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Extending the Kuznets Curve[1]

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Resum. Les darreres dècades s'han caracteritzat per un intens augment de les desigualtats salarials a nivell mundial. Aquest article allarga la hipòtesi clàssica de la Corba de Kuznets per cobrir les economies post-industrials i tractar d'explicar aquest fenomen. Segons la hipòtesi de la Corba de Kuznets Allargada, les desigualtats salarials podrien evolucionar segons una corba en forma d'N. La U-inverida d'aquesta corba seria deguda al procés de canvi estructural que acompanya a un procés de industrialització. I l'extrem dret de la mateixa, associada al creixement explosiu de la formació de capital humà en les economies modernes i post-industrials. En aquest sentit, els principals candidats per explicar el recent augment de les desigualtats: el canvi tècnic esbiaixat a favor del treball qualificat, la globalització (comerç i migracions) i els factors institucionals, estarien ja incorporats en l'evolució de la composició de la força de treball en termes de qualificacions. La limitada evidència empírica sobre aquest tema, tendeix a donar suport a la Corba de Kuznets Allargada.

Abstract. Recent decades have been characterized by a steep increase in wage inequality globally. In order to explain this phenomenon, this paper extends the classic Kuznets Curve to include post-industrial economies. According to this Extended Kuznets Curve (EKC) hypothesis, wage inequality may follow an N-curve. If the inverted U-shape of the EKC is attributable to the structural changes associated with industrialization, its right-hand side reflects the boom in human capital formation registered in modern and post-industrial economies. Thus, the main candidates to explain the recent upsurge in wage inequality, namely skill-biased technical change, globalisation and institutional factors, may be embodied in the evolution of the skill composition of the labour force. The available empirical evidence, albeit limited, tends to support the EKC hypothesis.

1.- Introduction

OECD economies have experienced a well-documented increase in wage inequality over the last few decades. This trend has attracted the attention of public opinion and has been a frequent object of study in the economic literature. Against this background, this paper seeks to update the classic Kuznets hypothesis of income distribution and extend it to account for the evolution in wage inequality in developed economies today.

Simon Kuznets' (1955) article, one of the most influential in economics, proposed a distributional hypothesis to account for the evolution in income inequality as a society advanced from an agricultural economy to one based on industry and service provision. In so doing he was acutely aware of the problems of his age; however, since the mid-1950s, societies have changed beyond recognition making the Kuznets Curve an old-fashioned instrument for analysing present-day economies.

The model presented here is based on the hypothesis proposed by Kuznets (1955), albeit limited to the study of wage inequality, extending the original theory to include the post-industrial period. The predictions of this new model are that, following the inverted-U curve described by Kuznets, wage inequality is likely to increase on account of one of the most fundamental changes to have been recorded in modern societies: namely, the remarkable boom in human capital formation and the impact this has had on the skill composition of the labour force.

In a similar vein, Conceição and Galbraith (2001) proposed what they referred to as the "augmented Kuznets Curve hypothesis", which predicted that in advanced economies intensively specialised in the production of knowledge goods, inequality would increase because of the monopolistic nature of this kind of industry. This theory was developed from the estimation of a new global dataset (UTIP-UNIDO) showing the evolution in pay inequality in the manufacturing sector. Subsequently, Galbraith (2007) claimed that the increase in pay inequality since the 1980s was a global event driven by global forces: most notably, the onset of economic monetarism.

In the first part of the paper, we develop what we wish to call the "extended Kuznets Curve (EKC) hypothesis", according to which, wage inequality follows an N-curve, whose driving forces are, first, the labour transition towards industry, and,

second, the increasing share of skilled labour. In other words, the composition of the labour force constitutes the main engine driving wage inequality in the long term.

The second part of the paper is devoted to testing this hypothesis. Despite there being a considerable number of papers dealing with wage inequality, most focus on the inequality associated with the skill differentials of the labour force or between economic sectors, or fail to take a sufficiently long-term perspective. These shortcomings are tackled in the present study in which we estimate a new long-term wage inequality series including both inter and intra-sectoral wage differentials for a specific country (Portugal) from the 1920s onwards. The period covered by this series starts when Portugal was a backward agricultural economy, its subsequent industrialization, and concludes with the boom in human capital that characterizes post-industrial economies.

This new Portuguese series shows that inter-sectoral wage inequality was the main driving force behind the country's overall wage inequality while the agrarian sector remained strong. However, with the demise of this sector, the wage inequality between skilled and unskilled workers became the main force behind overall wage inequality. The Portuguese series also shows that the EKC hypothesis fits perfectly well with the trends reported in this inequality. On the basis of this result, future research might usefully extend this analysis to other countries.

The rest of the paper is structured as follows. In the next section, the EKC hypothesis is outlined. The third section reports the data sources and methodology used in estimating the Portuguese wage inequality series. The fourth section describes the historical background and the evolution taken by Portuguese wage inequality. Finally, the last section concludes.

2.- The model

Following Kuznets (1955), we propose a wage inequality scenario with a number of variations that would fit the experience of countries in their transition from an agricultural to a post-industrial economy. The labour force is divided in two economic sectors: agricultural and non-agricultural. In turn, the latter is divided between unskilled and skilled labour. It is assumed that, at the beginning of the process, 80% of the labour force is employed in the agricultural sector and the remaining 20% in the non-agricultural sector and that in each time period, 10% of the labour force moves from the agricultural to the non-agricultural sector. Secondly, it is assumed that, at the

beginning of the process, skilled labour in the non-agricultural sector accounts for just 5% and that this share increases by 5% each period. Thirdly, an assumption is made regarding the average wages of the three groups of workers. Here, two scenarios are defined; in the first, the average wages of skilled, non-agricultural workers are 50% higher than those of unskilled, non-agricultural workers, while the latter are 50% higher than agricultural wages. In the second scenario, the difference between each pair of categories is 100%. In both cases, relative wages (between the different groups) are assumed to be constant over time.

Finally, and in line with Kuznets (1955), three wage dispersion scenarios are assumed to prevail within each group: wages are equal or unequal or wage dispersion is at a medium/normal level. For skilled workers, the wage dispersion at each level is higher than that for unskilled workers, which in turn is higher than that found among agricultural workers. The available empirical evidence lends support to this assumption.[3] Table 1 shows the amount of income pertaining to each decile of the three groups under each of the three scenarios.

