International Comparisons of Unit Labor Costs and Manufacturing Competitiveness: Sources, Trends, and Implications

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Abstract
Unit labor costs (ULCs), defined as compensation per unit of output, are a widely used measure of international cost competitiveness. Trends in ULCs, however, differ widely across countries and, traditionally, have been explained in terms of underlying movements in productivity, compensation, and exchange rates. This paper examines the availability of ULC, productivity, and compensation data used for assessing international competitiveness. Three major data sources are reviewed: The Conference Board International Labor Comparisons (ILC) program, the OECD Structural Analysis Database (STAN), and the EU KLEMS Growth and Productivity Accounts. For each source, the paper derives and compares measures of manufacturing ULCs for overlapping countries. Despite some methodological and computational differences, the three databases yield similar conclusions about changes in competitiveness over time, as well as similar rankings of competitiveness relative to the U.S. Finally, using the ILC database, the paper presents ULC trends and levels for detailed manufacturing industries to shed light on variations in industry cost competitiveness.

Key Words: international, competitiveness, unit labor cost, productivity, manufacturing, industry

1. Introduction

Since 2008, the global economy has been wracked by economic crises that have resulted in monetary and financial imbalances, weak labor markets, and political uncertainty as nations try to find the right combination of policies to return to sustainable growth. Maintaining, and increasing, international competitiveness is one path to recovery and a key driver of living standards. Competitiveness is determined by both productivity and the cost of inputs, and importantly the cost of labor because it accounts for a significant share of production cost. In the manufacturing sector, while there are other costs of production, labor costs dominate the cost structure in several manufacturing industries and can vary markedly across geographical locations. Competitive advantage, however, is not determined by wage rates alone. What matters is the wage rate relative to productivity, or unit labor costs (ULCs). ULCs, defined as compensation costs per unit of output, are therefore a commonly used measure of international competitiveness.

This paper addresses international competiveness in the context of internationally comparable datasets of productivity and unit labor costs. As a first step, the paper reviews the literature on ULCs and their use in assessing competitiveness across countries.

Second, the paper examines three sources of international competitiveness statistics: The Conference Board International Labor Comparisons (ILC) program, the OECD Structural Analysis Database (STAN), and the EU KLEMS Growth and Productivity Accounts. For each source, the country and industry coverage and the methodology used in calculating competitiveness measures are compared. Are available sources up to the task of assessing and explaining competitiveness? To address this, the paper derives measures of ULCs from each database and compares results for overlapping countries, including the United States, Belgium, Finland, France, Germany, Italy, the Netherlands, and Sweden.

The remainder of the study uses the ILC database to examine trends and levels of manufacturing ULCs for the selected countries plus additional countries in the database. ULCs for both sector and sub-sector industries are decomposed into trends and levels of hourly compensation costs, productivity, and exchange rates to identify which industries across countries are gaining and losing competitiveness relative to the corresponding industry in the U.S. The paper concludes by identifying future applications and extensions of competitiveness databases for the economic research community.

2. Literature Review

The traditional view of international competitiveness focuses on the negative relationship between growth in ULCs and growth in export shares as the major factor affecting differences in competitiveness and growth across countries. However, this approach to competitiveness has long been criticized as being overly simplified. Various studies analyzing differing time periods from the 1960s to the mid-1990s have found that countries with the fastest economic growth and increase in trade flows have also experienced the fastest growth in ULCs. In the literature, this counterintuitive result is known as "Kaldor's Paradox," after Kaldor (1978), who identified a positive relationship between ULC growth and export growth in analyzing 12 countries for the period 1963 to 1975 (Fagerberg 1996 reached similar results for 1978-1994). More recent studies, however, have focused on assessing competitiveness of emerging economies such as Senegal (Mbaye and Golub 2003) and South Africa (Edwards and Golub 2004) and have found the traditional view of competitiveness to hold.

Competing findings on the impact of ULCs on export shares by Kaldor and others highlighted the importance of non-price factors as determinants of international competitiveness. A related literature, for example, focuses on the specific goods that countries produce and trade, and the implications for growth and competitiveness. As Hausmann, Hwang, and Rodrik (2005) so eloquently put it, "What you export matters." They develop a quality index for a country's export basket that reflects each product's associated level of income, measured as a weighted average of the per capita GDP of countries exporting the given product. Using this framework, the authors show that certain goods are associated with higher productivity levels than other goods and that developing capabilities in the higher value added products yields better growth performance. Building on this work, Hidalgo, Klinger, et al. (2007) define the "product space" where higher quality goods are situated in a dense highly interconnected core while lower quality goods are located in a sparse periphery with fewer nearby products. They argue that a country's product structure is not only determined by factor endowments (per traditional trade theory), but also by a country's ability to jump to higher quality goods that are closely related to its current export basket. Thus, to the extent that poor countries are trapped in the periphery of the product space explains their inability to catch up to rich countries at the more sophisticated core. Felipe, Kumar, and Abdon (2010) take this a step further by defining the “low product trap” and identifying specific “good” and “bad” products based on their income content and their connectivity to other products. This product quality literature recognizes the role of a country’s product structure as a major determinant of international competitiveness.

A large part of the literature that focuses directly on ULCs explains ULC growth in terms of the underlying movements in productivity, compensation, and exchange rates (Lewney, et al. 2012). A common “finding” is that exchange rates have a dominant influence on ULC trends. Several studies (Hooper and Vrankovich 1995; van Ark, Stuivenwold and Ypma 2005; Broeck, Guscina and Mehrez 2012) develop estimates of ULC levels for manufacturing industries to assess competitiveness at the industry level. In these analyses, a primary theme is how to convert the ULC output denominator into a common currency (often a debate between using purchasing power parities and unit value ratios). Even when the same countries are examined, level ULC estimates differ markedly across the studies and appear sensitive to the time period, data sources, measures of national price levels, and the benchmark country used.

