Labor productivity changes and wages: Cost-push effects

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Abstract

Among the causes of current economic problems in the European Monetary Union (EMU), the increasing differences in the competitiveness among the members of EMU play an important role. The real wages e.g. in Germany grew in the last years very slowly, significantly behind the growth of the labor productivity and consequently the competitiveness of Germany was rising stronger than in the other economies. Recent studies deal mostly with aggregated models and overlook structural changes behind this phenomenon. In this paper, we analyze the changes in labor productivity and wages, and the cost-push effects, in different countries of the European Union, based on World input output tables nad Price input-output model. Using the structural decomposition we identify the impact of changes in average hourly wage and in hourly labor productivity on the prices.

Keywords: *labor productivity, price model, structural analysis*

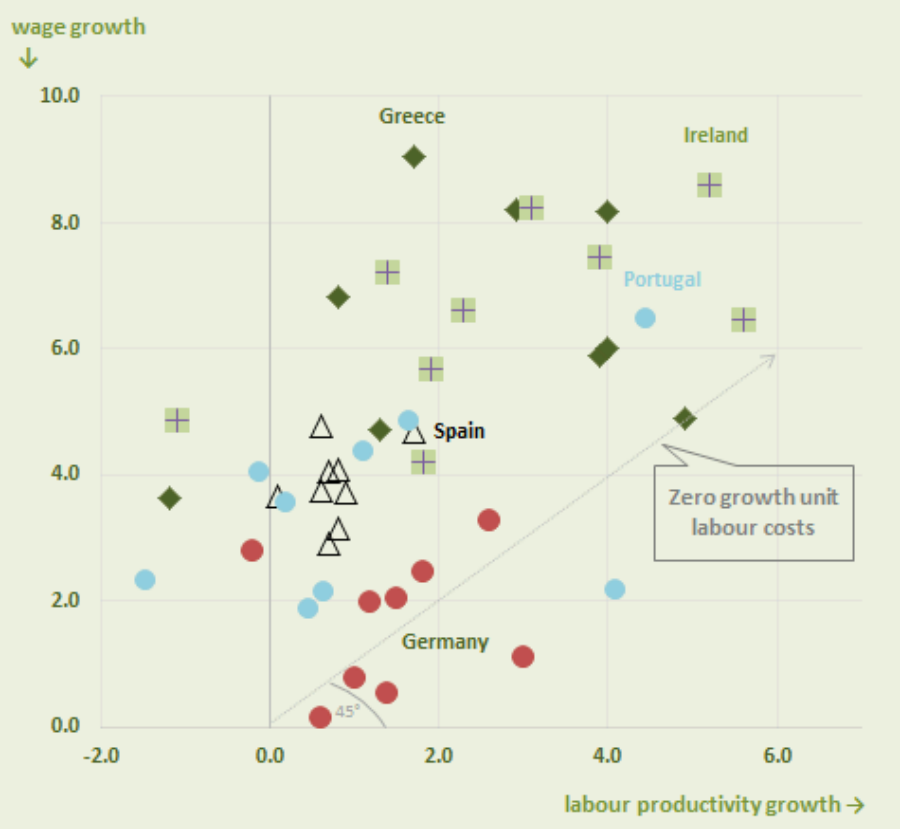
1 Introduction and motivation

The relationship between wage growth and productivity growth has become the particular policy relevance in recent years in the light of the economic crisis and imbalances between Eurozone countries. If the development of wages is not in line with productivity growth, the economy could lose its competitiveness and vice versa. The comparison of this relation in countries facing serious economic issues today (Greece, Portugal, Spain, and to lesser extend in Ireland) with the German economy reveals important differences between them. While in Greece, Portugal, Spain and Ireland, the annual wage growth was higher than the productivity growth between 2000 and 2008, in Germany, the wages grew in line with productivity growth and in several years the productivity growth was even higher than wage growth (see Fig.1). Other things equal, this leads to an important split in competitiveness and its development. While Germany was able the increase its competitiveness throughout this period, the other countries were losing their position and competitiveness. Peeters-Den Reijer (2011, p. 3) explained this phenomenon in this way: "Member states in the monetary union are no longer able to adjust their nominal exchange rate. They can therefore only compete with their real exchange rates where the main adjustment mechanism is the unit labor cost (wage growth minus productivity growth). A moderate development of wages positively affect the current account, in that a lower wage growth is beneficial in terms of international competitiveness and therefore will lead to higher exports and thus on current account balances. Oppositely, countries with abundant wage growth loose in terms of international competitiveness. Their higher wages translate in higher export prices and consequently lower exports of goods and

services, and therefore will show a deficit on the goods and services balances of the current account."

Figure 1

Relation between productivity growth and wage growth, 2000-2008, in %.



Source: Peeters and Den Reijer (2011) based on OECD and EU.

Even though the macroeconomic development and relation between these two variables is very important for overall competitiveness of an economy one can not overlook its structural characteristics behind. Modern economies are characterized by complex interrelations between industries that need to be taken into account in analyzing the changes in competitiveness of the economy. We have to go beyond the aggregated models on the one hand side and the separate analysis of each industry on the other side. Each industry should be considered as a part of a complex set of interdependencies. In this context, input-output analysis allows us to take into account all these interdependencies among industries. European Commission (2005, p. 33) highlighted the importance of this approach as well: "Input-output analysis shows that the competitiveness of the EU economy is not the result of merely aggregating individual industries' performance but the result of a complex network of relationships between them."