Table 1 – Three wage dispersion scenarios for each group											
	Equal				Medium				Unequal		
	Agr	Lunsk	Lsk		Agr	Lunsk	Lsk		Agr	Lunsk	Lsk
d1	10,0	9,0	6,0	d1	9,0	8,0	5,0	d1	8,0	7,0	4,0
d2	10,0	9,2	6,9	d2	9,2	8,4	6,1	d2	8,4	7,7	5,3
d3	10,0	9,4	7,8	d3	9,4	8,9	7,2	d3	8,9	8,3	6,7
d4	10,0	9,7	8,7	d4	9,7	9,3	8,3	d4	9,3	9,0	8,0
d5	10,0	9,9	9,6	d5	9,9	9,8	9,4	d5	9,8	9,7	9,3
d6	10,0	10,1	10,4	d6	10,1	10,2	10,6	d6	10,2	10,3	10,7
d7	10,0	10,3	11,3	d7	10,3	10,7	11,7	d7	10,7	11,0	12,0
d8	10,0	10,6	12,2	d8	10,6	11,1	12,8	d8	11,1	11,7	13,3
d9	10,0	10,8	13,1	d9	10,8	11,6	13,9	d9	11,6	12,3	14,7
d10	10,0	11,0	14,0	d10	11,0	12,0	15,0	d10	12,0	13,0	16,0

Agr: labour in the agricultural sector; Lunsk: unskilled labour in the non-agricultural sectors; Lsk: skilled labour in the non-agricultural sectors.

Source: author's own

Based on this information, the evolution in total wage inequality has been estimated for six different scenarios. Appendix 1 shows the calculations made under these six scenarios.

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[3] See Lemieux (2007), Table 1. The U.S. statistics on wage inequality (1974-2004) show that wage dispersion increases at higher education levels. The Portuguese data also show that wage dispersion increases in more highly skilled occupations.

The evolution in wage inequality from a backward agricultural economy to a modern, post-industrial one under these scenarios, measured with the GE(0) index, is shown in Figure 1 (the specific data can be seen in Appendix 1). The different series show that wage inequality follows an N-curve. More specifically, wage inequality peaks when the agricultural sector employs 20-40% of the labour force, and increases again when the agricultural sector is marginal and 36% of the labour force is employed in the skilled group.

Figure 1 – The evolution in inequality under different scenarios
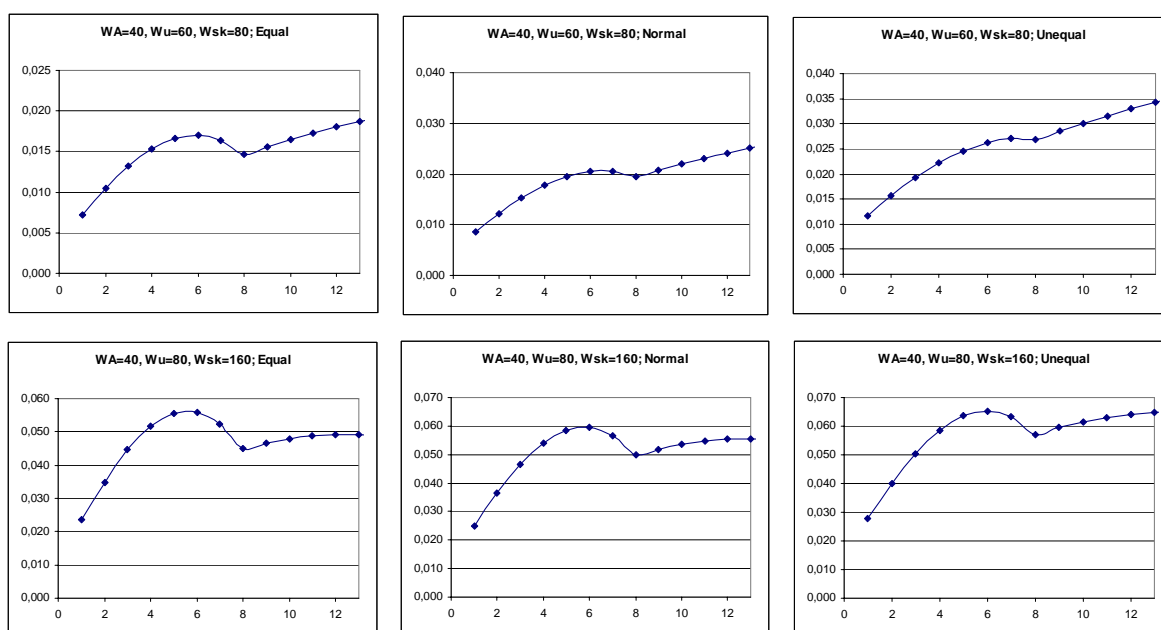
Obviously, this is a somewhat crude and simplistic portrait of reality. Overall, the assumption that the relative wages of the groups and the wage inequality within each remain constant over time is not especially convincing. Despite this, the simulation seeks to extend the *original* Kuznets hypothesis to include post-industrial economies, and the assumption of constant relative wages lies at the heart of the *original* Kuznets curve.

In this context, changes in relative wages may simply serve to magnify the changes in inequality predicted by the EKC. To begin with, the left-hand side of the EKC (i.e. the inverted-U curve) reflects the transition from a labour market dominated by agricultural workers to one dominated by their industrial counterparts. In this context, Lewis' (1954) growth model predicts that, when industrialisation begins, wages are likely to remain constant because there tend to be large labour surpluses in the

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agricultural sector. Thus, agricultural wages may fall behind industrial wages for a while, but once the labour surpluses are exhausted, agricultural wages may converge once more with industrial wages. Notice that these changes in relative wages may first increase and then compress wage inequality, which would reinforce the same effect provoked by the labour transition predicted by the model. In the case of the right-hand side of the EKC where inequality begins to grow, associated with an increasing proportion of skilled workers, there are a number of reasons to believe that this change in the curve may coincide with an increase in the skill premium as well as with wage dispersion among skilled workers.

Conceição and Galbraith (2001), who were the first to broach the subject of an augmented Kuznets curve, divide the economy into three sectors: sector S, producing low-tech services, sector C, producing consumer goods and machinery, and sector K, the most advanced of the three, producing knowledge goods. A post-industrial economy becomes increasingly specialized in sector K, which is monopolistic and highly unequal, while the wages paid are necessarily high because companies have a strong incentive to contract the best talent since "the winner takes all". Accordingly, wage inequality is likely to grow in a post-industrial economy increasingly specialized in Sector K.

Similarly, other authors have considered skill-biased technical change to be the main cause of the recent increase in wage inequality.[4] The argument forwarded is that as technology is complementary to skilled labour, it increases the relative demand for skilled labour and hence its relative wage. By contrast, Lemieux (2008) has pointed out that, in some countries, wage inequality increases are concentrated at the very top of the wage distribution, which would tend to invalidate the technical change argument.