There appears to be very little research done to explain differences in ULCs as the main driver of cost competitiveness. One exception is De Broeck, Guscina, and Mehrez (2012), who develop a measure of manufacturing industry competitiveness for Slovakia and other CEE countries. They regress relative industry-to-sector ULCs on real GDP per capita, the lagged unemployment rate, and the industry’s export share, and use the model’s residual to indicate deviations in industry ULCs from the manufacturing sector “norm.” That is, deviations below (above) the “norm” signal that the industry is more (less) competitive relative to the sector as a whole. Further, changes in an industry’s deviation from the sector norm imply changes in competitiveness over time. One limitation of the study is that it focuses on intra-country industry competitiveness and does not explicitly explain differences in competitiveness across countries. Rather, it identifies industries within countries that are becoming more or less competitive relative to the sector as a whole.

Thus, with the exception of De Broeck, Guscina, and Mehrez (2012), there is a lack of econometric analysis using ULCs as the independent variable. This means that there has been no real attempt to explain the structural determinants of ULCs, and how such structural differences across countries affect differences in international competitiveness. While this is beyond the scope of this paper, it begins by identifying and building upon existing sources of competitiveness indicators that will facilitate such studies.

3. Comparing Sources of International Competitiveness Statistics

The lack of internationally comparable data for economic analysis is not a new challenge. The need for a larger number of countries, additional industries, and longer historical time series can limit the comparability and reach of economic research. To address the needs of the research community, The Conference Board International Labor Comparisons (ILC) program, the OECD Structural Analysis Database (STAN), and the EU KLEMS Growth and Productivity Accounts continue to improve and expand their datasets for assessing industrial performance and competitiveness across countries. Table 1 and the following sections provide a brief overview of each dataset.

Table 1: Comparing Sources of International Competitiveness Statistics

	The Conference Board International Labor Comparisons (ILC) program	**OECD STructural ANalysis (STAN) Database**	**EU KLEMS Growth and Productivity Accounts**
Countries	12	15	12
Years	1950-2012	1970-2011	1970-2012
Mfg Industries	ISIC Rev4	ISIC Rev4	ISIC Rev4
subsections	9	15	9
divisions	22	22	2
Variables	value added, real (VaR) labor cost, employed (LC) hours worked, employed (HrA)	value added, volumes (VALK) compensation, employees (LABR) hours worked, employees (HRSE) hours worked, employed (HRSN)	value added, real (VA_Q05) labor cost, employed (LAB) hours worked, employed (H_EMP)
Sources	National statistical agencies: National accounts National industrial surveys/censuses		
Methodology	Estimates for self-employed (labor cost, hours worked) Employment taxes and subsidies accounted for in labor cost	Data on self employed available to adjust to total employed concept	Estimates for self-employed (labor cost, hours worked)
	Rooted in SNA93 / ESA95 Estimates for missing industry detail Series linked to bridge different vintages of national accounts and classification systems		

3.1 The Conference Board International Labor Comparisons Program

The Conference Board ILC program, previously a division of the U.S. Bureau of Labor Statistics, publishes trends (indexes) of total manufacturing labor productivity and ULCs for 19 countries across North America, Europe, and Asia Pacific. Preliminary estimates of ULCs by manufacturing sub-industry are available for 12 countries.[1] Indexes for underlying series on real gross value added, total hours worked, total compensation, and total employment are also available. Time series for the total manufacturing sector data begin in 1950 and are updated annually to include data through the previous year.

Since the 1960s, the ILC program has published productivity and ULC trends referring to the manufacturing sector only. As part of this paper, ILC has developed preliminary estimates of competitiveness indicators for 31 manufacturing industries (9 subsections and 22 divisions) based on the International Standard Industrial Classification, Revision 4 (ISIC Rev.4). As an additional extension, ILC has developed level (U.S. dollar-based) estimates of productivity and ULCs by converting underlying data on value added to 2005 U.S. dollars using sector specific purchasing power parities (PPPs) derived from the Groningen Growth and Development Centre (GGDC). The PPPs were estimated by combining GGDC[2] gross output relative prices for the manufacturing sector and sub-industries with corresponding exchange rates from the Penn World Tables (PWT).[3]

3.2 OECD Structural Analysis Database

The OECD STAN database includes underlying measures of output, labour input, investment, and international trade that allow users to construct indicators for assessing

[1] ILC productivity and ULC series for total manufacturing cover: North America: U.S. and Canada; Europe: Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, United Kingdom; Asia Pacific: Australia, Japan, Singapore, South Korea, and Taiwan. Industry level data exclude Czech Republic, Norway, Spain, United Kingdom, Australia, Singapore, and South Korea.

[2] GGDC relative prices from Inklaar and Timmer (2012).

[3] PWT exchange rates from Feenstra, Inklaar and Timmer (2013).

productivity, growth, and competitiveness. Data cover 15 OECD countries[4] and historical estimates go back to 1970. For the purpose of developing competitiveness indicators, data on real gross value added are supplemented by employment and hours worked series referring to both total employment and employees. The number of self-employed is also available. Labor cost data refer to compensation of employees only. STAN provides comprehensive coverage for the manufacturing sector under ISIC Rev.4, publishing measures for 37 manufacturing industries (15 subsections and 22 divisions).

