Review of Keynesian Economics, Vol. 2 No. 4, Winter 2014, pp. 490–507

Unit labor costs in the eurozone: the competitiveness debate again*

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Unit labor costs in some of the eurozone countries, calculated using aggregate data, increased significantly during the years before the crisis. In this paper, we show that: (i) the construction of unit labor costs using aggregate data, the standard practice, leads to serious problems of interpretation; (ii) aggregate unit labor costs are not a sum or an average of firms' unit labor costs; and (iii) aggregate unit labor costs are simply the product of the share of labor in total income times the aggregate price deflator. As such, they simply reflect the distribution of income between wages and profits. We conclude that aggregate unit labor costs should not be calculated, and certainly should not be used as a measure of competitiveness. Data for 1980–2007 confirms that aggregate unit labor costs increased across the eurozone. But of the 12 countries studied, the labor share declined in nine, it increased in one (Greece), and it remained constant in two. Overall, aggregate unit labor costs increased as a result of the increase in the price deflator. We conjecture that the increase in unit labor costs was the result of the non-tradable sectors gaining share in the overall economy. Recent data for 2008–2012 indicate that aggregate unit labor costs have stopped increasing and have even declined in some countries. This is due to the fact the labor shares have continued declining and that the overall price deflator has dramatically reversed its upward trend, either flattening or declining.

Keywords: *competitiveness, eurozone, income distribution, unit labor costs*

JEL codes: *D31, D33, E25, J30*

1 INTRODUCTION

Discussions regarding the need to regain competitiveness in the euro area have taken center stage in policy forums in the context of the crisis that started in 2008. The issue is particularly important for Greece, Ireland, Italy, Portugal, and Spain. No matter how the crisis started, analysts have concluded that these countries suffer from a competitiveness problem, namely that workers are too expensive given their labor productivity – that is,

* We are grateful to two referees, and to the editor, for very useful suggestions. The usual disclaimer applies. This paper represents the views of the authors and not necessarily those of the Asian Development Bank, those of its Executive Directors or of the countries they represent. Respective e-mails are: jfelipe@adb.org (corresponding author); and ukumar@adb.org.

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they have high unit labor costs.[1] Given that devaluation is not possible because countries are part of the euro, and that the monetary union has imposed fiscal rigidity and removed monetary independence, it appears that adjustment has to come either through increasing wages and prices in countries such as Germany, or through decreasing prices and wages in the periphery. Since the policy of the European Union does not allow the former, the *only* solution is persistent deflationary pressures on the periphery.[2] For this reason, policy discussions have focused on analyses of unit labor costs. A number of economists have concluded that closing the 'competitiveness gap,' in particular with Germany, requires downward adjustments in relative wages in these five countries (Black 2010; Levy 2012) – that is, the so-called *internal devaluation* solution.[3]

Unit labor costs are defined as the ratio of a worker's total compensation (or money-wage) to labor productivity.[4] Assuming the numerator is measured in euros per worker and the denominator is measured in number of pencils per worker, the firm's (for a specific product) unit labor cost is measured in euros per pencil (that is, total labor cost per unit of output). Algebraically:

$$ulc^q = w_n/(q/l), \tag{1}$$

where w_n denotes total labor compensation, q is physical output (for example, number of pencils), and l is employment (for example, number of workers). Equation (1) should be viewed as a technical relationship, as labor productivity should be thought of in terms of a production function (a microeconomic concept), the blueprint to make pencils.

Firms, obviously, do care about unit labor costs because they track the relationship between their labor costs and how productive their workers are. If a firm's unit labor cost increases, and even more so vis-à-vis those of its competitors, it will most likely lose market share, and its growth expectations will be negatively affected. The solution to this problem is a combination of wage restraint and increase in labor productivity, the latter usually achieved by introducing labor-saving techniques that are profitable.[5]

Equation (1), however, is not the one used in the empirical exercises that have led to the conclusion that some eurozone countries are uncompetitive. These analyses have used data for sectors, or for the whole economy. At the aggregate level, however, unit labor costs cannot be calculated using equation (1), as the measure of aggregate output is not a physical quantity (q), but the sector's or economy's value-added. Hence, the formula used is a variant of equation (1) that many economists believe is a correct aggregate. Indeed, to calculate aggregate unit labor costs (ULC), researchers need to use

1. We acknowledge that the crisis has many aspects that we do not discuss – for example, the debt situation, unemployment, etc. The analysis in this paper concentrates exclusively on the use of unit labor costs in the current discussion.
2. Of course, the European Central Bank could devalue the euro. This option has not been considered, and if it were, it would help exports outside the European Union, not within the euro area. Moreover, it is obvious that some countries would oppose this measure. With separate currencies, a partial solution to the eurozone problem would be to adjust exchange rates so that Germany's currency would appreciate and those of the debtor countries depreciate.
3. Paul Krugman, for example, has written extensively in his blog advocating this view of the problem. For example, http://krugman.blogs.nytimes.com/2010/05/17/et-tu-wolfgang/.
4. The money-wage rate is the nominal wage rate plus all other labor-related costs to the firm such as payments in kind related to labor services, social security, severance and termination pay, and employers' contributions to pension schemes, casualty, and life insurance, and workers compensation, and, in some cases, payroll taxes as well as fringe benefits taxes, etc.
5. See Allard and Everaert (2010), Blanchard (2007), or Syverson (2011).

'aggregate' labor productivity, and this has important implications. Aggregate labor productivity is calculated by dividing the economy-wide (or sector's) value-added in real terms (itself calculated as nominal value-added divided by a deflator, often the GDP deflator) expressed in euros of a base year, by the number of workers – that is:

$$ULC = w_n/ALP = w_n/(VA_r/L) = \frac{w_n}{(VA_n/P)/L}, \quad (2)$$

where w_n is the average money-wage rate or labor compensation, ALP is aggregate labor productivity, VA_r is real value-added (in euros of a base year), L is the number of workers, and P is the value-added deflator. This implies that the aggregate unit labor cost is a unitless magnitude, unlike that of a firm.

