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UNIT LABOUR COST AS AN INDICATOR OF COMPETITIVENESS: THEORETICAL PERSPECTIVES ON RECONCILING METHODOLOGICAL CHALLENGES[3]

For decades, economists have faced the dilemma of identifying the key factor in export competitiveness. While some argue that exports are almost exclusively influenced by non-price competitiveness, others emphasise the importance of cost competitiveness and highlight unit labour cost (ULC) as a key factor. Based on a systematic review of the literature, this paper concludes that cost competitiveness, as measured by ULC, is an important determinant of the export performance of firms, sectors and economies, but has significant limitations. The methodological difficulties in assessing this relationship are analysed, and suggestions for improvement and guidelines for future research are provided. Although the traditional ULC is a biased indicator, newer indicators do not address all of its shortcomings. Microeconomic studies generally confirm a negative relationship between exports and ULC, but it is important to control for product quality in order to improve estimates. Although the methodological approach has progressed, fully controlling for endogeneity remains a challenge, and the results are still subject to limitations. This paper suggests that using value added instead of gross exports and indicators such as vertically integrated ULC would improve the accuracy of the estimates and reduce the bias in the results. It also emphasises the importance of shocks that precede changes in ULC and the possibility that long-term deviations from the ULC trend significantly affect exports. The relationship between ULC and exports is multi-faceted and complex, and is subject to methodological challenges such as endogeneity, simultaneity and shocks affecting the economy, sector or firm, which need to be isolated when assessing and interpreting the results.

Keywords: unit labour cost; exports; literature review
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1. Introduction

The current economic situation in Europe, characterised by energy transition initiatives and inflationary pressures, has intensified the focus on national competitiveness and the central role of cost factors in boosting export performance. While an inverse relationship between costs and exports may seem intuitive, the empirical results are surprisingly mixed and cast doubt on the effectiveness of measures to reduce labour costs as a direct tool to increase exports. Cost competitiveness indicators are generally recognised as balancing constraints to economic development (European Commission, 2017). Although they are not sufficient on their own to measure competitiveness, they provide insights into an economy's ability to maintain the balance between input prices, such as wages, and productivity. Unit labour cost (ULC) is an important measure of cost competitiveness and is calculated as the ratio of labour costs per worker to labour productivity. Their importance stems from the fact that labour costs make up a significant part of total production costs. Consequently, increases in labour costs that are not offset by corresponding increases in productivity can lead to higher product prices, which have a negative impact on exports. The inclusion of wages and productivity in ULC captures both elements of price and non-price competitiveness, making the relationship with exports inherently complex but undeniably significant.

However, empirical estimates of this relationship have yielded mixed and sometimes contradictory results. This paper aims to provide a comprehensive literature review of the relationship between ULC and exports and to contribute to a broader understanding of estimates of trade elasticity (Armington, 1969) and the interaction between costs and exports. We critically analyse the existing studies that have estimated this relationship using reduced-form models and econometric methods, emphasising the methodological challenges associated with such estimates. In particular, we address issues of endogeneity, the limitations of ULC as an indicator and the selection of appropriate export measures, all of which are crucial for an accurate assessment. The paper highlights that many studies overlook the complexity of ULC, the influence of various economic shocks on the ULC-export nexus, and the potential biases inherent to ULC as a measure of cost competitiveness. Despite the mixed results, most studies emphasise the continued importance of cost competitiveness for export performance, even in high-technology sectors. To encourage future research, we offer guidelines for improving estimation techniques to provide a more accurate and nuanced understanding of the relationship between cost competitiveness and exports.

The structure of this paper is as follows: following the introduction, we provide an overview of the existing research on the ULC-export relationship. The third section addresses the shortcomings of both aggregate and microeconomic ULC as indicators of cost competitiveness. The fourth section looks at recently developed alternative indicators to mitigate the limitations of ULC. The fifth section addresses the methodological difficulties in assessing the ULC-export relationship and proposes solutions for future research. The final section summarises the main findings and implications of the study.

2. The Relationship between Unit Labour Cost and Exports: Theory, Models, and Empirical Findings

The relationship between ULC and macroeconomic variables, especially exports, is the subject of extensive research, although theoretical models do not always provide a clear, direct explanation. The study of the ULC-export link intensified in the 1970s in the field of international economics (Olczyk, 2016). At the time, the theory of comparative advantage was predominant, emphasising labour productivity as the primary driver of exports. According to these models, countries with a lower ULC have a competitive advantage in the production of certain export goods.

However, these early models struggled to explain the growing phenomenon of two-way trade in similar industries between countries. Consequently, the late 1970s saw the development of new models, including monopolistic competition (Dixit, Stiglitz, 1977) and the New Trade Theory (Krugman, 1979). Both frameworks highlighted specialisation as a source of competitive advantage (Olczyk, 2016). The New Trade Theory (Krugman, 1979) assumes that nations can achieve increasing returns and economies of scale, leading to a reduction in ULC, lower prices, improved cost competitiveness and an expansion of exports. At the same time, following the findings of the Kaldor paradox (Kaldor, 1978)[4], research attention gradually shifted from price and cost competitiveness to non-price factors. This period also saw the emergence of the literature on the technology gap, which links exports to sector-specific advantages arising from technological asymmetries between countries, such as product and process innovation. In addition, numerous econometric models, including export supply, demand and gravity models, have been developed assuming a negative relationship between ULC and exports.

In the late 1980s and 1990s, the relationship between ULC and exports became more closely linked to international competitiveness (as measured by export performance) and technology, as studied in the Schumpeterian literature and the technology gap literature. Studies by Fagerberg (1998), Dosi et al. (1990), Amendola et al. (1993), Amable & Verspagen (1995), and Landesmann and Pfaffermayr (1997) emphasised the importance of technology as a key determinant of the dynamics of the export share of OECD countries, while the importance of costs (relative ULC) was acknowledged, albeit seen as "less important than most believe" (Fagerberg, 1988). Research in this period, which relied on aggregate and sectoral data, often produced unexpected results, with ULC coefficients frequently being non-significant or even positive, confirming the Kaldor paradox. At the time, costs were generally seen as crucial for short-term export competitiveness, while non-price factors, productivity and innovation were seen as key factors of long-term success.

Consequently, studies began examining the ULC-export relationship across different industries, hypothesising that costs have a greater impact in resource-intensive and low-tech

[4] Kaldor paradox refers to a situation where relative ULC is positively correlated with export market shares, while the conventional theory suggests otherwise. It was found by Kaldor (1978). Kaldor paradox should not be confused with Leontief paradox (Leontief, 1953), which refers to a paradox where a relatively more capital abundant country (USA) had a lower capital/labour ratio in exports than in imports.

sectors compared to high-value-added, non-price-dependent industries. Carlin et al. (2001) and Škuflić & Novinc (2025, forthcoming) found somewhat lower export sensitivity in high-technology sectors, while Decramer et al. (2016) found no significant differences. Laursen & Meliciani (2010) surprisingly found that ULC is a significant predictor of exports in ICT and low-tech sectors, but not in medium and high-tech sectors. Ederer & Reschenhofer (2018) find higher elasticity of manufacturing value added shares with respect to relative ULC for sectors that are more dependent on exports. Keil (2024) shows that cost elasticity is higher in industries that are more innovation-oriented and is lower in industries that are less innovative (the technologically less advanced). This is somewhat surprising, but the author attributes it to the degree of openness to international trade – industries that are more exposed to foreign competition are also the ones that innovate more. Škuflić & Novinc (2025, forthcoming) similarly find that the elasticity of exports with respect to ULC increases with export intensity – the more the company is oriented towards the foreign market, the more it is exposed to foreign markets (which may be more competitive) and the higher its export elasticity.

