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## Assessing Competitiveness Using Industry Unit Labor Costs: an Application to Slovakia

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**IMF Working Paper**

European Department

**Assessing Competitiveness Using Industry Unit Labor Costs: an Application to Slovakia**

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**Abstract**

Conceptual ambiguities and statistical weaknesses hamper the assessment of external competitiveness. The term competitiveness, while applied extensively, is often imprecisely defined, which can result in analytical errors and mistaken policy advice. Furthermore, aggregate statistical measures of competitiveness in terms of exchange rate misalignment can be biased. To address these issues, this paper makes two contributions. First, it clarifies the external competitiveness concept, highlighting the dichotomy between productivity-driven long-run growth and short-run deviations from the underlying growth trajectory, which can be related to exchange rate misalignment. Second, it develops a disaggregated statistical approach for examining competitiveness based on unit labor costs at the three digit industry level in a group of comparable countries. The case of Slovakia is used to illustrate these concepts, but the analytical insights have general application.

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## I. INTRODUCTION

**Properly assessing external competitiveness is a key analytical and policy challenge.**

Detecting a lack or loss of competitiveness is essential to identifying a build-up of unsustainable imbalances and guiding a smooth adjustment. This is particularly important in countries such as Slovakia that face the major challenge of maintaining external competitiveness within the European monetary union. Euro adoption in the beginning of 2009 has been beneficial for the country overall, but has eliminated the availability of independent exchange rate and monetary policies to correct macroeconomic imbalances. A widely voiced concern is that Slovakia could follow the footsteps of some earlier euro adopters that saw appreciating real exchange rates and widening current account deficits result in severe financial turbulences.

**Conceptual ambiguities and econometric limitations hinder the assessment of external competitiveness.** Various methodologies can give different, and sometimes even conflicting, results. Furthermore, because most methodologies rely on aggregate measures such as the real effective exchange rate (REER), they fail to capture changes in the economic structure or sectoral shifts. This is in particular the case in convergence countries such as Slovakia, where the assessment is further complicated by equilibrium real exchange rate appreciation.

**To help strengthen the analytical underpinnings of competitiveness evaluation, this paper makes two contributions.** First, it clarifies the external competitiveness concept, highlighting the dichotomy between long-run per capita growth, which is determined by productivity growth, and short-run deviations from an underlying growth trajectory, which can be related to exchange rate misalignment. Second, the paper develops a disaggregated statistical approach for examining competitiveness. Based on unit labor cost (ULC) at the three digit industry level in a group of comparable countries, the paper estimates unit labor cost norms for each industry in each country and measures short-term competitiveness in each industry and country in terms of deviation from the norm. The paper uses the case of Slovakia to illustrate these contributions, but its analytical insights have general application.

**The econometric estimation is based on a panel dataset of nine central and eastern European (CEE) countries and 65 industries between 1994 and 2008.** The data shows significant differences in ULCs across sectors, countries and period, highlighting the difficulties in using aggregate measures that fail to capture these differences. These nine countries are all characterized by productivity catch-up with higher-income EU members.<sup>2</sup>

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<sup>2</sup> Because ULC are based on output per labor, it is a better measure for productivity when supply shocks are more important than demand shocks. However, with the sample composed entirely of converging new EU members, the impact of demand shocks has been relatively less important during this period.

**Two measures of competitiveness at the industry level are proposed.** The first measure is constructed simply by the ULC in a given sector and country relative to the sectoral average across countries—relative ULC. The second one is derived from regressing the relative ULC on various explanatory variables such as the level of GDP per capita, the lagged unemployment rate, and the size of the sector in the country’s total exports. The predicted value can be interpreted as a norm for relative ULC, and the deviation from the norm, the regression’s residual, captures competitiveness. These measures perform well in explaining export growth of an industry in a country.

**The case study of Slovakia illustrates some of the ambiguities commonly used methodologies can entail and demonstrates the usefulness of this approach.** Its results indicate that the country was competitive in most manufacturing sectors during 2000–07, i.e. actual ULCs were below the corresponding sectoral norms, and that competitiveness in the majority of sectors improved over time.

**The rest of the paper is constructed as follows.** Section II discusses conceptual issues related to competitiveness. Section III provides an overview of macroeconomic developments in Slovakia, providing context to the country case study. Section IV discusses Slovakia’s long-term competitiveness. Section V discusses commonly used exchange rate-based methods of evaluating Slovak competitiveness, and Section VI presents the analysis using the proposed UCL-based measure across industries and countries.

## II. INTERNATIONAL COMPETITIVENESS: CONCEPT AND MEASUREMENT

**The term competitiveness, while applied extensively to countries, is not uniformly defined or measured.**<sup>3</sup> Some definitions refer to a country’s long-term growth potential as related to productivity, while other refer to short-term exchange rate misalignment (i.e., whether a currency is over or undervalued). For example, the World Economic Forum defines competitiveness “as the set of institutions, policies, and factors that determine the level of productivity of a country” (World Economic Forum, 2010), and the European Commission (2010) argues that “productivity growth... is the key driver of competitiveness in the long run.” On the other hand, for instance, the IMF Executive Board noted when concluding the 2008 Article IV Consultation with the United States that “... the decline in the dollar’s real effective exchange rate has moved U.S. competitiveness relatively close to medium-term fundamentals.”

**The ambiguity of the concept can result in analytical errors and mistaken policy advice** (Krugman, 1994). It causes many to consider competition among countries as a zero sum

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<sup>3</sup> In the remainder of the paper, we use the *external competitiveness* term to refer to competitiveness applied at the country level.

game: if one country does better, other countries, its competitors, are hurt. However, better economic performance in one country often can benefit other countries. The ambiguity can also lead one to conclude, incorrectly, that a country's disappointing long-term growth reflects exchange rate misalignment. Theoretical and empirical analysis suggests, on the contrary, that long-run growth is a matter of domestic productivity and inputs of factors, with the real exchange rate moving in line with the value dictated by fundamentals.<sup>4</sup>

**Further to the conceptual ambiguity, different statistical measures of external competitiveness are being used.** A number of commonly employed indicators focus on determinants of productivity such as human capital and the business environment.<sup>5</sup> A range of other indicators focus on exchange rate misalignment, including measures developed by the IMF's Consultative Group on Exchange Rate Issues (CGER) based on the deviation of the CPI-based REER from an estimated norm or equilibrium. REERs for the economy as a whole in part reflect developments in non-traded goods and services, and can help detect unsustainable demand-led booms in the non-traded sector.

**Zooming in on competitiveness measures for traded goods and services, cost-based indicators appear superior.** Such indicators track the relative evolution of unit costs of production expressed in a common currency and are more closely correlated with changes in market shares in both domestic and foreign markets than the REER for the economy as a whole (Lipschitz and McDonald, 1991). In view of conceptual and data availability challenges, often only one factor, labor, is considered, and relative ULC<sup>6</sup> is used as the corresponding competitiveness indicator. However, wage-based measures can be difficult to use for cross-country analysis to the extent that many different possible wage definitions and measures continue to be applied. In contrast, CPI-based REER data has been to a very large degree standardized for most countries for a long period. Moreover, external competitiveness ultimately is based on prices. Using ULC is an indirect way of assessing prices, which assumes that the link between ULC and prices is stable across countries and time. However, changes in other factors such as the degree of product market competition may weaken the link between ULC and prices.

