**OPTIMAL WAGE FORMATION AND RENT EXTRACTION**

**Evidence from five European Countries**

by*

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**Abstract**: This paper analyses the optimal behaviour of a trade union trying to extract capital rents. It shows that wages can increase or decrease with accumulated investment depending on technology and outside income opportunities. The theoretical model is tested, using data from the Manufacturing Sector of five European Countries, during the period 1954-1995. We find that, wages responded negatively to installed capital during periods in which the prospects of alternative opportunities were rather poor while this response turned positive during periods of "euphoria". There is evidence that union members show a more aggressive behaviour when the labour market becomes more "sclerotic", and there is a safety net of good alternative income opportunities.

**Keywords**: Trade unions, Wage setting, Capital formation.
**Jel classification**: J5, E25

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## I. INTRODUCTION

It has long been recognized that in unionised labour markets, rent extraction by wage-setters is an important issue. Rent seeking behaviour depends on the structure of the labour market (e.g. union power and rigidities) as well as the state of the economy (e.g. firm's profitability, recent investment, outside opportunities and the business cycle). For instance, a strong trade union is expected to raise its wage demands, when there is evidence that the firm is doing well and has heavily invested in the recent past (see e.g. Grout 1984). This is supported by the empirical investigation of Nickell and Jackman (1991) and Manning (1993).

The present paper studies the optimal response of wages to installed capital, and shows how this response is influenced by technology and outside income opportunities. We focus on installed capital due to its importance as an economic fundamental for extracting higher rents. As Ploeg (1986) points out, once capital is in place, wage setters have an incentive to raise their wage demands.

Using annual data from the manufacturing sector of five European countries (France, Greece, Italy, Portugal and Spain) during 1954-1995 tests the theoretical predictions of the model. The countries which constitute the so-called French-Mediterranean group (Siebert, 1997), have been chosen due to many similarities in their labour markets and their macroeconomic evolution (Layard et al, 1991).[1]

The theoretical model is a monopoly union model. The optimal response of wages to the capital stock is positive, when the wage elasticity of labour demand is relatively low. Intuitively, when higher wage demands do not cause large falls in employment, the union can safely extract higher rents from installed capital by pushing for higher wages. On the other hand, this response is lower or even negative, when the wage elasticity of labour demand is relatively high and in addition the alternative wages are rather low. That is, a flexible labour market, in combination with poor outside income opportunities, may discourage the union from extracting higher rents even when accumulated investment increases.

The empirical analysis does not reject the theoretical predictions. In all countries real wages response to accumulated investment was positive, with coefficient starting from 0.2 (France) to 6.5 (Italy), during periods of a rather inelastic labour demand and a generous social welfare state. In other words, wage setters had a more aggressive behaviour when the labour market was "sclerotic", and there was a safety net of high alternative wages in the case they become unemployed. By contrast, wages had a lower response during periods of increased labour market flexibility and a less protective social welfare state. This seems to be the case for France during 1986- 1995, 1965-1975 in Greece, the years 1985-1993 in the Italian labour market, and 1978-1985 for Spain. This finding is consistent with

[1] They share similar bargaining structures, high unionisation or coverage rates, increased significance in social welfare system, job protection and in general rather regulated labour markets. For a more detailed analysis of their common characteristics see Miaouli, 2001.

evidence provided by Saint-Paul (1996) for other European economies.[2]

The rest of the paper is organised as follows. Section II presents the theoretical model. Section III gives the econometric results. Section IV closes the paper.

## II. THE THEORETICAL MODEL

Assume that a firm and a trade union interact in a deterministic monopoly union model.[3] The firm behaves competitively. At any time t, it chooses employment ($\ell_t$) by taking as given real wages ($w_t$). The union behaves as a Stackelberg leader. It chooses $w_t$ by taking into account the firm's optimal employment decision. We assume that while the firm can vary its labour input ($\ell_t$) instantaneously, its capital stock ($k_t$) is exogenously given (see also Sargent, 1987, chapter I).[4]

*Objective Functions*

The union maximises a utilitarian utility function. At time t, its payoff is $\ell_t w_t + (n - \ell_t) b_t$, where $n$ and $b_t$ are respectively the union membership, and the alternative wage rate. It is assumed that $n$ is exogenous and constant, and $b_t$ follows an exogenous process (defined below). Hence, the union's payoff at t is effectively $\ell_t (w_t - b_t)$, i.e. wage rents. Therefore, the union solves

$$\max_{w_t} [\ell_t (w_t - b_t)] \tag{1}$$

The firm maximises its net cash flow. At time t, its payoff is $f(k_t, \ell_t) - w_t \ell_t - \lambda(\ell_t)$.The production function *f*(.) is increasing and concave in *k* and *l*. We also assume that it is linearly

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2 In particular, Saint-Paul (1996) gives evidence that countries with inelastic labour demand tend also to have high unemployment benefits. Additionally, high unemployment benefits are associated with stronger trade unions. This is what we find here: namely, during some periods for all countries, unions became more aggressive by taking advantage of low elasticities and generous alternative wages.

3 Alternative models are based upon bargaining over either the wage-employment decisions jointly (as in the efficient bargain model), or over wages only (as in the right-to-manage model) with employment decided unilaterally by the firm. We use the monopoly union model on grounds of tractability. Alogoskoufis (1990) also uses a monopoly union model for the Greek economy.

4 This makes the model static. We keep the analysis static because we want to focus on rent seeking. The dynamic version of the model is in Jafarey et al (1994).

homogeneous in $k$ and $\ell$. As we show below, any linearly homogeneous production technology leads to independence of optimal wages from the capital stock. Hence, what is needed is a mechanism to break the linear homogeneity of the production technology. The introduction of the $\lambda(.)$ function plays this role. It can be thought as capturing employment and is an increasing and convex function.[5] Alternatively, we could break linear homogeneity directly by assuming decreasing returns to scale in the $f(.)$ function. Here, we prefer to use the $\lambda(.)$ function because: (a) it is additively separable with $f(.)$ and this makes the algebra simpler; (b) it keeps the model closer and more comparable the relevant literature (see e.g. Ploeg 1987).

Therefore, the firm solves

$$\max_{\ell_t}[f(k_t, \ell_t)-w_t\ell_t-\lambda(\ell_t)] \tag{2}$$

*Solution*

The firm solves (2) by taking $w_t$ as given. Deriving the first-order condition with respect to $\ell_t$ and totally differentiating, we get the firm's optimal policy function for employment. Thus,

$$\ell_t=\ell(k_t,w_t) \tag{3}$$

where, $\ell_k(.)>0$ and $\ell_w(.)<0$ (see Appendix A for comparative statistics). That is, employment is a positive function of capital and a negative function of real wages.

The union solves (1) subject to (3). The first-order condition with respect to $w_t$ gives the mark-up of the union's wage over the alternative wage, $(w_t-b_t)$. Thus,

$$(w_t-b_t)=\frac{-\ell(k_t,w_t)}{\ell_w(k_t,w_t)}\rangle 0 \tag{4}$$

[5] These costs can be thought as administrative costs associated with labour management, time keeping, payroll costs, etc. This is not the same with employment adjustment costs that are associated with firing or hiring rules

so that the mark-up is positive as it should be in a monopoly union model. Total differentiation of (4) gives the union's optimal policy function for wages. Thus,

$$w_t = w(k_t, b_t) \tag{5}$$

where $w_k(.) = -[\ell_k(.) + (w_t - b_t)\ell_{kw}(.)]/D > 0$ and $w_b(.) = \ell_w(.)/D > 0$. Here, $D \equiv [2\ell_w(.) + (w_t - b_t)\ell_{ww}(.)] < 0$, since $\ell_w(.) < 0$ and $\ell_{ww}(.) < 0$ (the latter is a sufficient condition for the union's maximisation problem to be well-defined).

Equation (5) represents a reduced-form solution for $w_t$ as a function of the exogenous $k_t$ and $b_t$. Observe the comparative static results: while $w_b(.) > 0$ is a standard and intuitive result (i.e. the union wage rate is increasing in the alternative wage rate), the sign of $w_k(.)$ is ambiguous. It is this sign which is analysed in the next subsection.

*The effect of installed capital on union wages*

The effect of the capital stock $k_t$ on $w_t$ is ambiguous. As the comparative statics in (5) show, the ambiguity of the sign of $w_k(k_t, b_t)$ is due to the presence of the cross-effect $\ell_{kw}(k_t, w_t)$, whose sign is in general unknown depending on the third-order derivatives of the production function $f(k_t, \ell_t)$ and the employment costs function $\lambda(\ell_t)$.[6]

A sufficient condition for $w_k(.) > 0$ is $\ell_{kw}(.) > 0$. To understand this, it is useful to distinguish a direct and an indirect effect. An increase in the capital stock $k_t$ leads *ceteris paribus* to an increase in the marginal product of labour and so an initial increase in wages $w_t$. This direct effect is being captured by $\ell_k(.) > 0$. However, there is also an indirect effect being captured by the cross derivative $\ell_{kw}(.)$. Consider first the case where $\ell_{kw}(.) > 0$, i.e. an increase in the capital stock decreases the wage elasticity of labour demand.[7] In this case, the initial increase in wages -being driven by the direct effect- does not cause a large fall in employment, and therefore wage rents go up. Hence, the union can safely push for higher wages. This explains why $\ell_{kw}(.) > 0$ is sufficient for $w_k(.) > 0$.

Consider now the case where $\ell_{kw}(.) < 0$, i.e. an increase in the capital stock increases the wage

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and would make the model dynamic (see e.g. Bentolila and Bertola, 1990).

[6] This happens because, due to the $\lambda(.)$ function, the production technology is not linearly homogenous (see Appendix B). More on this in Ploeg 1987.

[7] Recall that $\ell_w(.) < 0$. Hence, an increase in $\ell_w(.)$ is equivalent to a decrease in the absolute value of the wage elasticity of labour demand.

elasticity of labor demand. In this case, the initial increase in wages - driven by the direct effect - causes a large fall in employment, and therefore wage rents do not increase or may go down. If, at the same time, outside opportunities are poor, the union cannot afford to push for higher wages. That is, as the comparative statics in equation (5) above show, $w_k(.) \leq 0$ if (i) the cross-effect $\ell_{kw}(.)$ is negative, and (ii) the initial markup $(w_t - b_t)$ is already relatively large.[8]

Therefore, the response of $w(.)$ to $k_t$ is positive when $\ell_{kw}(.) > 0$. This is an intuitive result. However, the response of $w(.)$ to $k_t$ could be significantly lower or even negative, when $\ell_{kw}(.) < 0$ and the initial $(w_t - b_t)$ is already sufficiently high. In the latter case, technology and outside opportunities discourage the union from trying to extract higher rents from an increase in installed capital. In particular, the union is discouraged when the wage elasticity of labour demand is high and the alternative wage is low relative to the union wage. It seems that here is verified what Booth (1995) has pointed out: "the ability of the trade union to extract a share of profits depends on... the collective bargaining structure, market structure and technology...".

*Policy Regimes in various countries*

1. France

The last twenty-five years could be split into two main periods-regimes according to the evolution of social institutions and the conditions in the labor market. The first lasted until the-mid 1980s and the second from 1986 up to now.