Another strand of research focused on the relationship between ULC and export breadth and examined market and product diversification using firm-level data. The well-established observation that exporters outperform non-exporters in various characteristics such as productivity and ULC (Bernard, Jensen, 1999; Wagner, 2009) led to the assumption that firms with low ULC would have higher export participation, given the relationship between ULC and productivity (Melitz, 2003). However, the empirical results were mixed. Basile (2001) and Decramer et al. (2016) confirmed a weak negative relationship between ULC and export probability, while Stojčić & Bezić (2012) found no statistically significant relationship, although they observed a negative coefficient. Gan et al. (2016) demonstrated a more robust effect of minimum wage growth on export decisions. Altomonte et al. (2013) showed that R&D-active firms had a stronger negative ULC impact on the probability of exporting, suggesting that controlling for product quality through R&D mitigates the effect of the minimum wage. Wakelin (1998) found a negative ULC-export relationship for non-innovative firms, but a positive one for innovative firms, indicating that higher ULC could indicate higher human capital. Decramer et al. (2016) confirmed that higher ULC reduces the likelihood of expanding export destinations and product diversity.

Firm-level studies generally confirm the importance of ULC, with export intensity correlating negatively with ULC in Abraham et al. (2010) and Stojčić (2012), although Stojčić & Bezić (2012) find a positive correlation. Beise-Zee & Rammer (2003) found a negative correlation for manufacturing companies, but an insignificant one for service firms. Decramer et al. (2016) and Škuflić & Novinc (2025, forthcoming) provided detailed firm-level analyses that confirmed a negative correlation between ULC and exports and emphasised the role of firm heterogeneity. The latter study shows that the ULC-exports link is non-linear, varies over time and is influenced by firm productivity, export propensity and technology intensity.

A large body of literature examined the relationship between price/cost competitiveness and macroeconomic imbalances, especially after the 2008/2009 financial crisis. Before the crisis, the macroeconomic fundamentals of the Eurozone were often overlooked, with the main focus on inflation convergence and fiscal sustainability. The Rehn-Meidner rule, which

argued for stable ULC through productivity-dependent wage growth (Collignon, Esposito, 2020), guided much of this policy.

Some studies attributed the emerging macroeconomic imbalances in the new EU member states and peripheral countries to competitiveness gaps created by unsustainable wage (ULC) growth (Zemanek et al., 2010; Belke, Dreger, 2013; Chen et al., 2013). This perspective argued in favour of internal devaluation through wage restraint. However, other studies challenged this view and argued that domestic demand, capital flows and financial sector growth were the main causes of the imbalances (Diaz Sanchez, Varoudakis, 2013; Dieppe et al, 2012; Podstawski, 2014; Comunale, Hessel, 2014; Staehr, Vermeulen, 2019). Gabrisch & Staehr (2013) found that changes in ULC did not Granger-cause current account imbalances. Piton (2021) argues that the non-tradable goods sector (whose competitiveness is only indirectly and weakly related to exports) has contributed most to the increase in ULC and shows that the convergence process (faster productivity growth in the periphery countries) and the relative decline in profit margins (compared to the core countries) were the main causes of the relative ULC divergence between the two groups of countries. The weak correlation between ULC and exports is therefore not surprising.

The weak ULC-export relationship was further supported by studies using aggregate data, with Staehr (2020) and Jakšić et al. (2020) finding that ULC is insignificant. Storm & Naastepad (2015) found that ULC is significant for annual data, but not for quarterly data. Bierut & Kuziemska-Pawlak (2017) found different results depending on the model specification. Gräber et al. (2019) confirmed Kaldor's paradox. Boggio & Barbieri (2016) confirm that the level, but not the growth rate, of ULC is a significant predictor of export shares and conclude that the cost level, and not its dynamics, is important for exports. Accordingly, and despite the strong growth of ULC in the new EU Member States since the beginning of the 20th century, the cost level is still lower than in the core countries, so the price can be competitive.

Finally, it is worth mentioning a strand of literature that has not always directly observed the relationship between exports and ULC, but rather focused on the problems of relocation of production (the phenomenon of offshoring), and changes in global value chains, decisions that indirectly influenced export dynamics. These studies conclude that costs, including labour costs, are a key factor in these processes (Da Silveira, 2014; Johansson, Olhager, 2018). Grodzicki & Skrzypek (2020), analysing the automotive industry, conclude that cost competitiveness is more important for low-income countries – countries in the periphery need to keep wages low to remain part of the value chain. Core countries, on the other hand, can afford higher wages since they compete more on technology and innovation. As a result, short-term wage changes influence offshoring decisions. If wages suddenly rise in a supplier country, manufacturers quickly reduce their orders from that country. Therefore, Grodzicki & Skrzypek (2020) highlight that low costs are still the most effective way to develop the industry and increase exports in the EU periphery countries by acting as low-cost suppliers in global value chains. These conclusions underline that high ULC is negatively associated with exports in the long run, at least in those industries where production can be relocated to countries with relatively low costs.

3. Issues with Unit Labour Cost Calculation

Previous studies have shown a complex and sometimes contradictory relationship between ULC and exports, with results varying from positive to negative and even statistically insignificant. While lower ULC is often associated with improved export competitiveness, this is not always the case, especially in high-tech sectors where innovation and non-price factors are of greater importance. Conversely, high ULC can have a negative impact on long-term export performance, exacerbated by macroeconomic imbalances and inflation, as seen in the new EU member states. To achieve sustainable competitiveness, it is therefore not only necessary to control the growth of labour costs, but also to promote technological modernisation.

Some of the discrepancies in the research results are surely a consequence of the inherent complexity of ULC as an indicator of cost competitiveness. Contrary to popular belief, aggregate ULC – whether sectoral or economy-wide – is not simply a weighted average of firm-level ULC. Instead, it is the product of labour's share in value added and the price deflator and essentially reflects the distribution of income between labour and capital. As a result, changes in aggregate ULC can result from shifts in both income distribution and price competitiveness. This can lead to situations in which ULC and price competitiveness move in opposite directions. For example, a decline in the price deflator (indicating improved price competitiveness) may be offset by an even greater increase in the labour share, resulting in higher ULC and a perceived loss of competitiveness. Research suggests that the decline in the labour share of manufacturing value added in Eurozone countries before the financial crisis contributed to a lower gross wage bill, mainly due to the shrinking share of manufacturing in total value added. So, while the overall ULC might have increased, the competitiveness of the manufacturing sector has not deteriorated to the same extent.

This discrepancy illustrates the compositional fallacy of the ULC. Gaulier & Vicard (2012, 2013) show that a large part of the overall growth in ULC in the eurozone countries before the global financial crisis came from the non-manufacturing sector, while the ULC of the manufacturing sector, which is crucial for foreign trade, remained relatively stable. Fluctuations in ULC thus reflected rising prices in the non-tradable goods sector, which have little direct impact on the competitiveness of exports. This underscores the need for cross-sectoral analysis to accurately interpret the overall movements in ULC and their relationship to exports. As many sectors of the economy are inherently non-tradable (e.g. the public sector, construction and some services), it can be misleading to rely solely on aggregate ULC as an indicator of competitiveness. As Knibb (2016) illustrates, average wages in Germany remained relatively stable between 2000 and 2011, but this stability masked significant sectoral differences, with teachers' wages stagnating while wages in industry rose slightly. Stagnant teacher wages and thus slower growth in aggregate ULC do not contribute to international competitiveness.

