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Wages and employment by skill level in Southern and Eastern Europe during the crisis

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Abstract

Occupations and sectors are the two fundamental dimensions of structural change. From the evolution of the high/low-skill employment levels and wage ratio, we can understand which sectors have been undertaking a process of technical change. By using Eu-Silc database we investigate four "Southern Europe" countries (Italy, Spain, Greece, Portugal), three "Eastern Europe" countries (Poland, Hungary, Bulgaria), UK and Austria. Our analysis shows that the crisis seems to have radically changed the behavior of economies and sectors. It emerges that Poland behaves in a similar way to Austria (with a growing role of technology and Skill Biased Technical Change), while in Hungary the economic system seems to be restructuring as Iberian countries.

Keywords: Technical change, Labour, Skill premium, Country studies
JEL classification: O33, O47, P51

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1. Introduction

Occupations and sectors are the two fundamental dimensions of structural change. From the evolution of the high-skill and low-skill employment levels, and their wage ratio, in the various economic sectors, we can understand which of them have been undertaking a process of technical change. This paper focuses on the financial crisis and the Great Recession, which has apparently made many middle-skill workers slip into unemployed, while high-skill employment has kept increasing, even to larger extent than in the decade preceding the crisis. The consequent rise in polarization for both wage and employment by skill level mainly stemmed from the loss of jobs in manufacturing and the rise in employment in high-tech services (European Commission, 2016). By comparing the negative impact of the recession on the labour market across the European Union countries, it also emerges that both macroeconomic and microeconomic policies have worked poorly in counteracting the GDP loss (Brada and Signorelli, 2012).

We conduct statistical estimates concerning wages and employment by skill level in some European economies to infer the strategies followed by firms during the crisis. On the basis of a theoretical framework and by relying on the latest data from Eu-Silc database for the elaboration of the skill premium and the high-skill/low-skill ratio for sectors of manufacturing and services, we define four strategies about types of investment and responses to international competition, also considering whether labour market institutions constraint technical choices by firms. We investigate four "Southern Europe" countries (Italy, Spain, Greece and Portugal), three "Eastern Europe" countries (Poland, Hungary and Bulgaria) and two other European Union countries (United Kingdom, Austria).

Our analysis shows that the crisis seems to have radically changed the behavior of economies and sectors, amplifying the role of Skill Biased Technical Change. But economies, and sectors, do not all behave the same way. With regard to Eastern economies, it emerges that Poland behaves in a similar way to Austria (with a growing role of technology and Skill Biased Technical Change), while in Hungary the economic system seems to be restructuring as Iberian countries (firms struggle to raise labour productivity by firing part of the low-skill workers).

The paper is organized as follows: Section 2 reviews the literature on technical change and sketches the theoretical background. In Section 3, by relying on a CES production function with high-skill and low-skill workers, we define and compute the values of a "technology ratio" for manufacturing and services in our set of European countries. On the basis of the results for the skill premium and the high-skill/low-skill ratio, Section 4 introduces our hypotheses about the strategies followed by firms during the crisis. Section 5 documents the patterns of sectors and the values of wages and employment drawn from the Eu-Silc database and presents the results. Section 6 remarks the main changes of behavior of economies and sectors, with special regard to Eastern economies.

2. Theoretical background

The standard CES production function:

$$Y = A\left[\gamma K^{\frac{\sigma-1}{\sigma}} + (1-\gamma)L^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

is defined over the capital (K) and the labour (L) factors and designates with A the parameter for technical progress, with γ the coefficient determining the relative weight between the two factors and with $\sigma \in (0, \infty)$ the elasticity of substitution.

This production function portrays Hicks-neutrality. The two factors can be: a) perfect substitutes when $\sigma = \infty$, or b) complements when $\sigma = 0$ (with $\sigma = 1$, the CES function rolls back to a Cobb-Douglas).

Since the 1960s, many authors have endavoured in estimating the elasticity of substitution with no clear results, which also depend upon the assumptions made about the characteristics of technical change, whether it is Hicks-neutral (e.g. Arrow et al., 1961; Berndt, 1976) or factor augmenting (e.g. David and van de Klundert, 1965), the choice of the years and the countries covered by the studies, as well as the methodology employed for the estimates. However, the empirical evidence investigating on σ between K and L being higher or lower than 1 has been so far inconclusive. More recent research work conducted on data for advanced countries has found $\sigma > 1$ (Guscina, 2006; Karabarbounis and Neiman, 2013); the opposite results ($\sigma < 1$) was found in an estimate dealing with the United States (Lawrence, 2015).

Starting from the 1980s, the rising financial effort put in R&D, and an increasingly educated human capital, have been boosting total factor productivity (TFP). Technical change was more rapidly introduced in the productive

system of advanced countries (Griliches, 2001). In the United States, after a soaring labour demand for the very educated labour force in the United States, largely exceeding a growing supply of university graduates, the definition of SBTC (skill-biased technical change) was introduced to indicate the broader adoption of high-skill-augmenting techniques (Acemoglu, 2002). Innovation embodied in new machineries produced by ICT sectors, and the more recent introduction of robotics and automatization in manufacturing, have led to the substitution of middle-skill clerks with computers and information technologies in routine and non-routine tasks (Acemoglu and Autor, 2011; Haskel et al., 2012; Autor et al., 2017). The wage and employments levels of low-skill workers decrease too, but their fall loses speed as an effect of a soaring demand for low skill services (child care, restaurants, etc.) (Arpaia et al., 2009; Bassanini and Manfredi, 2012; Michaels et al., 2014).

In European countries, these evolutionary paths concerning occupations and sectors have been accelerated by the financial crisis and the following Great Recession. We study the technical choices which firms of manufacturing and service sectors put forward in Europe. To this aim, we make reference to a more recent version of the CES production function, which distinguishes between high-skill (H) and low-skill (L) workers (Acemoglu and Autor, 2011).

$$Y = \left[(A_L L)^{\frac{\sigma-1}{\sigma}} + (A_H H)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{1}$$

where A_L and A_H are two separate technology terms and the value of σ, the elasticity of substitution between H and L, discriminates between A_L, where technical change is L-augmenting, and A_H, where technical change is H-augmenting.

