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Abstract

In this paper we show that value-added mark-ups tend to be pro-cyclical in manufacturing and counter-cyclical in market services. However, at the sectoral level value-added mark-ups may be misinterpreted if intermediate input variations are ignored. This is particularly true in the case of the manufacturing sectors, although less so in that of market services. In fact, this is *the main explanation* for the (pro-cyclical) behaviour of relative services-manufacturing mark-ups which, in turn, play an important role in their relative price dynamics of these sectors. In addition, fluctuations in demand also play a role. In the case of services, mark-ups depend negatively on current output and positively on future output; hence in periods when demand is recovering (declining) mark-ups widen (narrow). By contrast, in the manufacturing sectors mark-ups depend positively on the current output gap and negatively on future expected demand, i.e. when demand is recovering (declining) current mark-ups fall (rise).

JEL Classification: D43, E32
Key words: Sectoral mark-ups, gross output, aggregation, intermediate inputs.

1 Introduction

Since the mid-eighties the macroeconomic literature has devoted growing efforts to identifying the existence of imperfect competition and to quantifying its relevance. Following a seminal paper by Hall (1986), a number of articles have been dedicated to the estimation of steady-state mark-ups at the sectoral level [Hall (1988), Caballero and Lyons (1990), Roeger (1995), Basu and Fernald (1997), and Burnside et al. (1997) among others]. Along with the quantification of the levels of mark-ups, there has been an interest in analysing their behaviour over the business cycle [see, for example, Bils (1987), Domowitz et al. (1988), Rotemberg and Woodford (1991), etc.], to try to determine whether they are counter-cyclical or pro-cyclical, something for which economic theory does not provide a clear-cut answer. In the Spanish case some papers have been dedicated to the issue of measuring the levels of mark-ups [for example, Suarez (1992), Goerlich and Orts (1996) or Estrada and López-Salido (2004a)], but less analysis has been carried out on the cyclical behaviour of mark-ups [López-Salido and Velilla (2002) for an aggregate analysis, and Fariñas and Huergo (2003) for a disaggregated analysis of the manufacturing sectors][1].

Mark-ups are defined as the ratio of unit-production prices to marginal costs. This latter variable is not observed, so the challenge lies in estimating it. Marginal costs are defined as the cost of increasing production by increasing one of the productive factors, leaving the rest unchanged. Therefore, the expression for marginal costs will depend on the specification of the production function. In section 2 we show how alternative specifications of the technology affect the computation of marginal costs.

In the third section we present the cyclical correlations of the different estimations of mark-ups for the aggregate economy and the seventeen branches of activity we have considered. In addition, we also study the co-movements among sectoral mark-ups. In the fourth section some theoretical models of mark-up behaviour are estimated for the seventeen branches of the market economy. In this section we put the emphasis on how to extract aggregate conclusions from this disaggregated approach, that is, how to move from gross-production mark-ups to value-added mark-ups.

The final section sets out some of the conclusions reached in the paper, which are summarised as follows: First, for most of the sectors the static models of mark-up behaviour are rejected by the data in favour of dynamic models. Second, mark-ups are pro-cyclical in most of the branches, and they depend negatively on future expected profits. When these results are aggregated we find that manufacturing mark-ups behave pro-cyclically and those of market services counter-cyclically, although manufacturing dominates the market economy results. Finally, the relative prices of intermediate inputs play an important role in determining mark-ups in most of the sectors. From an aggregate perspective, their impact on value-added mark-ups is positive, and much more important in the manufacturing sectors than in market services.

1. The cyclical behaviour of mark-ups is an empirical question with important implications not only for the response of prices to different economic policies, but also for output fluctuations. Note that, in models incorporating imperfect competition, output can only change if the real marginal costs schedule shifts and/or mark-ups change.

2 Measuring sectoral mark-up variations

As pointed out in the introduction, mark-ups are defined as the ratio between the unit price of output and the marginal cost embedded in its production. In general, the marginal cost is not observable; therefore the challenge lies in estimating it. The marginal cost is defined as the cost of increasing production through an increase in any productive factor, keeping the other productive factors at their original levels. Thus, the first relevant aspect to notice is that the marginal cost will depend on the production technology assumed. In this section we explain how marginal costs change when several of the hypotheses embedded in the most commonly used production function –the Cobb-Douglas specification– are relaxed.

The second aspect addressed in this section relates to the productive factor taken as reference to calculate marginal costs. Most of the empirical papers analysing mark-ups take labour as the productive factor whose increase allows the firm to expand its production. This is so because production is proxied by value added. When production is measured using gross output, a new productive factor should be considered, namely intermediate consumption. This input is probably a better alternative to labour for estimating marginal costs. The problem is that, to avoid double-counting problems, this option can only be considered in a disaggregated approach. This is the approach we follow in this paper.

2.1 Value-added production function

Beginning with value added (*VA*), in order to obtain an analytical expression for the mark-up, we depart from a general production function such as:

$$VA_t = F^{VA}\left(K_t, z_t^{VA} L_t\right) \qquad [1]$$

where *K* is the capital stock, *z* (labour-augmenting) technological progress and *L* labour. Assuming this production function to show constant returns to scale and that firms take wages as given, first order conditions for labour for profit maximization imply that:

$$P_t^{VA} z_t^{VA} F_L^{VA}\left(K_t, z_t^{VA} L_t\right) = \mu_t^{VA} W_t \qquad [2]$$

where P^{VA} is the value-added deflator, F_L^{VA} the derivative of the production function with respect to labour, μ^{VA} the mark-up and *W* the nominal wage. Rearranging terms, the mark-ups can be expressed as follows:

$$\mu_t^{VA} = \frac{\gamma_{Lt}^{VA}}{S_{Lt}^{VA}} \qquad [3]$$

where γ_L^{VA} is the elasticity of output with respect to labour $\left(F_L^{VA} \frac{L}{VA}\right)$ and S_L^{VA} the labour income share in terms of value added $\left(\frac{W\,L}{P^{VA}\,VA}\right)$.

As can be seen, the appearance of that elasticity is what forces a specific form of the production function to be assumed before the mark-ups are estimated. In the case of a Cobb-Douglas one:

$$VA_t = K_t^{1-\alpha}\left(z_t^{VA} L_t\right)^{\alpha} \qquad [4]$$

the elasticity of output with respect to labour, is constant and equal to α, so the mark-up is:

$$\mu_t^{VA} = \frac{\alpha}{S_{Lt}^{VA}} \qquad [5]$$

which, in log-deviations from the steady-state $\left(\bar{\alpha} / \bar{S}_L^{VA} \right)$, is:

$$\hat{\mu}_t^{VA} = -\hat{s}_{Lt}^{VA} \qquad [6]$$

A second possibility is the production function being a CES, so allowing the elasticity of substitution between labour and capital to be different from one:

$$VA_t = \left[\alpha_K K_t^{1-\frac{1}{\sigma}} + \alpha_L \left(z_t^{VA} L_t \right)^{1-\frac{1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \qquad [7]$$

In this case, the elasticity of output with respect to labour is not a constant; it depends on the productivity of capital:

$$\gamma_{Lt}^{VA} = 1 - \alpha_K \left(\frac{VA_t}{K_t} \right)^{\frac{1-\sigma}{\sigma}} \qquad [8]$$

Substituting this last expression in [3], the expression for mark-ups would be:

$$\mu_t^{VA} = \frac{1 - \alpha_K \left(\frac{VA_t}{K_t} \right)^{\frac{1-\sigma}{\sigma}}}{S_{Lt}^{VA}} \qquad [9]$$

which, in terms of log-deviations from the steady state is:

$$\hat{\mu}_t^{VA} = -\hat{s}_{Lt}^{VA} - \eta \left(v\hat{a}_t - \hat{k}_t \right) \qquad [10]$$

with $\eta = \left(\frac{1 - \bar{\mu}^{VA} \bar{S}_L^{VA}}{\bar{\mu}^{VA} \bar{S}_L^{VA}} \right) \left(\frac{1-\sigma}{\sigma} \right)$. As can be seen, this last parameter needs to be estimated (or calibrated) before obtaining a time series of mark-ups. In any case, for reasonable values of steady-state mark-ups, its sign will depend on the elasticity of input substitution (σ). Over the business cycle, the ratio of value added to capital should, in general, be a pro-cyclical variable, given the stock nature of capital as opposed to the flow that value added represents. This means that CES mark-ups will be more pro-cyclical (less counter-cyclical) than Cobb-Douglas mark-ups when σ is higher than one, and less pro-cyclical (more counter-cyclical) when σ is lower than one. The intuitive explanation for this result is the following: if, following a demand shock, wages increase above the user cost of capital, this will induce a substitution of capital for labour. In such a circumstance, when the elasticity of substitution is higher than one, marginal costs decline by more than in the Cobb-Douglas case, while labour declines by more than capital is increased. The opposite happens when the elasticity of input substitution is lower than one.