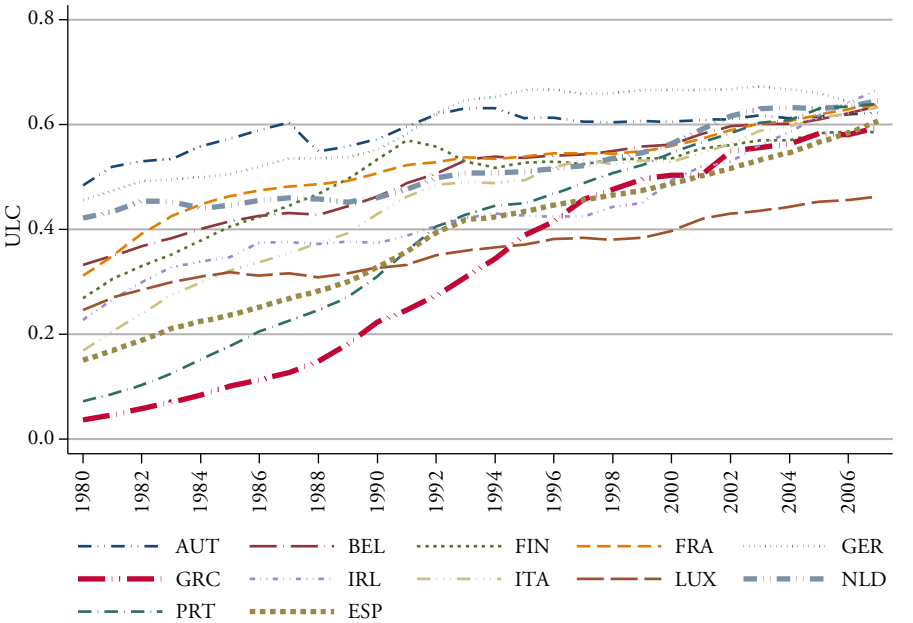
The remainder of the paper is structured as follows. Section 2 corroborates using data for 1980–2007 – that is, right up until the crisis – that indeed aggregate unit labor costs calculated using equation (2) increased across the eurozone; in some countries significantly more than in others. Section 3 shows that, while unit labor costs calculated with aggregate data are algebraically related to the firm-level unit labor costs (equation (1)), the former is not a correct proxy for the latter. Section 4 shows that unit labor costs calculated with aggregate data can be properly interpreted as the labor share in value-added times the price deflator. We find that in most countries studied, labor shares have declined. This interpretation is different from the standard one (that is, that aggregate unit labor costs a measure of competitiveness) and has important implications. Section 5 argues that the decline in labor shares is related to the increase in the share of non-tradables in the economy. Section 6 offers some conclusions. Finally, as a postscript, Section 7 provides an update of the analysis using data for 2008–2012.

2 WHAT DOES THE STANDARD INTERPRETATION TELL US ABOUT ULCs IN THE EUROZONE?

The standard interpretation of equation (2) is that the ULC is a measure of competitiveness. It is calculated as the ratio of the average nominal labor compensation to 'aggregate' labor productivity.

Figure 1 shows the unit labor costs of 12 countries of the eurozone during 1980–2007 calculated using equation (2). Data used throughout the paper are for the total economy. The source of all variables is the OECD (http://stats.oecd.org). Unit labor costs reported by the OECD are calculated as the ratio of total labor costs to real output. Real output is the constant price value-added, with 2005 base-year. The share of labor income reported by the OECD database is calculated as the ratio of total labor costs to nominal output. The measure of total labor costs is the compensation of employees adjusted for self-employment.

Figure 1 shows that unit labor costs increased during 1980–2007 in all countries without exception, in some cases by a factor of 16 (for example, Greece). The ratio of the 2007 value to the one in 1980 for Portugal is 9, corresponding to an average annual growth rate of 8.45 percent; 4 and 3.7 for Spain and Italy, equivalent to average annual growth rates of 5.31 percent and 5.1 percent, respectively; and 2.9 for Ireland, corresponding to an average annual growth rate of 4.1 percent. Germany and the Netherlands were among those that registered the lowest increases, where the 2007–1980 ratios are 1.4 and 1.5, respectively (average annual growth rates of 1.2 percent and 1.6 percent, respectively). Under the standard interpretation of unit labor costs,



Notes: AUT = Austria, BEL = Belgium, FIN = Finland, FRA = France, GER = Germany, GRC = Greece, IRL = Ireland, ITA = Italy, LUX = Luxembourg, NLD = Netherlands, PRT = Portugal, ESP = Spain. ULCs shown here are as reported in the OECD database.
Source: OECD and authors' estimates.

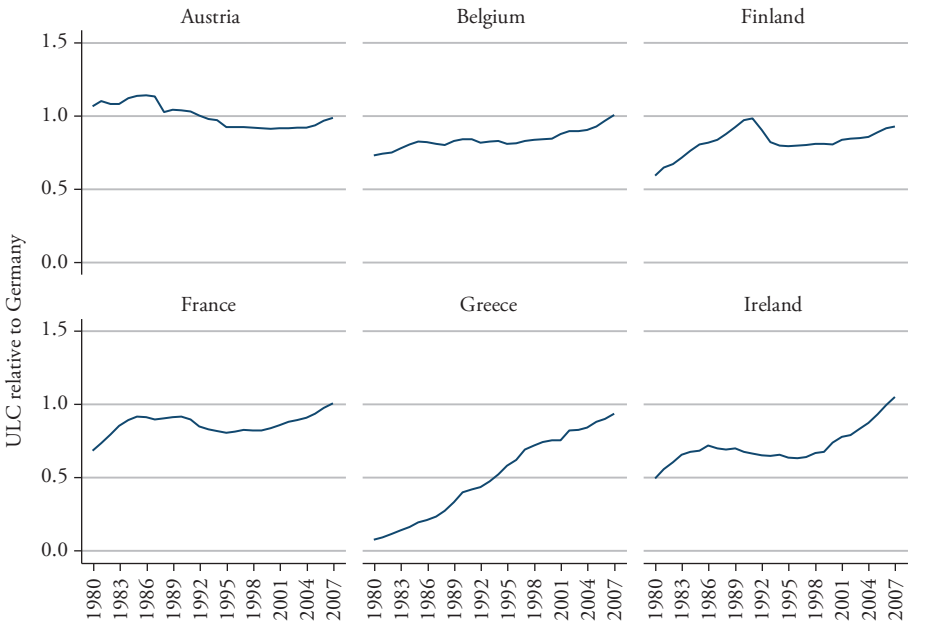
Figure 1 Unit labor costs in the eurozone, 1980–2007

the reason for these increases is that workers' nominal compensation grew faster than labor productivity.

Often, however, comparisons are made relative to a country. To do this, we simply divide the unit labor cost (ULC), as calculated as in equation (2), of one country by that of the base country, which in our case we take to be Germany.