Given competitive labor markets, the skill premium derived form equation 1 is:

$$\frac{w_H}{w_L} = \left(\frac{A_H}{A_L} \right)^{\frac{\sigma-1}{\sigma}} \left(\frac{H}{L} \right)^{-\frac{1}{\sigma}} \tag{2}$$

The spreading of the above mentioned H-augmenting technical change, which corresponds to high substitutability of high to low skill workers, strengthened the consensus on $\sigma > 1$ as originally reckoned by Autor et al. (2003).

3. Evidence on the evolution of technology in some European countries (2004-2015)

The EU-Silc database has been employed to compute the skill premium (SP=$\frac{w_H}{w_L}$) and high skill ratio (HR=$\frac{H}{L}$) ratios for nine countries and assess the evolution of the technology ratio ($\frac{A_H}{A_L}$) under the assumption of $\sigma > 1$. Actually, elasticity of $\sigma \simeq 1.4$ is consistent with a large body of empirical literature based on a wide array of datasets (time series as well as cross sections) and methods (Hamermesh, 1993; Hornstein et al. 2005).

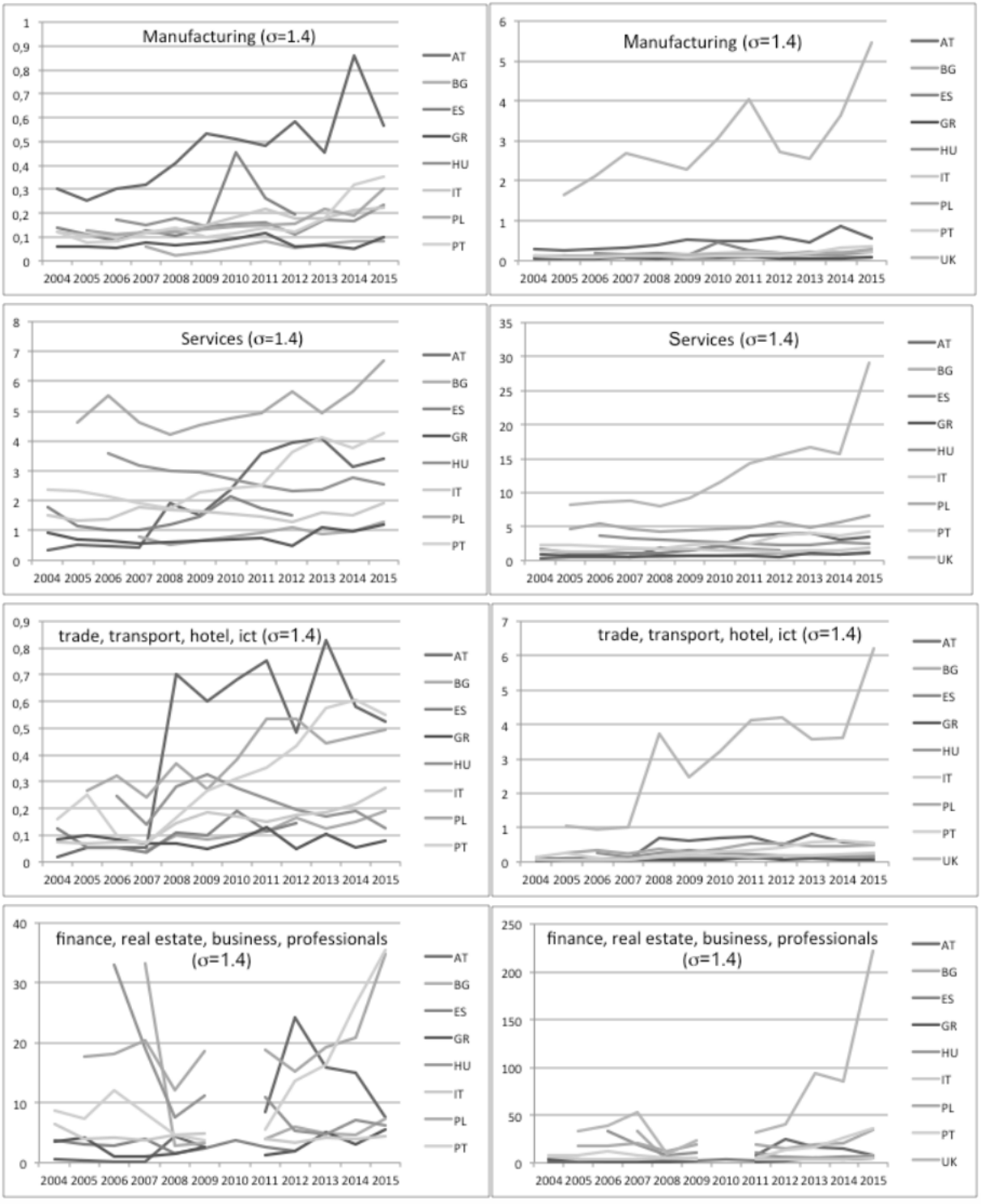
The following manupulation of the CES function has been used to calculate the technology ratio ($\frac{A_H}{A_L}$) for Manufacturing (M), Services (S) as a whole, and two subsets of services("trade, transport, hotel, ICT" and "finance, real estate, business, professionals"), given $\sigma = 1.4$:

$$ln\left(\frac{A_H}{A_L} \right) = \frac{1}{\frac{\sigma-1}{\sigma}} ln(SP) + \frac{1}{\sigma} ln(HR) \tag{3}$$

Figure 1 shows that the technology ratio ($\frac{A_H}{A_L}$) is impressively higher for the UK, so much as to need a set of separate diagrams with a much wider scale (right-hand side column of Figure 1). Across time, the trend is always upward sloping althogh to a lesser extent for Manufacturing and low skills Services.

A more complex picture emerges for the remaining countries on the left-hand side of Figure 1, where some countries (e.g. Greece, Bulgaria) always show a rather flat trend, while other countries (e.g. Hungary, seems to have a rising trend for Manufacturing while declining for Services, or Portugal where the trend is rising in both Manufacturing and Services but only in most recent years). Moreover, while the scales of Manufacturing and low-skill services have a comparable size, those of Services and especially high-skill services show much wider variations.

Figure 1: The evolution of technology



4. Four Technical Strategies

The behavior of the technology ratio ($\frac{A_H}{A_L}$) across countries and time suggests that the reaction by firms to the crisis has followed different paths depending on the need to face competition by technical change (also taking into account labour market institutions) or by making recourse to restructuring or downsizing of productive processes. Two hypotheses have been devised to set up the corresponding strategies .