Autor, Katz and Kearney (2006) have improved the traditional distinction between skilled and unskilled workers, by distinguishing between three different groups: skilled workers, skilled workers engaged in routine tasks and unskilled workers engaged in non-routine tasks. According to this classification, skill-biased technical change would have a positive impact on the wages of the first group but not on those of the second. This could help to explain why workers at the top of the distribution have been doing well, whereas those in the middle have been losing ground and converging

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[4] See Acemoglu (2002), Katz and Murphy (1992), Juhn, Murphy and Pierce (1993) and Levy and Murnane (1992)

with unskilled workers, in a scenario of increasing polarization of the labour market. According to Piketty and Saez (2006), rises in top income shares since the 1980s can be attributed basically to several non-economic factors: the invention of new remuneration tools, such as pay-for-performance systems, that generate more dispersion; the increasing power enjoyed by executives to fix their own pay; and changes in the prevailing social norms that have allowed sharp increases in the top wages that previously would have been unthinkable. In addition, liberalization policies in the labour market and the falling rate of unionisation may also have had an impact on wage inequality.[5]

As we have seen, there are many possible causes of increased wage dispersion. However, what they have in common is that they begin to have a noticeable effect once the share of skilled labour becomes significant. This would seem to be a pre-condition for the emergence of sector K in the Conceição and Galbraith model. Furthermore, the macroeconomic impact of skill-biased technical change on wage inequality may also be negligible below a certain threshold of skilled labour.

Finally, the role adopted by the relevant labour market institutions could result in greater pay inequality as the share of skilled labour gains in importance. In an industrial economy, labour force characteristics are largely homogeneous and worker interests largely coincide, both of which favour high rates of unionisation and political demands for a specific type of labour market regulation. The result is a compression in the wage distribution. However, in a post-industrial economy, where there has been remarkable growth in the share of skilled labour, the working classes have become increasingly heterogeneous, promoting the development of conflicting interests. Such a trend obviously hinders collective action as common interests become increasingly hard to define. This in turn erodes labour market institutions and fuels increasing wage inequality. From this perspective, the increasing participation of skilled labour in an economy seems to facilitate institutional changes causing wage inequality to grow.

Blackburn and Prandy (1965) claim that the proximity in relations between white-collar workers and management can lead to a sharing of values and a sense of cultural homogeneity, thereby alienating this group of workers from the trade union movement. This argument would seem to account for the negative impact of white-collar status on unionisation and, by contrast, for the positive correlation between trade

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[5] See Lemieux (2008), Card (1992), Freeman (1993), DiNardo, Fortin and Lemieux (1996) and Autor, Katz and Kearney (2005)

union membership and jobs requiring physical or manual work (Riley, 1997). The emergence of a post-industrial society has been closely associated with the increasing share of skilled, white-collar workers in total employment, which would seem to account for the decline in unionisation.

The EKC hypothesis predicts the evolution in wage distribution as a society evolves from an agrarian-based economy to a post-industrial one solely on the basis of labour movements between sectors. In line with the *original* Kuznets curve, we assume relative wages remain constant. However, as shown above, actual changes in relative wages seem likely to reinforce the predictions of our model.

The next section tests the validity of the EKC hypothesis in the Portuguese case drawing on new evidence for Portuguese wage inequality since 1921.

3.- Data and methodology

The data sources and the methodology used to construct the Portuguese wage database presented in this paper are described in Appendix 2. The database covers all economic sectors. Workers are classified into these economic sectors and, within each sector, most are then classified into skill categories. However, for the agricultural sector there is only one skill category. In the case of the services sector, there is no information until 1950 when the sources begin to provide average wages for the sector. Finally, from 1985 onwards service sector workers are also classified into different skill categories.[6]

The main shortcomings in this new series are concerned with data scarcity. A secondary problem is that the number of sectors and skill groups reported varies over time, resulting in a number of discontinuities that have been overcome by combining them so as to minimize any distortions.[7] In Lains, Gomes and Guilera (2008), a robustness analysis served to confirm that these changes to the data characteristics did not generate distortions.[8]

On the basis of this information the GE(0) index was then calculated. This index was chosen, as opposed to better known indices (such as the Gini coefficient), because

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[6] Lains, Gomes and Guilera (2008) provide a precedent for this estimation for the period 1944-74.
[7] Specifically for the years 1949-50 and 1984-85. See Appendix 2 for details.
[8] See Lains, Gomes and Guilera (2008), p. 16.

it offers certain advantages, not least its potential to be decomposed. The GE(0) index (mean logarithmic deviation) can be defined as:[9]

$$GE(0) = \frac{1}{n} \cdot \sum_i \cdot \log\left(\frac{\mu}{y_i}\right)$$

(1)

where n is the number of individuals in the sample, μ the average wage, and y_i the individual wage.

The GE(0)index can be decomposed as:

$$GE(0) = \sum_k \frac{n_k}{n} \cdot GE(0)_0{}^k + \sum_k \frac{n_k}{n} \cdot \log\left(\frac{\mu}{\mu_k}\right)$$

(2)

where n_k is the number of individuals in sector k and μ_k the average wage of sector k. The first term in the equation is a measure of inequality within each sector, while the second term measures inequality between sectors.

The GE(0) index can be further decomposed to see if the changes in these "between" and "within" coefficients are due to changes in prices or quantities, as:[10]

$$\Delta GE(0) = \sum_k \overline{\left(\frac{n_k}{n}\right)} \cdot \Delta T_0{}^k + \sum_k \overline{GE(0)_0}{}^k \cdot \Delta \frac{n_k}{n} + \sum_k \left(\overline{\left(\frac{\mu_k}{\mu}\right)} \cdot \overline{\left(\log \frac{\mu_k}{\mu}\right)}\right) \cdot \Delta \frac{n_k}{n} + \sum_k \left(\overline{\left(\frac{n_k \cdot \mu_k}{n \cdot \mu}\right)} - \overline{\left(\frac{n_k}{n}\right)}\right) \cdot \Delta \log\left(\frac{\mu_k}{\mu}\right)$$

(3)

where

$$\overline{GE(0)_0}{}^k = \frac{1}{2} \cdot \left(GE(0)_0{}^k(t) + GE(0)_0{}^k(t+1)\right)$$

The first term in the expression represents the impact of changes in within subgroup inequality on total inequality change; the second and third terms indicate the effect of changes in the population shares on the within and between components, respectively; and the last term is the contribution to total inequality change of changes in the relative wage of each sector (i.e. sectoral wage/average wage).

4.- An illustration: the evolution in wage inequality in Portugal throughout the twentieth century.

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[9] The GE(1) index was calculated with similar results. More detailed information on those indices can be found in Mookherjee and Shorrocks (1982).

[10] The original decomposition proposed by Mookherjee and Shorrocks (1982) has been modified in order to improve its potential. More specifically, in the original decomposition, the fourth term contains $\log(\mu)$ and not $\log(\mu_k/\mu)$. The global result does not change, but using the relative wage for each sector instead of the absolute wage enables us to determine the exact contribution of each sector to the yearly change in inequality of the fourth component.

During the twentieth century, Portugal was subject to significant variations in many factors that were closely related to the evolution in its wage distribution. In this section we review the main events of those years and provide a historical context for the analysis of the country's wage inequality trends.