STAN originated in the early 1990s as a resource for developing international input-output tables, for assessing technology diffusion across countries, and for general structural analyses. Indicators were initially available for manufacturing industries only, but over various iterations the database has grown to cover the whole economy and over 100 industries across all sectors. Country data are updated on a rolling basis as they become available. Further, while STAN provides measures necessary for growth accounting exercises, the database is increasingly used only for productivity analysis due to various methodological limitations (as discussed in O'Mahony and Timmer 2009).

3.3 EU KLEMS Growth and Productivity Accounts

The EU KLEMS database is designed for advanced growth accounting and international comparisons of the sources of output and productivity growth. The database provides output and input measures dating back to 1970 for the U.S., Japan, and 10 countries in Europe.[5] Detailed breakouts of inputs are available for capital (K), labor (L), energy (E), material (M), and service inputs (S). For constructing competitiveness indicators, data are available on real gross value added, as well as employment, hours worked, and labor compensation referring to total employed persons. While coverage of the manufacturing sector is limited to 11 industries (9 subsections and 2 divisions), EU KLEMS provides measures for the total economy and 47 distinct sector and industry groupings under ISIC Rev.4. A defining characteristic of EU KLEMS is that it is based on growth accounting methodology that is rooted in neo-classical production theory (O'Mahony and Timmer 2009). The underlying theoretical framework yields productivity and growth indicators that are consistent across countries and industries, thus enhancing the international comparability of calculated measures. Database updates occur on an ad hoc basis (generally every two or three years) and are dependent on special funding grants by the European Commission.

3.4 Comparing ILC, STAN, and EU KLEMS

All three databases—ILC, STAN, and EU KLEMS—offer indicators for assessing industrial performance and competitiveness across countries. While ILC focuses on direct measures of competitiveness, both STAN and EU KLEMS go beyond this offering and provide variables required for growth accounting (including gross output, intermediate inputs, and capital). With minor differences, however, the country, industry, and historical coverage are consistent across all three. Countries included are predominantly mature European economies, with U.S. data also available to make key comparisons. While two of three sources include Japan and South Korea, other parts of Asia, and Latin America in its entirety, are missing. All three databases have converted industry estimates

[4] OECD STAN covers: Austria, Belgium, Czech Republic, Denmark, Germany, Finland, France, Hungary, Italy, Netherlands, Norway, South Korea, Slovenia, Sweden, and the U.S.

[5] European coverage of EU KLEMS includes: Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, and the United Kingdom. EU KLEMS offers additional country coverage in the ISIC Rev.3 version of the database.

to an ISIC Rev.4 basis and provide industry breakdowns for the manufacturing sector. STAN offers by far the most industry detail, while EU KLEMS publishes only highly aggregated manufacturing industries (subsections).[6] ILC provides the longest historical time series back to 1950 for the manufacturing sector. Even within databases, however, coverage differs across countries, industries, and variables due to data limitations.

3.4.1 Methodological Comparison

The sources and methodology used in constructing the databases are also consistent and conform to international standards in this area. Underlying data are predominantly obtained from the National Accounts programs of national statistical agencies. Countries included follow guidelines of the System of National Accounts (SNA93), or its European equivalent (ESA95), which ensures conceptual harmonization of basic data series. Other official government sources, such as establishment or labor force surveys, are used when series are not available from national accounts. These alternative data sources are often used to fill missing industry detail or other gaps. Longer historical time series are frequently constructed by linking series based on different vintages of national accounts or different industrial classification systems. Further, in the latest version of EU KLEMS, data on output, value added and employment are made fully consistent with corresponding series in STAN.

ILC and EU KLEMS make additional adjustments to labor compensation data from national accounts, which refer to employees only. The compensation of self-employed persons is not captured as labor income in national accounts, but rather grouped as “other income” (van Ark, Stuivenwold, and Ypma 2005). ILC and EU KLEMS therefore estimate total labor compensation by assuming that the average compensation of the self-employed equals that of employees. When other variables for the self-employed are missing (e.g. hours worked) a similar approach is followed where average characteristics of employees are applied to the self-employed. While labor compensation series available in STAN refer to employees only, an adjustment could be made using other variables in the database and similar assumptions.

3.4.2 Empirical Comparison

For assessments of competitiveness, the ILC, STAN, and EU KLEMS databases contain the variables needed to construct estimates of ULCs and related measures of labor productivity and hourly compensation costs. Figure 1 presents manufacturing ULC levels relative to the U.S. calculated from each source by dividing labor compensation by real value added. Compensation is converted to U.S. dollars using market exchange rates from the International Monetary Fund (IMF) and value added is converted to 2005 U.S. dollars using derived PPPs from the GGDC, as described previously. Countries selected—Belgium, Finland, France, Germany, Italy, the Netherlands, and Sweden—are those with overlapping coverage across all three databases and with conversion factors available from the IMF and GGDC.

As shown in Figure 1, the three databases of competitiveness measures yield similar trends in ULCs but different levels. Common trends are partially the result of a common source of exchange rate data for converting compensation to U.S. dollars. Similar levels for STAN and EU KLEMS are also expected due to the use of identical series for value added. Any remaining differences between these two sources are the result of differences