The last possibility considered in this paper is the existence of overhead labour ($\bar{L}$). In this case the production function will be:

$$VA_t = K_t^{1-\alpha} \left[z_t^{VA} \left(L_t - \bar{L} \right) \right]^{\alpha} \qquad [11]$$

As in the previous case, the elasticity of output with respect to labour (γ_L^{VA}) is not constant, but depends on the relevance of the fixed cost:

$$\gamma_{Lt}^{VA} = \alpha \frac{L_t}{L_t - \bar{L}} \qquad [12]$$

Substituting this expression in [3], the expression for mark-ups is:

$$\mu_t^{VA} = \frac{\alpha \dfrac{L_t}{L_t - \bar{L}}}{S_{Lt}^{VA}} \qquad [13]$$

which, in terms of log-deviations from steady-state is:

$$\hat{\mu}_t^{VA} = -\hat{s}_{Lt}^{VA} - \delta \hat{l}_t \qquad [14]$$

with $\delta = \dfrac{\bar{\rho} - 1}{\bar{\mu}^{VA} \bar{S}_L^{VA} - (\bar{\rho} - 1)}$, being ρ the index of returns to scale. As in the previous case, this last parameter needs to be estimated (or calibrated), although it should be non-negative, as long as overhead labour implies increasing returns to scale ($\rho > 1$), and profits in the steady state should be positive or nil ($\rho \leq \mu$). This term, from a cyclical perspective, makes the mark-ups less pro-cyclical (more counter-cyclical) than in the Cobb-Douglas case, due to the pro-cyclical behaviour of labour.

2.2 Gross output production function

When production is proxied by gross output (*Y*), an additional productive factor (intermediate consumption, *M*) should be included in the production function, which now adopts the following expression:

$$Y_t = F^Y\left(K_t, z_t^Y L_t, M_t\right) \qquad [15]$$

Assuming this production function to present constant returns to scale and that firms take wages and intermediate consumption prices (P^M) as given, first order conditions for labour and intermediate inputs for profit maximization will be, respectively:

$$P_t^Y z_t^Y F_L^Y\left(K_t, z_t^Y L_t, M_t\right) = \mu_t^Y W_t \qquad [16]$$
$$P_t^Y F_M^Y\left(K_t, z_t^Y L_t, M_t\right) = \mu_t^Y P_t^M \qquad [17]$$

where P^Y is the gross output deflator, F_L^Y and F_M^Y the derivatives of the production function with respect to labour and intermediate inputs, respectively, and μ^Y the gross output mark-up.

Thus, we can obtain two expressions for mark-ups, the first one using labour:

$$\mu_t^Y = \frac{\gamma_{Lt}^Y}{S_{Lt}^Y} \qquad [18]$$

and the second one using intermediate consumption:

$$\mu_t^Y = \frac{\gamma_{Mt}^Y}{S_{Mt}^Y} \qquad [19]$$

Notice that [18] is not exactly equal to [3] because now the labour income share is calculated in terms of gross output instead of value added. In the same vein, for the second measure of mark-ups it is necessary to calculate the intermediate-consumption income share (S_M^Y).

In the case of a Cobb-Douglas production function, these two expressions imply:

$$\hat{\mu}_t^Y = -\hat{s}_{Lt}^Y = -\hat{s}_{Mt}^Y \qquad [20]$$

Thus, the deviations of labour income and intermediate consumption shares from their steady-state values allow us to calculate the change in mark-ups. The main advantage of using intermediate inputs is that they are not subject to the adjustment costs involved in demanding labour, although the differences should be minor in the Spanish case, as long as the weight of temporary employment contracts is high enough.

3 The cyclical behaviour of mark-ups

As noted before, economic theory does not provide a clear answer for the cyclical behaviour of mark-ups. In fact, there exist models predicting both pro-cyclical and counter-cyclical movements in the ratio of unit output price to marginal cost. In this section we proceed by analysing simple correlations of the different measures of the cyclical component of mark-ups with the business cycle. First, we concentrate on the market economy and on the manufacturing and services sectors. We then use sectoral information for seventeen branches[2]. This information allows us to study the patterns of the co-movements among sectoral mark-ups.

3.1 Aggregate analysis

As noted before, at aggregate level we calculate mark-ups only from value-added production functions. We consider three main aggregates: the market economy and the manufacturing and market-services sectors. We think it is worth analysing the manufacturing and market-services sectors separately because the different degree of competition they face from the external sector could have an impact on the cyclical behaviour of their mark-ups.

We have calculated the three proposed estimates of mark-ups: those derived from a Cobb-Douglas production function (C-D), from a CES production function and considering the existence of overhead labour. In these last two cases, as some parameters should be calibrated at their steady-state values, we have considered the historical averages of labour income shares and an estimate of steady-state mark-ups [taken from Estrada and López-Salido (2004a)] plus an elasticity of input substitution of 0.5 and 2 in the CES case [CES (2) and CES (3), respectively] and the non-existence of pure profits in the long-run ($\rho = \mu$) in the case of overhead labour [O-L (4)]. That will allow us to assess the sensitivity of the results to these particular assumptions.

In Figure 1 we have plotted the cyclical component of the inverse of the labour income share (that is, the mark-up in the case of a Cobb-Douglas production function) for these three aggregates together with the cyclical component of the corresponding value added. As can be seen, a negative correlation with the output gap[3] is apparent, at least for the market economy and market services, although this correlation does not seem to be contemporaneous. In the case of the manufacturing sectors the picture is less clear: at least at the beginning of the nineties and in the subsequent recovery, a positive correlation with the output gap is obtained.

This evidence is presented more formally in Table 1, where we have calculated the correlation of the cyclical component of the inverse of the labour income share and the other expressions of mark-ups with respect to lagged, contemporaneous and leaded output gap of the sector itself and of the market economy. For the *market economy*, the labour income share is negatively correlated with the output gap. Most of these results also hold when we use a CES production function. The correlation continues being negative, and the output gap lags mark-ups, but notice that the contemporaneous correlation increases in absolute value when the elasticity of input substitution (σ) is 0.5 and diminishes when it is 2 (although at the peak these correlations are more stable). This is a straightforward implication of the fact that the ratio of value added to the capital stock is pro-cyclical (see Figure 2), and the sign of that coefficient will be positive (negative) when the elasticity of substitution is lower (higher) than one. In the case of overhead labour, the correlations continue being negative and higher in absolute terms. From expression [14] we can see that this is again the expected result, as

2. The data set used for this analysis is an updated version of that presented in Estrada and López-Salido (2001).
3. The output gap is defined as the deviation of value added from its H-P trend.

long as we subtract from the inverse of the labour income share the cyclical component of employment, which is pro-cyclical.

In the *manufacturing* sectors the results are not so clear. The inverse of the labour income share is negatively correlated with the lagged business cycle and positively with the leaded one. In the case of a CES with elasticity of substitution of less than one or overhead labour, negative lagged correlations dominate, while with a CES with an elasticity of substitution higher than one a positive leaded correlation arises. More surprising is to find that when calculating these correlations with respect to the market economy output gap, they become negative with the output gap lagging mark-ups. This aspect will be analysed later.

Finally, in the case of *market-service* sectors, negative correlations are estimated for the different production functions and specifications of output-gaps. The difference with respect to the previous cases is that the output gap now leads mark-ups, that is, a decline (increase) in activity is followed by an expansion (contraction) of mark-ups.

3.2 A disaggregated view of mark-ups

The main advantage of using disaggregated information is the possibility of considering a new productive input from which a new measure of mark-ups can be estimated. In fact, intermediate consumption could be considered a plausible alternative to the use of labour information.

Thus, in Table 2 we perform an exercise similar to that in the previous section, but now considering the maximum disaggregation of our database and calculating three measures of mark-ups: the cyclical components of the inverse of the labour income share in value added, the inverse of the labour income share in gross output and the inverse of the intermediate-input income share in gross output. The first measure is included to facilitate the comparison with aggregate results; the second establishes a bridge between the former and that obtained with intermediate inputs. We have also calculated the mark-ups considering a CES production function (with labour and capital) and overhead labour, although they are not reported to save space[4].

Most of the manufacturing branches show positive correlations of the cyclical component of the inverse of the labour income share with the sectoral output gaps (the only exceptions are *Non-metallic minerals*, *Other manufacturing sectors* and *Paper*) and, in the case of market services, the most relevant branches (*Retail trade and hotels and restaurants* and *Other market services*) show negative correlations; *Energy* and *Building* mark-ups seem to behave as pro-cyclical variables and, in the case of *Agriculture*, non-significant correlations appear. Moreover, these signs are retained in the case of the inverse of the labour income share as a proportion of gross output (the only exceptions being *Energy*, *Plastics* and *Building*). The difficulties arise when analysing the cyclical correlations of the inverse of the intermediate income share, because important changes emerge. There are nine branches of activity where the correlation has the opposite sign to before (*Energy*, *Food*, *Other manufacturing sectors*, *Paper*, *Plastic*, *Building*, *Retail trade and hotels and restaurants*, *Transport* and *Other market services*). This suggests that the consideration of intermediate inputs could be important to properly analyse mark-ups at the business cycle frequency.

When these cyclical correlations are calculated with respect to the aggregate market economy output, the outcomes, as in the previous section, change dramatically in some cases. In the manufacturing branches, there is a predominance of counter-cyclical behaviour when mark-ups are proxied by the cyclical component of the inverse of the labour income share (the only exceptions are *Metal*, *Non-metallic minerals* and *Other manufacturing sectors*), and negative correlations are also encountered in *Agriculture*, *Energy* and all the market-services branches. In the case of the cyclical component of the inverse of the

4. In general, these results did not significantly alter the conclusions. They are available upon request.

intermediate income share, the number of changes in the sign of the correlations is smaller compared with own-sector output gaps.

