Are Factor Shares Constant? An Empirical Assessment from a New Perspective

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Abstract

The relative stability of the aggregate labour share of income has almost acquired the condition of a "stylized fact" of economic growth. However, new as old contributions to the empirical literature on the constancy of the factor shares of income (see Solow (1958) and Young (2005)) have recognized that this fact does not prove to be true if one evaluates the constancy of the US aggregate labour share relative to what one would expect given industrial labour shares variability. Both these authors find that the US aggregate labour share fluctuates just as much -not less- as any of its underlying components. I confirm this apparently puzzling finding using data for the Spanish economy from 1955 to 2005 and data for the US economy over 1958-1996. I show that the factor shares, aggregate and industrial, have not been constant. I also show that movements in the aggregate labour share are the result of systematic changes in the sectorial composition of output and also systematic changes in the industrial labour shares. I claim that both industrial and aggregate labour shares' movements can be explained in terms of well established economic principles. Thus the main contribution of this paper is to offer an empirically testable hypothesis of the non-constancy of the factor shares of income. In the face of a persistent increase in the labour share of income, firms/sectors may reallocate resources to sectors whose labour shares are lower and/or adopt different (new or existing) labour saving technologies, whose effects are to reduce -internally- the labour share of income. If such an hypothesis is accepted, it would open challenging new horizons both for models of business cycles and growth. In particular, fights over the distribution of income could be at the core of output fluctuations; endogenous and biased technical progress could be the main engine of long-term growth, and may be not at a constant growth rate.

[1]I thank Michele Boldrin for his valuable suggestions and discussion of previous drafts. I am also grateful to seminar participants at Carlos III Macroeconomics Workshop for their constructive comments, which led to a significant improvement in the presentation. Financial support by Comunidad de Madrid and European Union Social Fund is gratefully acknowledged.

1 Introduction

The belief that the shares of national income going to labour and physical capital are nearly constant is deeply anchored in economists' minds. Most growth and business cycles models are built on this assumption. Recent contributions in the literature showing that for one internally consistent definition of "relatively constant" the aggregate factor shares have not been constant[1], and drawing attention to the variability of these shares at more disaggregated levels of analysis, for instance, at the industrial level[2], have left unaffected its status of "stylized fact". Quite on the contrary, huge efforts are being devoted to reconcile the "stylized fact" of a nearly constant aggregate labour share with the evidence of higher variability at the industrial level[3].

As a matter of fact, the US aggregate labour share has fluctuated for almost a century in the narrow range $0.65 - 0.70$. Hence, if one defines stable as remaining somewhere between 0.65 and 0.70 during a long period of time, then obviously US aggregate labour share has been stable. This probably justifies the practice of computing the long-run average and claiming that it is constant. The residual oscillations around this long-run average are then attributed to some irrelevant and unexplainable randomness. Hence, the widely-spread belief remains that observed movements in the aggregate labour share are of "second-order" importance for a model of business cycles, and much less important for a model of growth.

The object of this paper is to suggest that changes in the aggregate labour share are of "first-order" importance to understand business cycles, and probably also the growth process. To reach this conclusion one only needs to define the expectations about how variable the aggregate labour share ought to be from a new perspective. I want to show that the pattern of behaviour of the aggregate shares is not arbitrary. Hence, observed oscillations around a conveniently-assumed constant long-run average are not random. By looking at the behaviour of the sectorial factor shares, we are able to rationalize observed evolution of the aggregate labour shares "in terms of an analytical framework that embodies well-established economic principles and sensible presumptions about the underlying relationships and facts. This is itself strong evidence against the white noise hypothesis"[4]. I will show that changes in the sectorial composition of output are an important determinant of the evolution of the aggregate labour share and that the comovement of industrial labour shares is another important determinant. Furthermore, the pattern of behaviour of the industrial components of the aggregate labour share is itself coherent with the interpretation of the shifts in the aggregate labour share suggested above and constitutes a fundamental force underlying aggregate labour shares movements.

Previous findings have huge implications for models of business cycles and

[1] For instance, Andrew T. Young (2005), following Solow (1958).

[2] Two such contributions are Jones Ch. (2003) and Andrew Young (2005).

[3] Jones Ch. (2003) and Young and Zuleta (2005) are two such efforts.

[4] I owe this nice expression to Harberger (1998), who uses it in a different context but with quite similar objectives.

growth. The most obvious one regards the most frequently adopted specification of the aggregate production function, the Cobb-Douglas. More importantly, intersectorial dynamics are of first-order importance to understand medium-run oscillations of the aggregate labour share. Last but not least, induced biased technical change appears as a potential important determinant of the pattern of distributive shares (aggregate and sectorial).

Section 2 discusses how to be "variable and irrelevant", hence constant. We define the conditions under which economists would be allowed to neglect observed short-run oscillations or medium-run shifts in the labour shares. Section 3 reports empirical results for the Spanish economy. Section 4 reports results for the US economy. Section 5 derives implications of the findings and some concluding remarks.

2 Defining constant labour shares

> "Even if it is sometimes observed that the pattern of distributive shares shows long-run shifts or short-run fluctuations, the former can be explained away and the latter neglected on principle"
>
> Robert Solow (1958, p.618)

What are the assumptions underlying Solow's assertion? Start by the short-run fluctuations. There is a very neat statistical definition of the hypothesis of constant factor shares. Assume the labour share is represented as:

$$LS_t = \overline{LS} + \varepsilon_t$$

where ε_t is a white noise disturbance term. That is, the value of the labour share fluctuates randomly around a constant value. This statistical definition of constant factor shares is equivalent to the joint hypothesis of a Cobb-Douglas production function and perfectly competitive good and factors' markets.

Alternatively, one may consider the following specification of the time series structure of the labour share:

$$LS_t = \phi + \rho \cdot LS_{t-1} + \varepsilon_t$$

where ε_t is a white noise disturbance term. Under this alternative specification, the value of the labour share fluctuates around a constant long-run value, but deviations from this long-run value are persistent. This statistical definition admits different economic interpretations none of which is completely inconsequential. The less harmful interpretation for the currently accepted model of business cycles would attribute this behaviour of the labour shares to exogenous biased technical shocks. That is, in economic terms, the joint hypothesis would be: a Cobb-Douglas production function, biased technological shocks affecting directly the value of the parameter of the production function[5] and perfectly competitive good and factors' markets. This is the view adopted by Young

[5] Let the production function be:

(2003), and he also proves that biased technical shocks substantially change the predictions of an otherwise standard RBC model with respect to the ones obtained under the usual assumption of neutral technical shocks. In particular, labour productivity is found to be highly countercyclical. Alternatively, the previous statistical hypothesis can be read in economic terms as the following joint hypothesis: a Constant Elasticity of Substitution production function, possibly biased technical shocks and perfectly competitive good and factors' markets. And so on and so forth. There are an infinite number of combinations that one may think of that would yield time-varying labour shares. None of this is very informative, except for showing that there is probably something to it. And one should be cautious not to neglect short-run oscillations in the factor shares.

Next, let us focus on long-run shifts in the factor shares, and the conditions that would allow us to "explain these away". Clearly, trend variations in the labour shares might be caused either by structural changes or by trend changes in some other economic variables such as capital per unit of labour, output per worker, and technical progress. By structural changes, one may mean various things: institutional changes, changes in the sectorial composition of output (industrialization and tertiarization), changes in the way production is organized (urbanization, globalization...). Trends in the capital-labour ratio and technical advances could affect the value of the labour share and this effect depends on the value of the elasticity of substitution. All the structural factors have in common that they are generally not considered by most models of growth. Hence, any changes in the labour shares that could be attributed to changes in any of these factors are in some sense unimportant. Then, the residual change in the labour share, if any, could be explained in the framework of a neoclassical model of growth, assuming an aggregate production function with an elasticity of substitution different from one (and may be not too different from one[6]). Again, we are left with no precise definition of how to be "variable and irrelevant".

In a sense, any definition of "constant" labour shares in terms of *how variable* one may expect the labour share to be is too subjective[7]. Thus, the empirical results can be given different interpretations. None of these definitions will help us remove or confirm the status of "stylized fact" attributed to the aggregate labour share of income.

Now, address the problem from a different perspective. And ask, instead, if the movements in the aggregate labour share are systematic, not arbitrary, in the sense, they can be related to their underlying determinants and interpreted "in terms of an analytical framework that embodies well-established economic principles and sensible presumptions about the underlying relationships and facts".

$$Y_t = A_t K_t^{\alpha_t} L_t^{1-\alpha_t}$$

where A represents the level of neutral technical progress, K stands for physical capital, L is labour. Biased technical shocks are introduced in the form of shocks to the assumed constant long-run value of α_t.

[6] Young (2005), "I can't believe it's not Cobb-Douglas"

[7] Even the cleanest statistical hypothesis to represent "constant" labour shares, as random additions to a constant value, raises the objection that it is too restrictive. Hence, too easily rejected.