Hypothesis 1. Technical change is in place. Under the hypothesis $\sigma > 1$, the H e L workers are gross substitutes, but in case of excess demand of high-skill workers there is a rise in the skill premium ($\frac{w_H}{w_L}$), while in case of excess demand of the low-skill workers there is a fall in the skill premium ($\frac{w_H}{w_L}$). Two equilibria can be identified so to define a first set of two strategies:

i The skill-biased technical change (SBTC), where capital is complementary to H workers, presents an excessive relative demand for high-skill workers, so that H workers substitute to L workers. Labour market institutions do not constrain the choice of the techniques by the firms. Since the SBTC strategy corresponds to a raise in $\frac{A_H}{A_L}$, under the elasticity of substitution $\sigma > 1$ there is an excess relative demand for high-skill workers, such that the wage premium increases. Therefore, $\frac{A_H}{A_L}$ goes up, the SP increases, and so does the HR, because it is profitable to augment the number of high-skill workers and pay them more.

ii The Complementary Technology (CT) is the definition introduced by Acemoglu (2003) to capture the tendency by European firms to take into account labour market regulation in setting up their productive techniques. First, suppose that a new technology doubles workers' productivity, that wage is one-half of the worker's productivity, and that there is institutional wage compression due to a minimum wage (by law, or effectively defended by unions). Given the minimum wage constraint, by adopting the technology the firm becomes the residual claimant of the increase in productivity. In fact, the new technology will be introduced if the rent accruing to the firm (the difference between the doubled productivity and the minimum wage that the firm has to pay to the low-skill workers) is higher than the cost of its introduction. Second, suppose that another labour market institution, the employment protection legislation (EPL), causes employers an high cost to fire workers, especially in the case of the more protected low-skill workers. Hence, the high-skill/low-skill ratio is likely to be lower than in the absence of EPL. Given this constraints, the second strategy then consists in the introduction of technical change biased to the low-skill workers even under $\sigma > 1$, which entails a decrease both in SP and HR.

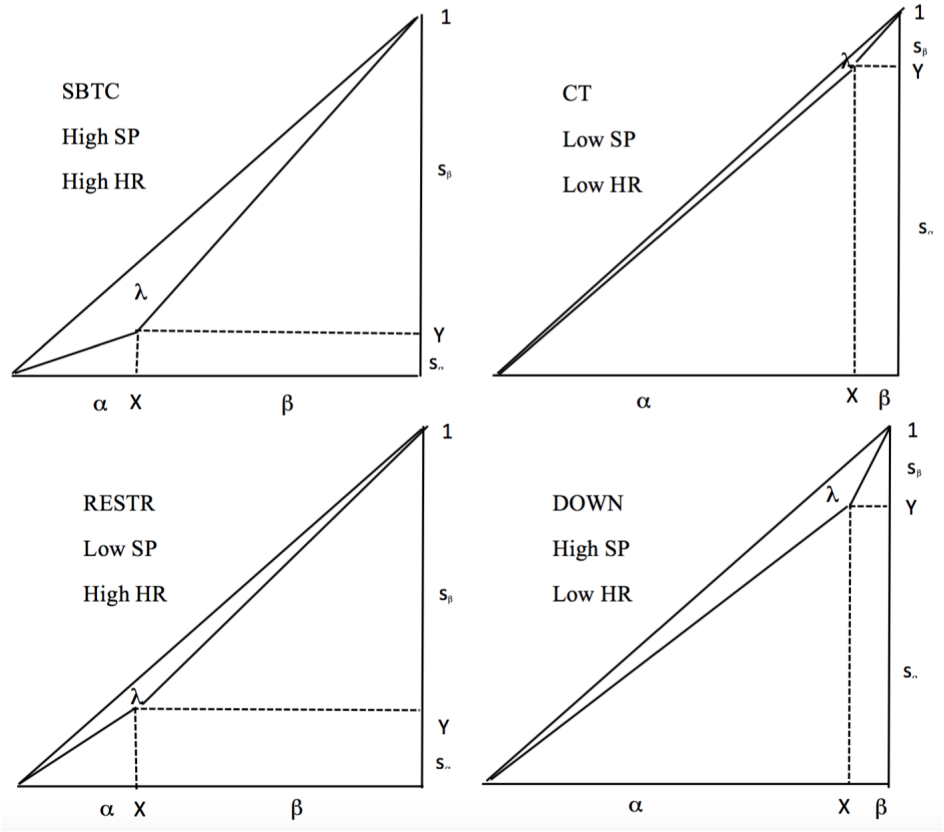
Hypothesis 2: It is plausible to assume that during the recent crisis most firms belonging to traditional sectors abstained from introducing innovations. We stick to the assumption that in the period 2007-15 technical choices in these sectors are flat. Hence, the skill premium directly depends on supply and demand of H and L workers in the labour market (Autor et al., 2003). In advanced countries, in reacting to harsh price competition by emerging economies, these firms must accept the constraint that labour market institutions exert on the wage and employment levels of low-skill workers. They make recourse to the following two strategies:

iii Restructuring (RESTR), which was the preferred strategy in countries with weak institutions (predominantly flexible labour market). Firms struggle to raise labour productivity by firing part of the low-skill workers: HR increasing and SP decreasing.

iv Downsizing (DOWNsize), which was the preferred strategy in countries with strong institutions (predominantly rigid labour market): since employers find very costly to fire workers, but they are not disposed to keep in production the redundant labour force, especially low-skill workers, they make recourse to the outsourcing of stages of production, which leads to a shrinking of the firm size HR decreasing and SP increasing.

Each strategy, reflecting the production decisions by firms, is sketched in Figure 2. The four diagrams portray couples of high and low values for SP and HR. In each diagram the ratio between the area λ limited by the diagonal and the whole triangle area can be though of as a wage inequality index. Unlike the Gini index, where percentiles are equally numerous, the employed workers by low skill and high skill level respectively on the X axis have been partitioned into two groups denoted by α and β where $\alpha + \beta = 1$; while on the Y axis s_α and s_β ($s_\alpha + s_\beta = 1$), indicate their respective wage shares.

Figure 2: Wage Shares by Skill Levels



The four diagrams in Figure 2 show how the combination of SP and HR (high and low) levels would result in wage inequality evaluated by "Wage Shares by Skill Levels" (WSSL).