Another example of the composition fallacy is the contrasting effects of wage cuts at the company and national levels. An individual firm cutting wages has minimal impact on product demand, while nationwide wage cuts significantly affect aggregate demand, even if they improve cost competitiveness. Greece is the most prominent example of this after the sovereign debt crisis. In addition, different wage-setting mechanisms in different sectors can

influence the macroeconomic development of ULC. With increasing interdependence in wage negotiations within the tradable goods sector in the EU, the impact on wages, and consequently on ULC and exports, may differ between tradable and non-tradable sectors (Gächter et al., 2013).

Finally, structural economic changes, such as the shift from agriculture (with a high share of self-employed) to industry or the service sector (with employer-employee relationships), can also lead to an increase in ULC (Knibb, 2016; Myant, 2016). This is reflected in Eurostat's calculation of nominal ULC:

$$ULC = \frac{\frac{compensation\ of\ employees\ (all\ industries, nominal\ prices)}{number\ of\ employees\ (all\ industries)}}{\frac{GDP\ in\ constant\ prices}{total\ employment\ (all\ industries)}} \quad (1)$$

The shift of employment from agriculture to industry or the service sector changes the composition of the labour force, increasing the numerator in the equation without necessarily impacting the denominator[5]. This structural change highlights an important limitation – over time, the share of labour in value added has declined in certain industries, reducing the impact of labour costs on total production costs and competitiveness.

Myant (2016) further illustrates this complexity by examining global value chains (GVCs). The relocation of production from developed countries such as Germany to less developed countries such as the Czech Republic focuses on reducing costs, particularly labour costs. While technology transfer might suggest equal real productivity, measured productivity in the Czech Republic appears lower due to lower wages and consequently lower value added per worker. This misperception distorts the ULC calculations. In addition, the increasing internationalisation of production reduces the relative role of labour, making the ULC alone a potentially misleading indicator of price competitiveness as it neglects other cost factors (Karadeloglou, Benkovskis, 2015).

The European Commission (2017) points out another significant limitation – ULC's failure to take into account quality heterogeneity within the sector. It warns against mechanical interpretations and points out that economic crises or recessions caused by institutional failure can lead to a decline in ULC due to employment declines (indicating apparent competitive gains). In addition, ULC is usually presented as an index, which is challenging due to the arbitrary selection of a common base year for all countries, potentially masking initial imbalances (Collignon, Esposito, 2020). Importantly, in less developed countries, an increase in ULC can reflect natural convergence processes rather than a deterioration in competitiveness (Collignon, Esposito, 2020).

These shortcomings underline the inadequacy of aggregate ULC as a robust measure of economy-wide cost competitiveness. It is therefore not surprising that studies often find ULC as an insignificant predictor of exports. In contrast, ULC at the firm level provides a more reliable perspective that mitigates aggregation bias and composition errors. At this level,

[5] This might be especially relevant in new member states of the EU, since the share of value added in the agriculture, forestry and fishing sector is declining and is higher in these countries on average than in the old members of the EU (Stefanova, 2022).

ULC directly reflects a firm's labour cost per unit of output. An increase in labour costs at the firm level, ceteris paribus, reduces profit margins and exerts upward pressure on prices, which is likely to lead to a decline in export volumes (unless demand is completely inelastic or there is Giffen's paradox).

However, even firm-level ULC has limitations. It represents the average labour cost per unit of output, calculated as the ratio of labour costs to labour productivity. As it is derived from company financial statements, it is usually approximated by ratios such as compensation of employees to: a) sales revenue (Stojčić, 2012; Stojčić, Bezić, 2012); b) turnover (Crespo, Segura-Cayuela, 2014); c) value added deflated by the deflator of the corresponding manufacturing sector (Decramer et al., 2016) or the implicit deflator for the whole manufacturing industry (Valdec, Zrnc, 2015).

Although this indicator is at the firm level, it still requires some aggregation. Ideally, the ULC should be calculated and analysed for each individual product and market, but such detailed data is usually not available. Furthermore, the ULC can be distorted if higher-quality, more productive firms have higher labour costs. If product quality is not fully captured in value added, these firms may have a high ULC, falsely indicating lower competitiveness (Castellani, Koch, 2015). Consequently, price changes reflected in ULC may be due to actual price fluctuations or quality improvements, making it difficult to isolate the pure price effect.

Therefore, firm-level ULC growth doesn't necessarily indicate cost pressures. It reflects how employee compensation per unit of revenue (or value added) is growing, which can be driven by factors such as increases in human capital and skills. For R&D intensive firms, ULC growth may not necessarily be a barrier to exporting, as their competitiveness depends more on product quality than price (Altomonte et al., 2013). The impact of R&D or human capital investments on ULC is therefore ambiguous. While employee compensation typically rises, if this is not fully reflected in value added, ULC might rise. Thus, ULC at the firm level captures both the efficiency and quality of the workforce (Altomonte et al., 2013).

It is noteworthy that microeconometric studies usually confirm the expected negative relationship between ULC and exports, while the results at higher levels of aggregation are more often not significant or show a positive relationship (Kaldor paradox) – a phenomenon we refer to as the "ULC disconnect"[6]. This disconnect is likely due to the fundamental differences in the construction of ULC between the micro and macro levels. Aggregate ULC is not simply a weighted average of firm-level ULC and suffers from various shortcomings, while the link between microeconomic ULC and exports is more direct.

4. Improving the Unit Labour Cost indicator

The previous chapter described numerous shortcomings of aggregate ULC that can have a significant impact on their relationship with exports. In response, various solutions, including

[6] This result could also reflect the different methods of constructing ULC at the microeconomic and higher aggregation levels (see Chapter 3). The term "ULC disconnect" is inspired by the "exchange rate disconnect" observed in studies on the relationship between real exchange rates and exports, where microeconomic estimates are often more significant than sectoral or aggregate estimates.

new indicators, have been developed to address these problems. For example, ULC calculated exclusively for the manufacturing sector should theoretically correlate better with exports, as most merchandise exports come from this sector. However, this calculation still takes into account numerous non-traded goods and services, leading to distortions. This chapter examines alternative indicators in detail.

Gächter et al. (2013) and Lommatzsch et al. (2016) have introduced the Trade-Weighted Unit Labour Cost (TWULC). TWULC is calculated as the weighted sum of sectoral ULCs, where the weights are the shares of each sector's exports in the country's total exports (either gross or value-added exports). This is an improvement over the standard ULC, as sectors are weighted by their share of exports rather than total value added, thus reducing aggregation bias. This reflects the cost competitiveness of sectors that are truly exposed to international competition to a greater extent (Gächter et al., 2013) and effectively distinguishes between tradable and non-tradable sectors. The calculation based on value-added exports also takes into account the growth of global value chains (GVCs), which provides a more accurate picture for countries with high shares of imported inputs, as gross exports can lead to significant distortions (European Commission, 2017).

