Understanding the Dynamics of Labor Shares and Inflation

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Abstract

Calvo-style models of nominal rigidities currently provide the dominant paradigm for understanding the linkages between wage and price dynamics. Recent empirical implementations stress the idea that these models link inflation to the behavior of the labor share of income. Gal, Gertler, and Lopez-Salido (2001) argue that the model explains the combination of declining inflation and labor shares in Euro area. In this paper, we show that with realistic parameters, the canonical Calvo-style model cannot explain the joint behavior of inflation and the labor share in Europe. In addition, we show that the model fails very badly in sectoral data with consistently negative estimated coefficients on the labor share in a number of different inflation specifications. Indeed, the use of a traditional output gap measure proved more successful in terms of a positive relationship with inflation.

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1 Introduction

Recent years have seen a significant trend in macroeconomics towards widespread usage of models based on strong microeconomic foundations. As a result, the dominant model of pricing behavior that has emerged combines the Keynesian idea of price rigidity with the assumption that firms behave in an optimal manner when facing such rigidities. Frictionless neoclassical theories imply that optimization involves setting price as a markup over marginal cost, so the optimal pricing formula that emerges from simple models of nominal rigidity (such as the Calvo model) features firms setting prices as a markup over a weighted average of current and expected future values of nominal marginal cost. It is now well-known that this also implies a relationship between aggregate inflation on the one hand, and expected future inflation and real marginal cost, on the other. This relationship, known as the New-Keynesian Phillips Curve (NKPC), has featured in many empirical studies in recent years. In most of these recent empirical applications, researchers have followed Galí and Gertler (1999) and Sbordone (2002) and proxied marginal costs with unit labor costs (the ratio of compensation to real output). Thus, this approach proxies real marginal cost, and hence inflationary pressures, with the labor share of income (the ratio of compensation to nominal output).

The joint behavior of inflation and the labor share in Europe provides a particularly interesting testing ground for the labor share approach to modelling inflation dynamics. As documented by Galí, Gertler, and Lopez-Salido (2001), the Euro area has seen significant declines in both inflation and in the labor share of income (see Figure 1).[1] The NKPC approach suggests that these developments may be related: If the underlying market structures and technology have not changed, then high labor shares reflect lower-than-desired markups and thus trigger inflation. If the empirical relationship between inflation and the labor share reflects this causal relationship, then understanding the dynamics of the labor share in the Euro area should be a central concern of policy-makers and researchers.

In this paper, we re-examine the joint behavior of inflation and the labor share in Europe. We start by discussing the theoretical relationships underpinning the potential link between inflation and the labor share. Most of the recent literature has viewed the

[1] This chart follows Galí, Gertler, and Lopez-Salido (2001) in using the ratio of compensation of employees to nominal GDP as its measure of the labor share. Broader measures that account for self-employed individuals, such as those reported by Eurostat, show a higher value for the labor share, but essentially the same pattern of decline over time.

Calvo model as a framework for understanding the behavior of inflation contingent on the behaviour of the labor share, which is then viewed as exogenous. We show that the Calvo model actually makes relatively strong predictions for the *joint* dynamics of inflation and the labor share. We then review the aggregate evidence relating to the behavior of inflation and labor shares in Europe. We show that the model can only be reconciled with the joint behavior of inflation and labor share if one is willing to assume an unrealistic parameter values for for the discount rate used by firms and level of price stickiness.

In light of this question mark against the existing evidence, it is useful to gather further evidence on the validity of the labor-share-based NKPC model. To provide this additional evidence, we turn to sectoral data. Our principal source has data from 1970-2005 for forty-two sectors for all EU-15 countries and additonal data for the US.

There are a number of reasons why such data may be useful in assessing the NKPC. The model requires an assumed constant value for the optimal markup over marginal cost, for the average duration of prices, and for the elasticity of output with respect to capital, and these values determine the coefficients of the NKPC relationship. It is likely that each of these parameters vary widely across sectors, and also that their average aggregate values may change over time. This suggests that the theoretical case for a stable link between labor shares and inflation is stronger when applied to sectoral data. In addition, a sectoral approach allows for far more identifying variation to be used to assess the model; this may be particularly useful in the European context where there are potential questions about whether the inflation-labor share relationship reflects correlation rather than causation. Perhaps surprisingly, then, there turns out to be little evidence of this relationship in the sectoral data. In fact, both reduced-form and structural NKPC-style inflation regressions report *negative* coefficients on the labor share.

Based on our analysis of both the aggregate and sectoral data, we conclude that the NKPC approach does not provide a good explanation of the joint behavior of inflation and the labor share.

The contents of the paper are as follows. Section 2 outlines the theoretical results underlying the potential link between inflation and the labor share. Section 3 revisits the aggregate Euro-area evidence. Section 4 presents evidence on the link between inflation and the labor share using sectoral data. Section 5 then uses the sectoral data to assess the factors underlying the decline in labor share in Europe. Section 6 concludes.

2 Theoretical Background

This section reviews the theoretical results underlying recent empirical models relating inflation to the labor share of income.

2.1 The Theoretical NKPC

The most popular formulation of price rigidity in the recent macroeconomics literature is Gulliermo Calvo's (1983) model of random price adjustment. The model assumes a continuum of firms indexed by $j \in [0, 1]$ so that each period a random fraction $(1 - \theta)$ of firms reset their price, while all other firms keep their prices unchanged. Thus, the evolution of the (log) price level is given by

$$p_t = \theta p_{t-1} + (1 - \theta)\, p_t^* \tag{1}$$

where p_t^* is the price chosen by those who can reset their prices. (We will use lowercase letters to denote logs). Each firm is assumed to face an isoelastic demand curve for its product of the form

$$Y_t(j) = \left(\frac{P_t(j)}{P_t}\right)^{-\epsilon} Y_t \tag{2}$$

where P_t is the aggregate price level and Y_t is aggregate output. With this market structure, a firm's optimal reset price is determined by

$$p_t^* = \log \mu + (1 - \theta\beta) \sum_{k=0}^{\infty} (\theta\beta)^k\, E_t mc_{t,t+k}^n, \tag{3}$$

where $\mu = \frac{\epsilon}{\epsilon-1}$ is the frictionless optimal markup, β is the firm's discount factor, and $mc_{t,t+k}^n$ is the nominal marginal cost expected at time $t + k$ for a firm that resets its price at time t. In other words, firms take into account that their prices will likely be fixed over some period by setting their price equal to a weighted average of expected future nominal marginal costs.

If marginal costs are identical across all firms, then it is well known that this model implies a new-Keynesian Phillips curve (NKPC) for inflation of the form:

$$\pi_t = \beta E_t \pi_{t+1} + \frac{(1 - \theta)(1 - \theta\beta)}{\theta} \left(mc_t^r + \log \mu\right), \tag{4}$$

where

$$mc_t^r = mc_t^n - p_t \tag{5}$$

is real marginal cost. This relationship is derived in Appendix A.1.