Here we have a more objective definition. If there are strong facts about *how* the labour shares fluctuate, then we may be able to advance some hypotheses empirically testable. In such a case, observed changes in the aggregate shares could be shown to be of "first-order" importance for a model of business cycles, and possibly also for a model of growth.

We break down changes in the aggregate labour share into three components: changes in the sectorial composition of output, changes in the industrial labour shares and correlations of these industrial labour shares. We evaluate the contribution of each of these components to the observed behaviour of the aggregate labour share not only in terms of the percent variability they account for. We pay special attention to the comovement with the aggregate share, how each component is related to the pattern of the aggregate distributive shares.

Suppose the economy is divided into N industries, with labour shares $LS_{it}, \forall i = 1...N, t = 1...T$, and weights in total value added $\omega_{it}, \forall i = 1...N, t = 1...T$. The labour shares and weights are observed over T time periods.

Let each sectorial labour share be computed as:

$$LS_{it} = \frac{CompensationEmployees_{it} \cdot \frac{TotalEmployment_{it}}{Employees_{it}}}{GVA_{it}}$$

that is, each self-employed in sector i is attributed a wage equal to the average wage earned by an employee in sector i. Hence, it is assumed that the self-employed are as productive as the employees[8].

Let the aggregate labour share be computed as:

$$LS_t = \sum_{i=1}^{N} \omega_{it} \cdot LS_{it}$$

Changes in the aggregate labour share during the period $t - h$ to t can be decomposed into three components:

$$\Delta LS_t = \sum_{i=1}^{N} LS_{it-h} \cdot \Delta\omega_{it} + \sum_{i=1}^{N} \omega_{it-h} \cdot \Delta LS_{it} + \sum_{i=1}^{N} \Delta\omega_{it} \cdot \Delta LS_{it}$$

The first term measures the effect of the changes in the sectorial composition of output on the aggregate labour share, holding the industrial labour shares constant at their $t-h$ values. The second term measures the effect of changes in the industrial labour shares on the aggregate share, holding sectors' value added shares at their $t - h$ values. Finally, the last term measures the contribution of the comovement between sectorial labour shares and value added shares.

Changes in the value added shares may be an important factor determining the evolution of the aggregate labour share. If the aggregate labour share does

[8] Since there are no direct estimates of labour productivity in corporate and non-corporate businesses sector by sector, we cannot evaluate the accuracy of this assumption. However, the data do show that the self-employed are mainly concentrated in low-productivity sectors.

not go above the magic value 0.70, this might be due to systematic shifts in the weights: sectors with low labour shares gaining in weight with respect to sectors with high labour shares.

A second intersectorial force is the comovement between industrial labour shares. Note that it is negative correlations among these shares which drives the aggregate labour share down. Statistically, this assertion amounts to observing that the variance of the aggregate labour share is lower the higher the covariance between its industrial components, provided this comovement is negative. From the economic point of view, negative comovement of the industrial labour shares plays a role through the interaction with changes in sectors' value added shares. Sectors with declining labour shares should gain weight at the expense of sectors with increasing labour shares. This can be seen as the dynamic version of the first force described above.

The underlying assumption of both intersectorial determinants is that capital owners reallocate investments in an effort to maximize their returns on capital or equivalently reduce the labour share (both are equivalent provided that the capital-output ratio does not change).

Finally, the relative stability of the industrial labour shares is a meaningful determinant of the relative stability of the aggregate labour share. Interestingly, the pattern of the industrial distributive shares admits an interpretation coherent with the one given to the evolution of the aggregate labour share in terms of its intersectorial determinants. Relationships between industrial shares and relative factor prices and quantities and estimates of Harrod-neutral technical progress are investigated.

3 Spanish Evidence

Table 1 shows the share of labour in total income generated in the Spanish private productive sector over the period 1955-2005 (biannual data), at the aggregate level and for each of five big sectors. The data are issued from *Renta Nacional de España y su Distribución Provincial* (Fundación BBVA) for the period 1955-1995 and from the *National Accounts* (Instituto Nacional de Estadística) for the period 1995-2005. Aggregate labour share is computed as the weighted average of sectorial labour shares, with weights equal to the sectors' value added shares. The sectors' labour shares are calculated as the ratio of total labour earnings to gross value added. To compute total labour earnings, the self-employed are imputed a wage equal to the average wage earned by the sector's employees[9].

[9] In Agriculture, data on farmers' mixed income is available (1955-1995), which makes possible to compute the labour share as:

$$LS_{a,t} = \frac{CompensationEmployees_{a,t}}{GVA_{a,t} - MI_{a,t}}$$

where $CompensationEmployees_a$ measures compensation of farm employees, GVA_a is total gross value added in agriculture and MI_a measures mixed income of farmers. This measure

TABLE 1.- Aggregate and 5 big sectors' Labour shares in Spain, 1955-1995/2005

Sector Year	A&F	E	I	B	S	Total	Total updated
1955	0,79	0,28	0,42	0,71	0,50	0,55	0,55
1957	0,80	0,26	0,44	0,71	0,50	0,56	0,56
1959	0,80	0,27	0,44	0,71	0,51	0,56	0,56
1961	0,80	0,26	0,46	0,71	0,53	0,57	0,57
1963	0,78	0,28	0,48	0,69	0,52	0,57	0,57
1965	0,76	0,29	0,49	0,67	0,54	0,56	0,56
1967	0,74	0,29	0,51	0,68	0,55	0,57	0,57
1969	0,70	0,26	0,52	0,68	0,56	0,57	0,57
1971	0,70	0,26	0,53	0,70	0,56	0,57	0,57
1973	0,70	0,29	0,52	0,70	0,57	0,58	0,58
1975	0,68	0,30	0,55	0,71	0,58	0,59	0,59
1977	0,67	0,36	0,56	0,75	0,61	0,61	0,61
1979	0,65	0,36	0,61	0,77	0,63	0,63	0,63
1981	0,61	0,36	0,64	0,86	0,65	0,65	0,65
1983	0,61	0,37	0,63	0,88	0,67	0,66	0,66
1985	0,62	0,35	0,63	0,85	0,65	0,65	0,65
1987	0,61	0,30	0,62	0,83	0,65	0,63	0,63
1989	0,63	0,28	0,61	0,75	0,64	0,62	0,62
1991	0,64	0,30	0,64	0,70	0,62	0,62	0,62
1993	0,66	0,29	0,72	0,79	0,62	0,65	0,65
1995	0,70	0,28	0,66	0,74	0,59	0,62	0,62
1997	0,69	0,27	0,67	0,79	0,60		0,62
1999	0,76	0,27	0,69	0,78	0,59		0,63
2001	0,67	0,27	0,64	0,74	0,64		0,64
2003	0,62	0,27	0,64	0,71	0,61		0,62
2005	0,70	0,28	0,62	0,66	0,60		0,61

Note: A&F represents agriculture and fishing; E: energy; I: industry; B: building; S: the private productive services i.e., government and Real Estate excluded.

The aggregate labour share shows a clear upward trend over the entire time period. The aggregate share first increased by approximately 10 percentage points of total income (during 1955-1983), then decreased by around 4 percentage points (1983-1995). During 1995-2005, the aggregate labour share has fluctuated in the narrow range $0.61 - 0.64$.

The levels of the sectors' labour shares are highly different and these differences are persistent. However, all sectors' labour shares exhibit an increasing trend until 1983 (on average around 15 percentage points of total income changed hands over this period) and decreasing trend during 1983-1995[10] (on average a bit less than 10 percentage points of total sectorial income changed hands over the period). During 1995-2005, the most noticeable changes are the decline in the industrial labour share (down by 5 percentage points) and the decline in the building sector's labour share (down by 13 percentage points). The labour share in Agriculture exhibited a different pattern of behaviour all during the sample period: it first decreased by 20 percentage points (1955-1983), then increased by 10 percentage points (1983-1995), and since then it has fluctuated around the value 0.70.

Table 2 reports sectors' value added shares during the period 1955-2005.

of the labour share provides a more accurate description of the share of total income accruing to labour in this particular sector especially during the period 1955-1983.

Since the National Accounts do not provide information on farmers' mixed income for the most recent period (1995-2005), the labour share in agriculture during 1995-2005 is computed by imputing to self-employed farmers a wage equal to the average wage farm employees earn.

[10] with the exception of Industry, whose labour share rose from 0.63 in 1983 to 0.66 in 1995.