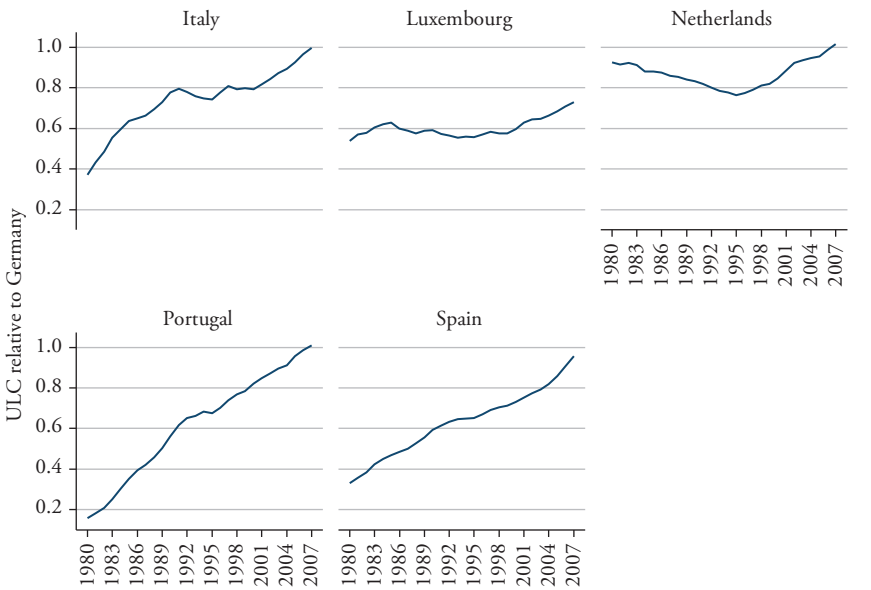
Figures 2a and 2b show the 11 countries' unit labor costs relative to that of Germany.[6] The figures show that the relative unit labor costs of Greece, Ireland, Italy, Portugal, and Spain increased systematically after 1980. Post-1995, all ULCs increased vis-à-vis that of Germany.

6. In the working paper version (Felipe and Kumar 2011), we argue that Germany may not be the right comparator country. Using a measure of product sophistication called 'product complexity,' Felipe et al. (2012) show that the export baskets of Germany and of some of the peripheral eurozone countries are very different. The top 100 most complex products (in a data set containing over 5000 products) represent 18 percent of Germany's export basket but only 0.81 percent of Ireland's total exports; 0.89 percent of Spain's; 0.02 percent of Greece's; and 0.04 percent of Portugal's. France, Italy, and the Netherlands have higher shares, 3.0–3.5 percent, but still smaller than Germany's. Even though some of the most complex products are tradable, they are exported by a small group of countries, giving them significant market power. In short, countries like Greece, Ireland, Portugal, and Spain do not compete directly with Germany in many of the products they export, and the market conditions they face are also different. Hence comparing their 'aggregate' ULCs and drawing conclusions is also probably misleading.



Source: OECD and authors' estimates.

Figure 2a Unit labor costs relative to Germany, 1980–2007 (countries A–I)



Source: OECD and authors' estimates.

Figure 2b Unit labor costs relative to Germany, 1980–2007 (countries I–S)

3 THE RELATIONSHIP BETWEEN FIRM-LEVEL UNIT LABOR COSTS AND AGGREGATE UNIT LABOR COSTS

Given that equations (1) and (2) are obviously not the same, the logical question to pose is whether the aggregate unit labor cost in equation (2) is a good *approximation* to some *average* of the individual firms' unit labor costs in equation (1). If the answer is yes, then the aggregate unit labor cost could be used to discuss competitiveness the way it is usually done. If the answer is no, how misleading is it?

Recall that each product's unit labor cost is measured in euros per unit of the product (for example, a pencil). To see what this implies for our discussion, we start by rewriting the economy-wide (or aggregate) labor share as a weighted average of the firms' labor shares as follows:

$$s_l^n = \sum_{i=1}^{k} \left[\left(\frac{p^i q^i}{\sum_{i=1}^{k} p^i q^i} \right) * s_l^i \right] = \sum_{i=1}^{k} \phi^i * s_l^i, \tag{3}$$

where $s_l^n \equiv (w_n L / VA_n)$ is the (economy-wide) aggregate share of labor in total output (with both numerator and denominator measured in nominal terms), ϕ^i is the share of firm i's value-added in total value-added, and s_l^i is the share of labor in firm i's value-added – that is:

$$s_l^i = \frac{w_n^i l^i}{p^i q^i} = \frac{ulc_q^i}{p^i}, \tag{4}$$

where w^i is the average labor compensation of firm i, l^i is the number of workers (or hours) in firm i, p^i is the price charged by firm i, q^i is the quantity produced by firm i, and ulc_q^i is the unit labor cost of firm i. Equation (4) shows that the firm's labor share equals its unit labor cost divided by the selling price.

Combining equations (2), (3), and (4), the aggregate unit labor cost (ULC) can be written as follows:

$$\begin{aligned} ULC = s_l^n * P &= \left[\sum_{i=1}^{k} \left\{ \left(\frac{p^i q^i}{\sum_{i=1}^{k} p^i q^i} \right) * s_l^i \right\} \right] * P = \left(\sum_{i=1}^{k} \phi^i * s_l^i \right) * P \\ &= \left(\sum_{i=1}^{k} \phi^i * \left(\frac{w_n^i l^i}{p^i q^i} \right) \right) * P = \left(\sum_{i=1}^{k} \phi^i * \left(\frac{ulc_q^i}{p^i} \right) \right) * P \end{aligned}, \tag{5}$$

that is, as the product of the sum of the firms' labor shares (each weighted by its share in aggregate value-added) times the economy-wide price deflator. Recall that each firm's labor share can be written as the ratio of its unit labor cost divided by the unit price charged.

While equation (5) shows that the aggregate unit labor cost *ULC* is indeed related to the firms' unit labor costs (ulc^i), the right-hand side of the equation contains three variables. Note that $s_l^i = \frac{ulc_q^i}{p^i}$ (equation (4)), the firm's labor share, is a unitless magnitude (as

the units in both numerator and denominator are the same and hence cancel out). We then multiply it by the share in value-added (ϕ^i) and add up across all firms – that is, $\sum_{i=1}^{k} \phi^i * s_l^i$, which yields the aggregate labor share (s_l^n). Finally, the latter is multiplied by the aggregate price deflator (P). This means that the aggregate unit labor cost will increase or decrease as a result of what happens to all or one of the variables in equation (5), not only ulc^i. And, of course, it is also possible that some firms' unit labor costs decline and yet the aggregate increases.

As a consequence of the above analysis, it must be noted that a weighted average of the firms' unit labor costs as $ULC^* = (\sum_{i=1}^{k} \phi^i * ulc_q^i)$ is not a valid aggregate unit labor cost, as it would be incorrect (effectively, it is not possible) to add the (different) units of each component (that is, euros per pencil plus euros per automobile, etc.).