Although a general assessment is difficult to outline because the SP and HR ratios may vary to a great extent, and so the ranking of the four strategies from the most to the least unequal cannot be theoretically predicted, one may get a glimpse of the differences in wage inequality by looking to the four combinations of a high or low values for each indicator. The highest values for WSSL are found with SBTC and Downsizing depending upon the relative number of low skill to high skill workers and to how high is the skill premium. The Complementary technology strategy, where both SP and HR are low, seems to succeed in keeping the low-skill busy and the wage inequality limited. Finally, Restructuring may or may not be the least unequal strategy (vis-à-vis the Complementary technology) depending upon how low is the SP and how high is the HR. Wage inequality and so the WSSL, of course, cannot take into account the circumstances of those who, having become unemployed, have no wages at all. It might be worth recalling that, although wages usually represent the lion's share of personal income, wage inequality more strictly relates to the labour market rules, while income inequality usually looks at disposable equivalent income and refers to the whole population.

5. Data and results

Our analysis is based on EuSilc dataset and covers the years 2004-2015, distinguishing between two sub periods: before (2005-7) and after (2007-15) the crisis. It encompasses 9 countries (Austria, Bulgaria, Greece, Hungary, Italy, Poland, Portugal, Spain and the UK) and analyses 7 sectors: Agriculture, Construction, Manufacturing (including electricity, gas and water supply; mining and quarrying), and Services (also subdivided into "trade, transport, hotel,

ICT", "finance, real estate, business, professionals", "public administration", "other services"). Basically, all the available years and all the available data on a country's production pattern were employed, while the countries to be analysed were selected on the basis of the information about the monthly incomes.

The definition of skilled or unskilled workers is derived by the ISCO-08 classification, following OECD(2015): High-skill occupations (ISCO-08 codes: 1 Managers, 2 Professionals, 3 Technicians and associate professionals; Low-skill (ISCO-08 codes: 4-9)[1].

We measure skill premia, and WSSL, by using the Gross Monthly Earnings[2]. The gross amount is the value before tax and social insurance contributions are deducted. It refers to the monthly amount in the main job for employees. It includes usual paid overtime, tips and commission but excludes income from investments-assets, savings, stocks and shares. We trashed the cases with negative or null monthly wage and, for each country and each year, we cut off the first and last percentile of the wages distributions. We consider only full-time employees[3].

Table 1, 2 and 3 show the results when all the available years are considered for each country. In the tables, in addition to the SP, HR and WSSL trends, there are also the changes in the weights of the various sectors (sector employees/ total employees).

A preliminary indication of the data is that it is indispensable to think in sectoral terms:analyzing the dynamics of SP and HR for the whole economy of a country can be misleading since each sector follows a specific pattern.

Uk and Austria seem to be basically oriented to SBTC with a growing WSSL. The result is compatible with what is shown in Figure 1, where "core" nations have a higher $\frac{A_H}{A_L}$ ratio.

Iberian countries are restructuring their economic systems and WSSL diminishes. Italy is slightly oriented to SBTC in manufacturing and to Downsize in services (where a preeminent role is played by trade, transport, tourism, ICT, etc.). Greece seems to go toward SBTC, but the results are not unique: the main sectors (trade, transport,tourism,ict) are CT or RESTR oriented and this can imply that among those sectors, tourism is the one growing fast (one can guess that ICT should be more related to SBTC). Actually, in Figure 1 Greece exhibits a very low technology ratio ($\frac{A_H}{A_L}$), for all the economy and for the first group of services (trade, transport, tourism, ICT). In our theoretical framework, a low ($\frac{A_H}{A_L}$) is a requirement to identify a CT strategy, and this seems to apply to these sectors in Greece. Both Italy and Greece exhibit a growing WSSL.

A huge difference emerges between Poland and Hungary: the former behaves similarly to UK and Austria with a SBTC trend, even if the weight of manufacturing is quite a lot higher, while the latter shows a RESTR-trend in manufacturing and a CT strategy in services. Again, this difference between Poland and Hungary are consistent with the results of figure 1, where the former presents an higher technology ratio ($\frac{A_H}{A_L}$) in the whole economy and, in particular, in services. In Poland the WSSL grows while it decreases in Hungary. Bulgaria seems strongly oriented towards SBTC. But the data about Bulgaria only concern the period after the 2007 crisis/Great Recession. Could the crisis have led to a change in strategies? In particular, the crisis/shock could have accelerated the transition to SBTC. If this is the case, analyzing the long run could be misleading.

Actually, figure 1 shows a growing pattern of the technology ratio after the 2007. This trend, which is a requirement for SBTC strategies, is particularly clear for Austria, Uk, Poland and, to a lower extent, for Italy and Portugal. The comparison between the two periods can not neglect the effect of the crisis on the levels of employment, which are spotted as reminder in figure 3. Table 2, 3 and 4 show the results if two periods are considered: before and after 2007.

Table 2 confirms that UK and Austria are following a SBTC strategy (with growing WSSL) after the crisis, but the pattern of Austria seems to have changed around 2007. Before this year, Austria was more oriented towards Restructuring. This results is consistent with the rearing of the technology ratio in Austria after 2007 (Figure1).

[1] In Eu-Silc we use the variables pl050 (ISCO-88, 2-digit) and pl051 (ISCO-08, 2-digit). The change from ISCO-88 to ISCO-08 occurred in 2009. The differences between ISCO-88 and ISCO-08 could affect the results, but the eventuality is very low because we actually use the 1-digit classification and, hence, the differences between the two codifications are minimal. http://www.ilo.org/public/english/bureau/stat/isco/isco08/index.htm

[2] The variable in Eu-Silc is py200g. This variable has many missing values (ie, it is not available for Germany), but it is the only variable about "earnings" or "income" that is time coherent with the variable about ISCO classification. In the dataset, the main variable about income refers to the previous year, while ISCO classification refers to the current year.

[3] Summing up, we keep only the cases with valide responses about wages (Eu-Silc: py200g), ISCO classification (pl050/pl051), sector of activity (pl110/pl111), employment (pl040) and temporary or full time (pl030/pl031). When data processing deserved weights, we use the personal cross-sectional weight provided by Eu-Silc (pb040).