TABLE 2.- Sectors' value added shares in Spain, 1955-2005

Sector Year	A&F	E	I	B	S
1955	0,24	0,05	0,31	0,07	0,34
1957	0,24	0,05	0,29	0,07	0,34
1959	0,24	0,05	0,29	0,07	0,35
1961	0,22	0,05	0,30	0,07	0,35
1963	0,22	0,05	0,29	0,08	0,36
1965	0,18	0,05	0,31	0,09	0,37
1967	0,16	0,05	0,31	0,09	0,40
1969	0,15	0,05	0,31	0,09	0,40
1971	0,13	0,05	0,31	0,09	0,42
1973	0,12	0,04	0,31	0,11	0,42
1975	0,11	0,04	0,31	0,12	0,42
1977	0,10	0,04	0,31	0,12	0,43
1979	0,09	0,04	0,30	0,12	0,45
1981	0,08	0,04	0,31	0,09	0,48
1983	0,08	0,05	0,30	0,09	0,49
1985	0,08	0,05	0,29	0,08	0,50
1987	0,07	0,05	0,28	0,08	0,52
1989	0,07	0,05	0,26	0,09	0,52
1991	0,06	0,05	0,25	0,11	0,54
1993	0,06	0,05	0,22	0,10	0,57
1995	0,06	0,04	0,22	0,10	0,57
1997	0,06	0,04	0,23	0,09	0,58
1999	0,05	0,04	0,22	0,10	0,59
2001	0,05	0,03	0,22	0,12	0,58
2003	0,05	0,03	0,20	0,13	0,59
2005	0,04	0,03	0,19	0,15	0,59

Note: Value added shares are computed as $GVA_{it}/\Sigma GVA_{it}$ for all i=1...5, where gross value added are measured in current terms.

The period 1955-1995 in Spain is one of *structural change*: agriculture represented one fourth of total value added in 1955 and only 5% in 1995, industry exhibited a somewhat oscillating pattern (increase-stagnation-then decrease), and the private productive services expanded from around one third of total value added to around 60% of total value added. During 1995-2005, the changes in sectors' value added shares are by no means comparable to previous period changes. However, the decline of the industry's share of total value added and the jump in the building sector's share of value added are worth mentioning.

Table 3 quantifies the effects of the intersectorial forces on the aggregate labour share as well as those of changes in the industrial labour shares.

TABLE 3.- Decomposition of changes in aggregate labour share, in percentage terms, Spain, 1955-2005

Sample period	1955-1983	1983-1995	1995-2005
Changes in sectorial composition	-40%	-5%	-102%
Changes in sectors' labour shares	89%	77%	179%
Covariance term	51%	28%	23%
Changes in aggregate labour share	10,4 p.p.	-4,3 p.p.	-0,9 p.p.

Let us focus on the period 1955-1995. Changes in the sectorial labour shares account for most of observed variation of the aggregate labour share. During

1955-1983, they account for 90% of observed increase in the aggregate labour share. During 1983-1995, they account for 77% of observed decrease in the labour share.

During 1955-1983, changes in the sectorial composition of output would have led to a reduction of the aggregate labour share by 4 percentage points, on the assumption that sectorial labour shares had remained fixed at their initial values. Agriculture's share of value added went down by 15 percentage points, the relative share of the private productive services increased by 15 percentage points and industry's share of value added remained approximately constant. In 1955, Agriculture had the largest sectorial labour share and the private productive services the smallest. However, the labour share of income in agriculture decreased during 1955-1983, while the labour share in the services sector increased. Hence, the covariance term positively contributed to the overall growth of the aggregate labour share. This term more than compensated the negative contribution of changes in the sectorial composition of output, assuming fixed sectorial labour shares. As a result, the sum of these two components contributed to observed increase of the aggregate labour share by 1 percentage point.

During 1983-1995, changes in the sectorial composition of output, on the assumption that sectorial labour shares had remained fixed at their 1983 values had a negligible contribution to observed evolution of the aggregate labour share. On the contrary, changes in the sectorial composition of output interacted with changes in the sectorial labour shares accounted for approximately one fourth of observed decrease of the aggregate labour share. During 1983-1995, agriculture's share of value added went further down (by 3 percentage points), the share of the private productive services in total value added increased (by 7 percentage points), and there was an important decline in the share of industry (down by 8 percentage points). Both the labour shares in agriculture and industry increased during this period, while the labour share in the private productive services sector decreased. As a result, aggregate labour share declined by 1 percentage point.

The covariance term is composed of the interaction of changes in the sectorial composition of output and changes in the sectorial labour shares. Let us look directly into the changes in the sectorial labour shares. Are there any significant (positive or negative) intersectorial correlations? Under the assumption that sectorial labour shares' fluctuations are statistically independent, the variance of the aggregate labour share is computed as:

$$Var^*(LS) = \sum_{i=1}^{5} (\omega_i)^2 \cdot Var(LS_i)$$

where $(\omega_i)^2 \ \forall i = 1...5$ are sectors' shares of value added in 1983.

The actual variance of the aggregate labour share incorporates the effect of intersectorial correlations. Positive correlations between sectors increase this variance, negative correlations reduce it. The actual variance of the aggregate labour share is also affected by changes in sectors' shares of value added. To remove this effect, the aggregate labour share is recomputed as the weighted

average of the sectorial labour shares, with fixed weights as of 1983. That is, aggregate labour share at time t is computed as:

$$LS_t^{(83)} = \sum_{i=1}^{5} \omega_{i,1983} \cdot LS_{i,t}$$

The variance of this aggregate labour share series is then computed, $Var\left(LS_t^{(83)}\right)$, and compared against the benchmark, $Var^*(LS)$. Table 4 reports the results.

TABLE 4.- Actual Variance of the aggregate labour share and theoretical variance, under the assumption of independence of sectors' labour shares

Sample period	1955-1983	1983-1995	1995-2005
Var(LS^{83})	0.0022	0.00025	0.00017
Var*(LS)	0.0012	0.00032	0.00016

During 1955-1983, sectorial labour shares were strongly positively correlated. The actual variance is nearly twice as high as the variance one would obtain if the labour shares had evolved independently. On the contrary, during 1983-1995, between sectors' correlations are smaller and negative. The difference between the actual variance and the theoretical variance is smaller and negative.

To summarize, during 1955-1983, the aggregate labour share rose by more than 10 percentage points, from 0.55 to 0.66, and correlations between sectors were very high and positive, which explains the positive contribution of the covariance component. The rise of the sectorial labour shares appears as the main factor underlying the rise of the aggregate labour share. On the contrary, during 1983-1995, the aggregate labour share declined by 4 percentage points, from 0.66 to 0.62. During this period cross-sector correlations were smaller and negative. In addition, resources were reallocated towards those sectors whose labour shares decreased during the period (building and the private productive services) and away from the sector whose labour share increased during this period, industry. Hence, the period 1955-1983 is one of generalized increase in the sectors' labour shares and this minimizes the effect of changes in the sectorial composition of ouput on the aggregate labour share (sectorial reallocation of resources would have driven the aggregate labour share down by 4 percentage points). During 1983-1995, sectorial labour shares evolve in opposed directions, and the covariance component helps reduce the aggregate labour share.

During 1995-2005, the aggregate labour share declines by less than 1 percentage point. The main contributor to this change is the change in the sectorial labour shares.

The lessons we draw from this decomposition exercise are:

- When there is room for substantial changes in the sectorial composition of output, they tend to reduce the aggregate labour share.
- When changes is the sectorial labour shares are not highly positively correlated, the covariance term tends to reduce the aggregate labour share.

Regional Labour shares,
Spain, 1955-1995.
Source: Fundación BBVA

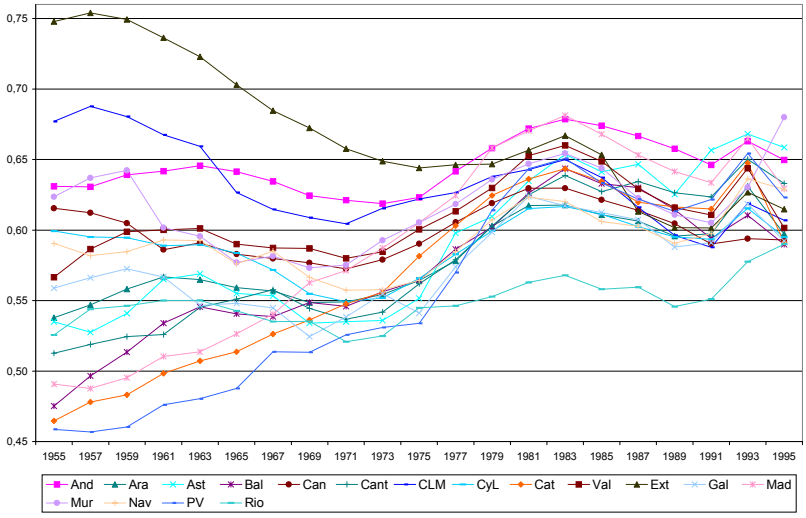


Figure 1:

- Changes in the sectorial labour shares appear as an important determinant of the aggregate labour share. Industry-specific labour shares dynamics are worth investigating.

Before we address this issue, we will inspect the Spanish regional labour shares. Regions are interesting units of analysis because they have quite different industrial structures and they may also have different capital-labour intensities and different efficiency levels within each particular sector.

Figure 1 below plots the regional labour shares for the sample period 1955-1995.

Regional labour shares started very different and converged during 1955-1983. In 1983, the difference between the region with the highest labour share and that with the lowest labour share was as high as 11 percentage points of regional GDP. From 1983 onwards, regional dispersion has remained approximately unchanged. What factors explain regional differences in the aggregate labour shares?

