The future is no longer what it was. The Divorce between GDP and Employment (preliminary version, please do not quote or circulate)

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Abstract

This paper is aimed at studying the long run relationship between GDP per capita growth and the job "required" by such a growth. That relationship, which has been positive for a long period after World War II, leading to a more equal and wealthy society via the labour market, turned out to be non-positive since the middle of the 1980s, thus giving rise to the so-called "Jobless Growth" and "Jobless Recovery" phenomena. By analysing data from OECD and KLEMS databases over the period 1970-2015, we found that the changing relationship between GDP and employment can be explained by the "Great Decoupling" hypothesis, suggesting that, in the last decades, increases in labour productivity were not coupled with increases in median income. Our findings further suggest that different economic sectors specifically contributed to the productivity change in accordance with their technological and knowledge intensity.

Keywords: Extended Crises, Structural Change, Productivity, Jobless Growth

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1. Introduction

One of the most accepted ideas in economics is that economic growth is fundamental to reduce unemployment. Also productivity growth is a major force in increasing the overall performance of an economy, its effect on (un)employment in recent years has become controversial. In the 1990s, while a large part of Europe (except for Italy) was facing a strong increase in productivity (see Ban van Ark et al., 2008), employment rate (at country level) did not increase as much (despite high GDP growth rates). By investigating the Indian labour market, Bhalotra (2002) found that structural transformation has produced a long and stable output growth that was not linked with a stable growth in manufacturing employment. In particular: "several industries had negative growth in employment [...], in manufacturing as a whole, employment growth was insignificantly different from zero" (p.16).

Focusing on the US, Khemraj et al. (2006) stressed that the recession in 1991, and even more so, in 2001 presented, on average, a much slower labour market recovery with respect to the business cycle than previous post war crises. Moreover, "there appears to be a structural change in the relationship linking growth to unemployment reduction" (Semmler and Zhang, 2005, p.5). This correlation is generally known as the Okun's relation: "in postwar period, on the average, each extra percentage point in the unemployment rate above four percent has been associated with about a three percent decrement in real GNP" (Okun, 1962 p. 135). The 2007 Great Recession has challenged our confidence in the empirical regularity, negatively linking GDP growth and unemployment. Meyer and Tasci (2012) pointed out that while "US real GDP growth contracted by 0.5 percentage points" (p. 1) in 2009, the unemployment rate grew by 3.0 percentage points. Similarly, in 2011, US unemployment dropped by 0.8 percentage points while US real GDP grew 1.6 percent.

Our contribution is aimed at studying the relationship between GDP (per capita) growth and the job "required" by that growth, at the times of the fourth industrial revolution[1], structural change and global integration. While the link between GDP growth and (un)employment rate variation can mainly rely on cyclical mechanisms, we look at the relationship between employment rate and GDP per head in a long run perspective. In this work, long run is intended as a period long enough to observe changes in the allocation of capital goods within the production process as well as in the underlying technology able to trigger a structural change in the economy[2]. From a Schumpeterian perspective this contributes to the literature on economic development since technological innovation is intended as a disrapting variation in economic structures that is not reversible

Since the 1980s, world leading economies have been facing flattening population dynamic, population aging and labour substitution (as well as reallocation) to capital. While GDP per head presented a positive slope in the long run (with some notable exceptions in Japan and Italy), the increased output did not affect social and economic conditions of the population. Brynjolfsson and McAfee (2014) stress the never before seen "decoupling" between wage and productivity growth. Labour productivity and GDP per head has continued to soar since second WWII, but, in the last decades, workers have not obtained advantages from this process (in the US, the median hourly wage grew in the period 1973-2011, by 0.1 percent while the productivity increased by 1.56 per year).

Piketty (2014) underlines that, in the post-WWII period, the main channel through which large increase in output (GDP) led to a more equal society, was the labour market. High employment rates (and sustained employment growth) pushed salaries growth thus making wealth (namely the ratio between wealth and income) less important. On the contrary, what we are observing throughout main world economies since the 1980s are the increasing estimates of the ratio between wealth and income (Piketty and Zucman, 2014).

The main engine of improved economic conditions of the population in post WWII, or, in other words, the marriage between GDP per head growth and high employment, have remained stagnant since the 1980s. The "Great Decoupling" between wage growth and productivity growth could be the result of the loss of the positive relation between GDP growth and employment growth. The way this relation has changed since the 1980s has given rise to the so called "Jobless Growth" and "Jobless Recovery" hypothesis. The two approaches differentiate in terms of timing and causes. While Jobless Growth is a long run process, that, as it will be discussed in the paper, could be the effect of labour saving productivity growth. Jobless Recovery is a short time process, mainly related to the business cycle, which could be caused by labour saving productivity growth as well as by labour market frictions that are unrelated to productivity increase. The two approaches are only partially coupled. They can co-exist, assuming that Jobless

[1] Schwab (2017).

[2] Our analysis covers a period of almost half a century, since 1970 to present days.

Recovery could be the catharsis of Jobless Growth, thus the moment in which labour saving productivity growth manifests its negative effects on labour markets, or they can be independent and exists independently. Since our analysis is yearly based, we mainly investigate Jobless Growth dynamics.

Our contribution is twofold. First, this paper contributes to the literature on Jobless Growth: using data from OECD and KLEMS database[3] over the period 1970-2015. We first seek to understand if, when and how the relationship between employment and growth has changed by means of appropriate estimates and how it relates with the productivity growth in 12 countries (namely Chile, China, Denmark, France Germany, Hungary, Japan, Italy, Russia, Spain UK, US)[4]. We also show that increases in labour productivity were not coupled with increases in median income in the last decades and we provide an interpretation of this phenomenon (in line with Brynjolfsson and McAfee - 2014 - Great Decoupling). Second, we disaggregated each economy in different sectors on the basis of their technology and knowledge intensity. From this point of view, the paper contributes to the literature by providing a complete overlook of the dynamics linking Jobless Growth and Great Decoupling, and by investigating, for the first time, the sectoral composition of the relation between economic growth and employment in a cross country setting. Labour saving productivity growth is the major candidate to explain Jobless Growth and the Great Decoupling, as they represent two different manifestations of the same underlying phenomenon. At the same time, we found that labour reallocation affected the analysed countries in different ways with different effects on their overall performances.

The paper is structured as follows: Section 2 provides an overview of how the relation between GDP growth and (un)employment has been investigated in literature. We provide a comprehensive review of the literature on the so-called "Jobless Growth" and "Jobless Recovery" by focusing on how structural changes have affected the relation between economic growth and (un)employment since the 1970s. Section 3 presents an overview of data on employment and GDP from the OECD productivity database. Section 4 analyses the relation between GDP, employment and productivity growth of the 12 nations. Section 5 analyses the Great Decoupling hypothesis. Section 6 disaggregates labour and GDP in their sectoral components to stress how the structural change that occurred in the 1980s, has affected the relation between GDP growth and (un)employment. Section 7 concludes.

2. Employment and economic growth: an unstable relation

Jobless Growth and the Great Decoupling represent two different manifestations of the end of the simultaneous increase of GDP, productivity and economies ability to create a significant number of different-skilled jobs. Both the two approaches look at the issue of economic growth regardless of the economic returns to population (growth without development). In particular, productivity and employment trends began decoupling significantly at the end of the past century, by growing the former and stagnating the latter, leading to lower households income. While this paper is mainly focused on Jobless Growth and Great Decoupling, we cannot let aside Jobless Recovery which can represent a possible outcome of Jobless Growth. Moreover, in literature, Jobless Growth and Jobless Recovery have been often analysed jointly.

Since the 1980s, the new phenomenon of jobless recoveries has puzzled economic scholars. After the WWII, they witnessed a certain degree of regularity in the output fluctuations, characterised by a marked volatility of most real macroeconomic variables (McConnell and Perez-Quiros, 2000). Post-crisis periods produced high-growth recoveries along with a great capacity in job creation. Then all of a sudden, during the 1980s the positive correlation between output and employment changed. With regard to the US, many scholars documented this "structural break" in the first quarter of 1984, which is considered the beginning of the Great Moderation era (Kim and Nelson, 1999; McConnell and Perez-Quiros, 2000; Mendez et al., 2016), a period of sharp decline in aggregate volatility (Faberman, 2008). All the subsequent recessions (in the early 1990s, in the early 2000s and after 2007) were followed by periods characterised by a less pronounced output growth, with a significant lag in employment recover or even with jobless recoveries (Bachmann, 2012; Berger, 2012, Jaimovich and Siu, 2015; Morin, 2013). Mendez et al. (2016) calculated that employment continued to decrease for 21 months after the 2001 recession in the US, causing the loss of nearly

[3]KLEMS: database on measures of economic growth, productivity, employment creation, capital formation and technological change in the industry - Kapital, Labour, Energy, Materials e Services project (KLEMS), O'Mahony and Timmer (2009), Timmer et al. (2010). See `http://www.worldklems.net/` and `http://www.euklems.net/`.

[4]In appendix Brazil and India whom data are limited in time and quality.

1.08 million jobs before growing again. The post-2008 recovery was less sluggish, as employment reached its lowest point in 8 months, but more severe in quantitative terms, having caused the loss of 1.26 million jobs[5].

Employment does not seem to be the only weak link in such a contest. Camacho et al. (2011) remarked a clear change in the business cycle, affecting both GDP and employment. Prior to 1984, recessions were "V-shaped", meaning that they rapidly recovered after troughs, whereas after 1984 they ended up being "L-shaped", thus facing extended weak recovery periods with permanent effects on the output level. While statistically confirming these findings, Gali et al. (2012) suggested that we should consider relabelling recent recoveries as "slow recoveries" instead of jobless recoveries and focus on the structural interpretation for their poor performances. Even though the empirical evidence regarding the last three jobless recoveries is universally accepted, there is no unanimous consensus on their causes. Several explanations have been proposed in order to understand recent post-crisis employment performances, generally falling into four broad categories: a) the structural change; b) the long run effects of the business cycle; c) the cyclicality of productivity; d) the changes occurred in the labour market institutions.

As for the structural change issue, meant as the permanent relocation of workers from some industries to others, Groshen and Potter (2003) suggested that recessions imply cyclical and structural adjustments, whose effects are temporary and permanent in terms of job creation/destruction respectively. Unlike cyclical adjustments, structural changes imply capital and workforce shift from some kind of firms/industries towards new firms/industries. In doing so, workers have to acquire different skills, which is a time-consuming activity, finally leading to temporal mismatch between output recovery and employment recovery. Since the structural component has become increasingly important during recent recessions, jobless recoveries risk becoming a structural factor during post-crisis recovery periods.

Other explanations consider the job polarisation phenomenon, which regards the increasing concentration of employment both in the highest and lowest-paying jobs. Jaimovich and Siu (2015) demonstrated that job polarisation affects jobless recoveries. They noted that the US experienced a contraction in middle-skill and routine occupations, which have been accounting for about 50% on total employment over the last 30 years, and that these job losses were concentrated in economic downturns. They concluded by suggesting that, as jobless recoveries have regarded only the declining routine jobs, which represent the main cause slowing down employment recoveries since the polarisation process had begun. According to Autor and Dorm (2013), the crisis of middle-skill jobs depends on two complementary processes. On the one hand consumers' preferences for customised goods and services; on the other hand the role played by technological innovations, which allows replacing employees with automated work in case for routine job tasks. These hypotheses hold when considering the following evidence: since the 1980s, the polarisation between job and wages in low-educated and low-paying occupations has mainly occurred in the service industries (assisting or caring for others). In fact, in the context of a low-educated jobs, non-neutral technological progress has had a great impact with regard to the production of goods (higher substitutability between human beings and machines), but only a minor effect when involving personal services.

Different explanations can be considered among the long run effects of the business cycle. Engemann and Owyang (2007) found out that the failure in creating new jobs during the 1991 and 2001 recessions can be attributed to a different speed in the transition between business cycle regimes. The rate of transition between recession and expansion has become particularly low in the manufacturing of both durable and non-durable goods since the 1980, meaning that its workforce is increasingly less responsive to its lags. Their results suggest that the decline in cyclicality may have started precisely in the manufacturing sector.

By considering hours per worker as an intensive margin and employment as an extensive margin, Bachmann (2012) attempted to link recessions' duration and business cycle persistence. In particular, he suggests that the different employment dynamics pre and post-1984 depended on the major role assumed by the intensive margin. After the

[5]With respect to the aim of this paper, we suggest that the employment rate, calculated as the ratio between total employment and total population, is a more suitable indicator than the unemployment rate, calculated as the ratio between total unemployment and total labour force. The latter, in fact, does not consider the withdrawal from the labour market. For instance, low-skill workers employed in routine jobs can be easily replaced by automation, hardly succeeding in finding new jobs and finally dropping out the labour force. Hence, those (ex)workers would disappear both from the numerator and the denominator of the unemployment rate. On the contrary, even though ignored by the numerator, it leaves record in the denominator of the employment rate. Furthermore, considering employment instead of unemployment is crucial since it allows us to link in structural terms the amount of (per head) labour needed to produce a given quantity of (per head) GDP. That said, employment rates considerably vary in accordance with different periods and different countries. The average of the OECD countries was equal to 61% in 1969, 55% in 1983 and in 2010. In the same years the difference between US and Japan was respectively -7, -4 and +2 percentage points (OECD data, downloaded at http://stats.oecd.org/Index.aspx?DataSetCode=LFS_D)

end of a short recession, there is no need for hiring new employees as employment is still relatively high. The same happens in the early phase of a recovery, when firms prefer increasing the hours per workers instead of hiring new workforce. With regard to the cyclicality of productivity, some scholars underline the relationship between labour productivity and job recovery. Koenders and Rogerson (2005) affirm that, during recessions, managers focus on removing inefficiencies accumulated during booming periods, ultimately leading to an increase of labour productivity and to a slump in employment. Similarly, Berger (2012) assumes that firms thrive during periods of expansion, employing new workers. During recessions, they layoff unproductive workers, causing an endogenous labour productivity increase which permits them to meet the expanding demand without hiring new workers.

Morin (2013) suggests that, since ICTs are increasingly cheaper, crisis and recessions are used to substitute workers with computers, showing that about 5 million jobs over the 2007-2010 recession and recovery could have been destroyed by this process in the US. Finally, the changes occurred in the labour market institutions considered by Peck and Theodore (2005) who focused on the role of the temporary staffing industry, which is supposed to be increasingly responsible for macroeconomic adjustments in the labour market and for having delayed and slowed down job recovery during the 2001-2004 recession.

Finally, Schreft and Singh (2003) stressed the effects caused by the increasing use of just-in-time employment practices in modern economies. They suggested that post-1991 and post-2001 recoveries were the first to be characterised by a significant replacing of non-temporary and full-time jobs with part-time and temporary jobs, and by the increase in overtime hours and the contemporary reduction of regular time hours. Just-in-time employment practices are particularly attractive for firms in the early stage of recovery as they are not obliged to permanently hire new workforce before a durable recovery, and, at the same time, they can expand their output without affecting their cost on a permanent basis. In their opinion, this is the main cause of jobless recoveries.

In the paper we applied a variation of the Wayne and Gravino (2016) methodology that derives from Okun's approach, thus it is useful to briefly discuss some literature on it. The theoretical framework developed to explain the Okun's "law" existence spans from the Keynesian approach to a purely neoclassical point of view. Theoretical analysis has mainly tried to conciliate long run theory (along the lines of Solow model - thus in absence of unemployment) with short run Business Cycle Theory (Adachi, 2007) or has investigated the channel throughout production function transforms input into output (Prachowny, 1993)[6]. What is particulary important for our analysis is the issue raised by Prachowny (1993, p. 332): Okun's coefficients has to be considered as a mutatis mutandi and not at ceteris paribus relation. In order to mantain 3.0 percent result, the following condition must be satisfied: a 1.0 percent point reduction of unemployment, a 0.5 percent increase in working hours per man and a further 0.2 increase of working hours per week. Last but not least, "manhour productivity must rise by 1.4 percent" (Okun, 1970, p. 142 in Prachowny, 1993, p. 332). In other words, GDP growth-unemployment relationship is mainly affected by productivity growth, even though it has been lessened by the technological changes occurred after the 1980s.

In the next section we further explore the employment-GDP link by focusing on the long run relationship between GDP per head, productivity and "labour utilization"[7] rather than on the short run relationship between GDP and unemployment. In the long run, the positive relation between GDP growth and employment can be affected by variation in GDP, in labour productivity as well as in population trend. We therefore focused on the relation between GDP per head and employment rate on total population to stress the interplay between total output per head and the necessary total labour to produce it.

Nonetheless, in the long run income distribution is a concern that cannot be left aside. Piketty and Zucman (2014), in line with Solow, suggest that slower growth will entail a rise in the ratio between capital and income, ultimately exacerbating inequalities; this is a sufficient, but not a necessary condition. While Piketty found in productivity slowdown and population growth the main cause of the increase in wealth-income ratio (particularly in Europe), Brynjolfsson and McAfee (2014), mainly focusing on US economy, showed that this result could be the consequence of the "Great Decoupling" between productivity and wage growth. From the 1950s to 1982, real GDP per head, labour productivity, employment and median household income grew at the same pace (with labour productivity and median income growing even faster than the other two variables). From 1981 to 2001, the growth rate of median household income dramatically slowed down with respect to the other three variables. This happened because "the

[6] Doubtless Okun was mainly looking to the short run interpretation of the coefficients: firms react to changes to aggregate demand by modifying their output, thus their inputs.

[7] In the OECD database we use, "labour utilization" is defined as "hours worked per head of population".

economy generated plenty of low-paying jobs" McAfee (2012)[8]. Afterwards, the US economy was not even able to continue generating new jobs. While the analysis of the sectoral and sub-sectoral composition of jobs and wages in US economy is behind the scope of this paper[9] we will discuss at the end of next section how the "Great Decoupling" is in line with our data and how this could affect long run economic performances of the countries in analysis.

3. Trends of GDP (per head) and employment: an overview of data from the OECD Productivity Database

Following Gordon (2010), if we merely consider and decompose the identity, we obtain:

$$GDP = \frac{GDP}{H}\frac{H}{E}\frac{E}{N}N \tag{1}$$

where
- $\frac{GDP}{H}$: output per hour, hourly productivity;
- $\frac{H}{E}$: hours per employee;
- $\frac{E}{N}$: employment to (all) population ratio[10];
- N: population.

This identity clearly shows the close interplay between productivity, employment and output. In the long run, similar to a cross country comparison, each variable enters the equation differently depending on the time period and/or geographical location of an economy. Labour composition, welfare regulations, relative weight of industrial sectors and technology all concur in GDP formation. While Gordon (2010) was mainly interested in the cyclical component of this relation, our main interest regards the (potential) living standard that can be sustained with that production, namely the total output per head and the amount of work needed to support it. We can rearrange (1) dividing by N both sides:

$$\frac{GDP}{N} = \frac{GDP}{H}\frac{H}{E}\frac{E}{N} \tag{2}$$

In this framework, productivity can be considered "per worker" ($\frac{GDP}{E}$) or (as in the case of equation 2) distinguishing between hourly productivity ($\frac{GDP}{H}$) and the hours worked by each worker ($\frac{H}{E}$).

In the next sections we will focus on each component of equation 2 (considering both hourly productivity and productivity per worker) to show that in the long run important changes took place, in particular, with regard to hourly productivity and number of hours worked. While until the 1980s both component of the GDP per head grew simultaneously and concurred to the total GDP per head growth, after the 1980s only the productivity component explains GDP growth: on the contrary, occupation trend appears less related to GDP growth. Graph 1 shows how the relation between GDP per head growth and yearly employment variation differ across countries and over time.