While TWULC is better at measuring the cost competitiveness of export sectors, it still focuses exclusively on labour costs and neglects other important factors such as capital investment, raw material and energy prices, which also affect competitiveness. Furthermore, the TWULC is an indicator of cost competitiveness and not a measure of overall competitiveness. It does not take into account non-price factors such as innovation, technological progress, and product quality, which are crucial for long-term export success. In addition, it is better suited to explaining historical export trends than to assessing future export potential, as it assigns little weight to sectors with low current export shares, even if they have high growth potential. The data used to calculate the TWULC comes from databases such as the World Input-Output Database (WIOD), which have significant time lags, limiting their applicability for timely competitiveness policy prescriptions (Gächter et al., 2013). TWULC does some improvement over ULC by reducing aggregation bias and potentially better reflecting global value chains, but it still has many issues inherent to the ULC. Therefore, TWULC, like ULC, should be used in conjunction with other indicators of competitiveness, including productivity, R&D investment and export sophistication.

The Embodied Unit Labour Cost (EULC) introduced by Marczak and Beissinger (2021) measures sectoral cost competitiveness by averaging the nominal ULC of the observed sector with those of all domestic and foreign sectors that supply it, using Leontief value-added weights. A similar indicator is Vertically Integrated Unit Labour Cost (VULC) proposed by Grodzicki and Skrzypek (2020). It applies the same logic to the entire value chain – it maps deflated labour costs to the real value added of all upstream industries and thus expresses the labour costs contained in a unit of final output. Both indicators extend the traditional ULC and the trade-weighted ULC (TWULC) by including indirect suppliers.

However, they differ in two key respects: (i) VULC covers the entire vertically integrated industry, while EULC is limited to a single production sector, and (ii) VULC is calculated in real terms, while the original EULC is exclusively nominal. Common advantages are the ability to capture cost pressures transmitted through global supply chains and a more realistic benchmarking of competitiveness than direct cost measures. The specific weaknesses of the

EULC arise from its nominal construction: it ignores international price level differences and real productivity growth, so that rising nominal wages can be falsely interpreted as a deterioration in competitiveness. VULC solves the deflation problem and enables a breakdown into domestic and foreign cost segments, but it also has its disadvantages – like the EULC, it focuses exclusively on labour and ignores capital, energy and raw material costs; it relies on large, infrequently updated input-output databases, which limits timeliness and coverage; it relies on the assumption of fixed Leontief technology coefficients, potentially misvaluing sectors where rapid automation is occurring; and because input-output tables do not distinguish between intra-firm and market transactions, it can obscure cost shifts within multinational firms. Consequently, while EULC and VULC both represent significant improvements over traditional ULC metrics, each should be interpreted as a partial, and backwards-looking indicator of competitiveness rather than a comprehensive diagnostic tool.

Collignon & Esposito (2020) have developed the Wage Competitiveness Index (WCI), which addresses the problem of the arbitrary base year for the ULC index. The WCI is based on the long-term theoretical assumption that the return on capital adjusts within a currency union. A key advantage of the WCI is its strong correlation with export performance, which makes it a more reliable indicator of international competitiveness. Furthermore, unlike the other indicators mentioned, the WCI takes into account capital productivity in addition to labour costs, providing a more comprehensive and accurate picture of overall competitiveness. This index also helps to identify genuine macroeconomic imbalances, such as overvalued wages in certain countries within a monetary union.

Despite these advantages, the WCI has notable caveats. Its calculation is more complex than that of the ULC, as it requires the estimation of equilibrium wages based on the return on capital. Furthermore, while the WCI is effective for analysis within a currency union, its applicability outside such unions is limited, as it does not take into account the impact of the exchange rate. Although it includes capital productivity, the WCI does not explicitly consider non-price factors of competitiveness such as innovation, institutional quality and labour market regulation. Ultimately, the WCI is a more advanced and accurate indicator of competitiveness within the eurozone compared to the ULC. However, the complexity of the calculations and the limited applicability outside the monetary union could hinder its wider use.

In summary, none of the cost competitiveness indicators presented in this chapter fully address all the limitations of the ULC, although they do represent progress. As these indicators are relatively new, none has yet established itself as a definitive replacement for ULC. Institutions such as the IMF, the ECB and the OECD continue to use ULC in their work. However, compared to the period before the global financial crisis of 2008/2009, the understanding of ULC, including its strengths and weaknesses, has improved considerably. While alternatives to aggregate ULC have been developed, microeconomic ULC remains relatively under-analysed, although some of the issues discussed in the previous chapter are also relevant to it. In fact, ULC at the firm level captures not only the efficiency of the firm but also the quality of the workforce. This problem does not arise with total factor productivity (TFP), which Altomonte et al. (2012) recommend as a superior measure of firm performance, particularly in terms of international competitiveness, and advocate its use in analysing sources of competition and formulating economic policy recommendations.

However, this recommendation does not diminish the importance of ULC as a measure of cost competitiveness, as TFP is not and cannot be a measure of price and cost competitiveness, but rather of multifactor productivity.

5. Methodological Difficulties in Assessing the Relationship Between Unit Labour Cost and Exports: Past, Present and Challenges for the Future

Apart from the inherent limitations of the ULC indicator discussed in Chapter 3 and the general difficulties of using it as a reliable measure, the assessment of its relationship to exports is further complicated by several factors (Gächter et al, 2013): quality and consumer preferences may play a more significant role than ULC, common economic shocks may drive export fluctuations, while changes in the ULC may be of secondary importance, changes in ULC may only affect exports if they differ significantly from those of major trading partners, and market composition (dynamic vs. saturated) may influence the sensitivity of exports to ULC.

Even if ULC were a perfectly "clean" indicator of competitiveness, accurately estimating its relationship to exports would be challenging due to methodological difficulties. First, ULC is inherently "highly endogenous" as wages and labour productivity – both endogenous variables – are its components. This endogeneity leads to different relationships between ULC and exports depending on the underlying factors. The relationship between ULC and exports varies depending on the nature of the preceding shocks. To explain this in more detail, let us assume that there is a wage shock that directly increases ULC (numerator), which is likely to increase prices and reduce exports. Conversely, a demand shock increases production, which initially reduces ULC and stimulates wage growth. Gumiel & Hahn (2018) show that demand shocks initially reduce ULC, which only increases after the third quarter after the shock. Thus, the relationship between ULC and exports is negative after a wage shock, but ambiguous following a demand shock.

Several important points emerge – the type, magnitude and duration of shocks significantly influence the ULC-export relationship. In addition, the reactions of firms to these shocks shape this relationship. While it is often assumed that rising ULC is passed on to prices and affects exports, firms may adjust prices, output and profit margins differently. This is the common view in the literature, where rising ULC is passed on to prices, reducing demand for exports. However, this view may be too simplistic – the adjustment of firms to shocks strongly shapes these relationships. A company can increase prices after a wage shock or leave them unchanged. It can change output volumes, profit margins, the use of other inputs, etc. It is the reaction of the firm that determines the relationship between ULC and exports. This highlights one of the main problems associated with ULC as an indicator of cost competitiveness, as it embodies an endogenous adjustment process, so the standard regression analysis actually finds the relationship between ULC and exports for the "average" shock that preceded the change in ULC, where it is not entirely clear what an "average" shock is. Controlling for other covariates cannot fully solve this problem, as numerous shocks can influence ULC. Therefore, the ULC-exports relationship is likely to be complex, non-linear, discontinuous and potentially asymmetric (Novinc, Škuflić, 2025, pp. 16-33).