2.2 The Labor Share NKPC: Two Versions

A problem with implementing this model empirically is that marginal cost cannot be observed. However, this problem has been addressed in the literature as follows. First, assume that output can be produced according to a a Cobb-Douglas production function of the form

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}. \tag{6}$$

Then assume that, at all points in time, capital and labor inputs are chosen so as to minimize the current flow costs of these inputs. One can show that this type of cost minimization implies that[2]

$$MC_t^n = \frac{1}{1-\alpha} \frac{W_t L_t}{Y_t} \tag{7}$$

Thus, keeping the assumption that all firms have the same value for marginal cost implies an empirical version of the NKPC of the form

$$\pi_t = \beta E_t \pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} (s_t + \omega) \tag{8}$$

where

$$S_t = \frac{W_t L_t}{P_t Y_t} \tag{9}$$

is the labor share of income, and

$$\omega = \log \left(\frac{\mu}{1-\alpha} \right) \tag{10}$$

An alternative variant of this model assumes that each firm has its own separate Cobb-Douglas production function so that the output at time $t+k$ of a firm that has last set its price at time t is

$$Y_{t,t+k} = A_{t,t+k} K_{t,t+k}^{\alpha} L_{t,t+k}^{1-\alpha} \tag{11}$$

Under the assumption that each firm has the same level of technology and the same level of capital ($A_{t,t+k} = A_t$ and $K_{t,t+k} = K_t$), we show in Appendix A.2 that there is a link between the vintage-specific marginal cost, $mc_{t,t+k}^n$, and the average marginal cost of the form

$$mc_{t,t+k}^n = mc_t^n - \frac{\epsilon\alpha}{1-\alpha} (p_t^* - p_{t+k}) \tag{12}$$

[2] A corresponding equation can be derived relating marginal cost to capital inputs. However, most of the literature on the New Keynesian Phillips curve treats capital as a fixed factor.

This expressions says that marginal cost of the firm that last set prices k period's ago is higher if today's price level is higher: This is because this firm has attracted additional demand due to its low relative price. This equation can be combined with the optimal price, and price-level definition equation, to give an alternative formulation of the NKPC as

$$\pi_t = \beta E_t \pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} \frac{1-\alpha}{1+\alpha(\epsilon-1)} (s_t + \omega) \tag{13}$$

This relationship is also derived in Appendix A.2.

There is one aspect of the NKPC relationship, whether of the form of (8) or (13), that is worth stressing prior to our empirical work. These relationships are generally understood to imply a stable relationship between inflation and the labor share. However, it is perhaps more accurate to say that inflation in these models is related to the *gap* between the log-labor share and a frictionless optimal level, $-\omega$, which is determined by microeconomic market structure (through ϵ) and technology (in the form of the elasticity of output with respect to capital, α). If these factors change over time, then we shouldn't necessarily expect a stable relationship between inflation and the labor share. In addition, since the economy is made up of multiple sectors that have different market structures and different technologies, it is also possible that sectoral shifts may render the aggregate relationship unstable.

2.3 The Joint Dynamics of Inflation and the Labor Share

The recent literature on the NKPC has generally emphasized that the model provides a framework for understanding the behavior of inflation contingent on the behaviour of the labor share, which is then assumed to be an exogenous variable determined by factors such as labor market conditions and institutions. However, it is worth emphasizing that the model makes some quite strong predictions for the dynamics of the labor share itself.

To derive these predictions, start from the standard NKPC equation in equation (13)

$$\pi_t = \beta E_t \pi_{t+1} + \gamma (s_t + \omega) \tag{14}$$

with $\gamma = \frac{(1-\theta)(1-\theta\beta)}{\theta} \frac{1-\alpha}{1+\alpha(\epsilon-1)}$. Note that this equation can be re-written in terms of price levels as

$$p_t - p_{t-1} = \beta E_t p_{t+1} - \beta p_t + \gamma (s_t + \omega) \tag{15}$$

The labor share can then be expressed as a function of unit labor costs $ulc_t \left(= \log\left(\frac{W_t L_t}{Y_t}\right)\right)$ and the price level

$$s_t = ulc_t - p_t \tag{16}$$

so that the price level can be expressed as

$$E_t p_{t+1} - \left(\frac{1+\beta+\gamma}{\beta}\right) p_t + \frac{1}{\beta} p_{t-1} = -\frac{\gamma}{\beta}\left(ulc_t + \omega\right) \tag{17}$$

This second-order stochastic difference equation in the price level has a solution of the form

$$p_t = \lambda p_{t-1} + (1-\lambda)\left[\omega + (1-\beta\lambda)\sum_{k=0}^{\infty}(\beta\lambda)^k E_t ulc_{t+k}\right] \tag{18}$$

where λ is a root between zero and one of the quadratic equation

$$x^2 - \left(\frac{1+\beta+\gamma}{\beta}\right) x + \frac{1}{\beta} = 0 \tag{19}$$

We can use this relationship to derive predictions for the dynamics of the labor share. To do this, note that substituting in this equation for the price level, the labor share can be written as

$$\begin{aligned} s_t &= u_t - \lambda p_{t-1} - (1-\lambda)\left[\omega + (1-\beta\lambda)\sum_{k=0}^{\infty}(\beta\lambda)^k E_t ulc_{t+k}\right] && (20) \\ &= \lambda\left(ulc_t - ulc_{t-1} + ulc_{t-1} - p_{t-1}\right) \\ &\quad - (1-\lambda)\left[\omega + (1-\beta\lambda)\sum_{k=0}^{\infty}(\beta\lambda)^k E_t\left(ulc_{t+k} - ulc_t\right)\right] && (21) \\ &= \lambda s_{t-1} + \lambda\Delta ulc_t - (1-\lambda)\omega - (1-\lambda)\sum_{k=0}^{\infty}(\beta\lambda)^k E_t \Delta ulc_{t+k} && (22) \end{aligned}$$

This can be re-written as

$$s_t + \omega = \lambda\left(s_{t-1} + \omega\right) + \lambda\Delta ulc_t - (1-\lambda)\sum_{k=0}^{\infty}(\beta\lambda)^k E_t \Delta ulc_{t+k} \tag{23}$$

These calculations show that—contingent on assumptions about firm's expectations about the growth in unit labor costs—the NKPC model makes strong predictions about the dynamics of the labor share. A number of predictions can be emphasized

- The labor share should display persistence, in the sense of being dependent on its own lagged value.

- An increase in today's value of unit labor cost inflation will raise the labor share, but expectations of an increase in future unit labor cost inflation will reduce the labor share.

- If unit labor cost inflation is stationary, then the labor share will fluctuate around a constant average value.

- Only if unit labor cost inflation is expected to be zero on average will the model settle down to an average labor share of $s = -\omega$, as would be consistent with the frictionless optimal price markup of $\frac{\epsilon}{\epsilon-1}$ over marginal cost. This is because markups that are, on average, below their frictionless optimal values are required to generate systematic inflation.

- This latter pattern reflects the existence of a long-run tradeoff between markups and inflation in the NKPC model. This can be derived from figuring out the long-run steady-state consistent with the dynamic labor share equation just derived, but is easier to obtain directly from the steady-state of the NKPC inflation equation:

$$\pi^* = \frac{\gamma}{1-\beta}(s^* + \omega) \tag{24}$$

2.4 Calibrating the Inflation-Labor Share Tradeoff

What is the nature of this tradeoff described in equation (24) between inflation and the labor share? For realistic values, the tradeoff turns out to be a very large one: Relatively small deviations of the labor share from its frictionless optimal value of $-\omega$ should generate very large movements in inflation.

To illustrate the type of joint movements in the labor share and inflation that can be generated by realistic parameter values, we consider a simple simulation of a period of disinflation. Ultimately, in this model price inflation is driven by unit labor cost inflation. So we consider a thought experiment in which the economy starts out in a steady-state with 8 percent per year unit labor cost inflation, and then experiences a permanent shift in the tenth period to 2 per cent unit labor cost inflation.