Table 1: Longest possible period

(a) UK and Austria

		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
UK 2005 - 2015	**TOTAL ECONOMY**		SBTC	up	+1.3%	+3.3%
	AGRICULTURE	1% → 1%	SBTC	up	+0.1%	+5.6%
	CONSTRUCTION	7% → 7%	SBTC	up	+0.7%	+3.9%
	MANUFACTURING*	18% → 15%	SBTC	up	+1.1%	+3.2%
	SERVICES	74% → 77%	SBTC	up	+1.4%	+3.1%
	- trade, transport, hotel, ict	23% → 26%	SBTC	up	+1.8%	+4.7%
	- finance, real estate, business, professionals	18% → 18%	SBTC	up	+3.2%	+3.4%
	- public administration	30% → 30%	SBTC	down	+0.2%	+3.2%
	- other services	4% → 4%	RESTR	up	+0.6%	-0.6%

		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
AT 2004 - 2015	**TOTAL ECONOMY**		SBTC	up	+0.2%	+6.3%
	AGRICULTURE	1% → 1%	CT	down	-2.4%	-5.8%
	CONSTRUCTION	8% → 10%	RESTR	up	-0.3%	+4.4%
	MANUFACTURING*	27% → 24%	SBTC	up	+0.4%	+1.7%
	SERVICES	63% → 65%	SBTC	up	+0.3%	+8.5%
	- trade, transport, hotel, ict	22% → 26%	SBTC	up	+1.1%	+11.2%
	- finance, real estate, business, professionals	11% → 12%	RESTR	down	-0.2%	+6.5%
	- public administration	20% → 23%	SBTC	down	+0.1%	+10.0%
	- other services	10% → 3%	SBTC	up	+0.5%	+9.6%

(b) Southern countries

		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
IT 2004 - 2015	**TOTAL ECONOMY**		SBTC	up	+0.6%	+0.4%
	AGRICULTURE	3% → 2%	DOWNsize	up	+2.4%	-4.1%
	CONSTRUCTION	7% → 7%	DOWNsize	down	+0.5%	-2.9%
	MANUFACTURING*	29% → 26%	SBTC	up	+0.3%	+1.6%
	SERVICES	60% → 65%	DOWNsize	up	+0.9%	-0.3%
	- trade, transport, hotel, ict	18% → 23%	SBTC	up	+1.1%	+3.4%
	- finance, real estate, business, professionals	8% → 10%	DOWNsize	up	+2.1%	-2.8%
	- public administration	27% → 26%	DOWNsize	up	+0.3%	-0.6%
	- other services	7% → 5%	DOWNsize	up	+1.1%	-1.4%

		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
PT 2004 - 2015	**TOTAL ECONOMY**		RESTR	down	-1.5%	+5.5%
	AGRICULTURE	2% → 2%	RESTR/CT	down	-3.8%	+0.0%
	CONSTRUCTION	12% → 6%	RESTR	up	-2.3%	+14.8%
	MANUFACTURING*	26% → 23%	RESTR	up	-1.8%	+6.5%
	SERVICES	60% → 69%	RESTR	down	-1.3%	+4.0%
	- trade, transport, hotel, ict	24% → 28%	RESTR	up	-0.3%	+5.2%
	- finance, real estate, business, professionals	7% → 10%	SBTC	up	+1.9%	+5.1%
	- public administration	25% → 27%	RESTR	down	-2.0%	+3.5%
	- other services	4% → 4%	RESTR	up	-2.4%	+9.5%

		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
GR 2004 - 2015	**TOTAL ECONOMY**		SBTC/RESTR	up	+0.06%	+1.9%
	AGRICULTURE	1% → 2%	CT	down	-2.4%	-2.7%
	CONSTRUCTION	8% → 3%	RESTR	up	-0.5%	+27.5%
	MANUFACTURING*	17% → 14%	SBTC	up	+0.6%	+1.1%
	SERVICES	73% → 81%	SBTC	up	+0.2%	+0.6%
	- trade, transport, hotel, ict	29% → 35%	CT/RESTR	down	-0.2%	-0.01%
	- finance, real estate, business, professionals	9% → 10%	DOWNsize	up	+0.9%	-0.2%
	- public administration	30% → 32%	SBTC	up	+0.3%	+2.0%
	- other services	5% → 4%	SBTC	up	+0.7%	+3.8%

		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
ES 2004 - 2012	**TOTAL ECONOMY**		RESTR	down	-0.7%	+2.8%
	AGRICULTURE	3% → 3%	DOWNsize	down	+0.8%	-7.7%
	CONSTRUCTION	6% → 6%	RESTR	up	-0.6%	+14.4%
	MANUFACTURING*	24% → 19%	RESTR	down	-0.8%	+2.9%
	SERVICES	61% → 72%	RESTR	down	-1.0%	+0.5%
	- trade, transport, hotel, ict	23% → 27%	RESTR	down	-1.5%	+2.8%
	- finance, real estate, business, professionals	10% → 11%	DOWNsize	up	+1.0%	-3.2%
	- public administration	24% → 27%	RESTR	down	-2.0%	+1.8%
	- other services	4% → 6%	RESTR	down	-0.7%	+0.8%

(c) Eastern european countries

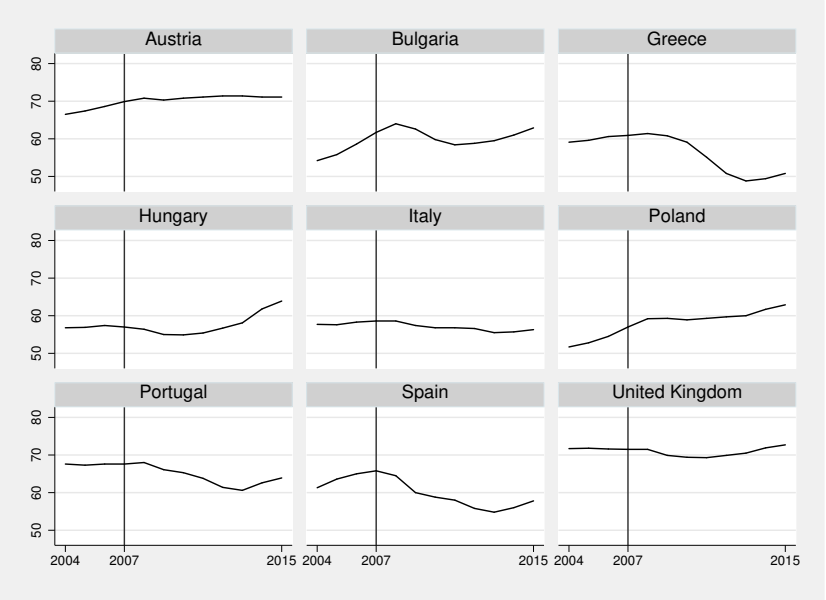
		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
PL 2005 - 2015	**TOTAL ECONOMY**		SBTC	up	+0.5%	+0.8%
	AGRICULTURE	2% → 3%	SBTC	up	+1.4%	+1.5%
	CONSTRUCTION	8% → 8%	DOWNsize	up	+1.0%	-3.3%
	MANUFACTURING*	29% → 29%	SBTC	up	+0.7%	+2.5%
	SERVICES	61% → 60%	SBTC	up	+0.5%	+0.8%
	- trade, transport, hotel, ict	23% → 24%	SBTC	up	+1.0%	+1.1%
	- finance, real estate, business, professionals	8% → 9%	SBTC	up	+1.6%	+1.5%
	- public administration	26% → 25%	SBTC	up	+0.2%	+0.8%
	- other services	4% → 2%	RESTR	down	-0.6%	+2.9%