The last century in Portugal was characterized by considerable political unrest. The First World War proved to be a highly destabilizing event and the years that followed the conflict were marked by grave financial problems, social altercations and political instability. The disorder was quashed with the imposition of an authoritarian regime. In 1926, the Republic was overthrown in a military coup that ushered in a dictatorship that would control the country until 1974. This period began fairly "lightly", due to the broad discredit of the previous regime, but the intensity of political repression increased with time as attempts were made to block the reforms demanded by the political opposition. Finally, in 1974 a military coup, followed by a revolutionary process, saw democracy return to Portugal. Later, in 1986, Portugal joined the EEC, and since that date the country has converged in political and institutional terms with the other EU member states.

Table 2 compares Portugal's growth rates with those in the "core" European countries. Between 1913 and 1950, Portugal's per capita income growth rates were around 1.4%, rising during the forties, which permitted a modest convergence with the European core. By contrast, during the "golden age" of capitalism, Portugal grew at a very high pace, rapidly converging with the European core. However, from the time of the democratic transition to membership of the EEC, economic growth became sluggish. Finally, from 1986 to the end of the century, economic growth accelerated and Portugal converged once again with the EU core.

Table 2 - Growth in real income per capita		
	Portugal	European Core
1913-29	1,35	1,39
1929-38	1,28	1,16
1938-50	1,56	1
1950-73	5,47	3,55
1973-86	1,52	2,01
1986-98	3,45	1,88
1913-98	2,79	2,06
European core: unweighted average index for: the UK, France, Belgium, the Netherlands, Germany (West Germany to 1991), Italy, Denmark, Norway, and		

Sweden.
Source: Lains (2003), p.373

The growth experienced led to marked sectoral changes. As can be seen in Table 3, the structure of the active population was altered completely, and from being an agricultural economy at the beginning of the century, Portugal's economy was gradually transformed into an industrial and services oriented economy by the end of the century. However, the take-off phase did not really begin until the second half of the twentieth century.

Table 3 - Labour shares by sectors in Portugal			
	Agriculture (%)	Industry (%)	Services (%)
1900	62,2	18,7	19,1
1910	57,8	21,6	20,5
1920	56,0	20,5	23,4
1930	54,4	19,0	26,6
1940	52,6	21,1	26,3
1950	49,1	24,5	26,4
1960	43,5	28,9	27,5
1970	32,7	33,4	33,9
1981	19,2	38,9	41,9
1991	10,8	37,9	51,3
2001	5,0	35,1	59,9
Sources: Valério (ed.) (2001) for 1900-1991 and INE online statistics for 2001			

A further phenomenon that should be mentioned, given its importance for the evolution in wage inequality, is internal and external migration. Internal migration accelerated in the periods of rapid economic growth and industrialization (during the "golden age", for example), facilitating an elastic supply of unskilled labour. On the other hand, emigration became quite intensive during the sixties. Subsequently, the decolonization of the late sixties and early seventies had a marked impact on Portugal's immigration rates. Thus, a country that had traditionally been a place of emigration became, at the end of the twentieth century, a destination for migration inflows. The intensity of Portugal's integration in international trade also varied greatly, falling between the First World War and the 1930s, since when it has enjoyed constant growth.

Figure 2 shows the evolution in Portugal's wage distribution throughout the twentieth century. Up to 1927 wage inequality fell, before increasing in two stages in

the years leading up to 1959 (between the late twenties and the early thirties, and during the fifties[11]). It then fell markedly until 1981. Over the last 25 years, there has been a slow increase in wage inequality. If we examine the two components making up the GE(0) index, two different patterns emerge. The coefficient measuring inequality between sectors (the between coefficient) increased in step with the GE(0) index from 1927 to 1959, and declined continuously thereafter.[12] On the other hand, the coefficient measuring inequality within sectors (the within coefficient) remained relatively stable between 1944 and 1959, and thereafter assumed a bell-shape until the late seventies, registering a peak of maximum inequality in 1968. The early eighties saw no variation, and from the late eighties onwards the within coefficient has increased steadily. The global picture suggests that while the between coefficient was the driving force behind wage inequality until the eighties, the within component has been driving it since then.
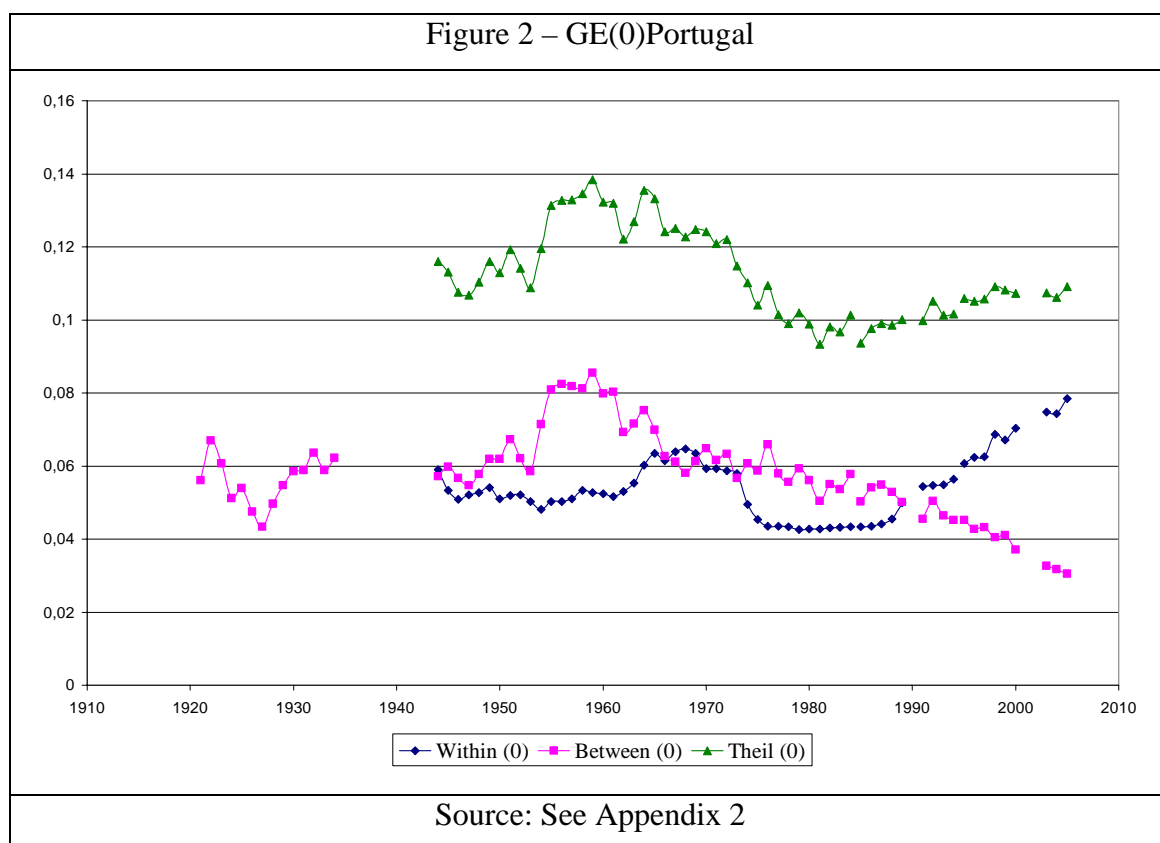
Figure 2 – GE(0)Portugal