We use a standard value of $\beta = 0.99$ for the discount rate, consistent with a real discount rate of about four percent per year, and use $\theta = 0.75$, consistent with an average price duration of one year as suggested by the evidence for the Euro area presented by Dhyne et al (2005). We use the version of the model with variable marginal cost and set

$\epsilon = 11$ and $\alpha = 0.175$, following Galí, Gertler, and Lopez-Salido (2002) but the simulation is not very sensitive to sensible variations in these parameters. This value of α was chosen to match a reported average value of labor share for Europe of 0.75 with the frictionless optimal value of $\frac{1-\alpha}{\mu}$.

This average labor share value of 0.75 does not match the historical series shown in Figure 1. The reason for this is that, in both the data we use in our analysis and in the calibration of the simulation, we are following Galí, Gertler, and Lopez-Salido (2002, henceforth GGL). The historical series that we use in our regressions follows GGL in using the Area Wide Model's quarterly measure of compensation divided by GDP as the proxy for the labour share. However, some components of labour income, such as self-employed income, are not included in the Area Wide Model dataset that was used by GGL. Eurostat publish a broader measure annual measure and this is the source of the 0.75 labor share used by GGL and also by us to calibrate α. (Both measures show a similar pattern of decline over time.)

Figure 2 shows the results of this simulated thought experiment. The figure shows that the NKPC framework is capable of predicting a combination of a decline in inflation and a decline in the labor share of income, as indeed has been observed. However, for the realistic parameter values used here, it can also be seen that the decline in the labor share needed to generate this substantial drop in inflation is *very* small: The labor share declines from about 0.756 in the eight percent inflation case to 0.752 in the two percent case. Simulations for a wide range of realistic parameter values all showed that the implied decline in the labor share would be less than one percentage point. These calculations compare, for example, with an actual decline of ten full percentages points as reported by Eurostat.[3]

Before running any regressions, then, we think these calculations provide some grounds for skepticism as to whether the NKPC framework can adequately account for the joint behavior of inflation and the labor share in Europe. Two aspects of these calculations worth noting are the role played by the discount rate β and the price stickiness parameter θ. Under the variable marginal cost derivation, long-run coefficient determining the link between the labor share and inflation is

$$\frac{\gamma}{1-\beta} = \frac{(1-\theta\beta)}{(1-\beta)} \frac{1-\theta}{\theta} \frac{1-\alpha}{1+\alpha(\epsilon-1)} \tag{25}$$

As we will see below, one way to get the NKPC to match the data is to use parameters

[3] See various editions of the Statistical Annex of European Economy.

that give a small tradeoff, so that the large observed decline in the labor share can still be consistent with the observed amount of disinflation. The value of this tradeoff depends positively on β and negatively on θ. So, the NKPC can be parameterised to match the observed patterns by using a value for β that reflects an implausibly high rate of time preference and/or a value for θ that implies implausibly high levels of price stickiness.

3 Empirical Estimates for the Euro Area

In this section, we update the estimation of the labor share NKPC for the Euro area previously presented by Galí, Gertler, and Lopez-Salido (2001, 2002). In line with our earlier discussion of the theory, we present estimates for two different versions of the model corresponding to two different assumptions about the parameter ζ in the equation

$$\pi_t = a + \beta E_t \pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} \zeta s_t \tag{26}$$

In the first case, we set $\zeta = 1$, consistent with constant marginal cost across all firms. In the second case, we set $\zeta = \frac{1-\alpha}{1+\alpha(\epsilon-1)}$. As this equation has more free parameters than variables, we need to make some assumptions about some of the parameter values and hence we follow Galí, Gertler, and Lopez-Salido (2002, henceforth GGL) in assuming $\epsilon = 11$ and $\alpha = 0.175$, as discussed in the previous section. This value of ϵ is consistent with a frictionless desired markup over marginal cost of $\mu = \frac{\epsilon}{\epsilon-1} = 1.1$. This is at the low end of the estimates reported in studies such as Rotemberg and Woodford (1999): It implies very elastic demand and thus a relatively low market power. For example, with $\epsilon = 11$, a ten percent increase in price reduces demand by sixty five percent. For this reason, we also report a value of $\mu = 1.4$, consistent with $\epsilon = 3.5$.

Table 1 reports results from GMM estimation using the Euro area data from the Area Wide Model (AWM) of Fagan, Henry, and Mestre (2001). For comparison purposes, we report results from the original data set used by GGL which ended in 1998:Q2, and for an updated version that ends in 2008:Q4.

We also follow GGL in our choice of instruments: We use five lags of inflation, and two lags of the labor share, wage inflation, and detrended output (obtained from a regression of the log of real GDP on a time trend and its square). For the earlier sample used by GGL, we have replicated their figure of $\beta = 0.914$. For the updated sample, we obtain an estimate of $\beta = 0.874$, consistent with an annualized rate of time preference of over 40 percent. [4]

For each of our samples, we obtain three different estimates of the price stickiness parameter, θ based on our three different sets of assumptions about firm-specific marginal cost. In all of these cases, however, the estimated average price durations are significantly higher than the average price durations reported in the Inflation Persistence Network findings of Dhyne et al (2005).[5] Another unsatisfactory feature of these results is the estimated discount rate. While we do not report robustness checks here, we can confirm that these features of the results (low values of β and high values of θ) are robust to the use of many different instrument sets.

As we noted above, the unsatisfactory estimates of the discount rate and price stickiness parameters are necessary for the NKPC model to capture the magnitude of the apparent empirical relationship between inflation and the labor share in the Euro area. This low estimate of the discount rate and high estimated rate of price stickiness imply a very different tradeoff between these two variables than is implied by the more realistic theoretical calculations underlying Figure 2. To see this, Figure 3 repeats the simulation exercise on the effects of a permanent decline in unit labor cost inflation, but this time using the estimates of β and θ obtained from our full sample. In this case, the labor share declines from about 0.87 in the high inflation steady-state to about 0.78 in the low inflation case, a decline of similar magnitude to that observed in the data.

A final calculation not reported in the table is that if we impose a value of $\beta = 0.99$, the estimation then produces a value of $\theta = 0.943$, consistent with an average price duration of about four and a half years. Consistent with our discussion above, if the regression cannot match the empirical tradeoff with a low value of the discount rate, it is required to match it by estimating a very high value for price stickiness.

These calculations show that to fit the Euro area data, the NKPC needs to rely in a crucial fashion on assuming rates of time preference and price stickiness that are far higher than can be considered reasonable.

[4] This is calculated from $0.874^4 = 0.58$.

[5] The results for the $\mu = 1.1, \alpha = 0.75$ cases match those in the corrected work of Galí, Gertler, and Lopez-Salido (2002) rather than the earlier 2001 paper which reported incorrect results for this case due to a programming error.

4 A Sectoral Approach

In light of the questions just raised about the adequacy of the labor share NKPC as a model of aggregate Euro-area inflation dynamics, it is useful to consider other sources of data with which to test the model. In this section, we report results from regressions based on sectoral data. We first describe the potential advantage of a sectoral approach and then report both reduced-form and structural estimation results. Another paper that also uses sectoral data to estimate New-Keynesian Phillips curves is Imbs, Jondeau and Pelgrin (2007). This paper differs substantially from ours in that its principal concern is relating sectoral estimates to aggregate estimates and also in using a very specific French dataset whereas our data covers the US and the EU.