Biases in the estimates of ULC exports arise from the nature of ULC, its calculation and economic shocks. However, endogeneity due to omitted variables, reverse causality and simultaneity also pose problems. If exports are the left-hand-side variable and ULC on the right, then an increase in exports may coincide with a decrease in ULC, inducing simultaneity bias (recall that ULC at the firm level is the ratio between compensation of employees and value added of production/sales; similarly, in aggregate ULC, the productivity, i.e. output per worker, is in the denominator). A reverse causality mechanism operates in the sense that export growth enhances productivity, partly through learning from exporting, where firms improve efficiency by adopting new technologies and management practices from international markets. This productivity growth then leads to higher wages and, consequently, an increase in ULC. Additionally, the rent-sharing mechanism plays a role, as firms benefiting from export expansion share part of their increased profits with employees. While this process highlights the link between productivity and output growth, it is more accurately explained through export-led growth theories rather than the traditional Kaldor-Verdoorn effect (Verdoorn, 1949; Kaldor, 1966), which primarily emphasises increasing returns driven by domestic demand.

The endogeneity of ULC is therefore a major methodological challenge. Researchers have attempted to mitigate this problem using autoregressive distributed lag models, instrumental variables and the generalised method of moments (GMM). Kiviet et al. (2017) show that the generalised method of moments may fall short for "truly endogenous" regressors such as ULC. Some authors use the first lag of ULC (Mbaye, Golub, 2002; Boggio, Barbieri, 2016), which might mitigate the problem of reverse causality to a certain extent. While studies regularly acknowledge the problem of endogeneity, they rarely pay attention to solving it. However, the effectiveness of these methods remains uncertain.

Different approaches to parameter identification might be beneficial in aiding endogeneity. Malgouyres & Mayer (2018) analysed the impact of labour cost reduction on French firms' exports by using the predicted treatment intensity, based on the composition of the workforce before the reform, as an instrument for the actual changes in labour costs at the firm level. However, they estimate ULC coefficients as negative but not statistically significant due to high standard errors. When they applied an ex-ante approach (structural estimation of the model, a usual method for assessing the ULC-export relationship), they confirmed a negative relationship but cautioned against drawing conclusions about the impact of labour cost reduction on export competitiveness. Alhola & Keränen (2022) came to similar conclusions in their study on competitiveness reform in Finland. They estimated that the reform reduced Finnish companies' labour costs by about 10% compared to a control group of OECD countries, but found no significant impact on exports. In the second part of their study, they estimated the structural relationship between ULC and exports without identifying the reform as a shock. It is noteworthy that they used the local projection method and obtained lower estimates (between -0.05 and -0.1) than most other studies. Similarly, Gan et al. (2016) examined the impact of minimum wage increases on Chinese firms' exports and estimated a coefficient of around -0.09. Like the two previous studies, their approach is somewhat more focused on controlling for endogeneity compared to other studies.

In most papers, the estimated ULC coefficient is negative, but its value varies considerably, and the coefficients are often positive or statistically insignificant. This variability is not

surprising given the differences in export measures (the dependent variable), ULC definitions (the main regressor), control variables, levels of analysis (firm, sector, aggregate economy), ULC measurement (levels, first differences, logarithmic transformations), econometric methodologies, and model specifications (including static vs. dynamic models and lag structures). When a negative and significant coefficient is found, it is usually between 0 and -1, indicating inelasticity of exports with respect to ULC, which is plausible. Studies that confirm the Kaldor paradox (positive ULC coefficients) are mostly from the last century and use aggregate or sectoral data. Conversely, contemporary studies, especially those using microeconomic data, usually confirm the expected negative sign of the ULC, which contrasts with the results at higher levels of aggregation (the "ULC disconnect" phenomenon).

As Storm & Naastepad (2015) explain, the insignificance of ULC is not surprising, as labour costs account for about 16% of output value. Consequently, a 1% increase in ULC would lead to a price increase of 0.16%, assuming full cost pass-through. However, a full pass-through is unrealistic, so the weak impact of ULC may be due to a limited pass-through of labour costs to prices. The literature suggests that the pass-through is incomplete and weaker in a low inflation environment with well-anchored inflation expectations (Bobeica et al., 2019; Bobeica et al., 2021; Boranova et al., 2019), varies over time and was lower after 2008/2009 than before the crisis (Peneva, Rudd, 2017; Heise et al., 2022; De Luigi et al., 2019). Studies examining export prices/unit values confirm weak (Bekes et al., 2013; Herrero, Rial, 2023) or insignificant (Malgouyres, Mayer, 2018) pass-through effects. Therefore, the post-2009 studies may reflect a weaker pass-through.

While the analysis has focused on the key regressor (ULC), examining the dependent variable (exports) is also crucial. Most studies use gross export shares, which include imported intermediates and re-exports. Domestic costs do not affect foreign value added on these exports, but they do affect value added on exports. Therefore, gross exports may dampen the estimated impact of cost competitiveness, as suggested by Decramer et al. (2016). Their study uses net, gross and value-added exports, showing that the values of the ULC coefficients vary with the choice of export measure, with value-added exports yielding the largest coefficients and gross exports the smallest. Similarly, Lommatzsch et al. (2016) show that value-added exports improve the predictive power of the real effective exchange rate compared to gross exports, with sensitivity being up to four times greater. These results suggest that studies using gross export shares may underestimate the true impact of ULC on value-added exports. Additionally, Keil (2024) shows that the manufacturing value-added cost sensitivity to ULC is higher using Vertically Integrated ULC (VULC) instead of “traditional” ULC.

Furthermore, the ULC concept itself, which combines wages and productivity, can lead to distortions. It is wrong to treat these components as equivalent. Productivity includes physical production, changes in value added (e.g. selling at higher prices) and the efficiency of the production process (Dosi et al., 2015). The predominant component is unclear. Decramer et al. (2016) find that wages are insignificant, but productivity is, while Alhola & Keränen (2022) confirm the opposite. Dosi et al. (2015) observe different wage effects (positive, negative, and insignificant as well) and generally positive productivity effects. Baccaro & Tober (2022) find puzzling results, with wage effects differing across eurozone countries and productivity being significant only in Germany, out of the five analysed countries.

ULC is usually analysed in terms of levels, first differences or growth rates, whereby deviations from trends are rarely taken into account. However, these deviations can be significant. Exports may not react to minor deviations, but longer-lasting or significant deviations can have a greater impact. For example, an overvaluation of the real effective exchange rate may have a greater impact than an undervaluation (Blecker, 2023). This might be relevant for structural change and relocation of plants as well. As for the long-run relationships between ULC and exports, cointegration methods require unit roots, which export shares and relative ULC may not have. Differencing variables avoids non-stationary panel problems but loses long-run information. Razmi (2015) suggests using both levels and growth rates (Keil, 2023).

In sum, this chapter has demonstrated that the relationship between ULC and exports is far from straightforward. Beyond the inherent limitations of ULC as a measure of competitiveness, numerous external factors and methodological challenges complicate accurate assessment. The influence of quality, consumer preferences, economic shocks, and market dynamics, coupled with the endogeneity of ULC itself, creates a complex and often ambiguous relationship. The impact of shocks, the strategic responses of firms, and the choice of econometric methods all significantly affect the estimated ULC-export link.