During 1968 and early 1970s we observe in France large discrecionary increases in minimum wages. They rise again during the 1981-1985 years of recession and under the presidency of F. Mitterand.[9] This is also a period of high firing costs and rising unemployment.[10] In 1983-1986 some measures are taken to increase the flexibility, by reducing firing costs with the creation of a two-tier system. Amid these steps the replacement ratio is still high, around 57% and the duration of unemployment benefits long, around 3.75 years (1985). Thus, the labor market remains sclerotic and this serves as a safe background for a more aggressive behavior on behalf of the wage setters.[11]

After 1986 starts a weak recovery of the French economy and the government takes more initiatives towards a less regulated labor market. During the presidency of J.J. Chirac 1985-89, we have an across-the-board reduction in firing costs combined with a more “open” job protection legislation and

[8] In other words, even with $\ell_{kw}(.) < 0$, the response of $w(.)$ to $k_t$ can be positive. Low values of the markup allow the direct effect $\ell_k(.)$ to dominate regardless of the cross-effect $\ell_{kw}(.)$.

[9] It is often argued that these increases are responsible for the high and persistent unemployment in France. However, this has not been proved empirically.

[10] These costs may be partly blamed for the slow adjustment of employment towards labour market conditions.

[11] In the same period, the prospects for a more credible macroeconomic environment increase in connection with the start of the EMS. This may have influenced the power of wage setters.

stable minimum wages (Saint-Paul, 1996). Over the 1990s, France has tried to implement a variety of special programs to encourage part-time work and work sharing, temporary exemptions and other ad hoc measures (OECD, 1995a) so as to increase the adaptability and flexibility of the labour market.[12] The end of 1993, finds the country with unemployment growth around 0.6%, lower real wage rigidity at 0.23, and a more competitive labour market. Within this environment, the evolution of the wage markup and the different regimes are shown in Figure 1 below.

Figure 1 in here

where, Figure 1 plots the real wage (continuous line) and the alternative wage measured as the government consurnption-GDP ratio (dotted line). The area between these two lines gives the markup.

2. Greece

It is generally believed that the postwar period in Greece can be divided into two distinct institutional periods/regimes (see, Alogoskoufis, 1995): First, the period until 1974. Second, the post-1974 democratic period.

Until 1967, the Greek state is autocratic, both politically and economically. There are strong right-wing governments which - after a short period of socialist administrations and political instability in the mid 1960s - are followed by a military coup in April 1967. The dictatorship restricts political and civil rights and lasted until July 1974. During this autocratic period, the government has effective control over labour unions by restricting their power, and at the same time the role of the welfare state is extremely undermined. Low unemployment benefits and minimum wages along with the absence of firing costs characterize the Greek labour market. In such an environment, employment decisions are expected to be sensitive to wage demands (i.e. the labour demand to be elastic, see Lianos 1995), and in addition to have a rather high markup of market wages over alternative wages. [13]

In 1974, democracy is restored and the political system liberalized. The previous years of political suppression lead to a significant expansion of the role of the state (as the public demanded a redistribution of income and a bigger welfare state), a wave of nationalizations and an increase in the power of trade unions. As a result, the labour market becomes highly sclerotic (see Emerson, 1988) with generous unemployment and social benefits. In such an environment, employment decisions are

[12] Many of the labour market programs have been aimed at moderating the adverse employment effects of high minimum wages and payroll taxes-which remain the highest of all OECD countries for some decades.

[13] These two features go along with Saint-Paul (1996) who provides evidence from other European markets that high labor demand elasticities coexist with institutions that keep alternative wages low.

expected to be insensitive to wage demands (i.e. the wage elasticity of labour demand to be low, see Lianos 1995), and the markup of market wages over alternative wages to be rather low.[14] The evolution of the markup and the wage elasticity of labour demand are shown in Figure 2 and Table 2 below.

Figure 2 and Table 2a in here

The different periods can be easily detected.

3. Italy

Attempting the identification of clearly distinct periods in the Italian labour market has proven not an easy task. However, one could finally argue for the following regimes: The years 1970-mid 1980s, 1985 1992 and from 1993 until now.

Starting from 1968 and 1970, a "panoply" of regulations and practically infinite firing costs are introduced in the labor market following a wave of strikes. In 1973-1974, the oil shocks affect Italy more than other countries due to its greater dependence on imported oil. In 1976 a two-year period of a strong recovery of output starts.[15] It seems that around mid-1970s the country displays the characteristics of an indexed economy with a highly regulated labour market hit by a negative supply shock. This lasts until the early 1980s.

After the years of "economic euphoria", some first attempts -determined duration contracts- are attempted towards more labor market flexibility. Additionally, in 1984 the government trying to set a ceiling to wage indexation limited to one year challenges trade unions, which are defeated in the dispute.[16] The next years, employment opportunities ameliorate with a massive creation of jobs and in 1985, restructuring and early retirement schemes are implemented.[17] Within a more credible macroeconomic environment (see, Giavazzi and Spaventa 1989), the state financing of layoffs in the labour market, is a way to bypass the opposition of the unions to outright firing of industrial workers.[18] These are the first years of the “opening” in the labor market. Real wage rigidity decreases at 0.06, replacement ratio at 2% and the duration of benefits is 0.5 year.[19] Despite these steps, the stop-and-go

[14] This is consistent with Saint-Paul (1996) who observes that labor markets with low wage elasticities tend also to have strong trade unions and high unemployment benefits.

[15] Real GDP growth rate led by increased exports neared 10% along with an investment boom of about 30%. Such ratios were twice or three times as high as in the OECD area.

[16] The opposition and the more militant unions called for a national referendum and were defeated. This defeat and an unusual display of firmness on the part of the government affected expectations far more than the measure itself.

[17] 535 thousand new jobs created in the entire economy, and 400 thousand were new government jobs.

[18] Up to 1990 the number of hours paid through this system at 80-90% of the ordinary wage increased by three times. Despite that employment in large enterprises, fell by more than 21%, the number of hours lost through strikes declined rapidly from 75 million hours lost in 1980 to 16 million in 1985, a reduction of almost 80%.

[19] Other similar steps are: the authorization to lay off for economic reasons, the liberalization of DDCs and

strategy characterizes still labour market policies. Firing costs remain excessive and the specific "benefit" system still subsidizes partial unemployment for workers who retain their employee status within their firm. There is no doubt, these are years of gradual deregulation within a regime of protected "insiders". Finally, the last period after 1993-1994 seem to signal a really different attitude of both enterprises and wage setters. Within this environment, the evolution of the wage markup and the different regimes are shown in Figure 3 below.
Figure 3 in here

4. Portugal

Two periods could be seen in Portuguese labour market: the first, has to do with the unsettled years of transition to democracy after the 1974 revolution, and the second the years 1982-1995.
Early 1970s, the Portuguese labour market is strongly unionized (Bover et al, 2000)[20]. High dismissal costs, protective minimum wage legislation and unemployment benefits signal a regulated market. Towards, the end of 1980s' the eligibility criteria for unemployment benefits are eased, the maximum duration period increases both for insurance and assistance benefits, and their coverage is rising to nearly 50%. All these measures reinforce the "sclerotic" character of the labour market. However, the next years some attempts towards higher flexibility start. Portuguese trade unions in many categories, find difficult to set wages above the national minimum wage and additionally, there is no public financing of unions' activities. This leaves space for labor market adjustment through wage movement, while employment is subject to significant lags. The combination of minimum wages currently affecting only about 3% of the work force, lower firing costs and a stricter unemployment benefit system provide nowadays a picture of a different market with increased flexibility and adaptability.

5. Spain

We can detect three periods during the last thirty years for the Spanish labour market. The first from 1970 until the beginning of the next decade, the second one from 1984-1992 and the last one from 1993 up to now.
The social explosion of the 1970s, in the wake of Franco's death, finds Spain with a breakdown in labor relations. Employer and employee affiliation in national organizations is compulsory and the centrally determined wage uniformly low. The period 1974-1977 is one of political transition. It is an era of low growth, high inflation, low capital accumulation and restrictions on the demand side of the economy. It is the beginning of the economic crisis, partly due to the oil-price shocks and the accelerating inflation.[21] It seems that it is a period of a non-protective welfare state, poor alternative income opportunities and wage moderation.

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further easing of firing restrictions for large firms in 1991.
[20] Unemployment increased in the 1970s; by 1985 it reached over 10%.

In 1984 starts a significant increase in the generosity of unemployment benefits.[22] It is an effort to catch up with the prevailing social security systems in more advanced EU countries and to face the severe effects of the persistently high unemployment, which by the mid-1980s exceeded 20%. However, it jeopardizes the sustainability of the social security system. The next years fixed-term contracts are introduced. This may have had perverse effects on wage determination. As firms are now using fixed-term contract employment to buffer fluctuations in demand, workers with permanent contracts worry even less about becoming unemployed, and thus they are not eager to accept wage concessions in the face of high unemployment. A two-tier labor market is created; well-protected insiders with permanent contracts insulated from the risk of job loss and outsiders on temporary contracts with low firing costs. Until the end of the 1980s the market retains its character as a highly regulated and one of the most rigid worldwide.[23]

Then, during the 1992 recession Spain tries to reform the unemployment insurance system rather unsuccessfully; Again a effort for reform in 1993, targeting at lessening the major labor market rigidities. This time, it is the "…successful Spanish reform…" (Saint Paul, 1996). As a result, the employment response to wage moderation in 1999 is much higher than that of 1995, which is twice of that of 1992. The market has definitely taken the route towards more flexibility and deregulation. The evolution of the markup and the different regimes are shown in Figure 4 below.

Figure 4 in here

## III. EMPIRICAL APPLICATION TO SOUTH EUROPEAN COUNTRIES

### *III.1 The Data*

The wage rate ($w_t$) is hourly earnings divided by the output price index in manufacturing, and the capital stock ($k_t$) is the private capital stock (see Data Appendix for sources).

We will use the government consumption-GDP ratio as a proxy for the alternative wage, bt. We do not use simple unemployment benefits for two reasons: First, because the data on unemployment benefits in some cases are of poor quality, in some others cover only a short period of time and finally in time series they usually are a percentage of wages. Second, and more importantly, because in these countries unemployment and supplementary benefits may underestimate alternative wage opportunities $b_t$. For instance, according to OECD Economic Surveys, the alternative wage reflects beliefs not only about unemployment benefits, but about the size of the whole public sector. The idea is that $b_t$ incorporates aspirations to find permanent jobs in the public sector (including public

[21] Between 1974 and mid 1980's employment destruction is about 15%.

[22] Spain enjoyed a generous unemployment benefit system before that period. Despite that, the recent rise leads the replacement ratio to its highest level around 80%.

[23] The mismatch index in 1982-89 is in its highest level, showing a strong tendency to increase workers' relative bargaining power and thus leading to higher wage settlements.

enterprises). Political pressure, at both national and local level, can explain employment policy in the public sector, where "overmanning" seems pervasive and a permanent job is guaranteed.

### *III.2 Econometric Specification*

Equation (5) above gives the behaviour of real wages. In the empirical work, following equation (5) we will study the response of real wages to the capital stock, and how this response changes when technology and outside opportunities change. We will use annual data from the manufacturing sector of five European countries (France, Greece, Italy, Portugal and Spain) over the period 1954-1995[24]. As Layard et al (1991) and Manning (1993) say, this is an interesting and unexplored issue. To do this, we will use three different techniques: (i) OLS with multiplicative dummy variables; (ii) window regression analysis (iii) a Kalman filter approach.