**ULC-based indicators for traded goods and services as a whole still have weaknesses, however.** They are affected by shifts in the composition of output and by sector-wide

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<sup>4</sup> Haddad and Pancaro (2010) summarize the recent literature on the relationship between economic growth and the real exchange rate.

<sup>5</sup> These determinants are often captured under the "nonprice fundamentals" label.

<sup>6</sup> ULC growth is approximately equal to growth in hourly labor compensation minus growth in labor productivity. Labor productivity growth in turn can be decomposed into a contribution made by multifactor productivity growth, that made by increased capital intensity, and that resulting from changes in the composition of the workforce (labor quality); see Kaci (2006) for more detail.

changes that could be misinterpreted as changes in external competitiveness. For instance, aggregate ULCs will be affected by shifts between sectors with different labor intensity (and different ULC). Furthermore, ULCs reflect various sector-specific developments with no direct impact on external competitiveness. For example, an improvement in the global technology (or price) in a given sector could lead to lower ULC in that sector across the globe, and to a corresponding reduction in the aggregate ULC of the countries in which it operates. However, this drop in ULC does not imply that the sector is now more competitive (see Honohan and Walsh, 2002, for the case of Ireland). Furthermore, one reason why ULCs may differ across industries, is that sectors are imperfectly competitive, prices include monopoly profits, and some of these profits are captured by workers.

**To address some of the weaknesses of the aggregate ULC-based indicators, this paper utilizes disaggregated ULCs.** Inspired by CGER methodology, a norm for an industry in a given country and period is derived using coefficients estimated in cross-country regressions for a sample of comparable countries. Deviations of the ULC from the norm in a given sector and country suggest that the sector in the country in question is more (less) competitive. A country-wide measure of competitiveness could be calculated by aggregating deviations from the sectoral norms across the country's sectors.

**The proposed approach builds on recent research that advocates a disaggregated approach to assessing external competitiveness.** This approach considers product heterogeneity and analyzes relative cost competitiveness by product. Fabrizio et al. (2007) focuses on differences in product quality, and argue that moving up the technology and quality ladder, as reflected in rising unit value ratios,<sup>7</sup> has allowed CEE countries to gain market share. Bennett and Zarnic (2009) apply a heterogeneous-product approach to France, Germany and four Mediterranean euro zone member countries. They employ the same cost measure as our paper, relative unit labor costs, but at a higher level of aggregation (two digit industry level).<sup>8</sup> Neither Fabrizio et al. nor Bennett and Zarnic introduce a norm against which to assess external competitiveness.

### III. OVERVIEW OF SLOVAKIA'S ECONOMY SINCE 1993

**Slovakia has experienced fast economic growth since independence, interrupted by two crises.** On average, real GDP grew by 4.7 percent annually between 1993 and 2008, notwithstanding a slowdown in the late 1990s as a result of the Asian/Russian crises. Output contracted again in 2009. Although Slovak growth overall exhibited a pattern similar to that

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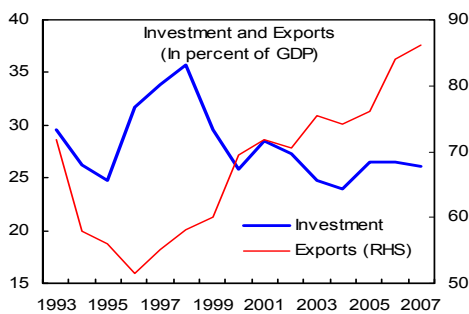
<sup>7</sup> The unit value ratio is calculated as the unit value of a country's exports of a given product relative to the unit value of all countries' exports of that product.

<sup>8</sup> Bennett and Zarnic also introduce a methodology to identify countries' direct international competitors more accurately and include services exports in their analysis.

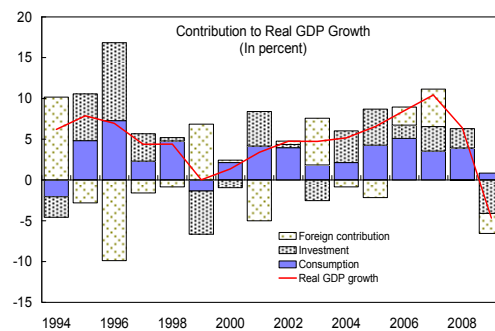
in the rest of CEE, it fluctuated more than in other countries in the region. In particular, GDP in Slovakia declined more during the Asian/Russian crisis, and expanded more in the following years and until the recent global financial crisis.

**Rapid growth raised the level of GDP per capita and reduced its gap with other euro area countries.** By 2008, GDP per capita in Slovakia was at about 41 percent of the level in the euro zone, compared with 10 percent in 1993. Furthermore, because of the fast growth during 2002–08, GDP per capita in Slovakia outpaced that in many other CEE countries: in 2008 Slovakia's GDP per capita of \$17,630 was the third highest among CEE countries (behind Slovenia and the Czech Republic).

**From the aggregate demand point of view, GDP growth was mainly driven by investment and exports.** Investment jumped to more than 30 percent of GDP between 1996 and 1998. Following a temporary decline after the Asian/Russia crisis, investment rebounded, reaching 27 percent of GDP in 2008. Exports started to surge in the wake of the investment boom, expanding on average by an annual rate of more than 10 percent during 2000–08.

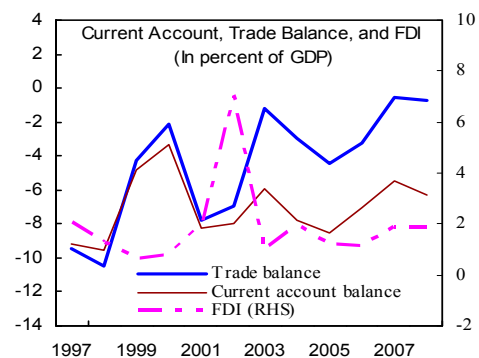


Source: WDI.



Sources: WEO, and IMF staff calculations and projections.

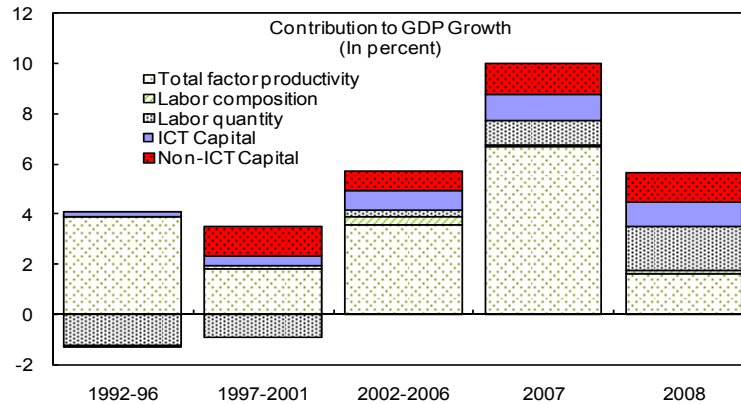
**The mirror picture can be observed in the current account developments.** During 1996–98, the surge in investment and related imports widened the current account deficit to about 9 percent of GDP. However, as exports grew with investment projects reaching the production phase, the current account deficit declined. Another spike in investment in 2002–07 was followed by a rise in exports and a decline in the current account deficit to roughly 3 percent of GDP in 2008. As the investment booms mainly reflected foreign direct investment (FDI), financing the current account imbalance did not present challenges.