4.1 Advantages of a Sectoral Approach

The NKPC model is generally tested using macroeconomic data. However, unlike some macroeconomic theories, this theory of pricing behavior can also be applied to sectoral data. This is because the underlying microfoundations of the model (price stickiness, firm-specific demand functions, and optimal pricing) can all be assumed to apply to an individual sector, as opposed to the whole economy. Indeed, there are a number of reasons to expect that the model (if true) would be more accurate when applied to sectoral data.

One reason is that, as illustrated in Section 2, it is not the labor share, per se, that determines inflationary pressures in the NKPC model. Instead, it is the deviation of this labor share series from its frictionless optimal value of ω that determines inflationary pressures. The value ω is in turn determined by the optimal markup parameter, μ, as well as the value of α, which is the elasticity of output with respect to capital. It seems very likely that these parameters will differ across sectors, and thus that the true "inflationary" level of the labor share will differ across sectors. In our sectoral regressions, we control for this by including dummy variables which allow for differences in the inflationary level of the labor share across sectors, across countries, and across years.

A second reason to expect that the model might work better at the sectoral level is the assumption regarding price stickiness. Aggregate models rely on the assumption that all prices are equally sticky, so that θ is a common parameter across all firms. However, perhaps the most robust fact to emerge from research on consumer price quotes, such as Bils and Klenow (2004) and Dhyne et al (2005) is that price stickiness varies systematically across sectors. So, for example, service sectors tended to have far stickier prices than manufacturing. The Calvo theory thus predicts that the sensitivity of inflation to the labor share should differ systematically across sectors, and thus that aggregate estimates could be considered "mongrel" estimates that will turn out to be unstable in the face of shifts in the sectoral composition of output. See Imbs, Jondeau and Pelgrin (2007) for a discussion of the how aggregation bias can effect aggregate level estimates of the New Keynesian Phillips curve if there are underlying sectoral differences in parameters.

With these advantages in mind, we use two different sectoral datasets. Our first, and most relevant, analysis uses data from EU-KLEMS (see www.euklems.net for full details). The database contains information for a range of countries on output, labour input, and compensation for forty-two disaggregated sectors of the economy over a thirty-six year period from 1970-2005. The data also has sector-level deflators which we use as our measure of inflation. In our analysis, we use data on the fifteen pre-enlargement EU countries. One caveat regarding the compensation (and thus labor share) figures in the EU-KLEMS dataset is that they do not allow for income accruing to self-employed individuals. Adjustments for self-employment have been made elsewhere in the literature (for example Batini et al. 2000), typically by assuming that the average compensation of a self-employed individual is the same as the sectoral average wage. Whilst this adjustment may shift the measured level of the labor share somewhat, it is not obvious that any effect would be observed in the changes over time that are the subject of this analysis.

To further assess the consistency of our results, we also used a US sectoral database. Specifically, we used the NBER productivity database, which has data on 459 US manufacturing sectors available for 1959-1996. One advantage of this database is that it contains price indexes for gross sectoral output, rather than price indexes for value added constructed by researchers. Such indexes are less likely to suffer from measurement error. The theoretical arguments from the previous section can be applied to price indexes for gross sectoral output by changing the production function to include intermediate inputs and by measuring the labor share as the share of compensation in total nominal gross output.

4.2 Reduced-Form Regressions

We begin by reporting results for simple reduced-form regressions, which have the advantage of being easy to interpret. The top panel of Table 2 reports the results from simple regressions of this form using the aggregate AWM data. These results confirm what can be seen in Figure 1 in that they show a positive and significant relationship between labor share and inflation. This remains the case when lags of inflation are added.

The rest of Table 2 shows the results from running these regressions using sectoral data. Specifically, we report results from regressions of the form:

$$\pi_{ijt} = a_i + a_j + a_t + \sum_{k=1}^{2} \rho_k \pi_{ij,t-k} + \sum_{k=0}^{1} \gamma_k s_{ij,t-k} \tag{27}$$

where π_{ijt} is price inflation in sector i in country j in year t and s_{ijt} is the corresponding labor share.

The middle panel shows the results for the EU-KLEMS cross-country data. The results from these regressions are perhaps somewhat surprising in light of the aggregate correlations. Coefficients on the contemporaneous labor share are significantly negative in all cases. We also report regressions that used both the current and lagged values of the labor share as explanatory variables. These results show that the lagged values of the sectoral labor shares are positively related to inflation with coefficients about equal in size to the negative coefficients on the current labor share. In other words, the regression evidence points to a significant negative effect of the *change* in the labor share on sectoral inflation.

The bottom panel replicates the regressions using NBER productivity database. In this case, the price inflation is the rate of change of the gross shipments deflator and the labor share is the share of compensation in the total value of shipments. Overall, the results are strikingly similar to those generated for the EU-KLEMS data, with negative coefficients for the contemporaneous labor share in all cases.

To provide comparisons with more traditional reduced-form regressions, Table 3 also presents estimates of regressions that add a traditional HP-filter measure of the output gap using the EU-KLEMS data as above. In all instances, the output gap has a positive and significant coefficient, while the coefficients on the other variables are almost identical to those reported in Table 2. This provides a useful “reality check” for critics of traditional gap measures. While the theoretical deficiencies in such measures (relating to the unobservability of potential output) are well known, in practice they still tend to work well as proxies for inflationary pressures.

4.3 NKPC Regressions

Table 4 moves beyond reduced-form regressions to present direct estimates of NKPC relationships

$$\pi_t = a + \beta E_t \pi_{t+1} + \gamma s_t \tag{28}$$

using our sectoral data. These regressions were estimated via GMM using an instrument set that consists of two lags of inflation and two lags of the labor share as instruments for future inflation.[6] We estimated this model in two different ways with both the EU-KLEMS and NBER data sets.

Our first method estimates "pooled" coefficients that are assumed to be common across all of the available sectors. Specifically, it uses regressions of the form

$$\pi_{ijt} = a_i + a_j + a_t + \beta E_t \pi_{ij,t+1} + \gamma s_{ijt} \tag{29}$$

This approach assumes that sector, time, and year dummies account for the cross-sectional differences in the frictionless value of the labor share. However, the discount rate and sensitivity of inflation to the labor share are assumed constant across sectors. As with the reduced-form regressions, this produces significantly negative coefficients on the labor share. In addition, both datasets give implausibly low estimates for the discount rate parameter: The EU-KLEMS dataset gives a rather unlikely β estimate of 0.485, whilst the NBER data gives an equally implausible 0.229.

Our second method estimates this equation separately for each of the available sectors and then reports the averages. In other words, it estimates

$$\pi_{ijt} = a_{ij} + \beta_{ij} E_t \pi_{ij,t+1} + \gamma_{ij} s_{ijt} \tag{30}$$

so that each sector has its own frictionless level of the labor share, discount rate, and sensitivity of inflation to the labor share. One reason to apply this method is that price stickiness varies widely across sectors, so the NKPC model predicts that the coefficient on the labor share of income should vary across these sectors. However, these results again directly reject the NKPC as a model of the inflation process. With both the EU-KLEMS and NBER data, the average estimates of γ_{ij} turn out to be negative. Indeed, with both datasets, the vast majority of the estimated sectoral γ_{ij} coefficients.

[6] Experimentation with various instrument sets showed that the results presented here were not very sensitive to this selection.