Everything else being the same, if a stable and positive relationship between GDP and employment has always been confirmed (only if Okun's coefficients remain stable), we should therefore observe a dispersion of points mainly in the first and the third quadrant. However, this does not seem to be the case. Particularly, we observe a non-negligible number of points in quadrant four (between 19 to 38 percent of points which represent periods of economic expansions associated with a reduction of employment). Moreover, while differences across countries have always been observed[11], points associated to more recent years (squares) stand in the proximity of the x-axis. When looking only at the points referring to the new millennium it seems that the GDP-employment relationship is absent for all major world economies, except for the Mediterranean PIGS (even though, as it will be discussed later, Italy has never presented a significant relationship between employment and GDP) and Latin America (allthough in this case data are limited with respect to the number of countries and in the time span). Notwithstanding the presence of different

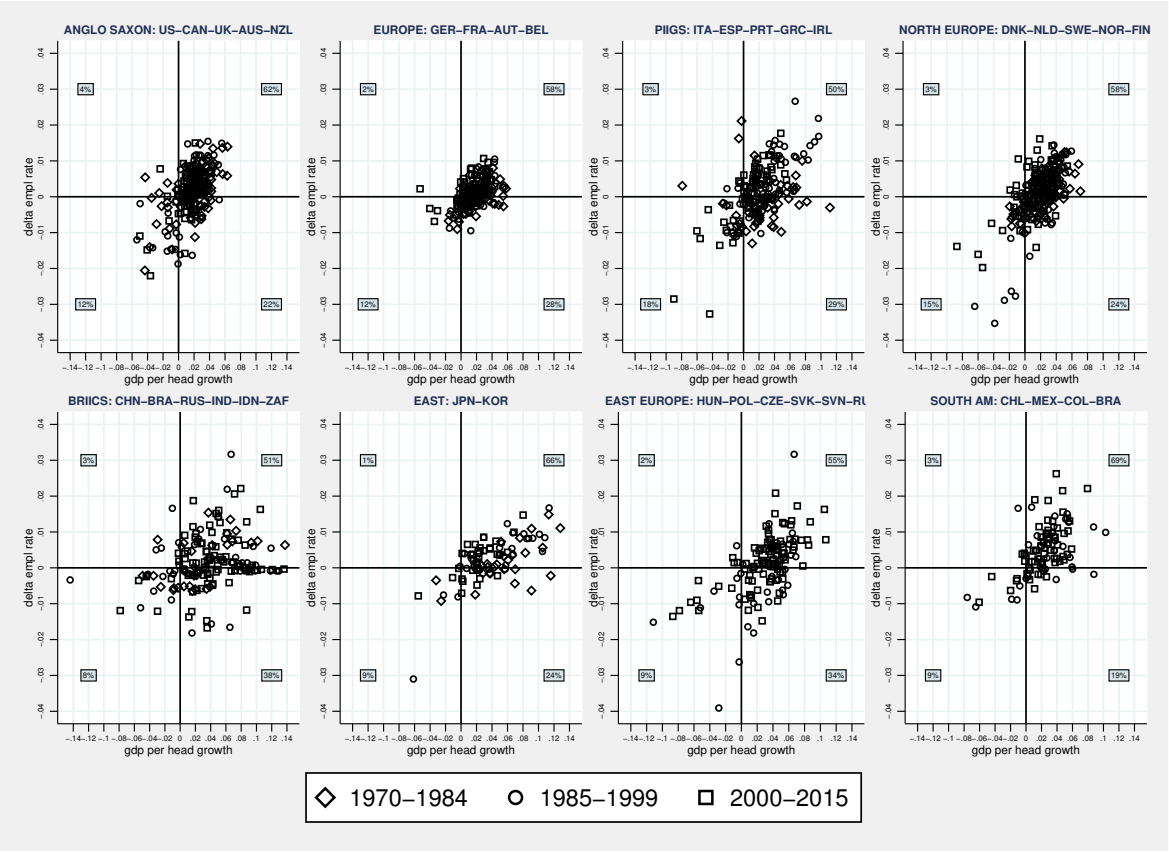
[8] http://andrewmcafee.org/2012/12/the-great-decoupling-of-the-us-economy/

[9] See Valentini et al. (2017) for a detailed analysis of sectoral composition of the US and other six economies, we will come back to sectoral composition in the last section of the paper focusing on sectoral output and job creation.

[10] The employment rate is generally measured as the number of working persons on the population aged 15-65.

[11] Several analyses have been conducted stressing the importance of changes in the Okun coefficients in the long run inside countries (Hamada and Kurosaka, 1984; Bhalotra, 1998; Prachowny, 1993, Khemraj et al., 2006; Gordon, 2010; Canarella and Miller, 2016), comparing different countries, both in the short and in the long run (Lee, 2000; Freeman, 2001, S^gner and Stiassny, 2002; Psarianos, 2016), and even to model specification (Weber, 1995), however the fundamental mechanism that links economic growth and unemployment reduction is generally undisputed.

Figure 1: GDP growth and employment rate changes



Source: own computation on OECD Compendium of Productivity Indicators. OECD Compendium of Productivity Indicators provides a comprehensive overview of recent and longer term trends in productivity levels and growth in OECD and selected non-OECD countries. The most recent edition of the Compendium, as well as information on the methodologies used in the OECD Productivity Database, are available on the OECD productivity internet page: OECD productivity internet page, or at http://stats.oecd.org. Ireland 2012 excluded (outlyer, out of scale)

estimates across some countries and over time, the common path seems to be in line with the "Jobless Growth" hypothesis.

Schnabel (2002) estimates coefficients relating GDP growth and unemployment for 12 countries in the period 1954-2000, comparing them with the work of Moosa (1997), Lee (2000) and several other authors: coefficients not only differ among countries, but are also sensitive to the period in analysis (suggesting a huge change in almost every country except for the US and the Netherlands after 1990s) and to the methodology used. The author concludes that "the assumption of constant parameters does not hold for longer periods", corroborating the idea that Okun's coefficients are not independent from other elements in the economy and that we should not expect them to be stable, finally questioning its status of "law". The contributions of Knoester (1986), Blackley (1991), Moosa (1997), Sˆgner and Stiassny (2002), International Monetary Fund (2010), Ibragimov and Ibragimov (2017), Hutengs and Stadtmann (2013) provide multiple country analysis and, independently from the empirical specification and time span, stress different behaviour across countries and through time [12].

Figure 1 raises a question on the other component of GDP growth, labour productivity. Looking at equation

[12]While generally researches agree on the fact that US and UK shows (un)employment more responsive to economic growth than larger European countries and Japan, few of them try to identify why and what determines such different trajectories. Sˆgner and Stiassny (2002), focusing on a sample of 15 OECD countries, found that countries presenting a higher level of protection on labour markets are those with lower employment responsiveness to GDP variation. This result is confirmed also in Psarianos (2016) in which 13 European Union countries are analysed. Hutengs and Stadtmann (2013) investigate the effect of the difference in estimates, thus the cyclical component across countries in the Eurozone showing that the youngest cohort is more exposed to the cyclical component thus to the business cycle. Their result corroborates the idea that labour market

2, when labour productivity presents a positive variation, two different scenarios are possible. On the one hand, if GDP per head is stable (or if GDP per head growth is slower than productivity growth), then employment (E) has to decreases or population (N) must grow more than E (thus employment rate has to decrease). Under this scenario, productivity growth is labour saving. As a consequence, if we observe no GDP per head growth (or slow GDP per head growth compared to productivity growth) in the presence of increasing productivity trends, we will observe a decreasing employment rate in the population (or, as it will be discussed later, a reduction in the number of hours worked). On the other hand, if GDP per head grows more than productivity, then we are witnessing an increase in E since both components have to increase. This is the scenario that major world economies had been facing until 1980s. The two scenarios have different aftermaths on labour markets and on equilibrium wages. As it will be discussed at the end of the next section, digital economy, despite great promises on widespread increases in wages as result of increase in productivity, kept incomes almost flat for most workers.

4. Trends of GDP (per head) and employment: countries' patterns

Figure 2, 3 and 4 show the trends of labour and GDP in 12 countries[13] from the 1970s to 2016[14]. The data highlights the patterns followed by these countries with regard to employment rate (on total population), GDP per head, working hours and labour productivity. In addition, figures show the rolling estimates of the employment and GDP per head variation[15] computed following the Wayne and Gravino (2016) methodology[16]. We have modified their methodology in order to consider the growth of the GDP per head and the changes of the employment rate for the whole population:

$$\Delta e_t = \alpha + \beta \Delta y_t + \epsilon_t \tag{3}$$

where:
- Δe_t is the change in the employment rate for the whole population ($\Delta \frac{E}{N}$);
- Δy_t is real output per head growth ($\Delta \frac{GDP}{N}$);
- β is a measure of the elasticity of the employment rate with respect to output per head;
- α shows the change in the employment rate when there is no change in real output.

We estimate β by using the OECD Productivity database[17] and by performing rolling estimates over time-slots of 20 years[18]. In the long run we can expect that, given the technological change affecting both man-hours and total factor productivity, the relation could change even within nations. In Figures 2,3 and 4 we only present the graphical trends of the estimated "betas", while Tables B1-B3 in Appendix B report the detailed results of regressions.

Figures 2, 3 and 4 highlight some regularities. First of all, the majority of the countries in analysis presents growing GDP per head in the long run (with fluctuations due to local or international crisis as in 2007-08)[19]. France, Italy and Japan behave differently. France presents a long run stagnation since the beginning of the new millennium while stagnation in Italy and Japan started even earlier. We are therefore observing a world trend characterised by the growth of the left side of equation 3. The growth of the GDP per head could depend on an increase in labour productivity and/or an increase in employment. When noting that both components are increasing or the continuous

regulation affects the responsiveness of employment to business cycle being the youngest cohorts subject to less rigidities in the labour market. IMF (2010) link the changing shape of Okun's coefficient to the combined effect of recession, financial crisis, housing market and sectoral shock that led to a massive increase of unemployment and disruption of labour force.

[13] Data about Brazil and India are in Appendix.

[14] Where data are available.

[15] Countries' choice is driven by: (a) the attempt to represent all the "groups" of Figure 1; (b) the attempt to include the more representative countries; (c) data availability (nonetheless, in Figure 4 some information on China and Russia are missing); (d) India and Brazil, given the lack of data, are presented in Appendix A.

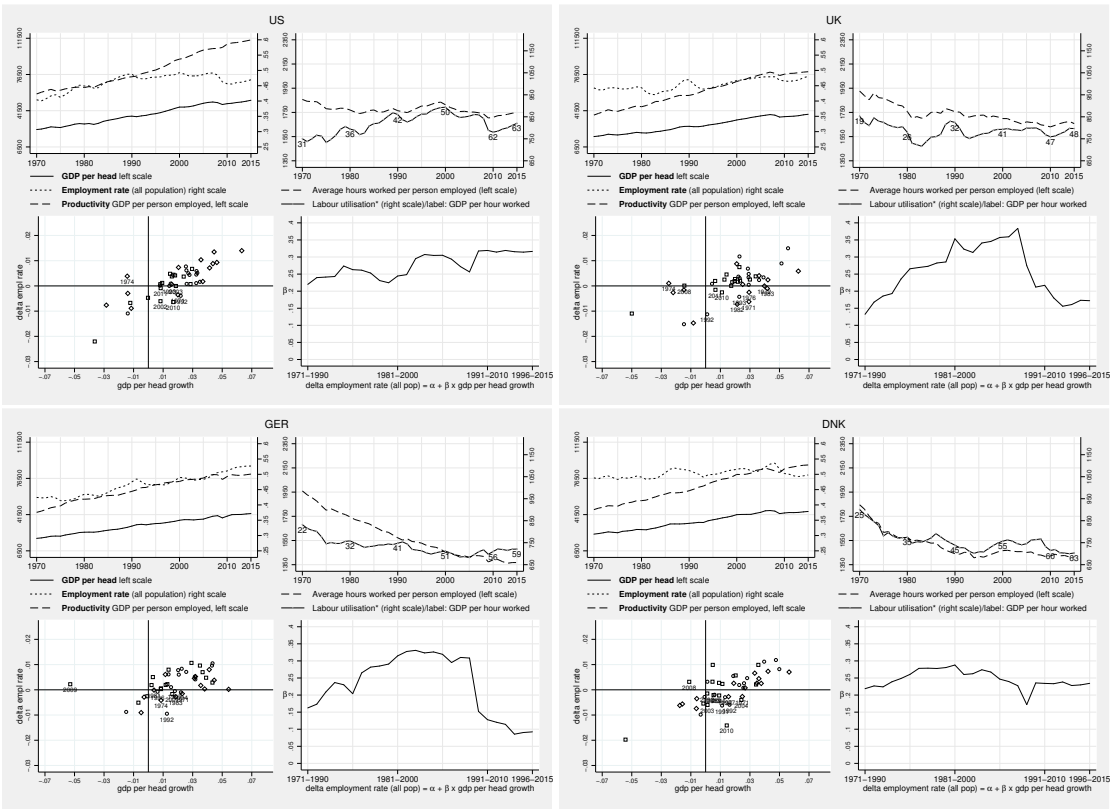
[16] As stressed in the literature review, there are several approaches to disentangle Okun's relation. In fact, we are not trying to estimate the Okun's coefficient, because we use different variables, but it is useful to refer to that literature in methodological terms . We follow Wayne and Gravino (2016) approach since it allows to break down the estimation at sectoral level.

[17] All the data from OECD come from: http://stats.oecd.org "Productivity" and "Labour" sub-sections.

[18] The windows length relies on three pillars: the will to run quite robust estimates (hence, with at least 20 observations); the claim to see some changes over time; the availability of data. For detailed results of regressions, see Tables B.1, B.2 and B.3 in Appendix B.

[19] Since for the vast majority of countries and years we observe positive variation of GDP per head, from now on thus we will analyse the relation between GDP per head growth and employment from a positive perspective, thus we generally expect that as GDP per head increases so employment rate (however it is true also the contrary).

Figure 2: GDP and labour trends



GDP: USD, const. prices, 2010 PPPs - Labour utilization*: hours per head of population
Source: own calculation on OECD Compendium of Productivity Indicators and OECD Productivity Database.
http://www.oecd.org/std/productivity-stats/oecd-compendium-of-productivity-indicators-22252126.htm; http://www.oecd.org/std/productivity-stats/; http://stats.oecd.org

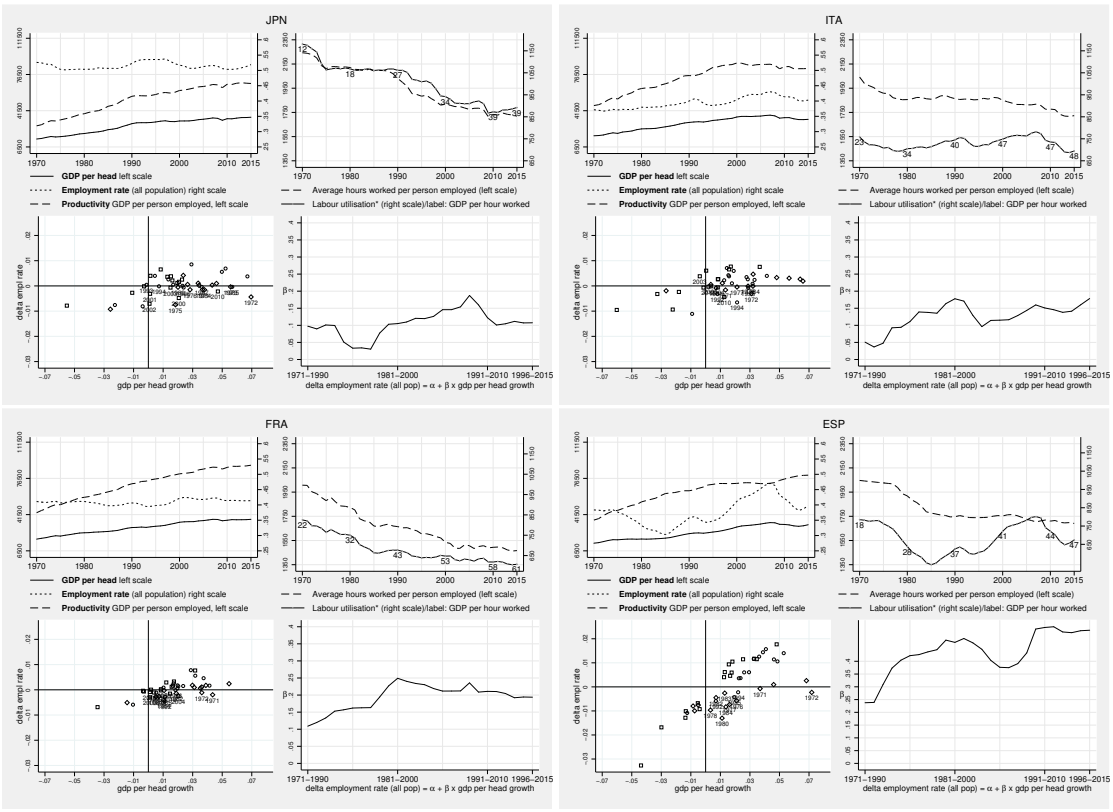
rise in employment rates, it could therefore be argued that the positive relation between GDP and employment still exists (with all the caveat debated in literature). However, our analysis does not fully support this positive outlook.

Labour productivity, measured as GDP per employed, has rapidly grown until the beginning of the 2000s in each country (except for Italy), before slowing down in several countries at the beginning of the new millennium (though continuing to follow a positive trend). Even though investigating the determinants of the sectoral composition of productivity growth is behind the goal of this work of this work (in section 6 we will focus on the sectoral composition of employment growth), we can affirm without undue speculation that automatization and ICT has had a major impact in changing the way we produce goods (Brynjolfsson and McAfee, 2014; DeCanio, 2016)[20] .

In line with equation 2, we also decompose labour productivity in terms of output per hour and labour utilization, namely $\frac{H}{N}$ the number of hours per head for total population. When faced with a dramatic hourly productivity increase, which has almost doubled over the period in each country, the number of hours worked per head has fallen in almost every major economy, except the US. This is in line with two trends already identified in the literature. On the one hand, population agin as well as reforms in social security systems and longer education curricula have modified the proportion of active population in the last two decades (this fact strengthens our choice to focus on the whole population)[21]. On the other hand, less labour is required to produce the same number of goods. The combined effect of these two forces puts pressure on working hours as well as on employment on population rates. While the general consensus agrees that it is better to produce more with less work, this could have major negative impact on employment rates, salaries and, at last, on income distribution (Piketty, 2014). Such a situation makes a public

[20] See, among the others, Valentini et al. (2017) for a deepening of the trajectories of productivity in different sectors.
[21] Thus population dynamics plays a non-negligible role in this relation.

Figure 3: GDP and labour trends(2)



GDP: USD, const. prices, 2010 PPPs - Labour utilization*: hours per head of population
Source: own calculation on OECD Compendium of Productivity Indicators and OECD Productivity Database.
http://www.oecd.org/std/productivity-stats/oecd-compendium-of-productivity-indicators-22252126.htm; http://www.oecd.org/std/productivity-stats/; http://stats.oecd.org

intervention necessary so that technological improvements can effectively improve the quality of life (also by reducing working time). On the contrary, if the phenomenon is not managed, imbalances and inequalities can prevail, reflecting in a slump in aggregate demand.

