parity – a concept that holds empirically in its relative form over the long-run. The reliance on changes in ULCs and REERs as the only indicators for external competitiveness is in most cases unreliable since these indicators have some notable shortcomings (Myant, 2016). A change in relative ULCs or REERs is at best a proxy of price competitiveness in terms of the labour inputs in the production process. As such these competitiveness indicators omit important dimensions of export competitiveness which are not related to relative costs, such as quality of the product, lack of substitutes, brand recognition, location advantages and after-sales services (Benkovskis and Wörz, 2013; Collignon and Esposito, 2017).

The REER, its theoretical underpinnings and common analytical use rest on a set of restrictive assumptions. One crucial assumption states that consumers' utility depends solely on consumed quantities, thus attributing no role to product quality or taste (Benkovskis and Wörz, 2013). The REER was initially built to explain dynamics in models of perfect competition, where price is the single most important factor for competitiveness. And for a homogenous product like potatoes, consumers will generally prefer to buy the cheapest products. Many markets, however, do not fit the model of perfect competition and the price is only one of the many factors which determine consumers' product choice. In such markets quality of the product or other characteristics could be equally if not more important in the consumer's decision process and this is likely to be reflected in higher product price and hence in higher productivity.

Another highly restrictive assumption behind the REER comes from the lack of available data on prices and elasticities of substitution at the disaggregated product level. In order to overcome these data shortcomings, the calculation of a REER index relies on the restrictive assumption that changes in individual product prices are equal to those of an aggregate price index and the elasticity of substitution between any two suppliers is the same for each commodity (Benkovskis and Wörz, 2014).

Furthermore, the REER might not be an appropriate indicator when structural changes in the economies are taking place. Since most methodologies rely on using aggregate price measures, the REER fails to capture changes in the economic structure or sectoral shifts, especially in converging countries (De Broeck and Mehrez, 2012). This problem arises from the Balassa-Samuelson effect – the extent to which differences in productivity growth between tradable and non-tradable industries explain the observed differences in inflation between converging countries and the developed countries (Balassa, 1964; Samuelson, 1964). The Balassa-Samuelson effect has major implications for the interpretation of the REER. If the productivity growth differential between the traded and non-traded goods sectors is larger in the NMS as compared to the euro area average, the relative price of non-traded to traded goods will be rising faster in the former. Under a fixed exchange rate regime the Balassa-Samuelson effect will result in higher consumer price inflation and REER appreciation without this affecting negatively export competitiveness (Mihaljek and Klau, 2003). The reason is that the catching up process is driven mainly by technological innovation and productivity gains which mostly occur in the tradable sector. Growing prosperity then spills over to the non-tradable sector through wage growth and other price rises, causing REER appreciation in the whole economy above that of partner countries (Meshulam and Sanfey, 2019).

In addition, REER uses indices that depend on the choice of an arbitrary base year at which all countries start from supposedly equal conditions (Collignon and Esposito, 2017). This approach ignores the substantial disequilibria that may prevail at the moment when the index starts, so that the future evolution might reflect the adjustment of levels toward the equilibrium. The issue here is that an index shows cumulative changes; it says nothing about the level of relative costs and whether they reflect an equilibrium or disequilibrium in the arbitrarily chosen base year (Collignon and Esposito, 2017; Blandinières at al., 2017).

Another shortcoming of the REER as a measure of competitiveness was pointed out by Bems and Johnson (2015). Global supply chains alter the nature of international competition and the authors demonstrate this with a simple example. Consider how a yen depreciation affects Japan's trading partners in Asia. The conventional logic is straightforward: Japanese goods become more competitive, so consumers switch expenditure towards them. This lowers the demand for goods produced by other Asian countries. When input trade is important, this conventional logic is incomplete. Because Japan supplies inputs to Asian trading partners, the yen depreciation also lowers the downstream production costs for downstream Asian producers, making their goods more competitive and demanded. This counterbalances the demand-side expenditure switching channel. Which channel dominates is ultimately an empirical matter. Bems and Johnson (2015) point out that in conventional macro frameworks, each country's differentiated "product" competes against "products" from other countries on world markets. They argue that the rise of global supply chains has made this product-centric view obsolete: countries increasingly specialize in adding value at particular stages of production, rather than in producing entire finished products.[4] This has important implications for Bulgaria, which is one of the EU countries with the highest score in terms of participation in global supply chains (Ivanova and Ivanov, 2017).

2.2. Modification of the REER and Alternative Relative Price Indices

A strand of the literature has focused on trying to improve or substitute the REER as an indicator for competitiveness. This is probably the most common approach to analysing competitiveness apart from the standard REER/ULCs approach (Blandinières at al., 2017). As discussed in the previous section, the calculation of a REER relies on several restrictive assumptions, but recent literature on the topic has begun to question these assumptions (Benkovskis and Wörz, 2014).

In this regard Spilimbergo and Vamvakidis (2003) argue that if the assumption of constant elasticity of substitution is valid, then splitting the real exchange rate into components should not increase its predictive power in an export demand equation. They perform empirical investigations on a panel of 56 countries over 26 years and find that the elasticity of exports to the REER with respect to the Organisation for Economic Co-operation and Development (OECD) countries is less than with respect to non-OECD countries. Their findings do not support the assumption of constant elasticity.

De Broeck and Mehrez (2012) develop a disaggregated statistical approach for examining competitiveness. Based on ULCs at the three-digit level of disaggregation of industry data in a group of comparable countries, the paper estimates unit labour cost norms for each industry in each country and measures short-term competitiveness in each industry and country in terms of deviation from the norm. They use an econometric estimation, based on a panel dataset of 9 Central and Eastern European countries and 65 industries between 1994 and 2008. Their results show significant differences in the importance of

[4] For more examples, refer to Bayoumi at al. (2018).

relative ULCs across sectors, countries and period, highlighting the difficulties in using aggregate measures such as the economy-wide ULC-deflated REER.

Benkovskis and Wörz (2013) proposed the use of an adjusted relative export price index as a measure of competitiveness. This indicator is similar to the unit-value based REER but its advantage is that it is adjusted for the changes in quality, taste and variety. The adjusted relative export price index is derived by solving a utility maximization problem under the assumption that consumers value quality and variety. The analysis suggests that non-price competitiveness factors that are absent in the standard REER calculation have had a key role for the market share gains in large emerging market economies.

Gaulier and Vicard (2013) decompose ULCs into the share of labour compensations in nominal value-added (VA) and the price of VA using detailed sectoral data for euro area countries. They show that the bulk of the appreciation in ULCs is due to price developments in the non-tradable sector, explaining the disjunction between traditional measures of cost competitiveness (relative aggregate ULCs) and export performance.

Bems and Johnson (2015) modify the traditional REER indicators, arguing for recognition of the growing importance of vertical specialization and global value chains. To improve the performance of the REER, they derive a value-added REER and advocate the use of GDP deflators and trade measured in value-added terms. They show that input linkages enable countries to gain competitiveness following depreciations by supply chain partners, and hence counterbalance "beggar-thy-neighbour" effects. They also conclude that cross-country differences in input linkages imply that the elasticity of demand for value-added is country specific. The work of Bayoumi at al. (2018) is focused in the same direction and complements to a large extent the work of Bems and Johnson (2015).

2.3. Accounting Type Decompositions: Constant Market Share Analysis

Measuring changes in export market shares is an alternative way to assess a country's competitiveness, as rising market shares reveal a strong performance of a country's producers in international markets and vice versa (Blandinières at al., 2017). The "classical" constant-market share analysis (CMSA) was first applied to trade flows by Tyszynski (1951). In the following decades the methodology underwent various modifications, aimed at enriching its analytical features and tackling some issues with its application (Dyadkova and Momchilov, 2014). At its core all formulations of the CMSA try to explain the change in the aggregate export market share of a country by attributing it to two main factors – the particular structure of exports and the competitiveness of its products (Dyadkova and Momchilov, 2014). The key assumption is that a country's export share in a given market should remain unchanged over time, unless affected by additional factors such as competitiveness. The competitiveness factor in this setup is typically obtained as the unexplained residual from the accounting decomposition of the export growth, after accounting for the rise in external demand and the product and partner structure of the exporting economy.

Benkovskis and Wörz (2014) decompose the changes in export market shares using a demand-side oriented theoretical model in the spirit of Armington (1969). Specifically, they present a novel indicator that allows decomposition of changes in global market shares into several contributions, including price and non-price factors. What they find is that for all countries under consideration, the contribution of non-price factors (taste and quality) to cumulative changes in export market shares (competitiveness) is the strongest, while relative prices have the second largest contribution to competitiveness.

2.4. Equilibrium Wage Analysis

Collignon and Esposito (2017) proposed the use of the so-called "equilibrium wage" in analysing sectoral competitiveness instead of REER/ULC metrics. Their concept of nominal equilibrium wages avoids problems with the base year of price indices and provides information on the levels of the variable. Equilibrium wages are not market clearing wages, but the wage levels at which all sectors in the euro area would be on a balanced growth path, defined by having the same return on the capital stock, so that all regions and sectors grow at a uniform rate. The authors define "competitiveness" as the relation of actual wages to equilibrium ones. When a country or economic sector operates with wages higher than the equilibrium level, this implies that it is overvalued and suffering from competitive disadvantages. By contrast, when wages are lower than equilibrium, the sector has a competitive advantage. By including the return on capital in the analysis of competitiveness the authors also take into account some non-price competitiveness components, which are related to the amount of capital in the economy, as well as productivity. The idea behind the concept of equilibrium wages is that wages are part of production costs and as such they must be related to broader productivity developments, technological progress and the accumulation of capital, skills and knowledge. The famous Rehn-Meidner rule, whereby wages ought to increase by the rate of inflation plus labour productivity, ignores the impact of capital productivity on equilibrium wages (Collignon and Esposito, 2017). Unlike the Rehn-Meidner rule, the equilibrium wage concept allows wages to increase when either labour or capital productivity rises. The equilibrium is thus derived from the assumption that in perfect markets the return on capital in a given country ought to be equal to the return of competitors. The paper finds that in the transition economies of Central and Eastern Europe wages are highly undervalued.

2.5. Fixed Parameters from a Trade Gravity Model

Another strand of the literature focuses on estimating competitiveness based on the fixed parameters from trade gravity models. Böwer, Michou and Ungerer (2014) employ a gravity model of trade to explain the poor export performance of Greece. The model uses a dataset of bilateral value-added exports of goods and services of 39 exporters and 56 importers for 18 sectors. Constructing a competitiveness ranking based on the country fixed effects of their baseline regressions, the authors find that actual Greek value added exports fall short by 33% of the estimated value predicted by the model on average between 1995 and 2009.

2.6. Selected Country Studies

After having discussed some of the most widely-used indicators of external competitiveness it is also worth examining whether the detachment of the dynamics of cost competitiveness metrics (such as the REER) and of export performance is unique for Bulgaria, or whether it is encountered in other countries as well. It appears that this phenomenon is quite wide-spread and is common across Central and South Eastern European countries, as well as the so-called "periphery euro area" countries. This has given rise to labels such as "Spanish Paradox" (Cardoso, Correa-Lòpez and Doménech, 2012), which try to explain the absence of a negative relationship between REER appreciations and export performance. In the case of Spain the authors conclude that non-price determinants of competitiveness have been more important than export prices in explaining the change of world exports shares. Giordano and Zollino (2015) examine the usefulness of the REER in explaining export performance for the case of large euro area economies and find that for Italy and Spain it performs poorly and that non-price competitiveness proves important in explaining Italian and Spanish exports. However, such "paradoxes" are not specific to EU countries only. Benkovskis and Wörz (2013) analyse nine large emerging economies[5] over the period 1996–2011. The share of these emerging economies in world trade has risen strongly which cannot be explained by REER dynamics. Argentina is the only country among the group whose REER lies significantly below the levels observed in the mid-1990's. In contrast, China has shown an appreciation of its REER while its global market share has

[5] These countries are: Argentina, Brazil, Chile, China, India, Indonesia, Mexico, Russia and Turkey.

greatly increased over the same period. The authors show that China has made huge gains in international competitiveness due to non-price factors, such as quality. Similarly, Brazil, Chile, India and Turkey show improvements in their competitive position when accounting for non-price factors.

2.7. Previous Studies on Bulgaria

Previous studies on Bulgaria's export performance and its relation to competitiveness have focused mainly on assessing price competitiveness (typically through a REER-type indicator) and all of them have concluded that the appreciation of the REER has had a low negative or none at all effect on real export dynamics (Nenova, 2004; Stoevsky, 2009; Penkova-Pearson, 2011). However, a possible limitation of these papers is that they do not explicitly account to a sufficient degree for the dynamics of non-price competitiveness. This may result in underestimation of the contribution of price competitiveness to export dynamics, and the heterogeneity across economic sectors. For this reason, in our work we try to address these two areas and to build upon previous works. In order to model the effect of price and non-price competitiveness on export performance our paper uses as a foundation some of the work related to applied usage of the Constant Market Share (CMS) theory and the computation of alternative REER metrics (in our case these are sector-specific relative labour cost metrics), outlined in this section.

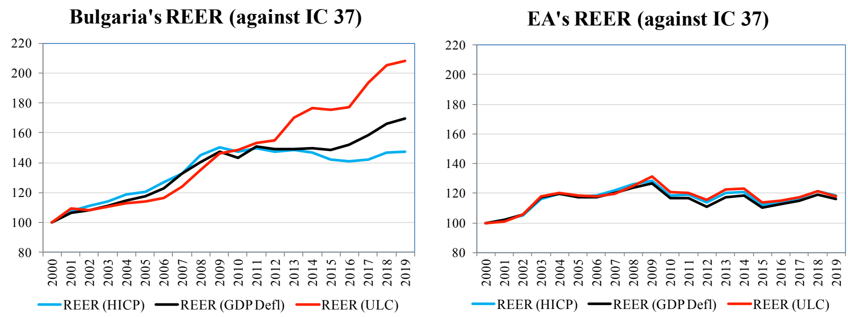
3. Descriptive Analysis of the Link between Price Competitiveness and Export Performance

3.1. REER and Export Performance in the Converging EU Member States

Since the REER is typically the starting point of any competitiveness analyses, the aim of this section is to investigate in details what the appreciation of the REER implies for Bulgaria and the NMS, what drives it, what are the different types of REER indicators and what are the implications for assessing the external competitiveness position of the economy.

The standard claim in more recent literature on export performance in Bulgaria and the rest of the NMS is that export competitiveness in these countries is likely eroding due to the appreciation of the REER, typically deflated with ULCs for the whole economy (IMF, 2019; EC, 2020). The ground for concern can be illustrated in Chart 1.

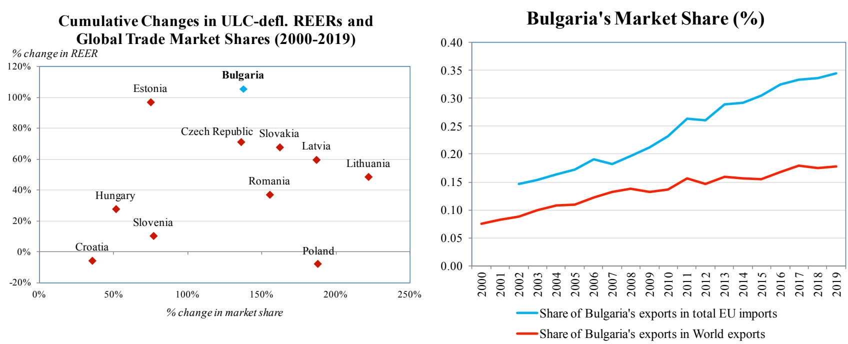
Chart 1. **BG's and EA's REER (against a group of 37 industrialised countries), Index 2000 = 100**



Source: European Commission.

In the last 20 years the REER of Bulgaria (especially deflated with ULCs) has appreciated significantly more than the REER of the EA. During that period, however, global trade market shares of Bulgaria and the NMS have been increasing steadily hand in hand with the appreciation of their REERs (see Chart 2), which highlights the limitations of using REER as a competitiveness metric.

Chart 2. **Disconnect between ULC and market share dynamics**



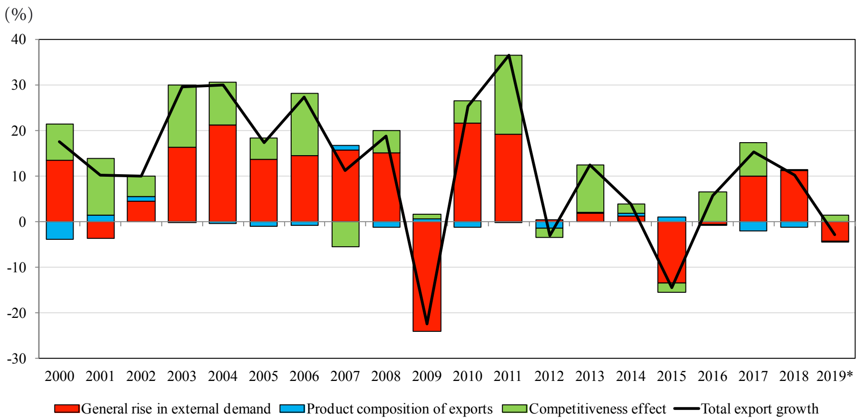
Sources: European Commission, EUROSTAT, AMECO, own calculations.

The accounting decomposition[6] of the nominal export of goods growth of Bulgaria suggests that the gains in market share are not just caused by exporting goods the demand for which grows faster than the world average (see Chart 3).

[6] Constant market share type decomposition.

This implies that the increase in Bulgaria's market share over the years is likely driven at least partially by competitiveness gains (see Chart 3).

Chart 3. **Constant Market Share (CMS) accounting-type decomposition of Bulgaria's nominal export growth in US dollars**



Notes: *The data used for the calculation is in US dollars, due to the global coverage of the calculation. For the world import we use the imports of the group of countries that are members of the World Trade Organisation (WTO). *Source data for 2019 is not yet fully finalised and could be revised.*

"Total Export Growth" in the graph presents the annual growth rate of the total export of goods of Bulgaria to the rest of the world in nominal terms, measured in US dollars.

"General rise in external demand" in the graph presents the annual growth of the combined total imports of all WTO members, measured in US dollars. According to the CMS theory, this is the growth rate that Bulgarian exports should maintain in order to sustain the country's market share in global trade at a constant level.

"Product composition of exports" in the graph presents an additional correction that is done on top of the "General rise in external demand" in order to account for the product structure of Bulgaria's exports. Since the demand for some product groups is growing more than for others, a country's market share in global trade could potentially increase even if the export growth for each product group matches the world import growth for the same group, due to the higher than average demand for this product. The factor "Product composition of exports" aims to correct for this phenomenon. As such the combination of the bars of "General rise in external demand" and "Product composition of exports" can be interpreted as the annual growth rate which is necessary for Bulgarian exports in order to maintain the country's market share in global trade for each product group at a constant level.