		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
HU 2006 - 2015	**TOTAL ECONOMY**		CT	down	-0.6%	-0.1%
	AGRICULTURE	3% → 4%	CT	down	-1.5%	-9.0%
	CONSTRUCTION	7% → 7%	DOWNsize	up	+0.3%	-0.1%
	MANUFACTURING*	28% → 26%	RESTR	up	-0.2%	+1.7%
	SERVICES	61% → 63%	CT	down	-0.6%	-0.6%
	- trade, transport, hotel, ict	26% → 22%	CT	down	-1.4%	-1.0%
	- finance, real estate, business, professionals	8% → 9%	CT	up	-0.5%	-6.1%
	- public administration	24% → 29%	DOWNsize	up	+1.1%	-2.0%
	- other services	4% → 3%	SBTC	up	+0.1%	+1.9%

		Weight	Strategy	WSSL	Skill Premium (annual average growth rate)	High Skilled Ratio (annual average growth rate)
BG 2008 - 2015	**TOTAL ECONOMY**		SBTC	up	+1.8%	+5.3%
	AGRICULTURE	5% → 4%	RESTR	up	-1.0%	+7.4%
	CONSTRUCTION	14% → 8%	SBTC	up	+1.8%	+3.3%
	MANUFACTURING*	29% → 27%	SBTC	up	+2.8%	+3.4%
	SERVICES	53% → 60%	SBTC	up	+1.0%	+4.0%
	- trade, transport, hotel, ict	27% → 30%	RESTR	up	-0.5%	+4.6%
	- finance, real estate, business, professionals	6% → 8%	SBTC	up	+3.2%	+3.9%
	- public administration	18% → 20%	SBTC	up	+1.2%	+4.9%
	- other services	2% → 3%	RESTR	down	-0.3%	+1.0%

*: Manufacturing; Electricity, gas and water supply; Mining and quarrying. Source: own calculation on Eu-silc Database.

Figure 3: Employment rate (population 15-64)



Source: Eurostat

Table 3 (south countries): The tendency of Italy towards SBTC in manufacturing and Downsize in services is confirmed after (during) the crisis. But, again, they were RESTR/CT and SBTC before the crisis, respectively. Also the trend of Greece to SBTC starts after 2007.

In Portugal and Spain both manufacturing and services follow a RESTR trend after the crisis, as when a single period was analyzed. But it emerges that before the crisis the strategies of services were more oriented to CT.

Table 4 (eastern countries) highlights that the SBTC trends of manufacturing and services in Poland started after the crisis (as the rise of the technology ratio in figure 1), while before Downsizing was prevailing. This fact confirms that the results for Bulgaria (table 1) could be correlated with the period (after 2008). Hungary changes from Downsize to Restructuring in manufacturing and maintains CT in services.

6. Concluding remarks

The empirical analysis on SP and HR conducted on the basis of the theoretical framework of section 2 has highlighted some interesting points:

- A general analysis over the total economy is misleading, while a sectorial one is needed;
- The crisis seems to have radically changed the behavior of economies and sectors. In general, it seems to amplify the role of SBTC. The sector “Trade, transport, hotels, ict” significantly increases during the crisis.
- But not all the countries react with SBTC; Iberian countries and Hungary have taken the route of Restructuring both manufacturing and services (but CT for services in Hungary).
- During the crisis, the weight of the manufacturing sector diminishes with an SBTC behavior (UK, Austria, Italy, Greece, Poland, Bulgaria) or by Restructuring (Iberian countries and Hungary).
- During the crisis, only Italy and Hungary shows a negative dynamic of HR in the Public Administration sector (mainly health and education), while the other countries (governments...) are "restructuring" or the public sectors (or following SBTC).

On this basis, it is possible to “group” the countries:

Table 2: Before and after 2007, UK and Austria

(a) UK

	2005-2007					2007-2015				
	Weight	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****	**Weight**	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****
TOTAL ECONOMY		SBTC	up	+0.6%	+1.9%		SBTC	up	+1.5%	+3.7%
AGRICULTURE	1% → 1%	RESTR	down	-17.8%	+12.4%	1% → 1%	SBTC	up	+5.3%	+4.3%
CONSTRUCTION	7% → 8%	SBTC	up	+5.4%	+0.4%	8% → 7%	RESTR	down	-0.4%	+4.8%
MANUFACTURING*	18% → 18%	SBTC	up	+0.5%	+9.5%	18% → 15%	SBTC	up	+1.3%	+1.8%
SERVICES	74% → 74%	SBTC	up	+0.7%	+0.4%	74% → 77%	SBTC	up	+1.6%	+3.8%
- trade, transport, hotel, ict	23% → 22%	DOWNsize	up	+1.9%	-3.5%	22% → 26%	SBTC	up	+1.7%	+6.9%
- finance, real estate, business, professionals	18% → 18%	SBTC	down	+1.9%	+6.0%	18% → 18%	SBTC	up	+3.6%	+2.8%
- public administration	30% → 30%	CT	down	-1.5%	-0.5%	30% → 30%	SBTC	down	+0.6%	+4.2%
- other services	4% → 4%	CT	down	-0.6%	-4.4%	4% → 4%	SBTC	up	+0.9%	+0.4%