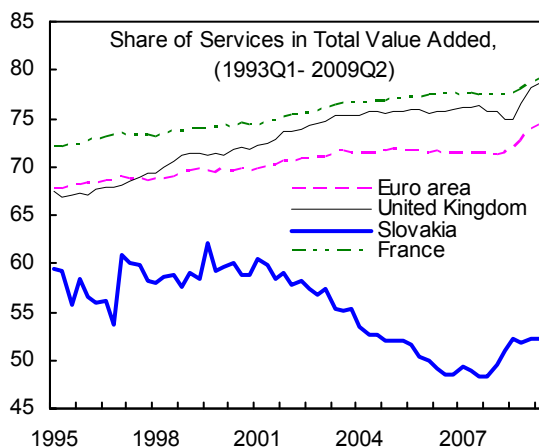
Source: WEO, and IMF staff



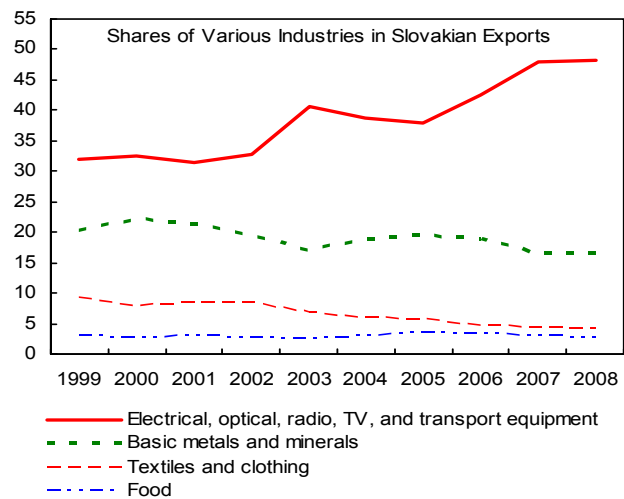
**A growth accounting framework suggests that economic growth was driven primarily by productivity gains and, to a lesser extent, capital accumulation.** During 1992–2001, total factor productivity (TFP) was the main driver of growth, while the contribution of labor was negative. The contribution of capital gradually gained importance in this period, reflecting the high level of investment and low initial capital base. In 2002–06, TFP continued to be the main growth engine, but the contribution of labor turned positive. In more recent years, employment gains began to make more significant contributions, and the contribution from capital rebounded, reflecting Slovakia’s second FDI wave.



**The share of industry in Slovak output has increased by about 10 percentage points during 2000–07.** This development has been common to CEE economies and is opposite to the trend in EU15 countries, where the share of services has risen. The growth in industry was mainly driven by product upgrade. In particular, production shifted from more traditional items, such as food products and textiles, toward the more advanced electrical and optical products and transport equipment. As a result, the share of high tech products in exports rose from about 30 to about 50 percent between 2000 and 2008.



Sources: Haver Analytics and IMF staff calculations.



Sources: NACE and IMF staff calculations.

#### IV. LONG-TERM PERSPECTIVE: COMPETITIVENESS AND PRODUCTIVITY

**Productivity gains have been the main driver of Slovakia's stellar growth.** As in other CEE countries,<sup>9</sup> labor input growth was sluggish in Slovakia during 1993–2008 and contributed overall little to output growth. Capital input growth accounted for around 1¼ percentage point a year of growth, on average, in this period, less than in other CEE countries. But the yearly contribution to growth from total factor productivity growth, at near 3½ percentage point on average, was the highest among the CEE countries and is the main explanation why Slovakia was the fastest grower in the region. Zooming in on labor productivity growth, Slovakia was together with the Baltic countries in the group of the best performers in the region, with annual gains of around 5 percent on average. Slovak output per hour worked more than doubled during 1993–2008 and is now the second highest in the CEE, behind Slovenia but significantly ahead of the other CEE4 countries. The remainder of this section explores the fundamentals of productivity.

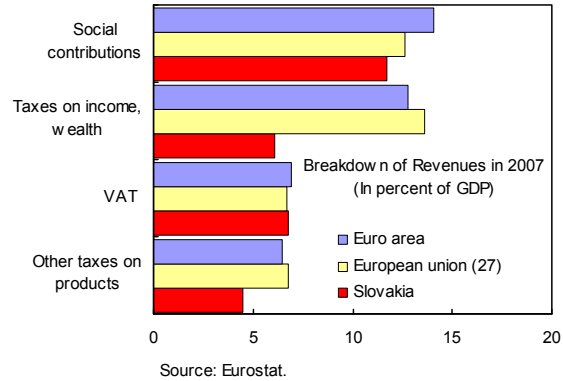
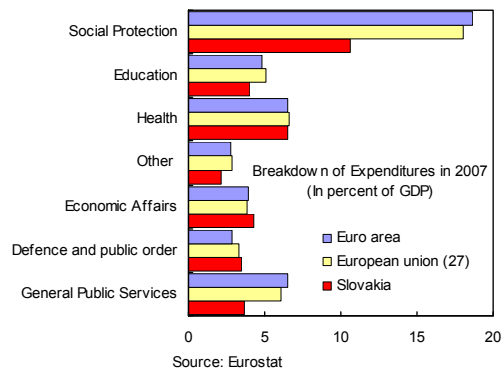
##### A. The Level and Composition of Government Spending and Revenue

**The composition of government spending and revenue could be more growth-oriented.** Compared with other euro area countries, Slovakia spends less on education and general public services as a percent of GDP, while spending more on defense and public order, and on economic affairs. Also compared with other euro zone countries, the taxation of labor is relatively high and that of goods and services relatively low. More detailed cross-country information on tax rates (KPMG 2010a and 2010b) shows Slovakia's corporate tax rate and highest personal income tax rate at both 19 percent to be significantly below global and OECD member averages. However, corporate tax rates in other countries have been moving toward the Slovak level. The indirect tax rate, also at 19 percent, is slightly above the global and the OECD member averages.<sup>10</sup>

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<sup>9</sup> The set of comparator countries includes Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, and Slovenia, the countries considered together with Slovakia in the econometric exercise in Section VI.

<sup>10</sup> The VAT rate was temporarily raised to 20 percent in 2011 as part of the fiscal consolidation effort.

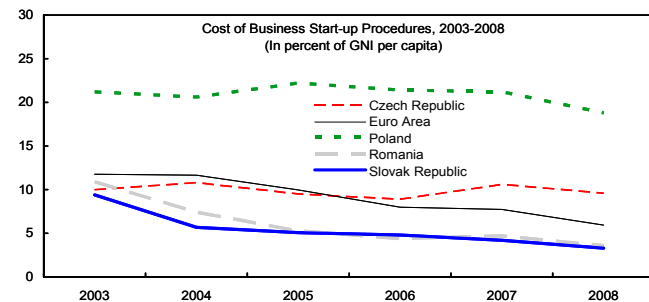
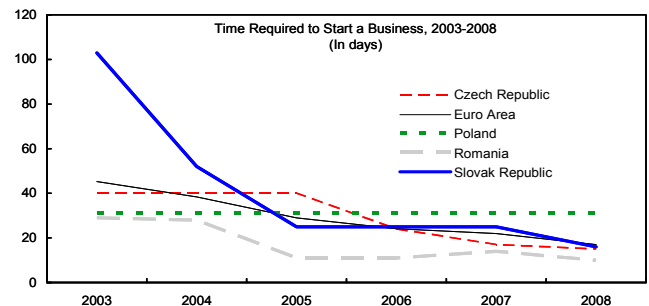


## B. Government Efficiency and Transparency

**Reducing corruption remains an important challenge.** Cross-country competitiveness surveys (e.g. World Economic Forum, 2010a, and IMD, 2010) consistently identify inefficiencies in the provision of public goods and services and a lack of transparency of government operations as major growth and productivity impediments. Moreover, Slovakia's position in cross-country rankings of corresponding indicators has slipped in recent years. Of particular concern are the effectiveness and independence of law enforcement and the court system. As to transparency, the widely used Corruptions Perceptions Index (Transparency International, 2010) suggests stagnation in Slovakia's score and a slide in the country's ranking during 2005–10. A range of procurement scandals and weaknesses in a number of oversight institutions stood in the way of improvement.