I will show that different sectorial structures are an important determinant of the regional pattern of distributive shares, especially at the beginning of the sample period and for the group of regions whose aggregate labour shares are above the national aggregate labour share[11]. This effect disappears as regional

[11] Table 1 in the appendix reports the average sectorial composition of output of the 6-richest and the 6-poorest regions in 1965, for selected years, 1965, 1983, 1995. It is interesting to

industrial structures converge. Comparative advantage in terms of industrial labour shares, i.e., regional industrial labour shares below the national value, becomes the most important determinant of the relative stability of regional labour shares once industrial structures have converged. Comparative advantage is also the main determinant of the relative stability of the aggregate labour shares of the regions whose aggregate labour shares are below the national labour share.

We break down the difference between each region's aggregate labour share and the national aggregate labour share into three components: differences in the sectorial composition of output, differences in the sectors' labour shares and a covariance component, the joint effect of differences in the sectorial structure and differences in the industrial labour shares.

Suppose each regional economy j is divided into N industries ($i = 1...N$), with labour shares $LS_{it}^{j}, \forall j = 1...17, i = 1...N, t = 1...T$, and weights in total value added $\omega_{it}^{j}, \forall j = 1...17, i = 1...N, t = 1...T$. The labour shares and weights are observed over T time periods. The regional aggregate labour share is computed as:

$$LS_{t}^{j} = \sum_{i=1}^{N} \omega_{it}^{j} \cdot LS_{it}^{j}$$

Let LS_t be the national aggregate labour share and LS_{it} be sector i labour share at the national level. Then, the difference between region's j aggregate labour share and the national aggregate labour share at time t can be decomposed into three components:

$$\begin{aligned} LS_{t}^{j} - LS_{t} &= \sum_{i=1}^{N} \omega_{it}^{j} \cdot LS_{it}^{j} - \sum_{i=1}^{N} \omega_{it} \cdot LS_{it} = \\ &= \sum_{i=1}^{N} \left(\omega_{it}^{j} - \omega_{it} \right) \cdot LS_{it} + \\ &\quad + \sum_{i=1}^{N} \omega_{it} \cdot \left(LS_{it}^{j} - LS_{it} \right) + \\ &\quad + \sum_{i=1}^{N} \left(\omega_{it}^{j} - \omega_{it} \right) \cdot \left(LS_{it}^{j} - LS_{it} \right) \end{aligned}$$

The first term measures the effect of differences in the sectorial composition of output on the difference between regional and national aggregate labour shares, holding the industrial labour shares constant at their national values.

notice that the 6 poorest regions in 1965 were also the regions whose aggregate labour shares were above the national aggregate labour share in 1965. These were: Andalucía, Castilla-La-Mancha, Castilla y León, Extremadura, Galicia and Murcia. Four out of the 6 richest regions in 1965 were also among the regions whose aggregate labour shares were below the national labour share in 1965. These were: Baleares, Cataluña, Madrid, País Vasco.

The second term measures the effect of differences in the industrial labour shares on the difference between regional and national aggregate shares, holding sectors' value added shares at their national values. Finally, the last term measures the contribution of the interaction of differences in the sectorial composition of output and differences in the sectorial labour shares.

We perform this decomposition analysis for three years in the sample period: 1965, 1983 and 1995. For each of these years, regions are grouped into regions whose aggregate labour shares were above the national labour share and regions whose aggregate labour shares were below the national labour share. Table 5 presents average results of this decomposition analysis for each group of regions.

TABLE 5.- Decomposition of differences in the regional labour shares

Year	1965	1983	1995
Regions whose labour shares are ABOVE the national labour share(1)			
Sectorial composition	24%	28%	15%
Comparative advantage	43%	35%	42%
Covariance	33%	38%	43%
Regions whose labour shares are BELOW the national labour share(2)			
Sectorial composition	-1%	7%	-12%
Comparative advantage	69%	63%	57%
Covariance	31%	30%	56%

Note: (1) In 1965: Andalucía, Canarias, Castilla-La-Mancha, Castilla y León, Valencia Extremadura, Galicia. In 1983: Andalucía, Valencia, Extremadura, Madrid. In 1995: Andalucía, Asturias, Murcia, Navarra, País Vasco. (2) In 1965: Baleares, Cantabria, Cataluña, Madrid, País Vasco, La Rioja. In 1983: Aragón, Baleares, Canarias, C-L-M, CyL, Cataluña, Galicia, Navarra, País Vasco, La Rioja. In 1995: Aragón, Baleares, Canarias, C-L-M, CyL, Cataluña, Valencia, Galicia, La Rioja.

In 1965, differences in the sectorial composition of output are important to explain greater than national labour shares. Regions whose aggregate labour shares are greater than the national labour share are specialized in agriculture (whose average labour share is high), and they are not specialized in industry (whose aggregate labour share is low). Their lack of specialization in industry is again the source of positive differences with respect to the national labour share in 1983. On the contrary, the sectorial composition of output of the regions whose aggregate labour shares are below the national share is not particularly relevant to explain the difference. Lower than national aggregate labour share is due to their comparative advantage in terms of industrial labour shares. The covariance term plays an important role in 1995, for both types of regions. Regions whose labour shares are above the national are specialized in sectors where they have "comparative disadvantage" in terms of labour shares. On the contrary, regions whose aggregate labour shares are below average are specialized in sectors where they have comparative advantage.

The lessons we draw from this static decomposition analysis confirm our previous findings:

- In summary, there are two margins to hold the regional labour shares

"relatively stable": one is the sectorial reallocation of resources and the other is the "relative stability" of the industrial labour shares.

- As development proceeds, the first margin becomes less important at the present level of sectorial disaggregation[12].

Now, we turn to the second important determinant of the "relative stability" of the aggregate labour share: the relative stability of its industrial components.

Table 2 in the appendix shows the labour share of income in each of the fifteen sectors into which we divided the Spanish private productive sector[13]. Figure 1 in the appendix plots these figures. Medium term and long-run fluctuations are large (more than ten percentage points) and persistent. The statistical hypothesis that the average value of any of these sectorial labour shares has been constant over successive time intervals (1955-1975 and 1977-1995) is easily rejected. Additionally, short-run fluctuations around a constant long-run value are found to be first-order autoregresive. Also, the business cycle component of the sectorial labour shares is found to be countercyclical i.e., when the sectorial value added rises, the labour share declines[14][15].

Let us focus for now at the medium and long-run oscillations. In all sectors, the period 1955-1995 is characterized by a long-run accumulation of capital relative to labour. At the same time, nearly all sectors had increasing labour shares[16]. These two facts suggest that the elasticities of substitution of the sectorial production functions must have been smaller than one. More precisely, assume each sector has a Constant Elasticity of Substitution production funtion and faces perfectly competitive good and factors' markets and labour augmenting technical progress accruing at a constant rate (which may be different sector by sector). Then, the kind of trend increase experienced by most sectorial labour shares would result from the adjustment of relative factor quantities and factor prices, for $\sigma_i < 1$ (σ_i represents the elasticity of substitution between the factors). Let the CES production function in sector i be:

$$Y_{it} = F(K_{it}, \widetilde{L}_{it}) = \left[a_i K_{it}^{-\rho_i} + (1 - a_i) \widetilde{L}_{it}^{-\rho_i} \right]^{-\frac{1}{\rho_i}}, 0 < a_i < 1, -1 \leq \rho_i \leq \infty$$

[12] Most probably, sectorial reallocation of resources would appear to have a relevant effect on the aggregate labour share if we looked at more disaggregated data and data measured at higher frequencies, monthly or quarterly data.

[13] These are: C1. Agriculture and Fishing, C2. Fuel and power products, C3. Ferrous and non-ferrous ores and metals, C4. Non-metallic minerals and minerals' products, C5. Chemical products, C6. Metal products and machinery, C7. Transport equipment, C8. Food, beverages and tobacco, C9. Textiles and clothing, leather and footwear, C10. Paper and printing products, C11. Rubber and plastic products and other manufactures, C12. Building, C13. Transport and communication services, C14. Financial and insurance services, C16. Residual of private productive services (includes: Recovery and repair services, Wholesale, Lodging and catering services, rest of private productive services).

[14] The business cycle component of the labour share series was computed applying the Hodrick-Prescott filter. The same results obtain if first-differenced logs of the labour share are used instead.

[15] The results of the statistical tests are available on request.

[16] The exceptions being: Agriculture and Fishing, whose labour share declined over 1955-1995 and Energy and power products and Financial and insurance services, whose labour shares exhibited a huge oscillation, first increasing then decreasing.

where $\widetilde{L}$ represents labour measured in efficiency units. Then, $\sigma_i = \frac{1}{1+\rho_i}$.

Previous proposition is easily testable[17]. First, we need to estimate the value of the elasticity of substitution of these CES production functions. This we do under the assumption that labour-augmenting technical progress comes at a constant rate equal to the average growth rate of the estimated sectorial series of Harrod-neutral technical progress[18]. The point estimates range in the interval $[0.46; 0.86]$[19]. The four big sectors (our previous five big sectors, excluding agriculture) have elasticities: 0.86 (Energy), 0.41 (Industry, excluding Energy and Building), 0.58 (Building) and 0.81 (Private productive services). These estimated values may account for the long-run evolution of the sectorial labour shares.