#### *Econometric Specification (i): Multiplicative Dummies*

This procedure compares regression coefficients of wages, $\boldsymbol{w_t}$, on the installed capital stock $\boldsymbol{k_t}$, across different regimes in the various countries. For France the first period is until the-mid 1980s. For Greece a regime switch is at 1975. In Italy the response changes after 1984. For Portugal there is no empirical verification for a change. Finally, a lower response in Spain is from 1978-1984.

Before going on to estimation, the variables $\boldsymbol{w_t}, k_t, b_t$ are tested for cointegration.[25] We use two methods: The residual based approach, and the Johansen procedure.[26] The first method based on the residuals of OLS regression of $w_t$ on $k_t, b_t$ favours the rejection of the null hypothesis of unit root for the residuals.[27] However, it is known that this method can be inefficient and can lead to contradictory results, especially when there are more than two *I(1)* variables under consideration. Hence, we also use the Johansen procedure to search, the existence of cointegrating vectors between the series $k_t, w_t, b_t$ see, Tables 1A-5A for the various countries. Despite the fact that the relevant criteria SBC, AIC, and LL often result in conflicting conclusions, there is evidence that for all the results favour the

[24] The exact sample period varies across countries due to data availability.
[25] However, someone could skip this step, since the regressions will take into account structural breaks in the capital stock and wages. It is known from Perron (1989) and others that by not taking into account possible structural breaks in the data, tends to favor the null of unit roots. That is, by including them in the regressions stationarity can be achieved and hence the spurious regression problem to be avoided.
[26] The Johansen ML approach provides a unified framework for estimation and testing of cointergrating relations in the context of vector autoregressive (VAR) error correction models.
[27] This happens after we have included in the regressions the relevant dummies which take into account important political and economic events in any country.

existence of a cointegrating vector at least of order one.[28]

Then, it seems important to investigate the causality of the variables included. We proceed thus, to the Granger causality test between $w_t$ , $b_t$ . The null hypothesis that $w_t$ does not Granger Cause $b_t$ can not be rejected almost for all countries.[29] Then follows the exogeneity test for the independent variables through the computation of the Wu-Hausman statistics.[30] This shows that the null hypothesis for the exogeneity of the variables $k_t$ , $b_t$ can not be rejected both at 5% and 1% significance levels.[31] This test can also be based on the Lagrange multiplier, or the likelihood ratio statistic reported in the same tables. All the three tests are asymptotically equivalent and the null hypothesis can not be rejected. [32]

Having verified the existence of cointegrating vectors and the exogeneity of the independent variables, we move on to the estimation of log-linear regressions of the following forms by using OLS.

$$w_t = f(k_t, k_t^i, b_{t-1}) \tag{6}$$

where, the superscripts $i = 1,2,3$ and denote the different periods-regimes for the various countries. The OLS estimates are presented in Tables 1-5. [33] In the regressions the lagged once real wage, $w_{t-1}$, is included to capture various sources of wage persistence, as well as $b_{t-1}$ (as a forecast for $b_t$ made at time t-1). Additionally, we have tried a business cycle effect, *bce*, which captures cyclical effects on real wages and hence allows us to focus on the systematic reaction of real wages to state variables.[34] Finally, a number of additive and multiplicative dummy variables are included. These represent years for specific and important economic events for each country such as, the oil shocks, autonomous wage explosions, major structural changes in the labour market, the influence of EMS, or implementation of stabilization policies.

Starting from France the results can be seen in Tables 1 and 1A. The response of $w_t$ to $k_t$ during the

[28] SBC, AIC and LL stand for Schwartz Bayesian criterion, Akaike information criterion, and log likelihood ratio correspondingly.

[29] The corresponding F statistics are: France F(2,24)=3.63, Greece F(2,35)=2.24, Italy (2,34)=0.77, Portugal F(2,19)=0.40 and finally Spain (2,23)=1,21 (see, Tables 1A-5A).

[30] It is known that the variable addition test can be used to compute Wu's $T_2$ or the Wu-Hausman statistic testing the exogeneity of the independent variables. It is carried out in the following manner. Run OLS regressions of $b_t$ on the variables $b_t(-1)\, b_t(-2)\, w_t(-1)\, k_t(-1)$ and save the residuals. Run OLS regression of $w_t$ on $k_t(-1)\, b_t(-1)\, w_t(-1)$ and test the significance of the addition of the previous residuals on the current regression. The Wu Hausman statistic, is equal to the value of the F statistic and it is distributed approximately as an F statistic with 1 and number of observations degrees of freedom.

[31] The relevant F statistics for the various countries (Tables 1A-5A) are: France F(1,19)=1.055, Greece F(1,28)=0.099, Italy F(1,22)=1.087, Portugal F(1,15)=1.132 and Spain F(1,17)=0.185.

[32] This also can be seen from the T statistic of the variable res, in the various tables.

[33] Non linear least squares and Two stages least squares have also been used without significant changes in the results.

period 1970-1985, is significantly positive from 0.134 (column II) to 0.203 (column V). However, during the sub-period 1985-1995, which seems to be characterized by steps towards a more elastic labour market, the coefficient on $k_t$ is significantly, lower from 0.008 (column III) to 0.073 (column V). These estimates are robust under various regression specifications reported in Table 2. Some additional investigation has been made concerning the above regime switches. The Wald test, was used to test the restriction that the coefficient of $\boldsymbol{k_t^{70-85}}$ , is equal to that of $k_t^{85-95}$ . The null hypothesis has been rejected (5% significance level) with the corresponding CHSQ(1)=7.045. Finally, Chow tests has been made concerning the stability of coefficients during the whole period and the 1985-1995 sub-period. The relevant F(4,18)=3.75 rejecting thus, the null hypothesis at 5% significance level.[35]

In the rest of the estimations, we observe the high degree of sluggishness in real wage adjustment ($w_{t-1}$) in all columns, the importance of the additive dummy for the period 1986-1995. Finally, the cyclical fluctuations (bce) in column IV do not seem to enter in a significant way the response of wage rents to accumulated investment. We tried to update the estimations up to 2000. The data availability does not allow us to draw robust conclusions, despite the fact that there is an indication of a regime switch during the years 1995-2000.

Examining Greece, the columns of Tables 2 and 2A, give a good picture of our results. The response of $w_t$ to $k_t$ during the whole period (column I) is positive and around 0.055. Chow tests concerning the stability of coefficients during the whole period has been run. Based on the data observation (see, Figure 2) and theoretical model, we examine the year 1974 as a break point. The Chow breakpoint test for this year and the Chow forecast test are used. The corresponding F statistics lead to the rejection of the null hypothesis of the stability for coefficients, at 5% significance level.[36] More investigation is needed then, and we proceed with the inclusion of additive and multiplicative dummies. Thus, during the sub-period 1975-1995, the response of $w_t$ to $k_t$, is positive from 0.152 (column III) to 0.096 (column VI). However, during the early period 1960-1974, which is a period of a more elastic labour market with a high wage markup, the coefficient of $w_t$ on $k_t$ is lower from 0.10 to 0.05. It seems that during these years wage setters show a different and milder behaviour with respect to wage targets they set during other years. These estimates are robust under various regression specifications reported in Table 2. Some additional investigation has been made concerning the above regime switches.

The Wald test, was used to test the restriction that the coefficient of $k_t^{60-74}$ , is equal to that of $\boldsymbol{k_t^{75-95}}$ . The null hypothesis has been rejected (5% significance level) with the corresponding CHSQ(1)=2.93. There was some indication from the data examination that a regime change might be established for the periods of conservative administrations (1975-1981) and Socialist administrations (1982-1990).

[34] However, the results do not depend on these modifications (estimates available on request).
[35] $F_{0.05, 4,18}$=2.93. However, the null of stability of coefficient is not rejected at 1% significance level.
[36] The Chow Breakpoint Test gives F(4, 28)=13.83, while the Chow Forecast Test gives F(20, 12)=4.90.

However, this has not been econometrically verified. We also experimented with changes in the coefficient on $k_t$ within the late period 1993-1998, but with no success. This is probably, due to the limited number of observations. Concerning the other variables, we report the high degree of sluggishness in real wage adjustment ($w_{t-1}$) and the significant positive effect from cyclical fluctuations (bce) in column III. Also, the additive dummies do not seem to influence significantly the previous estimations.

Tables 3 and 3A report the results for Italy. The response of $w_t$ to $k_t$ is positive from 6.029 (column II) to 9.582 (column IV). However, there is evidence that after 1984 there is a significant change and the response becomes significantly lower. These estimates are robust under various regression specifications reported in Table 3. The Wald test, used to test the restriction that the coefficient of $\boldsymbol{k}_{\boldsymbol{t}}^{70-85}$ , is equal to that of $k_t^{84-95}$ rejects the null hypothesis (5% significance level) with the corresponding CHSQ(1)=8.324. Finally, the Chow tests reject the null of the stability of coefficients at 5% significance level.[37] In the estimations we observe the high degree of sluggishness in real wage adjustment ($w_{t-1}$) in all columns, and the importance of the of the cyclical fluctuations influence (bce), is verified in column IV.

Going to Portugal we observe, in Tables 4 and 4a, that the response of $w_t$ to $k_t$ during the period under examination is positive and around 0.3. As it can be seen, the years after 1987 there is evidence for a change in the response of $w_t$ to $k_t$ . However the Wald test, used to test the restriction that the coefficient of $k_{87-95}$ , is equal to zero does not reject the null at 5% significance level with the corresponding CHSQ(1)=2.339.[38] In addition, the Chow breakpoint test gives an F(4,18)=1.95 for the year 1987, and the Chow Forecast test F(8, 14)=1.43. In other words, the empirical evidence does not allow us to establish a significant regime switch during the years 1987-1995.[39]

Finally we have the estimations for Spain in Tables 5 and 5A. We observe that the response of $w_t$ to $k_t$ is positive and around 0.2. The Chow Breakpoint Test indicates the year 1982 as a break point.[40] More investigation is needed then, and we proceed with the inclusion of additive and multiplicative dummies. Thus, during the years 1978-1985, we observe that the response of $w_t$ to $k_t$, is lower reaching –0.4 (column III). The Wald test, used to test the restriction that the coefficient of $\boldsymbol{k}_{\boldsymbol{t}}^{78-85}$ , is

[37] The Chow Forecast test gives F(9,13)=3.30 and the Chow breakpoint test, F(4,18)=3.08 higher than the corresponding critical values.
[38] When a quadratic time trend is included in the regression the null hypothesis is rejected with the corresponding CHSQ(1)=3.084. This however, is a restricted result and can not alter our conclusions.
[39] Probably, a larger data set could give us a different picture.
[40] The Chow Breakpoint Test gives F(4, 18) = 3.23 which rejects the null hypothesis of structural stability at 5% significance level but not at 1%, while the Chow Forecast Test gives F(12, 10)=1.90 which accepts the null.

equal to that of $\boldsymbol{k}_t^{86-95}$ rejects the null hypothesis (5% significance level) with the corresponding CHSQ(1)=3.283. The degree of sluggishness in real wage adjustment ($w_{t-1}$) in all columns is verified for Spain too.

Therefore, regime switches are observed in most countries, and this will be additionally investigated using window regressions and Kalman filtering analysis.

*Econometric Specification (ii): Window Regressions*

A second procedure for testing whether wage behaviour changes across regimes is to run window regressions. We use either 6 or 7-year window regressions with $w_t - b_t$ as the dependent variable and $k_t$ as the explanatory variable or rolling OLS of $w_t$ on $k_t, b_t$ .