„Competitiveness effect" in the graph presents the accounting difference between the actual annual growth rate of the Bulgarian export of goods ("Total Export Growth") and the hypothetical annual growth rate that Bulgaria would have to sustain in order to keep its market share in global trade unchanged, taking into account the correction done for the export product structure of Bulgaria (sum of the components "General rise in external demand" and "Product composition of exports"). Given the fact that this component is obtained as a residual, it should be interpreted with caution, since its dynamics can be caused by a number of things, which are not necessarily related to competitiveness, such as difference in relative export/import price dynamics.

Sources: World Bank's WITS database, own calculations.

These observations are in conflict with the conventional understanding of the relationship between REER and export growth. Therefore, we analyse in more detail what causes the REER appreciation in Bulgaria by looking at its components.

The REER represents a deflated version of the nominal effective exchange rate (NEER). The NEER tracks changes in the value of a given country's currency relative to the currencies of its principal trading partners. For clarification purposes we show that it is calculated as a weighted average of the bilateral exchange rates with the currencies of its main trading partners.

$$NEER_t = \prod_{i=1}^{n} (E_{i,t})^{w_i}$$

n = number of trading partners in the basket

$E_{i,t}$ = index of the average exchange rate of the currency of trading partner i *vis-à-vis* the domestic currency in period t. The interpretation of the index here is the amount of foreign currency per one unit of domestic currency

w_i = weight of the i trading partner's currency in the basket

An increase of the NEER index in our case indicates an appreciation of the domestic currency relative to the basket of currencies of the chosen trading partners in nominal terms.

Given the above formula, the group of competitor countries selected for the calculation of the NEER of a specific country is an important determinant for the overall dynamics of the NEER of this country. The European Commission (EC), which is one of the most popular sources of data for effective exchange rates for EU countries, uses four alternative groups of competitor countries[7]:

– a broad group of 42 countries (BG42);

– a group of 37 industrial countries (IC37);

– EU Member States;

– EA countries.

We discuss the implications from using the alternative groups of competitor countries on the NEER and REER later in the section.

Changes in cost and price competitiveness depend not only on exchange rate movements but also on cost and price trends. To account for this the REER assesses a country's (or currency area's) price or cost competitiveness relative to its principal competitors in international markets.

[7] For more information, see the section on "Price and Cost Competitiveness" on the website of the EC: https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/price-and-cost-competitiveness_en.

$$REER_t = \prod_{i=1}^{n} \left(\frac{E_{i,t} * P_{d,t}}{P_{i,t}} \right)^{w_i}$$

n = number of trading partners in the basket

$E_{i,t}$ = index of the average exchange rate of the currency of trading partner i *vis-à-vis* the domestic currency in period t. This is equivalent to the amount of foreign currency per one unit of domestic currency

w_i = weight of the i trading partner's currency in the basket

$P_{i,t}$ = price deflator in country i at time t

$P_{d,t}$ = price deflator in domestic country at time t

An increase of the REER index in our case indicates an appreciation of the domestic currency relative to the basket of currencies of the chosen trading partners in real terms.

The REER corresponds to the NEER deflated by selected relative price or cost deflators:

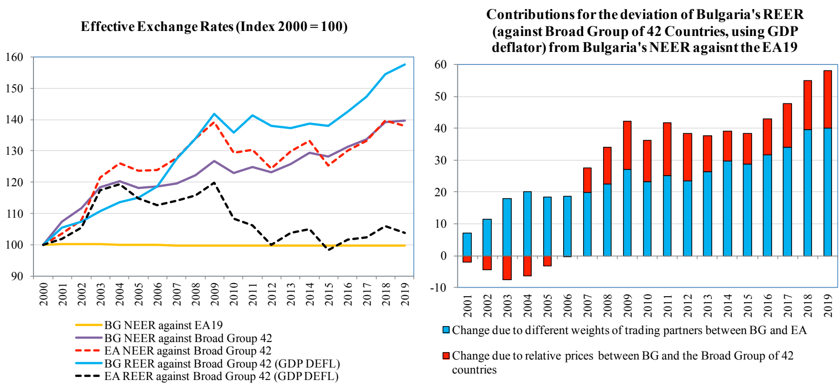
$$REER_t = \frac{P_{d,t}}{\prod_i (P^*_{i,t})^{w_i}} NEER_t$$

The deflators used by the EC are consumer price indices (CPI and HICP where available), the GDP deflator, the price deflator of exports of goods and services, and ULCs for the economy as a whole. Each one of them has its strengths and weaknesses (Schmitz at al., 2012). For example, the CPI/HICP baskets include many non-tradable goods and services, while they exclude capital and intermediate goods. This makes the CPI less useful for analysing international competitiveness, particularly if there are significant differences in productivity between the tradable and non-tradable sectors. Moreover, consumer prices can be distorted due to taxes and subsidies. However, this indicator is widely available for a large number of countries, which is not the case for all price deflators. The GDP deflator focuses on the production side of an economy and is one of the most preferred choices for a REER deflator (Blandinières at al., 2017). While this also includes non-tradable goods, it suffers from distortions stemming from taxes and subsidies. Using ULCs for the total economy has the disadvantage that also reflects costs in non-tradable goods. In addition, they do not cover all of the costs incurred by firms (*e.g.* the cost of capital, distribution costs and taxes are excluded). Moreover, factor substitution may affect these indicators without necessarily resulting in a change in productivity. Ideally, ULCs of the different economic sectors should be weighted in such a way as to reflect the exporting structures of a country and its competitors. However, this is very difficult to achieve in practice, so the institutions that compile REER statistics typically stick to using either ULCs for the total economy, or at best ULCs in the manufacturing sector, which is supposed to capture most of the export-oriented activities.

The calculation of the REER is data-intensive and the availability of the price deflators varies across the four alternative groups of competitor countries. More preferable deflators, such as sector-specific ULCs, are not available for a large number of the countries from the group of competitors. As illustrated in Chart 1 the choice of a deflator for the calculation of the REER leads to a notable difference in the final results for Bulgaria. The REER deflated with ULCs points to the largest appreciation, while the one deflated with HICP points to similar dynamics of the REER to that of the NMS and EA countries.

The fact that the REER is essentially a deflated NEER is convenient, since it allows us to perform an accounting decomposition of the changes in the REER into changes due to the underlying NEER and changes due to the relative price deflators (see Chart 4).

Chart 4. **Relevance of the choice of group of competitors in the calculation of the REER**



Sources: European Commission, own calculations.

In Chart 4 we demonstrate the importance of the choice of the group of competitor countries. For illustration purposes the broadest available group of competitor countries from the EC's database is chosen (BG42: consisting of 42 countries)[8] and the REER, obtained using the GDP deflator, is selected. The left-hand side graph shows that the NEER of Bulgaria against the euro area countries is constant at the value of 100, as would be expected due to the functioning of the currency board in Bulgaria that fixes the value of the BGN to that of the EUR. However, when the group of competitor countries is broadened to BG 42 economies, there is a notable difference between the dynamics of the NEER of Bulgaria and that of the EA, especially in the period 2003–2012. In that period the NEER of Bulgaria appears to be appreciating much more than that of the EA. The only underlying factor that has changed is the competitor countries' composition. This is why in the right-hand side graph the blue bars that represent the *"Change due to the different weights of trading partners b/n BG and EA"* is simply calculated as the difference between the index (2000 = 100) of the BG NEER (against EA19) and the index (2000 = 100) of the BG NEER (against BG42). Since both indices are set at 100 for the year 2000, their dynamics represent the cumulative change of the NEER relative to the base year 2000. In a similar fashion the *"Change due to relative prices between BG and EA"* is calculated as the difference between the index (2000 = 100) of the BG NEER (against BG42) and the index (2000 = 100) of the BG REER (against BG42). Since Bulgaria's NEER (against BG42) and REER (against BG42) have the same base year it can be concluded that all differences in their dynamics throughout the years are caused entirely by changes in the relative prices. As a final point on the right-hand side graph, it can be noted that by the end of 2019, most of the cumulative difference in the indices of Bulgaria's NEER (against EA19) and Bulgaria's REER (against BG42) are due to the different weights of trading partners, rather than the relative price changes, which has typically been the first suspect for the appreciation of the REER.[9]

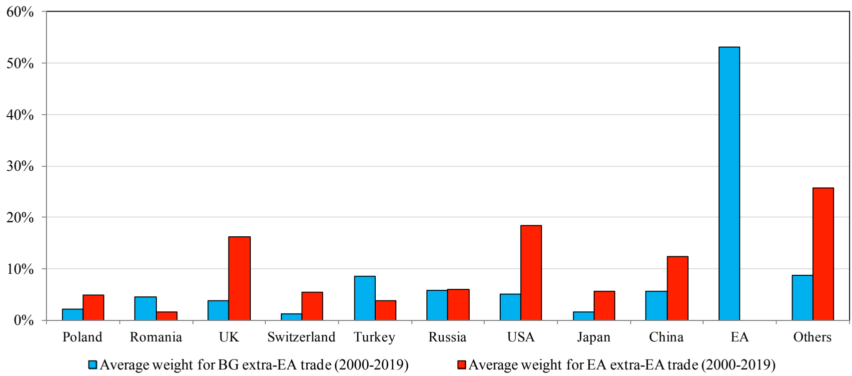
A closer look at the trade competitors' weights that the EC uses in their calculations of the NEER and the REER reveals that intra-EA trade is ignored in the calculation of the EA's NEER, while for Bulgaria, trade with the EA accounts for around 53% of the average weight of trade flows. Another important observation is that for Bulgaria the weight of currencies of neighbouring

[8] The countries that enter this broad group of 42 countries (BG 42) are the EU27 member states, Australia, Canada, Japan, Mexico, New Zealand, Norway, Switzerland, Turkey, United Kingdom, USA, Brazil, China, Hong Kong, Korea, and Russia. We consider this group as more representative for the external trade of Bulgaria, since the smaller group of 37 industrialized countries (IC 37) omits two key trading partners on the import side of Bulgaria – China and Russia. However, a notable disadvantage of using BG 42 instead of IC 37 is that the only deflators available for the calculation of the REERs for the BG 42 are the CPI and GDP deflators but ULCs are not available.

[9] We note that in this calculation, due to data limitations, the REER is obtained by using the GDP deflator, rather than the ULCs, which leads to a lower appreciation of Bulgaria's REER (see Chart 1) and would imply possible underestimation of the contribution of relative prices, especially in more recent years.

counties like Turkey and Romania is much higher than it is for the EA. At the same time in the calculation of the NEER/REER of the EA, global reserve currencies like the US Dollar, British Pound, Japanese Yen and Swiss Franc are much more important than they are for the calculation of the NEER/REER of Bulgaria. Chart 5 shows the average weights for the period 2000–2019 for both Bulgaria's and EA's trade partners. It should be noted that the weights tend to vary from year to year and this has important implications for the calculation of the REER and the NEER, since the indices of the bilateral exchange rates are raised to the power of the trade weights and even seemingly small changes in the weight of a given trade partner can result in a notable change in the NEER/REER index.

Chart 5. **Relevance of the choice of group of competitors in the calculation of the NEER/REER (against a Broad Group of 42 countries)**



Sources: European Commission, own calculations.

Having the weights of the competitor countries that are used in the calculation of the NEER/REER of Bulgaria and the EA allows us to calculate the contributions of different currencies towards the overall change of the NEERs. The results from this decomposition are presented in Appendix 1.

This section shows that the dynamics of the REER for Bulgaria and the degree of its appreciation relative to the REER of the EA is highly dependent on the choice of competitor groups and largely determined by the weights of the trading partners. Moreover, a particular attention should be paid to the deflator based on which the REER is obtained in the first place. For the case of Bulgaria the deflator that leads to the strongest appreciation of the REER is the ULC, which is why Section 3.2 discusses the driving factors behind the growth in ULC in Bulgaria.

3.2. Driving Factors behind the Dynamics of ULCs in Bulgaria

The aim of this section is to investigate the reasons behind the notable ULC growth in Bulgaria. The growth rate in ULCs and metrics derived from it (such as the ULC-deflated REER) are widely used to assess the sustainability of export competitiveness of countries. The standard argument is that if wages rise faster than productivity, then prices can be expected to rise and competitiveness to fall, leading to a current account deficit (Myant, 2016). The current account deficit should then be corrected by devaluation of the currency. In the specific cases of Bulgaria and the EA countries, where devaluations are not possible, there will be no means to correct the imbalance, which can be expected to continue and grow with time. Under such circumstances it is more likely that a correction of the imbalances would eventually materialise through crisis-like developments on the side of the real economy.

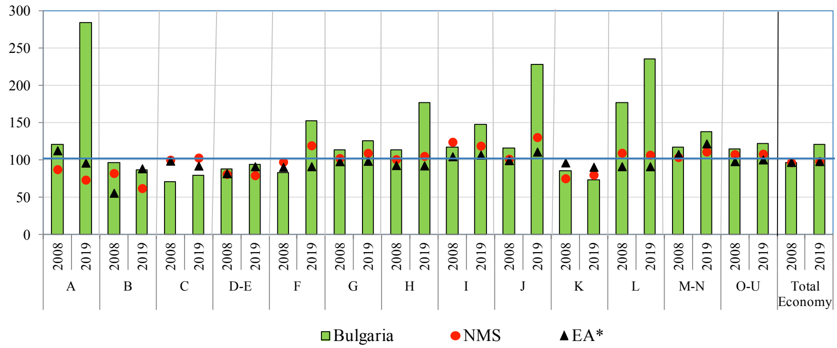
A shortcoming of the described mechanism is that most such analyses are confined to using ULCs for the whole economy, since detailed sectoral ULCs are often not available for countries outside the EU. Aggregate ULC-based indicators are affected by shifts in the composition of output and by sector-wide changes that could be misinterpreted as changes in external competitiveness (De Broeck and Mehrez, 2012). For instance, aggregate ULCs will be affected by shifts between sectors with different labour intensity (and different ULCs). ULCs may also reflect various sector-specific developments with no direct impact on external competitiveness. For example, an improvement in the global technology (or price) in a given sector could lead to lower ULCs in that sector across the globe, and to a corresponding reduction in the aggregate ULCs of the countries in which that sector operates. However, this drop in ULCs does not imply that the sector is now more competitive (De Broeck and Mehrez, 2012). Furthermore, one reason why ULCs may differ across industries is that sectors are imperfectly competitive, prices include monopoly profits, and some of these profits are captured by workers. This is why in this section we try to address this issue by looking at disaggregated sectoral ULCs at the most detailed breakdown that is available (A64 sectoral breakdown as defined in the National Accounts statistics).

ULCs are typically defined as the ratio between the compensation *per* employee (CPE) and the labour productivity as illustrated below:

$$ULC = \frac{CPE}{Labour\ Productivity}$$

Chart 6 reveals that real ULCs[10] for the whole economy have grown by much more in Bulgaria than in the EA, or the rest of the NMS since the early 2000s. However, what can be seen in Chart 6 is that the cumulative growth of ULCs relative to 2000 is stronger in Bulgaria than in the EA and the NMS because of several economic sectors (classified predominantly as non-tradable), which is likely caused by Balassa-Samuelson effects (Mihaljek and Klau, 2003).[11] Namely, these are the *agricultural* sector, the *real estate activities and construction* sectors, the *information and communications* sector, the *transportation and storage* sector, the *wholesale and retail trade* sector and the *public administration, defence, education and healthcare* sector (in which the cumulative increase in the ULCs is not that big but the sector has a significant share in both total value added and employment in Bulgaria). On the other hand, ULCs in the *manufacturing* sector, which is the one that generates the bulk of the export of goods volumes (see Section 4), appear to have decreased relative to 2000, especially in the period up to 2008.

Chart 6. **Real ULC by aggregate sectors, index 2000 = 100: Bulgaria, euro area, EU new member states (NMS)**



A – Agriculture B – Mining and quarrying C – Manufacturing D–E – Electricity, gas, steam, water
F – Construction G – Wholesale and retail trade H – Transportation and storage I – Accommodation and food service
J – Information and communication technical, admin, activities K – Financial and insurance L – Real estate activities
M–N – Scientific O–U – Pub admin, def, edu, health, arts, entertain

** The latest available data for the euro area is for 2018.*

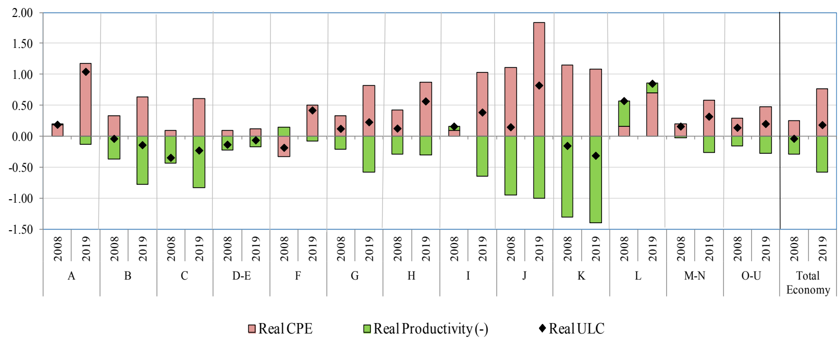
Sources: EUROSTAT, own calculations.

[10] We define "real ULCs" as the ratio of real compensation per employee (obtained by dividing the sector-specific nominal CPE in millions EUR by the respective sectoral gross value added deflator) and real productivity (obtained as the generated real value added per person employed in chain-linked volumes for a given economic sector). In this aspect the definition that we use is similar to the one used by the AMECO database.

[11] An in-depth discussion of the implications of the convergence and the Balassa-Samuelson effect for the Bulgarian economy are presented in Nenova (2004) and Чукалев (2010).

In order to obtain additional information on the drivers of the ULC growth in Bulgaria we decompose the ULC index for each sector into its two building blocks – compensation per employee and labour productivity. In Chart 7 we present the logarithmic transformation of the sectoral real ULCs and their building blocks (real CPE and real productivity) for Bulgaria, the EA and the NMS. The logarithmic transformation is an approximation of the actual ULC dynamic but it allows us to get additive contributions of the building blocks of the index. The contributions are calculated relative to the level of the ULC index in 2000. For example, the contribution of the growth of productivity in the *manufacturing* sector between 2008 and 2019 is represented by the difference between the two green bars that track the contribution of real productivity in Chart 7 for 2019 and 2008. In that particular example, the contribution of productivity towards the ULC growth between 2008 and 2019 in the *manufacturing* sector becomes more negative, which means that productivity has actually increased during this period.

Chart 7. **Cumulative contribution to real ULC change relative to 2000 by sectors (difference in natural logarithms of the respective components), Bulgaria**



A – Agriculture B – Mining and quarrying C – Manufacturing D–E – Electricity, gas, steam, water
F – Construction G – Wholesale and retail trade H – Transportation and storage I – Accommodation and food service
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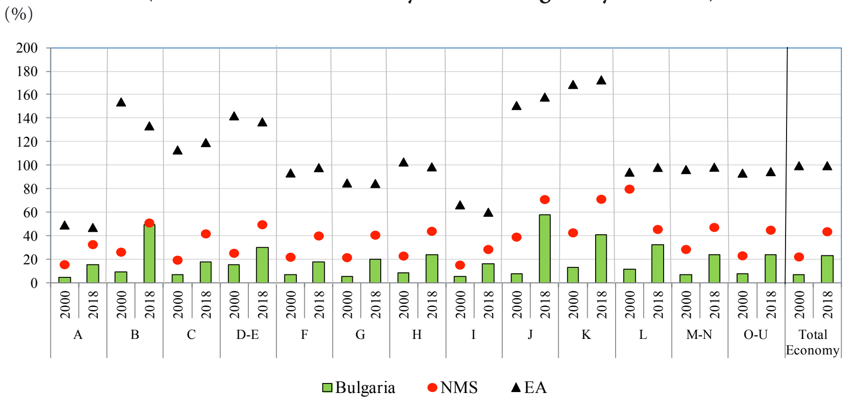
Sources: EUROSTAT, own calculations.