To this argument one needs to add the important fact that the denominator of equation (2), 'aggregate' labor productivity (VA_r/L), is not a trouble-free concept. Indeed, as we noted in Section 1, equation (1) is a technical relationship because its denominator is labor productivity (q). Economists think of labor productivity as derived from a production function, a technological relationship between output and inputs that must be expressed in physical terms. So-called aggregate production functions are thought by many economists to be natural extensions of the micro counterpart. This is incorrect. Aggregate production functions face such insurmountable theoretical and empirical problems that their use is extremely problematic (Felipe and Fisher 2003; Felipe and McCombie 2013).[7]

4 A REINTERPRETATION OF 'AGGREGATE' UNIT LABOR COSTS

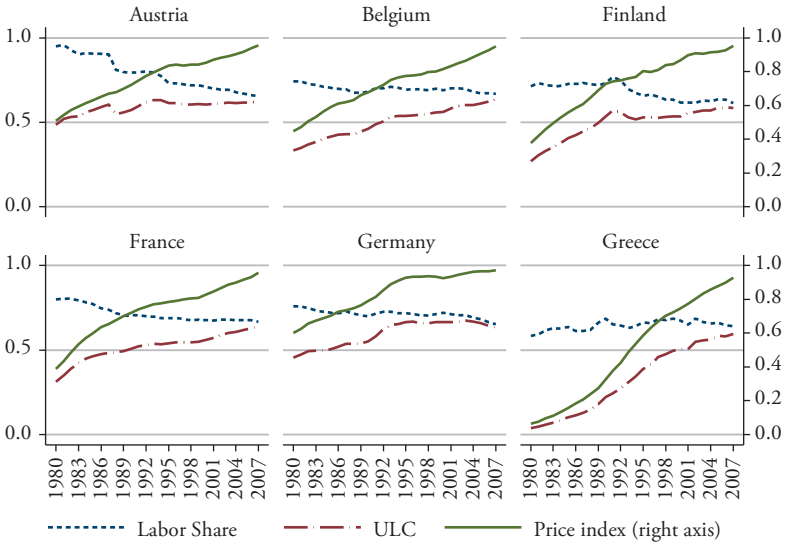
Given that aggregate unit labor costs ULC can hardly be interpreted as a measure of competitiveness parallel to the product-level unit labor costs, do they have any other interpretation? In this section we show that indeed they do, but this interpretation is very different from the standard one. To show this, note that equation (2) can be written as:

$$ULC = \frac{w_n}{(VA_n/P)/L} = \left(\frac{w_n L}{VA_n}\right) P = \left(\frac{\text{Total labor compensation}}{VA_n}\right) P = s_l^n * P. \quad (6)$$

This shows that the aggregate unit labor cost is nothing but the economy-wide labor share (a unitless magnitude), s_l^n, times the price deflator P (also unitless).

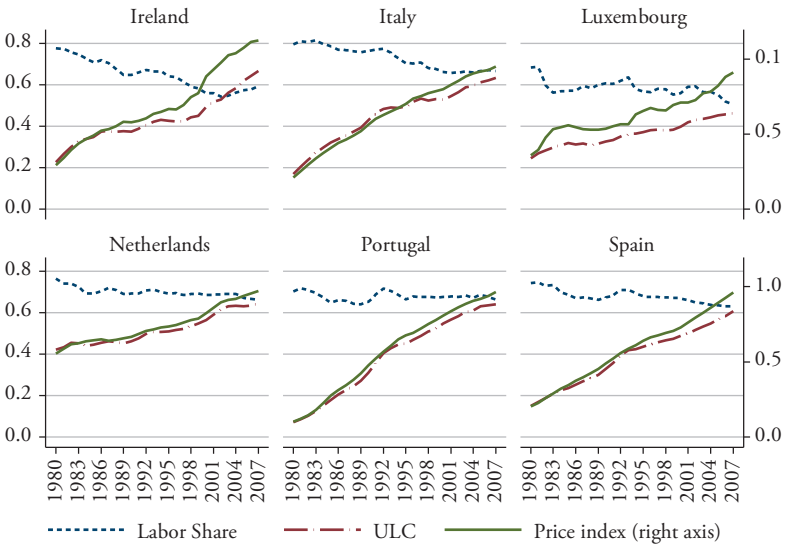
Figures 3a and 3b show the two components of the aggregate unit labor cost, namely the labor share and the price deflator for the 12 countries. The figures show that between 1980 and 2007, the labor share declined in Austria, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, and Spain. In Belgium and Portugal, it remained

7. The problem aggregate production functions face is that they can be derived by aggregating micro production functions only under conditions that real economies do not satisfy. Although this result has been in the literature for decades, some economists have minimized it on unconvincing grounds (see Felipe and McCombie 2013), while others are not even aware of it. We believe the aggregation problems in production functions are very serious for the notion of aggregate production function, and affect standard analyses of growth, technical progress, labor demand, etc., as well as the construction of 'aggregate' unit labor costs.



Note: The labor share and ULC are shown on the left-hand axis. The price index is shown on the right-hand axis.
Source: OECD and authors' estimates. ULC and labor shares are as reported in the OECD database. To ensure that equation (6) holds, the price index (P) is obtained by dividing ULC by the labor share.

Figure 3a Unit labor costs decomposed, 1980–2007 (countries A–G)



Note: The labor share and ULC are shown on the left-hand axis. The price index is shown on the right-hand axis.
Source: OECD and authors' estimates. ULC and labor shares are as reported in the OECD database. To ensure that equation (6) holds, the price index (P) is obtained by dividing ULC by the labor share.

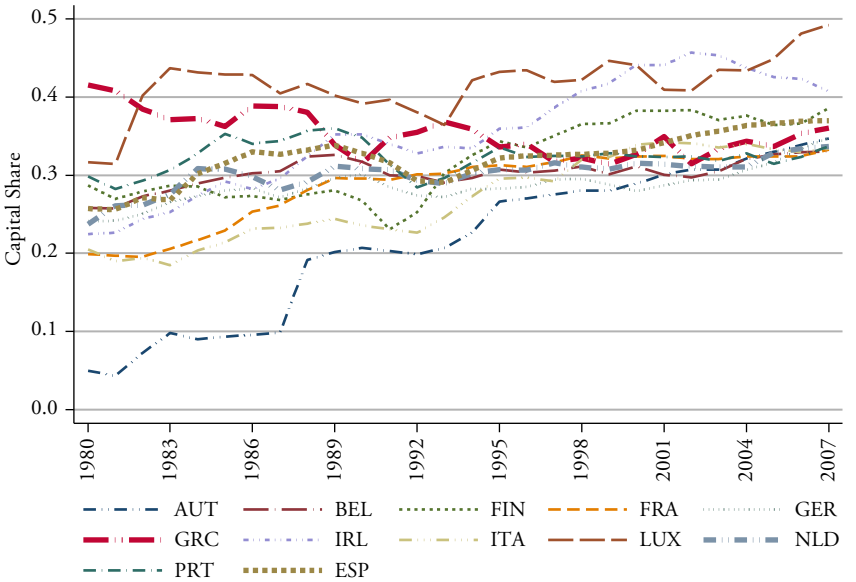
Figure 3b Unit labor costs decomposed, 1980–2007 (countries I–S)

almost constant; and only Greece's labor share does display an upward trend (the ratio of the 2007 to the 1980 values is 1.15; Greece started with the lowest labor share of all 12 countries in 1980, below 0.6). The outcome of this decline was a severe shortage of effective demand that was mainly solved with an increase in credit. This was very obvious in the peripheral countries.