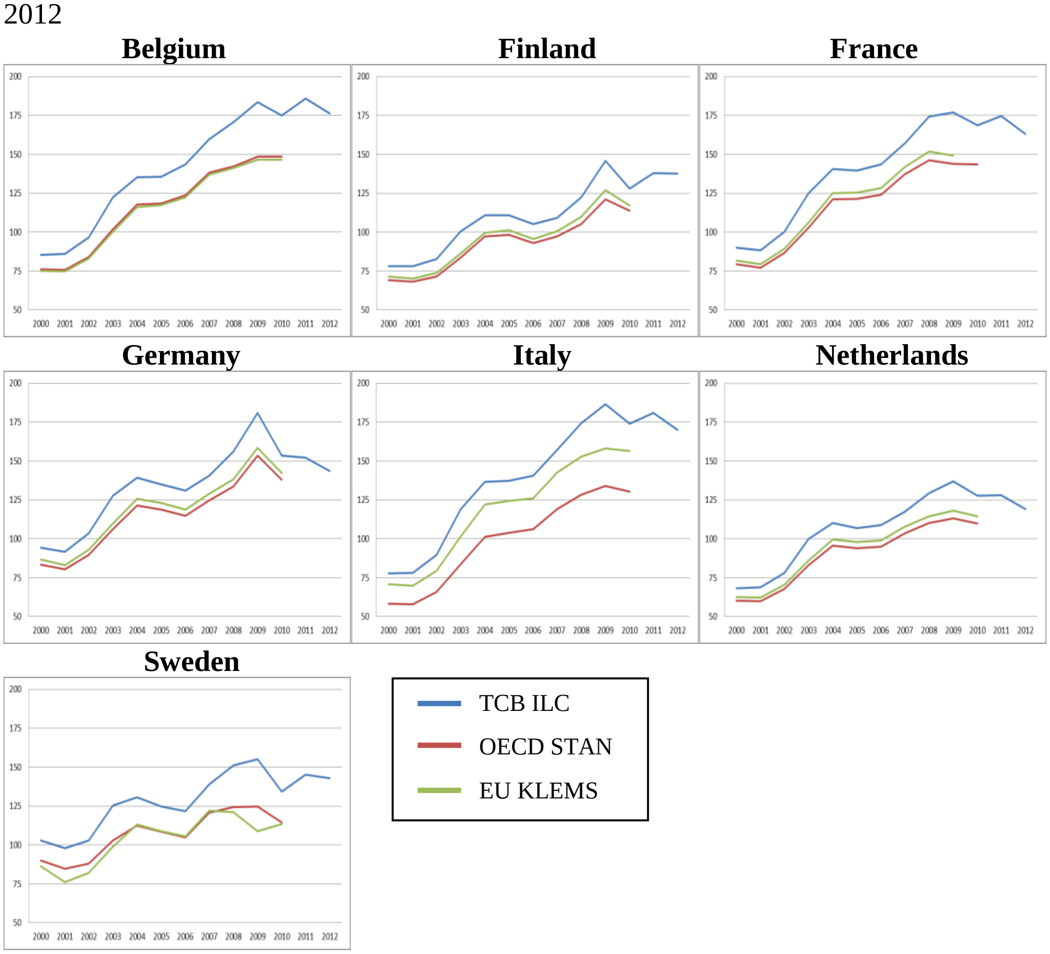
[6] EU KLEMS offers more detailed industry breakouts for manufacturing and other sectors in the ISIC Rev.3 version of the database.

in the coverage of compensation series. As mentioned earlier, the published STAN labor compensation variable refers to employees only; no adjustment for the self-employed is made. In Figure 1, the STAN-EU KLEMS gap for each country thus primarily reflects the magnitude of the adjustment for the self-employed. The gap is widest for Italy, where the incidence of self-employment in manufacturing is quite large.

The ILC database yields the highest ULC levels for all countries shown. These consistently higher results are likely due to a combination of factors, such as differences in the vintage of national accounts data used and technical discrepancies in the way gaps for the self-employed, hours worked, or other missing variables are filled.

Overall, trends in ULCs constructed using ILC, STAN, and EU KLEMS indicators are largely consistent whereas some deviations in ULC levels can be explained by methodological or computational differences. All three databases contain the fundamental tools for international comparisons of manufacturing competitiveness and would yield similar conclusions about changes in competitiveness over time, as well as similar rankings of competitiveness relative to the U.S.

Figure 1: Manufacturing unit labor costs relative to the United States (U.S.=100), 2000-2012