Chart 7 reveals that for most of the sectors that recorded notable increases in ULCs the main factor was the strong growth in real CPE that was not compensated by an equivalent increase in labour productivity. This is especially true for the *agricultural* sector, the *transport and storage* sector, the *wholesale* *and retail trade* sector, the *information and communications* sector and the *public administration, defence, education and healthcare* sector. For some of these sectors that are characterised by predominantly non-tradable products a significant part of the increase in CPE beyond that of productivity can be attributed to Balassa-Samuelson effects (Mihaljek and Klau, 2003), since Bulgaria is still a country that is undergoing real and nominal convergence. A notable example is the *public administration, defence, education and healthcare* sector, which is also one of the largest sectors in terms of value added and employment.

A case that deserves particular attention is the *information and communications* sector, where up to 2008 the increases in real CPE were more or less offset by increases in real productivity. After 2008 real CPE in the sector continued to increase, while productivity has remained almost unchanged. This sector includes IT services which can be sold internationally at very low transaction, time and transport costs. Moreover, offshoring of such activities away from developed economies towards countries with relatively cheaper labour in absolute terms has been a widespread practice (Liu and Trefler, 2011). This makes the difference in absolute levels of compensation per employees quite relevant, since they are the key factor that determines the final price of the products in this subsector (see Chart 8). Using nominal CPE is not the optimal option for such a comparison, since it ignores differences in price level, or the so-called purchasing parity standards (PPS), but sectoral CPE, corrected for the PPS, are not available. This is why the comparison of nominal CPE across countries should be made with caution. Nevertheless, it gives an overview of how absolute labour costs for firms look like across countries. Bulgaria's total economy CPE as of 2018 is 23% of that of the EA and the *information and communications* sector is the one where the Bulgarian compensations per employee are closest to that of the EA (standing at close to 37% of the EA levels in EUR).

Chart 8. **Nominal compensation *per* employee (CPE) by economic sectors in Bulgaria, euro area, and EU new member states (euro area's total economy CPE in the given year = 100)**



A – Agriculture B – Mining and quarrying C – Manufacturing D–E – Electricity, gas, steam, water
F – Construction G – Wholesale and retail trade H – Transportation and storage I – Accommodation and food service
J – Information and communication technical, admin, activities K – Financial and insurance L – Real estate activities
M–N – Scientific O–U – Pub admin, def, edu, health, arts, entertain

Note: *Nominal CPE for Bulgaria, NMS and EA for each economic sector is represented as a share of EA's total economy CPE for the respective year. Therefore EA total economy CPE for both 2000 and 2018 is equal to 100.*

Sources: EUROSTAT, own calculations.

This observation implies that the companies in the IT sector in lower-wage countries can allow CPE to increase more than productivity and still be able to offer comparable quality at a lower price for their final products than their higher-wage competitors. As a result, this sector is capable of increasing its share in both total gross value-added and total employment despite that ULC growth outpaces significantly productivity growth (see Chart 7). Of course, the strong growth of ULCs even under these conditions implies that Bulgarian firms in this sector could have likely reduced their supposedly superior profit margins (due to the cheaper in absolute terms labour costs) in order to accommodate the part of the increase in CPE that goes beyond the increase in productivity or have managed to reduce their other operating expenses.

Apart from the standard CPE/Productivity ratio, ULCs can be decomposed in alternative ways. From the CPE/Productivity ratio it can be mathematically derived that the ULC is also equivalent to the product of the ratio of employed (EMPL) to employees (EES) and the ratio of compensation of employees (COE) to value added (VA):

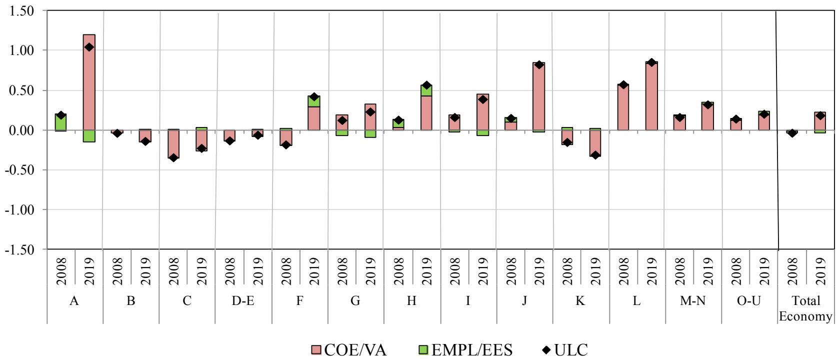
$$ULC = \frac{COE}{VA} * \frac{EMPL}{EES}$$

This decomposition can shed more light on whether structural changes that include people switching between being self-employed and being employees has also affected *ULC* dynamics. This is especially noteworthy for the *agricultural* sector, where the self-employed typically have a much higher share in total employment, as compared to other sectors and where structural changes in the economy have led to a significant decline in the sector's share in total value-added and employment (see Chart 9).

Chart 9. **Real ULC by aggregate sectors and its building blocks: Bulgaria, euro area, EU new member states**

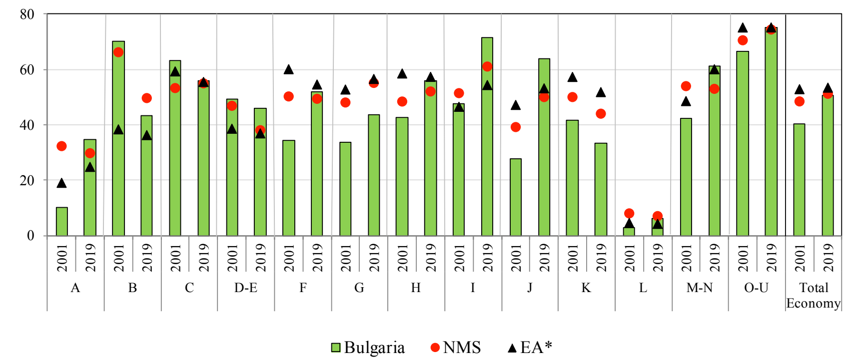
A – Agriculture B – Mining and quarrying C – Manufacturing D–E – Electricity, gas, steam, water
F – Construction G – Wholesale and retail trade H – Transportation and storage I – Accommodation and food service
J – Information and communication technical, admin, activities K – Financial and insurance L – Real estate activities
M–N – Scientific O–U – Pub admin, def, edu, health, arts, entertain

9a. Cumulative contribution to ULC change relative to 2000 by sectors, Bulgaria (natural logs of the respective components)

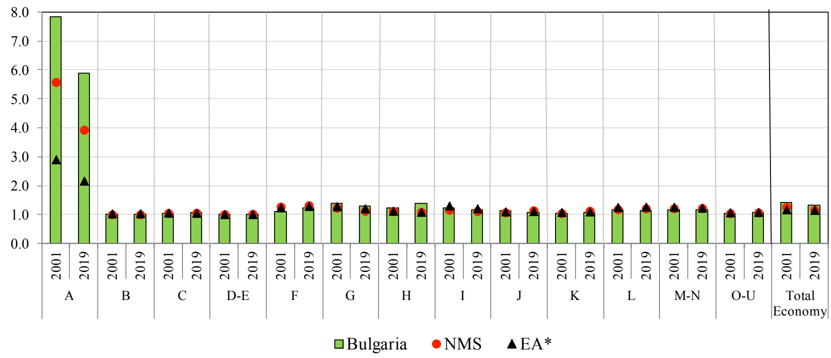


9b. Share of compensation of employees in value added by aggregate sectors

(%)



9c. Ratio of employed to employees by aggregate sectors



** The latest available data for the euro area is for 2018.*

Sources: EUROSTAT, own calculations.

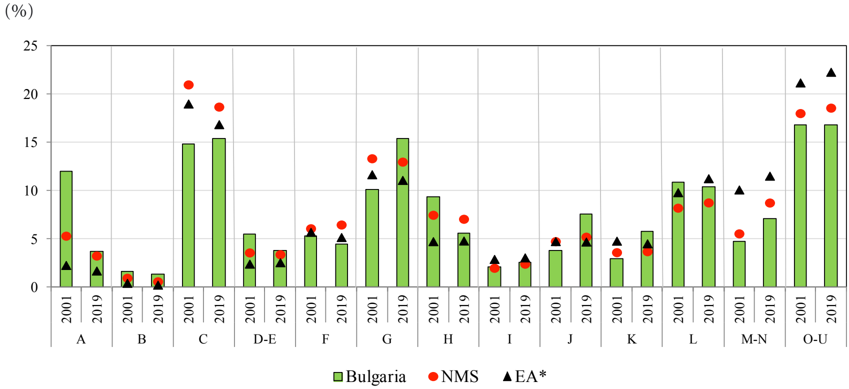
The data shows (see Chart 9a) that the ratio of employed to employees is not as important in explaining the ULC growth in Bulgaria as the ratio of compensation of employees to value added. The only exception, as expected, is the *agricultural* sector, where between 2000 and 2008 the growth in the ULCs could entirely be attributed to changes in the ratio of employed to employees. The changes in the ratio of employed to employees also appears to have contributed positively to the growth of ULCs in the *transport and storage* and the *construction* sectors.

Almost all of the Bulgarian sectors which exhibited strong ULC growth (with the exception of *financial and insurance*, *public administration and construction* sectors) tend to have a relatively higher share in Bulgaria's total gross value added, as compared to that in the EA and NMS (see Chart 10). Interestingly, for most of these sectors we observe an increase in their share in total gross value added relative to the early 2000s, despite the observed significant increases in their ULCs during the same period. The sectors in Bulgaria with strong ULC growth, which lost share in the total value added during the period 2001–2018, are the *agricultural* sector and the *transport and storage* sector. Data on employment (see Chart 10b) reveals that the shares of most of the sectors in total employment in Bulgaria, the EA and the NMS are more or less similar. For Bulgaria the share in total employment of the *agriculture* sector has declined between 2001 and 2019.

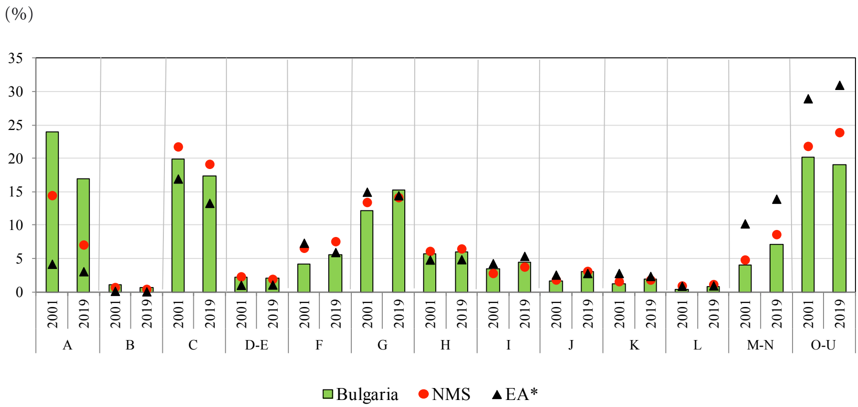
Chart 10. **Evolution of the shares of economic sectors in total value added and employment: Bulgaria, euro area, EU new member states**

A – Agriculture B – Mining and quarrying C – Manufacturing D–E – Electricity, gas, steam, water
F – Construction G – Wholesale andretail trade H – Transportation and storage I – Accommodation and food service
J – Information and communication technical, admin, activities K – Financial and insurance L – Real estate activities
M–N – Scientific O–U – Pub admin, def, edu, health, arts, entertain

10a. Share in value added by aggregate sectors



10b. Share in total employment by aggregate sectors



** The latest available data for the euro area is for 2018.*

Sources: EUROSTAT, own calculations.

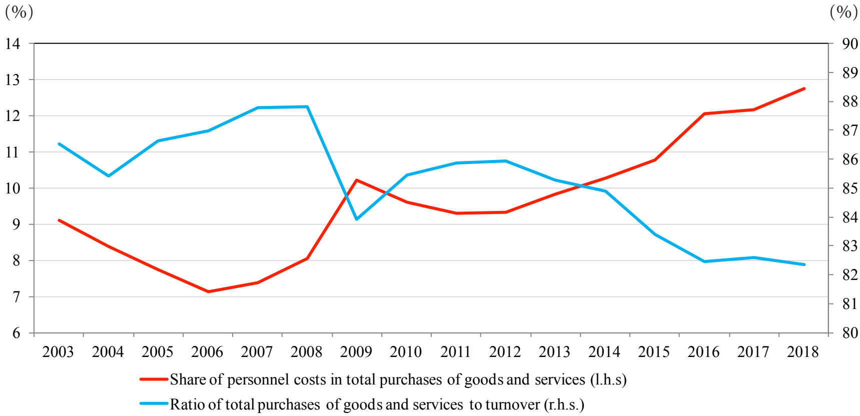
Based on this section it can be concluded that the cumulative growth of ULCs relative to 2000 is stronger in Bulgaria than in the EA and in the NMS because of several economic sectors. These sectors are not the ones that generate the bulk of the export of goods volumes and are characterised by predominantly non-tradable products. We attribute part of the increase in CPE beyond that of productivity in these sectors to Balassa-Samuelson effects, since Bulgaria is still undergoing real and nominal convergence. The notable increases in ULCs were typically caused by the strong growth in real CPE which was not compensated by an equivalently strong increase in labour productivity. The ratio of employed to employees is generally not as important in explaining the ULC growth in Bulgaria as the ratio of compensation of employees to value added. Almost all of the Bulgarian sectors which exhibited strong ULC growth in the period 2000–2018 (except *agriculture* and the *transport and storage*) managed to increase their share in total gross value added and employment relative to the early 2000s, which is a positive sign for the economic developments in those sectors.

3.3. Other Factors that Influence the Strength of the Link between ULC Growth and Competitiveness

The growth of ULCs alone is not sufficient to make conclusions on the viability of production of a given economic sector or its export competitiveness. However, when sustained over prolonged periods of time, ULC growth indicates that labour cost pressures are mounting in the particular sector. Such dynamics may put into question the viability of production unless one of the following happens:

1) Firms offset the increases in labour costs by reducing other production costs, such as material costs or operating expenses, leaving final prices of the products and profits unchanged. Different sectors operate with different cost of production structures. The significance of labour costs can be particularly high in services sectors but could be quite low in some capital- and material-intensive raw material extraction activities. The globalisation of production and the increased participation in GVCs have boosted production efficiency and have allowed firms to acquire input resources at lower rates, leaving them with more space to accommodate increases in labour costs, while at the same time maintaining final prices (Blandinières at al., 2017). Chart 11 demonstrates that this is exactly the case in Bulgaria.

Chart 11. **Labour and total costs for firms in Bulgaria**



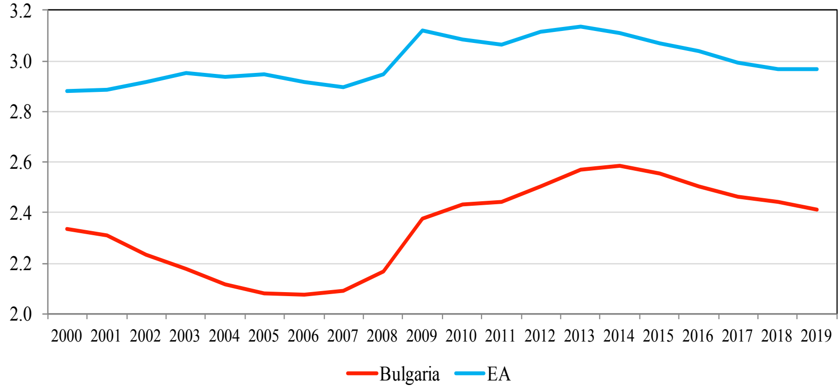
Notes: The series "Share of personnel costs in total costs" and "Ratio of total purchases of goods and services to turnover" are own calculations, based on EUROSTAT data from the Structural Business Statistics. The calculations are made for the total business economy sector (industry and services, except financial intermediation). Data for 2019 has not been published yet.

Sources: EUROSTAT, own calculations.

The share of labour costs in total costs in Bulgaria has increased after 2003 but its level remains low: 12.8% of total costs in 2018 versus 9.1% in 2003. For comparison, the same ratio in 2018 is 23.6% in Germany and 15.2% on average across the NMS. What is more, there is evidence of a compensating reduction in the costs of other production inputs. This can be concluded on the base of the ratio of total purchases of goods and services to total turnover, which in Bulgaria fell from 86.5% in 2003 to 82.4% in 2018;

2) In the longer-term firms appear to be increasing the capital-intensity of their production while reducing labour-intensity. As a result, labour costs per employee would increase but overall labour costs would remain constant or at least increase by less than per employee costs. This means that firms can keep their profits and the final prices of their products more or less unchanged, if the costs of the switch from labour to capital production inputs are not counted. A trend towards more capital-intensive production has been observed in certain manufacturing sectors in Bulgaria, where specific tasks have been robotised.

Chart 12. **Capital-to-output ratios in Bulgaria and the euro area**



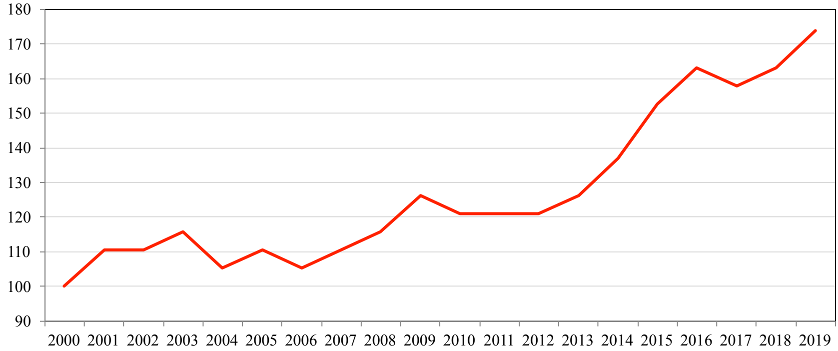
Source: AMECO.

Chart 12 reveals that the capital-intensity of production in Bulgaria has increased compared to its early 2000s levels, despite still falling short of the euro area level. This increase could also be considered a factor that allows firms to offset some of the labour costs increases;

3) Firms increase final prices without decreasing their profits. This is possible if the firms have sufficient market power or produce goods/services that have no close substitutes, or these products are differentiated by consumers for their quality and reputation and as such have low price elasticity to demand. An increase in the quality of the exported products has typically been put forward as the key factor behind global trade share increases that happen despite increasing labour costs (Benkovskis and Wörz, 2014). The intuition is that if the increase in the labour costs also leads to better quality of the products, then the export viability is less likely to be negatively affected by the labour cost increases.