(b) Austria

	2005-2007					2007-2015				
	Weight	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****	**Weight**	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****
TOTAL ECONOMY		RESTR	down	-1.3%	+4.6%		SBTC	up	+0.7%	+6.9%
AGRICULTURE	1% → 1%	RESTR	down	+6.2%	-5.8%	1% → 1%	CT	down	-1.8%	-7.8%
CONSTRUCTION	8% → 9%	DOWNsize	down	+1.4%	-6.5%	9% → 10%	RESTR	up	-1.2%	+11.3%
MANUFACTURING*	27% → 31%	RESTR/ SBTC	up	-0.05%	+0.9%	31% → 24%	SBTC	up	+0.6%	+2.1%
SERVICES	63% → 59%	RESTR	down	-1.8%	+6.6%	59% → 65%	SBTC	up	+1.0%	+9.2%
- trade, transport, hotel, ict	22% → 18%	RESTR	up	-3.0%	+20.1%	18% → 26%	SBTC	up	+2.7%	+7.9%
- finance, real estate, business, professionals	11% → 13%	CT	down	-3.7%	-13.2%	13% → 12%	SBTC	up	+1.2%	+14.9%
- public adiministration	20%→20%	RESTR	down	-1.0%	+12.1%	20%→23%	SBTC	down	+0.5%	+9.2%
- other services	10% → 8%	DOWNsize /CT	down	+0.0%	-0.9%	8% → 3%	SBTC/ RESTR	up	+0.06%	+13.9%

*: Manufacturing; Electricity, gas and water supply; Mining and quarrying. **annual average growth rate.
Source: own calculation on Eu-silc Database

- UK: SBTC before and after the crisis, both in manufacturing and services.
- Austria, Italy, Greece, Poland: RESTR, DOWNsize and CT before the crisis, SBTC after the crisis (peculiarity: DOWNsize in Italy for services)[4].
- Spain, Portugal, Hungary: Restructuring after the crisis (both manufacturing and service; peculiarity: CT in Hungary for services).

Among Eastern European countries, it is interesting that Hungary seems similar to Iberian countries, while Poland has some similarities with Austria and sounds like an "advanced" economies.

This paper aims to be purely descriptive about countries' patterns, but it is clear that the four strategies are not neutral in terms of consequences on the long run (how they affect economies competitiveness) and on the short

[4]The results about Poland are coherent with Stojcic et al. (2013). They analyzed the competitiveness of firms in transition economies, and they conclude that the most extensive strategic restructuring (innovation, investment in machinery and equipment) has taken place among Croatian and Polish firms: "we found more evidence of strategic restructuring in Croatia than in some of the other countries, as in Croatia the market share of firms was related to the productivity of investment in addition to labor productivity and unit labor costs. In this respect, the behavior of Croatian firms was closest to the behavior of firms in Poland, which was the only other country in the sample where firms demonstrated a similar pattern of behavior" (p. 102).

run (how they affect aggregate demand)[5]. Although the SBTC strategy is often associated to an increase of the unemployment rate of the low skill workers, by comparing our analysis regarding the strategies with the data about employment (Figure 3) it clearly emerges that the more SBTC-oriented countries (Austria, UK, Poland) perform better in terms of employment rates during the crisis[6].

[5]For an interpretation of the Great Recession which emphasizes sectoral dislocation following technical change and its consequence on the aggregate demand, see Delli Gatti et al. (2012) and Valentini et al. (2017).

[6]Only the data about Portugal don't seem to be in line with our rendition (it presents a growing technology ratio but not an SBTC trend).

Table 3: Before and after 2007, Southern countries

(a) Italy

	2004-2007					2007-2015				
	Weight	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****	**Weight**	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****
TOTAL ECONOMY		SBTC/ RESTR	up	+0.0%	+1.1%		SBTC	up	+0.9%	+0.2%
AGRICULTURE	3% → 2%	RESTR	down	-2.8%	+8.7%	2% → 2%	DOWNsize	up	+4.4%	-8.5%
CONSTRUCTION	7% → 8%	DOWNsize	down	+0.5%	-9.8%	8% → 7%	DOWNsize	up	+0.5%	-0.2%
MANUFACTURING*	29% → 29%	RESTR/CT	down	-0.3%	+0.05%	29% → 26%	SBTC	up	+0.6%	+2.2%
SERVICES	60% → 61%	SBTC	up	+0.5%	+1.5%	61% → 65%	DOWNsize	up	+1.0%	-1.0%
- trade, transport, hotel, ict	18% → 19%	RESTR	down	-0.8%	+1.7%	19% → 23%	SBTC	up	+1.9%	+4.0%
- finance, real estate, business, professionals	8% → 9%	DOWNsize	up	+1.4%	-1.8%	9% → 10%	DOWNsize	up	+2.5%	-3.2%
- public administration	27% → 27%	SBTC	up	+0.3%	+2.8%	27% → 26%	DOWNsize	up	+0.3%	-1.8%
- other services	7% → 7%	SBTC	up	+1.0%	+3.3%	7% → 5%	DOWNsize	up	+1.2%	-3.1%

(b) Greece

	2004-2007					2007-2015				
	Weight	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****	**Weight**	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****
TOTAL ECONOMY		CT	down	-1.0%	-3.7%		SBTC	up	+0.5%	+4.0%
AGRICULTURE	1% → 1%	CT	down	-26.9%	-31.4%	1% → 1%	SBTC	up	+8.1%	+11.2 %
CONSTRUCTION	8% → 9%	SBTC	up	+0.7%	+38.7%	9% → 3%	RESTR	up	-1.0%	+23.5 %
MANUFACTURING*	17% → 16%	RESTR	up	-0.1%	+3.5%	16% → 14%	SBTC	up	+0.8%	+0.1%
SERVICES	61% → 73%	CT	down	-1.0%	-5.2%	73% → 81%	SBTC	up	+0.6%	+2.8%
- trade, transport, hotel, ict	28% → 31%	RESTR	down	-2.2%	+0.4%	31% → 35%	DOWNsize	up	+0.6%	-0.2%
- finance, real estate, business, professionals	9% → 9%	CT/ DOWNsize	down	-0.0%	-2.0%	9% → 10%	SBTC	up	+1.3%	+5.9%
- public administration	30% → 27%	CT	down	-1.4%	-2.8%	27% → 32%	SBTC	up	+1.0%	+3.9%
- other services	5% → 5%	CT/RESTR	down	-0.8%	-0.0%	5% → 4%	SBTC	up	+1.3%	+5.3%