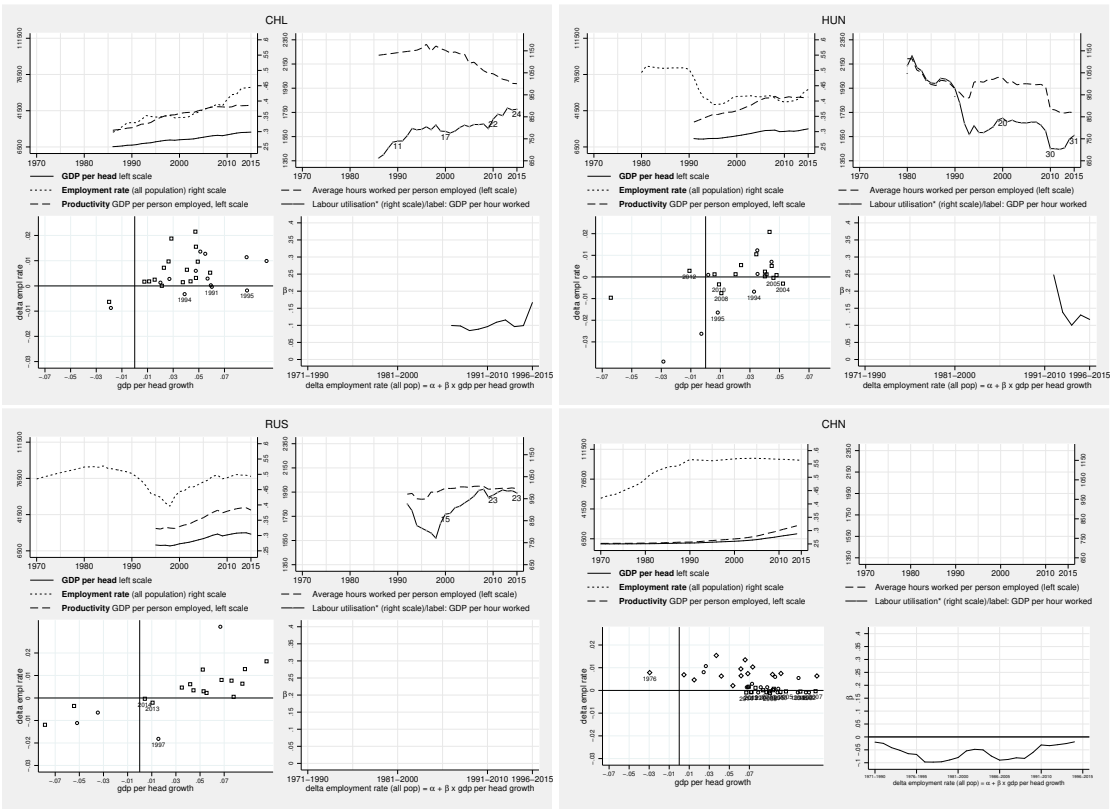
Since the middle of 1980s, we have been observing a flattening dynamic in employment-to-total population ratio. On average, countries show stable employment rates after the 1990s, ranging from 45 to 55 percent on total population. Among large economies of our sample only Mediterranean countries present employment rate that fluctuate around 40 percent, on average 5.0 percent less than others. Italy, in particular, stands out because of the hours per worker, whose level is higher than every other country in the sample (except for Japan), whereas labour utilization is largely below comparable economies. Only Central European economies, whose productivity per hour and employment rate are, however, respectively almost 20 and 10 percent higher than in Italy, show lower level of labour utilization.

In the UK and US, GDP per head and the employment rate grew simultaneously until the beginning of the 2000s. In the following years, the growth of the output head slowed down as well as the employment rate, which was found to be negative in certain years. In these countries, the slowdown of GDP per head seems to be more related to the reduction of employment growth rate than to the productivity braking.

Differently can be said for Germany and Denmark. Both countries experienced a slowdown in labour productivity growth after 2000. However, given the positive trend in GDP per head growth, their employment level was only partially affected. To support employment in period of labour productivity expansion without affecting GDP growth both countries have had to drastically reduce the amount of hours worked and labour utilization. However this reduction was not enough to produce stagnation.

Denmark, Germany, the UK and US, can be considered successful economies, even though, recently, their long run positive relation between economic growth and employment rate is weaker than what it used to be. These four

Figure 4: GDP and labour trends(3)



GDP: USD, const. prices, 2010 PPPs - Labour utilization*: hours per head of population
Source: own calculation on OECD Compendium of Productivity Indicators and OECD Productivity Database.
http://www.oecd.org/std/productivity-stats/oecd-compendium-of-productivity-indicators-22252126.htm; http://www.oecd.org/std/productivity-stats/; http://stats.oecd.org

countries showed significant increases in GDP per head associated with a limited increase in employment rate in the last decade. However, among them, UK and US experienced larger fluctuations in labour market and a limited reduction in the number of hours worked compared to Denmark and Germany. These latter show a more stable, positive trend in employment rate and an important reduction in the amount of hours worked and labour utilization. This is in line with the distribution of point in the scatter plot. Recent years are closer to the x-axis for US and UK, whereas for central European countries they are more sprawled. The large amount of points in quadrant IV and the relative small number of points in quadrant III suggest that these four economies have been continuously growing in terms of GDP per head during the period, but also that economic growth was not always linked to a rise in employment. Moreover, if we look at the specific years in quadrant IV for the US, UK and Denmark, it is easy to notice that they are years usually following a year affected by economic recession. This hint corroborates the Jobless Recovery hypothesis, even though, as we have already pointed out, yearly data do not allow us to go further in the investigation[22].

Focusing on "betas" estimates, the US (and similarly Denmark) has a relatively stable coefficient ranging between 0.25 and 0.33. These values, which are in line with literature achievements, suggest that the US economy still has a positive significant relation between GDP and employment growth, although its growth has stopped in recent years. The estimates for UK, on the contrary, are more unstable. The relation grew up to .35 until the 1990s and then dramatically fall to .15. A similar path has been followed by Germany. In general, the analysis of these economies support the idea that a positive relation between economic and employment growth still exists, even though macroeconomic

[22]Germany behave differently and points in quadrant IV usually anticipate the crisis identified by points in quadrant III, however the re-unification process and the common currency could have affected economic performances as well as data accuracy.

trends, the large amount of point in the fourth quadrant of the scatter plot and the decreasing values of the estimated "betas" suggest that this relation in the long run is less strong than it used to be. Since quarterly relation between employment and GDP growth is usually considered a measure of the employment sensitivity (responsiveness) to business cycle, the yearly data on population allows to measure the long run relation between our variables. Thus, since we are observing in recent years a large amount of points in quadrant IV we are supporting the Jobless Growth hypothesis.

In Figure 3, we grouped countries which have been suffering economic stagnation in the last decade. Specifically, we focused on Mediterranean countries and Japan. Despite large differences in socio-economic background, labour market organization and institutional setting, Japan and Italy behaved similarly in terms of GDP per head trends. The two countries further show the highest number of hours worked per employee among large economies not belonging to the former socialist countries. However, some differences exist with respect to labour utilization (which in Japan is largely higher than in other countries, but Russia), labour productivity (which has been stuck in Italy, when not decreasing, since 1990 while increasing in Japan), hourly output production (which in Japan is much lower than in other comparable economies, while in Italy has values similar to those of UK) and employment rate. France is similar to Italy in terms of employment rate even though average hours worked per employee is much lower than in Italy and labour productivity is higher (and similar to Central European countries presented in Figure 2 both in terms of output per worker and of hourly output). Spain had much more intense fluctuations in the labour market than the other countries of the group, with performances more similar to those of the emerging economies (over a shorter time span). This is in line with the relatively recent openness of Spanish economy to international markets occurred only after the end of the dictatorship in 1975.

A common trait between France, Italy and Japan (compared to Anglo-Saxon economies) is the relatively low reactivity of their labour markets to the business cycle. These three countries, in fact, show coefficients ranging from 0.05 (Japan) to 0.2 (France), which are much lower than those of the US.

Scatter-plot analysis shows two well-defined patterns. Post-crisis years appear to be more concentrated in quadrant III. France and Japan behave similarly to the US as recent years are close to the x-axis (resulting from a positive variation in output per head and a low variation in employment), while Italy and Spain show a significant presence of points in quadrant IV[23]. Looking at 2007, it is evident that Spain and Italy have been the countries most severely hit by the crisis.

To summarize, countries showing economic stagnation do not have a single trait in common, but a series of joint features that have negatively affected their performances. Mediterranean countries have not been able to deal with the increase in labour productivity, however, this increase did not provide employment levels similar to those of the Anglo-Saxon and Central European countries.

While output per hour worked in the economy is in line (or even higher) with those of other countries, Italy and Spain show an high level of hours worked by each worker, low employment rates and low levels of labour utilization. Japan retained a very high employment rate, by reducing worked hours and labour utilization (which are, however, both still higher than those of the other countries), while the output per hour worked did not increase as much as in the US.

Finally, despite the lack of data (or comparable trends in the long run) we provide some features about "emerging economies" (Figure 4). The definition "emerging economies" is non appropriate for the group of countries in analysis, since China is actually the second most important global economy (in terms of GDP) and Russia has been for decades the leading socialist economy. We define those countries as "emerging" since the output per head is still significantly lower than that of other countries analysed in this paper. Three of these countries were part of the socialist block and they share relatively high employment rate levels. Russia and Hungary also show a similar historical path, with the employment rate falling just after the collapse of Soviet Union. However, Russia has recovered their pre-1990s employment rates, labour utilization and average hours worked per employed, while Hungary did it at a slower pace. Nonetheless, hourly output is much higher in Hungary than in Russia which implies that Hungarian and Russian GDP per head are at the same level. China shows a flat trend of the employment rate, unrelated with the growth of GDP since the 1990s.

[23] Share of points in quadrant IV (all years): US 16%, UK 20%, Germany 20%, Denmark 27%, Japan 36%, France 38%, Italy 29%, Spain 27%, Chile 10%, Hungary 37%, Russia 33%, China 36%. Share of points in quadrant III and IV (drops of employment rate, years after 2007): US 22%-22%, UK 11%-22%, Germany 0%-0%, Denmark 22%-33%, Japan 33%-11%, France 33%-22%, Italy 55%-22%, Spain 66%-0%, Chile 11%-0%, Hungary 11%-22%, Russia 22%-22%, China 0%-100%.

In summary, we found that a) the analysed countries are all (except for Italy) facing a continuous growth in labour productivity; and b) they are also facing a long run growth in output per hour worked. Since these two variables enter positively equation (2), it follows that, in order to increase employment rate or, at least, to retain its level, we should observe GDP per head growth rates higher than productivity growth rates or a reduction in working hours large enough to keep the equation balanced. Nearly all countries in Figure 2 and 3 show a tendency in losing the positive relation linking economic growth (that is, if they ever had one) with employment growth due to the productivity increase.

Results are in line with the Jobless Growth hypothesis. Several countries have not been able to strengthen their economies by retaining employment and benefiting from the increased productivity. The common trend among different countries suggests that the structural change can be considered as the main factor in explaining the Jobless Growth phenomenon. The structural change, due to the automation of production, delocalization, increase in productivity (and reduction in goods relative prices) as well as to the growing importance of knowledge-based services, has shifted our economies from labour intensive to capital intensive productive systems, requiring ever less workers. The next section focuses on the income evolution for six countries showing that the Great Decoupling hypothesis is strictly linked to the labour saving triggered by productivity increase.

5. The Great Decoupling

Figure 5 provides information on real GDP per head, hourly productivity, labour utilization, labour share (namely the labour shares on GDP) and the hours worked (total and per head) in Denmark, Germany, Japan, Italy, UK and US (all the indexes are 1971=100). This allows us to identify the long run behaviour of each country for the variables in analysis. Similarly, Figure 6 conveys information on real GDP per head, hourly productivity, hours worked (total), real mean income and real median income. All data comes from the OECD, however, since income data are not available in the long run for each country, we provide different base year for each country.

The Great Decoupling hypothesis proposed by Brynjolfsson and McAfee (2014) for the US is generally confirmed for all analysed countries. Moreover, different trends can provide us some more information supporting the theory and some hints inspiring further research options. All six countries sustained growth in real GDP per head and in hourly productivity over the period. Since the two variables are closely related, it is not surprising that productivity growth implies a growth in the output. Nonetheless, figure 5 suggests that large increases in productivity did not result in large increases in output everywhere. Japan appeared to have been almost in stagnation since the 1980s, while Italy's growth ceased after 1994, when considering the GDP per head trend.

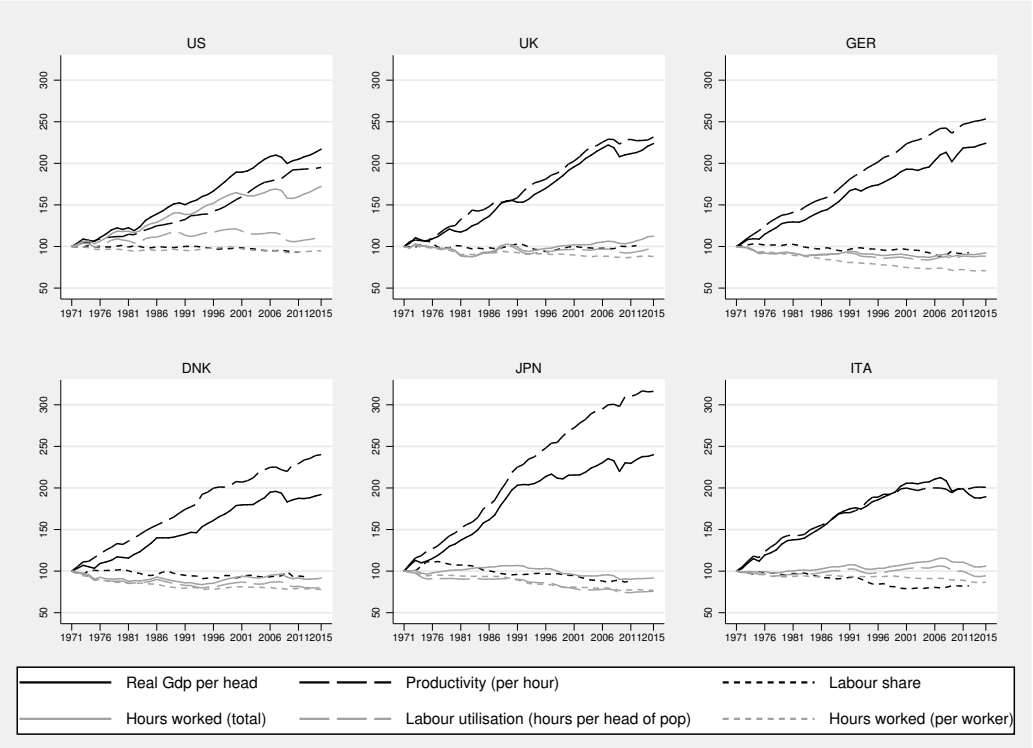
Over the period, the total amount of hours worked in the economy decreased in each country; even the US shows a decrease since the 1990s. US GDP per head increases more than productivity growth, while we can observe the opposite in all other successful economies: this can be explained by the fact that the United States is the only economy presenting an increase of labour utilization (thanks to a fast transition to services; Valentini et al., 2017).

To confirm Brynjolfsson and McAfee (2014) Great Decoupling hypothesis, however, it is necessary to focus on incomes. As shown in Figure 6, there are two main issues to be stressed, both corroborating the Great Decoupling hypothesis.

On the one hand, while GDP per head and hourly productivity grew almost doubling in each country, real mean and median income showed a much lower growth rate. In Germany, Italy, Japan and the US income grew by less than 20 percent. With the exception of the US, all these countries had a stable or decreasing number of hours worked in the economy. On the contrary, in the US, the total amount of hours worked grew more than income (80 percent and 20 percent respectively). US ended up working more and being more productive while the return to average income was much lower. On the base of these findings it can be argued that these four countries face a decoupling process between productivity and income. Denmark and the UK show a different trend. While income did not grow as much as productivity (let's say, a "tiny decoupling"), both countries had a marked positive trend in average mean and median income. Nonetheless, the growth rate of income is always lower than the growth rate of productivity and real GDP per head in all analysed countries.

On the other hand, the median income is in line or lower than the mean income. Specifically, in Italy, the US and the UK the median income grew less than the average income, while in the other three countries the two variables moved together. This means that in Italy, the US and the UK, not only did income not grow as much as productivity, but its distribution was not uniform throughout society. This evidence strengthens the Great Decoupling hypothesis:

Figure 5: The Great Decoupling



Source: own calculation on OECD Compendium of Productivity Indicators and OECD Productivity Database.
http://www.oecd.org/std/productivity-stats/oecd-compendium-of-productivity-indicators-22252126.htm; http://www.oecd.org/std/productivity-stats/; http://stats.oecd.org

the technological revolution is not only labour saving, but it also caused increasing inequalities by dramatically rising the income of a minority while the majority was not reaping any benefits.

In summary, a labour saving productivity growth has produced two main effect on the sample's economies. First, it allowed a GDP per head growth disjointed from increase in job positions which means that total output increased whereas work needed to produce that output decreased. Second, productivity growth did not result in an equal increase in mean and median income (as the result of stable or decreasing job positions and hours worked in the economy) thus reducing the labour share on real output over the period (Figure 5). While Piketty and Zucman (2014) were correct in stressing the increasing importance of wealth with respect to income in the last decades, the argument they proposed is not confirmed. Slowdown of population and productivity growth did not cause the sudden rise of the long run wealth income ratio (Solow's beta), which, on the contrary has been triggered by labour saving productivity growth[24] in absence of full occupation and in presence of a constrained ("not infinite") market for output which reduced the amount of worked hours and job positions putting pressure on salaries, and thus on incomes.

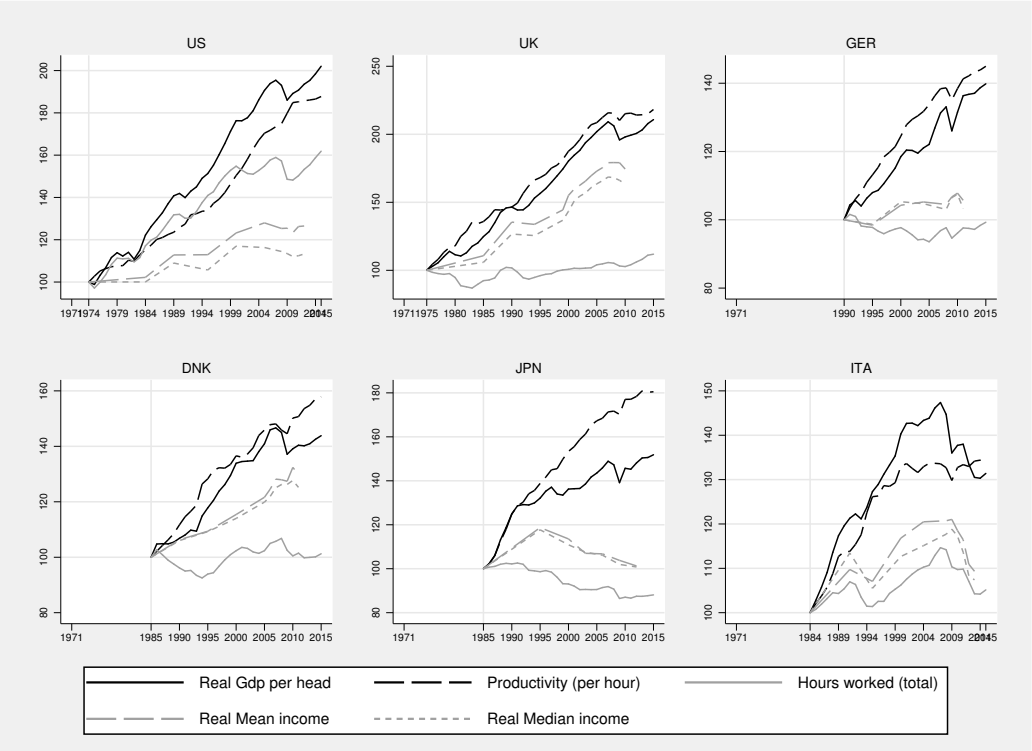
6. Sectoral analysis

In this section, we examine the relationship between GDP per head and employment by observing at sectoral composition before 2007 for six countries. We focus on the US, the UK, Germany, Denmark and two countries suffering long run economic stagnation: Japan and Italy. Our analysis is based on the OECD Productivity database and on the KLEMS database.

Following Section 4, we computed 20 years rolling estimates, covering the period 1971-2007. At the end of this period, the "betas" describing the relationship between GDP and employment in the whole economies present a sharp

[24] Standard Solow model has labour augmenting technological progress.

Figure 6: The Great Decoupling (2)



Source: own calculation on OECD Compendium of Productivity Indicators and OECD Productivity Database.
http://www.oecd.org/std/productivity-stats/oecd-compendium-of-productivity-indicators-22252126.htm; http://www.oecd.org/std/productivity-stats/; http://stats.oecd.org

decline (UK, GER, JPN) or stop its growing trend (US). We perform a sectoral analysis, in order to stress the effect of an increase in the output (per head) of the different sectors on the employment rate of all economy. Each increase in the output produced in a sector can affect the employment of an entire economy through:

- direct effect: the higher the productivity of a given sector, the lower the effect of its output growth on total employment and vice versa (in other words, sectors with high levels of productivity can dramatically increase aggregate GDP per head having a limited impact on employment);
- indirect effect: the growth of the output in a sector can generate a positive spill-over on other sectors of the economy via aggregate demand.