The results for France are shown in Figure 1a below. This Figure shows the evolution of the coefficient of $k_t$ on the horizontal axis dating the 1st year of the window. This coefficient is around 0.2 until 1985. In the following windows, it starts falling and it is stabilized at significantly lower levels.

The relevant results can be seen for Greece in Figure 2a. Running a 7 year regression of $w_t - b_t$ , on $k_t$ , we observe that for the sub-period 1963-1974 the response declines from 0.2 to negative numbers but after 1975 starts consistently to increase.

In Figure 3a we see the results for Italy. Running a 7year regression of $w_t - b_t$ , on $k_t$ , we observe that for the sub-period after 1985 the response declines. These estimates are consistent with a regime change shown in the previous estimations.

The results for Portugal are similar with the simple OLS regressions. Having tried different window regressions (4 and 5year) and the rolling OLS we did not succeed to detect any regime switch.

Finally, we go to Spain. Running a 5year window by rolling OLS we see that the years from 1978 up to 1985 there is a smaller response of $w_t - b_t$ with respect to $k_t$ .

*Econometric Specification (iii): Kalman Filters*

Finally, the theoretical predictions can be presented by the following state space model and will be estimated estimated using Kalman filter procedure.

$$w_t = c(1)w_{t-1} + c(2)b_{t-1} + sv1k_{t-1} + \varepsilon_t \tag{7}$$

$$sv1 = sv1(-1) + \eta_t \tag{8}$$

where, (7) represents the measurement equation, (8) the state or transition equation and the disturbances $\varepsilon_t$, $\eta_t$ are i.i.d.

Let's start from France. Maximum likelihood estimates of the parameters of the model are as follows :, $SV1{=}0.245$, $\sigma_{\varepsilon}^2{=}0.0514$. The first figure, shows the behaviour of the coefficient inscribed within the band of its $\pm$ two standard errors, which are produced by the succesive updating of the value of $\alpha_t$ through time. Observe that $sv_1$ is positive and increasing in absolute terms until the end of the 1986s, while during the period 1986-1995 is significantly falling. Therefore, this approach gives similar results with those implied by the OLS and window regressions.

Going to Greece the Maximum likelihood estimates of the parameters of the model are as follows : $SV1{=}0.0895$, $\sigma_{\varepsilon}^2 = 0.00024$.[41] The $sv_1$ starts from negative values until 1975 and then turns positive until the end of the sample period. This is consistent with what it has been found using OLS and window regressions. The estimates for Italy are: $SV1{=}8.846$, and $\sigma_{\varepsilon}^2{=}0.0036$. From the corresponding figure we observe that the response of $w_t$ on $k_t$ after 1985 becomes significantly lower than in the previous years. Trying various Kalman filtering specifications for Portugal (see, figure) we did not succeed in detecting any regime change and this is seems to verify the results of the previous estimations. Finally for Spain the particular estimates show that the years until 1985 the response of $w_t$ to $k_{t-1}$ is around 0.0834 with $\sigma_{\varepsilon}^2{=}0.0337$ but later on increases significantly and this goes until the first years of 1990. This is consistent too, with the results from the OLS regressions and the seven-year window estimations.

## IV. CONCLUSIONS

This paper models the interaction between firms and trade unions in a monopoly union model with capital. When the model is tested and estimated by using data from the manufacturing sector of the South European Countries and France over the period 1954-1995, the theoretical predictions are not rejected. That is, real wages response to the capital stock was different in 1960-1975 for Greece, 1986-1995 for France, 1985-1992 for Italy, and 1978-1985 for Spain, when technology and outside opportunities discouraged wage setters from extracting higher rents even when installed capital increased.

Possible extensions would include different union objective functions as well as the use of micro data for the econometric estimations.

[41] We have also tried a different specification for the Kalman filtering: $(w_t - b_{t-1}) = a_t k_t + \gamma_t (w_t - b_{t-1})_{-1} + \varepsilon_t$, $a_t = a_{t-1} + \eta_t, \gamma_t = \gamma_{t-1} + \vartheta_t$

## APPENDICES

APPENDIX A:

This Appcndix derives $\ell_k(.)$ and $\ell_w(.)$. Time subscripts are omitted since they are obvious. Total differentiation of (3) gives

$$\ell_k = -f_{12}/(f_{22} - \lambda'') \rangle 0$$

(A.1)

$$\ell_w = (f_{22} - \lambda'') \langle 0 \tag{A.2}$$

In (A.1), when $\lambda(.) = 0$, $\ell_k = \ell/k$ because of the homogeneity of f(.). Also note that the sign of $\widehat{\ell}_{kw}(.)$ will depend on the third order derivatives of f(.) and λ(.).

APPENDIX B:

This Appendix derives the sign of $\widehat{w}_k(.)$, when f(.) = $\mathrm{Ak}^{\beta}\ell^{1-\beta}$ αnd λ(.) = $a\ell^2/2$. In this case, $\ell(\mathrm{k;w}) = (1-\beta)\mathrm{Ak}^{\beta}\ell^{-\beta} - \alpha\ell$. Hence, (A.1)-(A.2) become

$$\partial\ell/\partial k = \ell/\left[k(1+\alpha\ell)\right] > 0 \tag{B.1}$$

$$\partial\ell/\partial w = \ell/\Psi < 0 \tag{B.2}$$

where $\Psi \equiv -\left[\beta(1-\beta)\mathrm{Ak}^{\beta}\ell^{-\beta} + \alpha\ell\right] = -\left[\beta\mathrm{w} + (1+\beta)\alpha\ell\right] < 0$. Observe that when α=0, $\partial\ell/\partial\mathrm{k} = \ell/\mathrm{k}$ as we said above in (A.1).

(B.1)-(B.2) and (5) in the text imply $-\ell/\ell_w = -\Psi = \left[\beta w + (1+\beta)\alpha\ell\right] = (w-b)$. Total differentiation gives

$$\partial w/\partial k = \left[(1+\beta)\alpha\ell_k\right]/M > 0$$

$$\partial w/\partial b = 1/M > 0$$

where $M \equiv [1-\beta-(1+\beta)\alpha\ell_w] > 0$ because $\beta$<1 and $\ell_w < 0$. Observe that if α=0, $\partial\mathrm{w}/\partial\mathrm{k} = 0$, as in Ploeg [1987].

DATA APPENDIX:

k = the log of real private capital stock in manufacturing (OECD, Flows and Stocks of fixed capital).

1 = the log of manhours in manufacturing (OECD, Labour Force Statistics).

w =the log of real production wage in manufacturing (OECD, Main Economic Indicators).

b = the log of government consumption to GDP ratio (OECD National Accounts). We use government consumption as a proxy for the alternative wage (b), because it is widely recognized that in Greece unemployment benefits underestimate the alternative wage.

y = the log of real GDP (OECD, National Accounts).

bce =the residuals from a double exponential smoothing of y, accounting for the cyclical component of output.

D54-74 = 1 in 1954-1974 and zero elsewhere.

D86-95 = 1 in 1986-1995 and zero elsewhere.

D84-92 = 1 in 1984-1992 and zero elsewhere.

D78-85 = 1 in 1978-1985 and zero elsewhere.

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**TABLE 1**
**France**

**Dependent Variable $w_t$ . Estimation period 1970-1995. OLS estimates**

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| $c$ | -3.011*<br>(-2.86) | -2.222*<br>(-2.28) | -2.013*<br>(-2.17) | -2.879*<br>(-2.61) | -1.540<br>(-1.67) |
| $k_{t-1}$ | 0.119*<br>(2.73) | 0.134*<br>(3.46) | 0.193*<br>(3.94) | 0.160*<br>(3.66) | 0.203*<br>(4.52) |
| $k_{86-95}$ | - | -0.002*<br>(-2.65) | -0.185*<br>(-1.84) | -0.002*<br>(-2.48) | -0.13*<br>(-2.45) |
| $w_{t-1}$ | 0.934*<br>(13.3) | 1.014*<br>(9.40) | 0.798*<br>(5.08) | 1.059*<br>(9.39) | 0.675*<br>(3.97) |
| $b_{t-1}$ | -0.249*<br>(-3.88) | -0.196*<br>(-3.26) | -0.197*<br>(-3.44) | -0.245*<br>(-3.42) | -0.174*<br>(-3.17) |
| $bce$ | - | - | - | -0.002<br>(-1.23) | - |
| $D_{86-95}$ | - | - | 2.497<br>(1.81) | - | - |
| $W_{86-95}$ | | - | | | 0.375*<br>(2.42) |
| $R^2$ | 0.94 | 0.96 | 0.97 | 0.96 | 0.97 |
| s | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 |

Notes: See the Appendix for definitions, variables, data sources and details about estimation and testing. $k_{74-85} = k_{t-1} * D_{74-85}$, $k_{86-95} = k_{t-1} * D_{86-95}$, $w_{86-95} = w_{t-1} * D_{86-95}$. T statistics in parentheses.

**Diagnostics Tests**

| | I | II | III |
|---|---|---|---|
| **Test statistics** | LM Version/F Version | LM Version/F Version | LMVersion/FVersion |
| **Serial Correlation** | CHSQ(1) = 0.378 | CHSQ(1)= 0.105 | CHSQ(1) = 0.078 |
| | F (1, 20) = 0.308 | F (1, 19) = 0.080 | F (1, 18) = 0.565 |
| **Functional form** | CHSQ(1) = 0.092 | CHSQ(1) = 1.301 | CHSQ(1) = 0.018 |
| | F(1, 20) =0.074 | F (1, 19) = 1.043 | F(1, 18) = 0.013 |
| **Normality** | CHSQ(2) = 1.526 | CHSQ(2) = 0.968 | CHSQ(2) = 0.104 |
| | Not applicable | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 0.704 | CHSQ(1) = 0.490 | CHSQ(1) = 0.082 |
| | F(1, 23) = 0.666 | F (1, 23) = 0.460 | F(1, 23) = 0.076 |

| | IV | V |
|---|---|---|
| **Test statistics** | LM Version/F Version | LM Version/F Version |
| **Serial correlation** | CHSQ(1) = 0.326 | CHSQ(1) = 0.152 |
| | F (1, 18) = 0.238 | F (1, 18) = 0.110 |
| **Functional form** | CHSQ(1) = 0.818 | CHSQ(1) = 2.173 |
| | F (1, 18) = 0.609 | F (1, 18) = 1.713 |
| **Normality** | CHSQ(2) = 0.447 | CHSQ(2) = 1.069 |
| | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 0.287 | CHSQ(1) = 0.089 |
| | F (1, 23) = 0.267 | F (1, 23) = 0.083 |

## TABLES 1A
## France

**Johansen Cointegration Test** Summary - **S**ample 1960-1995 - Series: $w, k, b$

| *Data Trend* | *None* | *None* | *Linear* | *Linear* | *Quadratic* |
|---|---|---|---|---|---|
| Rank or No of CES | No Intercept No trend | Intercept No trend | Intercept No trend | Intercept Trend | Intercept Trend |
| | | | *Log Likelihood by Model and Rank* | | |
| 0 | 243.08 | 234.08 | 240.76 | 240.76 | 245.02 |
| 1 | 241.34 | 246.06 | 249.32 | 254.35 | 258.51 |
| 2 | 247.87 | 252.57 | 254.96 | 260.43 | 264.09 |
| 3 | 249.02 | 256.37 | 256.37 | 265.90 | 265.90 |
| | | | *Akaike Information Criteria by Model and Rank* | | |
| 0 | -18.757 | -18.757 | -19.064 | -19.064 | -19.168 |
| 1 | -18.862 | -19.172 | -19.276 | -19.612 | -19.793 |
| 2 | -18.905 | -19.131 | -19.247 | -19.536 | -19.757 |
| 3 | -18.501 | -18.864 | -18.864 | -19.408 | -19.408 |
| | | | *Schwarz Criteria by Model and Rank* | | |
| 0 | -18.315 | -18.315 | -18.474 | -18.474 | -18.432 |
| 1 | -18.126 | -18.386 | -18.393 | -18.680 | -18.762 |
| 2 | -17.874 | -18.002 | -18.069 | -18.260 | -18.432 |
| 3 | -17.176 | -17.392 | -17.392 | -17.789 | -17.789 |
| *L.R. Test* | *Rank=2* | *Rank=2* | *Rank=1* | *Rank=1* | *Rank=1* |