Chart 13. **Technological intensity of Bulgaria's exports**

(index 2000 = 100)



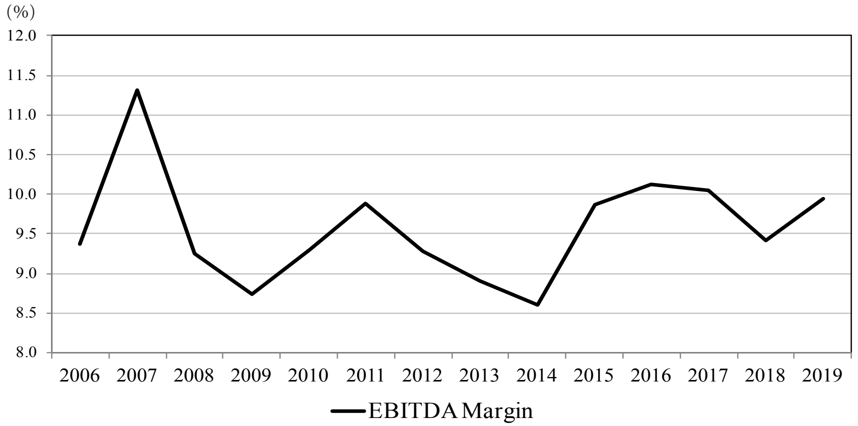
Notes: The series "Mid- and High-Tech Products in Total Exports" is constructed by the authors from the WB's WITS Trade Outcomes database, linked to the UN COMTRADE database. The data in WITS Trade Outcomes database is originally divided into five mutually exclusive technological groupings: high tech, medium tech, low tech, primary products, and resource-based products. The data in the graph presents the sum of the shares of mid- and high-tech products in total exports. This share is then transformed into an index with 2000 as a base year.

Sources: World Bank's WITS, UN COMTRADE, own calculations.

Chart 13 suggests that Bulgaria is switching more and more to the production and exports of mid- and high-tech products, which is consistent with a gradual export upgrading and climbing up the "quality ladder", as a result of the closer integration of the country in global value chains and the significant inward FDI inflows (Bajgar and Javorcik, 2019). As a result of the increased quality and sophistication of the exported products, it is intuitive to assume that labour costs would increase to accommodate the more knowledge-intensive nature of the production process;

4) Firms that operate with comparatively high profit margins choose to reduce them in order to meet the increased labour costs, keeping production factors and final prices of their products unchanged. Chart 14 reveals that firms in Bulgaria used to have a higher profit margin before the global financial and economic crisis of 2008/2009. Since then the margin has stabilised at a lower level, which does not seem to have decreased further in the last 10 years when ULCs increased and the REER appreciated more substantially. This suggests that Bulgarian firms have managed to redirect most of the adverse effects of the labour cost increases away from their profit margins.

Chart 14. **Profit margin in Bulgaria (total economy)**



Notes: The series "EBITDA Margin"[12] is calculated by the BNB based on firm-level data from the Bureau van Dijk's AMADEUS database. It represents the EBITDA margin in % (EBITDA/Operating revenue * 100) for the whole Bulgarian economy, defined as consisting of all firms in Bulgaria with more than 1 employee and more than 1,000 EUR of annual turnover. Filtered this way, the sample contains information on 363,347 firms out of the total 569,149 firms, available for Bulgaria in the AMADEUS database. The sample available to the authors for this indicator starts in 2006.

Sources: AMADEUS, own calculations.

If firms cannot react in one of the four described ways, a prolonged increase in labour costs would put into question the sustainability of the production process, which is also related to the sustainability of export competitiveness. It is apparent that factors such as product quality, capital intensity of production, profit margins and the share of labour costs in total costs are crucial in determining the strength of the relationship between labour costs and the sustainability of the production process. Since all the described factors are to a large extent sector- and even firm-specific, it would be imprecise to generalise competitiveness developments at the country level. A more suited approach would be to discuss competitiveness developments at the highest possible level of disaggregation. However, such level of data granularity is often not available.

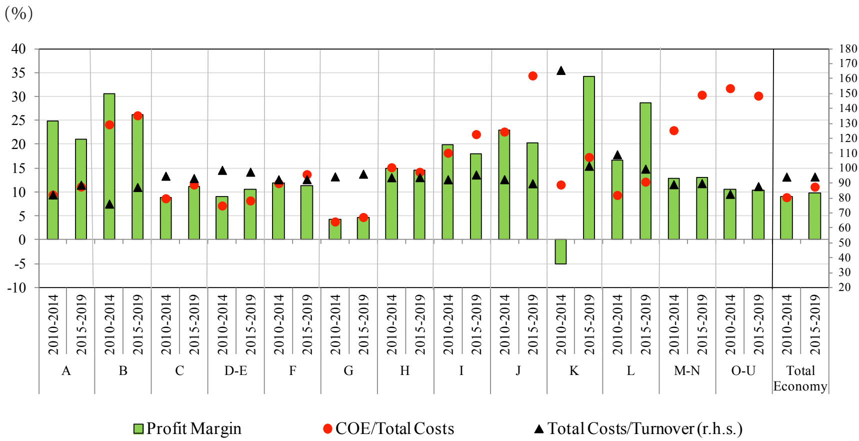
[12] The Earnings before Interest, Tax, Depreciation and Amortisation (EBITDA) margin is chosen as the best approximation of the profit margins of firms over alternative options such as net profit margin. The EBITDA, divided by Operating Revenue, includes the revenue streams and expenses related to the key operating activities of businesses; excludes the non-cash effects of depreciation and amortisation which are subject to accounting judgement; defines a wider stream of corporate profitability which is attributable to more stakeholders in comparison to other available profitability metrics e.g. net income and return on assets.

In Chart 15 we demonstrate how diverse these developments could be across sectors. The graph is constructed using firm-level data from the Bureau van Dijk's AMADEUS database. The AMADEUS database has a broader sectoral coverage as compared to EUROSTAT's Structural Business Statistics (SBS) and is timelier, with the latest available observation being 2019 (as compared to 2018 in the SBS). The data from the AMADEUS database is not completely equivalent to that of the SBS, since it has data on the agricultural sector, public administration, healthcare and education, whereas the SBS does not. For the purpose of our analyses, we limit the sample to firms with more than 1 employee and more than 1,000 EUR of annual turnover. This reduces the number of Bulgarian firms under study from 569,149 down to 363,347. Nevertheless, the sample is representative in terms of the generated turnover, with our choice of firms' sample generating around 98.5% of the total economy turnover that is recorded by the SBS in 2018 (and around 89% on average for the period 2010–2018). The AMADEUS database does not have data on exports of Bulgarian firms and has data for a rolling window for the past 10 years, so the earliest available data currently is 2010, which limits our capacity to draw conclusions about longer-term developments. We use averaged data for the periods 2010–2014 and 2015–2019 in order to address the fact that results for single years are likely affected to a significant degree by the cyclical position of the country in that year. Despite its limitations, the information that can be obtained from the AMADEUS database is quite valuable.[13]

Chart 15 shows that there is great degree of heterogeneity across economic sectors but generally there is no hard evidence for a strong link between increasing labour costs and decreasing profit margins with the exception of the *information and communications* sector, the *mining and quarrying* sector, the *agricultural* sector and the *accommodation and food services* sector.

[13] Detailed sectoral graphs regarding the developments of production costs and profit margins are presented in Appendix 2.

Chart 15. **Profit margin and production costs in Bulgaria**



A – Agriculture B – Mining and quarrying C – Manufacturing D–E – Electricity, gas, steam, water
F – Construction G – Wholesale and retail trade H – Transportation and storage I – Accommodation and food service
J – Information and communication technical, admin, activities K – Financial and insurance L – Real estate activities
M–N – Scientific O–U – Pub admin, def, edu, health, arts, entertain

Notes: *The series "Profit Margin" represents the EBITDA margin in % (EBITDA/Operating revenue * 100); The series "COE/Total Costs" represents the cost of employees, divided by the total costs for firms, defined as the sum of the material costs, operating expenses, depreciation expenses, cost of employees and interest payments;*
The series "Total Costs/Turnover" represents the total costs for firms, defined as the sum of the material costs, operating expenses, depreciation expenses, cost of employees and interest payments, divided by the annual turnover of the respective company;
The sample of firms is defined as consisting of all firms with more than 1 employee and more than 1,000 EUR of annual turnover. Filtered this way, the sample contains information on 363,347 firms out of the total 569,149 firms, available for Bulgaria in the AMADEUS database.

Sources: AMADEUS, own calculations.

In summary, this section suggests that Bulgarian firms have largely been able to mitigate the pressures from increasing labour costs suggested by the lack of a tendency towards profit margin decreases in recent years and the robust export performance. Moreover, factors such as the observed reduction of production costs other than labour costs, the increasing capital intensive production, the increasing share of mid-and high-tech products in total exports should also be considered. Last but not least the discussion of whether increasing ULCs have a dampening effect on competitiveness requires a sector-level and even firm-level disaggregation of the analysis. Therefore, our next section tries to give a brief overview of the possible statistics that we could use in order to empirically investigate the drivers of Bulgarian exports at the highest sectoral disaggregation possible.

4. Bridging the Data Gap between External Trade Statistics and ULC Statistics

A significant drawback in analysing the link between developments of sectoral ULCs and export performance is that the external trade statistics and ULCs statistics are compiled according to different methodologies, in which the economic sectors cannot be matched. Standard statistics on exports and imports are typically gathered by Customs Agencies and National Revenue Agencies and they are grouped according to the type of commodity that is being exported/imported such as petrol products, machinery products, food products and so on. Typical examples of such trade classifications are the Standard International Trade Classification (SITC), the World Customs Organization's Harmonized System nomenclature (HS) and its further development – the Combined Nomenclature (CN). At the same time ULCs are compiled according to National Accounts methodology where the sectors are grouped according to the NACE Rev.2 definition[14]. In the case of the external trade statistics the key characteristic that is captured is the type of good that is traded, while in the ULCs statistics the key characteristic is the economic sector in which an enterprise operates, regardless of the products that it produces.[15]

To help bridge this methodological gap between the two different statistics sources, EUROSTAT has recently published the novel trade in goods statistics by enterprise characteristics (TEC) database. The main objective of the TEC database is to bridge two major statistical domains which have traditionally been compiled and used separately, business statistics and the international trade in goods statistics (ITGS). Specifically, this new domain was created to answer the question "what kind of businesses are behind the trade flows of goods?". For this purpose, the trade in goods between countries is broken down by economic activity and products traded.[16]

[14] NACE Rev. 2 is a statistical classification of economic activities that was launched in 2002 and adopted in 2006. It replaced NACE Rev. 1.1 making it more detailed and more suitable to reflect different forms of production and emerging new industries. For further details, please refer to: https://ec.europa.eu/eurostat/web/nace-rev2.

[15] Note that the type of product that is being exported need not coincide with the economic sector in which the enterprise that produced it is registered. For example, we can have a firm, which is registered in the wholesale and retail trade economic sector and it trades furniture. In that case according to the ULC statistics we will have a record under the economic sector wholesale and retail trade rather than in the furniture manufacturing sector. However, the transaction in the external trade statistics would be recorded under "trade in furniture". As such, in this example it would be inconsistent to try to link the ULCs in the furniture manufacturing sector to the export dynamics of the "trade in furniture", since the transaction has impacted the ULCs in the wholesale and retail trade rather than in the furniture manufacturing sector.

[16] For more information, see: https://ec.europa.eu/eurostat/web/international-trade-in-goods/data/focus-on-enterprise-characteristics-tec.

As the TEC domain aims to categorise trade flows according to economic activities, product classifications which are based on the industrial origin of the goods are more suitable for analysis than classifications based on material of goods. For this reason, the Classification of Products by Activity (CPA) is used as the product classification in TEC. CPA is arranged so that each product heading is assignable to a single heading of the European activity classification – the NACE Rev. 2. This makes the two classifications "symmetrical" in their structure. Consequently, CPA 2008[17] has the same hierarchical structure as NACE Rev. 2. Within the international trade in goods statistics, the NACE classification refers to the economic activity of enterprises that are active in international trade in goods. The scope of TEC data is the same as for monthly trade in goods statistics, consisting of both intra- and extra-EU trade flows.

Despite the usefulness of the TEC database in bridging business statistics and international trade in goods statistics, it has two major drawbacks:

– It covers only the trade in goods while all external trade in services is not captured;

– Statistics by enterprise characteristics are yearly and cover only a short time-span, which makes them inappropriate for econometric modelling. For Bulgaria the first available observation is 2012 and the last one is 2018.

Nevertheless, the information in the TEC database is still very useful in analysing the link between labour costs and export competitiveness. In Table 1, we present the structure of Bulgaria's exports of goods by the economic sectors.

Table 1. **Share of Bulgaria's exports of goods by economic sector**

	2012	2013	2014	2015	2016	2017	2018
A PRODUCTS OF AGRICULTURE, FORESTRY AND FISHING	**0.6**	**0.6**	**0.7**	**0.5**	**0.6**	**0.6**	**0.5**
B MINING AND QUARRYING	**1.5**	**1.0**	**0.9**	**0.9**	**0.8**	**0.9**	**0.8**
C MANUFACTURING	**71.4**	**69.9**	**69.8**	**69.2**	**67.1**	**68.5**	**68.7**
– of which:							
C 10-12 Food, beverages, tobacco	6.0	6.1	6.5	6.7	6.9	6.0	5.9
C 13-15 Textile, wearing apparel, leather	8.3	8.2	8.6	8.2	8.2	7.1	6.8

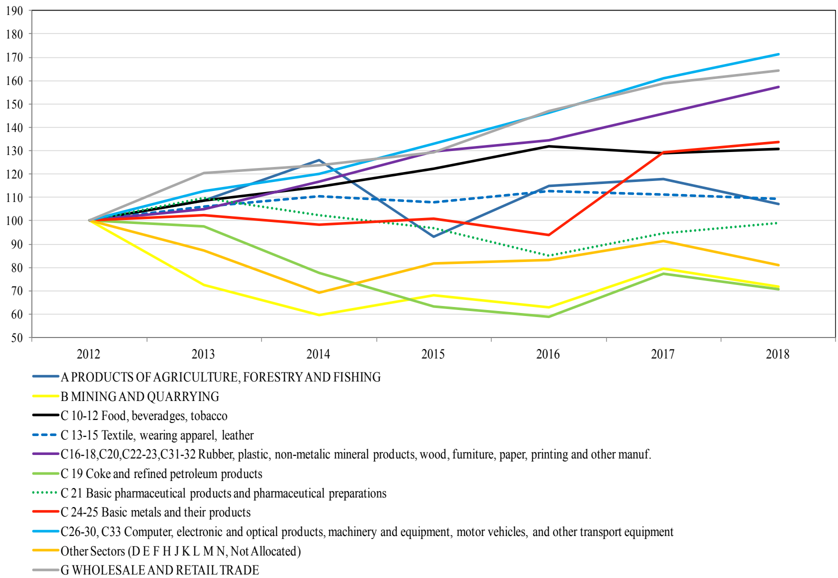
[17] CPA 2008 refers to a revision of the Classification of Products by Activity (CPA) compared to its 2002 version. The main changes include the introduction of new concepts, such as originals and intellectual property products, as well as the increase in detail in order to reflect new products and emerging services. For further details, see: https://ec.europa.eu/eurostat/web/cpa/cpa-2008.

	2012	2013	2014	2015	2016	2017	2018
C16-18,C20,C22-23,C31-32 Rubber, plastic, non-metalic mineral products, wood, furniture, paper, printing and other manuf.	10.9	10.7	11.9	12.9	12.7	12.2	12.8
C 19 Coke and refined petroleum products	13.7	12.5	10.1	7.9	7.1	8.2	7.3
C 21 Basic pharmaceutical products and pharmaceutical preparations	1.2	1.2	1.1	1.0	0.9	0.9	0.9
C 24-25 Basic metals and their products	18.7	17.9	17.3	17.3	15.3	18.6	18.8
C26-30, C33 Computer, electronic and optical products, machinery and equipment, motor vehicles, and other transport equipment	12.5	13.2	14.2	15.2	16.0	15.5	16.1
Other Sectors (D E F H J K L M N, Not Allocated)	**4.4**	**3.6**	**2.9**	**3.3**	**3.2**	**3.1**	**2.7**
G WHOLESALE AND RETAIL TRADE	**22.1**	**24.8**	**25.7**	**26.0**	**28.3**	**26.9**	**27.2**
– *of which:*							
G45 Wholesale and retail trade and repair of motor vehicles and motorcycles	1.0	1.3	1.4	1.4	1.5	1.6	1.5
G46 Wholesale trade, except of motor vehicles and motorcycles	20.0	22.5	23.3	23.4	25.7	24.4	24.7
G47 Retail trade, except of motor vehicles and motorcycles	1.0	1.1	1.1	1.2	1.0	0.9	1.1
Total Exports	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Sources: EUROSTAT's TEC database, own calculations.

The *manufacturing* is the largest exporting sector, which is responsible for between 65% and 70% of the total export of goods from Bulgaria (see Table 1). Within it, the most important exporting subsectors are the *basic metals and their products*, *computer, electronics, machinery and transport equipment* and the *rubber, plastics and non-metallic products*. Apart from the *manufacturing* sector, most of the remaining exports of goods are generated by the sector *wholesale trade, except of motor vehicles*. In terms of dynamics, the sectors that experienced the highest increase in their exports in the period 2012–2018 are the *computer, electronics, machinery and transport equipment* and the *wholesale trade, except of motor vehicles* (see Chart 16). At the same time the level of exports of the sectors *mining and quarrying* and *coke and refined petroleum products* fall significantly but it should be noted that the TEC statistics are nominal and this fall is likely affected by the downward trend in the prices of raw materials and crude oil during this period. After 2014 we also observe a strong pick-up in the export shares of the sectors outside the *agriculture*, *mining and quarrying*, *manufacturing* and *wholesale and retail trade*. This pick-up is driven by the sectoral category "*not allocated*", so we cannot make any conclusions regarding the possible factors behind it.

Chart 16. **Dynamics of Bulgarian export of goods by NACE Rev. 2 economic sectors, index 2012 = 100**



Sources: EUROSTAT's TEC database, own calculations.

The problem with the TEC data, as already discussed, is that the time span is too short and that the frequency of the data is yearly observations, published with a significant time lag. As such this data is not appropriate for econometric analyses. However, the TEC database has a useful feature that allows us to circumvent this problem. The TEC database provides a type of mapping between the exports of goods by the NACE Rev.2 economic sectors and the CPA external trade classification. Unlike the TEC database, external trade data by the CPA classification is available in the COMEXT database at a monthly frequency for a long time span (data for Bulgaria goes back to January 1999). The monthly observations are also published only with a small time lag, which allows for timely macroeconomic analyses. These properties of the CPA data make it convenient for econometric modelling. One of its drawbacks is that the CPA data is simply a proxy of the underlying developments in the external trade, as recorded by the TEC data. The goodness of the proxies varies across the NACE Rev.2 economic activity sectors, as illustrated in Table 2.