## C. Business Climate

**The business climate in Slovakia is fairly attractive by the standards of comparable countries.** According to the World Bank *Doing Business* 2011 indicators, Slovakia is ranked 41st out of 183 countries in terms of the overall ease of doing business. The country ranks high in terms of property registration and access to credit. The *Doing Business* reports also suggest significant improvements in recent years. For example, the time to start a new business shortened from more than 100 days in 2003 to less than 20 days in 2008. Costs of business start-up procedures (expressed as a percent of GNI per capita) declined gradually to among the lowest levels in the region. However, the business environment reform momentum overall slowed considerably from 2006. There remains substantial room for improvement in the areas of protecting

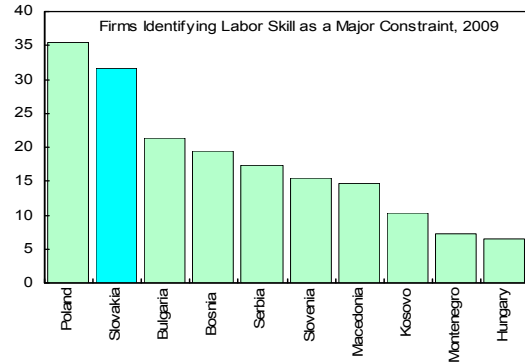


Source: WDI.

investors, trading across borders and the administrative burden of paying taxes in particular. More detailed information on the latter burden indicates that both the number of tax payments per year and the time to comply are significantly above average in Slovakia (The World Bank and PWC, 2011), in spite of the flat tax.

**Complementing the *Doing Business* indicators, the World Bank's *Enterprise Surveys* point to the level of taxation and an inadequately educated work force as major constraints.**

Many entrepreneurs indicate that they offer within-enterprise training to address the labor skills issue. Medium- and large-size firms also consider insufficient access to finance to be an important challenge (small firms tend to rely more on retained earnings).

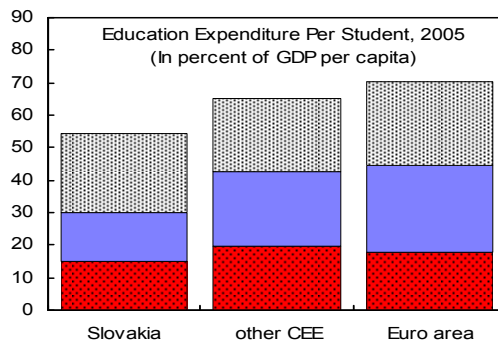


Source: World Bank, *Enterprise Surveys*.

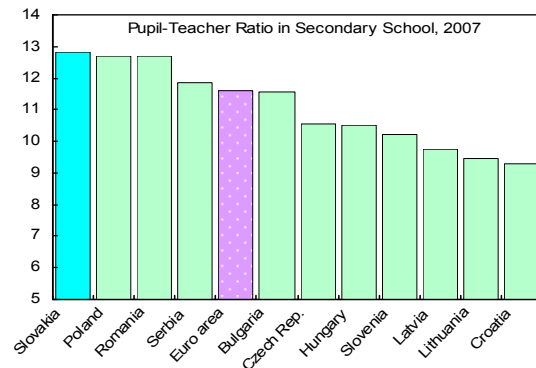
**The financial sector is relatively underdeveloped.** Cross-country financial development indicators and surveys (World Economic Forum, 2010b; Milken Institute, 2010) point to non-banking financial services and the domestic bond and equity markets as areas of relative weakness, and note little progress in recent years. Access to alternative sources of capital (such as venture capital and private placements) and international funding are other areas with scope for improvement. But these surveys also see retail financial access, including market penetration of bank accounts and commercial bank branches, as a relative strength.

#### D. Human Capital: Level and Quality of Education

**Some indicators suggest that the education system needs further improvement.** Public expenditures per student, as a share of GDP per capita, are lower in Slovakia than in other CEE countries. Indeed, the pupil-teacher ratio in secondary schools is among the highest in CEE countries. Nevertheless, participation rates in primary and secondary education are high.

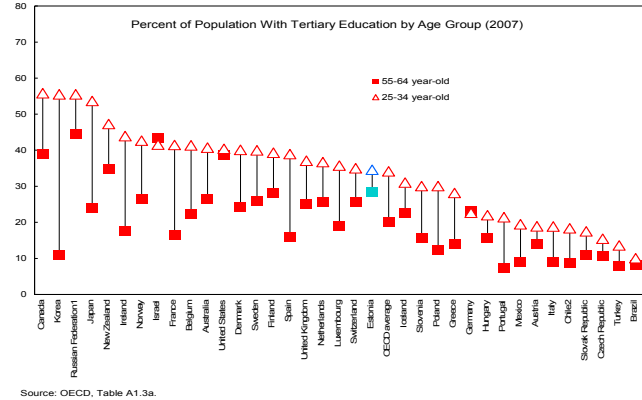


Source: WDI.



Source: World Bank EdStats Database.

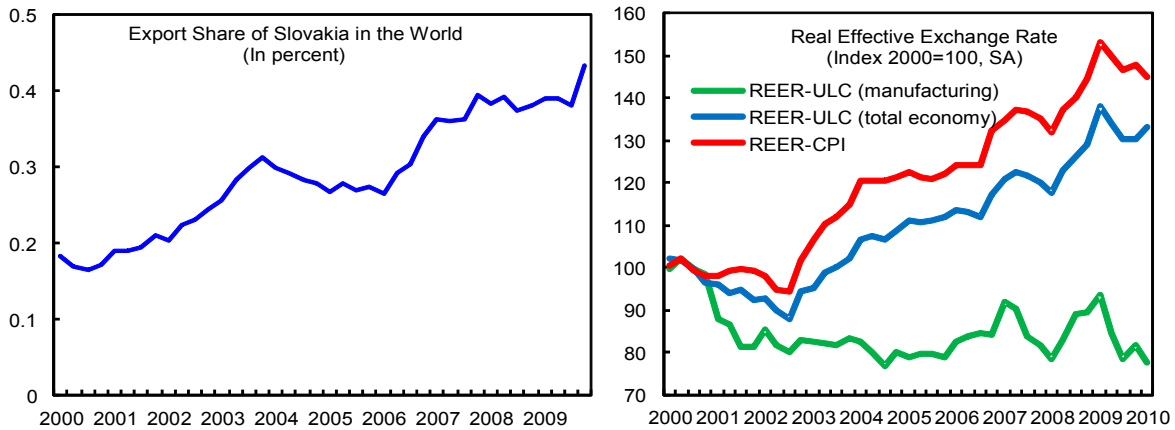
**Tertiary education is an area of particular concern.** The share of workers with higher education at 15 percent is low compared with other CEE countries and other OECD members more in general. Moreover, younger workers are only marginally better educated than older workers. Tertiary education is mostly focused on university-level training, while access to technical and vocational programs is lacking. Since such programs focus on technical, practical and occupational skills needed for direct access to the labor market, it is important to address this weakness.