Source: See Appendix 2

Equation (3) serves as an excellent guide for understanding the nature of the evolution in the within and between coefficients. As discussed above, the yearly changes in these coefficients can be decomposed into four components. The first indicates the impact of the changes to the within coefficient, considering that the sectoral labour shares remain constant, and provides a measure of the skill premium. The second measures the impact of changes in sectoral labour shares, considering that within inequality of each sector remained constant. The third estimates the same effect but for the between coefficient. Finally, the fourth term estimates the change in inequality due to changes in the relative wage of each sector, considering sectoral labour shares as being stable. Figure 3 shows the cumulative effect of each component on the evolution in wage inequality.

Figure 3 - Sources of wage inequality change in Portugal (x1000)
Source: See Appendix 2
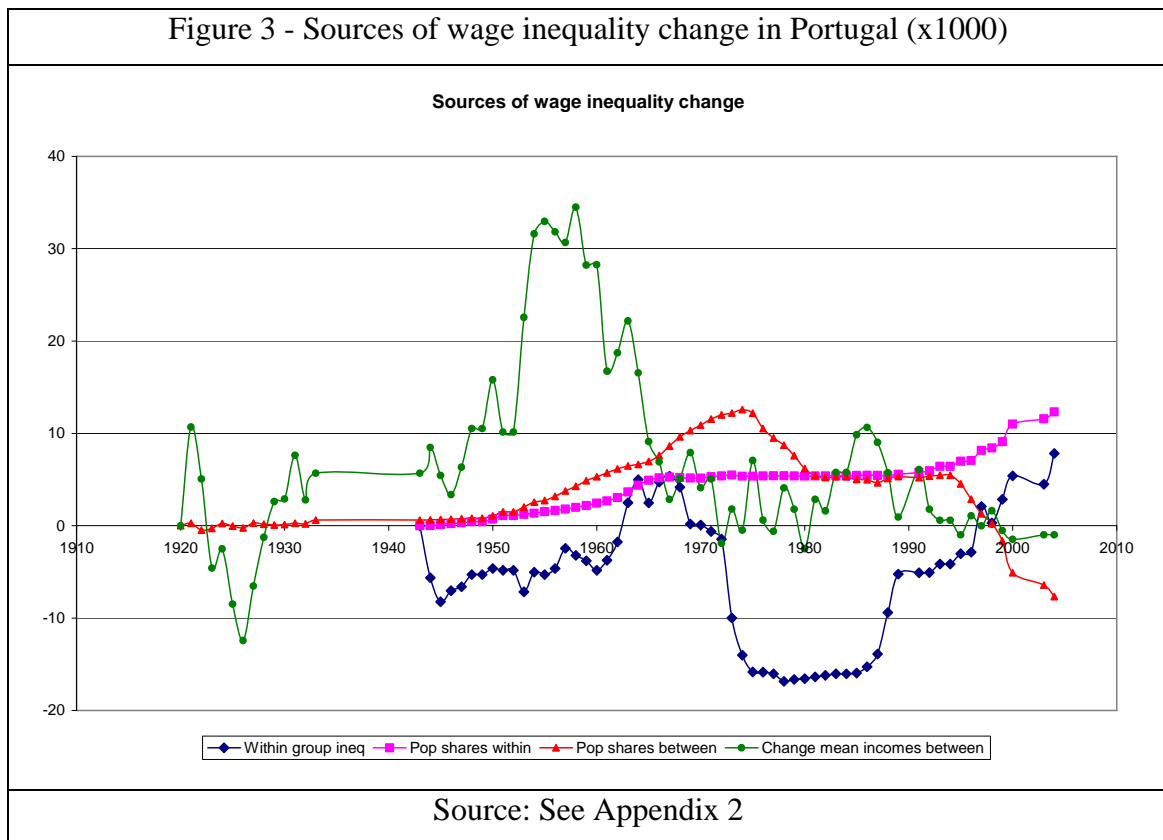
The first trend to be highlighted is that the second component increased throughout the century, which indicates that economic growth in Portugal has been characterised by the increasing size of the most unequal sectors at the expense of the

most egalitarian ones. One of the factors that might have had an impact on this component is the continuous transition in the labour force from agriculture (totally egalitarian by design) to the other sectors. This was the case until the mid eighties. In the years that followed, the labour transition from industry to the service sectors was the factor driving the increase in the second component.

Although the second component had a larger impact than the first in the long term, the magnitude of the first component (skill premium) was always greater and, as such, it was the main factor responsible for the short term oscillations in the within coefficient. As can be seen in Figure 3, the skill premium had a long-term tendency to increase. This accelerated from the mid-eighties onwards, with the parenthesis of the pre-revolutionary years, when the skill premium fell notably.

The third component increased until the mid-seventies and declined thereafter. Its evolution until the mid-eighties is due entirely to the expulsion of labour from the agricultural sector. When the majority of the labour force is engaged in agriculture, the agricultural wage is close to the national average. However, as the sector declines there is an increase in inequality to a point at which the agricultural wage falls far below the average. Yet the marked fall in size suffered by this sector means ultimately a decrease is recorded in inequality. By contrast, from the mid-eighties onwards, the decline in the third component is due to the increasing size of sectors with average wages closer to the national average, namely construction, wholesale and retail trade and other services.

Finally, the fourth component, which was in decline until 1927, rose rapidly thereafter until 1959. Then, from this year to 2005, it fell with a similar degree of intensity. This component increased when the average wages of the most and least productive sectors diverged and vice versa. The evolution of this component closely reflects the events that occurred in the Portuguese economy during this period. As economic growth began to accelerate, new economic sectors emerged and were able to pay higher wages, whereas the traditional ones (such as agriculture) lagged behind. This phase was sustained for some time because there was a large surplus of labour in the more backward sectors that kept wages down. When this surplus of labour began to move from agriculture towards the industrial and services sectors, the labour supply forces first slowed down the divergence and then reversed it and the wages of the different sectors began to converge.

The evolution shown by the second, third and fourth components is fully consistent with the *original* Kuznets hypothesis (the left-hand side of the N-curve),

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according to which, during the transition from an agricultural economy towards an industrialized one, (1) labour moves from egalitarian to unequal sectors (long-term increase in the second component), and (2) this labour transition is likely to increase inequality during initial stages and reduce it later on, which is consistent with the evolution in the third and fourth components. On the other hand, the evolution in the first and second terms explains the right-hand side of the EKC, that is, (1) an increasing labour share of the most unequal sectors, and (2) a rising skill premium.