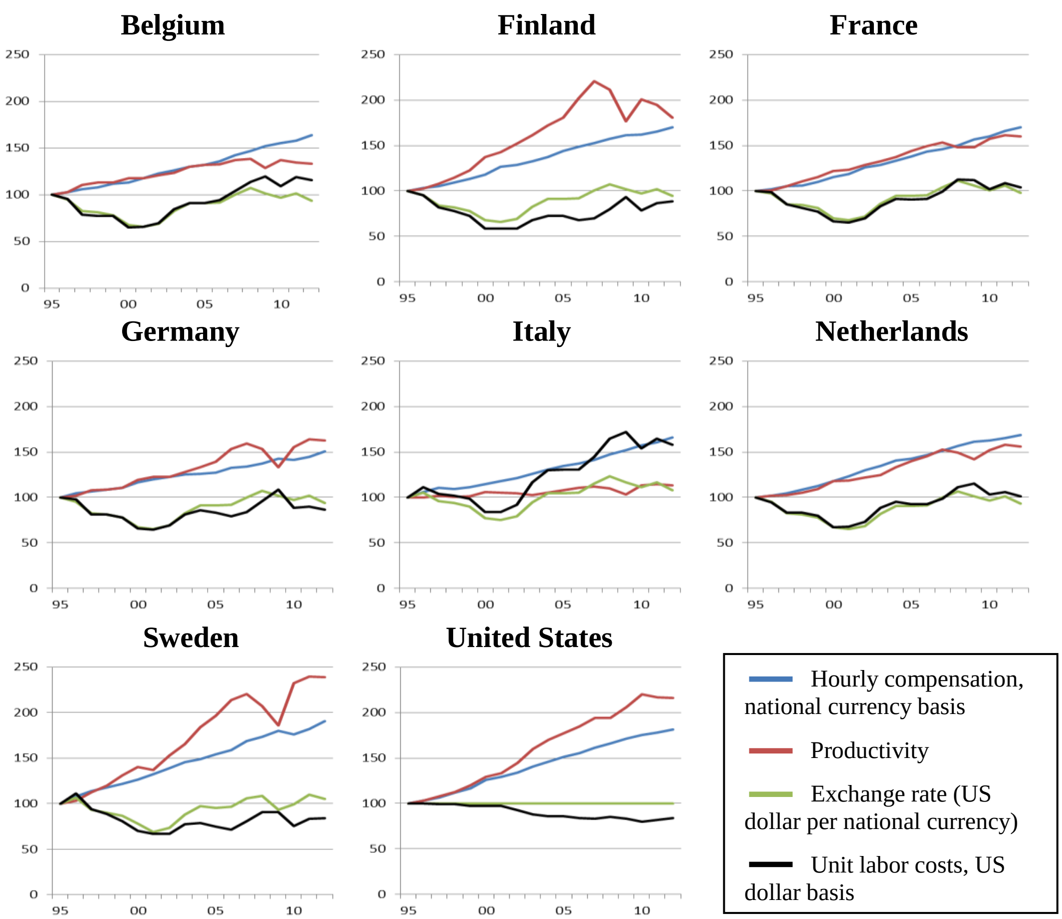


Note: Productivity converted at manufacturing level PPP; compensation at nominal exchange rate
Source: The Conference Board, International Labor Comparisons program

4. Comparing ILC Unit Labor Cost Trends

This and the following section employ the ILC database to further assess trends and levels of manufacturing ULCs, both for the sector as a whole and for its sub-industries. Although ULCs are defined as total compensation per unit of output, they can also be expressed as hourly compensation (converted to U.S. dollars using nominal exchange rates) divided by labor productivity. This relationship emphasizes that competitiveness is not only determined by wage rates, but also by the relative productivity of a country's workforce. As exchange rates are used to convert compensation to a common currency, ULC trends are also substantially affected by exchange rate fluctuations.

Figure 2: Manufacturing unit labor cost trends decomposed (1995=100), 1995-2012



Source: The Conference Board, International Labor Comparisons program

In Figure 2, manufacturing ULC trends constructed from the ILC database are decomposed into underlying trends in hourly compensation (total compensation per hour worked), labor productivity (value added per hour worked), and exchange rates (U.S. dollar per national currency unit). Trends (1995=100) are presented for the U.S. and seven European economies for the period 1995 to 2012. Increases in ULCs (black line) represent declines in manufacturing competitiveness. As shown in Figure 2, after several years of decreasing ULCs through the late 1990s, the trend reversed beginning in the new millennium and competitiveness across the European economies shown above began to deteriorate. In France and the Netherlands, where increases in compensation (blue line) were predominantly offset by increases in productivity (red line), rising ULCs were driven by the appreciation of the Euro. ULC trends are nearly identical to exchange rate trends for France and the Netherlands, but the strong link between exchange rates (green line) and ULCs denominated in U.S. dollars (black line) is visible for all countries compared. In Finland, Germany, and Sweden, productivity growth outpaced compensation growth for most of the period and muted increases in ULCs, despite national currency appreciations after 2000. In 2008 and 2009, in the wake of the global economic and financial crisis, productivity declined suddenly for all countries shown and resulted in a temporary spike in ULCs. In Italy, and to a much lesser extent in Belgium, compensation growth outpaced gains in productivity and, coupled with the appreciation of the Euro, led to large increases in ULCs after bottoming out in the early 2000s. In the United States, the growing gap between productivity and labor income continued to drive down manufacturing ULCs.