These results would suggest that there is a certain amount of heterogeneity with respect to the evolution of sectoral mark-ups. In order to elaborate on this conclusion, we have first calculated the correlations of sectoral output gaps with respect to the market-economy output gap. As can be seen in Table 3, apart from *Agriculture* and *Energy* –whose potential output is basically driven by the weather and oil-price shocks, respectively– and Communications, the correlations are positive (and mainly contemporaneous), although, in the manufacturing sectors, not very high (below 0.6 in most cases).

The second exercise consists of the computation of all the pairs of correlations among different definitions of sectoral mark-ups and, for the purposes of comparison, among the output gaps. The results are summarized in Figure 3, where they are presented in terms of histograms. In these charts each column represents the percentage of correlations between the two values of the horizontal axis. The darker columns correspond to the contemporaneous correlation and the lighter ones to the maximal correlation (in absolute terms). As can be seen from the first three panels, the sectoral mark-ups seem to behave quite similarly. Using maximal correlations, in the case of the cyclical component of the inverse of the labour income share in value added, only 6% of all the pair correlations are not significant and 59% are higher than 0.4[5]. Looking at the final panel of this figure it is surprising to find that the degree of co-movements among sectoral mark-ups is even higher than that of output gaps. In this latter case, the proportion of non-significant correlations is 13% and 49% higher than 0.4.

5. These statistics are 3% and 71%, respectively, for the inverse of the labour-income share of gross output and 11% and 48% for the inverse of the intermediate-income share.

4 Modelling mark-up behaviour

In this section we describe some theoretical models of mark-up determination[6].

4.1 The role of fluctuations in intermediate inputs

As discussed in the previous section, the standard approach of analysing the cyclical behaviour of mark-ups (i.e. by using the inverse of the labour income share) is a reasonable approximation under a variety of circumstances (elasticity of capital-labour substitution different than one and overhead labour). However, the results change (in some cases dramatically) when intermediate inputs are considered. This suggests that in order to properly rationalize the behaviour of mark-ups it is necessary to consider a framework that accounts for intermediate-input (price and quantity) variations.

In fact, when we proxy mark-ups by the inverse of the intermediate-input share, we are assuming that the elasticity of substitution between intermediate and primary inputs is unity, which is by no means uncontroversial. In the case of the US economy, different papers have estimated this elasticity to be around 0.7 [Rotemberg and Woodford (1996)], or even below [Basu (1995)]. In order to incorporate this possibility without expanding unnecessarily the dimension of the problem, we consider a non-separable production function in value added and intermediate inputs, where the value added itself is modelled as a Cobb-Douglas of the primary inputs (labour and capital):

$$Y_t = \left\{ \alpha_{VA} \left[K_t^{1-\alpha} \left(z_t L_t \right)^{\alpha} \right]^{1-\frac{1}{\sigma_M}} + \alpha_M \left[M_t \right]^{1-\frac{1}{\sigma_M}} \right\}^{\frac{\sigma_M}{\sigma_M - 1}} \qquad [21]$$

Assuming that firms have market power, and they take the wages and the prices of the intermediate inputs as given, the first order conditions for profit maximization allow us to write the mark-up as follows:

$$\mu_t^Y = \frac{\alpha}{\left[1 + \frac{\alpha_M}{\alpha_{VA}} \left(\frac{M_t}{VA_t} \right)^{1-\frac{1}{\sigma_M}} \right] S_{Lt}^Y} \qquad [22]$$

where $VA_t = K_t^{1-\alpha} \left(z_t L_t \right)^{\alpha}$. Given that, in equilibrium, the ratio of marginal productivities is equal to relative input prices and defining P^{CVA} as the deflator of value added at factor cost:

$$\frac{\alpha_M}{\alpha_{VA}} \left(\frac{M_t}{VA_t} \right)^{-\frac{1}{\sigma_M}} = \frac{P_t^M}{P_t^{CVA}} \qquad [23]$$

it is possible to relate the mark-up, not only to the labour income share, but also to the relative price of intermediate inputs:

$$\mu_t^Y = \frac{\alpha}{\left[1 + \left(\frac{\alpha_M}{\alpha_{VA}} \right)^{\sigma_M} \left(\frac{P_t^M}{P_t^{CVA}} \right)^{1-\sigma_M} \right] S_{Lt}^Y} \qquad [24]$$

As the value-added production function is a Cobb-Douglas, the minimization of value-added costs implies that the value-added deflator at factor cost can be expressed as follows:

$$P_t^{CVA} = \alpha^{-1} \, ULC_t^{VA} \qquad [25]$$

6. As these models are derived at the firm-level, we think it is more appropriate to estimate them by making use of the disaggregated sectoral information and using gross output to proxy production.

where *ULC* is the unit labour cost in terms of value added.

Thus, the mark-ups in terms of log deviations from the steady state are:

$$\hat{\mu}_t^Y = -\hat{s}_{Lt}^Y - \phi\left(\hat{p}_t^M - u\hat{l}c_t^{VA}\right) \quad [26]$$

This implies that the mark-up will be the inverse of the labour income share minus a coefficient multiplied by the relative price of intermediate goods. This coefficient has the following form: $\phi = (1-\sigma_M)\left(1-\frac{\overline{\mu}^Y \overline{s}_L^Y}{\alpha}\right)$. Therefore, as in the case of the CES production function for value added, for normal values of steady-state mark-ups and labour income share, compared with the Cobb-Douglas case, the impact of relative intermediate prices on mark-ups is positive when the elasticity of substitution of intermediate inputs (σ_M) is higher than one and otherwise negative.

4.2 Models of Mark-up Dynamics

In this section we present alternative models of mark-up dynamics. The simplest model consists of allowing for business-cycle variations in the elasticity of demand perceived by the representative firm. There are different ways of introducing such a feature. One way would be to assume different types of consumers, with different demand elasticity. In such a case, changes along the business cycle in the weight of the demand of each group would mean that the elasticity of aggregate demand would change over the cycle. Gali (1994) is an example of such an approach.

An alternative model is the "customer market" model [Phelps and Winter (1970)]. This model, by incorporating customer switching costs, introduces a dynamic element into the evolution of mark-ups. The intuitive explanation is as follows [a formal derivation can be found in Rotemberg and Woodford (1999)]: due to the existence of switching costs, if a firm reduces the price (the mark-up) it charges for the product today, it not only sells more to its traditional customers (the current market share), it also gains new customers (it expands its market share). As the firm has invested in customers today, in future its sales will be higher at any given price as compared with the situation in which it did not reduce prices. Thus, if the firm is expecting an increase in future profits, it will reduce mark-ups today, expanding its market share to consolidate in the future these expected profits. Moreover, in the homothetic case, it also implies that mark-ups are pro-cyclical, if profits tend to be pro-cyclical.

The second dynamic model is known as an "implicit collusion" model and it was developed by Rotemberg and Saloner (1986). This model assumes that the economy is made up of industries that imperfectly compete among themselves. Every industry comprises several firms that implicitly collude, in the sense that if one of them deviates from the agreement (by cutting prices) the others would punish it (by reducing prices in the future and, thus, profits). Therefore, from the formal derivation [see Rotemberg and Woodford (1999)], it can be shown that in this model actual mark-ups depend positively on future expected profits (if the future expected profits are relatively high, the firm has no incentive to break the agreement today by cutting mark-ups, because the punishment will be very high) and negatively on the current output gap (when profits are positively correlated with the cycle, future profits will be higher when the current output gap is negative).

4.3 Empirical Analysis

Let us define X_t as the stream of future expected profits (*B*):

$$X_t = \mathrm{E}_t\left[\sum_{j=1}^{\infty} \beta_t^j B_{t+j}\right] = \mathrm{E}_t\left[\beta_t\left(B_{t+1} + X_{t+1}\right)\right] \quad [27]$$

where β is the discount rate. Hence, we can jointly test the three classes of models described previously running regressions like:

$$\hat{\mu}_t = \varepsilon_y \hat{y}_t + \varepsilon_x \hat{x}_t \qquad [28]$$

In such a regression, the non-significance of ε_x would allow us to reject both dynamic models. In the event that it were significant, a positive sign would indicate that data support the collusive model, while a negative one would give support to the customer market model. For its part, ε_y captures the contemporaneous pro-cyclical or counter-cyclical nature of mark-ups.

The difficulty in estimating this expression lies in constructing a measure of future expected profits (X_t). In order to circumvent that problem, we have followed one of the approaches proposed by Rotemberg and Woodford (1991), previously applied for Spain by López-Salido and Velilla (2002). The procedure consists of writing expression [28] as a dynamic equation of current and future expected observed variables by making use of the relation that exists between profits, the business cycle and mark-ups. Thus, by using the previous orthogonality condition, it is possible to estimate the parameters of interest. Obviously, this will entail estimating the equation using generalized method of moments (GMM) techniques.

After some manipulation, the dynamic equation for mark-ups to be estimated is the following:

$$\mathrm{E}_t \left\{ \left[h + \frac{1-h}{\bar{\mu}-1} \varepsilon_x \right] \hat{\mu}_{t+1} - \hat{\mu}_t + \left[(1-h)\varepsilon_x - h\,\varepsilon_y \right] \hat{y}_{t+1} + \varepsilon_y \hat{y}_t - \varepsilon_x r_{t+1} \right\} = 0 \qquad [29]$$

where *r* is the real interest rate and *h* is a mixture of steady-state real interest rate and growth (this parameter is calibrated using the averages of the corresponding variables)[7].