It appears that the CPA groups are a good proxy for the *manufacturing* subsectors as defined in the NACE Rev.2, with on average 80% of the subsector's exports being composed by a single CPA group. This also applies for the sectors *agriculture* and the *mining and quarrying*, *electricity, gas and air conditioning*, *administrative and support service activities* and *water supply and waste management*. However, the combined weight of these sectors (without *manufacturing*) only produces around 2.7% of the total export of goods from Bulgaria in 2018. At the same time, the *wholesale and retail trade* sector (the second largest exporter after the *manufacturing* sector), exports too diverse types of CPA goods. Therefore, we cannot use an adequate CPA proxy in order to study the driving factors behind the dynamics of the sector's exports in an econometric setup. As shown in Table 2 the percentage of total export of goods of the *wholesale and retail trade* sector composed of a single CPA group ranges from 29% to 59% which is quite low.

Table 2. **Mapping between TEC exports data and the CPA external trade classification**

NACE code	NACE sector name	Code and name of the CPA group that accounts for the largest share of exports of the corresponding NACE sector	CPA group exports as % of NACE sector's total exports
A	*Agriculture, forestry and fishing*	CPA_A – Products of agriculture, forestry and fishing	74.9
B	*Mining and quarrying*	CPA_B – Mining and quarrying	87.9
C10	*Manufacture of food products*	CPA_C10 – Food products	85.6
C11	*Manufacture of beverages*	CPA_C11 – Beverages	78.6
C12	*Manufacture of tobacco products*	NA	NA
C13	*Manufacture of textiles*	CPA_C13 – Textiles	86.2
C14	*Manufacture of wearing apparel*	CPA_C14 – Wearing apparel	94.6
C15	*Manufacture of leather and related products*	CPA_C15 – Leather and related products	97.5
C16	*Manufacture of wood and of products of wood and cork, except furniture*	CPA_C16 – Wood and products of wood and cork, except furniture; articles of straw and plaiting materials	86.4
C17	*Manufacture of paper and paper products*	CPA_C17 – Paper and paper products	92.5

NACE code	NACE sector name	Code and name of the CPA group that accounts for the largest share of exports of the corresponding NACE sector	CPA group exports as % of NACE sector's total exports
C18	*Printing and reproduction of recorded media*	CPA_C17 – Paper and paper products	41.5
C19	*Manufacture of coke and refined petroleum products*	NA	NA
C20	*Manufacture of chemicals and chemical products*	CPA_C20 – Chemicals and chemical products	92.2
C21	*Manufacture of basic pharmaceutical products and pharmaceutical preparations*	CPA_C21 – Basic pharmaceutical products and pharmaceutical preparations	95.9
C22	*Manufacture of rubber and plastic products*	CPA_C22 – Rubber and plastic products	86.0
C23	*Manufacture of other non-metallic mineral products*	CPA_C23 – Other non-metallic mineral products	86.5
C24	*Manufacture of basic metals*	CPA_C24 – Basic metals	88.9
C25	*Manufacture of fabricated metal products, except machinery and equipment*	CPA_C25 – Fabricated metal products, except machinery and equipment	62.6
C26	*Manufacture of computer, electronic and optical products*	CPA_C26 – Computer, electronic and optical products	58.0
C27	*Manufacture of electrical equipment*	CPA_C27 – Electrical equipment	88.7
C28	*Manufacture of machinery and equipment n.e.c.*	CPA_C28 – Machinery and equipment n.e.c.	81.2
C29	*Manufacture of motor vehicles, trailers and semi-trailers*	CPA_C29 – Motor vehicles, trailers and semi-trailers	46.7
C30	*Manufacture of other transport equipment*	CPA_C30 – Other transport equipment	94.2
C31	*Manufacture of furniture*	CPA_C31 – Furniture	80.9
C32	*Other manufacturing*	CPA_C32 – Other manufactured goods	85.7
C33	*Repair and installation of machinery and equipment*	CPA_C28 – Machinery and equipment n.e.c.	41.0
D	*Electricity, gas, steam and air conditioning supply*	CPA_D – Electricity, gas, steam and air conditioning	97.9
E	*Water supply; sewerage, waste management and remediation activities*	CPA_E – Water supply; sewerage, waste management and remediation services	71.3
F	*Construction*	CPA_C28 – Machinery and equipment n.e.c.	15.5

NACE code	NACE sector name	Code and name of the CPA group that accounts for the largest share of exports of the corresponding NACE sector	CPA group exports as % of NACE sector's total exports
G45	*Wholesale and retail trade and repair of motor vehicles and motorcycles*	CPA_C29 – Motor vehicles, trailers and semi-trailers	58.6
G46	*Wholesale trade, except of motor vehicles and motorcycles*	CPA_A – Products of agriculture, forestry and fishing	29.1
G47	*Retail trade, except of motor vehicles and motorcycles*	CPA_C26 – Computer, electronic and optical products	33.9
H	*Transportation and storage*	CPA_B – Mining and quarrying	28.1
J	*Information and communication*	CPA_C26 – Computer, electronic and optical products	51.6
K	*Financial and insurance activities*	CPA_C32 – Other manufactured goods	25.4
L	*Real estate activities*	CPA_C29 – Motor vehicles, trailers and semi-trailers	23.3
M	*Professional, scientific and technical activities*	CPA_C28 – Machinery and equipment n.e.c.	21.6
N	*Administrative and support service activities*	CPA_C14 – Wearing apparel	67.7

Notes: *The classifications NACE Rev.2 and CPA 2008 are used. The presented number for the % of NACE exports that is explained by a particular CPA group is averaged over the available observations for the period 2012–2018. Missing observations are removed before the calculation.*

Sources: EUROSTAT's TEC database, own calculations.

5. Quantitative Estimates of the Effects of Price and Non-price Competitiveness on Export Performance

To this point we discussed the potential factors that can influence export performance in qualitative terms only. This section provides a quantitative assessment of the effects of price and non-price competitiveness on export performance in Bulgaria.

Unlike price competitiveness, non-price competitiveness is an unobservable variable for which choosing an even remotely relevant proxy is not straightforward. There are two possible approaches to this problem – constructing a proxy for non-price competitiveness based on observable variables outside the econometric model, or modelling an unobservable variable within our system. We have opted for the second by employing a state space model, since we have serious doubts of how reliable the available sector-specific observable proxies for non-price competitiveness would be.

5.1. State Space Modelling

State space models are a rather loose term given to time-series models, usually formulated in terms of unobserved components that make use of the state space representation for their statistical treatment. In this approach it is assumed that the development over time of the unobserved series of vectors $\lambda_1, \ldots, \lambda_n$, and the associated series of observations $y_1, \ldots, y_n$ is determined by the system of equations under study. The relationship between the λ_t and the y_t is specified by the state space model (Durbin and Koopman, 2012).

Many models can be represented in state-space form. The two main benefits to representing a dynamic system in a state space form are: 1) that the state space representation allows unobserved (state) variables to be incorporated and estimated along with the observable model; 2) that state space models can be analysed using a Kalman filter. The general form of the state space system includes two types of equations – an observation equation (also known as measurement/signal equation) and a state equation (also known as transition equation). The measurement equation describes the relationship between observed and unobserved (state) variables, while the state equation describes the dynamics of the unobserved (state) variables over time (using a first-order Markov process). Once a model is written in a state space form, the Kalman filter provides a procedure to compute both forecasts of the observable and unobservable variables, and the likelihood of the model, which can be used to derive maximum likelihood estimators of the model parameters.[18]

An example of a most basic setup of a state space system, similar to that presented by Durbin and Koopman (2012), is:

Observation equation: $y_t = Z_t\theta_t + \varepsilon_t \qquad \varepsilon_t \sim N(O, R)$

State equation: $\theta_t = F_t\theta_{t-1} + v_t \qquad v_t \sim N(O, Q)$

where y_t is a (n x 1) vector of dependent (observed) variables, θ_t is a (m x 1) vector, containing the respective state variable (unobserved variables), Z_t is a matrix for the coefficients or observable explanatory variables of order (n x m), F is a matrix of order (m x m) with estimated AR(1) coefficients of the state equations. The notation ε_t stands for an (n x 1) vector of observational errors with $E(\varepsilon_t) = 0$ and $var(\varepsilon_t) = R$, where R is a (n x n) variance-covariance matrix. Similarly, v_t stands for an (m x 1) vector of state errors with $E(v_t) = 0$ and $var(v_t) = Q$, where Q is a (m x m) variance-covariance matrix.

[18] For more information on state space modelling, see Durbin and Koopman (2012).

5.2 A State Space Model for Bulgaria's Exports

Our state space model setup for the export of goods by economic sectors is inspired by the conceptual ideas of the CMS theory, discussed in the literature review section. The key assumption in the CMS theory is that a country's export share in a given market should remain unchanged over time, unless affected by competitiveness factors. In practice this means that if the exports of a particular Bulgarian good are growing more than the average world demand for that particular good, then this would lead to an increase in Bulgaria's global trade share in that good's market. This change in the market share, according to the CMS theory, is a result of competitiveness gains. These competitiveness gains can be either related to price or non-price competitiveness.

In our empirical setup we model exports of a particular economic sector as determined solely by the world demand for the products of that particular economic sector, a price competitiveness factor and a non-price competitiveness factor. The export performance, world demand and price competitiveness are the observable variables in our setup, while the non-price competitiveness factor is an unobservable variable that we estimate within the system of equations with the help of the Kalman filter. As such the observation equation for each economic sector is composed of export of goods as a dependent variable and external demand, price competitiveness and non-price competitiveness as explanatory variables, along with an error term[19]. All variables are first seasonally-adjusted[20] and then enter the equation in log-levels, so that the estimated coefficients in front of them are interpreted as elasticities. The coefficient in front of external demand is calibrated to one in order to guarantee the consistency of the CMS theory in our setup – a percentage change in external demand should, all else equal, be mirrored by an equivalent percentage change in Bulgarian exports. If Bulgarian exports change by more or by less than the change in external demand, then this must be a result of changes in either price, or non-price competitiveness of the country.

In total we have three state equations in the system. Two of them are introduced in order to model the behaviour of the unobservable variable – non-price competitiveness. The unobserved non-price competitiveness factor is modelled with the help of a local linear trend specification. This specification is the standard state space approach for handling non-stationary, or strongly trending series, since it allows both the trend level and slope of the unobservable variable to vary over time (Durbin and Koopman, 2012). The local linear trend

[19] For more information on the variables that are used in the quantitative estimation, please refer to Appendix 3.

[20] The seasonal adjustment is done using the TRAMO-SEATS procedure in EViews.

specification is useful when a single linear trend does not fit the data well.[21] These characteristics best describe our idea of how an actual series of non-price competitiveness would behave based on the observed increase in global market share (Chart 2) and the dynamics of the competitiveness contribution to nominal export growth in the accounting decomposition in Chart 3. Furthermore, since we run the estimation using the log-levels of the described variables, rather than growth rates, it is prudent to allow for trending behaviour in the unobservable series, while the potential structural breaks or significant changes in the data, especially around the global economic and financial crisis of 2008/2009 dictate that we allow the slope and the level of the unobserved series to vary with time. As already mentioned, the implementation of a local linear trend specification in the state space system requires us to include two state equations (State equations 2 and 3 below). The first state equation is introduced in order to allow for time variation in the coefficient in front of the price competitiveness component in the observation equation (State equation 1). This will allow us to answer the question whether the importance of price competitiveness has changed over time, especially given the increasing participation of countries in GVCs and the long-term trend towards ULC increases. Thus, in the first state equation we model the coefficient in front of price competitiveness as a random walk, equal to its past value plus a white noise error term. Our state space system of equations takes the following form for each of the analysed sectors:

Observation equation:

$$exp_t = \beta 1 * demand_t + \beta 2_t * pr\_comp_t + \beta 3 * non\_pr\_comp_t + \varepsilon_t \qquad \varepsilon_t \sim N(0, \sigma_\varepsilon^2)$$

State equation 1:

$$\beta 2_t = \beta 4 * \beta 2_{t-1} + u_t \qquad u_t \sim N(0, \sigma_u^2)$$

State equation 2:

$$non\_pr\_comp_t = \beta 5 * non\_pr\_comp_{t-1} + \beta 6 * \lambda_{t-1} + v_t \qquad v_t \sim N(0, \sigma_v^2)$$

State equation 3:

$$\lambda_t = \beta 7 * \lambda_{t-1} + \eta_t \qquad \eta_t \sim N(0, \sigma_\eta^2)$$

This can be written in the following state space form:

[21] For more details on the local linear trend specification see Durbin and Koopman (2012).

$$\overbrace{exp_t}^{y_t} = 1 * demand_t + \overbrace{[pr\_comp_t \quad \beta 3 \quad 0]}^{z_t} * \overbrace{\begin{bmatrix} \beta 2_t \\ non\_pr\_comp_t \\ \lambda_t \end{bmatrix}}^{\theta_t} + \varepsilon_t \qquad \text{VAR}(\varepsilon_t) = \mathbf{R}$$

$$\overbrace{\begin{bmatrix} \beta 2_t \\ non\_pr\_comp_t \\ \lambda_t \end{bmatrix}}^{\theta_t} = \overbrace{\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}}^{const} + \overbrace{\begin{bmatrix} \beta 4 & 0 & 0 \\ 0 & \beta 5 & \beta 6 \\ 0 & 0 & \beta 7 \end{bmatrix}}^{F_t} * \overbrace{\begin{bmatrix} \beta 2_{t-1} \\ non\_pr\_comp_{t-1} \\ \lambda_{t-1} \end{bmatrix}}^{\theta_{t-1}} + \overbrace{\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}}^{coeff.\ matrix} * \overbrace{\begin{bmatrix} u_t \\ v_t \\ \eta_t \end{bmatrix}}^{errors}$$

$$\text{VAR}\begin{bmatrix} u_t \\ v_t \\ \eta_t \end{bmatrix} = \begin{bmatrix} \sigma_u^2 & 0 & 0 \\ 0 & \sigma_v^2 & 0 \\ 0 & 0 & \sigma_\eta^2 \end{bmatrix} = \text{matrix } \mathbf{Q}$$

The above is the general state space representation that we will apply to each of the manufacturing subsectors, defined in Table 1 of Section 4 with the exception of *"C19 Coke and refined petroleum products"*[22]. As a result, in total we have 7 different models, 6 of them for the different manufacturing subsectors and one for the manufacturing sector as a whole. The groups are defined as follows:

Group 1: *"C 10-12 Food, beverages, tobacco";*

Group 2: *"C 13-15 Textile, wearing apparel, leather";*

Group 3: *"C16-18,C20,C22-23,C31-32 Rubber, plastic, non-metallic mineral products, wood, furniture, paper, printing and other manufacturing";*

Group 4: *"C 21 Basic pharmaceutical products and pharmaceutical preparations"* ;

Group 5: *"C 24-25 Basic metals and their products";*

Group 6: *"C26-30, C33 Computer, electronic and optical products, machinery and equipment, motor vehicles, and other transport equipment";*

Total: *"C Manufacturing".*

In order to solve the state space system we have to provide initial starting values/means (a_1) and variances (P_1) for the unobservable variables (θ_1) in the system, such that:

$$\theta_1 \sim N\,(a_1, P_1)$$

[22] The reason why we remove the group "*C19 Coke and refined petroleum products*" is that the data for this group displays drastic shifts between consecutive time periods, which are hard to explain by macroeconomic developments. What is more, for some observations the real value added of the sector is negative, which leads to negative ratios of Bulgaria's ULC to EA's ULCs. As a result of the latter, the log-transformation cannot be applied to the proxy for price competitiveness.

Typically, when we know nothing about the unobservable variables it is reasonable to represent θ_1 as having a diffuse prior density (also known as diffuse initialisation of the Kalman filter), which is equivalent to setting the initial mean (a_1) to an arbitrary number[23] and setting the initial variance (P_1) to a very large number in order to reflect our uncertainty regarding the point mean starting value (Durbin and Koopman, 2012). In our case, however, we have sufficient initial information in order to set more concrete starting values. Below, we provide the initialisation of the state space model for the *total manufacturing* exports:

$$\overbrace{\begin{bmatrix} \beta 2_1 \\ non\_pr\_comp_1 \\ \lambda_1 \end{bmatrix}}^{\theta_1} = \overbrace{\begin{bmatrix} -0.2 \\ 4.6 \\ 0.0 \end{bmatrix}}^{mprior:\, initial\ means\ (a_1)}$$

$$VAR\overbrace{\begin{bmatrix} \beta 2_1 \\ non\_pr\_comp_1 \\ \lambda_1 \end{bmatrix}}^{\theta_1} = \overbrace{\begin{bmatrix} 0.001 & 0 & 0 \\ 0 & 0.001 & 0 \\ 0 & 0 & 0.9 \end{bmatrix}}^{vprior:\, initial\ variances\ (P_1)}$$

We set the initial value for the coefficient in front of price competitiveness ($\beta 2_1$) to -0.2 with a rather tight prior on the variance around it (0.001). The particular value for the starting mean is chosen, based on several criteria. To start with, we run a standard ordinary least squares (OLS) regression with exports as the dependent variable and a constant, external demand and the ratio of Bulgaria's ULCs to EA's ULCs as our explanatory variables. All three variables are indices with a base 2002 Q1 = 100 and have undergone log-transformation. From that regression we can obtain an estimate for the coefficient in front of the ratio of Bulgaria's ULCs to EA's ULCs, which can later be used as a starting value for the Kalman filter procedure in the state space model. However, our OLS regression almost certainly suffers from omitted variable bias due to non-inclusion of a proxy for non-price competitiveness, which makes the coefficient estimates for the price competitiveness proxy biased and unreliable. The estimated coefficient for the price competitiveness from the outlined OLS regression is -0.4 but at the same time the estimated coefficient in front of external demand is 1.8, indicating that the external demand variable is picking up some of the dynamics of the missing variable – non-price competitiveness. If we calibrate the coefficient in front of external demand to 1.0 in the OLS regression (in line with the prediction of the CMS theory), the estimated coefficient in front of price competitiveness falls from -0.4 to -0.1. As such it is desirable to set

[23] The value would depend on the specification of the series that is modelled: for growth rates the typical starting value is 0, but for variables in levels it is usually different from 0.

the initial value of the coefficient of non-price competitiveness to a value that lies somewhere in the middle of these two estimates. The precise value that we use for the initialisation of the coefficient is -0.2 and it was chosen based on the ability of the system to achieve convergence of the maximum-likelihood estimates, as well as based on maximisation of the log-likelihood statistic of the estimated state space model.

The initial value for the level of the non-price competitiveness unobservable variable ($non\_pr\_comp_1$) is easier to choose. Since all the variables that enter the system are log-transformed indices with a base 2002 Q1 = 100, the derived non-price competitiveness metric also has the same specification. As such we set the initial mean value of the non-price competitiveness variable to be 4.6, which is equivalent to the log-transformed value of 100. We set tight priors for the initial variance (0.001) of the 4.6 starting value to reflect our strong beliefs in the initialisation for non-price competitiveness.