**Pairwise Granger Causality** Tests - Lags 2

| Null Hypothesis | Observations | F-statistic |
|---|---|---|
| $b$ does not Granger Cause $w$ | 24 | 3.161 |
| $w$ does not Granger Cause $b$ | | 1.817 |

Computation of the **Wu-Hausman Statistic** - OLS estimates

| Dependent variable $b$ - 24 observations | | |
|---|---|---|
| Regressor | Coefficient | T-Ratio |
| $c$ | -1.03 | -1.15 |
| $b_{t-1}$ | 0.94 | 2.93 |
| $b_{t-2}$ | -0.51 | -2.38 |
| $w_{t-1}$ | 0.25 | 2.25 |
| $k_{t-1}$ | -0.38 | -0.71 |
| R-Squared | 0.97 | |

**Variable addition test** - Dependent variable $w$ -Variables to added **RES***

| Regressor | Coefficient | T-Ratio |
|---|---|---|
| $k_{t-1}$ | 0.06 | 1.83 |
| $w_{t-1}$ | 0.83 | 13.04 |
| $b_{t-1}$ | 0.14 | 1.81 |
| ***res*** | 0.423 | 1.02 |
| Lagrange Multiplier CHSQ (1)=1.263 | Likelihood Ratio Statistic CHSQ(1)=1.263 | |
| F-statistic F(1,19)=1.055 | | |

* res stands for the residuals of the previously reported regression

**TABLE 2 - Greece**

**Dependent Variable $w_t$. Estimation period 1960-1995. OLS estimates.**

| | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| $c$ | -0.939* | 1.371* | -2.010 | -1.515* | -1.810 | -1.002* |
| | (-2.15) | (-3.31) | (-2.94) | (-3.20) | (-2.71) | (-2.01) |
| $k_{t-1}$ | 0.056 | 0.061* | 0.152* | 0.071* | 0.089* | - |
| | (1.83)* | (2.15) | (1.84) | (2.19) | (1.82) | - |
| $k_{60-74}$ | - | -0.012* | -0.065* | -0.013* | -0.055 | 0.008* |
| | | (-2.96) | (1.78) | (-2.98) | (1.55) | (1.95) |
| $b_{t-1}$ | 0.145 | 0.052 | 0.073 | 0.077 | 0.088 | 0.073 |
| | (1.84) | (1.67) | (1.57) | (1.01) | (0.99) | (0.09) |
| $w_{t-1}$ | 0.829* | 0.781* | - | 0.756* | 0.788* | 0.843* |
| | (13.24) | (13.4) | - | (10.8) | (12.3) | (21.1) |
| $bce$ | | - | - | 0.028* | - | - |
| | | - | - | (2.65) | - | - |
| $(w-b)_{t-1}$ | - | - | -0.133 | | - | - |
| | | | (-1.17) | | - | - |
| $D_{67-74}$ | - | - | - | - | 0.024 | - |
| | | | | | (1.05) | - |
| $k_{75-95}$ | - | - | - | - | - | 0.033 * |
| | | | | | | (3.53) |
| $R^2$ | 0.98 | 0.99 | 0.99 | 0.98 | 0.99 | 0.99 |
| s | 0.07 | 0.05 | 0.05 | 0.04 | 0.04 | 0.05 |

Notes: See the Appendix for definitions, variables, data sources and details about estimation and testing. $k_{60-74} = k_{t-1} * D_{60-74}$, $k_{75-95} = k_{t-1} * D_{75-95}$. T statistics in parentheses.

**Diagnostics Tests**

| | I | II | III |
|---|---|---|---|
| **Test statistics** | LM Version/F Version | LM Version/F Version | LM Version/F Version |
| **Serial correlation** | CHSQ(1)= 0.649 | CHSQ(1)= 0.131 | CHSQ(1) = 0.596 |
| | F (1,28) = 0.562 | F (1,26) = 0.103 | F (1,26) = 0.478 |
| **Functional form** | CHSQ(1) = 0.0091 | CHSQ(1) = 4.315 | CHSQ(1) = 0.392 |
| | F(1,28) = 0.0084 | F(1,26) = 4.459 | F(1,27) = 0.313 |
| **Normality** | CHSQ(2) = 0.130 | CHSQ(2) = 0.762 | CHSQ(2) = 0.515 |
| | Not applicable | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 0.661 | CHSQ(1) = 0.395 | CHSQ(1) = 0.236 |
| | F(1,31) = 0.633 | F(1,31) = 0.375 | F(1,31) = 0.224 |

| | V | VI |
|---|---|---|
| **Test statistics** | LM Version/F Version | LM Version/F Version |
| **Serial correlation** | CHSQ(1) = 0.658 | CHSQ(1) = 0.299 |
| | F (1, 26) = 0.212 | F (1, 27) = 0.247 |
| **Functional form** | CHSQ(1) = 2.297 | CHSQ(1) = 2.402 |
| | F(1, 26) = 2.213 | F(1, 27) = 2.119 |
| **Normality** | CHSQ(2) = 1.547 | CHSQ(2) = 0.681 |
| | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 0.981 | CHSQ(1) = 0.316 |
| | F(1, 31) = 0.872 | F(1, 31) = 0.299 |

**TABLES 2A**

**Greece-Estimates of Wage Elasticities**

| Period | Elasticity of labour demand |
|---|---|
| 1963 -1973 | -0.285 |
| 1974 - 1993 | -0.132 |

Source: Lianos, Daouli (1995)

**Johansen Cointegration Test** Summary- **S**ample 1960-1995-Series: w k b k75

| *Data Trend* | *None* | *None* | *Linear* | *Linear* | *Quadratic* |
|---|---|---|---|---|---|
| Rank or No of CES | No Intercept No trend | Intercept No trend | Intercept No trend | Intercept Trend | Intercept Trend |
| ***Log Likelihood by Model and Rank*** | | | | | |
| 0 | 99.361 | 99.361 | 103.40 | 103.40 | 109.52 |
| 1 | 109.41 | 110.36 | 112.84 | 112.84 | 118.49 |
| 2 | 111.50 | 119.61 | 119.71 | 119.99 | 122.31 |
| 3 | 113.07 | 121.68 | 121.68 | 122.39 | 122.39 |
| ***Akaike Information Criteria by Model and Rank*** | | | | | |
| 0 | -12.241 | -12.242 | -12.169 | -12.177 | -12.191 |
| 1 | -12.574 | -12.792 | -12.768 | -12.730 | -12.774 |
| 2 | -12.402 | -12.670 | -12.707 | -12.643 | -12.726 |
| 3 | -12.260 | -12.440 | -12.535 | -12.480 | -12.585 |
| ***Schwarz Criteria by Model and Rank*** | | | | | |
| 0 | -11.526 | -11.524 | -11.271 | -11.272 | -11.128 |
| 1 | -11.514 | -11.674 | -11.510 | -11.448 | -11.356 |
| 2 | -10.983 | -11.162 | -11.101 | -10.947 | -10.944 |
| 3 | -10.380 | -10.531 | -10.573 | -10.393 | -10.447 |
| *L.R. Test* | *Rank=1* | *Rank=1* | *Rank=1* | *Rank=1* | *Rank=1* |

**Pairwise Granger Causality** Tests **-** Lags 2

| Null Hypothesis | Observations | F-statistic |
|---|---|---|
| $b$ does not Granger Cause $w$ | 31 | 6.585 |
| $w$ does not Granger Cause $b$ | | 2.234 |

Computation of the **Wu-Hausman Statistic** - OLS estimates

| Dependent variable $b$ - 33 observations | | |
|---|---|---|
| Regressor | Coefficient | T-Ratio |
| $c$ | -0.931 | -2.15 |
| $k_{t-1}$ | 0.06 | 1.83 |
| $w_{t-1}$ | 0.83 | 13.24 |
| $b_{t-1}$ | 0.14 | 1.84 |
| R-Squared | 0.98 | |
| Durbin's h-statistic | 0.85 | |

**Variable addition test** - Dependent variable $w$ -Variables to added **RES***

| Regressor | Coefficient | T-Ratio |
|---|---|---|
| $k_{t-1}$ | 0.06 | 1.83 |
| $w_{t-1}$ | 0.83 | 13.04 |
| $b_{t-1}$ | 0.14 | 1.81 |
| *res* | 0.32 | 0.31 |
| Lagrange Multiplier CHSQ (1)=0.12 | | Likelihood Ratio Statistic CHSQ(1)=0.12 |
| F-statistic F(1,28)=0.85 | | |

res stands for the residuals of the previously reported regression

TABLE 3 - **Italy**

**Dependent Variable $w_t$. Estimation period 1970-1995. OLS estimates**

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| ***c*** | -45.84* | -35.99* | -36.49* | -50.65* | -73.83* |
| | (-2.37) | (-3.32) | (-2.33) | (-1.39) | (-1.97) |
| $k_{t-1}$ | 7.439* | 6.029* | 6.231* | 9.582* | 6.819* |
| | (2.52) | (2.31) | (1.93) | (3.05) | (2.41) |
| $k_{85-93}$ | - | -0.278 * | -0.231* | -4.944* | -0.104* |
| | | (-2.04) | (-1.77) | (-1.94) | (-1.80) |
| $w_{t-1}$ | 0.875* | 0.475* | 0. 458* | 0.351* | 0.356* |
| | (9.45) | (2.98) | (2.01) | (2.40) | (4.65) |
| $b_{t-1}$ | -12.40* | -14.11* | -12.33 | -10.03 | -14.74 |
| | (-4.025) | (-2.67) | (-2.44) | (-2.27) | (-1.77) |
| $D_{85-93}$ | - | - | 1.029 | - | - |
| | | | (1.35) | | |
| ***bce*** | - | - | - | - | 4.477 |
| | | | | | (0.25) |
| $(w-b)_{86-93}$ | - | - | - | 0.456* | - |
| | | | | (1.83) | |
| $R^2$ | 0.90 | 0.89 | 0.89 | 0.91 | 0.90 |
| s | 60.07 | 40.14 | 40.03 | 33.83 | 36.3 |

Notes: See the Appendix for definitions, variables, data sources and details about estimation and testing. $k_{85-93} = k_{t-1} * D_{85-93}$, $(w-b)_{85-93} = (w-b)_{t-1} * D_{85-93}$. T statistics in parentheses.