Also, as our expression for mark-ups includes an additional parameter to be estimated, the elasticity of intermediate input substitution, combining [26] with [29] gives the final equation to be estimated as:

$$\mathrm{E}_t \left\{ \begin{array}{l} -\left[h + \frac{1-h}{\bar{\mu}-1} \varepsilon_x \right] \hat{s}^Y_{t+1} - \left[h + \frac{1-h}{\bar{\mu}-1} \varepsilon_x \right] \phi \left(\hat{p}^m_{t+1} - u\hat{l}c^{va}_{t+1} \right) + \hat{s}^Y_t + \phi \left(\hat{p}^m_t - u\hat{l}c^{va}_t \right) + \\ \left[(1-h)\varepsilon_x - h\,\varepsilon_y \right] \hat{y}_{t+1} + \varepsilon_y \hat{y}_t - \varepsilon_x r_{t+1} \end{array} \right\} = 0 \qquad [30]$$

We estimate this expression by GMM for each of the seventeen sectors we have considered. We use the first and the second lag of the endogenous variables as instruments, and the main results appear in Table 4.

The first interesting result from Table 4 is that the dynamic models of mark-up behaviour seem to be supported by the data. Only in two branches of activity is the parameter linking mark-ups to future expected demand (ε_x) clearly non-significant: *Paper* and *Other market services*. Besides, the sign of this parameter is negative in the remaining sectors except in *Retail trade and hotels and restaurants*. These latter results contrast with those obtained by López-Salido and Velilla (2002) for Spain at the aggregate level and Rotemberg and Woodford (1986) for the USA, although they are in line with the outcomes obtained for the UK by Small (1997) and Briton et al. (2000). As will be clarified later, these differences seem to be a result of: first, the different sample period (now we did drop out the

7. In particular $h = \frac{1+g}{1+r^*}$, g being the average growth rate of production and r* the equilibrium interest rate.

last part of the seventies and incorporate the final part of the nineties and the beginning of the 2000s); and, second, the consideration of gross output as opposed to value added[8].

With respect to the contemporaneous cyclical evolution of mark-ups (ε_y), the results are less evident, although pro-cyclical behaviour predominates. In eight branches of activity this parameter is non-significant (*Agriculture*, *Chemistry*, *Machinery*, *Transport equipment*, *Textiles*, *Paper*, *Plastic* and *Retail trade and hotels and restaurants*), and for the rest only in three cases the sign of this parameter is negative (*Non-metallic minerals, Other manufacturing sectors* and *Other market services*). In López-Salido and Velilla (2002) this parameter was non-significant when freely estimated, although the sign was negative; on the contrary, Fariñas and Huergo (2003) found a significant pro-cyclical behaviour of mark-ups in the case of manufacturing sectors. For other countries, Rotemberg and Woodford (1986) found a negative sign for the USA, and Small (1997) a positive one for the UK.

Finally, the parameter linking the behaviour of the inverse of the labour income share and the relative price of intermediate inputs is significant for all the sectors except *Plastic*, *Transport* and *Other market services*. In these cases the parameter is positive except for *Energy*. This means that in most cases the elasticity of intermediate input substitution is below one, as seems to be the case for the USA [see, for example, Basu (1995) or Rotemberg and Woodford (1996)].

4.4 From gross output to value added: aggregate implications

As we have pointed out, the main difficulty associated with the analysis of gross-output mark-ups is that it is not possible to directly aggregate them across sectors. This is due to the double counting of intermediate consumption that would arise in such case. Therefore, before aggregating, it is necessary to relate gross-output mark-ups and value-added mark-ups. In order to do that, we start with a generic production function for gross output, that is assumed to be differentiable in all its arguments:

$$Y_t = F\left(K_t, L_t, M_t, Z_t\right) \qquad [31]$$

Thus, the growth rate of gross output can be expressed as follows:

$$\Delta y_t = \frac{F_K\ K_t}{Y_t}\Delta k_t + \frac{F_L\ L_t}{Y_t}\Delta l_t + \frac{F_M\ M_t}{Y_t}\Delta m_t + \Delta z_t \qquad [32]$$

where, Δx is the growth rate of *X* and F_X the derivative of the production function with respect to *X*.

The first order conditions of the optimization problem solved by the representative firm (maintaining the hypotheses established in previous sections) imply the following:

$$\frac{F_X\ X_t}{Y_t} = \mu_t^Y\ S_{Xt}^Y \qquad for \quad X = K, L, M \qquad [33]$$

therefore, substituting in equation [32], the growth rate of gross output can be expressed as:

$$\Delta y_t = \mu_t^Y\left(S_{Kt}^Y\ \Delta k_t + S_{Lt}^Y\ \Delta l_t + S_{Mt}^Y\ \Delta m_t\right) + \Delta z_t \qquad [34]$$

When a production function is specified for value added, similar manipulations allow us to express the growth rate of value added as follows:

$$\Delta va_t = \mu_t^{VA}\left(S_{Kt}^{VA}\ \Delta k_t + S_{Lt}^{VA}\ \Delta l_t\right) + \Delta z_t^* \qquad [35]$$

8. The Sargan test of the orthogonality conditions is quite satisfactory: only for *Transport equipment* is the p-value below 10%. With respect to the second-order correlation of the residuals, Building is the only sector with a p-value below 5%.

where, now, the income shares are calculated with respect to value added. Since value added growth can also be expressed in terms of gross output as follows:

$$\Delta va_t = \frac{\Delta y_t - S_{Mt}^Y \Delta m_t}{1 - S_{Mt}^Y} = \Delta y_t - \frac{S_{Mt}^Y}{1 - S_{Mt}^Y}\left(\Delta m_t - \Delta y_t\right) \quad [36]$$

Substituting equation [34] in [36], we can express the growth rate of value added in the following way:

$$\Delta va_t = \frac{\mu_t^Y\left(1 - s_{Mt}^Y\right)}{1 - \mu_t^Y s_{Mt}^Y}\left(s_{Kt}^{VA}\Delta k_t + s_{Lt}^{VA}\Delta l_t\right) + \frac{s_{Mt}^Y\left(\mu_t^Y - 1\right)}{\left(1 - s_{Mt}^Y\right)\left(1 - \mu_t^Y s_{Mt}^Y\right)}\left(\Delta m_t - \Delta y_t\right) + \frac{1}{1 - \mu_t^Y s_{Mt}^Y}\Delta z_t \quad [37]$$

The comparison of this expression with that obtained in [35] allow us to identify the relation between gross output and value-added mark-ups, that is, the parameter multiplying the weighted average of input growth. In addition, it also establishes a relation between value added and gross-output productivity growth:

$$\mu_t^{VA} = \frac{\mu_t^Y\left(1 - S_{Mt}^Y\right)}{1 - \mu_t^Y S_{Mt}^Y} \quad [38]$$

$$\Delta z_t^* = \frac{S_{Mt}^Y\left(\mu_t^Y - 1\right)}{\left(1 - S_{Mt}^Y\right)\left(1 - \mu_t^Y S_{Mt}^Y\right)}\left(\Delta m_t - \Delta y_t\right) + \frac{1}{1 - \mu_t^Y S_{Mt}^Y}\Delta z_t \quad [39]$$

From the first expression it is interesting to notice that value-added mark-ups will generally be greater than or equal to gross-output mark-ups. They will coincide only in the absence of intermediate consumption or when there is perfect competition. The difference between them is directly related to the importance of intermediate consumption in production. The second equation establishes that the productivity growth obtained using value added could be contaminated by non-technological aspects in the absence of perfect competition, in particular by the changes in the intermediate consumption-production ratio. Furthermore, even if that ratio remains constant or there exists perfect competition, value-added productivity growth will be higher than gross-output productivity growth.

Using [38], it is possible to express the value-added mark-up in log deviations from steady-state as follows:

$$\hat{\mu}_t^{VA} = \frac{1}{1 - \bar{\mu}^Y \bar{S}_M^Y}\hat{\mu}_t^Y + \frac{\bar{S}_M^Y\left(\bar{\mu}^Y - 1\right)}{\left(1 - \bar{\mu}^Y \bar{S}_M^Y\right)\left(1 - \bar{S}_M^Y\right)}\hat{s}_{Mt}^Y \quad [40]$$

and, using equation [23] to express the intermediate-input share as a function of relative input prices:

$$\hat{\mu}_t^{VA} = \frac{1}{1 - \bar{s}_M^Y}\hat{\mu}_t^Y + \frac{\bar{s}_M^Y\left(\bar{\mu}^Y - 1\right)}{\left(1 - \bar{\mu}^Y \bar{s}_M^Y\right)\left(1 - \bar{s}_M^Y\right)}\phi\frac{\bar{\mu}^Y \bar{s}_L^Y}{\alpha - \bar{\mu}^Y \bar{s}_L^Y}\left(\hat{p}_t^m - u\hat{l}c_t^{va}\right) \quad [41]$$

From this expression it is easy to see that the response of value-added mark-ups to future expected and current demand is in the same direction as in the case of gross-production mark-ups, although the elasticity is higher. In fact, the elasticity increases with the importance of intermediate consumption in production. With respect to the relative price of intermediate inputs, the sign of the effect will depend on ϕ, which, in turn, depends on the elasticity of intermediate input substitution. When σ_M is lower than one value-added mark-ups increase when relative intermediate prices are higher and the opposite happens when σ_M is higher than one.