We initialise the time-varying intercept (λ_1) from the local linear trend specification in the state equations for non-price competitiveness with a mean of 0.0, since we have no prior information on what this value should be. To reflect our uncertainty regarding the starting mean value of the intercept, we increase the initial variance around our starting value to 0.9.

We have also set starting values for the defined system variance-covariance matrices **R** and **Q**.[24] We use them to obtain a maximum in the maximum-likelihood estimation of the coefficients of the model, while the mean and variance initial values for the unobserved variables initialise the iterative process of forecasting and updating in the Kalman filter in order to obtain estimates of the unobservable state variables. The starting value for **R** is lower than the starting value for **Q**, reflecting our certainty that the observation equation should not depart from the CMS theoretical relations. Thus, the error term should be small. In order to reflect our uncertainty regarding the true data generation processes of the unobserved variables we allow the variances of the error terms in the state equations to be larger than for the error terms in the observation equation. The starting values for the variances of the errors in the state equations are chosen in line with standard rule-of-thumb practices (Rummel, 2015:1, Rummel, 2015:2).

$$\mathrm{VAR}\begin{bmatrix} u_t \\ v_t \\ \eta_t \end{bmatrix} = \begin{bmatrix} \sigma_u^2 & 0 & 0 \\ 0 & \sigma_v^2 & 0 \\ 0 & 0 & \sigma_\eta^2 \end{bmatrix} = \text{matrix } \mathbf{Q} = \begin{bmatrix} 0.37 & 0 & 0 \\ 0 & 0.37 & 0 \\ 0 & 0 & 0.37 \end{bmatrix}$$

$$\mathrm{VAR}(\varepsilon_t) = \mathbf{R} = 0.05$$

[24] The estimation of the state space models is done in EViews. In EViews the variances and/or covariances that have not been specified are assumed to be equal to zero as a starting point.

The initialisation with the outlined starting values is performed for each of the defined six manufacturing subsectors and the overall manufacturing exports. In the cases where these starting values do not allow for the convergence of the maximum-likelihood estimates of the model, these starting values are modified in order to achieve convergence of the maximum-likelihood estimates and maximisation of the log-likelihood statistic of the estimated state space model. Such modifications were done almost entirely regarding the coefficient in front of price competitiveness ($\beta 2_1$) and were necessitated by the different cost structures across the manufacturing subsectors (see Chart 19).

5.3. Model Diagnostics

The assumptions underlying the linear state space model are that the disturbances ε_t, u_t, v_t, η_t are normally distributed and serially independent with constant variances. On these assumptions the standardized one-step ahead forecast residuals are also normally distributed and serially independent with unit variance (Durbin and Koopman, 2012). Thus, the main diagnostics after the Kalman filter are based on the predictive errors. Under the assumption that the model is specified correctly, these should form an independent sequence. Moreover, when scaled through by the standard error of prediction, they should be i.i.d. standard normal (Durbin and Koopman, 2012). In order to verify the validity of our estimates we compute the standardized one-step ahead forecast residuals with the help of the Kalman filter and analyse those residuals in the following manner:

– Visual inspection of the residuals' plot;

– Ljung-Box-Pierce Q-test for serial correlation;

– Jarque-Bera normality test.

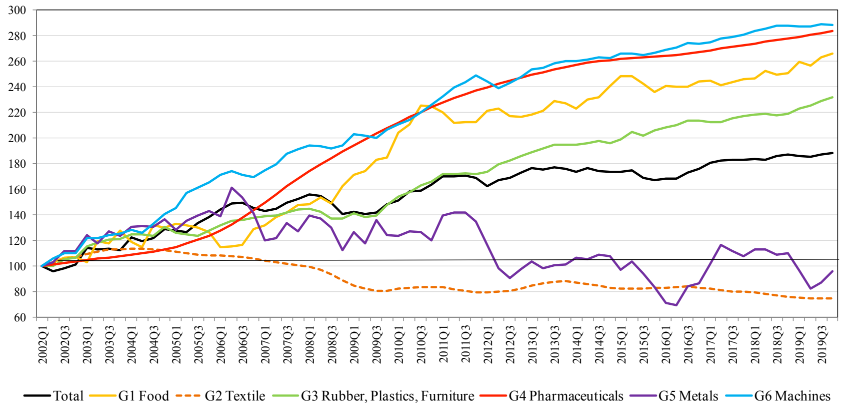
This diagnostics procedure is repeated for each of the six state space models. All models satisfy the requirement that the standardized one-step ahead forecast residuals are normally distributed and serially independent with unit variance.

The stability of the results is tested by changing the starting values for the mean and variance of the unobserved variables, which are used to initialise the Kalman filter. Although the stability of the results varies across the models for the different economic sectors, we conclude that our results are sensitive to the initialization values. This is especially true for the starting values for the mean and variance of the coefficient in front of price competitiveness and of the level of the non-price competitiveness. The instability of the results appears to be less problematic for total manufacturing exports, for Group 2 (textile products) and Group 6 (machinery products), where the results appear to be more stable to changes in the initial conditions of the unobserved variables. Nevertheless, the overall dependence of the results on the initialization values could be considered a shortcoming of the quantitative framework.

5.4. Results

As a result of the outlined estimations, we can conclude that the *machinery production*, followed by the *pharmaceuticals industry*, have been the two sectors where export non-price competitiveness has increased the most over the past two decades (see Chart 17). At the same time *textile production* and *metal production* are the two sectors where non-price export competitiveness has diminished over the years.

Chart 17. **Model-recovered estimates of non-price export competitiveness by economic sectors in Bulgaria, index 2002 Q1 = 100**



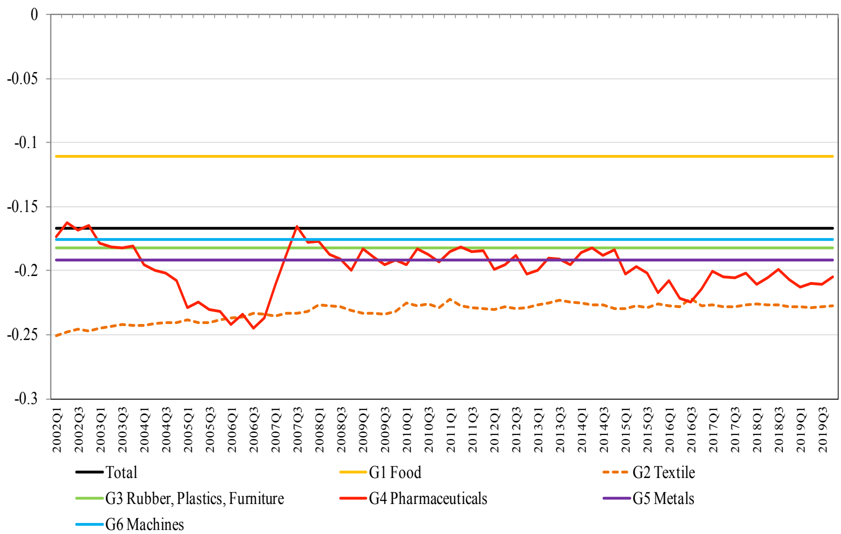
These results are largely supported by the observed dynamics of exports of goods in Bulgaria. The share of machinery exports in total exports according to the HS trade classification has increased from 11.1% in 2000 to 27.3% in 2019. For the export of pharmaceuticals the increase is from 1.4% in 2000 to 3.3% in 2019. At the same time the share of export of textile products in total exports of Bulgaria has fallen from 23.3% in 2000 to 11.7% in 2019. The share of the export of metals has also fallen from 20.7% in 2000 to 14.4% in 2019.

One shortcoming of our chosen empirical approach is that we cannot really say with confidence what factors are driving the non-price competitiveness gains of each sector. As already discussed on several occasions throughout this paper, there is no single definition of what competitiveness encompasses and this is especially true for non-price competitiveness. The most likely explanation for the more substantial gains in export non-price competitiveness of the *machinery* and *pharmaceuticals production* sectors is that these sectors are relatively more sophisticated than for example *textile* and *food production*. As such they offer a scope for a greater technological improvement in terms of the sophistication, quality and technological-intensity of the exported products. As already discussed in Section 3, an increase in the quality of the exported products has typically been put forward as the key factor behind global trade share increases. Bulgaria appears to be switching more and more to the production and exports of mid- and high-tech products, which is consistent with the idea of a gradual export upgrading and climbing up the "quality ladder". In our view this process of export upgrading and climbing up the "quality ladder" is achieved most easily in the sectors where the scope for further sophistication of production and for further increases of the technological-intensity is relatively higher. We would classify *machinery* and *pharmaceuticals production* as such sectors. What is more, these sectors in Bulgaria are among the ones with the highest integration in GVCs (Ivanova and Ivanov, 2017). Bems' and Johnson's (2015) argument that GVCs have made the product-centric paradigm obsolete relates would suggest that our results point to the conclusion that Bulgarian exporters in the machinery and pharmaceuticals production sectors have most likely managed to upgrade the sophistication of the products with which they participate in external trade and in the GVCs.

Another important finding from the estimated state space models is that there does not appear to be much variability of the importance of price competitiveness over the years. We should note that this finding could be influenced by the nature of the chosen specification and more specifically by the chosen initial priors, which are quite tight in terms of the allowed variance around the initially set coefficient values. We have estimated the state space model with different priors in order to see whether the lack of variability for most price competitiveness coefficients is sensitive to the choice of initial conditions. As already discussed in Section 5.3, our sense is that the initial conditions matter a lot for our results due to the relatively complex specification with several unobservable variables in combination with a short sample of just 72 observations. Even though the initial conditions matter largely for the estimated size of the coefficient of price competitiveness, the degree of variability of the estimated coefficient across time is relatively robust to different initial conditions.

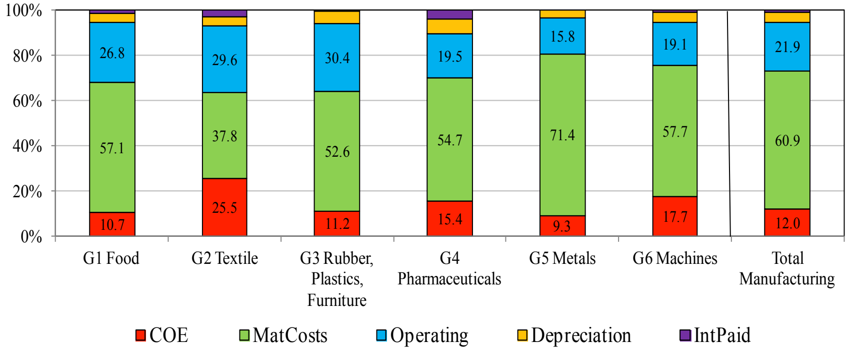
In our final specification the estimated coefficients on price competitiveness remain broadly unchanged with the exception of that of the *pharmaceuticals* industry, where the results point to a sharp decrease in the importance of price competitiveness in 2007, followed by a gradual recovery of the size of the coefficient over the next ten years, and that of the *textile* industry (see Chart 18). On average for the manufacturing sector, our results suggest that a 1% increase in our proxy for price competitiveness will result in 0.17% decrease in exports. The sector for which price competitiveness has the highest impact on exports is the *textile production* industry, where a 1% increase in the proxy for price competitiveness will result in roughly 0.23% decrease in exports. As compared to the average for the whole manufacturing sector, export in the *food production* industry appears to be less sensitive to price competitiveness changes.

Chart 18. **Estimated elasticity of exports to price competitiveness by economic sectors in Bulgaria**



The state space models' results appear broadly consistent with the conclusions that we can draw based on a descriptive analysis on firm level data from the AMADEUS database (see Chart 19). This analysis reveals that for Bulgaria labour costs across the manufacturing subsectors have lower shares in total production costs as compared to material and other costs. However, it seems that the estimated elasticities of exports to changes in price competitiveness broadly resemble the corresponding shares of cost of employees in total production costs of the given economic sector. Our results could also be compared to previous studies on Bulgaria, where the elasticity of export to changes in price competitiveness was estimated (Stoevsky, 2009 and Penkova-Pearson, 2011). Although these studies are quite different from ours in terms of the chosen estimation approach and sectoral coverage, we could conclude that our results suggest a higher elasticity of exports to price competitiveness changes as compared to previous studies on the topic. Stoevsky (2009) finds no statistically significant relationship between REER changes and real aggregate export growth, while Penkova-Pearson (2011) finds that the elasticity of real aggregate exports to changes in price competitiveness is -0.08%.

Chart 19. **Structure of the total costs of production of Bulgarian firms in 2019**

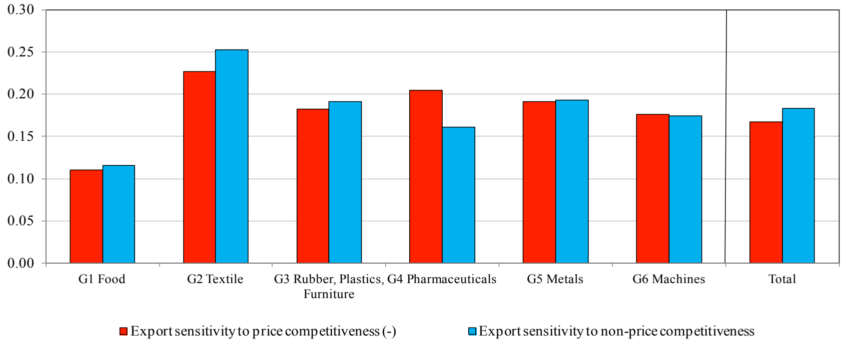


Notes: *The total costs of production are defined as the sum of the material costs, operating expenses, depreciation expenses, cost of employees and interest payments;*
The sample of firms is defined as consisting of all firms with more than 1 employee and more than 1,000 EUR of annual turnover. Filtered this way, the sample contains information on 363,347 firms out of the total 569,149 firms, available for Bulgaria in the AMADEUS database.

Sources: AMADEUS, own calculations.

The results from the state space models are also showing whether the export performance of the different economic sectors is more sensitive to price or non-price competitiveness changes. Such a conclusion can be drawn by comparing the size of the estimated coefficients in front of the proxy for price competitiveness and in front of the unobservable variable for non-price competitiveness in the observation equation of the state space system for each sector (see Chart 20). It should be noted, however, that as the non-price competitiveness term is obtained as an unobservable component, it has to be interpreted with caution, since its dynamics can also be driven by factors which are not necessarily related to competitiveness. This limitation aside, the results point to a very similar reaction of exports to changes in price and non-price competitiveness. The two sectors where this is not observed are the pharmaceutical and textile industries with pharmaceuticals being more sensitive to changes in price competitiveness, while textile production being more sensitive to non-price competitiveness changes.

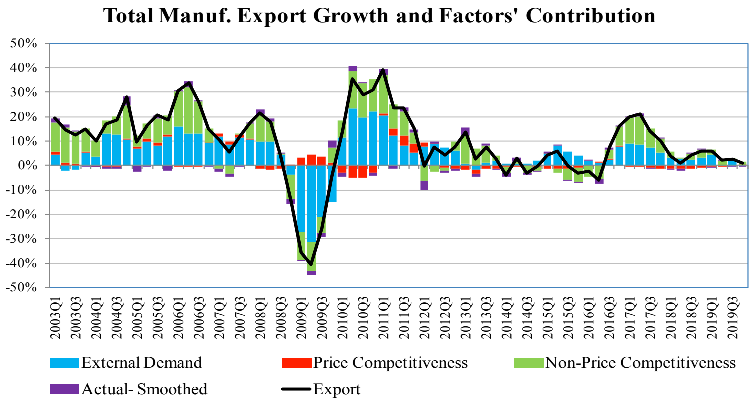
Chart 20. **Estimated sensitivity of Bulgarian exports to changes in price and non-price competitiveness (2019 Q4)**



Notes: *"Export sensitivity to price competitiveness (-)" in the graph represents the estimated coefficient in front of the proxy for price competitiveness in the state space model at Q4 2019, multiplied by -1 for an ease of comparison with the sensitivity of exports to changes in non-price competitiveness. Similarly, the "Export sensitivity to non-price competitiveness" in the graph represents the estimated coefficient in front of our unobserved variable for non-price competitiveness in the state space model at Q4 2019.*

Despite the similar elasticity of exports to changes in price and non-price competitiveness, our estimates reveal that non-price competitiveness has been much more dynamic as compared to price competitiveness and its changes over time have been the second most important factor in explaining Bulgaria's export performance after the changes in external demand (see Chart 21).

Chart 21. **Bulgarian export growth on an annual basis and factors' contributions**



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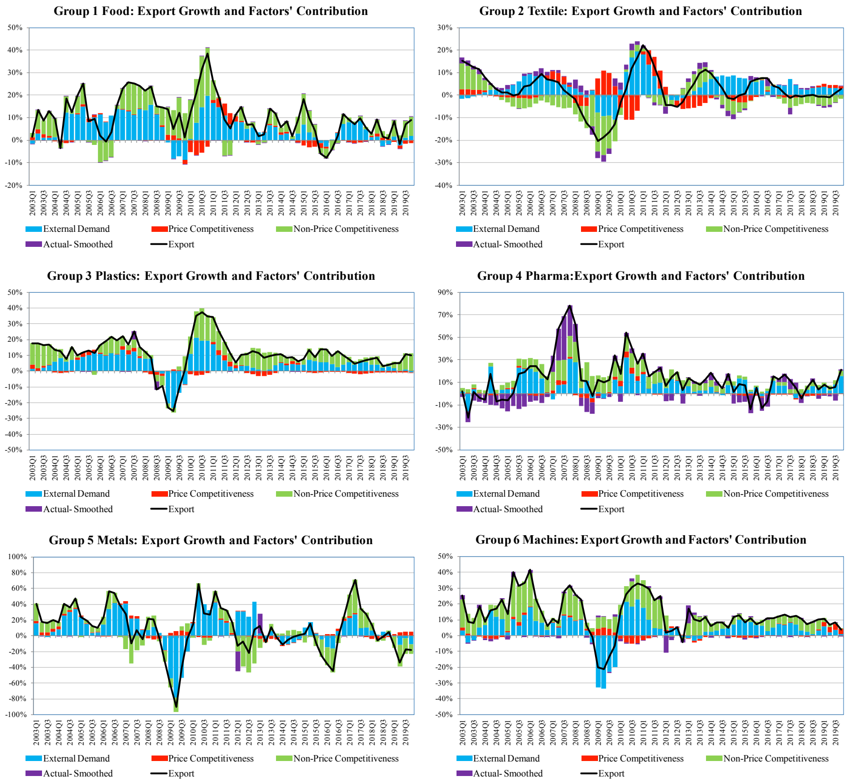
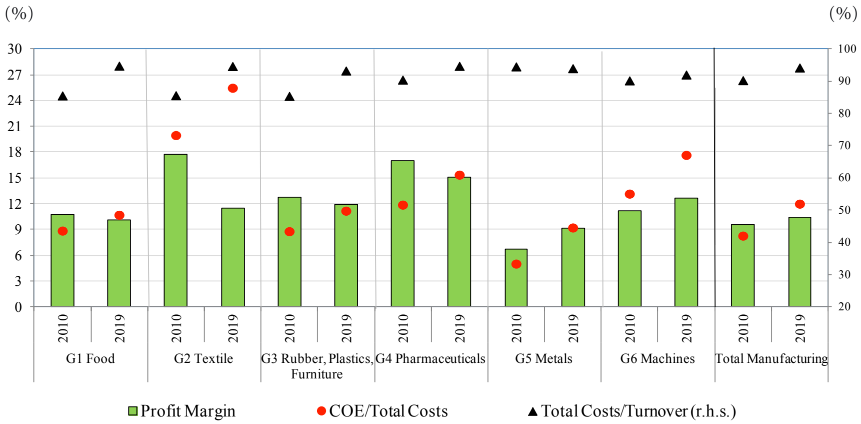


Notes: *"Actual-Smoothed" in the graphs represents the model residual and the effect of the Kalman filter smoothing.*

For most of the observed period the contribution of non-price competitiveness has been strongly positive, especially in the period before 2012 (for all sectors with the exception of textile and metal production). Since then it has declined but still contributes positively for most sectors. Our results suggest that, for the majority of the time after the beginning of 2012, price competitiveness has had a steady, although relatively limited, negative contribution to the export growth of most manufacturing subsectors. This is likely related to the increase in the share of compensation of employees to value added that was observed in the majority of Bulgaria's manufacturing subsectors (see Chart 22)[25], in contrast to the dynamics in the EA, where these shares decreased for most subsectors.