**Diagnostics Tests**

| | I | II | III |
|---|---|---|---|
| **Test statistics** | LM Version/F Version | LM Version/F Version | LM Version/F Version |
| **Serial correlation** | CHSQ(1) = 2.344 | CHSQ(1) = 1.189 | CHSQ(1)= 1.145 |
| | F (1, 21) = 2.255 | F (1, 20) = 1.026 | F (1, 19) = 0.945 |
| **Functional form** | CHSQ(1) = 0.196 | CHSQ(1) = 0.737 | CHSQ(1) = 0.017 |
| | F(1, 21) = 0.168 | F(1, 20) = 0.626 | F (1, 19) = 0.0137 |
| **Normality** | CHSQ(2) = 0.189 | CHSQ(2) = 0. 690 | CHSQ(2) = 0.883 |
| | Not applicable | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 3.447 | CHSQ(1) = 3.759 | CHSQ(1) = 3.159 |
| | F(1, 23) = 3.906 | F(1, 26) = 3.801 | F (1, 22) = 3.843 |

| | IV | V |
|---|---|---|
| **Test statistics** | LM Version/F Version | LM Version/F Version |
| **Serial correlation** | CHSQ(1) = 0.265 | CHSQ(1) = 1.106 |
| | F (1, 19) = 0.203 | F (1, 19) = 0.872 |
| **Functional form** | CHSQ(1) = 0.768 | CHSQ(1) = 1.621 |
| | F(1, 19) = 0.548 | F(1, 19) = 1.302 |
| **Normality** | CHSQ(2) = 3.115 | CHSQ(2) = 0.726 |
| | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 2.025 | CHSQ(1) = 2.760 |
| | F(1, 22) = 2.673 | F(1, 22) = 2.302 |

**TABLES 3A**
**Italy**

**Johansen Cointegration Test** Summary**- S**ample 1970-1995-Series: $\boldsymbol{w, k, b}$

| *Data Trend* | *None* | *None* | *Linear* | *Linear* | *Quadratic* |
|---|---|---|---|---|---|
| Rank or No of CES | No Intercept No trend | Intercept No trend | Intercept No trend | Intercept Trend | Intercept Trend |
| *Log Likelihood by Model and Rank* | | | | | |
| 0 | 187.75 | 187.75 | 189.37 | 189.37 | 194.07 |
| 1 | 197.64 | 199.64 | 201.12 | 201.12 | 205.68 |
| 2 | 203.28 | 205.29 | 206.00 | 206.00 | 209.69 |
| 3 | 203.48 | 209.52 | 209.52 | 209.69 | 209.69 |
| *Akaike Information Criteria by Model and Rank* | | | | | |
| 0 | -10.833 | -10.833 | -10.750 | -10.750 | -10.853 |
| 1 | -11.069 | -11.129 | -11.098 | -11.038 | -11.193 |
| 2 | -11.047 | -11.048 | -11.030 | -10.909 | -11.072 |
| 3 | -10.696 | -10.880 | -10.880 | -10.708 | -10.708 |
| *Schwarz Criteria by Model and Rank* | | | | | |
| 0 | -10.425 | -10.425 | -10.205 | -10.205 | -10.173 |
| 1 | -10.389 | -10.404 | -10.282 | -10.176 | -10.240 |
| 2 | -10.095 | -10.005 | -09.941 | -09.730 | -09.847 |
| 3 | -09.471 | -09.519 | -09.519 | -09.212 | -09.212 |
| *L.R. Test* | *Rank=1* | *Rank=1* | *Rank=3* | *Rank=0* | *Rank=0* |

**Pairwise Granger Causality** Tests **-** Lags 2

| Null Hypothesis | Observations | F-statistic |
|---|---|---|
| $\boldsymbol{b}$ does not Granger Cause $\boldsymbol{w}$ | 26 | 4.635 |
| $\boldsymbol{w}$ does not Granger Cause $\boldsymbol{b}$ | | 0.435 |

Computation of the **Wu-Hausman Statistic** - OLS estimates

| Dependent variable $\boldsymbol{b}$ - 26 observations | | |
|---|---|---|
| Regressor | Coefficient | T-Ratio |
| $\boldsymbol{c}$ | -1.23 | -0.80 |
| $\boldsymbol{b}_{t-1}$ | 0.64 | 4.47 |
| $\boldsymbol{w}_{t-1}$ | -0.36 | -1.68 |
| $\boldsymbol{w}_{t-2}$ | 0.37 | 1.72 |
| $\boldsymbol{k}_{t-1}$ | 0.28 | 0.27 |
| R-Squared | 0.97 | |

**Variable addition test** - Dependent variable W-Variables to added **RES***

| Regressor | Coefficient | T-Ratio |
|---|---|---|
| $\boldsymbol{k}_{t-1}$ | 0.28 | 3.99 |
| $\boldsymbol{w}_{t-1}$ | 0.97 | 87.98 |
| $\boldsymbol{b}_{t-1}$ | 0.03 | 0.02 |
| ***res*** | -0.23 | -1.04 |
| Lagrange Multiplier CHSQ (1)=1.271 | | Likelihood Ratio Statistic CHSQ(1)=1. 303 |
| F-statistic F(1, 22)=1.087 | | |

* res stands for the residuals of the previously reported regression

**TABLE 4**
**Portugal**

**Dependent Variable $w_t$ . Estimation period 1970-1995. OLS estimates**

| | I | II | III | IV |
|---|---|---|---|---|
| $c$ | -3.419* | -4.611* | -4.965* | -4.274* |
| | (-2.24) | (-2.54) | (-2.18) | (-2.76) |
| $k_{t-1}$ | 0.381* | 0.364* | 0.394* | 0.478* |
| | (3.60) | (3.35) | (2.67) | (3.34) |
| $k_{87-95}$ | - | -0.009* | -0.010* | -0.023 |
| | | (-1.75) | (-1.80) | (-1.14) |
| $(w-b)_{t-1}$ | 0.615* | 0.774* | 0.767* | 0.674* |
| | (8.16) | (10.67) | (9.66) | (7.42) |
| $bce$ | - | | 0.021 | - |
| | | | (0.18) | |
| $D_{87-95}$ | - | | - | 0.336 |
| | | | | (1.17) |
| $t$ | 0.574* | 0.002* | 0.002* | - |
| | (4.09) | (3.62) | (2.87) | |
| $R^2$ | 0.92 | 0.92 | | |
| s | 0.04 | 0.04 | | |

Notes: See the Appendix for definitions, variables, data sources and details about estimation and testing. $k_{87-95} = k_{t-1} * D_{87-95}$, $(w-b)_{87-95} = (w-b)_{t-1} * D_{87-95}$. T statistics in parentheses.

**Diagnostics Tests**

| | I | II | III |
|---|---|---|---|
| **Test statistics** | | | |
| **Serial correlation** | CHSQ(1) = 0.568 | CHSQ(1)= 0.523 | CHSQ(1) = 0.386 |
| | F (1, 20) = 0.445 | F (1, 19) = 0.383 | F (1, 18) = 0.256 |
| **Functional form** | CHSQ(1) = 0.132 | CHSQ(1) = 0.594 | CHSQ(1) = 0.369 |
| | F(1, 20) = 0.104 | F (1, 19) = 0.436 | F(1, 18) = 0.244 |
| **Normality** | CHSQ(2) = 2.498 | CHSQ(2) = 2.576 | CHSQ(2) = 3.181 |
| | Not applicable | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 0.452 | CHSQ(1) = 0.563 | CHSQ(1) = 0.013 |
| | F(1, 23) = 0.041 | F (1, 22) = 0.523 | F(1, 21) = 0.011 |

| | IV |
|---|---|
| **Test statistics** | |
| **Serial correlation** | CHSQ(1) = 0.349 |
| | F (1, 18) = 0.242 |
| **Functional form** | CHSQ(1) = 2.072 |
| | F(1, 18) = 1.563 |
| **Normality** | CHSQ(2) = 1.204 |
| | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 1.491 |
| | F(1, 21) = 1.455 |

**TABLES 4A**
**Portugal**
**Johansen Cointegration Test** Summary **- S**ample 1970-1995 - Series: ***w, k, b***

| *Data Trend* | *None* | *None* | *Linear* | *Linear* | *Quadratic* |
|---|---|---|---|---|---|
| Rank or No of CES | No Intercept No trend | Intercept No trend | Intercept No trend | Intercept Trend | Intercept Trend |
| | | | *Log Likelihood by Model and Rank* | | |
| 0 | 110.26 | 110.26 | 113.20 | 113.20 | 116.11 |
| 1 | 119.92 | 120.81 | 122.25 | 137.18 | 139.09 |
| 2 | 124.57 | 128.54 | 129.98 | 145.00 | 145.02 |
| 3 | 125.07 | 131.09 | 131.09 | 150.82 | 150.82 |
| | | | *Akaike Information Criteria by Model and Rank* | | |
| 0 | -10.658 | -10.658 | -10.653 | -10.653 | -10.643 |
| 1 | -11.043 | -11.032 | -10.973 | -12.440 | -12.430 |
| 2 | -10.902 | -11.110 | -11.155 | -12.527 | -12.422 |
| 3 | -10.323 | -10.641 | -10.641 | -12.402 | -12.402 |
| | | | *Schwarz Criteria by Model and Rank* | | |
| 0 | -10.211 | -10.211 | -10.056 | -10.056 | -09.897 |
| 1 | -10.298 | -10.237 | -10.079 | -11.496 | -11.386 |
| 2 | -09.858 | -09.967 | -09.962 | -11.235 | -11.081 |
| 3 | -08.981 | -09.150 | -09.150 | -10.762 | -10.762 |
| *L.R. Test* | *Rank=1* | *Rank=2* | *Rank=2* | *Rank=2* | *Rank=3* |

**Pairwise Granger Causality** Tests **-** Lags 2

| Null Hypothesis | Observations 26 | F-statistic |
|---|---|---|
| ***b*** does not Granger Cause ***w*** | | 3.652 |
| ***w*** does not Granger Cause ***b*** | | 0.401 |

Computation of the **Wu-Hausman Statistic** - OLS estimates

| Dependent variable ***b*** - 26 observations | | |
|---|---|---|
| Regressor | Coefficient | T-Ratio |
| $\boldsymbol{c}$ | -3.377 | -3.24 |
| $\boldsymbol{b}_{t-1}$ | 0.312 | 1.48 |
| $\boldsymbol{w}_{t-1}$ | -0.107 | -2.13 |
| $\boldsymbol{k}_{t-1}$ | 0.181 | 2.71 |
| R-Squared | 0.90 | |

**Variable addition test** - Dependent variable ***w*** -Variables to added **RES***

| Regressor | Coefficient | T-Ratio |
|---|---|---|
| $\boldsymbol{k}_{t-1}$ | 0.345 | 4.36 |
| $\boldsymbol{w}_{t-1}$ | 0.687 | 11.5 |
| $\boldsymbol{b}_{t-1}$ | 0.243 | 0.98 |
| ***res*** | 0.557 | 1.80 |
| Lagrange Multiplier CHSQ (1) = 4.006? | | Likelihood Ratio Statistic CHSQ(1)= 4.44? |
| F-statistic F(1, 19) = 3.53 | | |

**TABLE 5**
**Spain**
**Dependent Variable $w_t$. Estimation period 1970-1995. OLS estimates**

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| $c$ | -0. 462* | -0.027 | -0.035 | -0.023 | -0.612* |
| | (-1.68) | (-0.77) | (-0.12) | (-0.55) | (-2.31) |
| $k_{t-1}$ | 0.216* | 0.158* | 0.202* | 0.158* | 0.146* |
| | (4.87) | (3.02) | (2.74) | (2.64) | (2.16) |
| $k_{78-85}$ | - | -0.009* | -0.657* | -0.010* | - |
| | | (-1.82) | (-2.36) | (-1.85) | |
| $w_{t-1}$ | 0.671* | 0.648* | 0.589* | 0.647* | 0.772* |
| | (11.8) | (11.8) | (4.84) | (10.3) | (9.45) |
| $b_{t-1}$ | -0.461* | -0.371* | -0.406* | -0.370* | -0.461* |
| | (-6.88) | (-4.63) | (-4.69) | (-4.06) | (-7.18) |
| $bce$ | - | - | - | -0.005 | - |
| | | | | (-0.14) | |
| $D_{78-85}$ | - | - | 1.895* | | - |
| | | | (2.31) | | |
| $k_{90-95}$ | - | - | - | | 0.142* |
| | | | | | (1.83) |
| $R^2$ | 0.93 | 0.95 | 0.96 | | |
| s | 0.01 | 0.01 | 0.01 | | |

Notes: See the Appendix for definitions, variables, data sources and details about estimation and testing., $k_{78-85} = k_{t-1} * D_{78-85}$, $k_{90-95} = k_{t-1} * D_{90-95}$. T statistics in parentheses.