**V. SHORT-TERM PERSPECTIVE: EXTERNAL COMPETITIVENESS AS RELATED TO POSSIBLE EXCHANGE RATE MISALIGNMENT**

**A. Exchange Rate and Export Share Dynamics**

**REER and export share developments do not suggest exchange rate misalignment.** The country’s currency appreciated strongly in nominal terms against the euro from 2002 until the conversion to the euro in January 2009. In effective terms, the nominal exchange rate appreciated by around 40 percent during 2002–08. With inflation in Slovakia higher than in its trading partners, the CPI-based REER appreciated by about 50 percent in this period. However, this REER appreciation reflected mainly higher productivity growth in the traded sector. REER based on ULC in the manufacturing sector as a whole declined during the last decade, and Slovakia’s export share in world trade more than doubled.



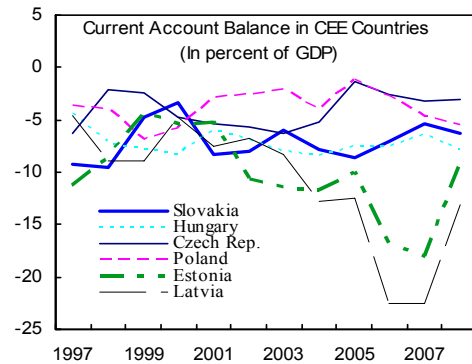
Sources: IMF, DOTS; OECD; and Haver Analytics.

**Concerns about a pick-up in inflation following Euro adoption and related real exchange rate appreciation proved unfounded.** Unlike what was observed in earlier euro adopters, Slovak inflation continued to decline after euro introduction, falling below the euro zone average. In the period from December 2008 (the last month before euro introduction) to December 2010, inflation was 3.1 percent in the zone as a whole, but only 1.3 percent in Slovakia, the second lowest number. A more detailed analysis of price adjustments around the time of euro adoption did not find evidence of systematic and significant price hikes in that period (Beblavý (2010), Lalinský (2010a and b)).

## B. Current Account Dynamics

**The evolution of the current account deficit does not suggest exchange rate misalignment either.** Slovakia's current account deficit, as a percent of GDP, has in fact declined since 2001. The deficit excluding FDI<sup>11</sup> and investment income—which mainly represents dividends related to earlier FDI—has improved even more significantly since then. Compared with

some other CEE countries that saw a steep increase in their current account deficits prior to the global financial crisis, Slovakia avoided a boom-bust cycle. Looking forward, the current account deficit is projected to remain below 3 percent of GDP over the medium term.



Source: WEO, and IMF staff calculations.

## C. Analytical Approaches to Exchange Rate Misalignment Assessment

**The IMF and other international organizations, including the EU, use a range of approaches to assess possible exchange rate misalignment.** Four of the most commonly used analytical methodologies are discussed below (for a more in-depth analysis, see Bussière et al., 2010, Lee et al., 2008, and Salto and Turrini, 2010). Reflecting the significant uncertainties surrounding misalignment estimates and methodological limitations, the different approaches do not necessarily point in the same direction, and interpreting their results involves an element of judgment.

### *The macroeconomic balance approach*

**This approach compares the observed current account position corrected for temporary factors with an estimated norm.** Specifically, using panel data for a

<sup>11</sup> Although FDI does not enter the current account directly, it often goes along with imports of goods.

representative sample of countries, a current account norm is estimated with variables that theoretically and empirically are expected to affect the current account. They include the fiscal balance, old-age dependency, population growth, the oil balance and output growth. Using the estimated coefficients from the panel regression, the country norm is calculated. The exchange rate is considered to be over (under) valued when the actual current account deficit corrected for temporary and one-off effects is above (below) the estimated norm.

**However, the methodology has several limitations.** The standard errors of the estimated coefficients tend to be quite large, limiting the accuracy of the estimates. Conceptually, the norm does not consider important variables that may impact aggregate saving such as cultural factors or government policies (Akerlof and Shiller, 2009). In this case, a deviation from the norm can reflect a country's decision to save more rather than an undervalued exchange rate. Forthcoming revisions to the CGER will address several shortcomings of the current methodology, including by introducing a deeper focus on policies. Nonetheless, the macroeconomic balance approach suggests that the Slovak currency was broadly in equilibrium in early 2011.

#### *The external sustainability approach*

**This approach calculates the current account position which stabilizes the stock of net foreign assets (NFA) as a share of GDP at its current level.**<sup>12</sup> The approach is estimation-free but corrects the variables entering the calculation for temporary factors. This approach suggests that the Slovak exchange rate was slightly undervalued (by 7 percent) in early 2011.

#### *The equilibrium real exchange rate approach*

**A third approach estimates an equilibrium exchange rate based on fundamentals.**

Specifically, using panel data from a representative country sample, the real exchange rate is regressed on a set of fundamental variables, including net foreign assets, productivity differentials, commodity terms of trade, and government consumption. Country-specific fixed effects are added given that real effective exchange rates are measured as index numbers with no natural common anchor across countries.<sup>13</sup>

**However, this methodology also has some limitations.** The introduction of fixed effects, necessary to address the index number issue, implicitly assumes that the exchange rate has fluctuated around its equilibrium in the sample period. However, in emerging economies, such as Slovakia, the upward trending of the REER creates a bias—the exchange rate in the

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<sup>12</sup> Or, more broadly, consistent with a specified evolution of the net foreign assets position; see Lee et al., 2008.

<sup>13</sup> Only misalignment estimates expressed as percentage deviations of the REER from equilibrium are comparable across countries.

early years will be considered undervalued in the early years of the sample and overvalued in the later years. To correct for this bias, recent specifications include the productivity differential between the traded and non tradable sector as additional variable, which reduces the bias. Furthermore, the approach is based on aggregate data, and hence fails to capture changes in the economic structure or sectoral shifts. The forthcoming revision to the CGER will address some of the shortcomings. According to the equilibrium real exchange rate approach, Slovakia exchange rate was above its equilibrium (by around 14 percent) in early 2011.

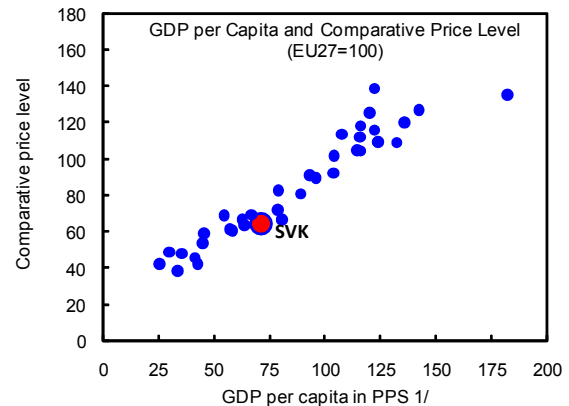
### *The purchasing power parity (PPP) approach*

**The relative price of output provides a broad measure of competitiveness.** The PPP of a country's output can be defined as the number of units of its domestic currency required to purchase the same output as one unit of a numeraire currency (both the euro for Slovakia). The PPP divided by the exchange rate between the domestic currency and the numeraire currency then provides an estimate of the price level in the given country relative to the one in a chosen benchmark country/group of countries. However, the relative price level's tendency to move up during convergence (the Balassa-Samuelson effect) complicates its interpretation as an external competitiveness indicator.