On the other hand, the 12 price deflators display a marked upward trend that compensates the constancy or decline of the labor share. This indicates that, except in Greece, the overall upward trend of the aggregate unit labor costs shown in Figure 1 was, exclusively, the result of the increase in the price deflator. If it is just this latter point that discussions of aggregate unit labor costs in the eurozone portray (that is, price increase differentials), then the construction and use of (aggregate) unit labor costs is unnecessary.

This reinterpretation of aggregate unit labor costs – that is, unit labor cost as a product of share of labor in total value-added and price deflator – can help understand the well-documented lack of empirical relationship between the growth in (aggregate) unit labor costs and output growth. This is referred to in the literature as *Kaldor's paradox* (Kaldor 1978; see ch. 4 of McCombie and Thirlwall 1994 for a discussion). Kaldor found, for the postwar period, that those countries that had experienced the greatest decline in their price competitiveness (that is, highest increase in unit labor costs) also had the greatest increase in their market share. Hence, the belief that low nominal wage growth vis-à-vis that of productivity will restore competitiveness and eventually lead back to growth is, at best, too simplistic and does not have strong empirical evidence.[8] Indeed, if the argument about the importance of unit labor costs as a measure of competitiveness were so simple and straightforward, researchers would have long ago found an unambiguous relationship between them and growth rates. In the context of the analysis of Harrod's multiplier and the balance of payments constraint, Kaldor (1970; 1971) argued that the growth rate of an economy depends on the growth rate of exports, which itself depends on world demand and the international competitiveness of exports. According to Kaldor, *export competitiveness* depends on the dynamic evolution of money wage and of productivity. As we have said, the evidence on the inverse relationship between output growth and the growth rate of unit labor costs is inconclusive, as at times researchers have found that the fastest growing countries in terms of exports and GDP in the postwar period have also experienced faster growth in their unit labor costs.[9,10] In the words of Fagerber (1988, p. 355): 'This … indicates that the popular view of growth in unit labor costs determining international competitiveness is at best too simplified. But why?' Fagerberg (1996) revisited this enduring puzzle by analysing the period 1978–1994 and concluded that the paradox also holds for this period.[11]

8. In Spain, for example, exports seemed to be the only bright spot in the economy in the midst of the crisis. This casts doubt on the argument that Spain's problem is high unit labor costs.
9. Kaldor's argument was, in fact, a bit more sophisticated. His conclusion of an inverse relationship between output growth and the growth in relative unit labor costs (that is, the differential between the growth rates of the unit labor costs in two countries) depended on two more equations, one expressing money-wages as a function of labor productivity, and Verdoorn's law.
10. Kaldor (1978) compared growth in unit labor costs and growth in value in market shares for exports for 12 countries for 1963–1975. He found that, for some of these countries, the relation between the two variables was positive. Kaldor concluded that no analysis of international competitiveness could be carried out by merely considering cost factors, and that the inclusion of other circumstances, such as the role of technology, was necessary. See De Benedictis (1998).
11. From standard specifications of export and import equations, assuming long-term balanced trade, and that firms set prices by applying a mark-up on *ulcs*, Fagerberg (1988) showed that the growth of output ($\hat{y}$) can be modeled as $\hat{y} = \gamma[\hat{ulc} - \hat{ulc}^*] + \delta\hat{y}^*$, where the superscript * refers to



Source: OECD and authors' estimates. The capital share is calculated as 1 minus the labor share. The latter is as reported in the OECD database.

Figure 4 Capital shares in the eurozone, 1980–2007

Finally, it should be obvious that if labor shares have declined across the eurozone, the shares of capital in total output must have increased, as by definition both shares add up to unity. Indeed, except in Greece, where capital's share has declined, Figure 4 shows a generalized increase in this share.

5 WHY HAVE LABOR SHARES DECLINED?

As we saw in the previous section, aggregate unit labor costs increased in all 12 countries, and this was due to the increase in the aggregate price deflator (P), while aggregate labor shares declined or were stable in 11 of the countries. Explaining why labor shares declined (in so many countries) is very complex. Tautologically, the reason is that the economy's wage bill grew more slowly than nominal GDP and, in the long run, this is because workers lost bargaining power. Stockhammer (2013) provides a very comprehensive review of the empirical literature of labor shares, which confirms their decline in both advanced and developing economies. He shows that the decline in the advanced

the rest of the world, ^ denotes growth rate, and the parameters γ, δ are functions of the price and income elasticities of exports and imports. In this formulation, economic growth is written as a function of the growth in relative unit labor costs and world demand. The variable γ is a function of the export-price and import-price elasticities, and will be negative provided the Marshall–Lerner condition is satisfied (that is, that the sum of these two elasticities is greater than one).

economies has been mostly the result of financialization.[12,13] Welfare state retrenchment (measured as government consumption as a share of GDP and union density) and globalization (measured as trade openness and terms of trade) have also had negative effects on the labor share. Lastly, he shows that technological change (measured as real GDP growth, the shares of agriculture and industry in GDP, the capital–labor ratio) has had only a modest negative effect.

A further reason that could help explain the decline in labor shares across the eurozone is firms' market power and, as a consequence, changes in the structure of the economy. Globalization ought to have decreased market power as a result of the entrance of new competitors, but at the same time it ought to have decreased the bargaining power of firms. Since there is no comprehensive data set to explore empirically firms' market power, we only explain how this mechanism may operate. To do this, we divide the economy into two sectors – tradables (T) and non-tradables (NT) – and write the aggregate labor share as a weighted average of both:

$$s_l^n = (\phi^T * s_l^T + \phi^{NT} * s_l^{NT}), \tag{7}$$

where ϕ^T and ϕ^{NT} are the shares in value-added of the two sectors. The change in the aggregate labor share in this two-sector case is:

$$\Delta s_l^n = \Delta\phi^T * s_l^T + \Delta\phi^{NT} * s_l^{NT} + \phi^T * \Delta s_l^T + \phi^{NT} * \Delta s_l^{NT}, \tag{8}$$

where Δ represents the change in the variable.

What are some plausible explanations for the decline in the aggregate labor share? Equation (8) indicates that this decline has to be the result either of one of the following arguments, (i), (ii), or (iii), or a combination of all of them:

(i) Assume the sectors' labor shares (s_l^T, s_l^{NT}) remain constant, which implies that $\Delta s_l^T = \Delta s_l^{NT} = 0$. Returning to equation (8), and since $\phi^T + \phi^{NT} = 1$, and $\Delta\phi^T + \Delta\phi^{NT} = 0$, the change in the aggregate labor share becomes $\Delta s_l^n = \Delta\phi^T * s_l^T + \Delta\phi^{NT} * s_l^{NT} = \Delta\phi^T * (s_l^T - s_l^{NT})$. A decline in the aggregate labor share requires that $\Delta\phi^T * (s_l^T - s_l^{NT}) < 0$. There are two possible cases for this to happen: (a) $\Delta\phi^T < 0$ with $(s_l^T > s_l^{NT})$ – that is, the share of the tradable sector in the economy's value-added fell, and the labor share of the tradable sector is larger than of the non-tradable sector; or (b) $\Delta\phi^T > 0$ with $(s_l^T < s_l^{NT})$ – that is, the share of the tradable sector in the economy's value-added increased, and the labor share of the tradable sector is smaller than that of the nontradable sector.