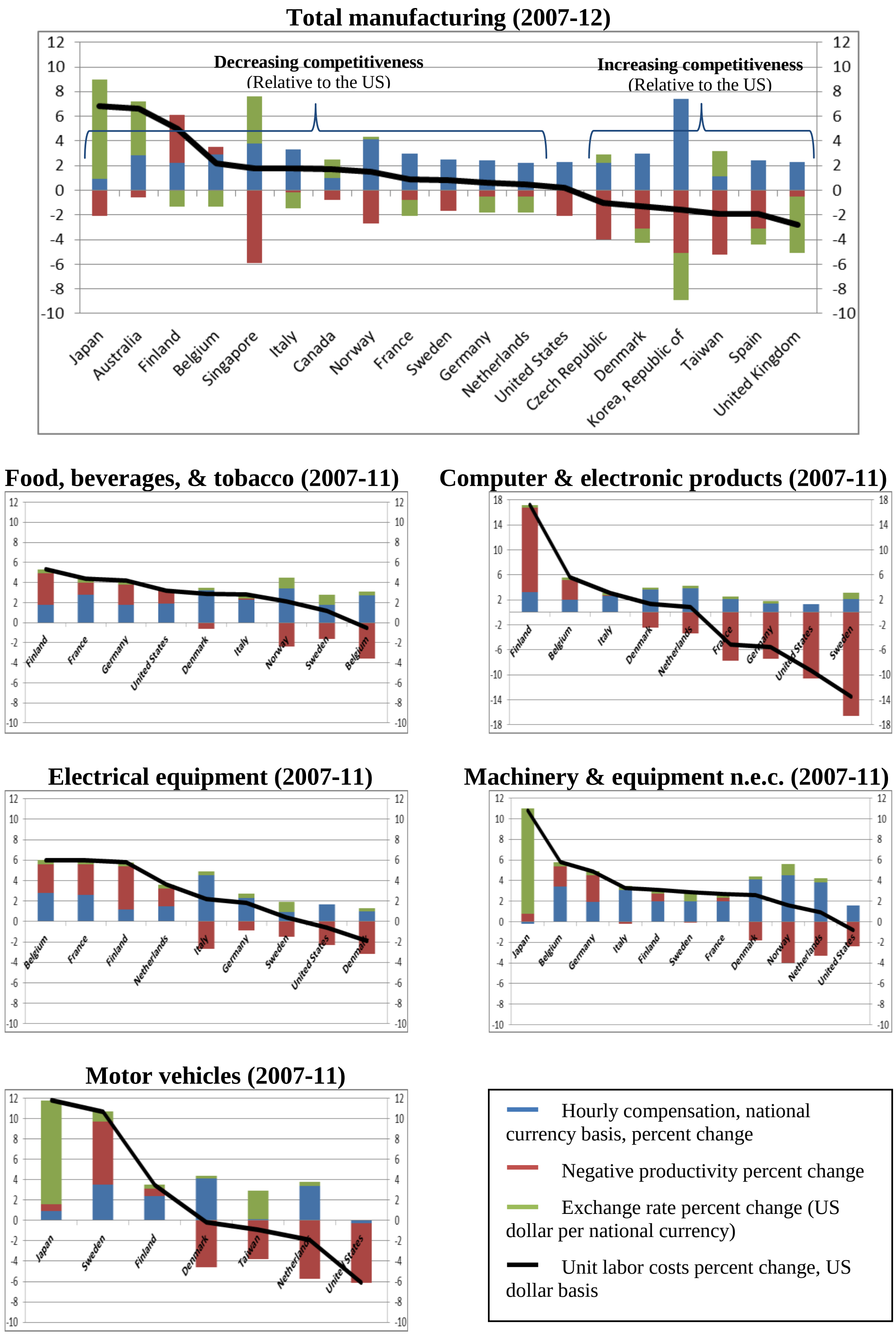
A similar ULC trend decomposition can be done for manufacturing sub-industries. Figure 3 presents the average annual growth rate of ULCs for both the manufacturing sector and for select manufacturing industries. Similar to Figure 2, growth in ULCs (black line) is decomposed into the underlying growth in hourly compensation (blue bars), labor productivity (red bars), and exchange rates (green bars). But in contrast to Figure 2, Figure 3 charts *negative* productivity growth so that increases in productivity are reflected below the zero axis. Thus, bars *above* the zero line contribute to *increases* in in ULCs, while bars *below* the zero line contribute to *decreases* in ULCs. ULC growth (black line) is equal to the difference between the bars above and below the zero axis.

On average during 2007-2012, ULCs in total U.S. manufacturing increased only slightly (0.2 percent). In Figure 3, all countries to the right of the U.S. saw declines in ULCs over the period and thus experienced increasing manufacturing competitiveness relative to the U.S. In contrast, countries to the left of the U.S. had larger increases in ULCs and thus experienced decreasing manufacturing competitiveness. Generally, for a country where manufacturing competitiveness deteriorated, increases in productivity (red bars below zero) were outpaced by increases in compensation (blue bars). In some cases, such as Japan and Australia, large currency appreciations exacerbated ULC growth. Finland and Belgium were the only countries compared that experienced declines in manufacturing productivity (red bars above zero) and, coupled with modest growth in compensation, resulted in substantial ULC increases.

For countries that gained a competitive edge in manufacturing compared to the U.S., high productivity growth during 2007-2012 drove ULCs down. In the United Kingdom, and to a larger extent in South Korea, compensation growth was overshadowed by both increases in productivity and large national currency depreciations.

Similar competitiveness analyses can be done for sub-industries within manufacturing. Figure 3 presents ULC growth decompositions for five manufacturing industries. Average annual growth rates of industry ULCs, hourly compensation, labor productivity, and exchange rates refer to the period 2007-2011. During the period, U.S. ULCs increased in food, beverages and tobacco due to declines in productivity coupled with compensation increases. However, U.S. ULCs decreased in computer, electrical equipment, machinery, and motor vehicle manufacturing as a result of modest to large productivity gains. Declines in U.S. ULCs in these industries were the largest or nearly the largest of all countries compared such that most economies lost competitive ground in

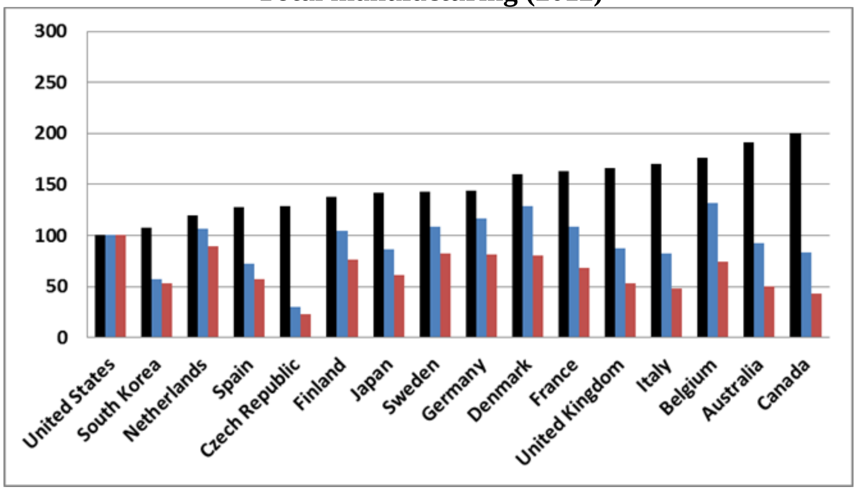
Figure 3: Unit labor cost trends decomposed, average annual percent change