Finally, we note that both the EU-KLEMS and NBER datasets also include data on the cost of material inputs. A similar approach to that used in Section 2 can justify using the *combined* materials and labor cost shares of gross output as a potentially superior proxy for real marginal cost. Table 5 repeats this regressions from Table 4 using this alternative proxy for marginal cost. Due to missing data on material costs in the EU-KLEMS data, this allows us to use 434 sectors rather than the original 630. The principal result from Table 4—a negative coefficient on the proxy for real marginal cost—emerges as being robust to the use of this alternative measure.

5 Understanding Europe's Declining Labor Share

Our assessment of the evidence from the previous sections is that the standard version of the NKPC model, based on the assumption of unchanged market structures and technologies, does not provide a good description of Europe's combination of declining inflation and a declining labor share. To gain a better understanding of the forces that have been behind the declining labor share, we now take a closer look at the sectoral data from EU-KLEMS. Before presenting these calculations, we should probably briefly repeat the caveat noted above that the EU-KLEMS data do not incorporate adjustments for self-employment, so they represent a somewhat restrictive measure of the labor share. However, comparisons of the national aggregate shares in the EU-KLEMS data with measures from Eurostat that do make these adjustments show that the evolution over time of the EU-KLEMS series matches the Eurostat series closely.

5.1 Patterns Across Countries

The idea of constant factor shares has commonly been suggested to be one of the stylized facts of long-run growth and indeed this idea still appears to be a reasonably accurate reflection of labor shares in economies such as the UK and the US. However, a long-term decline in labor shares has been observed in many European countries since the late nineteen-seventies. This downturn followed a relatively short-lived increase in the earlier part of that decade.[7]

The first two columns in Table 6 show labor shares in the fifteen EU countries as well as the EU aggregate at the peak year of 1980 and in 2005, while the third column reports the

[7] See Giammarioli et al. (2002) for a discussion of this period.

change over this period. The dominant pattern is one of decline, albeit at differing rates across the sample countries. Only two of the fifteen countries report increases in the labor share of income (Portugal and the UK). The increase in the UK's labor share is less than 1 percentage point, so Portugal is the only country to experience a large increase in the labor share, going from 47% in 1980 to 58% in 2005. The most dramatic decline is observed in Germany, where the labor share declined from 64% in 1980 to 55% in 2005.

5.2 Sectoral Composition Effects

An obvious explanation for the aggregate decline in the labor share is that it may simply be a result of changing the sectoral composition of economic activity. This arguement is put forward by Gollin (2002) for differences in cross-country levels of labor share and is easily extended to apply to changes over time within countries. Differences in labor shares across sectors are to be expected because some activities are innately labor-intensive while some are innately capital-intensive. In addition, competitive pressures also differ across sectors so equilibrium markups, which will also affect the long-run labor share, are also likely to vary. For these reasons, changes in the structure of the economy, whereby low labor share sectors begin to account for greater proportions of aggregate value-added than higher labor share sectors, could explain the decline in total labor share. However, our calculations show that this share-shift story fails to explain most of the aggregate decline.

To calculate the importance of sectoral share-shifts, we constructed counterfactual labor shares to compare to the actual evolution in each country. These alternative labor shares were generated using fixed sector weights, so that for each country, sectors were assumed to have the same contribution to the aggregate throughout the period as they had in 1980. This fixed-weight labor share in 2005 is compared to the actual values in the fourth and fifth columns of Table 6 for each country and the evolution of both actual and alternative labor shares for the EU-15 aggregate is graphed in Figure 4 for the entire period. These calculations indicate that restructuring of the economy from high to lower labor share sectors are not the main drivers of falling labor shares. Declines in the labor share would have occurred in almost all of the countries even if there had been no change in the distribution of value added shares of sectors since 1980. For the EU-15, for example, the observed decline in the labor share in the EU-KLEMS data was 4.6 percentage points over this period. Our calculations show that if there had been no change in the structure of the economy this decline would have been 3.63 percentage points.

5.3 Sector-Level Labor Shares

The importance of changes in the patterns of labor shares within sectors can also be highlighted by comparing the relative contributions of country and sector dummies when they are regressed on changes in the labor share. Table 7 reports R^2 from regressions of the change in the labor share in our 630 sectors between 1980 and 2005 on country and sector dummies. The results show that country effects alone account for just over 5% of the changes, whereas sector effects have greater explanatory power at about 18%. These results suggest that changes in technology, which will have effects across national borders, have likely been an important factor underlying the decline in the labor share in Europe, as has previously been suggested by Bentolila and Saint Paul (2003) and Blanchard (2006).

The changes in labor share by sector over the period 1980-2005 are presented in Table 8. The sectors are ranked by the extent of the change in labor share, and the first factor of note is the greater number of sectors experiencing declines in labor share compared to those where labor share increased. In addition, the declines in labor share were frequently steeper, with nine sectors experiencing declines of over 10 percentage points, whereas only one sector increased its labor shares by this amount.

A comprehensive analysis of the causes of the differential pattern of changes in labor shares across sectors is beyond the scope of this paper. However, one interesting and robust pattern is that sectoral labor shares displayed a significant pattern of reversion to a common mean over the period 1980 to 2005. There is a correlation of -0.3 between the initial level of a sector's labor share in 1980 and its subsequent percentage change: This relationship is illustrated in Figure 5.

In terms of the characteristics of the sectors, the largest declines in labor share tend to be associated with the more traditional manufacturing sectors such as transport, leather goods, mining and metals. On the other hand, services appear the most likely to have increased labor shares. These results suggest that as well as technological developments, changes in union density seem likely to have played a part in generating this pattern, and further investigation of these issues would be a good subject for future research.

6 Conclusions

This paper has presented new estimates of the relationship between inflation and the labor share of income, which has commonly been used in the literature on the NKPC as a proxy for real marginal cost. At an aggregate level, we find that the NKPC relationship predicted by the theory can only be replicated with existing data if estimated rates of time preference and price stickiness are unrealistically high.

We then used sectoral data for fifteen EU states to further examine the relationship between inflation and the labor share. The microeconomic foundations of the NKPC theory should hold at a sectoral level as well as, if not better than, at an aggregate level. However, we find no evidence to support the existence of a NKPC relationship at the sectoral level. On the contrary, and unlike the aggregate results, there are consistently negative coefficients on the labor share in a number of different specifications. Indeed, the use of a traditional output gap measure proved more successful in terms of a positive relationship with inflation.

Despite not finding a link in the sectoral data between inflation and the labor share, the question of why aggregate labor shares in the EU have declined since the nineteen-seventies remains of interest. The remainder of the paper therefore looks in more detail at the evolution of European labor shares. The contribution of changes in the structure of the economy found to explain some, but rarely the majority, of the decline in labor shares. By constructing a hypothetical labor share where the value-added shares of each sector remain fixed at their 1970 levels, we find the labor share of the EU-15 would still have declined by a substantial amount. This implies that falling labor shares within sectors rather than changes in the sectoral make-up of the economy have been the key element in the observed aggregate decline.

The final possibility that can explain the joint behavior of inflation and the labor share in Europe is that the underlying technology has changed in a number of sectors in a way that has increased the elasticity of output with respect to capital. Such a development could result in declines in the labor share that have no implications for inflation. The current stable of sticky-price models are silent, however, on how such technological changes could come about, which suggests the incorporation of more complex assumptions about factor substitution, along the lines of Acemoglu (2003) or Caballero and Hammour (1998). Alternatively, it may be necessary to incorporate non-neoclassical elements, such as non-competitive wage bargaining, as in Blanchard and Giavazzi (2003).

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A Derivation of the NKPC

This appendix derives the two different versions of the labor share NKPC model referred to in Section 2.