Now, assume we want to test the ability of the model to reproduce the behaviour of the sectorial labour shares over shorter time intervals. Sectorial labour shares experience persistent deviations from their long-run values. Some shock must be causing these deviations. Consider, the following hypothesis: there are technical shocks (possibly biased and with some degree of persistence) hitting each sector every period. Hence, the capital-labour ratios (in efficiency units) adjust to these shocks and these adjustments cause observed fluctuations of the labour shares. To test this hypothesis, we derive the series of biased technical shocks directly from the estimated series of Harrod-neutral technical progress. At time t, each "sector/firm" i observes the shock, which affects the ratio of marginal productivities of the factors, and chooses its capital-labour ratio (in efficiency units) according to the profit-maximizing rule:

$$\widetilde{k}_{it} = \frac{K_{it}}{\widetilde{L}_{it}} = g(\frac{w_{it}}{r_{it}}, B_{it}) = \left[\frac{a_i}{1-a_i}\frac{w_{it}}{r_{it}}\frac{1}{B_{it}}\right]$$

where $\widetilde{k}$ represents the capital-labour ratio measured in efficiency units and $\widetilde{L}$ represents labour in efficiency units. Then, the labour share in sector i is simply:

$$(1-\alpha_{it}) = 1 - \frac{a_i}{a_i + (1-a_i)\widetilde{k}_{it}^{\rho_i}}$$

[17] In what follows, I briefly summarize the procedure and results of such a test, which are described in full detail in section 2.6 of my dissertation.

[18] Harrod-neutral technical progress is calculated dividing the Solow residual by the instantaneous labour share of income, i.e.,

$$B_{it} = \frac{1}{(1-\alpha_{it})}\left[\left(\frac{\Delta Y}{Y}\right)_{it} - \alpha_{it}\left(\frac{\Delta K}{K}\right)_{it} - (1-\alpha_{it})\left(\frac{\Delta L}{L}\right)_{it}\right]$$

[19] Except for agriculture, whose estimated elasticity of substitution is greater than one (1.82), and two other sectors, whose estimated elasticities of substitution are too extreme to yield "reasonable" results in the simulation exercise that follows. These are: C7, 0.22 and C6, 4.7.

We checked this hypothesis for every sector where it was possible[20]. For the sake of brevity, we report results for the biggest sectors only: industry, services and building[21]. These results are quite general. In fact, the finer the sectorial disaggregation, the more explicit the differences between actual and simulated labour share series are. Figures 1 to 3 in the appendix plot actual and model labour share series. Simulated labour shares do not match the huge fluctuations actually experienced by the sectors' labour shares. In the services sector, actual labour share grows by ten percentage points more than predicted by the model from 1965 to 1983 and falls also more, by 6 percentage points, during 1983-1995. In the building sector, there is a difference of approximately 5 percentage points between actual and simulated series, first in their way up, then in their way down. In industry, actual labour share grows by 5 percentage points more than predicted by the model during 1965-1983. The model predictions are quite accurate for the period 1983-1995.

Even after taking into account the effect of varying growth rates of technical progress, the model is unable to reproduce medium term dynamics of the sectorial labour shares. The model misses the factors explaining why the labour shares grew more than predicted and why they also fell more. It would seem as if the elasticities of substitution had been initially lower than estimated long-run values. At some point (around 1983), the elasticity of substitution reaches its long-run value as in the industrial sector or an even greater value as in the services sector. In the building sector, the factor price actually decreased during 1983-1995 while the capital-labour ratio remained approximately constant.

At the aggregate level, we have documented a trend increase in the labour share, of approximately 7 percentage points -sample period 1955-1995-, 5 percentage points if we focus on the sample period 1971-1995. The capital-labour ratio increased by 184% over 1971-1995 or equivalently at an annual rate equal to 4.44%. The puzzling feature of the aggregate picture is that during 1983-1995, when the labour share declined at an annual rate equal to 0.5%, the capital-labour ratio increased at an annual rate equal to 3.1%. During the period 1971-1983, the labour share rose by 1.2% annually while the capital-labour ratio increased by 5.8% per year. A look at the series of Harrod-neutral technical progress shows two periods of very high positive rates of technical improvement, from 1965 to 1973 and from 1983 to 1989 (Figure 4 in the appendix). The jump in the growth rate of technical progress from 1983 onwards may explain the decline in the labour share in the face of a rising capital-labour ratio.

Within any given sector, a rising labour share of income automatically implies a declining capital share and if the capital-output ratio does not adjust, declining returns on investments. In the face of a very low elasticity of substi-

[20] Using Spanish data, we computed the model labour shares for each of the following sectors: C1, C2, C4, C6, C7, C9, C10, C11, C12, C14 and C16.

[21] The two excluded sectors are: energy and agriculture. The energy sector has been characterized for the greatest part of the sample period by a market structure close to monopoly. Agriculture seems to be a sector with a fully different pattern of behaviour. There is a clear downward trend of the labour share, interrupted at the end of the sample period. Here one may suspect that there are European and Spanish social funds reversing the falling trend of the labour share.

tution or even a putty-clay technology, firms/sectors may try to introduce new technologies that save on the expensive factor (as far as these are available) and/or may slowly substitute capital for labour. Both strategies would lead to an increase of the income share of capital.

Hence, from the sectorial evidence, the lessons we draw are:

- Medium run dynamics do not follow the logic of the model with CES production function plus varying rates of technical progress and at the same time, they seem key to understand the pattern of behaviour of the labour shares, their relative stability. That is, the labour shares rise and in response, efforts are made to force these shares down.

- Induced and biased technical improvement may play an important role as a mechanism to guarantee the relative stability of the industrial labour shares.

4 US Evidence

Table 3 in the appendix shows the share of labour in total income generated in the US private sector over 1958-1996 (annual data), at the aggregate level and for each of five big sectors. The shares were calculated from data included in the *35-KLEM* data set downloaded from Professor Dale Jorgenson's web page. Aggregate labour share is the weighted average of the sectorial shares, with weights equal to the sectors' value added shares. Sectors' labour shares were computed as the ratio of the value of the labour services to the sector's value added, both measured in current Million dollars[22].

The aggregate labour share shows a very slight downward trend, which is not statistically significant. The labour share represented 69% of total income in 1958 and 67% in 1996. Short-run fluctuations of the aggregate labour share range in the interval $[0.65; 0.70]$.

The sectors' labour shares are substantially different and these differences are highly persistent. Although fluctuations of the US sectorial labour shares are not as important as their Spanish counterparts, they are larger than observed fluctuations at the aggregate level. They turn around 10 percentage points of sectorial value added.

Table 4 in the appendix reports sectors' value added shares during 1958-1996. By 1958, when our times series start, the structural change in the US was almost completed. Agriculture's share of total value added was only 6%, industry's share was 30% and the private services' share was 54%. During the period 1958-1974, these shares remained stable. Also the aggregate labour share changed by less than half a percentage point. During 1975-1996, the share of industry went down to 25% of total value added while the share of services

[22] The methodology used to construct the *35-KLEM* database is described in Jorgenson et al (1987) and Jorgenson et al (2002). The estimated values of the labour services already include a correction for the labour earnings of the self-employed. No data are available on the composition of the workforce (ratio of employees/ total employment).

increased to 65%. The aggregate labour share decreased by 2 percentage points during this interval. Table 6 quantifies the effect of both the changes in the sectorial composition of output and the changes in the sectorial labour shares on the aggregate labour share.

TABLE 6.- Decomposition of changes in aggregate labour share, in percentage terms
US, 1958-1996

Sample period	1958-1974	1975-1996
Changes in sectorial composition	-153%	-6%
Changes in sectors' labour shares	195%	123%
Covariance term	58%	-17%
Changes in aggregate labour share	0,4 p.p	-2,3 p.p.

During 1958-1974, the decrease of agriculture's share of total value added accounts for the negative effect of the changes in the sectorial composition of output on the aggregate labour share's growth. During 1975-1996, a decreasing industrial share of value added helped reduce the aggregate labour share but this effect was more than compensated by the increase in the services share of value added. Overall, the main determinant of observed evolution of the aggregate labour share are the changes in the sectorial labour shares. In particular, during 1975-1996, the labour share decreased in all big sectors, the exception being the building sector.

The covariance term does not play a meaningful role. We checked correlations between changes in the sectorial labour shares. First, we recomputed a fixed-weight aggregate labour share, using the weights of 1985. The variance of this fixed-weight aggregate labour share turns out to be 0.0001359. Next, we computed the theoretical variance of the aggregate labour share, under the assumption that the sector labour shares moved independently in a statistical sense. This variance is equal to 0.0001374. Hence, the US sector shares fluctuated almost independently during 1958-1996.