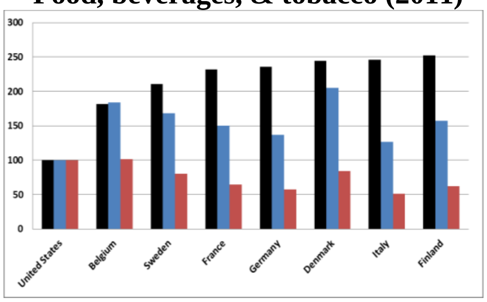
Source: The Conference Board, International Labor Comparisons program

Figure 4: Unit labor costs relative to the United States (U.S.=100)

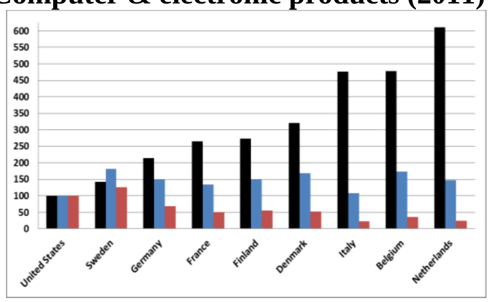
Total manufacturing (2012)



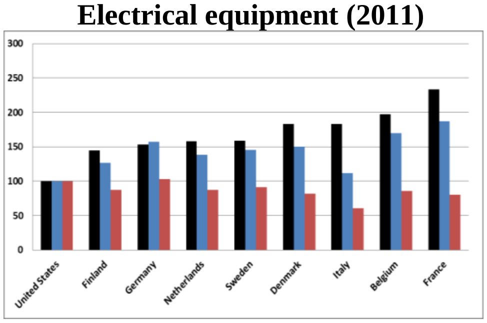
Food, beverages, & tobacco (2011)



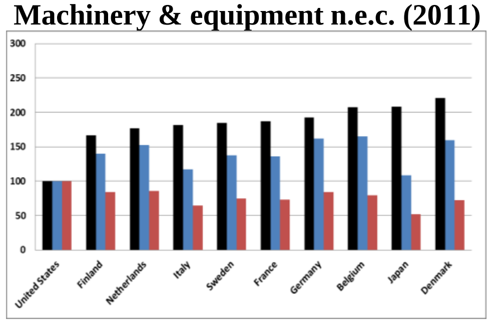
Computer & electronic products (2011)



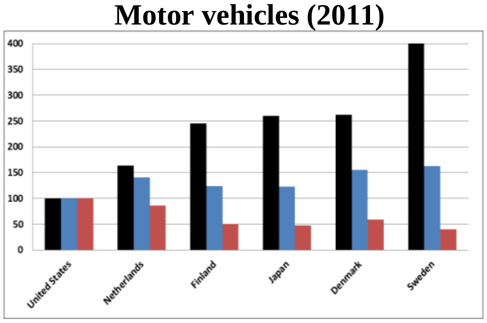
Electrical equipment (2011)



Machinery & equipment n.e.c. (2011)



Motor vehicles (2011)



Hourly compensation, US dollar basis
Productivity, US dollar basis
Unit labor costs, US dollar basis

Note: Productivity converted at manufacturing level PPP; compensation at nominal exchange rate
Source: The Conference Board, International Labor Comparisons program

these areas. In contrast, Swedish computer manufacturing and Danish electrical equipment manufacturing, both which experienced higher productivity growth than their U.S. counterparts, gained competitiveness against the U.S. during the 2007-2011 period. For Euro Area economies compared, competitiveness deteriorated most substantially in machinery, computers, and electrical equipment. In Japan, declining competitiveness across manufacturing industries was driven by the appreciation of the yen.

5. Comparing ILC Unit Labor Cost Levels

The most competitive economies not only improve competitiveness over time, but also operate at relatively low cost levels. Figure 4 presents ILC estimates of manufacturing ULC levels relative to the U.S. (U.S.=100). Sector estimates refer to 2012, while data for select industries refer to 2011. As in Figure 1 above, compensation is converted to U.S. dollars using IMF market exchange rates and value added is converted to 2005 U.S. dollars using derived PPPs from the GGDC. On the whole for the manufacturing sector, European economies are less competitive on costs compared to the U.S. Despite experiencing increases in competitiveness during 2007-2012 (as seen in Figure 3), Spain, the Czech Republic, Denmark, and the United Kingdom remained less competitive in manufacturing than the U.S. in 2012. With the exception of Denmark, these countries also had lower hourly compensation costs than the U.S., but low labor productivity rates drove ULCs above the U.S. level. Within Europe, Dutch manufacturing was the most competitive relative to American manufacturing: the Netherlands saw only marginally higher increases in ULCs than the U.S. over the 2007-2012 period, and ULC levels less than 20 percent higher than U.S. levels in 2012.

Outside of Europe, Japan, which experienced the largest decline in competitiveness during 2007-2012, nonetheless remained more competitive in 2012 than the largest economies in the Euro Area. Of all countries compared, South Korea was the most competitive against U.S. manufacturing with labor cost and labor productivity rates approximately half those of the U.S. In Australia and Canada, hourly compensation was also lower than in the U.S., but productivity in these countries was more than proportionally lower, resulting in ULC levels nearly twice those of the U.S.

Extending the analysis to manufacturing sub-industries reveals that, in 2011, the U.S. was most competitive in all industries shown in Figure 4. The U.S. competitive margin across industries was substantial given that cost levels in other countries exceeded 1.5 times U.S. costs in nearly all cases. Only cost levels in Swedish computers and electronics and Finnish electrical equipment were below the 1.5 threshold. Overall, the U.S. competitive lead in 2011 was smallest in electrical equipment and largest in computers and electronics, where ULCs in Italy and Belgium were nearly five—and for the Netherlands over six—times U.S. costs. That the overall competitive position of Dutch manufacturing differed so greatly from that of the country's computer and electronics industry underscores the importance of assessing competitiveness at the detailed industry level.