### **Estimates of Slovakia's relative price level do not suggest a competitiveness challenge.**

According to Eurostat calculations using the euro as numeraire currency and the 27 EU member countries as the benchmark

(Svennebye, 2010), Slovakia's price level in 2009 was about 67 percent of that in the EU27 as a whole. Its per capita income in the same year amounted to around 73 percent of the EU27 average. Using the results from standard cross-country regressions linking relative price levels to relative per capita income levels in the EU countries (Podkaminer, 2010),<sup>14</sup> Slovakia's relative price level in 2007–09 is in line with what a regression with a constant term and per capita income predicts.<sup>15</sup>



Source: Eurostat.  
1/ PPS: purchasing power standard

<sup>14</sup> For an early application of such regression to the transition economies see De Broeck and Sløk (2006), and for a methodological criticism Zaldueño (2008).

<sup>15</sup> According to the regression results in equation (1) from Podkaminer (2010),  $P = \exp(3.503617 + 0.010294 \cdot Y)$ , where P is the relative price level and Y the relative per capita income. This gives a predicted relative price level of 70½ percent in 2009.



## VI. COMPETITIVENESS ANALYSIS BASED ON SECTORAL ULC

**This section assesses short-term external competitiveness based on industry-level ULC, taking into account country-specific characteristics.** A sector in a country is considered more competitive if its ULC is below a calculated norm, and vice versa. Likewise, changes in the deviation of the sector's ULC from its norm imply an increase (decrease) in the sector's competitiveness over time. This approach allows a more accurate evaluation of competitiveness because it avoids the bias associated with the aggregation that doesn't capture changes in the economic structure or sectoral shifts. In addition, it provides insight into the dynamics of each sector and the economy as a whole.

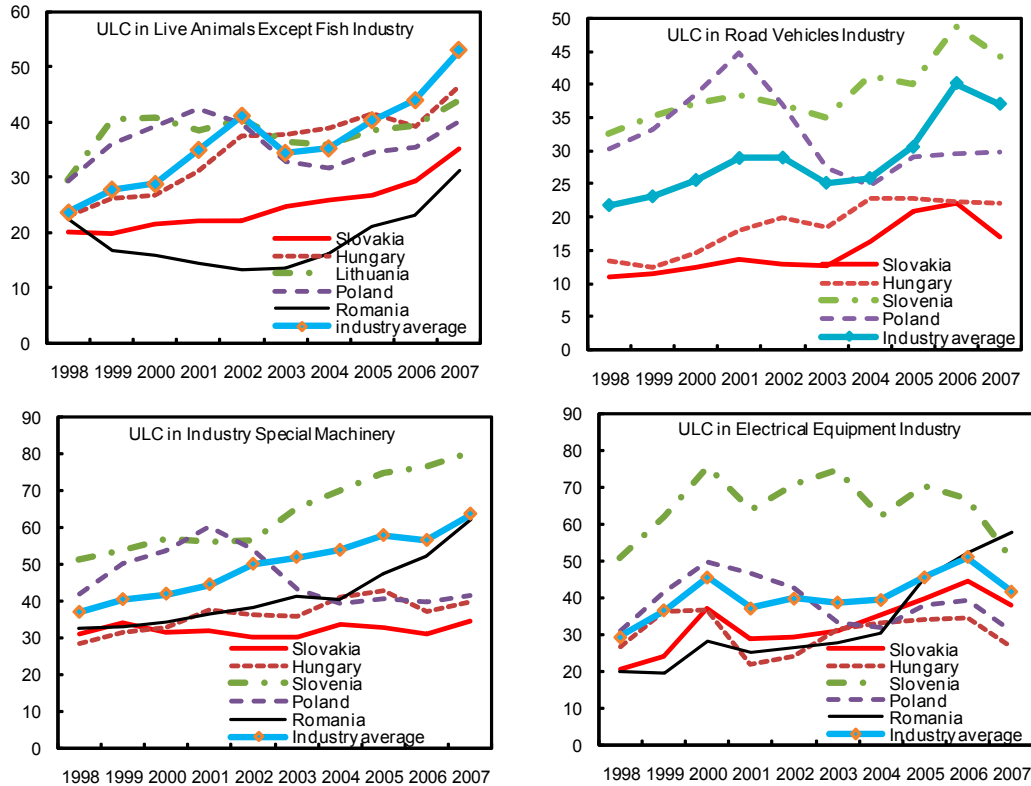
**The approach estimates for each three digit industrial sector and for each country the ULC level that is consistent with that sector's and that country's characteristics.** It allows evaluating competitiveness of each sector, the evolution over time and the interaction among sectors in the economy. Due to data limitations, we focus only on the industrial sector while tradable services are not considered.

**We use a panel dataset that includes 9 CEE countries and 65 industries between 1994 and 2008.** The sources of the data are the World Integrated Trade Solution (WITS) and the Industry Database Catalog NACE put together by the Vienna Institute for International Economics. To achieve a degree of country comparability, the sample includes Croatia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. Using WITS, which contains trade statistics detailed by product, we compute export shares of each sector during the period for each country. The NACE database provides ULC for each industry in each country as a percent of ULC in Austria in this industry.<sup>16</sup>

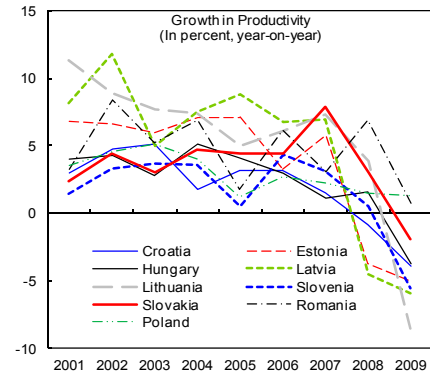
**A broad exploration of the data suggests several patterns.** First, ULCs differ significantly across sectors and across countries, underlying the difficulty in using aggregate ULC measures to evaluate competitiveness. Some of the differences can probably be explained by remaining heterogeneity at the three-digit sectoral level, suggesting that even our more disaggregated approach suffers from some aggregation bias. But the differences also represent variations in the production technology, human capital, business environment, taxes and so on. There are positive correlations of ULCs of the same sector (across countries) and of the same country (across sectors).

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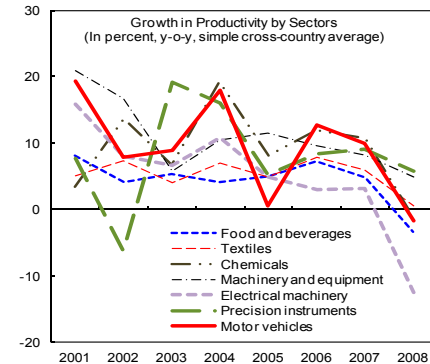
<sup>16</sup> The Vienna Institute database also transforms the data by relative GDP in PPP terms for each country, a transformation which we undo.