Let us now focus on the pattern of the sectors' labour shares. Table 5 in the appendix shows the labour share of income in each of the fifteen sectors into which we divided the US private sector[23]. Figure 6 in the appendix plots these figures. As in Spain, medium term and long-run fluctuations are large (more than ten percentage points) and persistent. The statistical hypothesis that the average value of any of these sectorial labour shares has been constant over successive time intervals (1958-1975 and 1976-1996) is rejected in all sectors, with the exception of sectors $C7$, $C10$, $C12$, $C13$. Additionally, short-run fluctuations around a constant long-run value are found to be first-order autoregresive. And also as in Spain, the business cycle component of the US sectors labour shares

[23] These are comparable to the 15 sectors into which we divided the Spanih private productive sector except for $C14$, which includes Real Estate in the US, but not in Spain.

is countercyclical[24][25]. However, what we called "medium-term" oscillations of the sector shares are much shorter in the US than they are in Spain.

How does the model with CES production function and varying growth rates of the labour-augmenting technical progress perform in the US? First, we estimated elasticities of substitution of the sectorial production functions. The point estimates fell in the range $[0.15; 0.78]$ if we exclude the sectors whose elasticities were too close to one[26]. Next, we simulated each sector labour share series under the assumption that firms/sectors observe "true" technical shocks and adjust their capital-labour ratios, measured in efficiency units, accordingly. The model labour shares reproduce quite accurately the actual labour shares in some of the manufacturing sectors (C5, C6, C7) and one of the services sectors, C14. However, the model labour shares generally fail to account for all of the observed variability of the sector labour shares. Actual short-run fluctuations of the sector shares are larger than those predicted by the model. Actual sector labour shares grow more and they also fall more than their model counterparts.

5 Concluding remarks

This paper has evaluated the "relative constancy" of the aggregate labour share from a new perspective with suggestive and challenging results.

Changes in the aggregate labour share are found to be quantitatively relevant in Spain, much less so in the US. Changes in the industrial labour shares are found to be quantitatively relevant both in Spain and in the US. However, our main finding is that changes in the labour shares, be it at the aggregate or sectorial levels, in Spain or in the US, may be explained in terms of an analytical framework that embodies well-established economic principles.

Based on the examination of sectorial and regional data as well as aggregate data, we are able to suggest an empirically testable explanation of the fact that various industries with widely-oscillating labour shares integrate an economy with a "relatively constant" aggregate labour share. The relative stability of the aggregate labour share is due to deliberate efforts on the part of firms/sectors to reduce the labour share of income as much as possible, given existing technical restrictions, factor supply conditions and commodity demand conditions. Such efforts may take the form of changes in the input ratios used in production, adoption of new labour saving technologies or reallocation of resources to sectors whose labour shares are lower.

If such an hypothesis is tested and accepted, it is not without important implications for models of growth and business cycles. Movements in the labour shares become central to understand and explain cyclical fluctuations of output and even its long-run growth rate since endogenous and biased technical progress

[24] The business cycle component is computed both by HP detrending the labour share series and by first-differencing the log of the series. Both detrending methods yield comparable results.

[25] Results of the statistical tests are available on request.

[26] These sectors are: C2, C3, C7, C9, C12, with elasticities: $1.19; 0.83; 0.86; 0.92; 0.94$. These sectors perform poorly in the simulations of the model labour shares.

may play a fundamental role in the "relative stability" of the factor shares of income.

Fundación BBVA, *Renta nacional de España y su distribución provincial, Serie homogénea, 1955-1993 y avances 1994-1997*. Bilbao, 1999.

References

[1] Harberger, A., "A Vision of the Growth Process", *American Economic Review*, 1998, 88 (1), 1-32.

[2] Instituto Nacional de Estadística, *Contabilidad Nacional*. Banco de datos Tempus, <www.ine.es>

[3] Jones, Ch. I., "Growth, Capital Shares, and a New Perspective on Production Functions", U.C. Berkeley Mimeo, June 2003.

[4] Jorgenson, D. W., Ho, M. S. and K. J. Stiroh, "Growth of U.S. industries and investments in Information Technology and Higher Education", Harvard University Mimeo, October 2002.

[5] Jorgenson, D. W., Gollop F. M. and B. Fraumeni, *Productivity and US economic growth*, Cambridge: Harvard University Press, 1987

[6] Jorgenson, D.W. *35-KLEM*
<hppt://post.economics.harvard.edu/faculty/jorgenson/data/35klem.html>

[7] Más, M., F. Pérez and E. Uriel, *El stock de capital en España y su distribución territorial*, Fundación BBVA e IVIE. Bilbao, 1998.

[8] Solow, R., "A Skeptical Note on the Constancy of Relative Shares", *American Economic Review*, 1958, 48, 618-631.

[9] Young, A. T., "Exposing a Prejudice Against a Bias: Biased Technical Changes and Aggregate Fluctuations", Emory University Mimeo, July 2003.

[10] Young, A. T., "One of the Things we know that Ain't so: Why US Labor's Share is not Relatively Stable", University of Mississippi Mimeo, August 2005.

[11] Young, A. T., "I can't believe it's not Cobb-Douglas. A US Elasticity of Substitution around 0.8", University of Mississippi Mimeo, December 2004.

[12] Zuleta, H and A. T. Young, "Labour's Shares: Micro and Macro: Accounting for both in a Two-Sector Model of Development with Induced Innovation", University of Mississippi Mimeo, August 2005.

A Tables

A.1 Sectorial composition of output in Spain

TABLE 1.- Sectorial composition of output in Spain for selected years, 1965, 1983, 1995

	1965				
	A&F	Energy	Industry	Building	Services
6 poorest regions in 1965	0,33	0,07	0,19	0,09	0,33
6 richest regions in 1965	0,13	0,03	0,35	0,09	0,40
National	0,17	0,05	0,29	0,08	0,41
	1983				
	A&F	Energy	Industry	Building	Services
6 poorest regions in 1965	0,17	0,06	0,23	0,11	0,44
6 richest regions in 1965	0,05	0,03	0,34	0,07	0,51
National	0,08	0,04	0,29	0,08	0,52
	1995				
	A&F	Energy	Industry	Building	Services
6 poorest regions in 1965	0,12	0,07	0,18	0,13	0,49
6 richest regions in 1965	0,03	0,03	0,26	0,09	0,59
National	0,06	0,04	0,21	0,09	0,60

Note: A&F represents agriculture and fishing; Services represents the private productive services i.e., government and Real Estate excluded.

Note: 6 poorest regions in 1965: Andalucía, Castilla-La-Mancha, Castilla y León, Extremadura, Galicia, Murcia. 6 richest regions in 1965: Baleares, Cataluña, Madrid, Navarra, País Vasco, Valencia.

A.2 Sectorial labour shares in Spain (15 sectors)

TABLE 2.- Sectorial Labour shares in Spain, 1955-1995

Sector / Year	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C16
1955	0,79	0,28	0,52	0,46	0,29	0,46	0,40	0,48	0,38	0,51	0,39	0,71	0,50	0,45	0,50
1957	0,80	0,26	0,51	0,45	0,28	0,47	0,42	0,49	0,41	0,52	0,42	0,71	0,52	0,42	0,50
1959	0,80	0,27	0,50	0,43	0,29	0,47	0,43	0,49	0,42	0,49	0,45	0,71	0,52	0,45	0,51
1961	0,80	0,26	0,53	0,45	0,31	0,50	0,42	0,51	0,43	0,48	0,48	0,71	0,56	0,53	0,50
1963	0,78	0,28	0,52	0,55	0,33	0,49	0,44	0,52	0,44	0,50	0,51	0,69	0,59	0,46	0,50
1965	0,76	0,29	0,48	0,50	0,35	0,50	0,50	0,52	0,44	0,52	0,55	0,67	0,62	0,50	0,50
1967	0,74	0,29	0,56	0,43	0,36	0,56	0,52	0,54	0,45	0,52	0,57	0,68	0,64	0,50	0,51
1969	0,70	0,26	0,50	0,46	0,37	0,58	0,52	0,54	0,47	0,55	0,55	0,68	0,64	0,56	0,52
1971	0,70	0,26	0,52	0,43	0,38	0,62	0,55	0,55	0,48	0,52	0,51	0,70	0,62	0,56	0,53
1973	0,70	0,29	0,47	0,41	0,40	0,61	0,52	0,57	0,50	0,52	0,49	0,70	0,61	0,62	0,54
1975	0,68	0,30	0,40	0,45	0,43	0,61	0,56	0,60	0,55	0,52	0,59	0,71	0,63	0,61	0,55
1977	0,67	0,36	0,44	0,43	0,47	0,62	0,66	0,57	0,56	0,53	0,58	0,75	0,65	0,62	0,58
1979	0,65	0,36	0,51	0,44	0,52	0,67	0,74	0,55	0,63	0,61	0,58	0,77	0,69	0,65	0,59
1981	0,61	0,36	0,56	0,51	0,53	0,72	0,73	0,55	0,63	0,71	0,65	0,86	0,73	0,55	0,61
1983	0,61	0,37	0,56	0,54	0,51	0,69	0,72	0,54	0,59	0,64	0,69	0,88	0,75	0,63	0,63
1985	0,62	0,35	0,53	0,55	0,47	0,66	0,76	0,58	0,60	0,65	0,69	0,85	0,73	0,56	0,62
1987	0,61	0,30	0,60	0,53	0,47	0,64	0,70	0,58	0,59	0,64	0,66	0,83	0,73	0,55	0,62
1989	0,63	0,28	0,58	0,47	0,49	0,67	0,69	0,53	0,57	0,67	0,69	0,75	0,74	0,50	0,61
1991	0,64	0,30	0,72	0,46	0,58	0,69	0,73	0,54	0,61	0,68	0,69	0,70	0,76	0,49	0,59
1993	0,66	0,29	0,80	0,57	0,66	0,76	0,84	0,55	0,76	0,78	0,83	0,79	0,79	0,51	0,59
1995	0,70	0,28	0,79	0,50	0,60	0,70	0,72	0,58	0,70	0,59	0,75	0,74	0,77	0,46	0,57