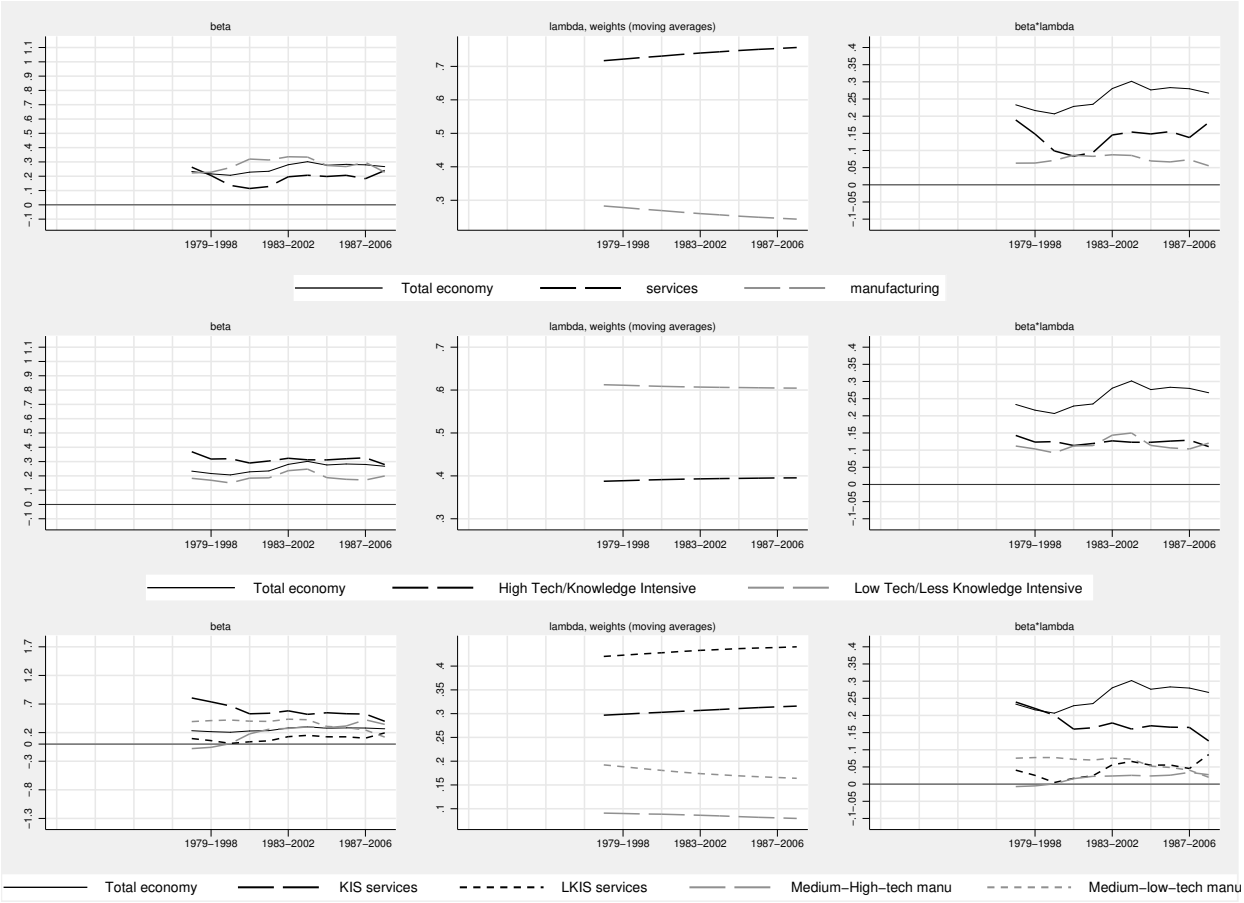
By applying Wayne and Gravino (2016) methodology to our per head analysis we were able to perform two strategies. The first strategy consists in estimating:

$$\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t \tag{4}$$

where:
- Δe_t is the change in the employment rate for the whole population;
- β_i is the responsiveness of the employment rate (all population) to sector i's output per head growth
- $\lambda_{i,t} = \frac{Y_{i,t}}{Y_t}$ is the weight of sector i's contribution to the country's total output
- ΔY_i is the real output per head growth in sector i;
- $\lambda_{i,t}$ is the weight of sector i, with respect to the country's GDP[25].

[25]The analysis is carried out by using KLEMS data, where "valued added" represents GDP.

Figure 7: **US** - "beta" estimates (Employment and GDP), 20 year windows, $\Delta e_t = \alpha + \sum_i \beta_\mathbf{i} \lambda_{\mathbf{i,t}} \mathbf{\Delta Y_{i,t}} + \epsilon_\mathbf{t}$



Source: own calculation on KLEMS and, for employment rate, OECD data. See footnotes in the text for details.

We apply two different specifications to define sector:
- Services vs Manufacturing (including Agriculture and Construction);
- High Tech (Medium-High Technology Manufacturing + Knowledge Intensive Services) vs Low Tech (Medium-Low Technology Manufacturing + Less Knowledge Intensive Services + Agricolture and Construction)

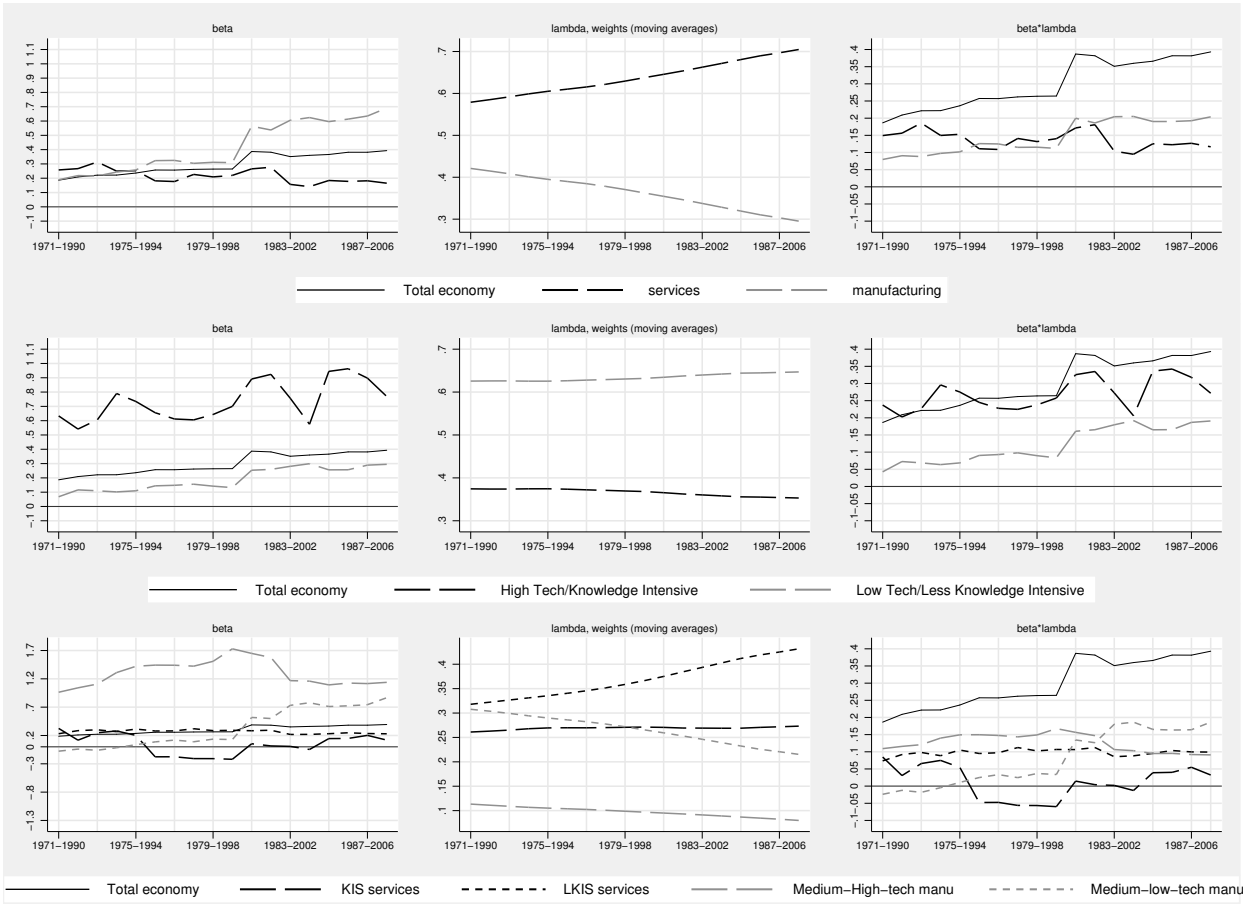
In doing so, we isolate the differential employment responsiveness β_i ("unemployment intensity"/"employment intensity", see Anderton et al., 2014) for each sector rather than simply estimating the composite term, $\beta_i \lambda_i$. However, the product of $\beta_i \lambda_i$ is useful since it yields the differential "component elasticities", i.e. the proportional reaction of employment to developments in each sector output. Specifically, the $\beta_i \lambda_i$ estimates show the change in the employment rate that is associated with a 1% increase in output of sector i, while β_i estimates show the change in the employment rate associated with an increase in sector i's output equivalent to 1% of total (all economy) GDP per head.

The second strategy is aimed at studying a more detailed level of disaggregation. Given the limited number of observation available, the most we can estimate are 3 parameters, including the constant. Hence, we arrange the previous approach in the following:

$$\Delta e_t = \alpha + \beta_i \lambda_{i,t} \Delta Y_{i,t} + \beta_{n-i}(1 - \lambda_{n-i,t}) \Delta Y_{n-i,t} + \epsilon_t \tag{5}$$

where:
- i= Less Knowledge Intensive Services (LKIS), Knowledge Intensive Services (KIS), Medium-High Tech Manufacturing (MH), Medium-Low Tech Manufacturing (ML) (plus construction and agricolture)

Figure 8: **UK** - "beta" estimates (Employment and GDP), 20 year windows, $\Delta e_t = \alpha + \sum_i \beta_{\mathbf{i}} \lambda_{\mathbf{i,t}} \mathbf{\Delta Y_{i,t}} + \epsilon_{\mathbf{t}}$



Source: own calculation on KLEMS and, for employment rate, OECD data. See footnotes in the text for details.

- $n - i$ are all the sector of the economy aggregated, but sector i;

Figures 7 to 12 graphically display the results of sectoral estimations while, Tables C4-C9 in Appendix C reports the detailed results of regressions. Despite the fact that each country shows different responsiveness to the business cycle as well as different sectoral weights, we can identify some common features.

Focusing on the first column of each figure, in line with the aggregated results of previous section, the estimated "beta" for total economy indicates that an increase of 1.0 percent of GDP per head has a 0.2 increase in employment rate (greater in US, lower in Japan, declining or stagnant in recent years). Nonetheless, each sector has a different impact in each country, both in terms of employment intensity and overall effect.

It follows that in order to deal with sectoral disaggregation, it is useful to perform the analysis considering λ_i, namely the relative weights of each sector. Each country of the sample has nearly the 70 percent of its output produced by the services sector. This result had yet to be achieved by the US in the 1980s. European countries, with the exception of Denmark, showed an increasing importance of services since the 1980s, even though their ratio was 10 percent points lower than the US. Finally, Japan was even later in this structural change: at the end of the considered period, services share was slightly above 60%.

By considering Figures 7 to 12 (partially summarized in table 1), we can understand by where manufacturing still plays a role and where instead services have become even more crucial. Notwithstanding in each country estimates β_i for services and manufactoring are not far from the β of the whole economy, we can point out some differences.

UK has higher β_i for manufacturing than for services. Overall, in UK manufacturing still plays an important role in

Table 1: Summary of some results presented in Figures 7-12

US

period	**employment intensity** (β)				**weight** (λ)				**employment reaction** ($\beta\lambda$)			
	Services		Manufacturing		Services		Manufacturing		Services		Manufacturing	
1978-1997	0.263		0.223		0.717		0.283		0.189		0.063	
1988-2007	0.240		0.228		0.756		0.244		0.182		0.056	
	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man
1978-1997	0.806	0.097	-0.079	0.393	0.297	0.420	0.091	0.192	0.239	0.041	-0.007	0.076
1988-2007	0.398	0.195	0.344	0.122	0.316	0.441	0.080	0.164	0.126	0.086	0.027	0.020

UK

period	**employment intensity** (β)				**weight** (λ)				**employment reaction** ($\beta\lambda$)			
	Services		Manufacturing		Services		Manufacturing		Services		Manufacturing	
1971-1990	0.258		0.189		0.579		0.421		0.149		0.080	
1988-2007	0.165		0.691		0.705		0.295		0.117		0.204	
	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man
1971-1990	0.324	0.231	0.964	-0.077	0.261	0.318	0.113	0.308	0.085	0.073	0.109	-0.024
1988-2007	0.118	0.230	1.138	0.866	0.273	0.432	0.080	0.215	0.032	0.099	0.091	0.186

GER

period	**employment intensity** (β)				**weight** (λ)				**employment reaction** ($\beta\lambda$)			
	Services		Manufacturing		Services		Manufacturing		Services		Manufacturing	
1971-1990	0.175		0.045		0.576		0.424		0.101		0.019	
1988-2007	0.418		0.339		0.673		0.327		0.282		0.111	
	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man
1971-1990	-0.367	0.436	0.149	0.027	0.243	0.333	0.156	0.268	-0.089	0.145	0.023	0.007
1988-2007	0.403	0.454	0.257	0.300	0.253	0.420	0.136	0.191	0.102	0.191	0.035	0.057

DNK

period	**employment intensity** (β)				**weight** (λ)				**employment reaction** ($\beta\lambda$)			
	Services		Manufacturing		Services		Manufacturing		Services		Manufacturing	
1971-1990	0.212		0.243		0.683		0.317		0.145		0.077	
1988-2007	0.257		0.184		0.726		0.274		0.187		0.050	
	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man
1971-1990	-0.002	0.256	-0.126	0.274	0.296	0.387	0.064	0.253	-0.001	0.099	-0.008	0.069
1988-2007	0.101	0.256	0.685	0.019	0.313	0.413	0.067	0.207	0.031	0.106	0.046	0.004

ITA

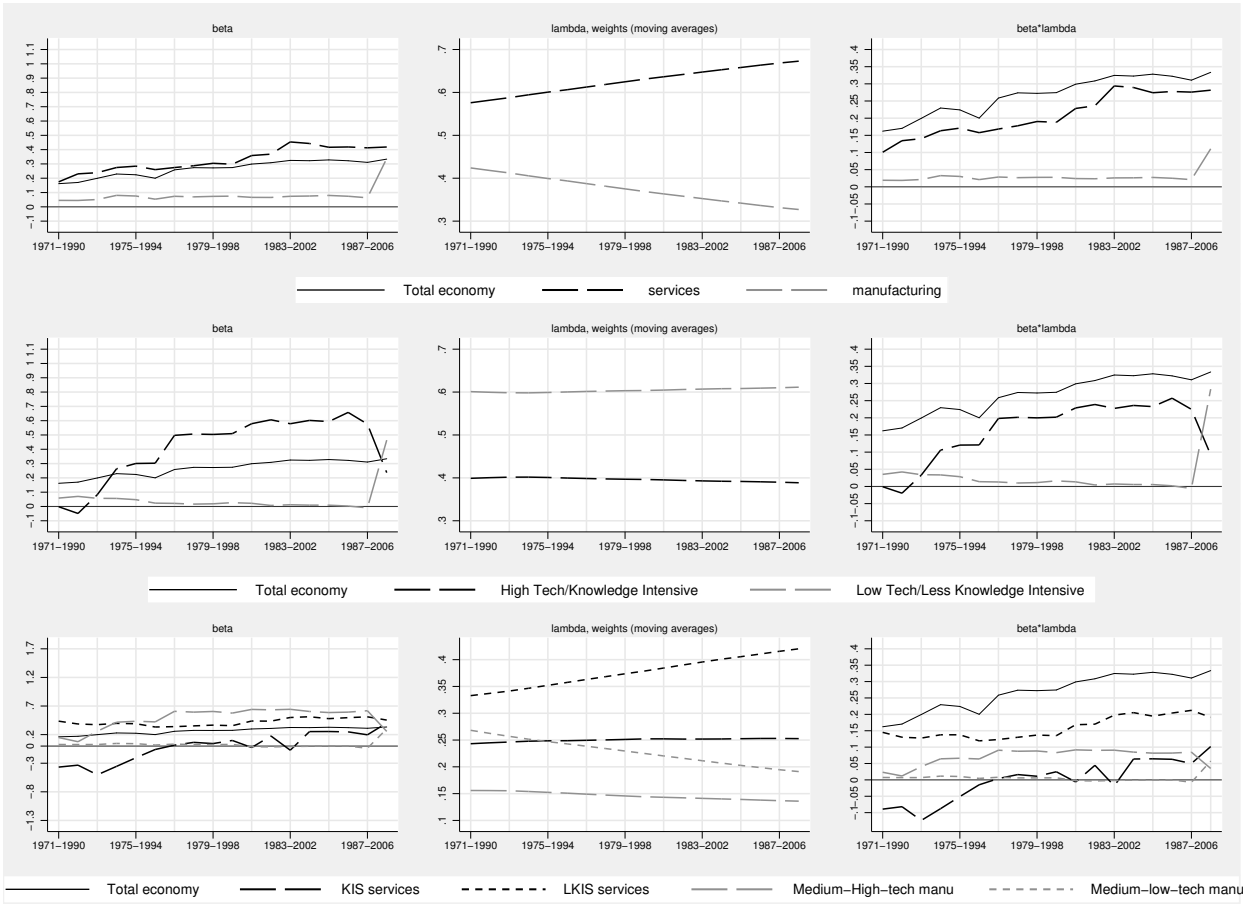
period	**employment intensity** (β)				**weight** (λ)				**employment reaction** ($\beta\lambda$)			
	Services		Manufacturing		Services		Manufacturing		Services		Manufacturing	
1971-1990	-0.019		0.138		0.582		0.418		-0.011		0.058	
1988-2007	0.367		-0.097		0.688		0.312		0.252		-0.030	
	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man
1971-1990	-0.092	0.077	-0.137	0.198	0.219	0.363	0.100	0.318	-0.020	0.028	-0.014	0.063
1988-2007	0.558	0.219	-0.602	0.081	0.241	0.447	0.077	0.236	0.134	0.098	-0.046	0.019

JPN

period	**employment intensity** (β)				**weight** (λ)				**employment reaction** ($\beta\lambda$)			
	Services		Manufacturing		Services		Manufacturing		Services		Manufacturing	
1974-1993	0.166		0.066		0.582		0.418		0.097		0.028	
1987-2006	0.276		0.080		0.649		0.351		0.179		0.028	
	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man	Know Int Serv	Less Know Int Ser	Med High Tech Man	Low Tech Man
1974-1993	-0.262	0.360	0.002	0.168	0.210	0.372	0.122	0.296	-0.055	0.134	0.000	0.050
1987-2006	-0.332	0.384	0.053	0.081	0.231	0.418	0.115	0.236	-0.077	0.161	0.006	0.019

Source: own calculation on KLEMS and, for employment rate, OECD data. See footnotes in the text for details

Figure 9: **GER** - "beta" estimates (Employment and GDP), 20 year windows, $\Delta e_t = \alpha + \sum_i \beta_{\mathbf{i}} \lambda_{\mathbf{i,t}} \mathbf{\Delta Y_{i,t}} + \epsilon_{\mathbf{t}}$