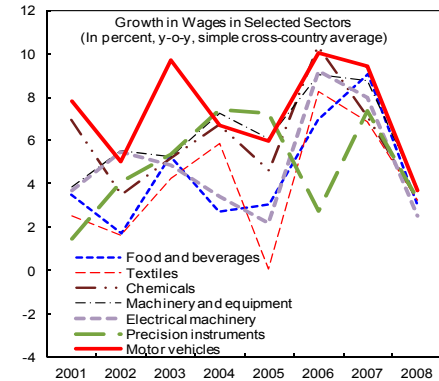
**Productivity growth differs across countries and over time.** In Slovakia, for example, productivity growth was relatively low in the beginning of 2000s, and then accelerated before following the general downward trend during the global financial crisis. Some of the difference reflects country-specific developments, but some also reflects the different sectoral composition of industry in each country and shifts between sectors with different ULCs.



**Indeed, productivity growth across sectors (computed by taking simple averages of the nine CEE countries) exhibits major differences.** Productivity has been increasing in machinery and equipment, medical, and precision instruments, while it has been declining in food and beverages, and electrical machinery. More recently, reflecting the crisis, productivity dropped in motor vehicles and textile industries.



**Although sectors with higher productivity growth exhibited higher wage growth, the differences are not pronounced.** This finding suggests significant labor mobility or wage equalization across sectors: higher wage growth in sectors with faster productivity growth tends to attract workers from other sectors, and translates into economy-wide higher wage growth. Moreover, wage growth became even more closely aligned across industrial sectors in recent years, suggesting tighter labor markets and more labor mobility.



**One way of evaluating competitiveness in a given sector is to compare ULC relative to the sectoral average across countries—relative ULC.** Table 1 presents the relative ULC in selected industries in Slovakia in 2000 and in 2007. It shows relative ULC declined in many industrial sectors and in Slovak industry as a whole between 2000 and 2007, suggesting overall competitiveness gains. Moreover, the change in relative ULC was negatively correlated with the change in export share, suggesting that industries where ULC dropped exhibited higher export growth.

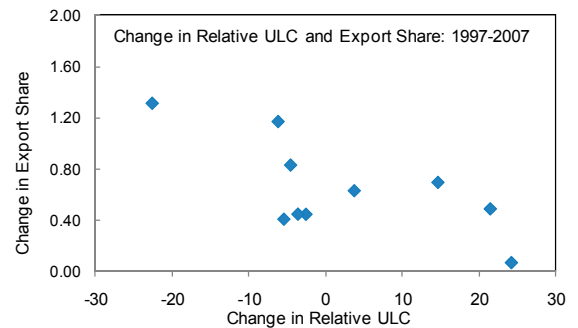


Table 1: Relative ULCs and Export Shares of Selected Industries

Industry	Export Share		Relative ULC		Change in	
	1998	2007	1998	2007	export share	rel. ULC
Road vehicles	0.40	1.23	50.40	45.89	0.83	-4.51
Building fixtures etc	0.40	1.57	43.17	39.54	1.17	-3.64
Telecomms etc equipment	0.09	1.41	80.16	57.60	1.32	-22.56
Iron and steel	0.87	0.94	72.69	97.00	0.07	24.30
Footwear	0.48	0.92	51.43	48.93	0.45	-2.50

**For our measure of competitiveness to be valid, it should be related to export share growth.** We evaluate this by regressing the growth in export share in each sector and each country on relative ULCs. These regressions want to illustrate how relative ULCs affect export shares controlling for a few other factors, and do not necessarily represent the best specification of a model aimed at explaining export shares. The results presented in Table 2 confirm that relative ULC is an important determinant of export share growth: industries with low ULCs relative to the ULC of industry as a whole exhibit higher export share growth. In addition, reflecting the comparative advantage of some industrial sectors, sectors with a

larger share in total exports of the country in which they are located enjoy higher export growth.

Table 2. Impact of ULC relative to Industry on Growth in Export Share

	(1) fe	(2) fe	(3) fe	(4) fe	(5) re	(6) Slovakia
ULC relative to industry	-0.093*** (0.028)	-0.093*** (0.028)	-0.079*** (0.029)	-0.106*** (0.029)	-0.043** (0.018)	-0.198*** (0.075)
ULC country average		0.003*** (0.036)		0.032 (0.038)	-0.015 (0.027)	0.622** (0.027)
Log of Size of industry in country's exports			22.66*** (1.357)	23.345*** (1.397)	2.446*** (0.459)	5.123*** (1.360)
Tarrif				-3.023*** (0.567)	-2.106*** (0.547)	-3.776** (1.760)
Observations	4017	4017	3995	3778	524	524
Number of panels	435	435	435	433	433	58

**However, using relative ULCs by industry as a measure of competitiveness has some drawbacks.** In particular, relative ULCs can reflect country-specific characteristics. For example, ULCs tend to be higher across sectors in countries with a higher level of GDP per capita. To the extent this reflects differences in institutions, product quality, production technology and the stock of human and physical capital, higher ULCs do not necessarily signal a lack of competitiveness. On the other hand, lower ULCs, and hence faster export growth, in emerging economies in part reflect convergence dynamics. External competitiveness in these circumstances could be better measured in terms of deviations from a norm based on industry and country characteristics.

**To address these drawbacks, we explore a measure of competitiveness based on the deviation from a relative ULC norm.** Table 3 presents the estimation results of regressing relative ULCs on the level of GDP per capita and the lagged unemployment rate in the country in which it operates, the size of the sector in the country's total exports, and the country-wide ULC. The results suggest that higher per capita income is associated with higher ULCs, as discussed above. Per capita income in this context can capture the effect of such variables as the quality of institutions, and the stock of human and physical capital.<sup>17</sup> A higher unemployment rate is associated with lower ULCs, reflecting lower wage pressure.

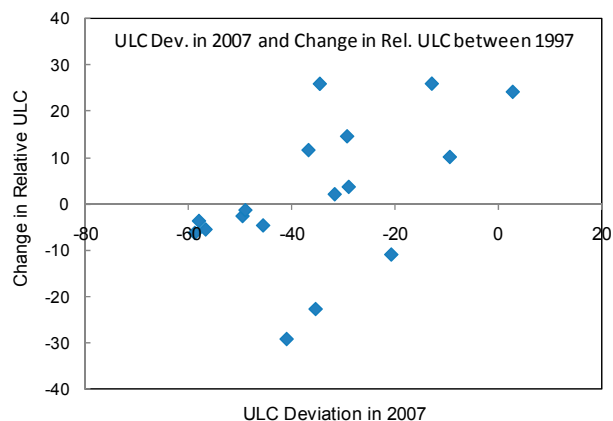
<sup>17</sup> However, to the extent real GDP per capita is a poor proxy of these variables, and if additional variables, labor taxation for instance, matter for the behavior of relative ULCs, the residuals of the regression of relative ULC on the selected regressors may reflect not only relative competitiveness but also omitted variables.

Finally, higher ULCs in the country as a whole tend to be associated with higher relative ULCs at the sectoral level, reflecting some country specific characteristics.