Using the results obtained in Table 4 for the dynamics of the gross-output mark-ups, we have calculated the parameters determining the evolution of value-added mark-ups (equation [41] and [28]). These parameters appear in Table 5. We have also aggregated them to obtain the main explanatory factors for mark-ups in the market economy and in the manufacturing and market-services sectors by using value-added weights.

As was to be expected, for the different sectors of the economy, the dependence of mark-ups on current and future expected output gaps has the same sign, although the elasticity is higher than in the case of gross-output mark-ups. Also, the difference between these two parameters widens when intermediate inputs are used more intensively, as is the case in the manufacturing sectors. When the results are aggregated, the first interesting finding is that, although market-economy mark-ups behave pro-cyclically in contemporaneous terms, this is a consequence of the current positive correlation of manufacturing mark-ups with respect to the cycle, because for market services the opposite is the case (although the parameters are non significant). Notice that this latter result is only a consequence of what happens in *Other market services* and, to a lesser extent, in *Retail trade and hotels and restaurants*, highly heterogeneous sectors that represent more than 75% of total market services value added.

The results for the dependence of mark-ups on future expected demand are qualitatively the same. Market-economy mark-ups depend negatively on the future expected output gap due to the behaviour of the manufacturing sectors, while the dependence of market-services sectors is negative. All in all, this implies that the dynamic models implicit in the evolution of mark-ups in the manufacturing and market-services sectors are clearly different.

In the case of the impact of the relative prices of intermediate inputs on mark-ups, the elasticity for the various sectors is now less than ϕ in absolute terms, and the differences are larger in the case of the market-service sectors. In fact, the aggregate results show a positive effect for the market economy that is repeated both for manufacturing and market services, although the size of the elasticity is much higher in the first case and non-significant in the second case.

5 Implications for the relative prices of non-tradables and tradables

In a recent paper, Estrada and López-Salido (2004 b) highlighted the role played by the relative mark-ups of market services and manufacturing sectors in explaining the inflation differential of these two branches of the Spanish economy. In particular, it was shown that in the most recent period this inflation differential cannot be explained solely by the Balassa-Samuelson hypothesis (the total factor productivity growth was very similar in both sectors), while the increase in relative mark-ups in the non-traded sector explained such a circumstance. Figure 4 illustrates again the size of the co-movements between the inflation differential and the evolution of the relative mark-ups in both sectors. As can be seen both time series show very similar patterns; with a contemporaneous correlation of 0.65. The chart also shows that both the inflation differential and mark-ups behave pro-cyclically. As can be seen in Table 6, in the first case the maximal correlation with the cycle is contemporaneous and around 0.52; in the case of relative mark-ups the maximal correlation is with a one-year lag, 0.61, although the contemporaneous correlation is also positive (0.60).

In order to rationalize this behaviour of relative mark-ups, we have used the previously estimated models for value added to decompose its evolution. In particular, we distinguish two specific components plus a residual term. The first component captures the impact on mark-ups of current and expected demand (that is taken as given). In the case of services, since mark-ups depend negatively on current output and positively on future outputs, in periods when the demand is progressively recovering (declining) mark-ups widen (narrow). On the other hand, in the manufacturing sectors, since mark-ups depend positively on the current output gap and negatively on future expected demand, when demand is progressively recovering (declining) current mark-ups narrow (widen). Thus, assuming that the cycles of services and manufacturing sectors are similar, this component will make relative mark-ups behave pro-cyclically. More importantly, the second component captures the impact on mark-ups of intermediate relative prices.

In Figure 5 we represent the evolution of relative mark-ups alongside these two components. As can be seen, the contribution of the relative intermediate prices is larger and more volatile, and it shows a positive relation with relative mark-ups. The maximal correlation of this component with the output gap is contemporaneous and around 0.47 (see table 6). The second component also shows a positive relation with relative mark-ups, although it seems to show a certain lag. Thus, the maximum correlation with the output gap is lagged one period and around 0.70, the contemporaneous correlation being insignificant.

These results imply that the contemporaneous pro-cyclical behaviour of relative mark-ups (which is responsible for the positive correlation of the inflation differential with the output gap) can be explained by the different impact that intermediate prices have on mark-ups in the services and manufacturing sectors, but the different impact that contemporaneous and future demand have on relative mark-ups justifies the (higher) lagged correlation.

If most of the pro-cyclical behaviour of relative mark-ups is the result of the impact of relative intermediate prices, an interesting question is what would have happened if we did not have information on this component. In such a case only the demand component of mark-ups would be available. After re-estimating the equations considering only current demand and future expected profits as determinants of mark-ups we have performed a similar exercise to before, calculating again the contribution to relative mark-ups of current and future demand. The results appear in Figure 6 alongside those obtained in the previous paragraph. As can be seen, the new component is higher, and the correlation with the output gap has also increased at all leads and lags (see Table 6). This means that omitting the role played by intermediate prices could lead to part of the (pro-cyclical) behaviour of relative mark-ups being incorrectly assigned to demand factors.

6 Conclusions

In this paper we have analysed the cyclical behaviour of mark-ups in the seventeen branches of activity corresponding to the Spanish market economy. Thus, we have constructed several sectoral mark-ups by assuming alternative technology specifications. Our empirical analysis supports the hypothesis that value-added mark-ups tend to be pro-cyclical in the manufacturing branches of activity and counter-cyclical in market services. We have also shown that, at the sectoral level, value-added mark-ups can generate misleading results if variations in intermediate inputs are not considered. From the analysis of the co-movements among gross-production based sectoral mark-ups we obtain a higher degree of synchronization than that obtained on the basis of value-added mark-ups.

After reviewing some theoretical models of mark-up determination, the results from sectoral estimations show that mark-ups are not only affected by current output gaps but also by future or expected demand. Nevertheless, there is a substantial amount of heterogeneity across sectors. Thus, in some sectors mark-ups are pro-cyclical and depend negatively on future expected profits (customer market model), while others tend to respond positively to expected demand (implicit collusion model).

Finally, when the sectoral results are aggregated some interesting conclusions arise. In the case of manufacturing sectors the customer market model is supported by the data, while the implicit collusion model is the relevant one in the case of market services. Also, relative intermediate-input prices play a significant role in the case of the open manufacturing sectors, while for market services they are less important. In fact, this is the main explanatory factor behind the (pro-cyclical) behaviour of relative services-manufacturing mark-ups, which, in turn, play an important role in the relative price dynamics of these sectors.

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TABLE 1. DESCRIPTIVE STATISTICS OF AGGREGATED MARK-UPS

		Std. Dev.	Correlation with					
			Sectoral Value Added			Market Ec. Value Added		
			Lag	Cont.	Lead	Lag	Cont.	Lead
MARKET ECONOMY	C-D (1)	1.29%	-	-	-	**-0.61**	-0.40	-0.08
	CES (2)	1.32%	-	-	-	**-0.60**	-0.59	-0.28
	CES (3)	1.31%	-	-	-	**-0.60**	-0.24	0.02
	O-L (4)	1.58%	-	-	-	**-0.67**	-0.66	-0.37
MANUFACTURING	C-D (1)	2.16%	-0.37	0.16	**0.40**	**-0.52**	-0.13	0.19
	CES (2)	1.87%	**-0.40**	-0.01	0.29	**-0.52**	-0.25	0.08
	CES (3)	2.34%	-0.35	0.23	**0.44**	**-0.51**	-0.08	0.24
	O-L (4)	2.14%	**-0.53**	-0.12	0.19	**-0.62**	-0.40	-0.07
MARKET SERVICES	C-D (1)	0.86%	-0.08	-0.24	**-0.58**	-0.34	-0.35	**-0.43**
	CES (2)	0.92%	0.02	-0.46	**-0.63**	-0.28	-0.51	**-0.51**
	CES (3)	0.89%	-0.12	-0.11	**-0.53**	-0.34	-0.25	**-0.36**
	O-L (4)	1.11%	-0.16	-0.42	**-0.72**	-0.42	-0.56	**-0.58**

Notes:
(1) Cobb-Douglas production function.
(2) CES with elasticity of substitution equal to 0.5.
(3) CES with elasticity of substitution equal to 2.
(4) Overhead labour.