**Diagnostics Tests**

| | I | II | III |
|---|---|---|---|
| **Test statistics** | | | |
| **Serial correlation** | CHSQ(1) = 0.184 | CHSQ(1) = 0.029 | CHSQ(1)= 1.516 |
| | F (1, 20) = 0.143 | F (1, 19) = 0.021 | F (1, 17) = 1.089 |
| **Functional form** | CHSQ(1) = 0.549 | CHSQ(1) = 1.127 | CHSQ(1) = 2.901 |
| | F(1, 20) = 0.435 | F(1, 19) = 0.865 | F (1, 17) = 2.143 |
| **Normality** | CHSQ(2) = 2.168 | CHSQ(2) = 1.218 | CHSQ(2) = 3.392 |
| | Not applicable | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 0.505 | CHSQ(1) = 0.253 | CHSQ(1) = 0.392 |
| | F(1, 22) = 0.470 | F(1, 25) = 0.270 | F (1, 22) = 0.354 |

| | IV | V |
|---|---|---|
| **Test statistics** | | |
| **Serial correlation** | CHSQ(1)= 0.051 | CHSQ(1)= 0.206 |
| | F (1, 18) = 0.034 | F (1, 18) = 1.148 |
| **Functional form** | CHSQ(1) = 1.204 | CHSQ(1) = 0.045 |
| | F (1, 18) = 0.869 | F (1, 18) = 0.032 |
| **Normality** | CHSQ(2) = 1.205 | CHSQ(2) = 1.505 |
| | Not applicable | Not applicable |
| **Heteroscedasticity** | CHSQ(1) = 0.251 | CHSQ(1) = 0.092 |
| | F (1, 23) = 0.231 | F (1, 23) = 0.083 |

## TABLES 5A
## Spain

**Johansen Cointegration Test** Summary**- S**ample 1970-1995-Series: $w, k, b$

| *Data Trend* | *None* | *None* | *Linear* | *Linear* | *Quadratic* |
|---|---|---|---|---|---|
| Rank or No of CES | No Intercept No trend | Intercept No trend | Intercept No trend | Intercept Trend | Intercept Trend |
| | | *Log Likelihood by Model and Rank* | | | |
| 0 | 126.49 | 126.49 | 142.14 | 142.14 | 151.31 |
| 1 | 149.75 | 149.93 | 156.96 | 156.99 | 164.20 |
| 2 | 157.38 | 160.61 | 165.39 | 168.40 | 171.51 |
| 3 | 160.20 | 167.21 | 167.21 | 175.28 | 175.28 |
| | | *Akaike Information Criteria by Model and Rank* | | | |
| 0 | -11.749 | -11.749 | -13.013 | -13.014 | -13.631 |
| 1 | -13.475 | -13.393 | -13.696 | -13.780 | -14.321 |
| 2 | -13.638 | -13.761 | -14.139 | -14.240 | -14.451 |
| 3 | -13.320 | -13.721 | -13.721 | -14.228 | -14.228 |
| | | *Schwarz Criteria by Model and Rank* | | | |
| 0 | -11.301 | -11.301 | -12.416 | -12.416 | -12.884 |
| 1 | -12.729 | -12.597 | -12.798 | -12.853 | -12.275 |
| 2 | -12.593 | -12.616 | -12.944 | -12.945 | -12.107 |
| 3 | -11.976 | -12.228 | -12.228 | -12.585 | -12.585 |
| *L.R. Test* | *Rank=3* | *Rank=3* | *Rank=2* | *Rank=3* | *Rank=3* |

**Pairwise Granger Causality** Tests **-** Lags 2

| Null Hypothesis | Observations | F-statistic |
|---|---|---|
| $b$ does not Granger Cause $w$ | 26 | 0.449? |
| $w$ does not Granger Cause $b$ | | 1.215? |

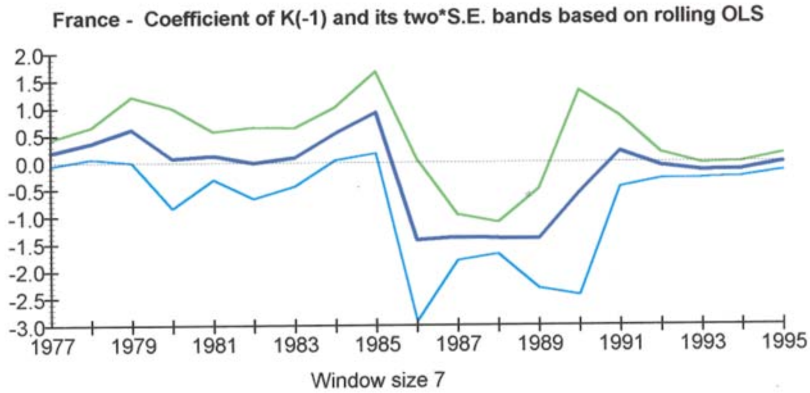
Computation of the **Wu-Hausman Statistic** - OLS estimates

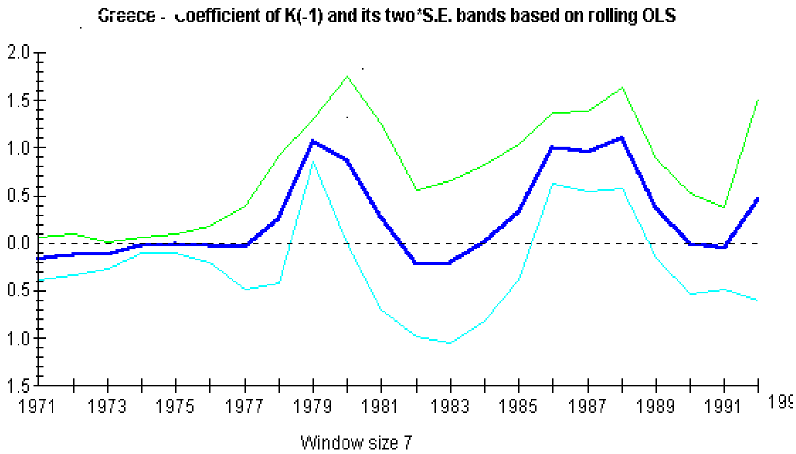
| Dependent variable $b$ - 26 observations | | |
|---|---|---|
| Regressor | Coefficient | T-Ratio |
| $c$ | -0.783 | -2.03 |
| $b_{t-1}$ | 0.821 | 3.21 |
| $b_{t-2}$ | -0.075 | -0.32 |
| $w_{t-1}$ | 0.203 | 1.01 |
| $k_{t-1}$ | 0.092 | 1.33 |
| R-Squared | | |

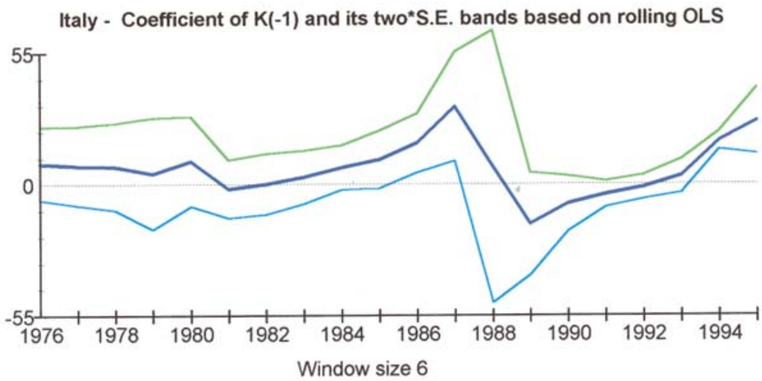
**Variable addition test** - Dependent variable W-Variables to added **RES***

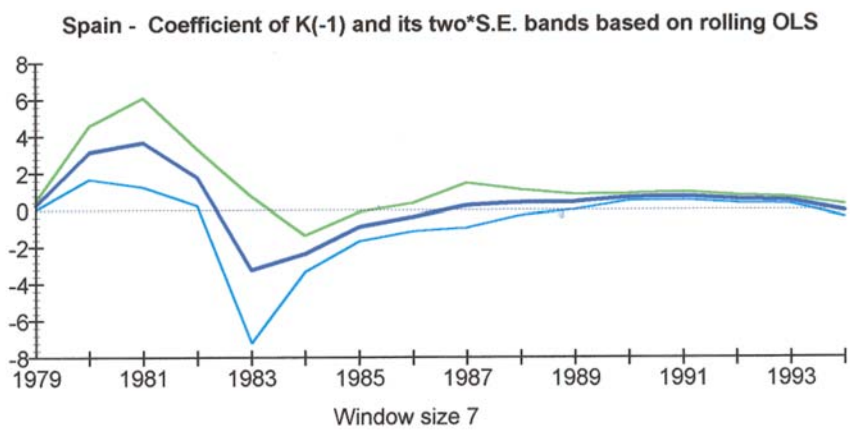
| Regressor | Coefficient | T-Ratio |
|---|---|---|
| $k_{t-1}$ | 0.216 | 4.73 |
| $w_{t-1}$ | 0.671 | 11.6 |
| $b_{t-1}$ | -0.460 | -6.72 |
| ***resb*** | 0.106 | 0.42 |
| Lagrange Multiplier CHSQ (1) = 0.237 | | Likelihood Ratio Statistic CHSQ (1) = 0.238 |
| F-statistic F(1, 22) = 0.185 | | |