12. Financialization is measured by the ratio of external assets plus external liabilities to GDP. This variable captures the rising indebtedness of households, more volatile exchange rates and asset prices, the shareholder value orientation of non-financial businesses, and the short-term view of financial institutions. Stockhammer argues that financialization has had two important effects on the bargaining position of labor: (i) firms have gained more options and mobility for investing; and (ii) financialization has empowered shareholders relative to workers.
13. Stockhammer (2013) used panel data since 1970 for a large sample of developed and developing countries.

Assume now that firms set prices as a markup (μ^i) over unit labor cost – that is,

$$p^i = (1 + \mu^i) ulc^i. \tag{9}$$

The share of labor in firm i's value-added can be written as in equation (4) – that is, $s_l^i = \frac{w_n^i l^i}{p^i q^i} = \frac{ulc_q^i}{p^i}$, where you will recall that w^i is the average labor compensation of firm i, l^i is the number of workers (or hours) in firm i, p^i is the price charged by firm i, q^i is the quantity produced by firm i, and ulc_q^i is the unit labor cost of firm i. Combining equation (9) and (4), the share of labor is the inverse of the one plus the markup:

$$s_l^i = \frac{ulc^i}{p^i} = \frac{1}{(1 + \mu^i)}, \tag{10}$$

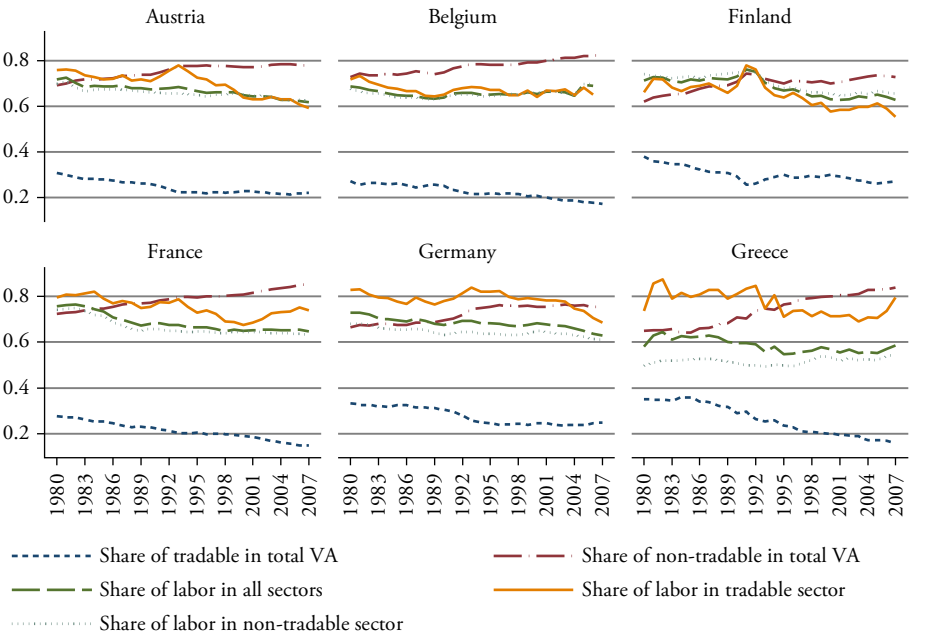
and, obviously, the capital share is $[\mu^i/(1 + \mu^i)]$, indicating that the higher the markup, the higher the capital share, and vice versa. From here it follows that $\mu^i = [(1 - s_l^i)/(s_l^i)]$, or the ratio of the capital share to the labor share.

Under the (plausible) assumption that the non-tradable sector has a higher markup because it is the more protected of the two, equation (10) implies that the labor share of the non-tradable sector is smaller than that of the tradable sector – that is, $s_l^T > s_l^{NT}$, that is, case (a) above. This would mean that the share of the non-tradable sector in the economy's total value-added increased (that is, $\Delta\phi^{NT} > 0$); and consequently, the share in total value-added of the sector with a smaller markup (or with a higher labor share – that is, the tradable sector) declined – that is, ($\Delta\phi^T < 0$). In other words, if this is the case, what we should observe across the eurozone is a decline in the size of the tradable sector and an increase in that of the non-tradable sector.

(ii) Assume the sectors' shares in total value-added (ϕ^T, ϕ^{NT}) remained constant. Then the change in the aggregate labor share is $\Delta s_l^n = \phi^T * \Delta s_l^T + \phi^{NT} * \Delta s_l^{NT}$. The aggregate labor share will decline (that is, $\Delta s_l^n < 0$) if $\left(\frac{\phi^{NT}}{\phi^T}\right) < -\left(\frac{\Delta s_l^T}{\Delta s_l^{NT}}\right)$ – that is, if: (a) the labor shares of the tradable and non-tradable sectors change in opposite directions; and (b) the absolute value of the ratio of the change in the labor share of the tradable sector to the change in the labor share of the non-tradable sector is greater than the ratio of the share in total value-added of the non-tradable sector to that of the tradable sector. If the non-tradable sector is the more protected of the two, and is the one with a higher and increasing markup, then the labor share of the non-tradable sector will decline ($\Delta s_i^{NT} < 0$), and the labor share of the tradable sector will increase ($\Delta s_i^T > 0$); and so will the ratio $\left(\frac{\Delta s_l^T}{\Delta s_l^{NT}}\right)$. In other words, given that there is an inverse relationship between the labor share and the markup, what we should observe is an increasing markup in the non-tradable sector, together with a declining markup in the tradable sector.