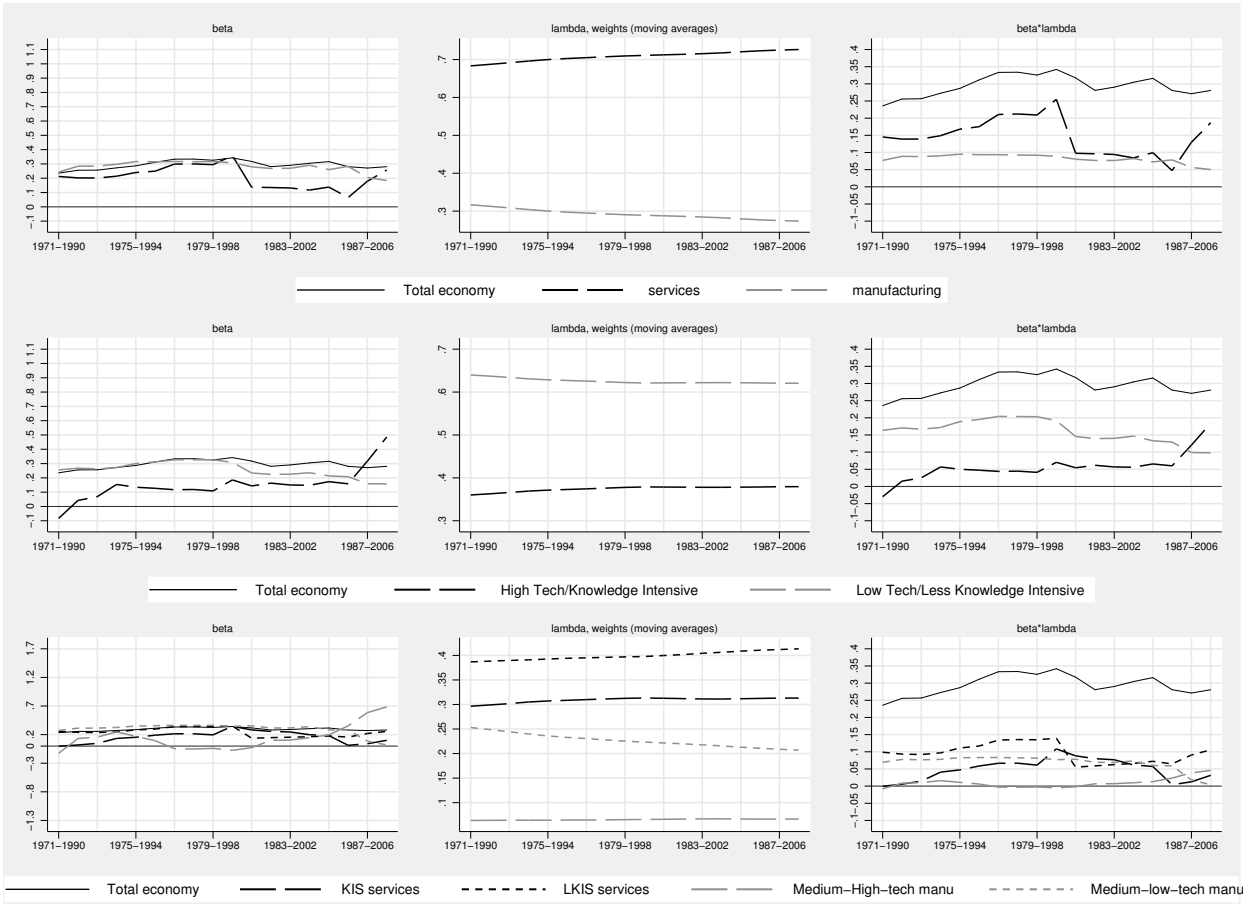


Source: own calculation on KLEMS and, for employment rate, OECD data. See footnotes in the text for details.

terms of employment reaction to GDP ($\beta\lambda$) because of two factors: a very high employment intensity (β) in High Tech Manufacturing, a still considerable (even if declining) share (λ) in Low Tech Manufacturing. At the same time, UK has the third highest share (λ_i) of Knowledge Intensive Services after US and Denmark. The UK is the only country that still has a growing β for the whole economy: it is facing structural change, favoring KIS sectors, employing many people in high tech manufacturing (in relation to the production level) and, as we know from previous sections, by partially reducing the hours worked by each employee (but with a sizeable difference between mean and median income).

The pattern for the US seems different from that of the UK. The β for the whole economy is still high, but has stopped its growth in the late 2000s. Overall, in the US services are more important than manufacturing in terms of employment reaction to GDP ($\beta\lambda$). This results from an high (but declining) β in KIS services and from the highest weight (λ) in the KIS among the considered countries. From the previous section we now know that the patterns of median and mean incomes indicate a growing inequality and that the number of worked hour did not decrease so much. In the US, structural change consisted in a transition towards KIS section, but with growing inequality and possible negative effects on the aggregate demand (real median income decreases from the begin of 2000s). Since the late 1990s this mechanism seems to be partially broken and then the crisis hits in 2007 (caused also by an implosion in the financial and real estate sectors, both classified KIS). In Valentini et al. (2017), relying on the theory of Delli Gatti et al. (2012) it is argued that the US's quick recovery from the crisis was mainly driven by public investments in other KIS sectors (education, energy, public funded research).

Figure 10: **DNK** - "beta" estimates (Employment and GDP), 20 year windows, $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$



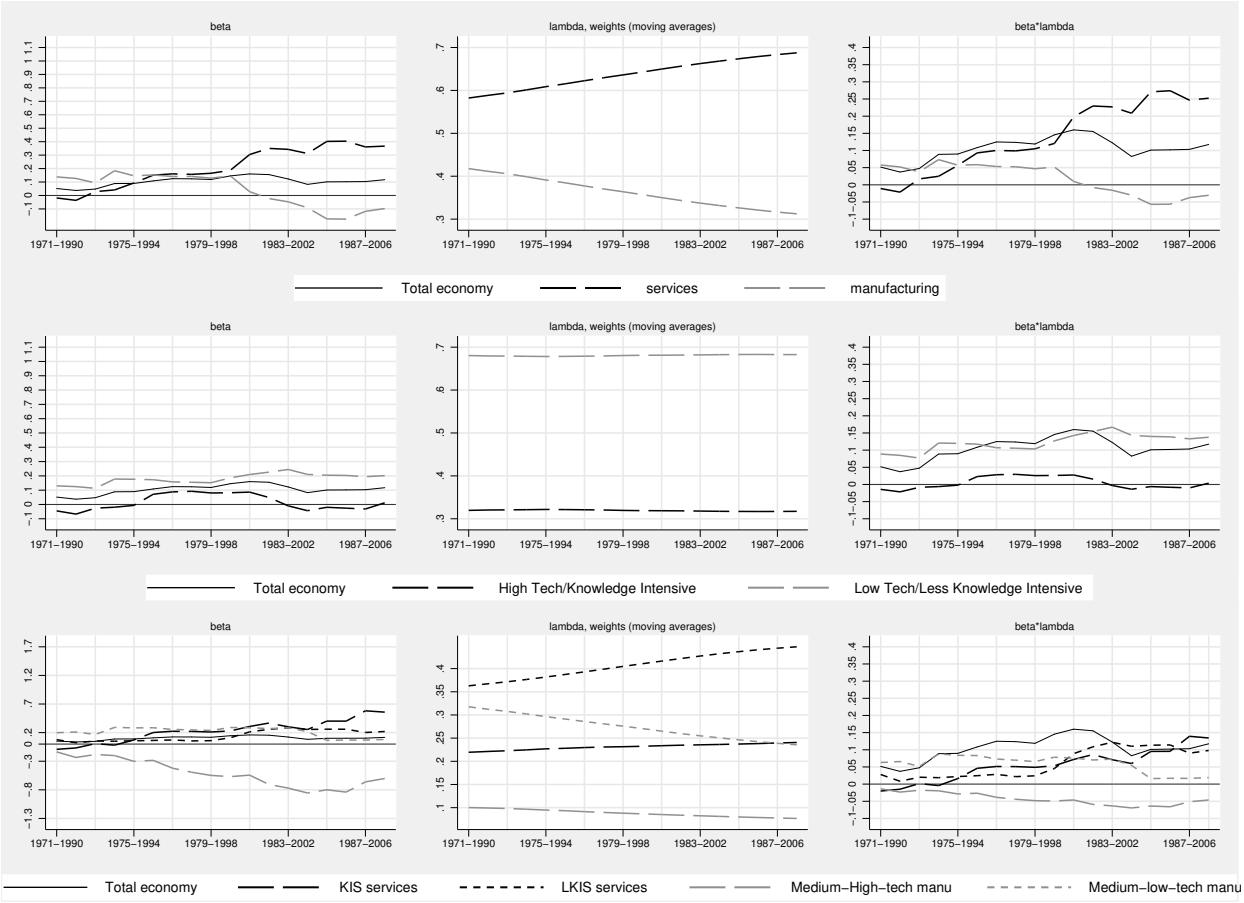
Source: own calculation on KLEMS and, for employment rate, OECD data. See footnotes in the text for details.

From the previous section we know that Germany and Denmark have in common a strong reduction in worked hours for employee and a substantially homogeneous growing trend of median and average incomes (not increasing inequality). The β (linking GDP per head and employment rate) for the whole economy is stable in Germany from the end of 1990s and it decreases in Denmark. However the countries differ under other points of view. In Germany, manufacturing still has a role in terms of weights (λ): the weight of the manufacturing is the second one among the considered countries (after Japan), and in particular, Germany, has the highest share of the economy constituted by High Tech Manufacturing (13.6%). In terms of $\beta\lambda$, at the end of the considered period, Germany presents the highest impact of manufacturing. The share of services increases but is still under 0.70 and both KIS and LKIS seem able to create jobs (β). The Denmark's pattern seems more similar to the one of the US: services represents almost 3 out of 4 of the economy and Knowledge Intensive Services play a major role. In Denmark the β of the overall economy decreases while it remains stable in the in US. The difference between Denmark and the US emerges from the previous sections' data: while Denmark, similar to Germany, reduced working hours and redistributed income (see average income and median), in the US, the hours worked of individual workers remain stable and inequality grows.

Looking at the data in Figures 11 and 12 (and Table 1), the sectoral pattern of Japan and Italy seems similar to that of Germany: a high share (λ) of the economy is covered by manufacturing, but in Germany it derives from a crucial role of High Tech Manufacturing while Italy and Japan have the highest levels of Low Tech Manufacturing[26].

[26]One of the factors explaining Germany?s quick rebound from the crisis consists in its superior technological performance which was able to enhance non-price competitiveness (Storm and Naastepad, 2015).

Figure 11: **ITA** - "beta" estimates (Employment and GDP), 20 year windows, $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$



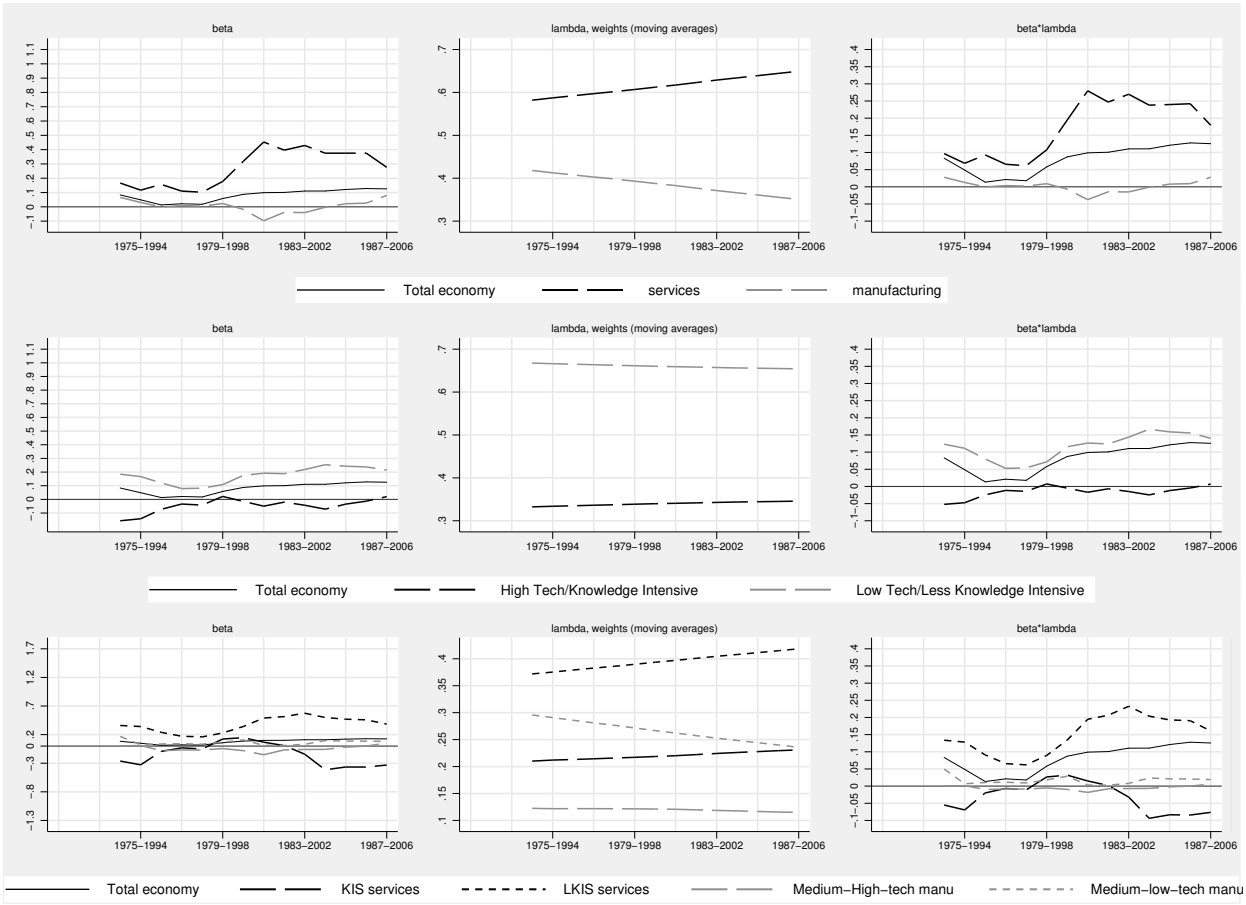
Source: own calculation on KLEMS and, for employment rate, OECD data. See footnotes in the text for details.

In Japan the share of High Tech Manufacturing is quite relevant, but it seems not to be able to create jobs: at the end of the period the β of High Tech Manufacturing is 0.05 for Japan and 0.257 for Germany. Moreover, Italy presents the highest share of LKIS and the second lowest share of High Tech Man (after Denmark, which in turn has an high rate of KIS).

Recent literature (OECD, 1996; Boix and Trullen, 2007; Compagnucci and Cusinato, 2014; Meliciani and Savona, 2015; Foray, 2004) suggests that after the ICT revolution and, more generally, within the so-called knowledge economy, we should adopt a technology/knowledge intensity classification. Broadberry (1995) suggests that choosing between craft flexible production technologies and standardised mass production inevitably entails long term differences in productivity levels as well as in human capital externalities, based on their different requirements related, for instance, to management and research skills. This approach ultimately allows us considering both manufacturing and services sectors. In fact, as noted by Desmarchelier et al. (2011), even though knowledge intensive services can be considered crucial for the economic growth and a substitute for the material capital accumulation, this latter still represents a relevant factor of economic growth. Focusing on the central graph of Figures 5 to 10, we can identify a common feature among Denmark, Germany, UK and US: 40 percent out of total output is provided by the knowledge/technology intensive sector. This percentage is quite lower (nearly 30%) in the cases of Italy and Japan.

Even though Japanese and Italian paths are similar to the German ones, they differ under a "quality" point of view. However the previous sections highlighted a major difference: at the end of the considered period in Germany labour utilization is around 750 hours per year, while in Japan and Italy around 850. In face of a decrease of the labour

Figure 12: **JPN** - "beta" estimates (Employment and GDP), 20 year windows, $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$



Source: own calculation on KLEMS and, for employment rate, OECD data. See footnotes in the text for details.

necessary for manufacturing, Germany drastically reduced the hours of each single worker, supporting a common trend of mean and median income.

So far, three countries are intensive in services and in knowledge intensive sectors. These countries outperformed (in terms of responsiveness to the business cycle, but also in terms of GDP per head growth); two countries are relatively more intense in manufactoring (and agriculture) and less in knowledge intensive sector. Germany, which stands in between (intensive both in manufacturing and in knowledge/technology intensive sector) is outperforming all the countries of the sample, but US.

To complete the analysis, we try to disentangle the importance of knowledge intensity in classical production. Large part of the literature attributes to automatization (especially in manufacturing) the cause of "Jobless Growth". Capital intensive production, in fact, requires less labour and the structural change to new production technology is leading to a loss of jobs even in presence of economic growth (in absence of economic spill-over). Moreover, as pointed out in Brynjolfsson and McAfee (2014, p. 64), increasing inequality is mainly driven by "skill-biased technical change" which favors people with more human capital. In other words, the technological revolution, due to ICT, was neither labour augmenting nor labour saving per se, but labour saving de facto because not every person in the economy was able to deal with it. This assumption is supported by the sustained growth of college graduates relative wages with respect to their share in the labour force which increased drastically since the 1980s. As Brynjolfsson and McAfee (2014) point out, this could have happened because the demand for graduates increased even faster than the offer in some countries (excluding Italy, for example, where unemployment is high even among graduates).

All countries have the LKIS share ranging between 35 to 40 percent of GDP per head, with similar trends among countries. Moreover, as estimates for LKIS services are similar, the overall effect of an output increase of 1 percent of this sector has similar effect on occupation in each country, except for Japan. As discussed in section 4, Japan retained high employment rates and did not reduced significantly the number of hour worked. These findings, along with those previously discussed, suggest that to keep employment while facing extreme growth in productivity, the Japanese economy dislocated large parts of workers possessing less human capital to LKIS services (as other countries did) to almost non-productive jobs. This implies that a 1% increase in the output of this sector in Japan has great consequences on employment because it requires large amount of labour force. This is also what mainly differentiate stagnation in Italy and in Japan. Japanese economy kept high levels of employment and considerable amount of hours worked (while decreasing) by sustaining non-productive jobs (productivity growth has been eroded by non-productive workers); by not being able to increase its productivity, Italy dramatically shifted its economy to LKIS services with much less positive effect on occupation.

Leading economies show a common feature. KIS services became (or already was) the second sector in each country, while in Italy and Japan it follows ML manufactoring, representing the third sector. This is in line with the fact that the former countries showed sustained GDP per head growth, while the latter were in stagnation. Nonetheless, it must be underlined that only in the US, KIS shows a substantial positive relation with the long run business cycle. Elsewhere the effect of a growth in KIS output on employment was much lower than that of LKIS. This evidence is in line with the proposed idea that technological revolution due to ICT outside US is labour saving de facto, meaning increased productivity (and output) in the KIS service had negligible effects on the rest of the economy.

This mechanism ended up by increasing inequality in the US since income of college graduates increased while all those referred to all other workers did not, as pointed out by Brynjolfsson and McAfee (2014). Nonetheless, throughout the market, higher income caused higher consumption also of goods produced in other sectors. This situation did not happen in those countries where flatter salaries were observed. Labour saving technological progress has put pressure on labour markets. The US economy deals with it by "leaving behind" those who were not able to catch up to progress. This can be very harmful in terms of social inequalities, considering that the US are far from the kingdom of meritocracy: as it is known (Pistolesi 2009), the level of education of the children is strongly linked to that of the parents; to be left behind would be mainly those citizens with access constraints to tertiary education. European countries (Denmark and Germany), starting from lower level of inequality tried to keep an equilibrium by reducing the amount of work without reducing average income. Japan (which anticipated other countries by a decade) adopted a completely different solution by "choosing to give up" GDP per head growth to sustain work.

7. Final remarks: options for future research

In this paper we study the relationship between GDP (per head) growth and labour "required" by that growth, at the times of the fourth industrial revolution, when facing manufacturing very high productivity growth, in the context of the structural change towards a service economy.

We merge the approaches of "Jobless Growth", "Jobless Recovery" and "Great Decoupling" in order to understand the data and interpret the long run pattern of several economies in this transition phase.

Considering data on worked hours (total and per worker), labour utilization, employment rate, productivity, GDP per head, mean income, median income, and by performing a sectoral analysis on the relation between GDP and employment rates, it is possible to make an initial interpretation: Japan seems to have anticipated other countries in terms of reduced amount of work (and incomes) due to high levels of productivity, also as a result of investments in robotics. Japan's crisis may have been magnified by a transition towards Less Knowledge Intensive Services. The other countries are now facing the same technological circumstances, but with different patterns. In the US, the exponential growth of the services sector (in particular knowledge intensive) has partially counterbalanced the decline in the "amount of jobs", but a crucial role was played by financial and real estate service industries: has the development of these "bogus" sectors reverberated in the bubbles and the subsequent crisis? Only the UK shows a still growing β for the whole economy: structural change is enhancing KIS sectors and high tech manufacturing has high employment intensity, worked hours are slowing reducing and there are sizeable differences between mean and median income.