A.1 Constant Marginal Cost Across Firms

The price-level definition equation

$$p_t = \theta p_{t-1} + (1-\theta)\, p_t^* \tag{31}$$

can be re-arranged to express the reset price as a function of the current and past aggregate price levels

$$p_t^* = \frac{1}{1-\theta}\left(p_t - \theta p_{t-1}\right) \tag{32}$$

Assuming the same value of marginal cost across firms, the optimal reset price equation becomes

$$p_t^* = \mu + (1-\theta\beta)\sum_{k=0}^{\infty}(\theta\beta)^k E_t\left(mc_{t+k}^r + p_{t+k}\right) \tag{33}$$

can be re-written in quasi-difference form as

$$p_t^* = (1-\theta\beta)\left(\mu + mc_t^r + p_t\right) + (\theta\beta)\, E_t p_{t+1}^* \tag{34}$$

Substituting in the expression for p_t^* as a function of the current and past price levels and we get

$$\frac{1}{1-\theta}\left(p_t - \theta p_{t-1}\right) = (1-\theta\beta)\left(\mu + mc_t^r + p_t\right) + \frac{\theta\beta}{1-\theta}\left(E_t p_{t+1} - \theta p_t\right) \tag{35}$$

After a bunch of re-arrangements, this equation can be shown to imply

$$\pi_t = \beta E_t \pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta}\left(mc_t - p_t + \mu\right) \tag{36}$$

where $\pi_t = p_t - p_{t-1}$ is the inflation rate.

A.2 Varying Marginal Cost Across Firms

If the output at time $t+k$ of a firm that has last set its price at time t is

$$Y_{t,t+k} = A_{t,t+k} K_{t,t+k}^{\alpha} L_{t,t+k}^{1-\alpha} \tag{37}$$

then this firm has marginal cost of

$$MC_{t,t+k}^n = \frac{1}{1-\alpha}\frac{W_t L_{t,t+k}}{Y_{t,t+k}} \tag{38}$$

This can be related to the average marginal cost as

$$MC_{t,t+k}^{n} = \frac{1}{1-\alpha}\frac{W_t L_t}{Y_t}\frac{L_{t,t+k}}{L_t}\frac{Y_t}{Y_{t,t+k}} = MC_t \frac{L_{t,t+k}}{L_t}\frac{Y_t}{Y_{t,t+k}} \tag{39}$$

Under the assumption that each firm has the same level of technology and the same level of capital ($A_{t,t+k} = A_t$ and $K_{t,t+k} = K_t$) then we can write

$$\frac{L_{t,t+k}}{L_t} = \left(\frac{Y_{t,t+k}}{Y_t}\right)^{\frac{1}{1-\alpha}} \tag{40}$$

So, then we have

$$MC_{t,t+k}^{n} = MC_t \left(\frac{Y_{t,t+k}}{Y_t}\right)^{\frac{\alpha}{1-\alpha}} \tag{41}$$

The form of the demand function then implies that

$$\frac{Y_{t,t+k}}{Y_t} = \left(\frac{P_t^*}{P_{t+k}}\right)^{-\epsilon} \tag{42}$$

So, we have the following relationship between the vintage-specific marginal cost and the average marginal cost

$$MC_{t,t+k}^{n} = MC_t \left(\frac{P_t^*}{P_{t+k}}\right)^{-\frac{\epsilon\alpha}{1-\alpha}} \tag{43}$$

Or, in logs

$$mc_{t,t+k}^{n} = mc_t^{n} - \frac{\epsilon\alpha}{1-\alpha}\left(p_t^* - p_{t+k}\right) \tag{44}$$

Thus, the formula for the optimal reset price can be written as

$$p_t^* = \mu + (1-\theta\beta)\sum_{k=0}^{\infty}(\theta\beta)^k \left[mc_{t+k}^{n} - \frac{\epsilon\alpha}{1-\alpha}\left(p_t^* - p_{t+k}\right)\right] \tag{45}$$

This re-arranges to

$$p_t^* = \frac{(1-\alpha)\,\mu}{1+\alpha\,(\epsilon-1)} + (1-\theta\beta)\sum_{k=0}^{\infty}(\theta\beta)^k \left[\left(\frac{1-\alpha}{1+\alpha\,(\epsilon-1)}\right) mc_{t+k}^{n} + \left(\frac{\epsilon\alpha}{1+\alpha\,(\epsilon-1)}\right) p_{t+k}\right] \tag{46}$$

or, more usefully

$$p_t^* = \frac{(1-\alpha)\,\mu}{1+\alpha\,(\epsilon-1)} + (1-\theta\beta)\sum_{k=0}^{\infty}(\theta\beta)^k \left[\left(\frac{1-\alpha}{1+\alpha\,(\epsilon-1)}\right) mc_{t+k}^{r} + p_{t+k}\right] \tag{47}$$

This expression implies that, relative to the previous version of the model with constant marginal costs across firms, $\left(\frac{1-\alpha}{1+\alpha(\epsilon-1)}\right)\left(mc_{t+k}^{r} + \mu\right) + p_{t+k}$ takes the place of $mc_{t+k}^{r} + \mu + p_{t+k}$

in the optimal pricing formula. Because nothing else in the derivation of the NKPC has changed, this means that $\left(\frac{1-\alpha}{1+\alpha(\epsilon-1)}\right)(mc_t^r+\mu)$ simply takes the place of $mc_t^r+\mu$, so the theoretical NKPC becomes

$$\pi_t = \beta E_t \pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} \frac{1-\alpha}{1+\alpha(\epsilon-1)} (mc_t^r+\mu), \tag{48}$$

and the empirical NKPC becomes

$$\pi_t = \beta E_t \pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} \frac{1-\alpha}{1+\alpha(\epsilon-1)} (s_t+\omega) \tag{49}$$

Table 1: Estimation of the Euro-Area NKPC

	β	θ	$\frac{\gamma}{1-\beta}$	Duration
1970:1-1998:2				
$\zeta = 1$	0.914	0.919	0.162	12.44
	(0.035)	(0.012)	(0.026)	(1.94)
μ=1.1, α=0.175	0.914	0.836	0.162	6.08
	(0.035)	(0.027)	(0.026)	(1.01)
μ=1.4, α=0.175	0.914	0.887	0.162	8.81
	(0.035)	(0.018)	(0.026)	(1.42)
1970:1-2008:4				
$\zeta = 1$	0.874	0.921	0.132	12.63
	(0.062)	(0.011)	(0.017)	(1.72)
μ=1.1, α=0.175	0.874	0.831	0.132	5.91
	(0.062)	(0.028)	(0.017)	(0.97)
μ=1.4, α=0.175	0.874	0.885	0.132	8.75
	(0.062)	(0.017)	(0.017)	(1.32)
Theoretical Calculations				
$\zeta = 1$	0.99	0.75	8.58	4
μ=1.1, α=0.175	0.99	0.75	2.58	4
μ=1.4, α=0.175	0.99	0.75	4.93	4

Notes: Figures in brackets are standard errors. β is the firm's discount rate, $1-\theta$ is the probability of resetting prices, Duration is defined as $\frac{1}{1-\theta}$, and γ refers to the parameter in the NKPC relationship $\pi_t = \beta E_t \pi_{t+1} + \gamma(s_t + \omega)$

Table 2: Regressions of Inflation on Labor Share

	S_t	S_{t-1}	π_{t-1}	π_{t-2}
Euro-Area Aggregate				
1970-2005	0.135			
	(0.007)			
	0.033		0.456	0.284
	(0.013)		(0.084)	(0.087)
Fifteen countries: 630 Sectors				
1970-2005	-0.012			
	(0.003)			
	-0.011		0.119	0.049
	(0.002)		(0.040)	(0.023)
	-0.294	0.289		
	(0.031)	(0.031)		
	-0.310	0.308	0.151	0.062
	(0.032)	(0.032)	(0.034)	(0.022)
459 US Manufacturing Sectors				
1959-1996	-0.059			
	(0.003)			
	-0.067		0.092	-0.203
	(0.004)		(0.008)	(0.008)
	-0.236	0.219		
	(0.006)	(0.006)		
	-0.255	0.232	0.099	-0.164
	(0.007)	(0.007)	(0.007)	(0.008)

Notes: Sector regressions include sector, time and country dummies. Figures in brackets are standard errors.