Note: C1. Agriculture and Fishing, C2. Fuel and power products, C3. Ferrous and non-ferrous ores and metals, C4. Non-metallic minerals and minerals' products, C5. Chemical products, C6. Metal products and machinery, C7. Transport equipment, C8. Food, beverages and tobacco, C9. Textiles and clothing, leather and footwear, C10. Paper and printing products, C11. Rubber and plastic products and other manufactures, C12. Building, C13. Transport and communication services, C14. Financial and insurance services, C16. Residual of private productive services.

A.3 Private sector and 5 big sectors' Labour shares, US

TABLE 3.- Aggregate and 5 big sectors' Labour shares in the US, 1958-1996

Sector Year	A&F	E	I	B	S	Total
1958	0,79	0,43	0,75	0,88	0,64	0,69
1959	0,76	0,43	0,72	0,90	0,63	0,68
1960	0,75	0,43	0,74	0,92	0,64	0,69
1961	0,75	0,44	0,74	0,91	0,64	0,69
1962	0,75	0,44	0,73	0,90	0,63	0,68
1963	0,68	0,43	0,72	0,90	0,64	0,68
1964	0,71	0,42	0,71	0,89	0,63	0,67
1965	0,65	0,40	0,70	0,88	0,62	0,66
1966	0,63	0,39	0,70	0,87	0,61	0,65
1967	0,68	0,39	0,72	0,87	0,61	0,66
1968	0,73	0,41	0,72	0,88	0,62	0,67
1969	0,68	0,44	0,73	0,88	0,64	0,68
1970	0,70	0,41	0,76	0,88	0,64	0,69
1971	0,69	0,41	0,74	0,87	0,63	0,68
1972	0,65	0,43	0,73	0,88	0,64	0,68
1973	0,55	0,41	0,74	0,89	0,65	0,69
1974	0,60	0,37	0,77	0,90	0,66	0,70
1975	0,71	0,41	0,73	0,87	0,67	0,69
1976	0,67	0,39	0,73	0,86	0,64	0,67
1977	0,65	0,41	0,73	0,86	0,63	0,67
1978	0,64	0,41	0,74	0,87	0,64	0,67
1979	0,62	0,36	0,76	0,86	0,64	0,68
1980	0,62	0,34	0,77	0,86	0,65	0,69
1981	0,60	0,34	0,76	0,88	0,67	0,69
1982	0,58	0,34	0,76	0,89	0,67	0,69
1983	0,62	0,32	0,74	0,87	0,63	0,66
1984	0,58	0,34	0,73	0,90	0,66	0,67
1985	0,61	0,34	0,73	0,90	0,65	0,68
1986	0,63	0,42	0,73	0,87	0,64	0,67
1987	0,51	0,37	0,71	0,90	0,65	0,68
1988	0,52	0,32	0,71	0,92	0,68	0,69
1989	0,58	0,32	0,71	0,87	0,66	0,68
1990	0,59	0,29	0,71	0,88	0,66	0,67
1991	0,64	0,36	0,71	0,89	0,64	0,67
1992	0,66	0,40	0,71	0,88	0,64	0,67
1993	0,64	0,39	0,71	0,88	0,64	0,66
1994	0,63	0,40	0,69	0,89	0,64	0,66
1995	0,61	0,40	0,68	0,90	0,65	0,67
1996	0,59	0,36	0,67	0,91	0,66	0,67

Note: A&F represents agriculture and fishing; E: energy; I: industry; B: building; S: the private services, i.e., government excluded.

A.4 Sectors' value added shares in the US

TABLE 4.- Sectors' value added shares in the US, 1958-1996

Sector Year	A&F	E	I	B	S
1958	0,06	0,03	0,30	0,07	0,54
1959	0,05	0,03	0,31	0,07	0,54
1960	0,05	0,03	0,31	0,07	0,54
1961	0,05	0,03	0,30	0,07	0,55
1962	0,05	0,03	0,31	0,07	0,55
1963	0,04	0,03	0,31	0,08	0,55
1964	0,04	0,02	0,31	0,08	0,55
1965	0,04	0,02	0,31	0,08	0,55
1966	0,04	0,02	0,31	0,08	0,55
1967	0,04	0,02	0,31	0,07	0,55
1968	0,04	0,02	0,31	0,08	0,55
1969	0,04	0,02	0,31	0,08	0,56
1970	0,04	0,02	0,29	0,08	0,58
1971	0,04	0,02	0,28	0,08	0,58
1972	0,04	0,02	0,28	0,08	0,58
1973	0,05	0,02	0,29	0,08	0,56
1974	0,04	0,04	0,30	0,07	0,55
1975	0,04	0,05	0,29	0,07	0,56
1976	0,04	0,05	0,30	0,07	0,54
1977	0,03	0,04	0,31	0,07	0,54
1978	0,03	0,04	0,31	0,07	0,54
1979	0,03	0,04	0,31	0,07	0,53
1980	0,03	0,05	0,30	0,07	0,54
1981	0,03	0,06	0,30	0,06	0,55
1982	0,03	0,06	0,28	0,06	0,57
1983	0,02	0,05	0,27	0,06	0,59
1984	0,03	0,05	0,28	0,06	0,59
1985	0,02	0,04	0,27	0,07	0,59
1986	0,02	0,03	0,27	0,07	0,61
1987	0,02	0,03	0,27	0,07	0,61
1988	0,02	0,03	0,27	0,07	0,61
1989	0,02	0,03	0,26	0,07	0,62
1990	0,02	0,03	0,25	0,06	0,63
1991	0,02	0,03	0,25	0,06	0,64
1992	0,02	0,02	0,25	0,06	0,65
1993	0,03	0,02	0,25	0,06	0,65
1994	0,02	0,02	0,25	0,06	0,65
1995	0,02	0,02	0,25	0,05	0,65
1996	0,02	0,02	0,25	0,05	0,65

Note: Value added shares are computed as $GVA_{it}/\Sigma GVA_{it}$ for all i=1...5, where gross value added are measured in current terms.

A.5 Sectorial labour shares in the US (15 sectors)