[25] A more detailed breakdown by years for the profit margin and production costs of Bulgaria's manufacturing subsectors is available in Appendix 4.

Chart 22. **Production costs across the manufacturing subsectors in Bulgaria**



Notes: *The total costs of production are defined as the sum of the material costs, operating expenses, depreciation expenses, cost of employees and interest payments;*
The sample of firms is defined as consisting of all firms with more than 1 employee and more than 1,000 EUR of annual turnover. Filtered this way, the sample contains information on 363,347 firms out of the total 569,149 firms, available for Bulgaria in the AMADEUS database.

Sources: AMADEUS, own calculations.

However, even so, considering the overall results for the whole manufacturing sector, the negative contribution of price competitiveness is more than offset by the positive contribution of non-price competitiveness (see Chart 21). As a result of this, Bulgaria has managed to continue to increase its share in global and EU trade (see Chart 2).

6. Conclusion

The growth in exports over the past 20 years has played a crucial role for the economic convergence of Bulgaria to the euro area. During this period Bulgaria's market shares both in global trade and intra-EU trade have more than doubled. This process was accompanied by a significant appreciation of Bulgaria's real effective exchange rate. This paper makes a thorough stocktaking analysis of whether the real effective exchange rate appreciation has weakened Bulgaria's export competitiveness by discussing and assessing the drivers of the country's export dynamics over the period 2000–2019. Particular emphasis is placed on the distinction between price and non-price competitiveness, their relative importance for Bulgarian exports and whether this importance has changed over time. A substantial contribution of the analysis is that it links sectoral labour cost statistics with sectoral exports of goods statistics (thanks to the use of EUROSTAT's recently published TEC database). The analyses are also complemented by the use of firm-level data from the AMADEUS database.

Starting from the standard argument in the economic literature that higher real effective exchange rate appreciation of a country relative to its main trading partners is a potential indication of loss of competitiveness, the paper illustrates that relying on the REER as an only indicator of export competitiveness could be misleading and insufficient particularly for converging economies. We demonstrate that export market share gains for Bulgaria cannot be explained by a specialisation in goods for which demand grows more than the world average, but are rather driven (at least to a certain extent) by competitiveness gains. Furthermore, when comparing REER dynamics between Bulgaria and the EA, the choices of the deflator and of the group of competitor countries lead to large differences in the magnitude of the relative appreciation of the REER in Bulgaria.

We pay particular attention to the dynamics of the ULCs in Bulgaria, which is the deflator that leads to the strongest appreciation of Bulgarian REER. Our analysis suggests that the observed increase in ULCs alone is not sufficient to make conclusions on export competitiveness, since firms in Bulgaria have been able to largely offset the negative effects from rising wages on production, profits and employment. Evidence suggests that Bulgarian firms have been able to compensate the increases in labour costs by reducing other production costs. Furthermore, as capital-intensity of production in Bulgaria has increased over the years, this has somewhat changed the production input mix for firms, moving it away from labour inputs. In addition, rising labour costs in Bulgaria can partly be explained with the observed increase in the sophistication and knowledge intensity of production, evidence of which is the increase in the share of mid- and high-tech products in total exports. On aggregate economy level, Bulgarian firms have managed to redirect the negative effects from labour cost increases away from their profit margins, which have remained broadly stable in the period after the global financial and economic crisis of 2008/2009.

Since factors that could mitigate the negative effect from increases in labour costs (such as share of labour costs in total costs, capital intensity of production, product quality and profit margins) are very much sector- and even firm-specific, competitiveness developments should be analysed at the highest possible level of disaggregation. A sectoral analysis of the drivers of ULC in Bulgaria demonstrates that the cumulative growth of ULC relative to 2000 is higher in Bulgaria as compared to the EA. This is mainly due to wage increases (beyond productivity growth) in non-tradable sectors that account for a very low share of the country's exports. This dynamics could be attributed to

Balassa-Samuelson effects rather than loss of competitiveness since Bulgaria is undergoing nominal and real convergence. Our analysis shows that almost all of the Bulgarian sectors which exhibited stronger than average ULC growth in the period 2000–2019 have managed to increase their share in total gross value added and employment, which contradicts the classical argument that sustained ULC increases would undermine production viability.

We use a state-space model framework in order to quantitatively assess the drivers of Bulgarian exports by economic sectors. The setup is applied only to the manufacturing sector and its subsectors due to data availability limitations. However, the manufacturing sector is the largest exporting sector in Bulgaria accounting for close to 70% of total export of goods from the country. The model setup is inspired by the theory for CMS analysis and therefore the exports of each manufacturing subsector is modelled as a function of external demand for the products of that subsector, a price-competitiveness term and a non-price competitiveness term.

The results show that all manufacturing subsectors, with the exception of textiles and base metals, have experienced significant non-price competitiveness gains for the period 2002–2019. Machinery and pharmaceutical production exhibit the highest improvement in non-price competitiveness. According to the results, the dynamics of Bulgarian exports has been driven mainly by external demand and non-price competitiveness, while price competitiveness has contributed to a much lower extent. Although the importance of price competitiveness for the dynamics of Bulgarian exports has been relatively stable over the years, after 2012 price competitiveness has had negative contribution to export growth for most manufacturing subsectors. The elasticity of exports to changes in price competitiveness appears to be highest for the textile and pharmaceutical industries. However, our results for the whole manufacturing sector suggest that the negative contribution of price competitiveness is more than offset by the positive contribution of non-price competitiveness.

Being focused on the manufacturing sector, the quantitative analysis is representative for trade in goods only. The lack of detailed trade in services data can be considered a weakness of the analysis in the paper, given that export of services accounts for roughly a quarter of total Bulgarian exports in the last five years. Also, the analyses in the paper are based on nominal data, due to the unavailability of export/import deflator data by disaggregated economic sectors. The lack of trade data in real terms means that the results in the paper are subject to influence stemming from different price dynamics in Bulgaria and the rest of the world. As such, our work could be further enhanced in future studies, given that such data becomes available.

Appendices

Appendix 1. **Decomposition of Bulgaria' and EA's NEER (against BG42)**

The figures below present the decomposition of Bulgaria's and euro area's nominal effective exchange rate against a broad group of 42 countries. A logarithmic transformation of the nominal effective exchange rate index is used in order to make the contributions of different currencies of trading partners' additive. Starting from the general formula for the NEER:

$$NEER_t = \prod_{i=1}^{n} (E_{i,t})^{w_i}$$

where:

n = number of trading partners in the basket;

$E_{i,t}$ = index of the average exchange rate of the currency of trading partner i *vis-à-vis* the domestic currency in period t. The interpretation of the index here is the amount of foreign currency per one unit of domestic currency;

w_i = weight of the i trading partner's currency in the basket.

The formula above can be represented in a logarithmic form in the following way[26]:

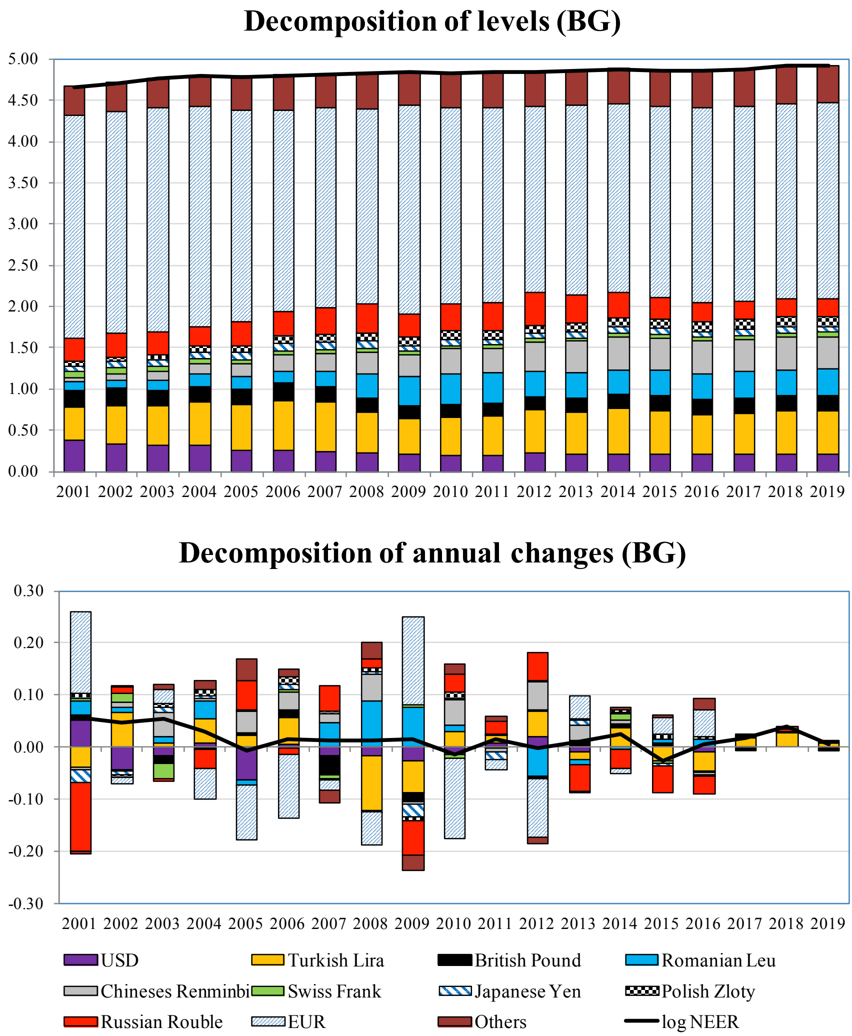
$$\text{neer}_t = (e_{1,t} * w_1) + (e_{2,t} * w_2) + \ldots + (e_{n,t} * w_n)$$

This formula is used to obtain the decomposition of the level of the NEER (in log terms) in Charts 23 and 24. Apart from that, since our series are in log-forms, their changes in time t relative to $t\text{-}1$ are approximations of the growth rates of the original yearly level series. This allows us to obtain the contributions to the annual growth rate of the NEER for Bulgaria and for the EA, presented in Charts 23 and 24 by the following formula:

$$\Delta\text{neer}_t = \Delta(e_{1,t} * w_1) + \Delta(e_{2,t} * w_2) + \ldots + \Delta(e_{n,t} * w_n)$$

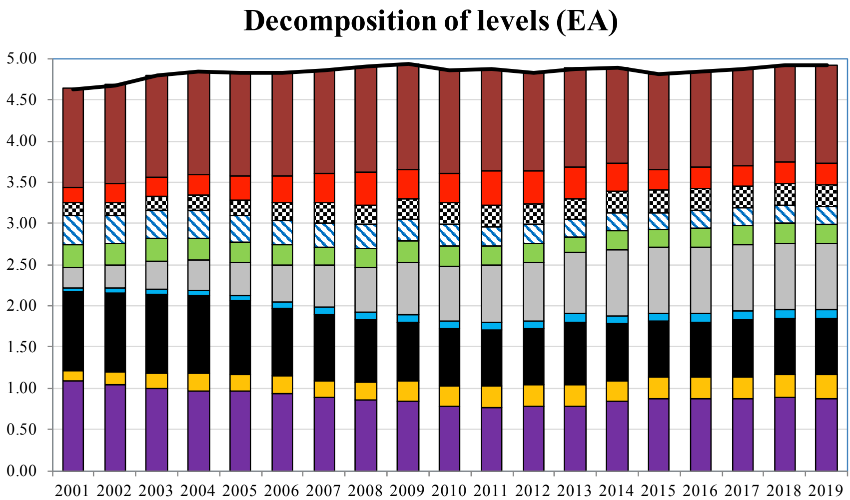
[26] The terms neer and e, presented in lower case letters, represent the logarithmic transformation of the original series in levels.

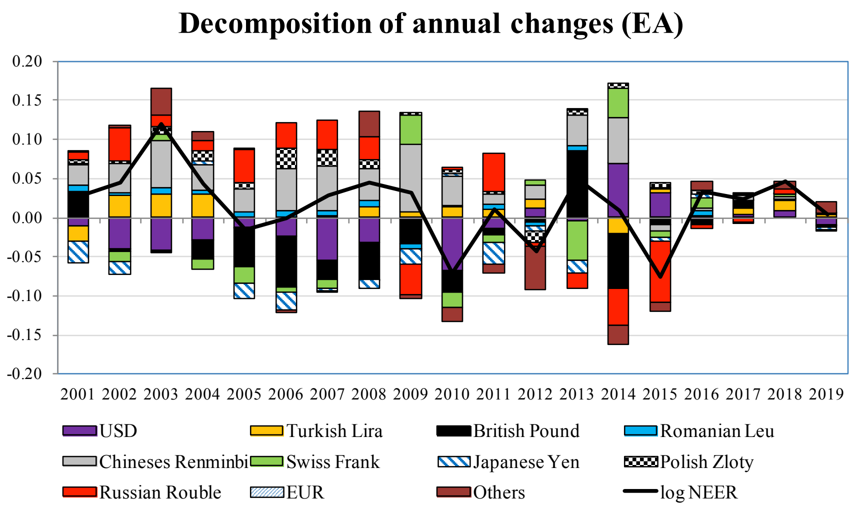
Chart 23. **Decomposition of Bulgaria's NEER (in logs) vs Broad Group of 42 countries, index 2000 = 100**



Sources: European Commission, own calculation.

Chart 24. **Decomposition of EA's NEER (in logs) vs Broad Group of 42 countries, index 2000 = 100**





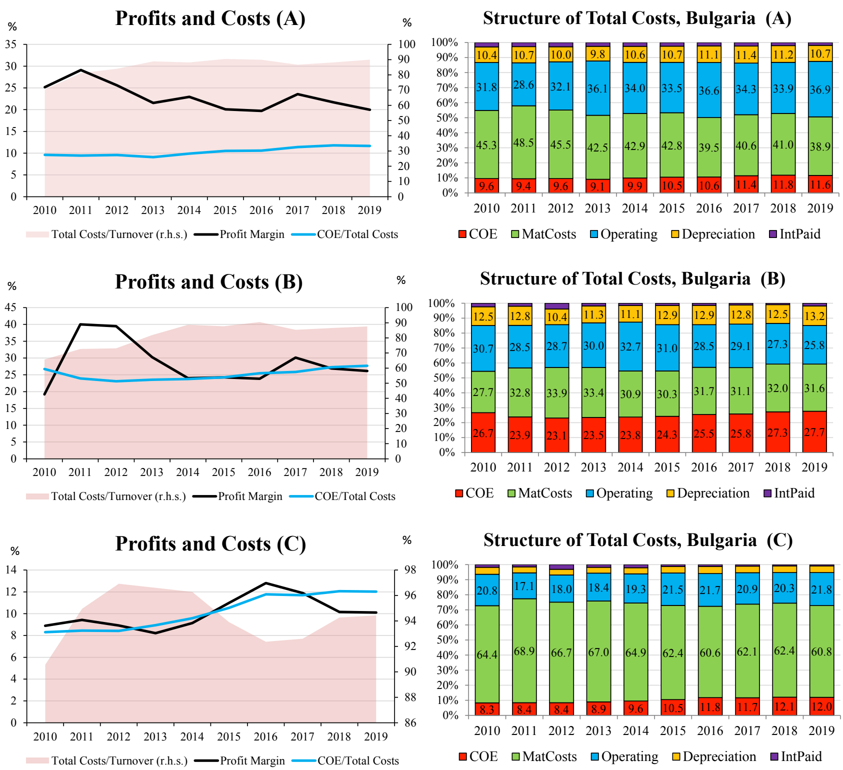
Sources: European Commission, own calculation.

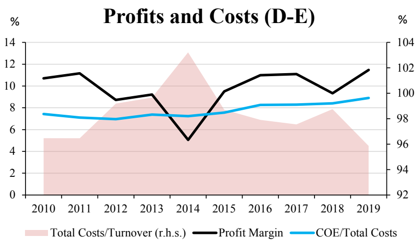
Appendix 2. **Profit Margins and Production Costs by Sectors, Firm-Level Data**

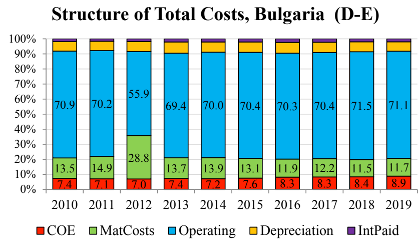
The Chart 25 below presents the profit margins and production costs by economic sectors based on the AMADEUS firm-level data for companies in Bulgaria with more than 1 employee and more than 1,000 EUR of annual turnover. Filtered this way, the sample contains information on 363,347 firms out of the total 569,149 firms, available for Bulgaria in the AMADEUS database.