Table 3: Regressions of Inflation on Labor Share and the Output Gap

	S_t	S_{t-1}	π_{t-1}	π_{t-2}	Gap
Fifteen countries: 630 Sectors					
1970-2005	-0.012				0.095
	(0.003)				(0.022)
	-0.011		0.119	0.049	0.065
	(0.002)		(0.040)	(0.023)	(0.020)
	-0.294	0.290			0.107
	(0.031)	(0.031)			(0.021)
	-0.311	0.308	0.151	0.062	0.078
	(0.032)	(0.032)	(0.034)	(0.022)	(0.019)

Notes: Sector regressions include sector, time and country dummies. Figures in brackets are standard errors.

Table 4: GMM Estimation of NKPC with Sectoral Data: Labor Share

	β	γ
Fifteen countries: 630 Sectors		
1970-2005		
Panel Estimation	0.485	-0.013
	(0.207)	(0.002)
Average across		
Sector Regressions	0.638	-0.046
	(0.034)	(0.029)
459 US Manufacturing Sectors		
1959-1996		
Panel Estimation	0.229	-0.104
	(0.120)	(0.013)
Average across		
Sector Regressions	0.839	-0.043
	(0.034)	(0.006)

Notes: Sector regressions include sector, time and country dummies. Figures in brackets are standard errors. Refers to β and γ from NKPC $\pi_t = \beta E_t \pi_{t+1} + \gamma(s_t + \omega)$

Table 5: GMM Estimation of NKPC with Sectoral Data: Combined Labor and Materials Shares

	β	γ
Fifteen countries: 434 Sectors		
1970-2005		
Panel Estimation	1.557	-0.017
	(0.116)	(0.005)
Average across		
Sector Regressions	0.842	-0.051
	(0.034)	(0.037)
459 US Manufacturing Sectors		
1959-1996		
Panel Estimation	-0.238	-0.032
	(0.129)	(0.010)
Average across		
Sector Regressions	0.807	-0.046
	(0.034)	(0.019)

Notes: Sector regressions include sector, time and country dummies. Figures in brackets are standard errors. Refers to β and γ from NKPC $\pi_t = \beta E_t \pi_{t+1} + \gamma(s_t + \omega)$

Table 6: Evolution of Country Labor Shares

	Labor Share 1980	Labor Share 2005	Actual Change in Labor Share	2005 LS using 1980 VA weights	Hypothetical Change in LS with fixed weights
Austria	0.623	0.548	-0.075	0.563	-0.059
Belgium	0.611	0.563	-0.048	0.590	-0.021
Denmark	0.641	0.639	-0.001	0.639	-0.001
Finland	0.620	0.566	-0.054	0.572	-0.048
France	0.582	0.580	-0.003	0.593	0.011
Germany	0.644	0.555	-0.088	0.602	-0.042
Greece	0.340	0.282	-0.058	0.300	-0.040
Ireland	0.516	0.470	-0.046	0.502	-0.014
Italy	0.518	0.455	-0.063	0.490	-0.028
Luxembourg	0.560	0.551	-0.010	0.606	0.046
Netherlands	0.658	0.574	-0.083	0.583	-0.074
Portugal	0.469	0.581	0.112	0.485	0.016
Spain	0.538	0.523	-0.014	0.534	-0.003
Sweden	0.646	0.625	-0.021	0.648	0.002
UK	0.649	0.657	0.009	0.692	0.044
EU-15	0.609	0.563	-0.046	0.573	-0.036

Table 7: Regressions including Country and Sector Effects

R^2	Change 80-05
Country Dummies	0.053
Sector Dummies	0.185
Country & Sector	0.234

Table 8: Changes in Sectoral Labor Shares - EU15

	1980	2005	Change		1980	2005	Change
Water Transport	0.688	0.321	-0.366	Pulp & Paper	0.641	0.607	-0.034
Radio & TV	0.855	0.659	-0.197	Machinery Rent	0.199	0.168	-0.031
Basic Metals	0.728	0.574	-0.154	Computer	0.723	0.693	-0.030
Chemical Products	0.657	0.504	-0.153	Wood & Cork	0.638	0.610	-0.028
Other Transport Equip.	0.952	0.805	-0.148	Other Community	0.581	0.558	-0.023
Electric, Gas & Water	0.448	0.309	-0.139	Food & Drink	0.600	0.582	-0.018
Post & Telecomms	0.610	0.472	-0.138	Real Estate	0.070	0.056	-0.014
Printing & Publish	0.714	0.580	-0.134	Textiles & textile	0.704	0.694	-0.010
Medical & Precision	0.762	0.642	-0.120	Auxiliary Transport	0.597	0.587	-0.010
Motor Vehicles	0.832	0.734	-0.098	Private Household	0.964	0.962	-0.002
Inland Transport	0.740	0.645	-0.096	Retail Trade	0.594	0.595	0.001
Financial Intermed.	0.611	0.516	-0.095	Public Admin.	0.824	0.829	0.005
Leather & footwear	0.674	0.586	-0.088	Fabricated Metal	0.671	0.676	0.006
Mining & Quarrying	0.334	0.259	-0.075	Air Transport	0.701	0.714	0.012
Construction	0.614	0.548	-0.066	Motor Sales	0.590	0.608	0.018
Minerals	0.655	0.605	-0.050	Rubber & Plastics	0.647	0.681	0.034
Wholesale Trade	0.615	0.568	-0.047	Hotels & Restaurants	0.518	0.555	0.037
Office Machinery	0.591	0.544	-0.047	Coke & Petroleum	0.322	0.360	0.038
Education	0.937	0.893	-0.044	Agriculture	0.244	0.294	0.050
Fishing	0.387	0.344	-0.043	Electrical Machinery	0.682	0.740	0.058
Machinery, nec	0.750	0.710	-0.039	Other Business	0.533	0.592	0.058
Health & Social Work	0.778	0.739	-0.038	Forestry	0.188	0.287	0.099
Manufacturing nec	0.685	0.648	-0.036	R & D	0.780	0.883	0.103