TABLE 2. DESCRIPTIVE STATISTICS OF SECTORAL MARK-UPS*

		S. D.	Correlation with					
			Sectoral Value Added			Market Econ. Value Added		
			Lag	Cont.	Lead	Lag	Cont.	Lead
Agriculture	C-D (1)	4.01%	-0.21	0.18	-0.08	**-0.59**	-0.32	0.12
	C-D (2)	3.33%	-0.16	-0.04	0.00	**-0.60**	-0.47	0.00
	C-D (3)	2.29%	-0.21	**0.50**	-0.21	-0.15	0.20	**0.35**
Energy	C-D (1)	3.58%	-0.45	**0.81**	-0.23	-0.28	**-0.30**	-0.05
	C-D (2)	7.01%	0.00	**-0.45**	0.00	0.34	0.06	**-0.42**
	C-D (3)	5.50%	-0.14	**0.58**	-0.08	**-0.39**	-0.19	0.27
Metals	C-D (1)	4.50%	0.21	**0.82**	0.48	-0.10	0.23	**0.32**
	C-D (2)	5.04%	0.08	**0.72**	0.35	-0.15	-0.02	-0.04
	C-D (3)	0.97%	**0.31**	0.08	0.20	0.16	0.00	**0.80**
Non-metallic minerals	C-D (1)	2.62%	**-0.31**	0.19	0.15	-0.37	0.08	**0.47**
	C-D (2)	2.41%	-0.07	0.15	0.00	-0.16	0.01	0.12
	C-D (3)	1.30%	**-0.40**	0.06	0.23	-0.37	0.10	**0.54**
Chemistry	C-D (1)	3.11%	0.19	**0.47**	0.16	**-0.49**	-0.05	0.15
	C-D (2)	3.38%	**0.35**	0.24	-0.07	**-0.28**	-0.04	0.09
	C-D (3)	0.92%	-0.32	0.32	**0.36**	**-0.32**	-0.04	0.09
Machinery	C-D (1)	2.62%	-0.22	0.35	**0.50**	**-0.58**	-0.20	0.18
	C-D (2)	3.63%	-0.39	0.25	**0.57**	**-0.62**	-0.27	0.07

	C-D (3)	0.95%	**0.54**	0.00	-0.50	**0.50**	0.31	0.15
	C-D (1)	3.82%	-0.05	**0.61**	0.34	**-0.57**	-0.17	0.14
Transport Equipment	C-D (2)	3.85%	-0.29	**0.39**	0.35	**-0.62**	-0.26	-0.04
	C-D (3)	0.94%	0.28	**0.28**	0.02	0.08	0.11	0.22
	C-D (1)	1.31%	-0.18	-0.17	0.15	**-0.37**	-0.08	0.28
Food	C-D (2)	2.14%	-0.54	**-0.79**	-0.34	**-0.38**	-0.37	-0.23
	C-D (3)	0.55%	0.51	**0.79**	0.48	0.21	**0.38**	0.42
	C-D (1)	2.15%	0.01	**0.35**	0.34	**-0.43**	-0.18	0.07
Textiles	C-D (2)	2.76%	0.03	0.14	0.09	**-0.37**	-0.23	-0.23
	C-D (3)	0.74%	-0.08	0.21	**0.26**	0.05	0.14	**0.45**
	C-D (1)	2.57%	**-0.45**	0.12	0.39	-0.25	0.07	**0.42**
Other manufacturing	C-D (2)	2.89%	**-0.43**	-0.23	0.19	**-0.37**	-0.17	0.10
	C-D (3)	1.05%	0.02	**0.50**	0.21	0.20	0.26	**0.38**
	C-D (1)	3.58%	**-0.29**	-0.22	-0.02	**-0.55**	-0.51	-0.31
Paper	C-D (2)	4.72%	-0.24	**-0.27**	-0.13	-0.41	**-0.42**	-0.29
	C-D (3)	1.19%	0.04	0.25	**0.27**	-0.06	0.05	0.13
	C-D (1)	2.16%	-0.12	-0.08	**0.34**	-0.23	-0.08	0.07
Plastic	C-D (2)	3.17%	**-0.42**	-0.37	0.25	-0.31	**-0.33**	-0.21
	C-D (3)	1.38%	**0.52**	0.47	-0.04	0.25	**0.42**	0.37
Building	C-D (1)	2.13%	-0.20	**0.37**	0.28	-0.09	-0.03	0.11

	C-D (2)	2.47%	**-0.40**	-0.08	0.06	-0.28	**-0.46**	-0.23
	C-D (3)	0.93%	0.46	**0.66**	0.30	0.42	**0.72**	0.51
Retail trade and hotels and restaurants	C-D (1)	1.11%	0.27	0.03	**-0.68**	0.06	-0.18	**-0.57**
	C-D (2)	1.39%	0.21	-0.10	**-0.72**	-0.03	-0.33	**-0.62**
	C-D (3)	0.78%	0.06	0.31	**0.42**	0.29	**0.48**	0.37
Transport	C-D (1)	2.26%	-0.06	**0.28**	0.22	**-0.32**	-0.04	0.15
	C-D (2)	1.92%	0.21	**0.48**	-0.05	-0.13	-0.08	-0.10
	C-D (3)	1.90%	**-0.47**	-0.23	0.44	**-0.42**	0.04	0.39
Communications	C-D (1)	2.39%	0.06	**0.39**	-0.17	-0.17	-0.28	**-0.34**
	C-D (2)	2.36%	-0.18	**0.28**	0.05	-0.28	**-0.29**	-0.24
	C-D (3)	5.47%	**0.33**	0.13	-0.33	0.07	-0.05	-0.16
Other market services	C-D (1)	1.10%	-0.37	-0.38	**-0.48**	-0.46	**-0.50**	-0.31
	C-D (2)	1.46%	-0.43	**-0.66**	-0.58	-0.34	**-0.62**	-0.49
	C-D (3)	1.60%	0.22	**0.64**	0.37	-0.03	0.41	**0.43**

Notes:

(1) Labour income share on value added.

(2) Labour income share on gross output.

(3) Intermediate income share on gross output.

TABLE 3. OUTPUT-GAP CORRELATIONS				
	Relative St. Dev.	Correlation with Sectoral Value Added		
		Lag	Cont.	Lead
Agriculture	2.85	-0.07	0.09	-0.01
Energy	3.50	-0.09	0.02	0.25
Metals	2.74	0.33	**0.57**	0.46
Non-metallic minerals	2.26	0.67	**0.82**	0.46
Chemistry	1.71	-0.25	0.40	**0.58**
Machinery	1.98	0.27	**0.56**	0.41
Transport Equipment	3.54	0.02	**0.47**	0.31
Food	2.15	0.45	**0.56**	0.55
Textiles	1.54	0.13	**0.58**	0.57
Other manufacturing	2.48	0.68	**0.72**	0.50
Paper	1.60	0.24	**0.57**	0.56
Plastic	1.79	0.15	0.65	**0.70**
Building	2.84	0.65	**0.79**	0.56
Retail trade and Hotels and restaurants	1.21	0.43	**0.80**	0.46
Transport	1.53	**0.57**	0.50	0.02
Communications	3.03	0.13	0.01	-0.03
Other market services	1.16	0.63	**0.73**	0.41

TABLE 4. RESULTS FOR THE MARK-UP MODEL [EQUATION 30]

GMM estimation 1980-2002 (Instruments: 1st and 2nd lag of endogenous variables)

Sectors	Parameter Estimates			Diagnostic Tests		
	ε_y	ε_x	ϕ	$\sigma \times 100$	Sargan Test	2nd order correlat.
Agriculture	0.146 (0.137)	-0.619 (0.100)	0.626 (0.099)	2.430	1.681 [0.891]	2.697 [0.260]
Energy	0.824 (0.027)	-0.177 (0.047)	-0.229 (0.065)	3.916	5.099 [0.404]	0.114 [0.945]
Metals	0.220 (0.040)	-0.567 (0.034)	0.474 (0.025)	0.997	5.594 [0.348]	3.363 [0.186]
Non-metallic minerals	-0.165 (0.082)	-0.756 (0.066)	0.753 (0.059)	1.253	7.356 [0.195]	0.105 [0.949]
Chemistry	0.153 (0.190)	-0.312 (0.057)	0.572 (0.049)	1.492	5.206 [0.391]	1.374 [0.503]
Machinery	0.254 (0.174)	-0.472 (0.095)	0.766 (0.104)	1.765	7.667 [0.176]	4.667 [0.097]
Transport Equipment	0.049 (0.170)	-0.604 (0.210)	0.656 (0.127)	2.488	9.265 [0.099]	4.270 [0.118]
Food	0.328 (0.167)	-0.711 (0.109)	0.185 (0.020)	1.046	8.242 [0.143]	2.377 [0.305]
Textiles	0.136 (0.137)	-0.444 (0.075)	0.489 (0.044)	1.388	9.135 [0.104]	4.853 [0.088]
Other manufacturing	-0.252 (0.067)	-0.584 (0.075)	0.809 (0.098)	1.474	4.711 [0.452]	3.395 [0.183]
Paper	-0.263 (0.186)	0.111 (0.092)	0.633 (0.068)	2.435	4.601 [0.467]	0.296 [0.863]
Plastic	-0.337 (0.338)	-0.723 (0.212)	-0.053 (0.170)	2.888	7.966 [0.158]	1.181 [0.554]
Building	0.198 (0.043)	-0.405 (0.044)	0.662 (0.050)	1.045	5.680 [0.339]	8.675 [0.013]
Retail trade and hotels & restaurants	-0.044 (0.160)	0.217 (0.036)	0.385 (0.106)	1.297	6.659 [0.247]	0.381 [0.827]
Transport	0.680 (0.323)	-0.278 (0.064)	0.082 (0.136)	2.583	7.898 [0.162]	2.690 [0.261]
Communications	0.271 (0.090)	-0.269 (0.047)	0.191 (0.020)	1.828	9.193 [0.102]	5.539 [0.063]
Other market services	-0.687 (0.238)	-0.019 (0.182)	0.104 (0.148)	1.871	6.205 [0.287]	1.670 [0.434]

Notes: σ, standard deviation; the Sargan test is distributed as a χ^2 with 5 degrees of freedom; 2nd order serial correlation is distributed as a χ^2 with 2 degrees of freedom. Standard deviations in brackets; p-values in square brackets.