(c) Portugal

	2004-2007					2007-2015				
	Weight	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****	**Weight**	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****
TOTAL ECONOMY		CT	down	-1.2%	-0.3%		RESTR	down	-1.6%	+7.8%
AGRICULTURE	2% → 2%	RESTR	down	+18.7%	+18.7%	2% → 2%	DOWNsize	up	+2.5%	-6.2%
CONSTRUCTION	12% → 12%	SBTC	up	+4.9%	+22.2%	12% → 6%	RESTR	down	-4.9%	+12.1 %
MANUFACTURING*	26% → 26%	RESTR	down	-2.3%	+2.5%	26% → 23%	RESTR	up	-1.6%	+8.1%
SERVICES	60% → 60%	CT	down	-0.7%	-1.8%	60% → 68%	RESTR	down	-1.5%	+6.3%
- trade, transport, hotel, ict	23% → 24%	CT	down	-2.1%	-8.4%	24% → 28%	SBTC	up	+0.3%	+10.5 %
- finance, real estate, business, professionals	7% → 8%	CT/ DOWNsize	down	-0.0%	-0.7%	8% → 10%	SBTC	up	+2.6%	+7.4%
- public administration	25% → 25%	RESTR	down	-0.3%	+0.5%	25% → 27%	RESTR	down	-2.6%	+4.7%
- other services	4% → 4%	RESTR	down	-9.7%	+11.8%	4% → 4%	SBTC	up	+0.5%	+8.7%

(d) Spain

	2004-2007					2007-2012				
	Weight	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****	**Weight**	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****
TOTAL ECONOMY		CT	down	-0.4%	-2.8%		RESTR	down	-1.0%	+6.3%
AGRICULTURE	3% → 3%	RESTR	down	-3.5%	+11.9%	3% → 3%	DOWNsize	down	+3.6%	-18.0%
CONSTRUCTION	12% → 14%	SBTC	up	+1.2%	+19.6%	14% → 6%	RESTR	up¢	-1.7%	+11.4 %
MANUFACTURING*	24% → 20%	RESTR	down	-1.2%	+0.6%	20% → 18%	RESTR	up	-0.6%	+4.4%
SERVICES	61% → 64%	CT	down	-0.7%	-6.1%	64% → 72%	RESTR	down	-1.1%	+4.7%
- trade, transport, hotel, ict	23% → 24%	CT	down	-3.6%	+11.0%	24% → 27%	RESTR	up	-0.2%	+12.0 %
- finance, real estate, business, professionals	10% → 11%	DOWNsize	up	+2.8%	-4.6%	11% → 11%	CT/ DOWNsize	down	-0.0%	-2.4%
- public administration	24% → 23%	CT	down	-1.4%	-3.8%	23% → 27%	RESTR	down	-2.3%	+5.3%
- other services	4% → 6%	RESTR	down	-6.8%	+1.8%	6% → 6%	SBTC	up	+3.1%	+0.2%

Table 4: Before and after 2007, Eastern European countries

(a) Poland

	2005-2007					2007-2015				
	Weight	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****	**Weight**	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****
TOTAL ECONOMY		DOWNsize	up	+0.5%	-4.7%		SBTC	up	+0.4%	+2.3%
AGRICULTURE	2% → 2%	DOWNsize	up	+9.0%	-19.0%	2% → 3%	RESTR	up	-0.5%	+7.4%
CONSTRUCTION	7% → 9%	CT	down	-5.0%	-17.2%	9% → 8%	SBTC	up	+2.6%	+0.6%
MANUFACTURING*	29% → 30%	DOWNsize	up	+1.8%	-4.5%	30% → 29%	SBTC	up	+0.4%	+4.4%
SERVICES	61% → 59%	DOWNsize	up	+1.5%	-2.0%	59% → 60%	SBTC	up	+0.2%	+1.5%
- trade, transport, hotel, ict	23% → 23%	DOWNsize	up	+1.6%	+4.1%	23% → 24%	SBTC	up	+0.8%	+2.4%
- finance, real estate, business, professionals	8% → 8%	SBTC	up	+2.1%	+5.4%	8% → 9%	SBTC	up	+0.7%	+0.6%
- public administration	26% → 24%	SBTC	up	+1.9%	+0.4%	24% → 25%	RESTR	down	-0.2%	+0.9%
- other services	4% → 4%	CT	down	-6.7%	-4.9%	4% → 2%	SBTC	up	+1.0%	+0.4%

(b) Hungary

	2006-2007					2007-2015				
	Weight	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****	**Weight**	**Strategy**	**WSSL**	**Skill Premium ****	**High Skilled Ratio ****
TOTAL ECONOMY		DOWNsize	up	+1.6%	-5.7%		RESTR	down	-0.9%	+0.7%
AGRICULTURE	3% → 4%	DOWNsize	up	+41.0%	-44.0%	4% → 4%	CT	down	-5.8%	-3.2%
CONSTRUCTION	7% → 7%	DOWNsize	up	+30.7%	-22.1%	7% → 7%	RESTR	down	-3.0%	+3.0%
MANUFACTURING*	28% → 27%	DOWNsize	up	+3.3%	-9.6%	27% → 26%	RESTR	up	-0.7%	+3.1%
SERVICES	61% → 62%	CT	down	-1.0%	-3.4%	62% → 63%	CT	down	-0.6%	-0.2%
- trade, transport, hotel, ict	26% → 26%	CT	down	-5.6%	-13.3%	26% → 23%	RESTR	down	-0.8%	+0.6%
- finance, real estate, business, professionals	8% → 8%	CT	down	-4.5%	-10.5%	8% → 9%	DOWNsize	up	+0.3%	-5.5%
- public administration	24% → 25%	CT	down	-2.0%	-0.9%	25% → 29%	DOWNsize	up	+1.5%	-2.1%
- other services	4% → 3%	SBTC	up	+39.7%	+5.4%	3% → 3%	RESTR	down	-3.9%	+1.5%

*: Manufacturing; Electricity, gas and water supply; Mining and quarrying. **annual average growth rate.
Source: own calculation on Eu-silc Database

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