(iii) An intermediate scenario is that there is some variation in the two sectors' labor shares (s_l^T, s_l^{NT}) as well as in the sectors' shares in total value-added (ϕ^T, ϕ^{NT}) – that is, they are not constant. Returning to equation (8), and since $\phi^T + \phi^{NT} = 1$, and $\Delta\phi^T + \Delta\phi^{NT} = 0$, we can write the change in the aggregate labor share as:

$$\begin{aligned} \Delta s_l^n &= \Delta\phi^T * s_l^T + (-\Delta\phi^T) * s_l^{NT} + \phi^T * \Delta s_l^T + (1 - \phi^T) * \Delta s_l^{NT} \\ &= \Delta\phi^T * (s_l^T - s_l^{NT}) + \phi^T * \Delta s_l^T + (1 - \phi^T) * \Delta s_l^{NT} \end{aligned}. \tag{11}$$



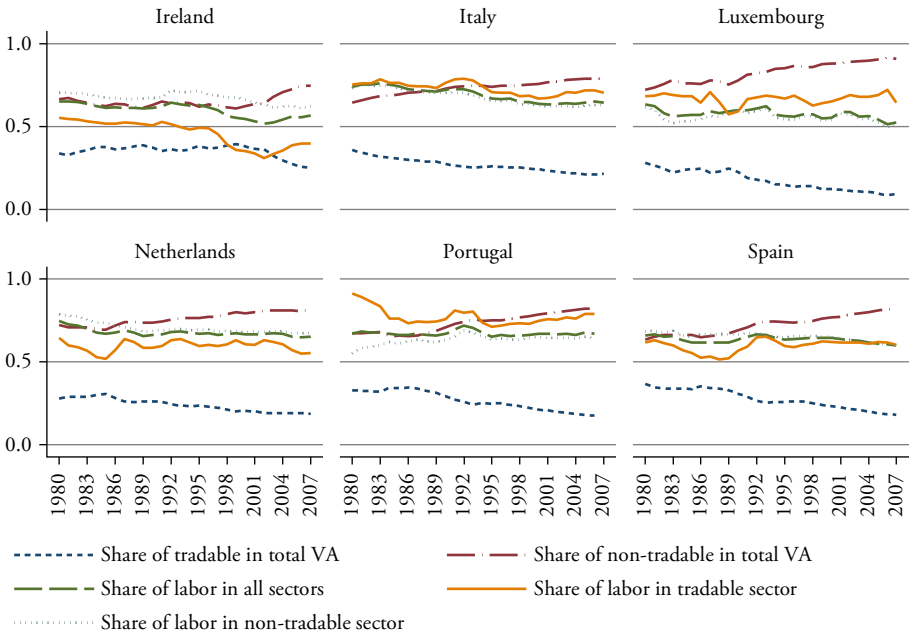
Notes: Since sectoral labor share are taken from a different source (EU KLEMS), aggregate labor share in the economy as calculated from the EU KLEMS database is also shown. Data on labor compensation for Belgium for 2007 was not available in the EU KLEMS database.
Source: EU KLEMS and authors' estimates.

Figure 5a Sectoral labor shares and shares in total value-added, 1980–2007 (countries A–G)

Obviously, this scenario throws up many possible different combinations in which the aggregate labor share can fall.

To see which of the three cases is closer to the reality of the eurozone, we turn to actual data for the shares of the tradable and non-tradable sectors in total value-added; and data for the shares of labor compensation in the respective total value-added of the tradable and the non-tradable sectors.[14] Data is shown in Figures 5a and 5b. The data used is from EU KLEMS.[15] The common pattern observed across the 12 countries is that the share of value-added in the tradable sector declined during 1980–2007. This indicates that scenario (ii) discussed above – that is, the sectors' shares in total value-added remained constant – does not seem to reflect the reality. Moreover, for scenario (ii) to hold, as noted above, the share of labor in the tradable and the non-tradable

14. The tradable sector includes agriculture, hunting, forestry, and fishing; mining and quarrying; and total manufacturing. The non-tradable sector includes electricity, gas, and water supply; construction; wholesale and retail trade; hotels and restaurants; transport, storage, and communication; finance, insurance, real estate, and business services; and community, social, and personal services.
15. EU KLEMS database, November 2009 release (March 2011 update). Available at: www.euklems.net.



Notes: Since sectoral labor share are taken from a different source (EU KLEMS), aggregate labor share in the economy as calculated from the EU KLEMS database is also shown. Data on labor compensation for Belgium for 2007 was not available in the EU KLEMS database.
Source: EU KLEMS and authors' estimates.

Figure 5b Sectoral labor shares and shares in total value-added, 1980–2007 (countries I–S)

sectors should change in opposite directions – that is, if the labor share increases in one, it should decrease in the other one. However, the data shows that the labor share declined in both sectors. At the same time, labor shares did not remain constant, as assumed in scenario (i) above. The actual pattern in the data thus lies between the two theoretical extremes discussed above – that is, scenario (iii). However, under scenario (iii), even if both Δs_i^T, Δs_i^{NT} are negative as shown by the data, the aggregate labor share could increase if the first term on the right-hand side of equation (11), $\Delta\phi^T * (s_l^T - s_l^{NT})$, is positive and outweighs the sum of the other two terms on the right-hand side, which are negative, as Δs_i^T, Δs_i^{NT} are negative and $\phi^T$and $\phi^{NT}$are shares and therefore, by definition, positive.

What does the data tell us about the first term on the right-hand side of equation (11)? First, the share of valued-added in the tradable sector declined over time – that is, $\Delta\phi^T < 0$. Second, in 8 out of the 12 countries, the labor share in value-added of the tradable sector is larger than that of the non-tradable sector – that is, $s_l^T > s_l^{NT}$. As a result, $\Delta\phi^T * (s_l^T - s_l^{NT})$ is negative, and the other two terms are negative as well, leading to a decline in the aggregate share of labor in value-added. In the other four countries, Finland, Ireland, the Netherlands, and Spain, this is not the case – that is, $\Delta\phi^T * (s_l^T - s_l^{NT})$ is positive, but still the aggregate labor share declined as the combined effect of the other two terms in equation (11), which are negative, outweighed

the positive effect of the decline in the share of the tradable sector, which has a smaller labor share in value-added ($s_l^T < s_l^{NT}$).

6 CONCLUSIONS

Unit labor costs are one of the most widely used variables in the analysis of competitiveness. They are defined as the ratio of a worker's total compensation or money-wage rate compensation to labor productivity (expressed, obviously, in physical terms). Therefore, at the firm level, they are measured in the country's currency (for example, euros) per unit of output (for example, per pencil).

At the aggregate level, however, there is no physical equivalent of output, and researchers use deflated value-added. We have shown that this is problematic as aggregate unit labor costs are not a straightforward aggregate of the firm-level unit labor costs. This analysis has several implications that question standard policy recommendations:

(i) Construction of unit labor costs using aggregate data (the standard practice) is misleading. While unit labor costs calculated with aggregate data are related to the individual firms' unit labor costs, the former are not simply the sum or a weighted average of the firms' unit labor costs. It is possible that individual firms' unit labor costs decline and the aggregate increases.
(ii) If anything, aggregate unit labor costs reflect the distribution of income between labor and capital (that is, the factor shares).

We have calculated and analysed aggregate unit labor costs for 12 countries of the eurozone during 1980–2007, before the onset of the crisis. The analysis indicates that aggregate unit labor costs in all of the eurozone increased. Greece and Portugal saw the fastest increases during this period (much faster than in the other countries) as a result of nominal wage rates that increased faster than (aggregate) labor productivity.

Under our proposed interpretation that aggregate unit labor costs are the economy's labor share times the price deflator, the increase in unit labor costs (in all countries) was due to the increase in the price deflator. Except in Greece, aggregate labor shares declined or remained constant in the other 11 countries.