TABLE 5.- Sectorial Labour shares in the US, 1958-1996

Sector / Year	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C16
1958	0,79	0,43	0,55	0,65	0,56	0,76	0,85	0,70	0,88	0,73	0,78	0,88	0,57	0,41	0,74
1959	0,76	0,43	0,54	0,64	0,51	0,73	0,89	0,69	0,87	0,71	0,77	0,90	0,57	0,41	0,72
1960	0,75	0,43	0,58	0,66	0,55	0,75	0,91	0,71	0,87	0,73	0,80	0,92	0,56	0,40	0,75
1961	0,75	0,44	0,60	0,66	0,54	0,75	0,87	0,70	0,87	0,73	0,78	0,91	0,55	0,42	0,74
1962	0,75	0,44	0,57	0,66	0,54	0,73	0,86	0,69	0,86	0,73	0,78	0,90	0,55	0,43	0,72
1963	0,68	0,43	0,54	0,64	0,53	0,71	0,85	0,67	0,85	0,73	0,78	0,90	0,54	0,46	0,72
1964	0,71	0,42	0,51	0,64	0,53	0,71	0,85	0,68	0,85	0,71	0,78	0,89	0,54	0,45	0,71
1965	0,65	0,40	0,50	0,66	0,52	0,68	0,85	0,68	0,83	0,71	0,77	0,88	0,55	0,42	0,70
1966	0,63	0,39	0,48	0,68	0,54	0,69	0,87	0,67	0,82	0,70	0,79	0,87	0,55	0,38	0,69
1967	0,68	0,39	0,50	0,70	0,57	0,71	0,88	0,68	0,83	0,72	0,78	0,87	0,56	0,36	0,70
1968	0,73	0,41	0,54	0,70	0,55	0,71	0,88	0,68	0,84	0,72	0,76	0,88	0,56	0,40	0,71
1969	0,68	0,44	0,58	0,69	0,58	0,74	0,89	0,68	0,84	0,72	0,76	0,88	0,57	0,43	0,73
1970	0,70	0,41	0,62	0,73	0,59	0,78	0,89	0,67	0,83	0,75	0,81	0,88	0,58	0,41	0,73
1971	0,69	0,41	0,61	0,70	0,57	0,74	0,89	0,67	0,84	0,74	0,78	0,87	0,58	0,39	0,72
1972	0,65	0,43	0,58	0,70	0,56	0,73	0,91	0,70	0,83	0,73	0,76	0,88	0,59	0,42	0,72
1973	0,55	0,41	0,56	0,70	0,56	0,75	0,90	0,73	0,86	0,72	0,75	0,89	0,60	0,46	0,73
1974	0,60	0,37	0,49	0,74	0,58	0,81	0,90	0,73	0,86	0,73	0,80	0,90	0,60	0,46	0,74
1975	0,71	0,41	0,57	0,72	0,57	0,77	0,89	0,60	0,82	0,72	0,75	0,87	0,58	0,54	0,74
1976	0,67	0,39	0,59	0,71	0,55	0,76	0,89	0,65	0,84	0,71	0,75	0,86	0,58	0,47	0,72
1977	0,65	0,41	0,59	0,72	0,58	0,75	0,89	0,66	0,82	0,72	0,74	0,86	0,58	0,41	0,72
1978	0,64	0,41	0,56	0,70	0,59	0,75	0,89	0,68	0,83	0,74	0,75	0,87	0,58	0,43	0,73
1979	0,62	0,36	0,55	0,72	0,61	0,78	0,90	0,70	0,84	0,75	0,76	0,86	0,60	0,43	0,73
1980	0,62	0,34	0,56	0,74	0,65	0,78	0,91	0,69	0,83	0,76	0,80	0,86	0,59	0,45	0,74
1981	0,60	0,34	0,56	0,77	0,60	0,77	0,91	0,65	0,82	0,75	0,79	0,88	0,57	0,53	0,74
1982	0,58	0,34	0,50	0,76	0,63	0,79	0,91	0,62	0,81	0,73	0,77	0,89	0,56	0,55	0,74
1983	0,62	0,32	0,45	0,72	0,60	0,77	0,87	0,63	0,79	0,73	0,75	0,87	0,53	0,47	0,72
1984	0,58	0,34	0,44	0,72	0,60	0,75	0,86	0,61	0,82	0,72	0,75	0,90	0,53	0,52	0,74
1985	0,61	0,34	0,40	0,71	0,62	0,77	0,91	0,59	0,82	0,71	0,74	0,90	0,53	0,48	0,75
1986	0,63	0,42	0,39	0,65	0,61	0,77	0,93	0,59	0,79	0,70	0,73	0,87	0,53	0,47	0,73
1987	0,51	0,37	0,41	0,69	0,54	0,75	0,87	0,58	0,80	0,69	0,73	0,90	0,53	0,46	0,76
1988	0,52	0,32	0,45	0,74	0,53	0,75	0,89	0,57	0,80	0,68	0,75	0,92	0,52	0,51	0,78
1989	0,58	0,32	0,47	0,75	0,53	0,76	0,91	0,55	0,79	0,67	0,74	0,87	0,53	0,49	0,75
1990	0,59	0,29	0,53	0,76	0,56	0,75	0,91	0,52	0,79	0,70	0,75	0,88	0,55	0,45	0,75
1991	0,64	0,36	0,50	0,75	0,58	0,76	0,87	0,53	0,78	0,71	0,74	0,89	0,54	0,42	0,75
1992	0,66	0,40	0,51	0,76	0,58	0,76	0,87	0,53	0,76	0,72	0,75	0,88	0,55	0,43	0,74
1993	0,64	0,39	0,49	0,76	0,58	0,75	0,87	0,56	0,77	0,73	0,74	0,88	0,55	0,41	0,73
1994	0,63	0,40	0,54	0,74	0,54	0,73	0,87	0,54	0,78	0,71	0,74	0,89	0,55	0,44	0,73
1995	0,61	0,40	0,49	0,72	0,51	0,72	0,87	0,51	0,80	0,70	0,73	0,90	0,56	0,42	0,76
1996	0,59	0,36	0,52	0,71	0,52	0,71	0,87	0,50	0,78	0,70	0,71	0,91	0,57	0,42	0,76

Note: C1. Agriculture and Fishing, C2. Fuel and power products, C3. Ferrous and non-ferrous ores and metals, C4. Non-metallic minerals and minerals' products, C5. Chemical products, C6. Metal products and machinery, C7. Transport equipment, C8. Food, beverages and tobacco, C9. Textiles and clothing, leather and footwear, C10. Paper and printing products, C11. Rubber and plastic products and other manufactures, C12. Building, C13. Transport and communication services, C14. Finance and insurance services, and Real Estate, C16. Residual of private productive services.

B Figures

B.1 Sectors' labour shares in Spain, 15 sectors

Figure 1

B.2 Actual and model Labour shares in Spain, Big sectors

Figure 2

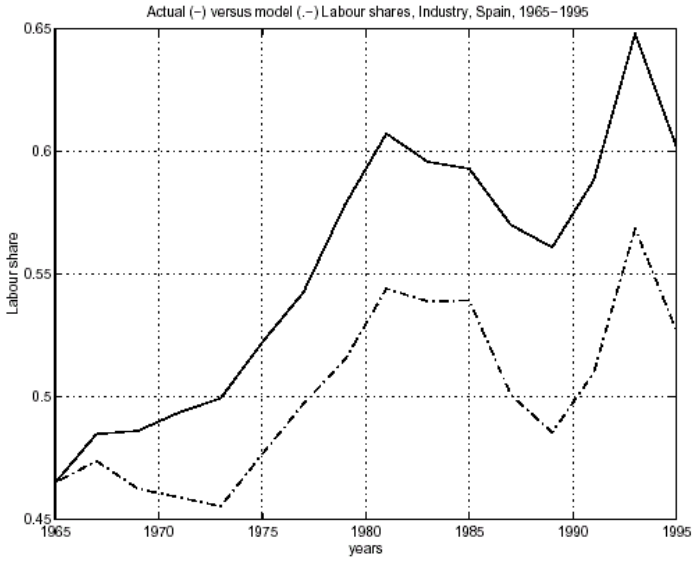


Figure 3

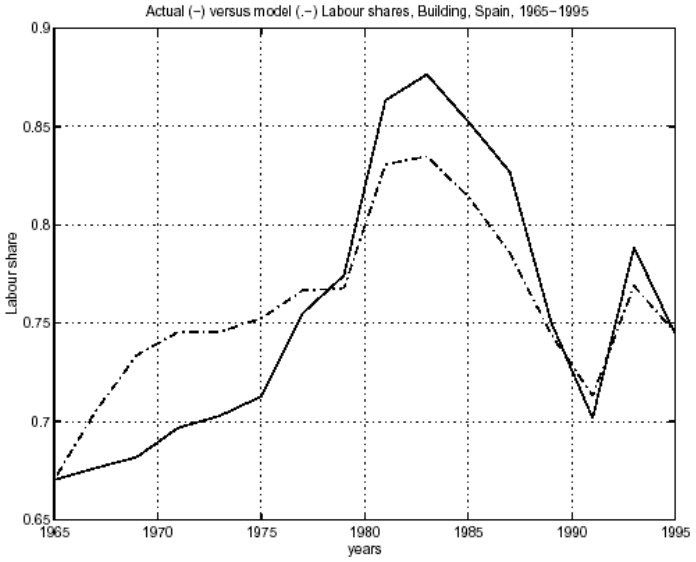
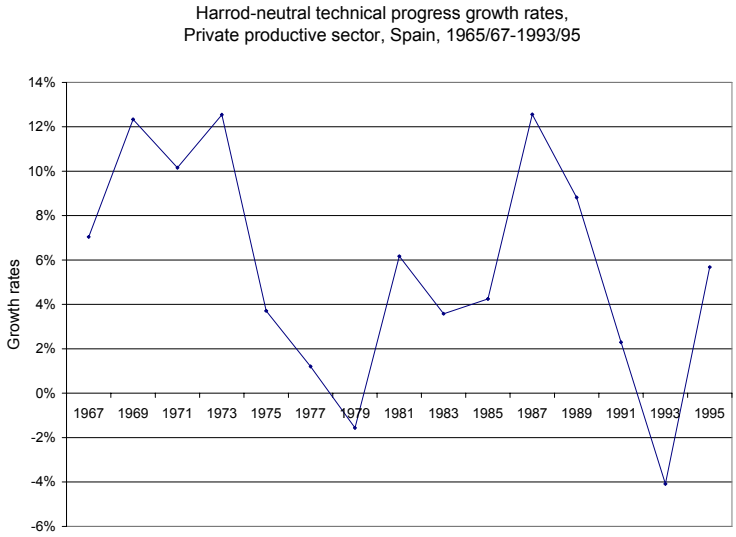


Figure 4

B.3 Labour-augmenting technical progress in the private productive sector, Spain

Figure 5



B.4 Sectors' labour shares in the US, 15 sectors

Figure 6