The issues of endogeneity, reverse causality, and simultaneity necessitate the use of advanced econometric techniques, yet the effectiveness of these methods remains a subject of debate. Studies employing quasi-experimental approaches and focusing on firm-level data provide valuable insights but yield inconsistent results. The pass-through of ULC to prices, which is often incomplete and influenced by macroeconomic conditions, further complicates the analysis. Moreover, the choice of: (i) export measure (gross vs. value-added); and (ii) ULC calculation (traditional vs. VULC), significantly influences the findings, with value-added exports and VULC providing a more accurate reflection of domestic cost impacts. Ultimately, understanding the ULC-export nexus requires a nuanced approach that considers the interplay of these factors. Studies employing robust endogeneity controls, focusing on value-added exports and VULC, may provide a more reliable understanding of the persistent cost sensitivities influencing export performance. However, the inherent complexity of the relationship necessitates careful economic reasoning and the use of advanced econometric techniques to draw meaningful conclusions.

6. Conclusion

The aim of this paper was to analyse the role of unit labour cost (ULC) as a determinant of export performance through a systematic review of the literature and to identify and clarify the main methodological challenges in assessing this relationship. Despite the expectation of a negative relationship, the empirical results in the literature are heterogeneous, which led to a detailed analysis of ULC as an indicator and the associated methodological difficulties. The analysis revealed that aggregate ULC is a biased indicator of cost competitiveness for several reasons, while microeconomic ULC, while mitigating some shortcomings, still does not exclusively measure cost pressures, but can also be influenced by the quality of labour and output. Newer indicators, such as Vertically Integrated Unit Labour Cost (VULC) and the

Wage Competitiveness Index (WCI) offer improvements, but do not eliminate all shortcomings.

A key contribution of this paper is that the type of shock that causes a change in ULC (e.g. wage shock, demand shock) and the response of firms to this shock (adjustment of prices, margins, output and other costs) have a decisive influence on the relationship between ULC and exports. Standard regression analyses, which often neglect this complexity, can lead to biased and inconsistent results. Over the years, a shift in the application of the methodology has been observed, but the complete elimination of endogeneity is often difficult, and the results are still subject to certain limitations. The Kaldor paradox, i.e. the positive relationship between ULC and exports in some studies, can be explained by insufficient control for endogeneity and the nature of the shocks.

Microeconometric studies usually confirm a negative and statistically significant relationship between ULC and exports, in contrast to macroeconomic and sectoral studies. However, even in these studies, the magnitude of the effect varies, indicating the importance of further research. This paper highlights that despite the importance of cost competitiveness, a one-sided focus on reducing labour costs without considering the broader economic context may have limited and even counterproductive effects on exports and economic growth. A holistic view of competitiveness is needed that includes non-price factors and considers the impact of policy on domestic demand and long-term productivity.

The following is recommended for future research: a) use value added exports instead of gross exports to isolate the impact of domestic costs more accurately; b) apply Vertically Integrated ULC (VULC), which takes into account labour costs along the entire value chain, to obtain a more realistic picture of cost competitiveness in the context of globalized production processes; c) control more carefully for endogeneity, ideally using quasi-experimental methods; d) explicitly model the impact of different types of shocks on ULC and exports, taking into account non-linearities and asymmetries in firms' responses; e) analyse the impact of deviations of ULC from its long-term trend, as prolonged imbalances may have more significant consequences for exports.

Contribution of individual authors

Lorena Škuflić and Filip Novinc carried out the research.

The first version was written by Filip Novinc. The second version was written by Lorena Škuflić.

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Declaration of Generative AI and AI-assisted technologies in the writing process

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References

Abraham, V., Sasikumar, S. K. (2010). Labour Cost and Export Behaviour of Firms in Indian Textile and Clothing Industry [online]. Available at: https://mpra.ub.uni-muenchen.de/22784/1/MPRA_paper_22784.pdf [Accessed 25 March 2025].

Alhola, S., Keränen, H. (2022). Dynamic effects of changes in cost competitiveness [online]. Available at: https://talouspolitiikanarviointineuvosto.fi/wp-content/uploads/2022/01/Alhola-Keranen-2022.pdf [Accessed 25 March 2025].

Altomonte, C., di Mauro, F., Osbat, C. (2013). Going beyond labour costs: how and why structural and micro-based factors can help explaining export performance? [online]. Available at: https://talouspolitiikanarviointineuvosto.fi/wp-content/uploads/2022/01/Alhola-Keranen-2022.pdf [Accessed 25 March 2025].

Amable, B., Verspagen, B. (1995). The role of technology in market share dynamics. – Applied Economics, 27, pp. 197-204. https://doi.org/10.1080/00036849500000024.

Amendola, G., Dosi, G., Papagni, E. (1993). The dynamics of international competitiveness. – Weltwirtschaftliches Archiv, 129(3), pp. 451-471. DOI: 10.1007/BF02707997.

Armington, P. S. (1969). A Theory of Demand for Products Distinguished by Place of Production. Staff Papers-International Monetary Fund, pp. 159-178 [online]. Available at: https://talouspolitiikanarviointineuvosto.fi/wp-content/uploads/2022/01/Alhola-Keranen-2022.pdf [Accessed 25 March 2025].

Baccaro, L., Tober, T. (2022). The role of wages in the Eurozone. – Review of international political economy, 29(4), pp. 1263-1286. https://doi.org/10.1080/09692290.2021.1888143.

Basile, R. (2001). Export behaviour of Italian manufacturing firms over the nineties: the role of innovation. – Research policy, 30(8), pp. 1185-1201. https://doi.org/10.1016/S0048-7333(00)00141-4.

Beise-Zee, R., Rammer, C. (2006). Local user-producer interaction in innovation and export performance of firms. – Small Business Economics, 27, pp. 207-222.

Békés, G., Muraközy, B., Munkácsi, Z., Oblath, G. (2013). Unit values, unit labor costs and trade performance in four Central European countries [online]. Available at: https://www.econstor.eu/bitstream/10419/108312/1/MTDP1329.pdf [Accessed 25 March 2025].

Belke, A., Dreger, C. (2013). Current Account Imbalances in the Euro Area: Does Catching up Explain the Development?. – Review of International Economics, 21(1), pp. 6-17. https://doi.org/10.1111/roie.12016.

Bernard, A. B., Jensen, J. B. (1999). Exceptional exporter performance: cause, effect, or both?. – Journal of international economics, 47(1), pp. 1-25. https://doi.org/10.1016/S0022-1996(98)00027-0.

Bierut, B. K., Kuziemska-Pawlak, K. (2017). Competitiveness and export performance of CEE countries. – Eastern European Economics, 55(6), pp. 522-542. https://doi.org/10.1080/00128775.2017.1382378.

Blecker, R. A. (2023). How important is the real exchange rate for exports and growth?. – European Journal of Economics and Economic Policies, 20(2), pp. 250-265. https://doi.org/10.4337/ejeep.2023.0099.

Bobeica, E., Ciccarelli, M., Vansteenkist, I. (2019). The link between labor cost inflation and price inflation in the euro area [online]. Available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2235~69b97077ff.en.pdf [Accessed 25 March 2025].

Bobeica, E., Ciccarelli, M., Vansteenkiste, I. (2021). The changing link between labor cost and price inflation in the United States [online]. Available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2583~50c8fa6c72.en.pdf?1a42a8d3358db9cb6dd4f1eaeb5f3640 [Accessed 25 March 2025].