Germany and Denmark reacted by redistributing work (those who works, work less) and income in order to support aggregate demand, but they follow a different pattern with a tendency towards High Tech Manufacturing (Germany)

and Knowledge Intensive Services (Denmark). Italy seems to be left at the mercy of economic fluctuation, with an excessive number of hours worked by each worker and with a dangerous tendency to try to recover through the jobs of Less-Knowledge-Intensive Services branches[27].

The stories of the different patterns provide insight: in order to produce the same amount of goods, less labour is required, but "less work" could be dangerous, as it could have a negative impact on employment rates, salaries and income distribution. This implies that public intervention is needed so that technological improvements can improve the quality of life (also reducing the time spent at work). Conversely, if the phenomenon is not managed, imbalances and inequalities can prevail, reflecting also in a slump in aggregate demand.

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[27] Storm and Naastepad (2015, p 21) point out: "While in the new international division of labour, Eurozone countries have to specialize in medium- and high-tech (knowledge-intensive) manufacturing (and services), basically competing on technological competences, this strategy is going to generate additional unemployment. One way to solve this conundrum is having low-wage low-productive minijobs as in Germany's sheltered sector, or as in the U.S. But this will imply greater inequality and more working poor - in short, greater social and political instability and vulnerability. The other -royal -road to go would be to redistribute working time in the core itself, reducing full-time working jobs and/or earlier (not later) retirement. If at all possible, it would involve a grand social compromise - and commitment to a broad-based accessible educational system (as the German apprenticeship one)".

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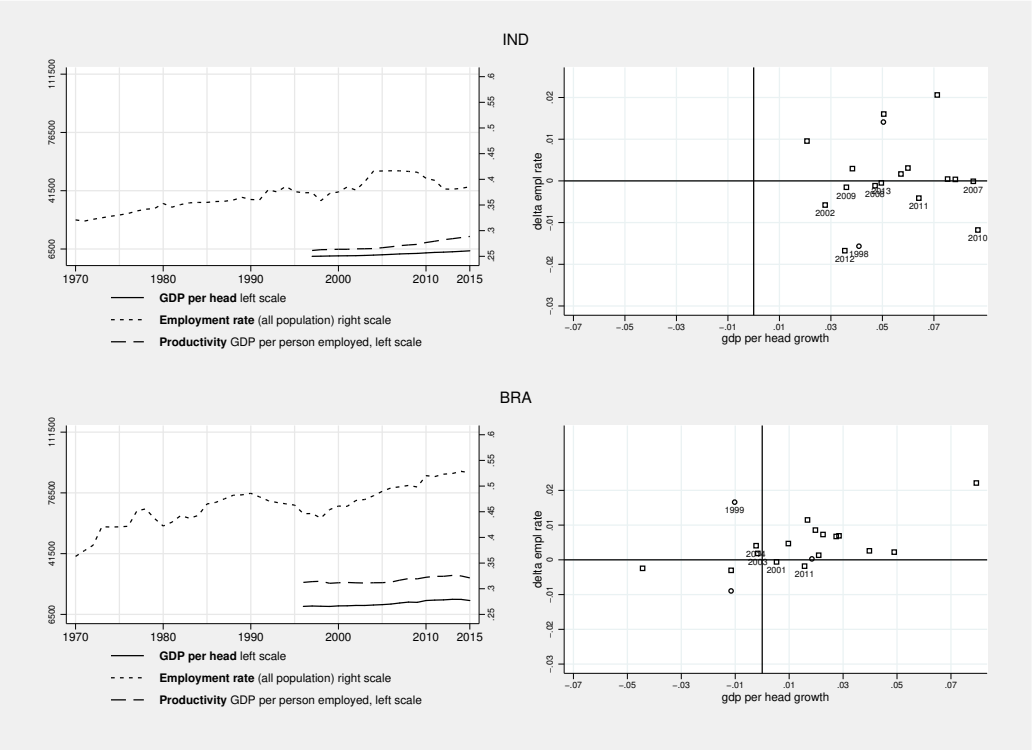
AppendixA. GDP and labour trends(4)



GDP: USD, const. prices, 2010 PPPs
Source: own calculation on OECD Compendium of Productivity Indicators and OECD Productivity Database.
http://www.oecd.org/std/productivity-stats/oecd-compendium-of-productivity-indicators-22252126.htm; http://www.oecd.org/std/productivity-stats/; http://stats.oecd.org

AppendixB. Detailed results of regressions

Table B.2: Total Economy. Regressions details $\Delta e_t = \alpha + \beta \Delta y_t + \epsilon_t$); Δe_t:
change in the employment rate for the whole population; Δy_t: real output per head growth. Our computation on OECD data (http://stats.oecd.org).
Robust standard errors.

	United States				United Kingdom				Germany				Denmark			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	0.220	0.036	6.047	0.000	0.132	0.053	2.491	0.023	0.162	0.071	2.287	0.035	0.219	0.029	7.602	0.000
1972-1991	0.240	0.038	6.351	0.000	0.168	0.057	2.928	0.009	0.173	0.071	2.456	0.024	0.227	0.029	7.699	0.000
1973-1992	0.241	0.039	6.261	0.000	0.186	0.058	3.206	0.005	0.209	0.072	2.891	0.010	0.224	0.031	7.178	0.000
1974-1993	0.243	0.040	6.065	0.000	0.193	0.066	2.943	0.009	0.237	0.063	3.751	0.001	0.239	0.034	6.951	0.000
1975-1994	0.274	0.032	8.633	0.000	0.236	0.065	3.597	0.002	0.230	0.064	3.589	0.002	0.249	0.035	7.202	0.000
1976-1995	0.263	0.032	8.148	0.000	0.266	0.071	3.723	0.002	0.204	0.068	3.016	0.007	0.261	0.040	6.488	0.000
1977-1996	0.261	0.034	7.617	0.000	0.269	0.071	3.800	0.001	0.265	0.036	7.400	0.000	0.278	0.043	6.515	0.000
1978-1997	0.253	0.034	7.420	0.000	0.273	0.071	3.852	0.001	0.282	0.030	9.380	0.000	0.279	0.042	6.598	0.000
1979-1998	0.231	0.033	6.987	0.000	0.282	0.073	3.894	0.001	0.285	0.029	9.752	0.000	0.278	0.042	6.643	0.000
1980-1999	0.225	0.034	6.566	0.000	0.286	0.074	3.884	0.001	0.291	0.030	9.708	0.000	0.281	0.043	6.574	0.000
1981-2000	0.244	0.036	6.736	0.000	0.353	0.052	6.735	0.000	0.315	0.030	10.323	0.000	0.288	0.047	6.064	0.000
1982-2001	0.248	0.034	7.221	0.000	0.323	0.065	5.002	0.000	0.328	0.033	10.018	0.000	0.260	0.057	4.549	0.000
1983-2002	0.295	0.027	10.932	0.000	0.313	0.069	4.544	0.000	0.331	0.033	10.089	0.000	0.262	0.052	5.088	0.000
1984-2003	0.307	0.024	12.617	0.000	0.341	0.060	5.663	0.000	0.323	0.026	12.355	0.000	0.274	0.047	5.783	0.000
1985-2004	0.305	0.038	8.013	0.000	0.346	0.057	6.099	0.000	0.326	0.027	12.300	0.000	0.267	0.053	5.031	0.000
1986-2005	0.305	0.041	7.494	0.000	0.357	0.055	6.444	0.000	0.319	0.026	12.386	0.000	0.247	0.054	4.609	0.000
1987-2006	0.294	0.043	6.754	0.000	0.359	0.056	6.428	0.000	0.295	0.029	10.245	0.000	0.240	0.057	4.193	0.001
1988-2007	0.272	0.046	5.868	0.000	0.384	0.055	7.009	0.000	0.310	0.028	10.946	0.000	0.227	0.066	3.425	0.003
1989-2008	0.256	0.040	6.454	0.000	0.275	0.110	2.502	0.022	0.308	0.030	10.359	0.000	0.172	0.079	2.191	0.042
1990-2009	0.318	0.047	6.749	0.000	0.212	0.051	4.118	0.001	0.152	0.085	1.790	0.090	0.236	0.047	4.976	0.000
1991-2010	0.319	0.044	7.311	0.000	0.217	0.054	3.987	0.001	0.128	0.077	1.658	0.115	0.234	0.046	5.093	0.000
1992-2011	0.314	0.053	5.909	0.000	0.180	0.033	5.453	0.000	0.120	0.076	1.582	0.131	0.233	0.047	4.994	0.000
1993-2012	0.319	0.056	5.728	0.000	0.156	0.027	5.766	0.000	0.114	0.068	1.678	0.111	0.238	0.044	5.397	0.000
1994-2013	0.316	0.058	5.442	0.000	0.161	0.026	6.113	0.000	0.086	0.052	1.651	0.116	0.228	0.049	4.681	0.000
1995-2014	0.314	0.061	5.117	0.000	0.173	0.024	7.222	0.000	0.090	0.053	1.717	0.103	0.230	0.056	4.077	0.001
1996-2015	0.316	0.062	5.129	0.000	0.172	0.025	6.934	0.000	0.092	0.053	1.732	0.100	0.234	0.057	4.100	0.001

Table B.3: Total Economy. Regressions details $\Delta e_t = \alpha + \beta \Delta y_t + \epsilon_t$); Δe_t:
change in the employment rate for the whole population; Δy_t: real output per head growth. Our computation on OECD data (http://stats.oecd.org).
Robust standard errors.

	Japan				Italy				France				Spain			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	0.098	0.045	2.184	0.042	0.051	0.012	4.327	0.000	0.109	0.021	5.260	0.000	0.238	0.069	3.457	0.003
1972-1991	0.090	0.050	1.775	0.093	0.037	0.018	2.002	0.061	0.120	0.017	7.003	0.000	0.239	0.072	3.312	0.004
1973-1992	0.101	0.046	2.220	0.040	0.048	0.018	2.592	0.018	0.133	0.018	7.275	0.000	0.309	0.070	4.411	0.000
1974-1993	0.100	0.043	2.324	0.032	0.093	0.042	2.217	0.040	0.153	0.017	8.982	0.000	0.373	0.047	8.015	0.000
1975-1994	0.051	0.038	1.340	0.197	0.094	0.042	2.225	0.039	0.157	0.018	8.585	0.000	0.404	0.037	10.919	0.000
1976-1995	0.033	0.030	1.090	0.290	0.111	0.060	1.843	0.082	0.162	0.023	6.920	0.000	0.422	0.039	10.737	0.000
1977-1996	0.034	0.030	1.128	0.274	0.139	0.068	2.041	0.056	0.163	0.027	6.000	0.000	0.426	0.037	11.649	0.000
1978-1997	0.030	0.029	1.035	0.314	0.138	0.068	2.015	0.059	0.163	0.029	5.602	0.000	0.437	0.037	11.787	0.000
1979-1998	0.077	0.039	1.981	0.063	0.135	0.070	1.934	0.069	0.194	0.035	5.475	0.000	0.445	0.040	11.093	0.000
1980-1999	0.103	0.038	2.686	0.015	0.164	0.084	1.939	0.068	0.227	0.048	4.768	0.000	0.483	0.050	9.684	0.000
1981-2000	0.105	0.037	2.806	0.012	0.178	0.081	2.183	0.042	0.249	0.051	4.876	0.000	0.474	0.040	11.796	0.000
1982-2001	0.110	0.035	3.101	0.006	0.171	0.093	1.847	0.081	0.240	0.053	4.549	0.000	0.489	0.050	9.818	0.000
1983-2002	0.121	0.034	3.515	0.002	0.129	0.112	1.149	0.265	0.234	0.051	4.591	0.000	0.472	0.051	9.191	0.000
1984-2003	0.120	0.033	3.581	0.002	0.096	0.105	0.914	0.373	0.230	0.048	4.751	0.000	0.447	0.052	8.574	0.000
1985-2004	0.126	0.035	3.612	0.002	0.114	0.100	1.138	0.270	0.219	0.047	4.701	0.000	0.404	0.050	8.055	0.000
1986-2005	0.146	0.035	4.173	0.001	0.115	0.094	1.227	0.236	0.212	0.046	4.590	0.000	0.376	0.055	6.804	0.000
1987-2006	0.146	0.036	4.080	0.001	0.116	0.097	1.199	0.246	0.212	0.047	4.527	0.000	0.375	0.058	6.518	0.000
1988-2007	0.154	0.038	4.027	0.001	0.129	0.099	1.300	0.210	0.212	0.048	4.428	0.000	0.391	0.060	6.546	0.000
1989-2008	0.187	0.030	6.192	0.000	0.144	0.085	1.696	0.107	0.236	0.038	6.215	0.000	0.433	0.040	10.752	0.000
1990-2009	0.160	0.030	5.344	0.000	0.160	0.036	4.445	0.000	0.209	0.035	5.971	0.000	0.526	0.036	14.711	0.000
1991-2010	0.122	0.039	3.144	0.006	0.151	0.036	4.200	0.001	0.211	0.037	5.679	0.000	0.532	0.032	16.488	0.000
1992-2011	0.101	0.032	3.136	0.006	0.146	0.036	4.074	0.001	0.210	0.037	5.708	0.000	0.535	0.030	18.052	0.000
1993-2012	0.105	0.031	3.419	0.003	0.138	0.033	4.202	0.001	0.205	0.032	6.423	0.000	0.515	0.035	14.816	0.000
1994-2013	0.112	0.032	3.498	0.003	0.141	0.033	4.255	0.000	0.192	0.028	6.799	0.000	0.512	0.035	14.428	0.000
1995-2014	0.107	0.033	3.278	0.004	0.160	0.029	5.579	0.000	0.194	0.028	6.962	0.000	0.520	0.036	14.477	0.000
1996-2015	0.107	0.035	3.049	0.007	0.178	0.025	7.144	0.000	0.194	0.029	6.685	0.000	0.522	0.035	14.732	0.000

Table B.4: Total Economy. Regressions details $\Delta e_t = \alpha + \beta \Delta y_t + \epsilon_t$); Δe_t:
change in the employment rate for the whole population; Δy_t: real output per head growth. Our computation on OECD data (http://stats.oecd.org).
Robust standard errors.

	Chile				Hungary				China			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990									-0.020	0.013	-1.574	0.133
1972-1991									-0.025	0.014	-1.810	0.087
1973-1992									-0.042	0.018	-2.278	0.035
1974-1993									-0.052	0.020	-2.587	0.019
1975-1994									-0.065	0.025	-2.645	0.016
1976-1995									-0.068	0.025	-2.743	0.013
1977-1996									-0.097	0.027	-3.619	0.002
1978-1997									-0.098	0.028	-3.509	0.003
1979-1998									-0.096	0.029	-3.368	0.003
1980-1999									-0.089	0.030	-2.995	0.008
1981-2000									-0.080	0.031	-2.571	0.019
1982-2001									-0.054	0.028	-1.899	0.074
1983-2002									-0.048	0.031	-1.549	0.139
1984-2003									-0.050	0.032	-1.553	0.138
1985-2004									-0.074	0.025	-2.954	0.008
1986-2005									-0.090	0.019	-4.664	0.000
1987-2006	0.099	0.045	2.214	0.040					-0.087	0.019	-4.618	0.000
1988-2007	0.098	0.045	2.165	0.044					-0.081	0.019	-4.288	0.000
1989-2008	0.085	0.046	1.828	0.084					-0.083	0.020	-4.067	0.001
1990-2009	0.089	0.041	2.148	0.046					-0.060	0.020	-2.957	0.008
1991-2010	0.096	0.046	2.087	0.051					-0.031	0.007	-4.448	0.000
1992-2011	0.109	0.051	2.147	0.046	0.248	0.117	2.108	0.049	-0.034	0.006	-5.290	0.000
1993-2012	0.116	0.069	1.677	0.111	0.138	0.056	2.479	0.023	-0.030	0.008	-3.632	0.002
1994-2013	0.096	0.074	1.294	0.212	0.100	0.032	3.144	0.006	-0.026	0.010	-2.706	0.014
1995-2014	0.099	0.074	1.348	0.194	0.130	0.041	3.171	0.005	-0.019	0.010	-1.930	0.070
1996-2015	0.167	0.057	2.948	0.009	0.117	0.037	3.190	0.005				

AppendixC. Detailed results of regressions, sectoral analysis

Table C.5: United States. Regressions details. Sectoral analysis. Our computation on KLEMS and OECD data. Robust standard errors.

(a) Strategy I: $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$; β_i: responsiveness of the employment rate (all population) to sector i's output per head growth; $\lambda_{i,t} = \frac{Y_{i,t}}{Y_t}$: weight of sector i; ΔY_i: real output per head growth in sector i

					Model 1								Model 2							
	Total Economy				Manufacturing				Services				High Tech/Knowledge Intensive				Low Tech/Less Know. Intensive			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1978-1997	0.233	0.036	6.443	0.000	0.223	0.081	2.748	0.014	0.263	0.124	2.128	0.048	0.369	0.155	2.375	0.030	0.183	0.058	3.166	0.006
1979-1998	0.216	0.037	5.894	0.000	0.228	0.088	2.595	0.019	0.205	0.126	1.622	0.123	0.318	0.169	1.875	0.078	0.169	0.061	2.763	0.013
1980-1999	0.207	0.037	5.552	0.000	0.260	0.095	2.750	0.014	0.136	0.125	1.083	0.294	0.320	0.165	1.935	0.070	0.151	0.060	2.498	0.023
1981-2000	0.228	0.040	5.750	0.000	0.320	0.092	3.472	0.003	0.114	0.118	0.969	0.346	0.290	0.102	2.830	0.012	0.184	0.057	3.214	0.005
1982-2001	0.235	0.039	6.069	0.000	0.314	0.072	4.352	0.000	0.128	0.114	1.126	0.276	0.304	0.087	3.506	0.003	0.186	0.058	3.215	0.005
1983-2002	0.280	0.036	7.768	0.000	0.336	0.075	4.464	0.000	0.196	0.099	1.978	0.064	0.323	0.094	3.432	0.003	0.236	0.063	3.767	0.002
1984-2003	0.302	0.028	10.772	0.000	0.334	0.075	4.469	0.000	0.207	0.103	2.006	0.061	0.312	0.092	3.386	0.004	0.247	0.063	3.954	0.001
1985-2004	0.276	0.041	6.788	0.000	0.275	0.083	3.326	0.004	0.198	0.104	1.900	0.074	0.312	0.084	3.722	0.002	0.188	0.068	2.777	0.013
1986-2005	0.283	0.045	6.303	0.000	0.268	0.084	3.177	0.006	0.206	0.099	2.094	0.052	0.320	0.080	3.980	0.001	0.176	0.077	2.288	0.035
1987-2006	0.280	0.045	6.207	0.000	0.297	0.083	3.588	0.002	0.183	0.096	1.910	0.073	0.326	0.068	4.814	0.000	0.171	0.072	2.359	0.031
1988-2007	0.267	0.045	5.917	0.000	0.228	0.061	3.747	0.002	0.240	0.081	2.972	0.009	0.279	0.049	5.709	0.000	0.199	0.066	3.001	0.008

(b) Strategy II: $\Delta e_t = \alpha + \beta_i \lambda_{i,t} \Delta Y_{i,t} + \beta_{ot}(1 - \lambda_{i,t}) \Delta Y_{ot,t} + \epsilon_t$; ot stands for "all the other sectors of the economy"; i= Knowledge Intensive Services (lkis), Less Knowledge Intensive Services (kis), Medium-High Tech Manufacturing (mh), Medium-Low Tech manufacturing (ml) (plus construction and agricolture)

	Knowledge Intensive Services				Less Knowledge Intensive Services				Medium-High Tech Manufacturing				Low-tech manufacturing			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1978-1997	0.806	0.184	4.386	0.000	0.097	0.096	1.008	0.328	-0.079	0.224	-0.354	0.728	0.393	0.135	2.920	0.010
1979-1998	0.738	0.171	4.322	0.000	0.060	0.093	0.647	0.526	-0.057	0.217	-0.262	0.797	0.411	0.130	3.157	0.006
1980-1999	0.667	0.196	3.409	0.003	0.011	0.083	0.133	0.896	0.009	0.208	0.042	0.967	0.420	0.121	3.467	0.003
1981-2000	0.529	0.178	2.972	0.009	0.039	0.081	0.487	0.633	0.179	0.154	1.160	0.262	0.400	0.114	3.522	0.003
1982-2001	0.538	0.184	2.928	0.009	0.057	0.086	0.664	0.516	0.259	0.141	1.839	0.083	0.396	0.114	3.492	0.003
1983-2002	0.581	0.204	2.852	0.011	0.130	0.088	1.478	0.158	0.274	0.136	2.007	0.061	0.435	0.111	3.923	0.001
1984-2003	0.520	0.202	2.570	0.020	0.152	0.104	1.460	0.163	0.300	0.137	2.193	0.043	0.425	0.111	3.842	0.001
1985-2004	0.547	0.198	2.768	0.013	0.126	0.107	1.179	0.255	0.286	0.147	1.951	0.068	0.309	0.124	2.487	0.024
1986-2005	0.530	0.180	2.952	0.009	0.127	0.108	1.174	0.256	0.316	0.176	1.795	0.090	0.290	0.173	1.679	0.111
1987-2006	0.525	0.172	3.052	0.007	0.103	0.101	1.025	0.320	0.424	0.153	2.763	0.013	0.246	0.164	1.498	0.152
1988-2007	0.398	0.141	2.834	0.011	0.195	0.099	1.977	0.065	0.344	0.133	2.580	0.019	0.122	0.153	0.797	0.437

Table C.6: United Kingdom. Regressions details. Sectoral analysis. Our computation on KLEMS and OECD data. Robust standard errors.