In short, as described above, the long-term evolution in wage inequality can be divided in two periods. The first lasted until the eighties and was characterized by the pre-eminence of inter-sectoral forces. The decomposition of the GE(0) index during this period has shown that the behaviour of its subcomponents fits perfectly well with the predictions made by the *original* Kuznets curve hypothesis. On the other hand, during the last two decades, the wage differentials between different skill groups have been the driving force behind the evolution in wage inequality providing empirical support to the EKC hypothesis.

5.- Final Remarks

There is an overwhelming consensus that wage inequality has increased in most developed economies since the mid-1980s. This has been well illustrated, for example, by Atkinson (2008), with a dataset comprising 19 OECD countries, and by Galbraith (2007), whose global dataset on pay inequality (UTIP-UNIDO)[13] was built from a variety of industrial statistics. While the increase in wage inequality differs in intensity and characteristics, it is today a global phenomenon - a fact that has led researchers to seek its causes in technological change, globalisation and institutional factors.

As discussed herein (see section 2), most potential explanations for the recent boom in wage inequality are related to the increasing share of skilled labour within the total labour force. In this sense, the post-1980 rise in wage inequality in post-industrial economies would provide some empirical support for the plausibility of the right-hand side of the EKC.

However, the left-hand side of the EKC is more difficult to test empirically because of data scarcity (global wage inequality series are particularly rare before the

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[13] See http://utip.gov.utexas.edu/data.html

second half of the twentieth century) and the poor quality of the datasets that are available. In some cases, agricultural wages are not included, while in others information is only provided for the top or bottom wage earners. Typically the sources do not illustrate wage dispersion between economic sectors and, in most instances, the period of time covered is not sufficiently long to monitor the whole transition from an agrarian to a post-industrial economy.[14]

Yet, most of the evidence seems to point to a compression in wage distribution during the golden age. The best example here is that of the Swedish case. By combining Söderberg's (1990) wage differential data for Sweden with Atkinson's (2008), we are able to analyse the evolution in global wage inequality from 1870 onwards (a period that covers the whole transition from an agrarian to a post-industrial economy). Thus, we see that wage inequality increased from 1870 to the 1930s, declined to the mid 1980s, before rising again.

Besides the case of Sweden, Portugal's also fits perfectly with the EKC hypothesis. However, in this instance, it is not only the evolution in wage inequality that lends support to the EKC, but the Portuguese data series highlights the main forces behind this evolution. Section 3 shows that wage inequality between sectors was the driving force until the 1980s, when it was replaced by inequality within sectors, which is exactly what the model predicts. Moreover, maximum wage inequality in Portugal was recorded when 40% of the labour force was engaged in agriculture (again in line with the model's predictions). However, the new growth in wage inequality appeared at a time when this sector accounted for 20% of the labour force, which is slightly higher than the model's predictions.

The main characteristic of the EKC hypothesis is that it is the labour market shares (percentage of agricultural labour, percentage of skilled labour) that are the forces driving wage inequality, and that changes in prices (relative wages) over time are not taken into account, which is exactly the same notion contained in the *original* Kuznets Curve hypothesis. And although this could lead to the mistaken conclusion that changes in relative wages are unimportant, the Portuguese case sheds considerable light on this issue. Figure 3 (see above) shows the contribution of changes in prices and labour market shares to the evolution in global wage inequality. Components 2 and 3 (skilled labour shares and sectoral labour shares respectively) are the variables

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[14] See, for instance, Goldin and Margo (1992), Galbraith and Kum (2005) and Atkinson (2008).

considered in the EKC hypothesis and it can be seen (Figure 3) that they evolved as expected. In spite of this, components 1 and 4 (skill premium and sectoral average wages), which are not considered in the hypothesis, varied significantly, and what is more, they varied with greater intensity than components 2 and 3. Yet, all four components followed similar trends.[15]

If this were a coincidence, the EKC would probably be nothing more than the evolution presented by one particular case. However, the evolution in relative wages may be closely related to the evolution in labour shares. In section 2, we have argued that the changes in labour shares (between sectors and skill levels) may be the driving forces of the evolution in relative wages. This means that the latter has an impact on wage inequality that would serve simply to intensify the inequality trends predicted by the EKC hypothesis. In other words, the evolution in relative wages may be embodied by the evolution in labour shares. In short, in spite of the limited number of assumptions underpinning the EKC hypothesis, it may be able to predict the evolution in wage inequality that would manifest itself in ordinary conditions.

The steep increase in global wage inequality in recent decades has been at the heart of a lively debate among economists, and has awoken the interest of the public in general. Recent studies have forwarded a number of hypotheses to account for this phenomenon, but no consensus has yet to be reached. On this matter, this paper provides a rather simplistic answer: wage inequality is increasing because we as workers are becoming increasingly different. This apparently trivial response may explain not only the recent rise in wage inequality but also its long term evolution. The driving force behind this EKC hypothesis is also to be found at the heart of the *original* Kuznets Curve hypothesis. It proved to be highly persuasive and influential in its original formulation, and so the extension of this same simple idea may be useful in explaining the recent boom in wage inequality globally.

If Kuznets (1955) stated that the transition of labour from agriculture to industrial activities would drive inequality in a certain direction, here we suggest that the boom in skilled labour may be responsible for the recent increase in wage inequality. Most importantly, in order to explain the evolution in wage inequality, there would then be no need to focus on relative wages because they would be merely a reflection of the skill composition of the labour force.

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[15] The main exception here is the sharp fall in the within group coefficient during the transition to democracy.

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Appendix 1

Table A1 – Wage inequality: first scenario

W Agriculture=40, W unskilled=60, W skilled=80; Wage dispersion inside: Equal

Period	1	2	3	4	5	6	7	8	9	10	11	12	13
Lagr/L	0,8	0,7	0,6	0,5	0,4	0,3	0,2	0,1	0,1	0,1	0,1	0,1	0,1
Lsk/Lnagr	0,05	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,45	0,5	0,55	0,6	0,65
Lunsk/L	0,19	0,27	0,34	0,4	0,45	0,49	0,52	0,54	0,495	0,45	0,405	0,36	0,315
Lsk/L	0,01	0,03	0,06	0,1	0,15	0,21	0,28	0,36	0,405	0,45	0,495	0,54	0,585
Wage A	40	40	40	40	40	40	40	40	40	40	40	40	40
Wage Unsk	60	60	60	60	60	60	60	60	60	60	60	60	60
Wage Sk	80	80	80	80	80	80	80	80	80	80	80	80	80
Av wage	44,2	46,6	49,2	52	55	58,2	61,6	65,2	66,1	67	67,9	68,8	69,7
GE (0)	**0,007**	**0,010**	**0,013**	**0,015**	**0,017**	**0,017**	**0,016**	**0,015**	**0,016**	**0,016**	**0,017**	**0,018**	**0,019**