Table 3. Determinants of ULC Relative to Industry  
(Used to Generate ULC norm)

	(1)	(2)
Log of real GDP per capita (PPP)	-6.66*** (1.240)	9.04 * (5.560)
Lag of unemployment rate	-0.481*** (0.105)	-0.278** (0.126)
Log size of industry in country's exports	-2.17* (0.839)	-2.325*** (0.839)
Time trend		-1.116*** (0.386)
Observations	4206	4206

**Based on these estimation results, we construct a measure of competitiveness derived from the regression's residual.** That is, a sector with relative ULC below the norm (predicted level) is more competitive, while one with relative ULC above the norm is less competitive. Table 4 presents this measure of competitiveness for Slovakia in 2000 and 2007 and by industrial sector. Overall, Slovakia has been competitive in most sectors, i.e. actual ULCs were below the corresponding sectoral norms. Furthermore, competitiveness improved over time in most sectors, suggesting that relative ULC grew slower than implied by the growth in the country's GDP per capita (i.e., wage growth was subdued compared with productivity growth). A competitiveness measure for the economy as a whole can be derived applying a proper weighting scheme to the deviations from the sectoral norms.<sup>18</sup>



<sup>18</sup> Bennett and Zarnic (2010) discuss a generic aggregation approach which takes into account the importance of each sector-destination pair in a country's total exports.

Table 4: Relative ULCs and Export Shares of Selected Industries

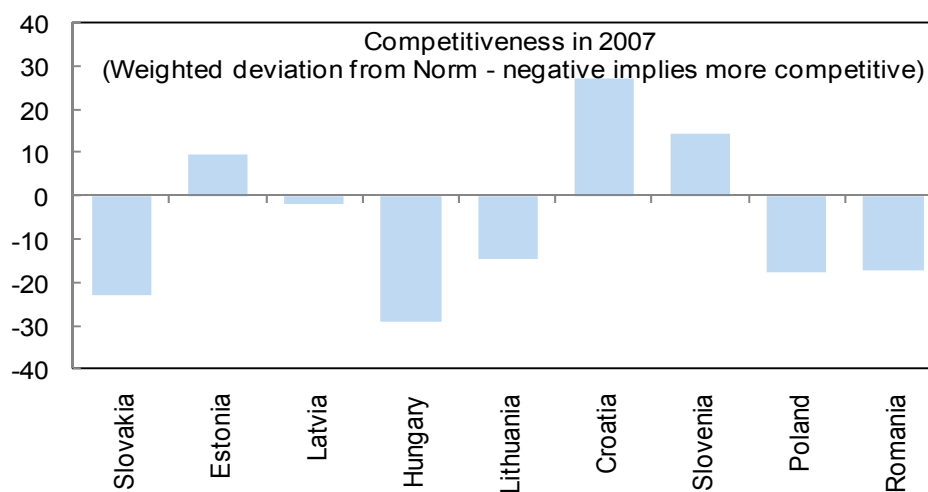
Industry	ULC deviation	Change in Rel. ULC	Change in export share
Building fixtures etc	-58.7	-6.1	1.2
Telecomms etc equipment	-35.3	-22.6	1.3
Road vehicles	-45.5	-4.5	0.8
Rubber manufactures nes	-28.9	3.8	0.6
Iron and steel	2.9	24.3	0.1
Footwear	-49.4	-2.5	0.4
Sugar/sugar prep/honey	-29.2	14.7	0.7
Furniture/furnishings	-57.9	-3.5	0.4
Paper/paperboard/article	-56.6	-5.4	0.4
Cork/wood manufactures	-34.5	26.0	0.5
Metal manufactures nes	-48.9	-1.2	0.4
Non-ferrous metals	-12.8	26.1	0.0
Railway/tramway equipmnt	-9.3	10.3	0.0
Inorganic chemicals	-31.6	2.2	0.4
Dairy products & eggs	-36.7	11.7	0.4
Leather manufactures	-20.6	-10.8	0.3
Industrial equipment nes	-40.9	-29.0	0.3

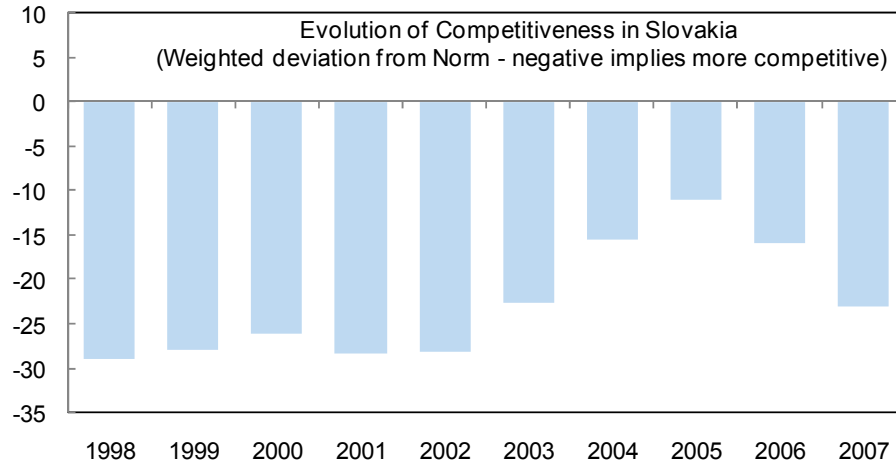
**To evaluate the validity of the proposed measure, its impact on export share growth is examined.** Regressing growth in export share on the estimated deviation from the relative UCL norm (on a sector by sector basis) shows that a positive deviation from the norm has a negative and significant impact on export share growth (Table 5). Again, these regressions want to illustrate how deviations from the relative ULC norm affect export shares controlling for a few other factors, and do not necessarily represent the best specification of a model aimed at explaining export shares. While conceptually regression-based measures of ULCs represent an improvement over plain relative ULCs, further work is needed to formally test the relative performance of the two measures empirically.

Table 5. Deviation from ULC Norm Helps Explain Growth in Export Share

	(1) F.E.	(2) F.E.	(3) F.E.	(4) F.E.
Deviation from ULC norm	-0.061** (0.029)	-0.057** (0.028)	-0.059** (0.027)	-0.090*** (0.028)
Log size of industry in country's exports		22.296*** (1.345)	20.406*** (1.359)	20.902*** (1.473)
ULC norm			-1.751*** (0.239)	-1.511*** (0.298)
Tarrif				-1.479*** (0.649)
Constant	7.93*** (0.427)	8.84*** (0.415)	183.75*** (23.845)	164.346*** (28.746)
Observations	3995	3995	3995	3778

**Finally, we compute a measure of overall competitiveness, as a weighted average of each sector's deviation, using the sectors' value added as weights.** This computation shows that in 2007, Slovakia was among the most competitive countries among CEE (surpassed only by Hungary). Competitiveness in Slovakia declined during 2002–05, and rebounded in 2006–07.





## VII. CONCLUSIONS

Using a case study of Slovakia, this paper presents a conceptual framework that could help reduce some of the conceptual ambiguities that continue to surround commonly used methodologies to analyze external competitiveness. It also presents an indicator for evaluating short-term external competitiveness based on the deviation of ULC from an estimated norm computed by industrial sector and by country, and illustrates the empirical validity of the new indicator in terms of export performance.

More analysis is needed to fine tune the specification of the relative ULC regressions. In particular, there are additional explanatory variables that may play a role in explaining ULCs across countries and over time, such as labor taxation, the stock of capital, and the quality of institutions. To evaluate the robustness of the regression-based ULC approach, it would also be helpful to extend the analysis to countries outside of the converging CEE region.

In addition, further work is needed to compare the empirical performance of the regression-based ULC measure with that of other competitiveness measures, including simple relative ULCs.



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