TABLE 5. VALUE-ADDED MARK-UP DETERMINANTS

Sectors	Output gap	Future profits	Intermediate prices
Agriculture	0.251	-1.064	0.059
	(0.235)	(0.172)	(0.009)
Energy	2.040	-0.438	-0.033
	(0.067)	(0.116)	(0.009)
Metals	0.693	-1.786	0.255
	(0.126)	(0.107)	(0.013)
Non-metallic minerals	-0.393	-1.799	0.297
	(0.195)	(0.157)	(0.023)
Chemistry	0.485	-0.989	0.256
	(0.602)	(0.181)	(0.022)
Machinery	0.666	-1.238	0.494
	(0.456)	(0.249)	(0.067)
Transport Equipment	0.184	-2.273	0.159
	(0.640)	(0.790)	(0.031)
Food	1.439	-3.119	0.002
	(0.733)	(0.478)	(0.000)
Textiles	0.431	-1.408	0.099
	(0.435)	(0.238)	(0.009)
Other manufacturing	-0.634	-1.596	0.538
	(0.186)	(0.205)	(0.065)
Paper	-0.709	0.299	0.101
	(0.501)	(0.248)	(0.011)
Plastic	-0.864	-1.854	-0.009
	(0.867)	(0.544)	(0.028)
Building	0.511	-1.044	0.422
	(0.111)	(0.113)	(0.032)
Retail trade and Hotels and restaurants	-0.072	0.356	0.154
	(0.262)	(0.059)	(0.042)
Transport	1.142	-0.467	0.022
	(0.542)	(0.107)	(0.037)
Communications	0.362	-0.359	0.012
	(0.120)	(0.063)	(0.001)
Other market services	-1.055	-0.029	0.101
	(0.366)	(0.280)	(0.144)
MARKET ECONOMY	**0.177**	**-0.626**	**0.158**
	(0.374)	**(0.240)**	**(0.067)**
MANUFACTURING	**0.360**	**-1.694**	**0.219**
	(0.519)	**(0.378)**	**(0.034)**
MARKET SERVICES	**-0.192**	**0.064**	**0.109**
	(0.348)	**(0.172)**	**(0.089)**

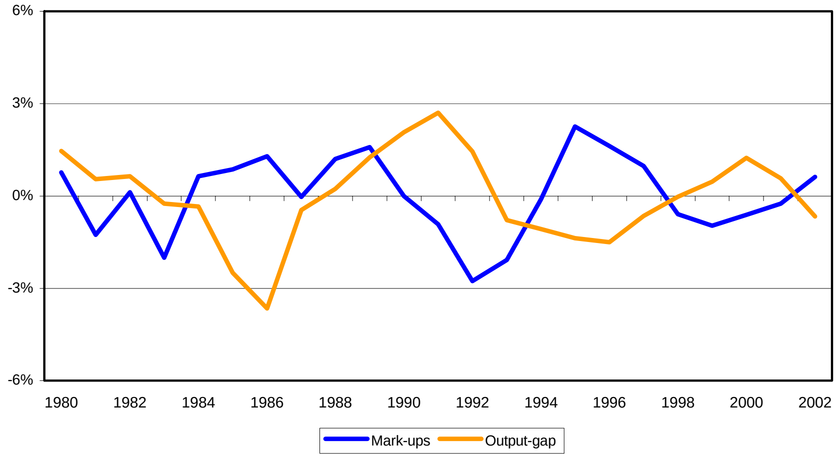
Note: Standard deviations in brackets.

TABLE 6. DESCRIPTIVE STATISTICS OF INFLATION DIFFERENTIAL, RELATIVE MARK-UPS AND THEIR COMPONENTS

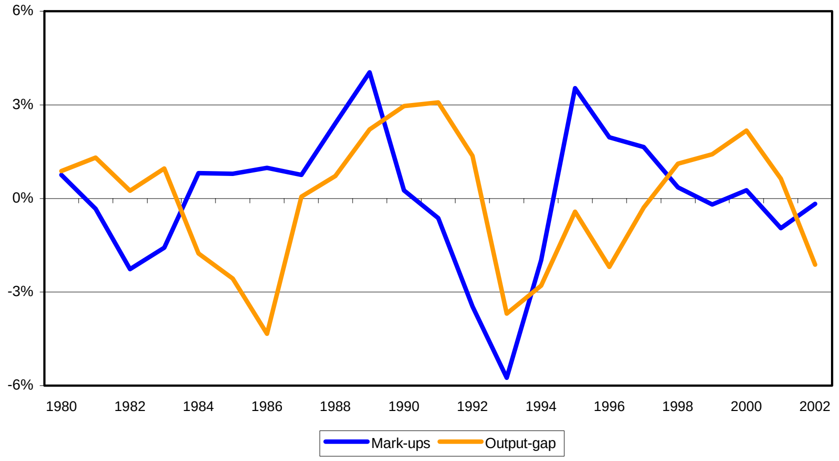
.	Correlation with output gap		
	Lag	Cont.	Lead
Inflation differential	**0.42**	**0.52**	**0.44**
Relative mark-ups	0.61	0.60	0.36
Demand component	0.70	0.06	-0.52
Intermediate price component	0.35	0.47	0.46
Residual	-0.17	-0.04	-0.02
Memorandum items: *Model without intermediate relative prices*			
Demand component	*0.76*	*0.20*	*-0.40*
Residual	*-0.38*	*0.20*	*0.66*

FIGURE 1. INVERSE OF LABOUR INCOME SHARE CYCLE

A. MARKET ECONOMY



B. MANUFACTURING SECTOR



C. MARKET SERVICES

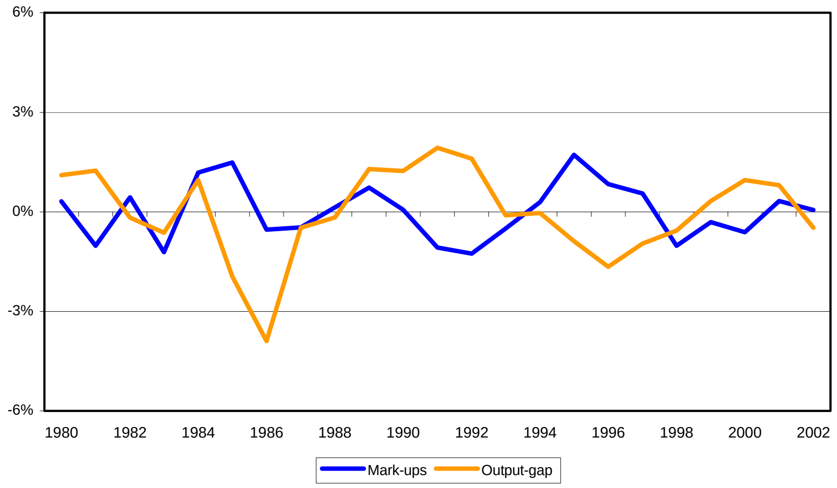
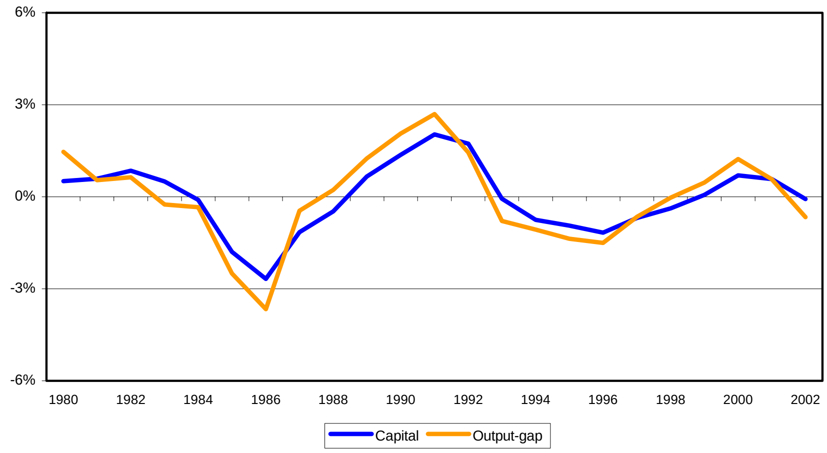
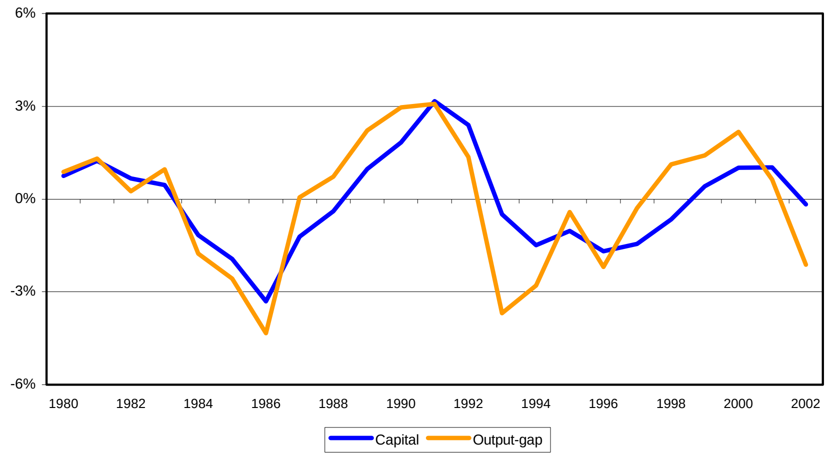