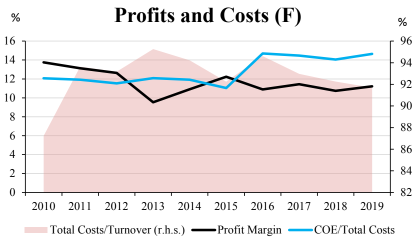
Chart 25. **Profit margins and production costs by economic sectors in Bulgaria**

A – Agriculture B – Mining and quarrying C – Manufacturing D–E – Electricity, gas, steam, water
F – Construction G – Wholesale andretail trade H – Transportation and storage I – Accommodation and food service
J – Information and communication technical, admin, activities K – Financial and insurance L – Real estate activities
M–N – Scientific O–U – Pub admin, def, edu, health, arts, entertain




Profits and Costs (D-E)
%
%
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs


Structure of Total Costs, Bulgaria (D-E)
70.9 70.2 55.9 69.4 70.0 70.4 70.3 70.4 71.5 71.1
13.5 14.9 28.8 13.7 13.9 13.1 11.9 12.2 11.5 11.7
7.4 7.1 7.0 7.4 7.2 7.6 8.3 8.3 8.4 8.9
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
COE
MatCosts
Operating
Depreciation
IntPaid


Profits and Costs (F)
%
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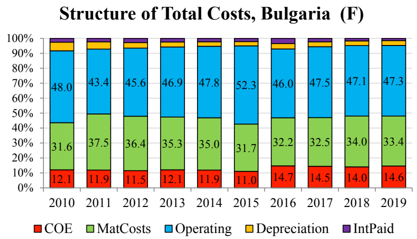
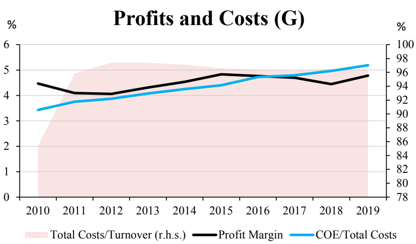
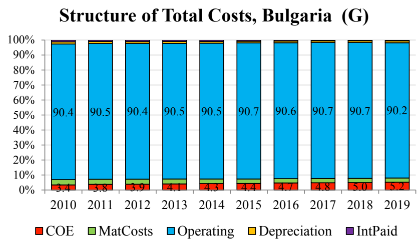
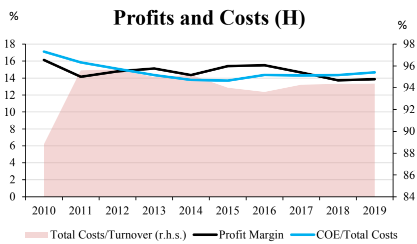
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs


Structure of Total Costs, Bulgaria (F)
48.0 43.4 45.6 46.9 47.8 52.3 46.0 47.5 47.1 47.3
31.6 37.5 36.4 35.3 35.0 31.7 32.2 32.5 34.0 33.4
12.1 11.9 11.5 12.1 11.9 11.0 14.7 14.5 14.0 14.6
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
COE
MatCosts
Operating
Depreciation
IntPaid


Profits and Costs (G)
%
%
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs


Structure of Total Costs, Bulgaria (G)
90.4 90.5 90.4 90.5 90.5 90.7 90.6 90.7 90.7 90.2
3.4 3.8 3.9 4.1 4.3 4.4 4.7 4.8 5.0 5.2
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
COE
MatCosts
Operating
Depreciation
IntPaid


Profits and Costs (H)
%
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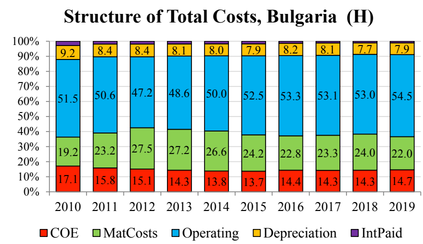
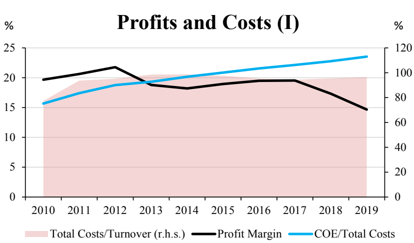
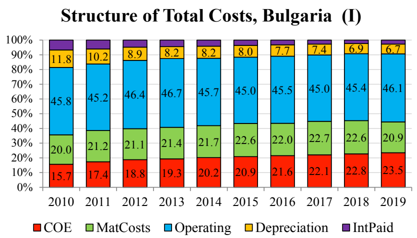
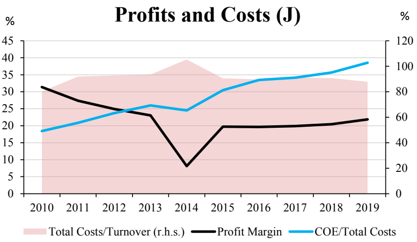
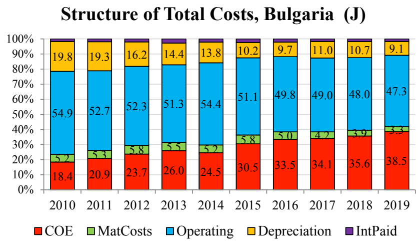
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs

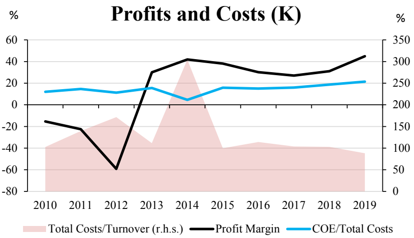

Structure of Total Costs, Bulgaria (H)
9.2 8.4 8.4 8.1 8.0 7.9 8.2 8.1 7.7 7.9
51.5 50.6 47.2 48.6 50.0 52.5 53.3 53.1 53.0 54.5
19.2 23.2 27.5 27.2 26.6 24.2 22.8 23.3 24.0 22.0
17.1 15.8 15.1 14.3 13.8 13.7 14.4 14.3 14.3 14.7
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
COE
MatCosts
Operating
Depreciation
IntPaid

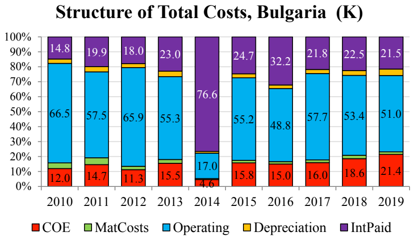

Profits and Costs (I)
%
%
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs

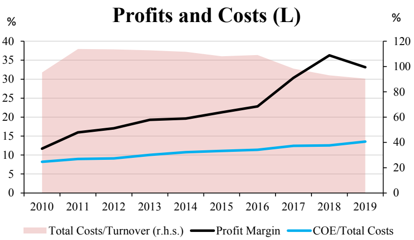

Structure of Total Costs, Bulgaria (I)
11.8 10.2 8.9 8.2 8.2 8.0 7.7 7.4 6.9 6.7
45.8 45.2 46.4 46.7 45.7 45.0 45.5 45.0 45.4 46.1
20.0 21.2 21.1 21.4 21.7 22.6 22.0 22.7 22.6 20.9
15.7 17.4 18.8 19.3 20.2 20.9 21.6 22.1 22.8 23.5
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
COE
MatCosts
Operating
Depreciation
IntPaid

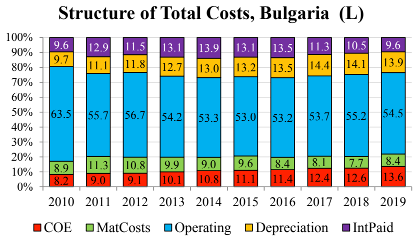

Profits and Costs (J)
%
%
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs

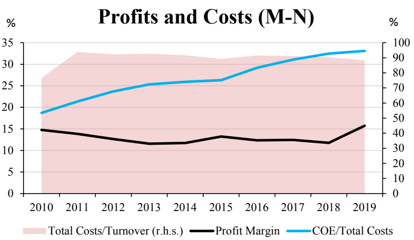

Structure of Total Costs, Bulgaria (J)
COE
MatCosts
Operating
Depreciation
IntPaid

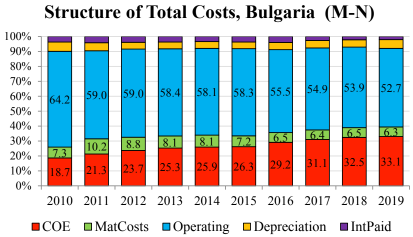

Profits and Costs (K)
%
%
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs

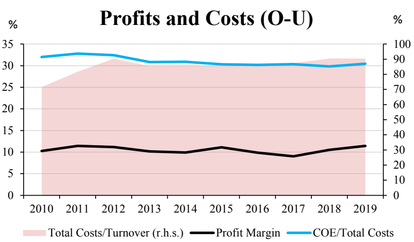

Structure of Total Costs, Bulgaria (K)
COE
MatCosts
Operating
Depreciation
IntPaid

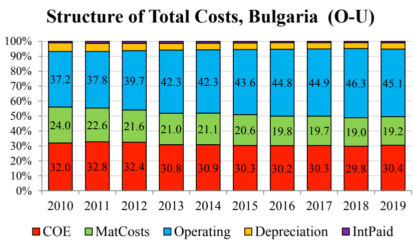

Profits and Costs (L)
%
%
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs

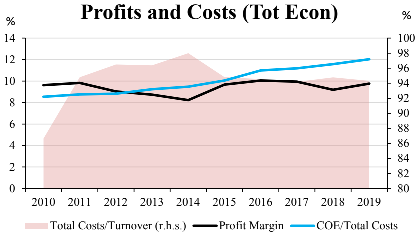

Structure of Total Costs, Bulgaria (L)
COE
MatCosts
Operating
Depreciation
IntPaid

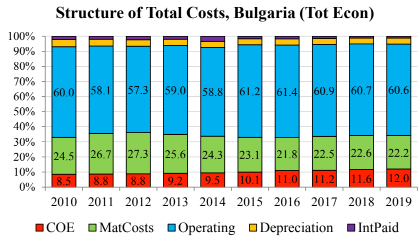

Profits and Costs (M-N)
%
%
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs


Structure of Total Costs, Bulgaria (M-N)
COE
MatCosts
Operating
Depreciation
IntPaid


Profits and Costs (O-U)
%
%
Total Costs/Turnover (r.h.s.)
Profit Margin
COE/Total Costs


Structure of Total Costs, Bulgaria (O-U)
COE
MatCosts
Operating
Depreciation
IntPaid





Sources: AMADEUS, own calculations.

Appendix 3. **Variables Used in the Regression**

This section contains detailed information on the variables used in the quantitative section of our analysis, where we employ a state space framework. Since our empirical estimation is focused on the manufacturing economic sector we construct a dataset that comprises of six manufacturing subsectors and the aggregate manufacturing sector[27]. For each of them the dataset contains three variables – exports of the respective economic sector, external demand for the products of each sector and price competitiveness of each sector. All variables are calculated in nominal terms, which is due to data availability. Furthermore, the analysis is confined only to trade in goods, since data for the trade in services is still insufficient for a proper analysis. Both of these restrictions could be considered as weaknesses of the conclusions drawn from our quantitative framework, since the results omit the services segment of external trade, while the lack of trade data in real terms means that our results could be influenced by different export/import price dynamics in Bulgaria and the rest of the world. All variables are seasonally adjusted prior to their usage in the state space model.

Bulgarian exports by manufacturing subsectors

As we have discussed in Section 4 of the paper, the product groups under CPA 2008 classification prove to be a suitable proxy for estimating exports of the NACE manufacturing subsectors. Therefore, in order to obtain series for the nominal Bulgarian exports of the six manufacturing subsectors that we have selected and total manufacturing, we use the Eurostat dataset for trade by CPA 2008. Based on the correspondence Table 2 in Section 4 we are able to match the NACE manufacturing sub-categories with their closest CPA trade groups, which are available in nominal terms at a monthly frequency. We then group the data for Bulgarian manufacturing exports into the chosen six subsectors and we

[27] For further details on the breakdown of the manufacturing subsectors that we use please refer to Section 5.2.

calculate a nominal "total manufacturing" Bulgarian exports. The figures are calculated in million EUR.

The final transformation of the data for Bulgarian exports by economic sector that enters our state-space models is specified in Table 3.

External demand

In order to construct external demand for Bulgarian exports for the selected six manufacturing subsectors and the total manufacturing exports we use two main datasets – Eurostat's nominal intra-EU27 trade flows by the CPA 2008 classification and World Bank's World Integrated Trade Solution (WITS) and its NACE Revision 1 classification for extra-EU27 nominal trade flows. We have opted for using these two sources as the Eurostat database alone does not provide extra-EU27 trade by CPA 2008 classification. We have selected the CPA 2008 classification and the NACE Revision 1 classification as they are most suitable to categorize trade flows according to our selected groups of manufacturing sectors.

The computation of external demand for Bulgarian exports in nominal terms of each of the six manufacturing subsectors and the total manufacturing export is done using world imports (the sum of intra-EU and extra-EU imports) of the respective sector by our trading partners, weighted according to their importance as a destination for Bulgaria's nominal exports. The figures are calculated in million EUR.

Quarterly data for imports by economic sector of the EU27 countries (intra-EU trade) is obtained from the Eurostat CPA 2008 trade dataset, where figures are in million EUR. World imports for extra-EU27 regions are constructed using the WITS database. The WITS database provides us with a detailed geographical and sectoral/product breakdown of Extra-EU27 trade based on which we calculate extra-EU imports by economic sector. The WITS data is originally in USD and at an annual frequency. Therefore, in order to use it in the calculation of our external demand metrics first we transform it in million EUR by the average annual exchange rate of the EUR against the USD. Then we interpolate the data to a quarterly frequency using the profile of the corresponding data for Bulgarian exports of the respective manufacturing subsector in nominal terms from the CPA database.

In this way, for each of our selected groups of manufacturing sectors we obtain quarterly world nominal imports in million EUR of nine geographical regions, which encompass all countries of the world (intra-EU trade from the Eurostat CPA 2008 trade database and the eight extra-EU regions from the WITS database). If we take as an example "*total manufacturing*", we construct quarterly series for world nominal imports of goods in million EUR by the manufacturing sector for each of the nine regions. Then we calculate quarterly growth rates of series for each region and weight it by the respective share of the region in Bulgaria's nominal exports of manufacturing goods. In this way we obtain a weighted growth rate of Bulgarian external demand for the "*total manufacturing*" sector. Similarly, we obtain the growth rate of external demand for all the rest manufacturing subsectors.

The final transformation of the data for external demand that enters our state-space models is specified in Table 3.

Price competitiveness

In our empirical estimation we define price competitiveness of the exports of each manufacturing subsector as the ratio of Bulgaria's real ULC to euro area's real ULC for the respective sector. Our choice of a proxy for price competitiveness is motivated by desire to incorporate most of the information on relative labour cost dynamics that is used in the calculation of the REER. The ratio of Bulgaria's ULCs to euro area's ULCs could be considered as equivalent to the REER of BG relative to the euro area, since the NEER remains constant due to the functioning of the currency board in Bulgaria. The data used in order to calculate Bulgaria's real ULC by economic sector and euro area's real ULC by economic sector is obtained from Eurostat and is based on National Accounts data by the A64 economic sector breakdown. All manufacturing subsectors are then aggregated into our six manufacturing groupings. Real ULC for *"total manufacturing"* is also calculated both for Bulgaria and for the euro area. A shortcoming of the chosen proxy for price competitiveness is that it measures Bulgaria's labour cost changes only relative to those in the euro area and not relative to the ones for rest of the world. Unfortunately, data on ULCs by A64 economic sector breakdown is not available for many extra-EU countries with which Bulgaria trades, hindering our ability to construct a more accurate price competitiveness metrics.

Furthermore, data from Eurostat by A64 economic sector breakdown is available only at an annual frequency with the data for the euro area aggregates still being unavailable for 2019. In order to guarantee that our analysis would cover the whole period prior to the COVID-19 pandemic, we construct an estimate for the euro area aggregate for 2019. The way in which this is done is through collecting data for the necessary variables by member state of the EA and constructing an EA real ULC aggregate for 2019 by economic sector ourselves.

As for the issue with having only annual data for Bulgaria's ULC and EA's ULC by economic sectors we interpolate the data in order to achieve quarterly frequency using the Denton technique. The interpolation technique is chosen so that it ensures that the interpolated series preserve the dynamics of the annual series to the highest possible extent.

Once we obtain quarterly series for Bulgaria's ULC and EA's ULC by our selected manufacturing subsectors, we calculate a price competitiveness term for each of our groups as the ratio between the series for Bulgaria and the series for the euro area.

The final transformation of the data for price competitiveness that enters our state-space models is specified in Table 3.

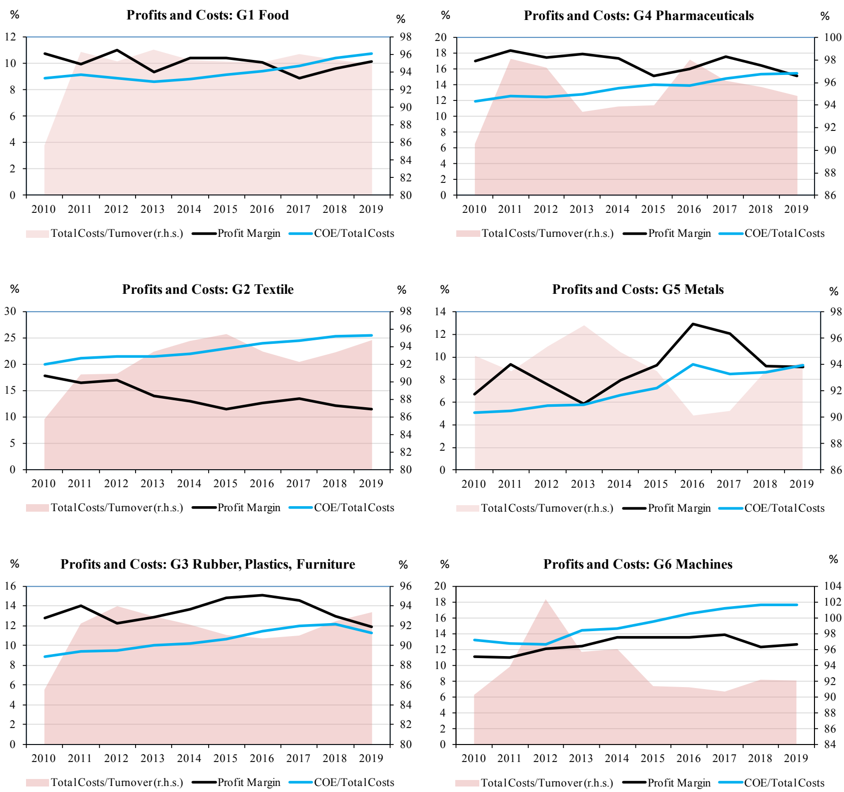
Table 3. **Variables used in the State-Space Models**

Variable Name	Description	Source	Coverage	Transformation
demand	External demand for Bulgarian goods for each subsector (index, based on weighted growth rates of nominal world imports of our trading partners in million EUR)	Eurostat, World Bank WITS, own calculations	2002Q1–2019Q4	Index 2002Q1=100 Logarithm transformation Seasonally adjusted data
pr_comp	Price competitiveness of each subsector (ratio of BG's real ULCs to EA's real ULCs)	Eurostat, own calculations	2002Q1–2019Q4	Index 2002Q1=100 Logarithm transformation Seasonally adjusted data
exp	Bulgarian exports of each subsector (nominal terms, million EUR)	Eurostat, own calculations	2002Q1–2019Q4	Index 2002Q1=100 Logarithm transformation Seasonally adjusted data

Appendix 4. **Profit Margin and Production Costs of Bulgaria's Manufacturing Subsectors**

The Chart below presents the profit margins and production costs by manufacturing subsectors based on the AMADEUS firm-level data for companies in Bulgaria with more than 1 employee and more than 1,000 EUR of annual turnover. Filtered this way, the sample contains information on 363,347 firms out of the total 569,149 firms, available for Bulgaria in the AMADEUS database.

Chart 26. **Profit margins and production costs by manufacturing subsectors in Bulgaria**



Sources: AMADEUS, own calculations.

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ISBN 978-619-7409-23-9 (online)

Elements of the 1 lev banknote, issue 1999, are used in cover design.