(a) Strategy I: $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$; β_i: responsiveness of the employment rate (all population) to sector i's output per head growth; $\lambda_{i,t} = \frac{Y_{i,t}}{Y_t}$: weight of sector i; ΔY_i: real output per head growth in sector i

					Model 1								Model 2							
	Total Economy				Manufacturing				Services				High Tech/Knowledge Intensive				Low Tech/Less Know. Intensive			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	0.186	0.060	3.122	0.006	0.189	0.081	2.325	0.033	0.258	0.174	1.479	0.157	0.633	0.280	2.264	0.037	0.068	0.056	1.222	0.238
1972-1991	0.209	0.065	3.201	0.005	0.219	0.094	2.326	0.033	0.267	0.176	1.517	0.148	0.541	0.297	1.822	0.086	0.116	0.081	1.436	0.169
1973-1992	0.222	0.067	3.331	0.004	0.216	0.096	2.248	0.038	0.314	0.176	1.787	0.092	0.606	0.298	2.034	0.058	0.110	0.082	1.343	0.197
1974-1993	0.222	0.073	3.024	0.007	0.243	0.131	1.855	0.081	0.250	0.196	1.274	0.220	0.790	0.332	2.379	0.029	0.102	0.083	1.224	0.238
1975-1994	0.236	0.078	3.018	0.007	0.258	0.138	1.869	0.079	0.253	0.202	1.250	0.228	0.734	0.420	1.747	0.099	0.110	0.124	0.882	0.390
1976-1995	0.257	0.090	2.853	0.011	0.323	0.201	1.604	0.127	0.182	0.220	0.826	0.420	0.656	0.494	1.327	0.202	0.144	0.180	0.801	0.434
1977-1996	0.257	0.092	2.800	0.012	0.325	0.196	1.660	0.115	0.177	0.200	0.882	0.390	0.612	0.474	1.289	0.215	0.148	0.183	0.808	0.430
1978-1997	0.262	0.092	2.836	0.011	0.304	0.212	1.432	0.170	0.227	0.245	0.927	0.367	0.606	0.471	1.285	0.216	0.156	0.177	0.878	0.392
1979-1998	0.264	0.093	2.846	0.011	0.312	0.198	1.571	0.135	0.209	0.198	1.058	0.305	0.643	0.491	1.309	0.208	0.142	0.177	0.806	0.432
1980-1999	0.264	0.093	2.852	0.011	0.309	0.195	1.587	0.131	0.220	0.178	1.233	0.234	0.700	0.479	1.460	0.162	0.132	0.167	0.792	0.439
1981-2000	0.387	0.052	7.487	0.000	0.564	0.123	4.583	0.000	0.266	0.138	1.927	0.071	0.891	0.362	2.460	0.025	0.254	0.110	2.312	0.034
1982-2001	0.382	0.085	4.514	0.000	0.537	0.120	4.496	0.000	0.277	0.143	1.936	0.070	0.924	0.423	2.184	0.043	0.259	0.107	2.430	0.026
1983-2002	0.351	0.091	3.858	0.001	0.605	0.114	5.316	0.000	0.157	0.116	1.354	0.194	0.757	0.485	1.560	0.137	0.281	0.103	2.721	0.015
1984-2003	0.360	0.090	4.004	0.001	0.624	0.115	5.432	0.000	0.141	0.113	1.251	0.228	0.575	0.435	1.323	0.203	0.299	0.099	3.035	0.007
1985-2004	0.366	0.087	4.224	0.001	0.596	0.119	5.022	0.000	0.184	0.130	1.411	0.176	0.945	0.335	2.821	0.012	0.256	0.088	2.921	0.010
1986-2005	0.382	0.083	4.612	0.000	0.613	0.124	4.947	0.000	0.178	0.128	1.386	0.184	0.963	0.343	2.809	0.012	0.257	0.087	2.961	0.009
1987-2006	0.382	0.083	4.601	0.000	0.635	0.122	5.222	0.000	0.182	0.127	1.431	0.171	0.898	0.302	2.971	0.009	0.289	0.078	3.720	0.002
1988-2007	0.393	0.088	4.482	0.000	0.691	0.142	4.860	0.000	0.165	0.123	1.345	0.196	0.769	0.296	2.601	0.019	0.295	0.079	3.752	0.002

(b) Strategy II: $\Delta e_t = \alpha + \beta_i \lambda_{i,t} \Delta Y_{i,t} + \beta_{ot}(1 - \lambda_{i,t}) \Delta Y_{ot,t} + \epsilon_t$; ot stands for "all the other sectors of the economy"; i= Knowledge Intensive Services (lkis), Less Knowledge Intensive Services (kis), Medium-High Tech Manufacturing (mh), Low-tech manufacturing (ml) (plus construction and agricolture)

	Knowledge Intensive Services				Less Knowledge Intensive Services				Medium-High Tech Manufacturing				Medium-Low Tech manufacturing			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	0.324	0.405	0.800	0.435	0.231	0.146	1.587	0.131	0.964	0.296	3.253	0.005	-0.077	0.099	-0.784	0.444
1972-1991	0.117	0.468	0.250	0.805	0.285	0.151	1.887	0.076	1.041	0.293	3.549	0.002	-0.040	0.109	-0.369	0.717
1973-1992	0.248	0.480	0.517	0.612	0.300	0.150	2.004	0.061	1.108	0.302	3.673	0.002	-0.061	0.107	-0.567	0.578
1974-1993	0.279	0.510	0.548	0.591	0.267	0.221	1.211	0.243	1.310	0.273	4.794	0.000	-0.016	0.137	-0.115	0.910
1975-1994	0.202	0.526	0.383	0.706	0.313	0.224	1.398	0.180	1.421	0.365	3.899	0.001	0.037	0.167	0.220	0.828
1976-1995	-0.177	0.545	-0.325	0.749	0.279	0.209	1.333	0.200	1.442	0.361	3.997	0.001	0.087	0.261	0.333	0.743
1977-1996	-0.176	0.488	-0.361	0.723	0.281	0.234	1.198	0.247	1.440	0.352	4.090	0.001	0.119	0.254	0.467	0.646
1978-1997	-0.208	0.556	-0.375	0.712	0.319	0.247	1.291	0.214	1.424	0.331	4.308	0.000	0.089	0.251	0.355	0.727
1979-1998	-0.209	0.561	-0.373	0.714	0.286	0.202	1.411	0.176	1.509	0.323	4.669	0.000	0.136	0.247	0.548	0.591
1980-1999	-0.221	0.545	-0.405	0.690	0.291	0.176	1.653	0.117	1.730	0.244	7.098	0.000	0.127	0.237	0.535	0.599
1981-2000	0.054	0.512	0.105	0.918	0.284	0.130	2.179	0.044	1.649	0.226	7.289	0.000	0.518	0.193	2.678	0.016
1982-2001	0.015	0.558	0.028	0.978	0.292	0.138	2.115	0.049	1.576	0.311	5.068	0.000	0.500	0.184	2.719	0.015
1983-2002	0.008	0.426	0.018	0.986	0.218	0.108	2.020	0.059	1.168	0.400	2.921	0.010	0.731	0.159	4.606	0.000
1984-2003	-0.048	0.365	-0.130	0.898	0.219	0.108	2.028	0.058	1.159	0.372	3.116	0.006	0.778	0.169	4.608	0.000
1985-2004	0.145	0.411	0.353	0.729	0.231	0.111	2.092	0.052	1.093	0.403	2.713	0.015	0.711	0.162	4.382	0.000
1986-2005	0.148	0.408	0.363	0.721	0.247	0.106	2.333	0.032	1.125	0.404	2.784	0.013	0.724	0.177	4.098	0.001
1987-2006	0.202	0.435	0.465	0.648	0.234	0.105	2.231	0.039	1.116	0.430	2.593	0.019	0.744	0.171	4.345	0.000
1988-2007	0.118	0.416	0.285	0.779	0.230	0.111	2.075	0.053	1.138	0.424	2.686	0.016	0.866	0.224	3.869	0.001

Table C.7: Germany. Regressions details. Sectoral analysis. Our computation on KLEMS and OECD data. Robust standard errors.

(a) Strategy I: $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$; β_i: responsiveness of the employment rate (all population) to sector i's output per head growth; $\lambda_{i,t} = \frac{Y_{i,t}}{Y_t}$: weight of sector i; ΔY_i: real output per head growth in sector i

					Model 1								Model 2							
	Total Economy				Manufacturing				Services				High Tech/Knowledge Intensive				Low Tech/Less Know. Intensive			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	0.162	0.065	2.505	0.022	0.045	0.045	0.999	0.332	0.175	0.135	1.290	0.214	-0.002	0.155	-0.012	0.990	0.059	0.041	1.438	0.169
1972-1991	0.170	0.065	2.624	0.017	0.045	0.043	1.038	0.314	0.231	0.101	2.275	0.036	-0.049	0.153	-0.320	0.753	0.071	0.041	1.718	0.104
1973-1992	0.199	0.065	3.084	0.006	0.051	0.046	1.111	0.282	0.239	0.112	2.122	0.049	0.082	0.213	0.386	0.704	0.057	0.046	1.237	0.233
1974-1993	0.230	0.057	4.005	0.001	0.080	0.060	1.339	0.198	0.275	0.123	2.236	0.039	0.264	0.181	1.456	0.164	0.056	0.047	1.194	0.249
1975-1994	0.224	0.058	3.875	0.001	0.076	0.058	1.298	0.212	0.285	0.119	2.385	0.029	0.301	0.185	1.621	0.123	0.048	0.045	1.048	0.309
1976-1995	0.200	0.064	3.104	0.006	0.053	0.060	0.888	0.387	0.260	0.110	2.366	0.030	0.303	0.181	1.676	0.112	0.023	0.043	0.539	0.597
1977-1996	0.259	0.038	6.866	0.000	0.074	0.065	1.138	0.271	0.275	0.100	2.749	0.014	0.497	0.099	5.026	0.000	0.022	0.043	0.504	0.621
1978-1997	0.274	0.033	8.286	0.000	0.070	0.066	1.058	0.305	0.287	0.100	2.877	0.010	0.507	0.103	4.929	0.000	0.017	0.043	0.382	0.707
1979-1998	0.272	0.032	8.483	0.000	0.073	0.067	1.096	0.288	0.305	0.098	3.097	0.007	0.504	0.101	4.994	0.000	0.019	0.045	0.412	0.685
1980-1999	0.274	0.033	8.234	0.000	0.075	0.086	0.869	0.397	0.298	0.097	3.080	0.007	0.510	0.097	5.262	0.000	0.027	0.054	0.497	0.626
1981-2000	0.299	0.033	9.124	0.000	0.066	0.085	0.774	0.449	0.359	0.103	3.495	0.003	0.579	0.105	5.504	0.000	0.022	0.053	0.421	0.679
1982-2001	0.309	0.035	8.778	0.000	0.066	0.097	0.674	0.510	0.368	0.103	3.588	0.002	0.606	0.114	5.333	0.000	0.007	0.052	0.137	0.892
1983-2002	0.325	0.033	9.845	0.000	0.074	0.109	0.677	0.508	0.454	0.113	4.030	0.001	0.579	0.109	5.329	0.000	0.012	0.063	0.187	0.854
1984-2003	0.323	0.027	12.106	0.000	0.076	0.109	0.694	0.497	0.443	0.089	4.987	0.000	0.602	0.113	5.320	0.000	0.009	0.061	0.151	0.882
1985-2004	0.328	0.026	12.601	0.000	0.080	0.110	0.727	0.477	0.416	0.086	4.817	0.000	0.594	0.111	5.334	0.000	0.009	0.062	0.145	0.886
1986-2005	0.322	0.025	12.644	0.000	0.074	0.108	0.684	0.503	0.419	0.084	4.982	0.000	0.658	0.151	4.366	0.000	0.003	0.057	0.054	0.957
1987-2006	0.311	0.026	11.795	0.000	0.063	0.100	0.635	0.534	0.413	0.084	4.915	0.000	0.576	0.123	4.686	0.000	-0.010	0.052	-0.186	0.855
1988-2007	0.334	0.026	12.826	0.000	0.339	0.077	4.394	0.000	0.418	0.042	9.869	0.000	0.237	0.121	1.956	0.067	0.464	0.096	4.810	0.000

(b) Strategy II: $\Delta e_t = \alpha + \beta_i \lambda_{i,t} \Delta Y_{i,t} + \beta_{ot}(1 - \lambda_{i,t}) \Delta Y_{ot,t} + \epsilon_t$; ot stands for "all the other sectors of the economy"; i= Knowledge Intensive Services (lkis), Less Knowledge Intensive Services (kis), Medium-High Tech Manufacturing (mh), Medium-Low Tech manufacturing (ml) (plus construction and agricolture)

	Knowledge Intensive Services				Less Knowledge Intensive Services				Medium-High Tech Manufacturing				Low-tech manufacturing			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	-0.367	0.201	-1.826	0.085	0.436	0.116	3.762	0.002	0.149	0.247	0.606	0.553	0.027	0.056	0.487	0.633
1972-1991	-0.334	0.206	-1.621	0.123	0.386	0.080	4.811	0.000	0.076	0.246	0.310	0.760	0.027	0.053	0.499	0.624
1973-1992	-0.502	0.262	-1.915	0.072	0.374	0.084	4.429	0.000	0.260	0.314	0.827	0.420	0.027	0.057	0.473	0.642
1974-1993	-0.354	0.267	-1.330	0.201	0.397	0.109	3.630	0.002	0.417	0.202	2.064	0.055	0.045	0.071	0.642	0.530
1975-1994	-0.205	0.301	-0.680	0.505	0.391	0.110	3.538	0.003	0.434	0.201	2.153	0.046	0.042	0.068	0.612	0.548
1976-1995	-0.060	0.381	-0.158	0.876	0.333	0.108	3.094	0.007	0.422	0.199	2.118	0.049	0.018	0.066	0.279	0.784
1977-1996	0.016	0.303	0.054	0.958	0.340	0.105	3.234	0.005	0.608	0.108	5.601	0.000	0.034	0.070	0.486	0.633
1978-1997	0.065	0.319	0.203	0.842	0.353	0.104	3.392	0.003	0.593	0.111	5.370	0.000	0.026	0.070	0.379	0.710
1979-1998	0.044	0.355	0.124	0.903	0.366	0.101	3.610	0.002	0.605	0.116	5.210	0.000	0.026	0.072	0.368	0.717
1980-1999	0.098	0.415	0.236	0.816	0.356	0.107	3.317	0.004	0.576	0.117	4.905	0.000	0.029	0.091	0.313	0.758
1981-2000	-0.025	0.409	-0.062	0.951	0.438	0.113	3.891	0.001	0.640	0.120	5.325	0.000	-0.011	0.073	-0.158	0.877
1982-2001	0.177	0.433	0.407	0.689	0.436	0.116	3.773	0.002	0.633	0.122	5.189	0.000	-0.015	0.081	-0.188	0.853
1983-2002	-0.072	0.436	-0.166	0.870	0.499	0.116	4.293	0.000	0.642	0.121	5.315	0.000	-0.008	0.093	-0.087	0.931
1984-2003	0.253	0.361	0.700	0.494	0.512	0.116	4.401	0.000	0.605	0.125	4.857	0.000	-0.004	0.096	-0.037	0.971
1985-2004	0.254	0.354	0.718	0.483	0.480	0.107	4.500	0.000	0.586	0.124	4.723	0.000	0.000	0.097	0.001	0.999
1986-2005	0.248	0.322	0.770	0.452	0.497	0.106	4.666	0.000	0.593	0.146	4.072	0.001	-0.000	0.097	-0.000	1.000
1987-2006	0.197	0.313	0.628	0.538	0.511	0.108	4.736	0.000	0.618	0.129	4.787	0.000	-0.038	0.074	-0.518	0.611
1988-2007	0.403	0.146	2.768	0.013	0.454	0.066	6.891	0.000	0.257	0.131	1.956	0.067	0.300	0.152	1.972	0.065

Table C.8: Denmark. Regressions details. Sectoral analysis. Our computation on KLEMS and OECD data. Robust standard errors.