Boggio, L., Barbieri, L. (2017). International competitiveness in post-Keynesian growth theory: controversies and empirical evidence. – Cambridge Journal of Economics, 41(1), pp. 25-47. https://doi.org/10.1093/cje/bev067.

Boranova, V., Huidrom, R., Nowak, S., Topalova, P., Tulin, V., Varghese, R. (2021). Wage growth and inflation in Europe: a puzzle?. – Oxford Economic Papers, 73(4), pp. 1427-1453. https://doi.org/10.1093/oep/gpab051.

Carlin, W., Glyn, A., Van Reenen, J. (2001). Export Market Performance of OECD Countries: An Empirical Examination of the Role of Cost Competitiveness. – The Economic Journal. 111(468). pp. 128-162. https://doi.org/10.1111/1468-0297.00592.

Castellani, D., Koch, A. (2015). Mapping competitiveness with European data. Bruegel Blueprint [online]. Available at: https://www.bruegel.org/sites/default/files/wp-content/uploads/imported/publications/Blueprint_XXIII_web.pdf [Accessed 25 March 2025].

Chen, R., Milesi-Ferretti, G. M., Tressel, T. (2013). External imbalances in the Euro Area [online]. Available at: https://www.imf.org/external/pubs/ft/wp/2012/wp12236.pdf [Accessed 25 March 2025].

Collignon, S., Esposito, P. (2020). Macroeconomic imbalances in Europe: How to overcome the fallacy of unit labour costs. – Journal of Policy Modeling. 43(3). pp. 673-691. https://doi.org/10.1016/j.jpolmod.2020.04.004.

Comunale, M., Hessel, J. (2014). Current account imbalances in the Euro area: Competitiveness or financial cycle? [online]. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2509303 [Accessed 25 March 2025].

Crespo, A., Segura-Cayuela, R. (2014). Understanding competitiveness [online]. Available at: https://cadmus.eui.eu/bitstream/handle/1814/32232/MWP_WP_Crespo_Segura-Cayuela_2014_20.pdf?sequence=1 [Accessed 25 March 2025].

Da Silveira, G. J. (2014). An empirical analysis of manufacturing competitive factors and offshoring. – International Journal of Production Economics, 150, pp. 163-173. https://doi.org/10.1016/j.ijpe.2013.12.031.

De Luigi, C., Huber, F., Schreiner, J. (2019). The impact of labor cost growth on inflation in selected CESEE countries. Focus on European Economic Integration [online]. Available at: https://www.semanticscholar.org/paper/The-impact-of-labor-cost-growth-on-inflation-in-Luigi-Huber/c369014c85fe67f654433f08d455a3acf93dea91 [Accessed 25 March 2025].

Decramer, S., Fuss, C., Konings, J. (2016). How do exporters react to changes in cost competitiveness?. – The World Economy, 39(10), pp. 1558-1583. https://doi.org/10.1111/twec.12412.

Diaz Sanchez, J. L., Varoudakis, A. (2013). Growth and competitiveness as factors of Eurozone external imbalances: evidence and policy implications. [online]. Available at: https://openknowledge.worldbank.org/entities/publication/f8dbaacf-e7de-59f5-a490-1d63f49fbd80 [Accessed 25 March 2025].

Dieppe, A., Dees, S., Jacquinot, P., Karlsson, T., Osbat, C., Ozyurt, S., ... Vyskrabka, M. (2012). Competitiveness and external imbalances within the euro area [online]. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2174899 [Accessed 25 March 2025].

Dixit, A. K., Stiglitz, J. E. (1977). Monopolistic competition and optimum product diversity. – The American economic review, 67(3), pp. 297-308.

Dosi, G., Pavitt, K., Soete, L. (1990). The economics of technical change and international trade [online]. Available at: https://www.jstor.org/stable/24231814 [Accessed 25 March 2025].

European Commision. (2017). Measuring competitiveness [online]. Available at: https://ec.europa.eu/docsroom/documents/28181/attachments/1/translations/en/renditions/pdf [Accessed 25 March 2025].

Fagerberg, J. (1988). International Competitiveness. – The Economic Journal, 98, 391, pp. 355-374. DOI: 10.2307/2233372.

Gabrisch, H., Staehr, K. (2015). The Euro Plus Pact: Competitiveness and External Capital Flows in the EU Countries. – Journal of Common Market Studies, 53(3), pp. 558-576. https://doi.org/10.1111/jcms.12220.

Gächter, M., Lorenz, H., Ramskogler, P., Silgoner, M. (2013). An Export-Based Measure of Competitiveness [online]. Available at: https://ideas.repec.org/a/onb/oenbmp/y2013i2b4.html [Accessed 25 March 2025].

Gan, L., Hernandez, M. A., Ma, S. (2016). The higher costs of doing business in China: Minimum wages and firms' export behavior. – Journal of International Economics, 100, pp. 81-94. https://doi.org/10.1016/j.jinteco.2016.02.007.

Gaulier, G., Vicard, V. (2012). Current account imbalances in the euro area: competitiveness or demand shock. [online]. Available at: https://ideas.repec.org/a/bfr/quarte/20122701.html [Accessed 25 March 2025].

Gaulier, G., Vicard, V. (2013). The signatures of euro area imbalances: export performance and the composition of ULC growth. [online]. Available at: https://www.ecb.europa.eu/home/pdf/research/compnet/policy_brief_2_export_performance_and_composition_of_ulc_growth.pdf [Accessed 25 March 2025].

Grodzicki, M. J., Skrzypek, J. (2020). Cost-competitiveness and structural change in value chains – vertically-integrated analysis of the European automotive sector. – Structural Change and Economic Dynamics, 55, pp. 276-287. https://doi.org/10.1016/j.strueco.2020.08.009.

Gumiel, J., Hahn, E. (2018). The role of wages in the pick-up of inflation. – Economic Bulletin Boxes, 5.

Heise, S., Karahan, F., Şahin, A. (2022). The Missing Inflation Puzzle: The Role of the Wage-Price Pass-Through. – Journal of Money, Credit and Banking, 54(S1), pp. 7-51 [online]. Available at: https://www.ecb.europa.eu/press/economic-bulletin/focus/2018/html/ecb.ebbox201805_04.en.html [Accessed 25 March 2025].

Herrero, D., Rial, A. (2023). Labor costs, KIBS, and export performance: A comparative analysis of Germany and Mediterranean economies. – Structural Change and Economic Dynamics, 65, pp. 184-198. https://doi.org/10.1016/j.strueco.2023.02.013.

Jakšić, S., Erjavec, N., Cota, B. (2020). Export and total factor productivity of EU new member states. – Croatian Operational Research Review, 11(2), pp. 263-273. https://doi.org/10.17535/crorr.2020.0021.

Johansson, M., Olhager, J. (2018). Manufacturing relocation through offshoring and backshoring: the case of Sweden. – Journal of Manufacturing Technology Management, 29(4), pp. 637-657. https://doi.org/10.1108/JMTM-01-2017-0006.

Kaldor, N. (1966). Causes of the slow rate of economic growth of the United Kingdom. Cambridge University Press [online]. Available at: https://www.cambridge.org/core/journals/recherches-economiques-de-louvain-louvain-economic-review/article/abs/n-kaldor-causes-of-the-slow-rate-of-economic-growth-of-the-united-

kingdom-an-inaugural-lecture-london-cambridge-university-press-1966-40-p-5-net-in-uk/471781704ADF4ED87FE0661959B8E12E [Accessed 25 March 2025].