We have discussed several possible reasons for decline in the aggregate labor shares. One is that the non-tradable sector of the economy, which probably applies a higher markup on unit labor costs, gained weight in the economy. A second plausible reason is an increasing markup in the non-tradable sector, together with a declining markup in the tradable sector. As per capita income increases, the share of services (often non-tradables) in the economy tends to increase.[16] If services are protected, markups will be higher. This will be more so for those services that continue to be non-tradable. A structural reform agenda of service sector liberalization will allow more entrants into the non-tradable sector. This will create competition and lower mark-ups, as well as usher in new ways of doing businesses, improve productivity, create new jobs, and support demand.

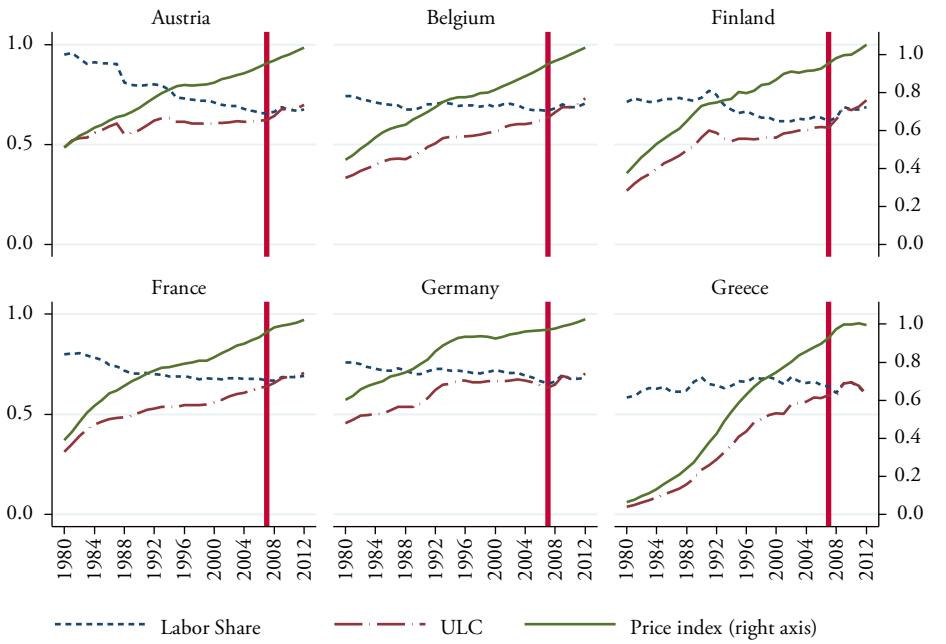
16. Services are usually non-tradable, though advances in information and communications technology have made some service sectors tradable (for example, logistics, and information and communications technology).

7 POSTSCRIPT

The above analysis has focused on the pre-crisis period and we showed that the increase in aggregate unit labor cost was the result of the increase in the price deflator, while labor shares declined. Obviously, much has changed since 2007, as what started as a banking crisis has evolved into a sovereign debt crisis. Fiscal expansionary policies quickly went out of favor and austerity policies have taken their place. A lot of emphasis has been placed on wage freezes and downsizing, in the middle of a lack of demand, to bring down unit labor costs to restore competitiveness. Clearly, it is interesting to see what has happened to (aggregate) unit labor costs since 2007.

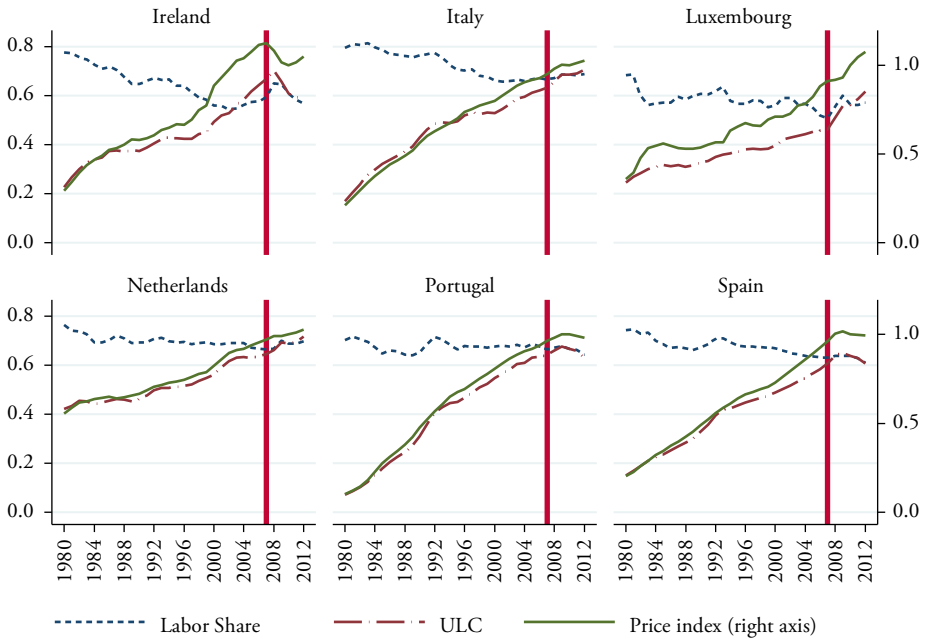
In this postscript we update our key results in Figures 3a and 3b with data for 2008–2012. Aggregate unit labor costs for this period are shown in Figures 6a and 6b. The figures show a clear change in trend, especially in Greece, Ireland, Portugal, and Spain, where aggregate unit labor costs have declined sharply. They declined or flattened in 2010, and thereafter the pace of increase slowed down.

We have also decomposed aggregate unit labor costs into the labor share and the price deflator. This decomposition is also shown in Figures 6a and 6b. The main reason for the deceleration in unit labor costs is the deceleration in the price deflator. In addition, the decline in labor share (after an increase in 2008 and 2009, probably due to the fall in GDP) has reinforced the moderation in ULC. However, it is to be noted that



Note: The labor share and ULC are shown on the left-hand axis. The price index is shown on the right-hand axis. The vertical line shows the year 2007.
Source: OECD and authors' estimates. ULC and labor shares are as reported in the OECD database. To ensure that equation (6) holds, the price index (P) is obtained by dividing ULC by the labor share.

Figure 6a Unit labor costs decomposed, 1980–2012 (countries A–G)



Note: The labor share and ULC are shown on the left-hand axis. The price index is shown on the right-hand axis. The vertical line shows the year 2007.
Source: OECD and authors' estimates. ULC and labor shares are as reported in the OECD database. To ensure that equation (6) holds, the price index (P) is obtained by dividing ULC by the labor share.

Figure 6b Unit labor costs decomposed, 1980–2012 (countries I–S)

the decline in labor shares is part of the long-term trend that was shown in Figures 3a and 3b. And, like before, ULCs have continued to follow the pattern of the price deflator.

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