Belegri et al. (2011, p. 329) try to address the following research question: „What change in the level of labor productivity by sector would have been required to deliver the actual change in final demands in Greece between 1995 and 2005, if working hours in each sector had been

reduced to their EU average?“ They decomposed the annual percentage change of the productivity of labor into the contribution of:

- a change in the final demand
- a change in the employment level (working hours)
- a combined effect of 1) and 2) (a decomposition with interaction term – simultaneous change)

An important conclusion of the article is that the labor productivity would have to increase considerably. The unweighted average change over sectors and years amounts to about 40 %. Moreover, the required adjustment of the Greek economy appeared to get more difficult every year, since it grew on average by 1,56 %, annually. In a decomposition analysis they find that both growing final demand and required reductions in working hours play an important role in the size of the required changes, but the later effect clearly dominates.

The rest of the paper is organized as follows. First, we explain the methodology used. Then, we report data and data sources used for computations. The Section 3 then presents the results and we summarize the study in concluding section.

2 Methodology

Let z_j represent the number of working hours per year in sector *j* and l_j the number of workers in sector *j*. Then, the number of hours worked per worker t_j is given by

$$t_j = \frac{z_j}{l_j} \tag{1}$$

Average hourly wage in particular sector h_j is given by

$$h_j = \frac{w_j}{z_j}, \tag{2}$$

where w_j equals the amount of wages paid in sector *j*. Define the labor requirements n_j in sector j as the share of hours worked per one unit of production x_j

$$n_j = \frac{z_j}{x_j} \tag{3}$$

It follows directly from the equation (3) that the hourly productivity π_j in sector *j* equals to

$$\pi_j = \frac{1}{n_j} \tag{4}$$

Wage intensity a_j^w in sector *j* is defined as the share of wages paid in sector *j* on total production of sector *j*, that is

$$a_j^w = \frac{w_j}{x_j} \tag{5}$$

We can express the wage intensity in sector *j* as a product of two factors. It is determined by the average hourly wage in this sector h_j and by the labor requirements per unit of production n_j. This decomposition follows from equations (2) and (3), so

$$a_j^w = h_j n_j = \frac{w_j}{z_j} \times \frac{z_j}{x_j} = \frac{w_j}{x_j} \tag{6}$$

From equation (4) it is obvious that we can rewrite the wage share as a ratio of average hourly wage and hourly labor productivity

$$a_j^w = \frac{h_j}{\pi_j} \tag{7}$$

Wage intensities (shares) in particular sectors of the economy show the amount of wages that are directly required in sector *j* to produce one unit of production of sector *j*. Wages are a part of production costs and therefore increased share of wages per one unit of production creates a push effect on prices of the production in particular sector. But part of the production of sector *j* is used as an input to production of other sectors and therefore its increased price impacts the cost of production in other sectors as well. To take into account these interdependent relationships between industries we will compute a Leontief inverse matrix R which is the key part of the ***Price Input-Output model*** (for a detailed explanation of the price model see e.g. Miller-Blair, 2009). Leontief inverse matrix is defined as follows

$$R = (I - A)^{-1} \tag{8}$$

where A is the matrix of input coefficients and I is the unit matrix. The elements a_{ij} in matrix A show the direct use of intermediate consumption in sectors per one unit of production. So, a_{ij} represents the value of intermediate consumption of products from sector *i* that is necessary to produce one unit of production in sector *j*. Elements in the Leontief inverse matrix take into account direct and indirect use of products per one unit of production delivered to final demand. Therefore, r_{ij} shows the value of direct and indirect production in sector *i* that is necessary to deliver a one unit of products of sector *j* into final demand. It also shows, how changes in the primary input prices are translated into the overall price changes of final products. Define the changes in the primary input prices as the changes in wage share vector $\mathbf{a}^w$, we can compute the overall ***cost-push effect on prices*** of final products $\mathbf{p}$

$$\Delta\mathbf{p} = \Delta\mathbf{a}^w (I - A)^{-1} \tag{9}$$

where $\Delta\mathbf{a}^w$ is a vector of changes in wage shares and $\Delta\mathbf{p}$ is a vector of cost-push effects on prices. From equation (7) it is clear that the change in wage share $\Delta\mathbf{a}^w$ is given by the change in hourly wage and labor productivity. If the change in hourly wage in sector *j* is higher than the increase in labor productivity in this sector, the wage share will increase and create an initial impulse for the price changes in the economy that are translated through Leontief inverse matrix into the overall cost-push effect on prices of final products. The overall cost-

push effect on prices is given by this initial change and by the interdependent relations between sectors in the economy. The same change in the wage share in different sectors has therefore different overall cost-push effect that depends on the structural characteristics of the economy and the position of the sector on production process. If the production of the sector *j* is an important input for most of the industries then the initial change in wage share in this sector will have very strong impact on prices of final products and therefore on competitiveness, and vice versa.

2.1 Database

The analysis was supposed to be based on World Input-Output Tables in previous years' prices[1]. But this dataset is still not available and it is still under revision. So the analysis will be based on national input-output tables for countries for which these data are available .

3 Empirical analysis

Work in progress.

4 Conclusions

Work in progress.

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