Table A2 – Wage inequality: second scenario

W Agriculture=40, W unskilled=60, W skilled=80; Wage dispersion inside: Normal

Period	1	2	3	4	5	6	7	8	9	10	11	12	13
Lagr/L	0,8	0,7	0,6	0,5	0,4	0,3	0,2	0,1	0,1	0,1	0,1	0,1	0,1
Lsk/Lnagr	0,05	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,45	0,5	0,55	0,6	0,65
Lunsk/L	0,19	0,27	0,34	0,4	0,45	0,49	0,52	0,54	0,495	0,45	0,405	0,36	0,315
Lsk/L	0,01	0,03	0,06	0,1	0,15	0,21	0,28	0,36	0,405	0,45	0,495	0,54	0,585
Wage A	40	40	40	40	40	40	40	40	40	40	40	40	40
Wage Unsk	60	60	60	60	60	60	60	60	60	60	60	60	60
Wage Sk	80	80	80	80	80	80	80	80	80	80	80	80	80
Av wage	44,2	46,6	49,2	52	55	58,2	61,6	65,2	66,1	67	67,9	68,8	69,7
GE (0)	**0,009**	**0,012**	**0,015**	**0,018**	**0,020**	**0,021**	**0,021**	**0,020**	**0,021**	**0,022**	**0,023**	**0,024**	**0,025**

Table A3 – Wage inequality: third scenario

W Agriculture=40, W unskilled=60, W skilled=80; Wage dispersion inside: Unequal

Period	1	2	3	4	5	6	7	8	9	10	11	12	13
Lagr/L	0,8	0,7	0,6	0,5	0,4	0,3	0,2	0,1	0,1	0,1	0,1	0,1	0,1
Lsk/Lnagr	0,05	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,45	0,5	0,55	0,6	0,65
Lunsk/L	0,19	0,27	0,34	0,4	0,45	0,49	0,52	0,54	0,495	0,45	0,405	0,36	0,315
Lsk/L	0,01	0,03	0,06	0,1	0,15	0,21	0,28	0,36	0,405	0,45	0,495	0,54	0,585
Wage A	40	40	40	40	40	40	40	40	40	40	40	40	40
Wage Unsk	60	60	60	60	60	60	60	60	60	60	60	60	60
Wage Sk	80	80	80	80	80	80	80	80	80	80	80	80	80
Av wage	44,2	46,6	49,2	52	55	58,2	61,6	65,2	66,1	67	67,9	68,8	69,7

Table A4 – Wage inequality: fourth scenario

W Agriculture=40, W unskilled=80, W skilled=160; Wage dispersion inside: Equal

Period	1	2	3	4	5	6	7	8	9	10	11	12	13
Lagr/L	0,8	0,7	0,6	0,5	0,4	0,3	0,2	0,1	0,1	0,1	0,1	0,1	0,1
Lsk/Lnagr	0,05	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,45	0,5	0,55	0,6	0,65
Lunsk/L	0,19	0,27	0,34	0,4	0,45	0,49	0,52	0,54	0,495	0,45	0,405	0,36	0,315
Lsk/L	0,01	0,03	0,06	0,1	0,15	0,21	0,28	0,36	0,405	0,45	0,495	0,54	0,585
Wage A	40	40	40	40	40	40	40	40	40	40	40	40	40
Wage Unsk	80	80	80	80	80	80	80	80	80	80	80	80	80
Wage Sk	160	160	160	160	160	160	160	160	160	160	160	160	160
Av wage	48,8	54,4	60,8	68	76	84,8	94,4	104,8	108,4	112	115,6	119,2	122,8
GE (0)	**0,023**	**0,035**	**0,045**	**0,052**	**0,056**	**0,056**	**0,052**	**0,045**	**0,047**	**0,048**	**0,049**	**0,049**	**0,049**

Table A5 – Wage inequality: fifth scenario

W Agriculture=40, W unskilled=80, W skilled=160; Wage dispersion inside: Normal

Period	1	2	3	4	5	6	7	8	9	10	11	12	13
Lagr/L	0,8	0,7	0,6	0,5	0,4	0,3	0,2	0,1	0,1	0,1	0,1	0,1	0,1
Lsk/Lnagr	0,05	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,45	0,5	0,55	0,6	0,65
Lunsk/L	0,19	0,27	0,34	0,4	0,45	0,49	0,52	0,54	0,495	0,45	0,405	0,36	0,315
Lsk/L	0,01	0,03	0,06	0,1	0,15	0,21	0,28	0,36	0,405	0,45	0,495	0,54	0,585
Wage A	40	40	40	40	40	40	40	40	40	40	40	40	40
Wage Unsk	80	80	80	80	80	80	80	80	80	80	80	80	80
Wage Sk	160	160	160	160	160	160	160	160	160	160	160	160	160
Av wage	48,8	54,4	60,8	68	76	84,8	94,4	104,8	108,4	112	115,6	119,2	122,8
GE (0)	**0,025**	**0,037**	**0,047**	**0,054**	**0,059**	**0,060**	**0,057**	**0,050**	**0,052**	**0,053**	**0,055**	**0,055**	**0,056**

Table A6 – Wage inequality: sixth scenario

W Agriculture=40, W unskilled=80, W skilled=160; Wage dispersion inside: Unequal

Period	1	2	3	4	5	6	7	8	9	10	11	12	13
Lagr/L	0,8	0,7	0,6	0,5	0,4	0,3	0,2	0,1	0,1	0,1	0,1	0,1	0,1
Lsk/Lnagr	0,05	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,45	0,5	0,55	0,6	0,65
Lunsk/L	0,19	0,27	0,34	0,4	0,45	0,49	0,52	0,54	0,495	0,45	0,405	0,36	0,315
Lsk/L	0,01	0,03	0,06	0,1	0,15	0,21	0,28	0,36	0,405	0,45	0,495	0,54	0,585
Wage A	40	40	40	40	40	40	40	40	40	40	40	40	40
Wage Unsk	80	80	80	80	80	80	80	80	80	80	80	80	80
Wage Sk	160	160	160	160	160	160	160	160	160	160	160	160	160
Av wage	48,8	54,4	60,8	68	76	84,8	94,4	104,8	108,4	112	115,6	119,2	122,8
GE (0)	**0,028**	**0,040**	**0,051**	**0,059**	**0,064**	**0,065**	**0,063**	**0,057**	**0,060**	**0,062**	**0,063**	**0,064**	**0,065**

Appendix 2: Sources and estimation of wage indices

1921-84

Agricultural wages

Agricultural wages are taken from various chapters of the *Anuário Estatístico de Portugal* conducted by the Portuguese Statistics Office (INE): for the period 1921-1928 they are from the chapter entitled *Indústria*, 1929-1954 from *Produção e Consumo*, 1955-1982 from *Preços e salários* and 1983-84 from *Emprego é salários*. The information is fairly homogeneous for the whole of this period and comprises male and female daily wages for different activities in each Portuguese district. The number of agricultural activities listed in the source falls over time, ranging from 28 to 1 for males and from 15 to 1 for females. Male and female daily wages in each Portuguese district are estimated as an unweighted average of wages for different activities. For the country as a whole, male and female daily wages are calculated as the weighted average of the wages of all districts.