6. Implications

The international comparisons of manufacturing ULC trends and levels from the previous sections suggest that comprehensive assessments of country competitiveness should include both directional and absolute indicators of competitiveness. In other words, how does competitiveness evolve over time and how do absolute costs compare across countries? In this light, countries and industries can be grouped as experiencing either increasing or decreasing competitiveness relative to the U.S. based on ULC trends, and as being either more or less competitive than the U.S. based on ULC levels. Carrying out this exercise, Figure 5 summarizes the competitive position of food, beverages and tobacco and of Swedish manufacturing relative to the U.S. In the figure, assessments of evolving competiveness are derived from the 2007-2011 average annual growth rates of ULCs presented in Figure 3, while assessments of absolute competitiveness are based on 2011 ULC levels presented in Figure 4.[7]

Figure 5: Competitiveness matrices relative to U.S. competitiveness

Food, beverages & tobacco

	More Competitive	Less Competitive
Increasing Competitiveness	-	BEL DNK ITA NOR SWE
Decreasing Competitiveness	-	FIN FRA GER

Sweden

	More Competitive	Less Competitive
Increasing Competitiveness	-	Food, bev & tobacco Computers & electronics
Decreasing Competitiveness	-	Total Mfg Electrical equipment Machinery Motor vehicles

Source: The Conference Board, International Labor Comparisons program

In Figure 5, although the U.S. was the most competitive (had the lowest ULC levels) in food, beverages and tobacco in 2011, Belgium, Denmark, Italy, Norway, and Sweden increased their competitive edge in the industry during 2007-2011 relative to the U.S. On the contrary, the industry's cost competiveness deteriorated in Finland, France, and Germany. For Sweden specifically, in addition to food, beverages and tobacco, the country's computers and electronics industry also gained competitiveness vis-à-vis the U.S. On the contrary, Swedish electrical equipment, machinery, motor vehicles, and manufacturing as a whole lost competitive ground against the U.S. Overall in 2011, all Swedish manufacturing industries were less competitive than corresponding industries in the U.S. Similar analyses can be repeated for additional countries, industries, and time periods to assess various facets of international manufacturing competitiveness.

7. Extensions

Despite recent efforts by The Conference Board ILC program, OECD STAN, and EU KLEMS to expand the offering of competitiveness indicators, additional research is needed to fill important gaps in data availability. Namely, emerging economies in Asia, Latin America, and Central and Eastern Europe are grossly underrepresented in the available data sets. Further, while the more easily quantifiable and tradable manufacturing sector remains most relevant for assessing international competitiveness, the importance of tradable services in the global economy has increased. A next step is to explore the construction of competitiveness indicators for service sectors and industries.

In the literature, ULCs are primarily used in explaining international differences in trade flows, investment, and economic growth. An important extension of the product quality literature is that transitioning to higher productivity products on the value chain implies an increase in wages. This may increase ULCs if labor cost increases outpace initial

[7] For total manufacturing, ULC growth rates refer to 2007-2012 and ULC levels refer to 2012.

productivity gains, providing a rationale for the existence of Kaldor's Paradox. This suggests exploring a more direct connection between product quality of the export basket and ULCs as an explanation for differences in competitiveness across countries.

The impact of ULCs on competitiveness, however, has been treated only in broad terms in the literature. Because wages and productivity tend to grow together, and because they are the main components of ULCs, wage and productivity growth counteract each other as determinants of competitiveness. While labor cost and productivity have been treated extensively in their own right, a richer econometric analysis of the structural determinants of ULCs is needed for a deeper understanding of international competitiveness. That is, can ULCs be explained by GDP, unemployment rates, and other macro and institutional factors that can in turn explain differences in competitiveness across countries? Thus, there is a need to explore possible explanatory variables for developing a model of ULCs.

Further, has the descriptive approach of examining trends and levels of competitiveness missed important cost competitive factors, such as capital cost? Incorporating the rich capital and other input data from STAN or EU KLEMS would extend the reach of the competitive analysis conducted in this paper.

Assessments of competitiveness based on ULCs hinge on the availability of price data for developing level estimates. The relative prices used in this paper to convert value added to U.S. dollars refer to gross output for specific manufacturing industries. This suggests exploring improvements in price level comparisons for manufacturing products.

8. Conclusion

This paper has reviewed three sources of international competitiveness indicators: The Conference Board International Labor Comparisons (ILC) program, the OECD Structural Analysis Database (STAN), and the EU KLEMS Growth and Productivity Accounts. All three datasets offer comparable country, industry, and historical coverage and provide the necessary indicators for constructing ULCs. Calculated ULCs from these sources follow similar trends, but ILC level estimates are consistently higher than those from the other two sources. The ILC deviation is largely due to computational differences, as well as discrepancies in the precise vintage of national accounts data used. All three databases would yield similar conclusions about changes in competitiveness over time, as well as similar rankings of competitiveness relative to the U.S.

Comprehensive assessments of country competitiveness should address both how competitiveness evolves over time (is competiveness increasing or decreasing?) and how absolute costs compare across countries and industries (is country or industry X more or less competitive than the U.S. or the corresponding U.S. industry?). Thus, a country or industry's overall competitive position vis-à-vis the U.S. can be summarized by constructing a matrix using trends and levels of ULCs. More in depth treatment of ULCs as a key driver of differences in competitiveness across countries is necessary, but in the meantime the existing sources of competitiveness indicators fulfill a great need.

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