Kaldor, N. (1978). The effect of devaluations on trade in manufactures. In Further essays on applied economics. Duckworth.

Karadeloglou, P., Benkovskis, K. (2015). Compendium on the diagnostic toolkit for competitiveness. – ECB Occasional Paper Series, No 163 [online]. Available at: https://www.ecb.europa.eu/pub/pdf/scpops/ecbop163.en.pdf [Accessed 25 March 2025].

Keil, S. (2023). The challenging estimation of trade elasticities: Tackling the inconclusive Eurozone evidence. – The World Economy, 46(5), pp. 1235-1263. https://doi.org/10.1111/twec.13333

Keil, S. (2024). Competing for manufacturing value added: How strong is competitive cost pressure on sectoral level?. – Structural Change and Economic Dynamics, 69, pp. 197-212. https://doi.org/10.1016/j.strueco.2023.12.003.

Kiviet, J. F., Pleus, M., Poldermans, R. W. (2017). Accuracy and efficiency of various GMM inference techniques in dynamic micro panel data models. – Econometrics, 5(1), p. 14. https://doi.org/10.3390/econometrics5010014.

Knibb M. (2016). A critique of nominal and real macro unit labour costs as an indicator of competitiveness. - World Economic Association Newsletter, 5(3) [online]. Available at: https://www.researchgate.net/publication/279763262_A_critique_of_nominal_and_real_macro_unit_labour_costs_as_an_indicator_of_competitiveness [Accessed 25 March 2025].

Krugman, P. R. (1979). Increasing returns, monopolistic competition, and international trade. – Journal of international Economics, 9(4), pp. 469-479. https://doi.org/10.1016/0022-1996(79)90017-5.

Landesmann, M., Pfaffermayr, M. (1997). Technological competition and trade performance. – Applied Economics, 29(2), pp. 179-196. https://doi.org/10.1080/000368497327254.

Laursen, K., Meliciani, V. (2010). The role of ICT knowledge flows for international market share dynamics. – Research Policy, 39(5), pp. 687-697. https://doi.org/10.1016/j.respol.2010.02.007.

Leontief, W. (1953). Domestic production and foreign trade; the American capital position re-examined. Proceedings of the American philosophical Society, 97(4), pp. 332-349. Available at: https://www.jstor.org/stable/3149288 [Accessed 27 April 2025].

Lommatzsch, K., Silgoner, M. A., Ramskogler, P. (2016). Trade in value added: Do we need new measures of competitiveness? [online]. Available at: https://www.econstor.eu/bitstream/10419/154369/1/ecbwp1936.pdf [Accessed 25 March 2025].

Malgouyres, C., Mayer, T. (2018). Exports and labor costs: evidence from a French policy. – Review of World Economics, 154(3), pp. 429-454. https://doi.org/10.1007/s10290-018-0320-x.

Marczak, M., Beissinger, T. (2022). A new sectoral unit labour cost indicator based on global value chains. – Applied Economics Letters, 29(13), pp. 1152-1157. https://doi.org/10.1080/13504851.2021.1915461.

Mbaye, A. A., Golub, S. (2002). Unit labour costs, international competitiveness, and exports: the case of Senegal. – Journal of african Economies, 11(2), pp. 219-248. DOI:10.1093/JAE/11.2.219.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. – Econometrica, 71(6), pp. 1695-1725. https://doi.org/10.1111/1468-0262.00467.

Myant, M. (2016). Unit labour costs: no argument for low wages in eastern and central Europe. – ETUI Research Paper-Working paper [online]. Available at: https://www.etui.org/sites/default/files/ez_import/16%20WP%202016%2008%20Unit%20labour%20costs%20wages%20CEE%20Myant%20Web%20version.pdf [Accessed 25 March 2025].

Novinc, F., Škuflić, L. (2025). Is Cost Competitiveness a Sufficient Driving Force for Croatian Exports?. – The South East European Journal of Economics and Business, 20(2), pp. 16-33.

Olczyk, M. (2016). Bibliometric approach to tracking the concept of international competitiveness. – Journal of Business Economics and Management, 17(6), pp. 945-959. https://doi.org/10.3846/16111699.2016.1236035.

Peneva, E. V., Rudd, J. B. (2017). The passthrough of labor costs to price inflation. – Journal of Money, Credit and Banking, 49(8), pp. 1777-1802. https://doi.org/10.1111/jmcb.12449.

Podstawski, M. (2016). What drives EMU current accounts? A time varying structural VAR approach. A Time Varying Structural VAR Approach. Podstawski, Maximilian, What Drives EMU Current Accounts? [online]. Available at: http://dx.doi.org/10.2139/ssrn.2778147 [Accessed 25 March 2025].

Razmi, A. (2015). Correctly analysing the balance-of-payments constraint on growth. – Cambridge Journal of Economics, 40(6), pp. 1581-1608. DOI: 10.1093/cje/bev069.

Staehr, K., Vermeulen, R. (2019). Heterogeneous effects of competitiveness shocks on macroeconomic performance across euro area countries. – The World Economy, 42(1), pp. 68-86. https://doi.org/10.1111/twec.12675.

Staehr, K. (2020). Export performance and capacity pressures in Central and Eastern Europe. – International Economics, 165, pp. 204-217. https://doi.org/10.1016/j.inteco.2020.12.008.

Stefanova, K. (2022). Labour Productivity Convergence of CEE Countries with the Euro Area – Evidence at Aggregate and Sectoral Level. – Economic Studies (Ikonomicheski Izsledvania), 31(7), pp. 3-19.

Stojčić, N. (2012). The competitiveness of exporters from Croatian manufacturing industry. – Ekonomski pregled, 63(7-8), pp. 424-445.

Stojčić, N., Bezić, H. (2012). Restructuring and barriers: Cross-country evidence on the competitiveness of exporters in transition. – Managing global transitions, 10(2), pp. 145-170.

Storm, S., Naastepad, C. W. (2015). Europe's hunger games: income distribution, cost competitiveness and crisis. – Cambridge Journal of Economics, 39(3), pp. 959-986. https://doi.org/10.1093/cje/beu037.

Valdec, M., Zrnc, J. (2015). The direction of causality between exports and firm performance: microeconomic evidence from Croatia using the matching approach. – Financial theory and practice, 39(1), pp. 1-30. DOI: 10.3326/fintp.39.1.1.

Verdoorn, P. J. (1949). On the Factors Determining the Growth of Labour Productivity. L'Industria. – In: McCombie, J. S. (2002). Productivity Growth and Economic Performance: Essays on Verdoorn's Law. London: Palgrave Macmillan.

Wagner, J. (2012). International trade and firm performance: a survey of empirical studies since 2006. – Rev World Econ, 148, pp. 235-267. https://doi.org/10.1007/s10290-011-0116-8.

Wakelin, K. (1998). Innovation and export behaviour at the firm level. – Research policy, 26(7-8), pp. 829-841. https://doi.org/10.1016/S0048-7333(97)00051-6.

Zemanek, H., Belke, A., Schnabl, G. (2010). Current account balances and structural adjustment in the euro area. – International Economics and Economic Policy, 7(1), pp. 83-127.