## Seven year window regressions

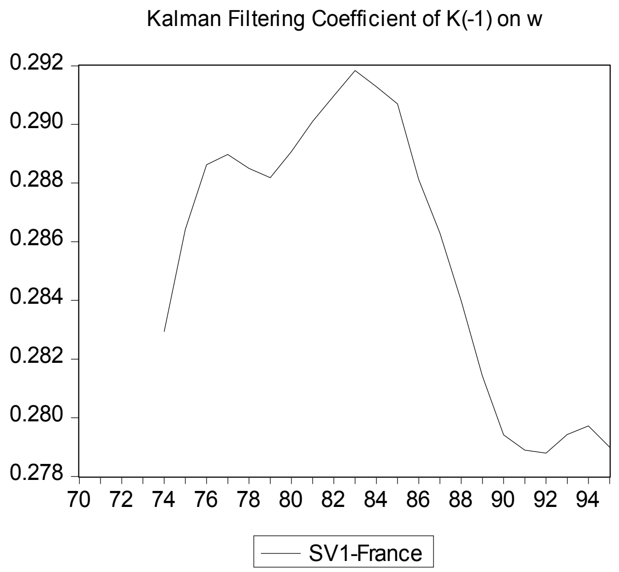


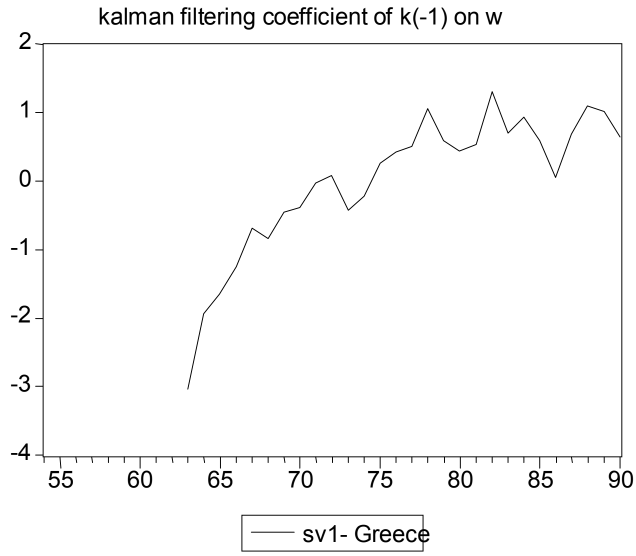



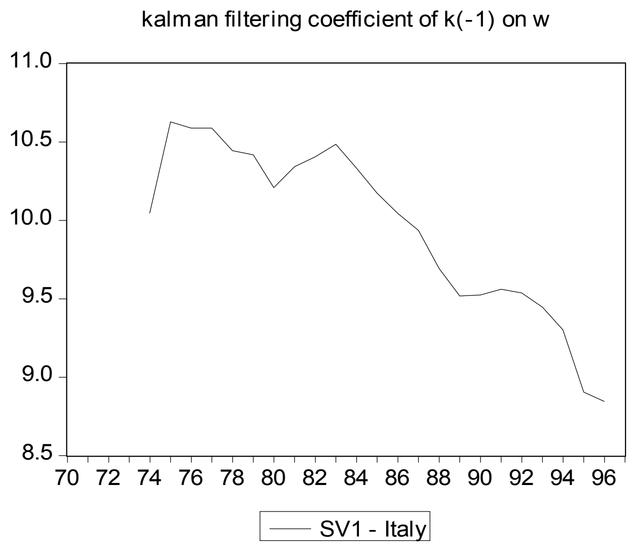



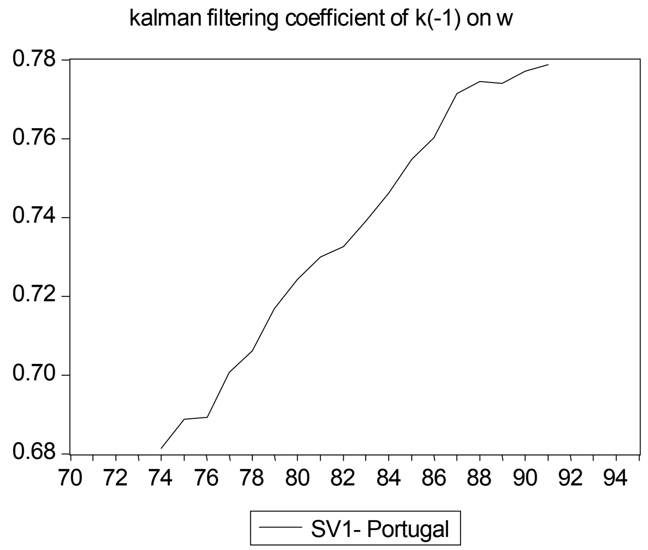



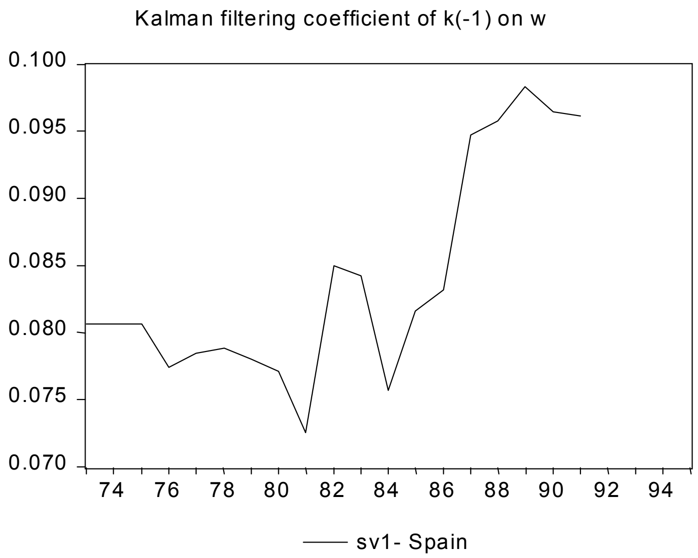
## Kalman Filtering Coefficients



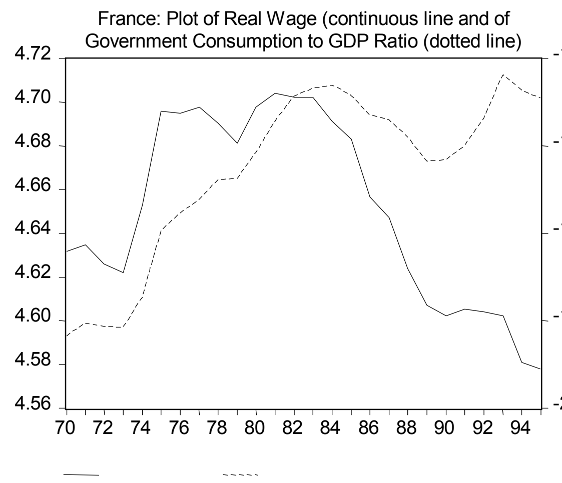



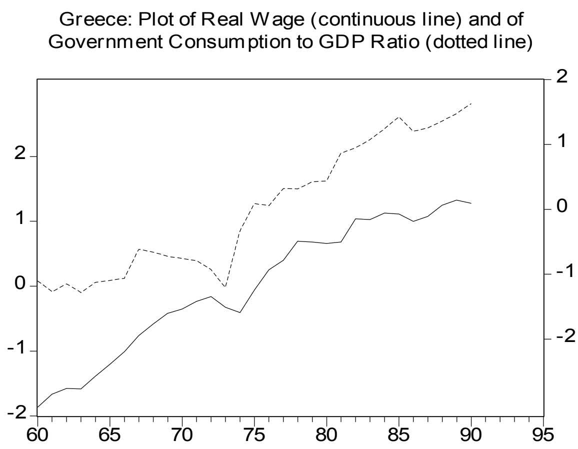



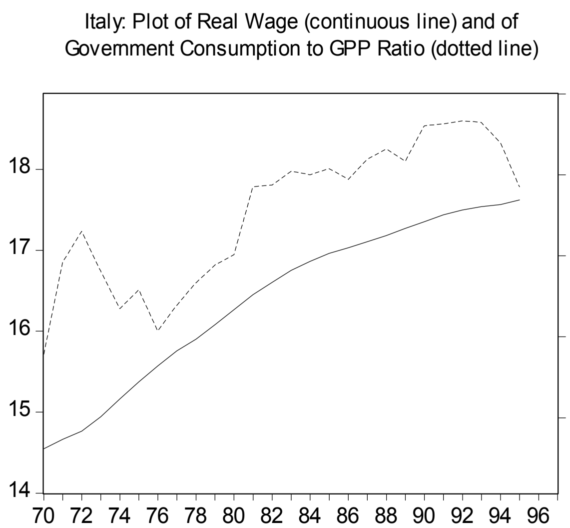



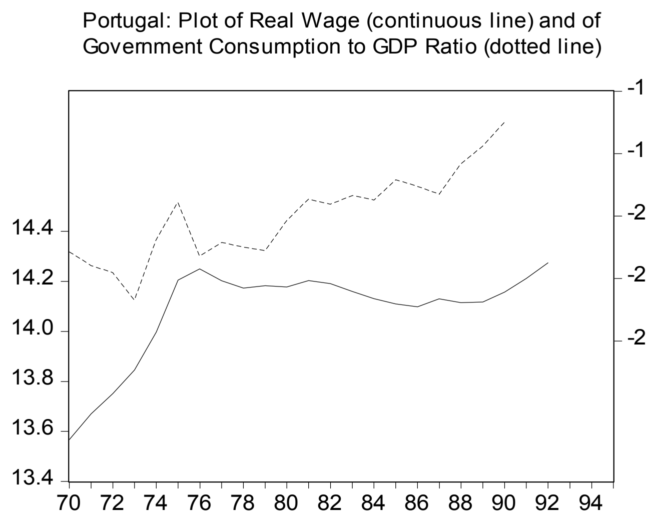



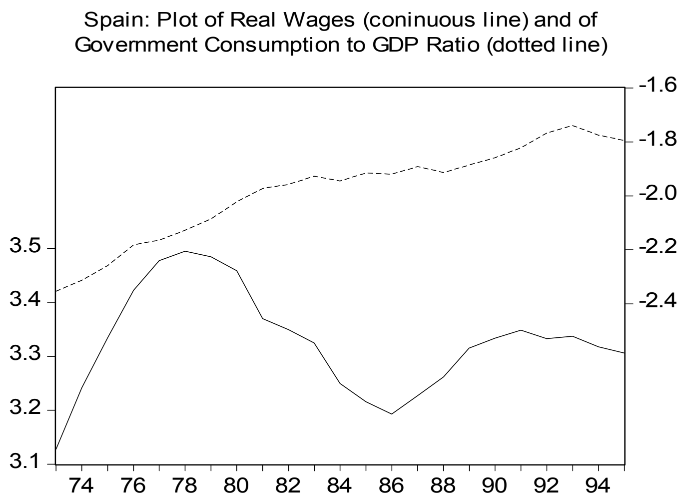
# Figures 1-5


France: Plot of Real Wage (continuous line and of
Government Consumption to GDP Ratio (dotted line)
4.72
4.70
4.68
4.66
4.64
4.62
4.60
4.58
4.56
-1.6
-1.7
-1.8
-1.9
-2.0
70 72 74 76 78 80 82 84 86 88 90 92 94


Greece: Plot of Real Wage (continuous line) and of
Government Consumption to GDP Ratio (dotted line)
2
1
0
-1
-2
2
1
0
-1
-2
60 65 70 75 80 85 90 95


Italy: Plot of Real Wage (continuous line) and of
Government Consumption to GPP Ratio (dotted line)
18
17
16
15
14
-1.7
-1.8
-1.9
-2.0
-2.1
70 72 74 76 78 80 82 84 86 88 90 92 94 96


Portugal: Plot of Real Wage (continuous line) and of
Government Consumption to GDP Ratio (dotted line)
14.4
14.2
14.0
13.8
13.6
13.4
-1.8
-1.9
-2.0
-2.1
-2.2
70 72 74 76 78 80 82 84 86 88 90 92 94


Spain: Plot of Real Wages (coninuous line) and of
Government Consumption to GDP Ratio (dotted line)
3.5
3.4
3.3
3.2
3.1
-1.6
-1.8
-2.0
-2.2
-2.4
74 76 78 80 82 84 86 88 90 92 94