Industrial wages

Industrial wages are also taken from the *Anuário Estatístico de Portugal*. For the period 1921-1934, wages are drawn from the chapter entitled *Indústria*. The source reports information on average daily wages for 30 sectors, by gender and for each Portuguese district. To estimate the national wage for each sector, a weighted average is calculated based on the active population in each district and sector. Female wages are excluded because information was not systematically collected and might interfere with the estimation.

From 1944 onwards, industrial wages come from a yearly survey conducted by the Portuguese Statistics Office (INE), which includes information on firms with 10 or more employees, in the following chapters: "*Produção e Consumo*" (1944-1967), "*Indústrias extractivas*" and "*Indústrias transformadoras*" (1968-1970), "*Rendimentos, salários e preços*" and "*Mão-de-obra*" (1971-1981) and "*Emprego e salários*" (1982-84). The structure of the data is not constant over time because both the number of industrial sectors and the categories of workers considered changed during the period studied. For 1944-1955, the survey classified workers into three main groups:

employees (*empregados*), industrial workers (*assalariados industriais*) and other workers (*outros assalariados*). Employees were those with a longer term contract, whereas industrial and other workers earned daily wages. More specifically, employees were owners with management responsibilities, earning a regular return (such as administrators, managers, economists, engineers, technical directors, secretaries, stenographers, typists, accountants, staff in charge of ordinary tasks in laboratories, personnel recruitment and staff of the social services of the company, i.e. clinics, schools, sports and other leisure activities). Workers comprised all personnel that participated directly in the production system, including masters and foremen. For employees (which we have classified here as "skilled workers"), the source gives information on their number at either December 31 or the period of maximum activity of the year, and also on the total wages received by this group in the whole year. For other workers (which we have classified here as "unskilled workers"), the source gives information on their number at either December 31 or the period of maximum activity, the number of working days per year and the total wages paid per year to this group. For 1956-1970, the source provides information on two occupational groups: employees (*empregados, administrativos, técnicos e de escritório*) and other workers (only one group). For employees ("skilled workers"), the source gives information on their number at either December 31 or the monthly average, and also on the total wages received by this group in the whole year. For other workers, the source gives information on their number at either December 31, or the monthly average, on the number of working days per year and on the total wages paid per year to this group. For 1971-1981, the information on wages is again classified into three groups: *dirigentes*, *outro pessoal* (both of them employees) and other workers. For employees ("skilled workers"), the source gives information on the monthly wage and the monthly average number of workers in each group (*dirigentes* and *outro pessoal*). For other workers ("unskilled workers"), the source provides information on hourly wages and the monthly average number of workers. For 1982-84, there are only two groups of workers: employees (*Dirigentes, Administrativos, técnicos e outros empregados*) and workers (*operarios*). For employees ("skilled workers"), the source gives information on the monthly wage and the monthly average number of employees. For workers ("unskilled workers"), the source provides information on hourly wages and the monthly average number of workers.

For s*killed workers,* for 1944-1955, daily wages are estimated by dividing the total amount of wages paid each year by the number of employees at December 31 and then dividing the outcome by 304 working days. For 1956-1970, daily wages are estimated by dividing the total amount of wages paid each year by the monthly average number of employees and then dividing the outcome by 304 working days. For 1971-1984, daily wages are estimated by dividing monthly wages by 25.33 (i.e., 304 working days divided by 12 months). From 1971 to 1981, monthly wages are a weighted average of the wages for the two groups of employees that are distinguished in the source. For *unskilled workers,* for 1944-1970, daily wages are estimated by dividing the total amount of wages paid each year by the number of working days per year. For 1971-1984, daily wages are estimated by multiplying hourly wages by eight (hours worked per day).

Here we assume a total of 304 working days, i.e., six working days per week, deducting official and religious holidays. The six-day working week was reaffirmed by law in 1934, *Decreto n. 24402* (Patriarca, 1995, pp. 372). The five-day working week was established only after 1974 (Leite and Almeida, 2001, pp. 169; and Barreto, 1990, pp. 57-117). During the Estado Novo there were nine days of official and religious holidays per year (Araújo. *et al.*, 1969, p. 207), and this situation did not change until 1976, *Decreto* 874/76, See Leite and Almeida (2001), pp. 200-201.

The number of industrial sectors considered in the survey is especially volatile: during these thirty years it varied from 21 to 187 sectors. To obtain homogenous data, the sectoral structure used by Pinheiro (1997) is used as a reference, and the information aggregated to fit that sectoral breakdown (CAErev1). In order to aggregate the different sub-sectors into these reference sectors, sectoral wages are weighted according to the number of workers in each sub-sector.

Services

Services wages are taken from the *Estatísticas das Sociedades* conducted by the Portuguese Statistics Office (INE). This source commences in 1950. The information is fairly homogeneous for the whole of this period. The source provides information on the number of workers and the total amount of wages paid per year in each sector. The source identifies 15 sectors up to 1952 and 21 sectors between 1952 and 1984. Daily wages for services are estimated by dividing the total wages paid per year by the number of workers in each sector, and by dividing the outcome by 304 working days.

The number of service sectors considered in the source has been aggregated to fit the CAErev1 breakdown (see Pinheiro, 1997). The process of aggregation takes into account the relative importance of employment in each subsector.

1985-2005

Wage data are taken from the *Quadros de pessoal*. This source covers workers in all sectors of activity. Within each sector, workers are classified into eight skill categories. As for the breakdown by sector, from 1985 to 1994, workers are classified into 17 sectors (only one sector for manufacturing), while from 1995 to 2005 there are 30 sectors (14 in manufacturing).

Employment

1921-34

Employment data are taken from Nunes (1989). This source provides active population statistics classified for each Portuguese district in 16 economic sectors: Agriculture; Fishing; Mining; Manufacture of food, beverages and tobacco; Textiles and clothes; Manufacture of wood; Manufacture of paper; Manufacture of non-metallic minerals; Manufacture of chemical products; Manufacture of basic metals; Other manufacturing; Construction; Electricity and gas; Transport and communication; Trade; and Other services.

1944-84

Employment data for the period after 1953 are taken from Pinheiro (1997), *Parte V, Trabalhadores por conta de outrem,* which were extrapolated backwards on the basis of the growth rate of the labour force by sectors provided by Valério (2001, Tables 4.6 and 4.7), taken from Nunes (1989).

1985-2005

Employment data are taken from the *Quadros de pessoal*