(a) Strategy *I*: $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$; β_i: responsiveness of the employment rate (all population) to sector i's output per head growth; $\lambda_{i,t} = \frac{Y_{i,t}}{Y_t}$: weight of sector i; ΔY_i: real output per head growth in sector i

					Model 1								Model 2							
	Total Economy				Manufacturing				Services				High Tech/Knowledge Intensive				Low Tech/Less Know. Intensive			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	0.236	0.031	7.531	0.000	0.243	0.055	4.452	0.000	0.212	0.039	5.464	0.000	-0.083	0.116	-0.716	0.484	0.256	0.028	9.016	0.000
1972-1991	0.256	0.033	7.849	0.000	0.284	0.048	5.868	0.000	0.202	0.040	5.022	0.000	0.042	0.114	0.374	0.713	0.268	0.030	8.881	0.000
1973-1992	0.257	0.035	7.253	0.000	0.285	0.058	4.917	0.000	0.201	0.038	5.248	0.000	0.069	0.126	0.543	0.594	0.263	0.034	7.662	0.000
1974-1993	0.273	0.040	6.846	0.000	0.298	0.062	4.770	0.000	0.214	0.051	4.199	0.001	0.154	0.154	0.997	0.333	0.272	0.040	6.726	0.000
1975-1994	0.287	0.041	7.020	0.000	0.317	0.054	5.918	0.000	0.240	0.055	4.366	0.000	0.135	0.146	0.924	0.368	0.300	0.040	7.532	0.000
1976-1995	0.311	0.042	7.334	0.000	0.315	0.057	5.558	0.000	0.249	0.057	4.345	0.000	0.127	0.147	0.864	0.400	0.311	0.047	6.594	0.000
1977-1996	0.333	0.048	6.954	0.000	0.317	0.055	5.732	0.000	0.299	0.082	3.667	0.002	0.117	0.146	0.801	0.434	0.326	0.055	5.981	0.000
1978-1997	0.334	0.048	6.980	0.000	0.316	0.054	5.865	0.000	0.300	0.082	3.670	0.002	0.119	0.153	0.776	0.449	0.326	0.054	6.000	0.000
1979-1998	0.326	0.049	6.635	0.000	0.317	0.053	6.008	0.000	0.295	0.084	3.529	0.003	0.109	0.155	0.702	0.492	0.327	0.054	6.098	0.000
1980-1999	0.342	0.052	6.607	0.000	0.308	0.053	5.841	0.000	0.358	0.077	4.676	0.000	0.186	0.177	1.050	0.309	0.309	0.053	5.842	0.000
1981-2000	0.317	0.058	5.445	0.000	0.280	0.059	4.752	0.000	0.137	0.182	0.752	0.462	0.144	0.201	0.715	0.484	0.234	0.067	3.508	0.003
1982-2001	0.281	0.072	3.916	0.001	0.268	0.077	3.488	0.003	0.135	0.183	0.739	0.470	0.163	0.211	0.772	0.451	0.224	0.095	2.366	0.030
1983-2002	0.290	0.069	4.192	0.001	0.270	0.076	3.533	0.003	0.132	0.180	0.731	0.475	0.150	0.243	0.617	0.545	0.226	0.090	2.494	0.023
1984-2003	0.305	0.066	4.581	0.000	0.291	0.079	3.671	0.002	0.117	0.193	0.608	0.551	0.148	0.247	0.600	0.556	0.236	0.091	2.588	0.019
1985-2004	0.316	0.078	4.044	0.001	0.260	0.094	2.760	0.013	0.138	0.188	0.736	0.472	0.173	0.268	0.646	0.527	0.214	0.092	2.334	0.032
1986-2005	0.281	0.080	3.498	0.003	0.283	0.091	3.103	0.006	0.065	0.168	0.389	0.702	0.159	0.266	0.596	0.559	0.208	0.091	2.295	0.035
1987-2006	0.271	0.076	3.578	0.002	0.205	0.065	3.139	0.006	0.179	0.157	1.140	0.270	0.317	0.268	1.186	0.252	0.159	0.081	1.969	0.065
1988-2007	0.281	0.079	3.560	0.002	0.184	0.074	2.490	0.023	0.257	0.180	1.428	0.172	0.486	0.247	1.962	0.066	0.158	0.087	1.813	0.087

(b) Strategy *II*: $\Delta e_t = \alpha + \beta_i \lambda_{i,t} \Delta Y_{i,t} + \beta_{ot}(1 - \lambda_{i,t}) \Delta Y_{ot,t} + \epsilon_t$; *ot* stands for "all the other sectors of the economy"; *i*= Knowledge Intensive Services (lkis), Less Knowledge Intensive Services (kis), Medium-High Tech Manufacturing (mh), Medium-Low Tech manufacturing (ml) (plus construction and agricolture)

	Knowledge Intensive Services				Less Knowledge Intensive Services				Medium-High Tech Manufacturing				Low-tech manufacturing			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	-0.002	0.126	-0.016	0.988	0.256	0.048	5.335	0.000	-0.126	0.244	-0.514	0.614	0.274	0.062	4.444	0.000
1972-1991	0.019	0.124	0.153	0.880	0.240	0.048	4.964	0.000	0.132	0.209	0.633	0.535	0.313	0.054	5.764	0.000
1973-1992	0.048	0.137	0.349	0.732	0.236	0.044	5.316	0.000	0.157	0.221	0.713	0.485	0.314	0.063	4.968	0.000
1974-1993	0.134	0.170	0.788	0.442	0.248	0.059	4.228	0.001	0.248	0.227	1.093	0.290	0.325	0.071	4.584	0.000
1975-1994	0.154	0.167	0.919	0.371	0.283	0.059	4.786	0.000	0.171	0.163	1.048	0.309	0.351	0.067	5.195	0.000
1976-1995	0.190	0.176	1.079	0.296	0.296	0.059	5.002	0.000	0.094	0.178	0.525	0.606	0.357	0.072	4.940	0.000
1977-1996	0.215	0.201	1.069	0.300	0.340	0.070	4.836	0.000	-0.046	0.199	-0.233	0.819	0.362	0.071	5.068	0.000
1978-1997	0.214	0.202	1.063	0.303	0.342	0.071	4.850	0.000	-0.052	0.221	-0.233	0.818	0.361	0.071	5.092	0.000
1979-1998	0.196	0.222	0.880	0.391	0.340	0.073	4.665	0.000	-0.040	0.230	-0.173	0.865	0.362	0.069	5.260	0.000
1980-1999	0.346	0.268	1.292	0.214	0.350	0.073	4.789	0.000	-0.074	0.239	-0.311	0.759	0.345	0.070	4.929	0.000
1981-2000	0.282	0.279	1.011	0.326	0.138	0.150	0.916	0.372	-0.028	0.286	-0.098	0.923	0.354	0.069	5.115	0.000
1982-2001	0.256	0.287	0.893	0.384	0.147	0.164	0.897	0.382	0.100	0.280	0.358	0.725	0.315	0.102	3.096	0.007
1983-2002	0.247	0.317	0.777	0.448	0.155	0.145	1.073	0.298	0.105	0.267	0.392	0.700	0.318	0.104	3.070	0.007
1984-2003	0.198	0.322	0.615	0.547	0.162	0.152	1.070	0.300	0.147	0.272	0.538	0.598	0.339	0.108	3.140	0.006
1985-2004	0.184	0.335	0.547	0.591	0.177	0.139	1.273	0.220	0.195	0.283	0.689	0.500	0.282	0.140	2.011	0.060
1986-2005	0.013	0.299	0.044	0.966	0.157	0.129	1.217	0.240	0.353	0.285	1.238	0.232	0.281	0.143	1.960	0.067
1987-2006	0.040	0.292	0.137	0.892	0.220	0.129	1.703	0.107	0.585	0.222	2.631	0.018	0.086	0.100	0.859	0.402
1988-2007	0.101	0.307	0.328	0.747	0.256	0.145	1.760	0.096	0.685	0.221	3.099	0.007	0.019	0.119	0.162	0.873

Table C.9: Italy. Regressions details. Sectoral analysis. Our computation on KLEMS and OECD data. Robust standard errors.

(a) Strategy I: $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$; β_i: responsiveness of the employment rate (all population) to sector i's output per head growth; $\lambda_{i,t} = \frac{Y_{i,t}}{Y_t}$: weight of sector i; ΔY_i: real output per head growth in sector i

					Model 1								Model 2							
	Total Economy				Manufacturing				Services				High Tech/Knowledge Intensive				Low Tech/Less Know. Intensive			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	0.052	0.011	4.762	0.000	0.138	0.029	4.766	0.000	-0.019	0.035	-0.538	0.597	-0.045	0.048	-0.940	0.361	0.130	0.022	5.838	0.000
1972-1991	0.037	0.018	2.092	0.051	0.126	0.043	2.943	0.009	-0.036	0.057	-0.635	0.534	-0.067	0.059	-1.130	0.274	0.125	0.030	4.147	0.001
1973-1992	0.047	0.018	2.666	0.016	0.093	0.044	2.112	0.050	0.029	0.055	0.530	0.603	-0.026	0.056	-0.466	0.647	0.113	0.031	3.639	0.002
1974-1993	0.089	0.039	2.265	0.036	0.184	0.078	2.355	0.031	0.041	0.053	0.784	0.444	-0.019	0.065	-0.296	0.771	0.178	0.068	2.628	0.018
1975-1994	0.090	0.040	2.235	0.038	0.146	0.094	1.551	0.139	0.093	0.084	1.106	0.284	-0.006	0.071	-0.092	0.928	0.176	0.070	2.518	0.022
1976-1995	0.108	0.060	1.818	0.086	0.153	0.100	1.527	0.145	0.151	0.114	1.321	0.204	0.071	0.087	0.815	0.426	0.173	0.080	2.173	0.044
1977-1996	0.125	0.067	1.873	0.077	0.141	0.100	1.405	0.178	0.161	0.124	1.298	0.212	0.088	0.094	0.936	0.363	0.158	0.079	2.005	0.061
1978-1997	0.124	0.066	1.865	0.079	0.142	0.099	1.425	0.172	0.157	0.126	1.246	0.230	0.092	0.087	1.057	0.305	0.155	0.083	1.871	0.079
1979-1998	0.119	0.067	1.775	0.093	0.129	0.101	1.271	0.221	0.165	0.130	1.272	0.221	0.081	0.084	0.965	0.348	0.152	0.085	1.784	0.092
1980-1999	0.145	0.084	1.735	0.100	0.145	0.126	1.154	0.265	0.187	0.133	1.411	0.176	0.082	0.086	0.956	0.353	0.186	0.105	1.779	0.093
1981-2000	0.160	0.084	1.902	0.073	0.028	0.202	0.140	0.890	0.305	0.136	2.239	0.039	0.087	0.101	0.853	0.405	0.209	0.112	1.864	0.080
1982-2001	0.155	0.094	1.646	0.117	-0.023	0.205	-0.112	0.912	0.350	0.143	2.452	0.025	0.049	0.140	0.349	0.731	0.226	0.117	1.937	0.070
1983-2002	0.123	0.109	1.122	0.277	-0.047	0.231	-0.204	0.841	0.343	0.145	2.359	0.031	-0.010	0.153	-0.063	0.951	0.245	0.132	1.855	0.081
1984-2003	0.083	0.098	0.846	0.408	-0.091	0.234	-0.390	0.702	0.312	0.153	2.034	0.058	-0.043	0.146	-0.298	0.770	0.210	0.137	1.531	0.144
1985-2004	0.101	0.095	1.061	0.303	-0.174	0.244	-0.715	0.484	0.402	0.110	3.640	0.002	-0.020	0.183	-0.107	0.916	0.205	0.136	1.507	0.150
1986-2005	0.102	0.088	1.157	0.263	-0.176	0.242	-0.727	0.477	0.404	0.109	3.717	0.002	-0.026	0.184	-0.141	0.890	0.203	0.125	1.624	0.123
1987-2006	0.103	0.091	1.141	0.269	-0.118	0.255	-0.463	0.649	0.361	0.122	2.959	0.009	-0.032	0.322	-0.098	0.923	0.195	0.153	1.273	0.220
1988-2007	0.117	0.094	1.246	0.229	-0.097	0.264	-0.369	0.717	0.367	0.124	2.952	0.009	0.012	0.303	0.039	0.970	0.202	0.145	1.392	0.182

(b) Strategy II: $\Delta e_t = \alpha + \beta_i \lambda_{i,t} \Delta Y_{i,t} + \beta_{ot}(1 - \lambda_{i,t}) \Delta Y_{ot,t} + \epsilon_t$; ot stands for "all the other sectors of the economy"; i= Knowledge Intensive Services (lkis), Less Knowledge Intensive Services (kis), Medium-High Tech Manufacturing (mh), Medium-Low Tech manufacturing (l) (plus construction and agricolture)

	Knowledge Intensive Services				Less Knowledge Intensive Services				Medium-High Tech Manufacturing				Low-tech manufacturing			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1971-1990	-0.092	0.064	-1.440	0.168	0.077	0.047	1.626	0.122	-0.137	0.111	-1.236	0.233	0.198	0.043	4.595	0.000
1972-1991	-0.068	0.091	-0.746	0.466	0.023	0.081	0.282	0.782	-0.235	0.145	-1.625	0.123	0.210	0.057	3.677	0.002
1973-1992	0.007	0.091	0.082	0.936	0.054	0.082	0.655	0.521	-0.182	0.133	-1.368	0.189	0.168	0.048	3.479	0.003
1974-1993	-0.019	0.112	-0.171	0.866	0.050	0.136	0.365	0.719	-0.201	0.147	-1.363	0.191	0.291	0.115	2.531	0.022
1975-1994	0.072	0.159	0.451	0.658	0.057	0.151	0.380	0.708	-0.302	0.194	-1.556	0.138	0.283	0.114	2.486	0.024
1976-1995	0.202	0.139	1.453	0.165	0.064	0.155	0.409	0.687	-0.284	0.192	-1.484	0.156	0.285	0.115	2.476	0.024
1977-1996	0.224	0.142	1.580	0.133	0.072	0.172	0.420	0.680	-0.422	0.350	-1.205	0.245	0.256	0.110	2.322	0.033
1978-1997	0.221	0.138	1.606	0.127	0.054	0.199	0.274	0.787	-0.493	0.398	-1.239	0.232	0.248	0.110	2.260	0.037
1979-1998	0.211	0.140	1.506	0.150	0.060	0.208	0.288	0.776	-0.548	0.382	-1.432	0.170	0.238	0.110	2.159	0.045
1980-1999	0.229	0.150	1.531	0.144	0.110	0.226	0.489	0.631	-0.569	0.352	-1.617	0.124	0.289	0.134	2.153	0.046
1981-2000	0.308	0.189	1.625	0.122	0.213	0.179	1.188	0.251	-0.543	0.317	-1.713	0.105	0.286	0.264	1.081	0.295
1982-2001	0.367	0.220	1.669	0.113	0.257	0.183	1.403	0.179	-0.706	0.301	-2.347	0.031	0.270	0.277	0.975	0.343
1983-2002	0.302	0.234	1.290	0.214	0.285	0.191	1.493	0.154	-0.770	0.288	-2.671	0.016	0.285	0.300	0.952	0.354
1984-2003	0.254	0.242	1.051	0.308	0.255	0.192	1.329	0.201	-0.855	0.266	-3.217	0.005	0.217	0.301	0.722	0.480
1985-2004	0.402	0.257	1.564	0.136	0.260	0.153	1.695	0.108	-0.800	0.301	-2.660	0.017	0.065	0.401	0.163	0.872
1986-2005	0.401	0.255	1.570	0.135	0.259	0.148	1.746	0.099	-0.839	0.310	-2.711	0.015	0.070	0.412	0.169	0.868
1987-2006	0.581	0.314	1.850	0.082	0.202	0.155	1.307	0.209	-0.661	0.412	-1.604	0.127	0.070	0.487	0.143	0.888
1988-2007	0.558	0.317	1.763	0.096	0.219	0.152	1.444	0.167	-0.602	0.427	-1.410	0.177	0.081	0.471	0.172	0.865

Table C.10: Japan. Regressions details. Sectoral analysis. Our computation on KLEMS and OECD data. Robust standard errors.

(a) Strategy I: $\Delta e_t = \alpha + \sum_i \beta_i \lambda_{i,t} \Delta Y_{i,t} + \epsilon_t$; β_i: responsiveness of the employment rate (all population) to sector i's output per head growth; $\lambda_{i,t} = \frac{Y_{i,t}}{Y_t}$: weight of sector i; ΔY_i: real output per head growth in sector i

					Model 1								Model 2							
	Total Economy				Manufacturing				Services				High Tech/Knowledge Intensive				Low Tech/Less Know. Intensive			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1974-1993	0.083	0.040	2.097	0.050	0.066	0.060	1.091	0.290	0.166	0.108	1.532	0.144	-0.157	0.064	-2.466	0.025	0.184	0.029	6.315	0.000
1975-1994	0.049	0.038	1.297	0.211	0.031	0.059	0.519	0.610	0.117	0.110	1.057	0.305	-0.142	0.067	-2.119	0.049	0.167	0.058	2.873	0.011
1976-1995	0.013	0.024	0.564	0.580	-0.000	0.051	-0.006	0.995	0.157	0.112	1.403	0.179	-0.073	0.052	-1.415	0.175	0.121	0.050	2.427	0.027
1977-1996	0.021	0.024	0.892	0.384	0.009	0.052	0.165	0.871	0.110	0.109	1.007	0.328	-0.034	0.068	-0.499	0.624	0.079	0.059	1.337	0.199
1978-1997	0.018	0.023	0.758	0.458	0.005	0.060	0.081	0.937	0.102	0.122	0.835	0.415	-0.042	0.073	-0.573	0.574	0.082	0.064	1.274	0.220
1979-1998	0.058	0.037	1.583	0.131	0.023	0.063	0.366	0.719	0.178	0.132	1.344	0.197	0.022	0.108	0.200	0.844	0.108	0.081	1.342	0.197
1980-1999	0.087	0.038	2.272	0.036	-0.018	0.069	-0.254	0.803	0.318	0.150	2.120	0.049	-0.015	0.107	-0.137	0.893	0.175	0.087	2.025	0.059
1981-2000	0.099	0.038	2.590	0.018	-0.097	0.065	-1.493	0.154	0.453	0.146	3.099	0.007	-0.049	0.140	-0.352	0.729	0.192	0.096	1.996	0.062
1982-2001	0.101	0.034	2.926	0.009	-0.039	0.069	-0.560	0.583	0.396	0.140	2.832	0.011	-0.020	0.136	-0.148	0.884	0.188	0.103	1.831	0.085
1983-2002	0.110	0.034	3.278	0.004	-0.040	0.067	-0.598	0.558	0.429	0.135	3.185	0.005	-0.043	0.133	-0.323	0.751	0.219	0.097	2.251	0.038
1984-2003	0.111	0.033	3.340	0.004	-0.003	0.061	-0.055	0.957	0.375	0.127	2.948	0.009	-0.072	0.107	-0.666	0.514	0.254	0.072	3.551	0.002
1985-2004	0.121	0.033	3.620	0.002	0.022	0.063	0.345	0.734	0.375	0.120	3.114	0.006	-0.035	0.103	-0.336	0.741	0.243	0.074	3.266	0.005
1986-2005	0.128	0.035	3.680	0.002	0.026	0.066	0.388	0.703	0.376	0.125	3.016	0.008	-0.013	0.102	-0.129	0.899	0.238	0.077	3.086	0.007
1987-2006	0.126	0.035	3.603	0.002	0.080	0.058	1.361	0.191	0.276	0.115	2.406	0.028	0.020	0.098	0.202	0.842	0.215	0.077	2.779	0.013

(b) Strategy II: $\Delta e_t = \alpha + \beta_i \lambda_{i,t} \Delta Y_{i,t} + \beta_{ot}(1 - \lambda_{i,t}) \Delta Y_{ot,t} + \epsilon_t$; ot stands for "all the other sectors of the economy"; i= Knowledge Intensive Services (lkis), Less Knowledge Intensive Services (kis), Medium-High Tech Manufacturing (mh), Medium-Low Tech Manufacturing (ml) (plus construction and agricolture)

	Knowledge Intensive Services				Less Knowledge Intensive Services				Medium-High Tech Manufacturing				Low-tech manufacturing			
period	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**	**beta**	**s.e.**	**t**	**p>|t|**
1974-1993	-0.262	0.128	-2.057	0.055	0.360	0.138	2.611	0.018	0.002	0.081	0.030	0.976	0.168	0.121	1.396	0.181
1975-1994	-0.327	0.112	-2.919	0.010	0.342	0.143	2.383	0.029	0.010	0.079	0.124	0.903	0.024	0.155	0.153	0.880
1976-1995	-0.093	0.155	-0.603	0.555	0.240	0.125	1.924	0.071	-0.081	0.028	-2.885	0.010	0.037	0.139	0.262	0.796
1977-1996	-0.031	0.149	-0.210	0.836	0.171	0.136	1.257	0.226	-0.068	0.054	-1.268	0.222	0.040	0.139	0.289	0.776
1978-1997	-0.052	0.159	-0.324	0.750	0.160	0.139	1.151	0.266	-0.070	0.054	-1.294	0.213	0.034	0.152	0.221	0.828
1979-1998	0.123	0.257	0.479	0.638	0.229	0.167	1.370	0.189	-0.044	0.057	-0.760	0.458	0.066	0.158	0.418	0.681
1980-1999	0.146	0.379	0.386	0.704	0.341	0.157	2.178	0.044	-0.080	0.055	-1.450	0.165	0.108	0.160	0.676	0.508
1981-2000	0.068	0.378	0.180	0.859	0.490	0.140	3.507	0.003	-0.152	0.111	-1.370	0.189	0.012	0.204	0.057	0.955
1982-2001	0.008	0.408	0.021	0.984	0.515	0.136	3.780	0.001	-0.066	0.120	-0.552	0.588	0.010	0.205	0.051	0.960
1983-2002	-0.142	0.405	-0.351	0.730	0.575	0.126	4.544	0.000	-0.060	0.116	-0.515	0.613	0.031	0.223	0.141	0.890
1984-2003	-0.415	0.329	-1.259	0.225	0.500	0.127	3.939	0.001	-0.057	0.103	-0.557	0.585	0.095	0.233	0.409	0.687
1985-2004	-0.367	0.401	-0.914	0.373	0.469	0.127	3.692	0.002	-0.018	0.098	-0.187	0.854	0.087	0.219	0.395	0.697
1986-2005	-0.367	0.393	-0.935	0.363	0.459	0.128	3.575	0.002	-0.001	0.113	-0.006	0.995	0.086	0.208	0.415	0.683
1987-2006	-0.332	0.322	-1.028	0.318	0.384	0.131	2.928	0.009	0.053	0.108	0.492	0.629	0.081	0.206	0.393	0.699