FIGURE 2. CAPITAL STOCK AND OUTPUT GAP

A. MARKET ECONOMY



B. MANUFACTURING SECTOR



C. MARKET SERVICES

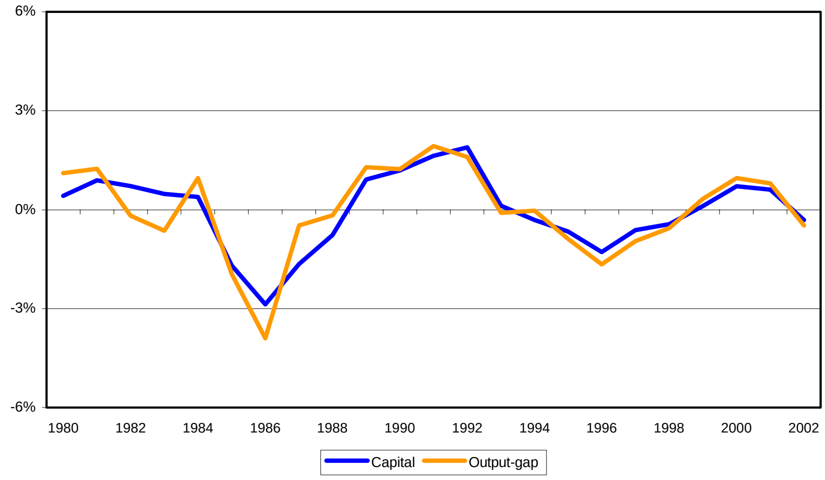


FIGURE 3. MARK-UPS COMOVEMENTS

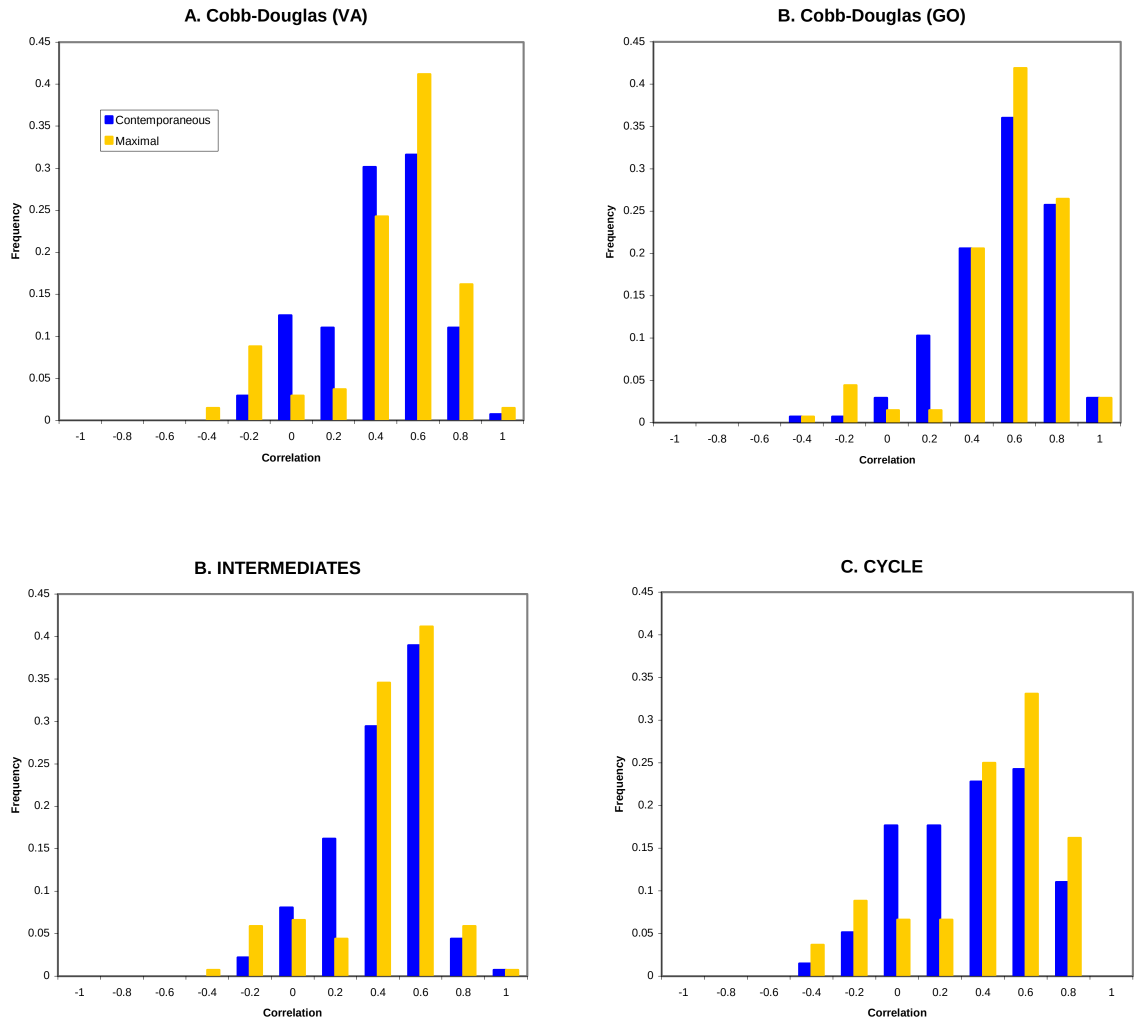


FIGURE 4. RELATIVE NON TRADABLE-TRADABLE INFLATION AND MARK-UPS

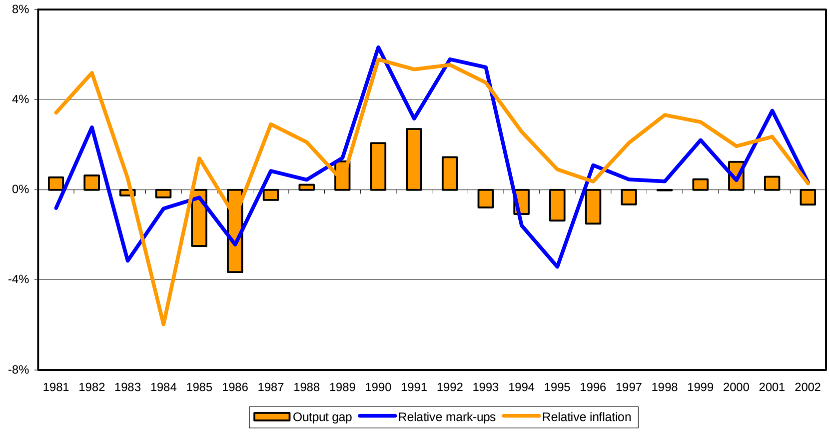


FIGURE 5. RELATIVE MARK-UPS COMPONENTS

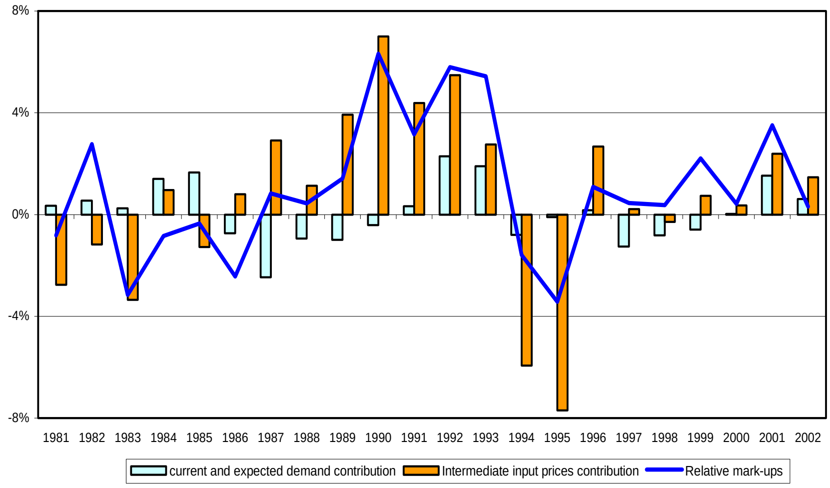
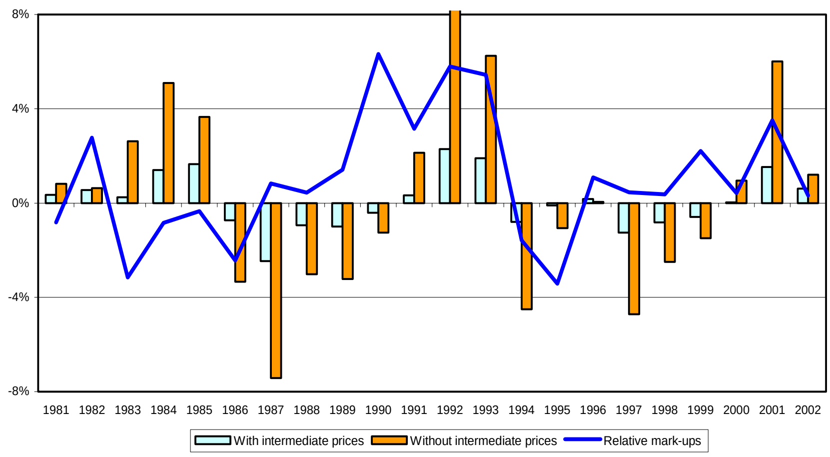


FIGURE 6. COMPARISON OF CURRENT AND EXPECTED DEMAND CONTRIBUTION



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