Figure 1

Inflation and The Labor Share in the Euro Area

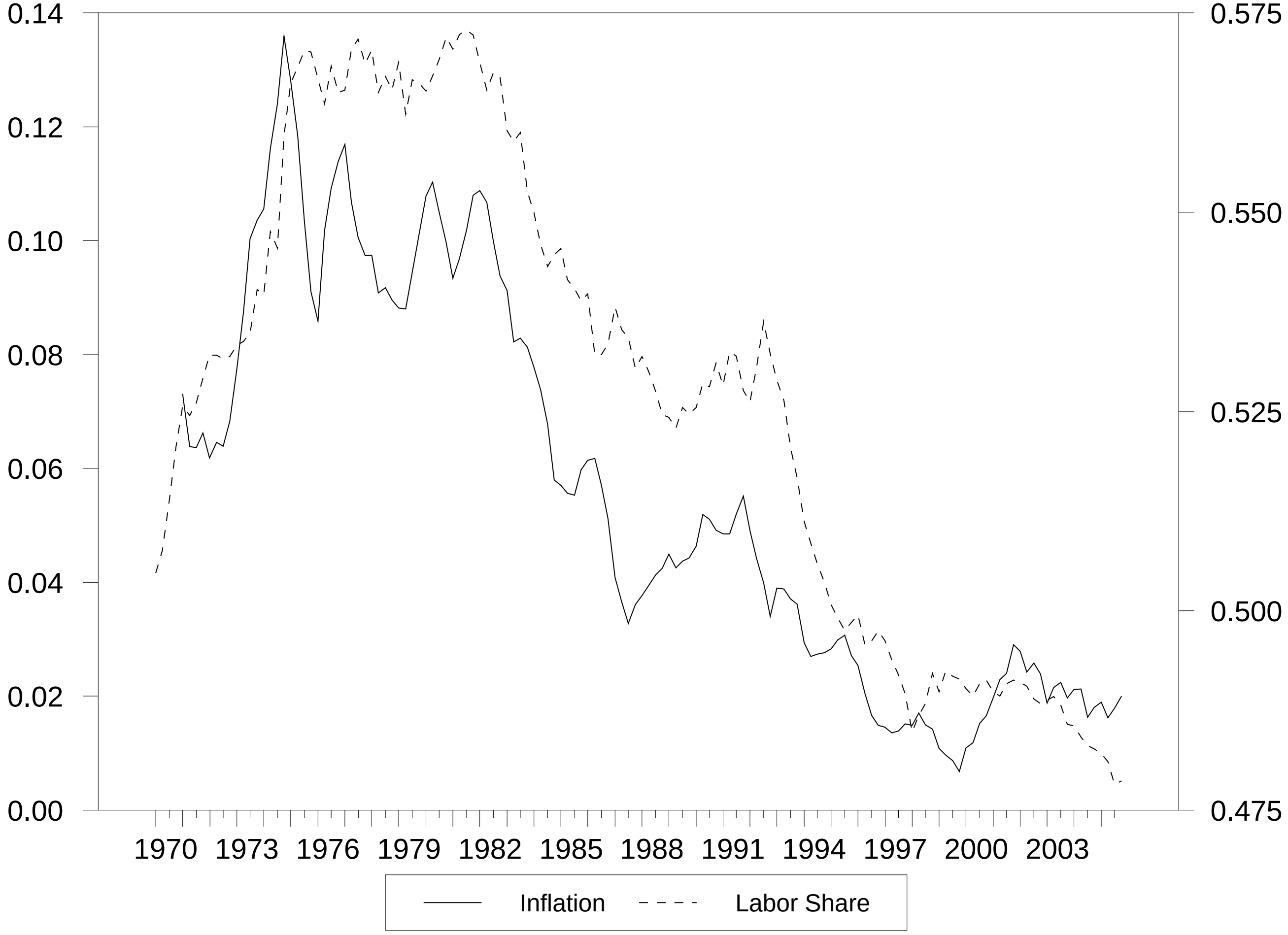

Figure 2

Labor Share Dynamics During Disinflation (beta=0.99, theta=0.75)

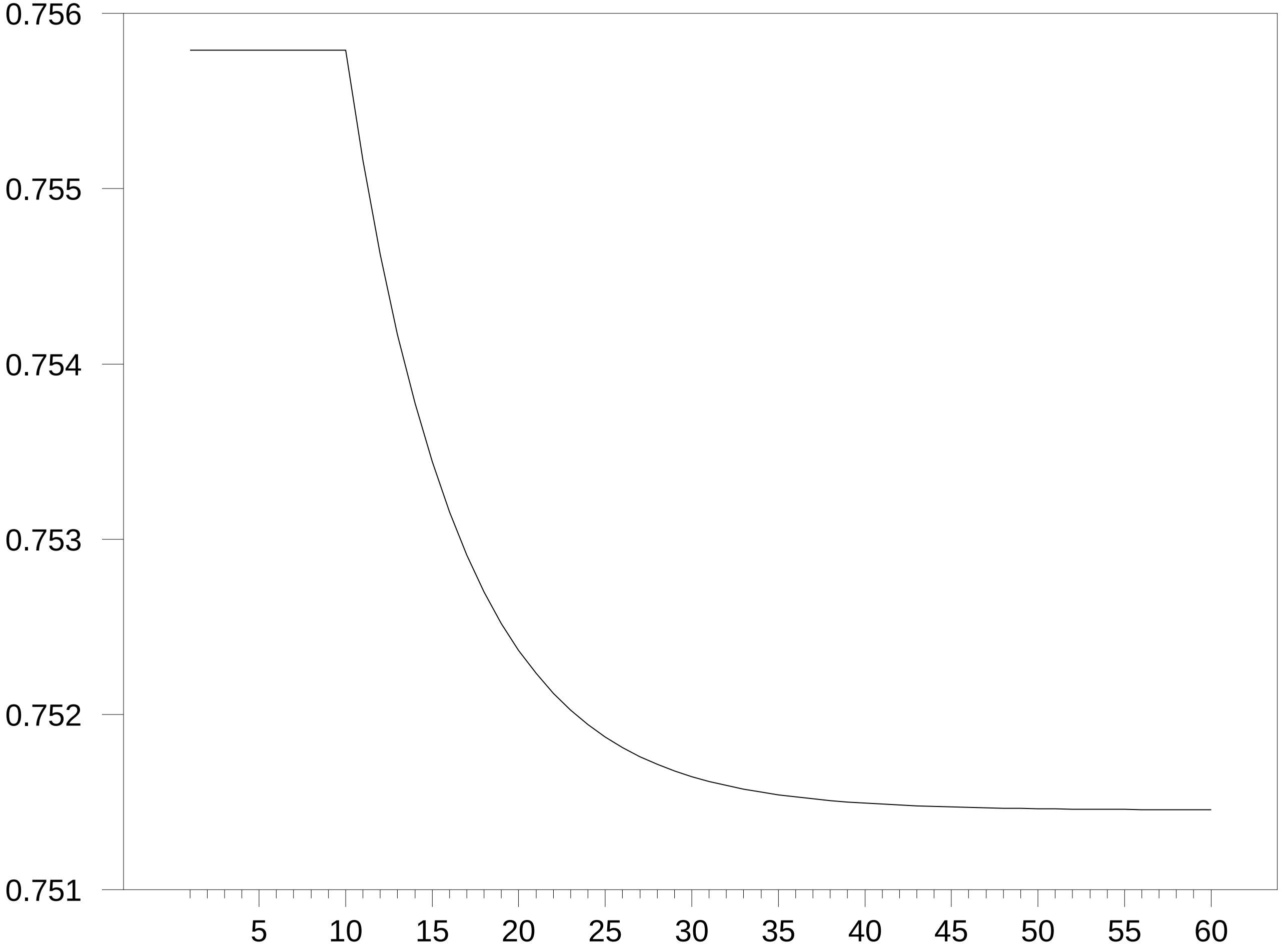

Figure 3

Labor Share Dynamics During Disinflation (beta=0.834, theta=0.817)

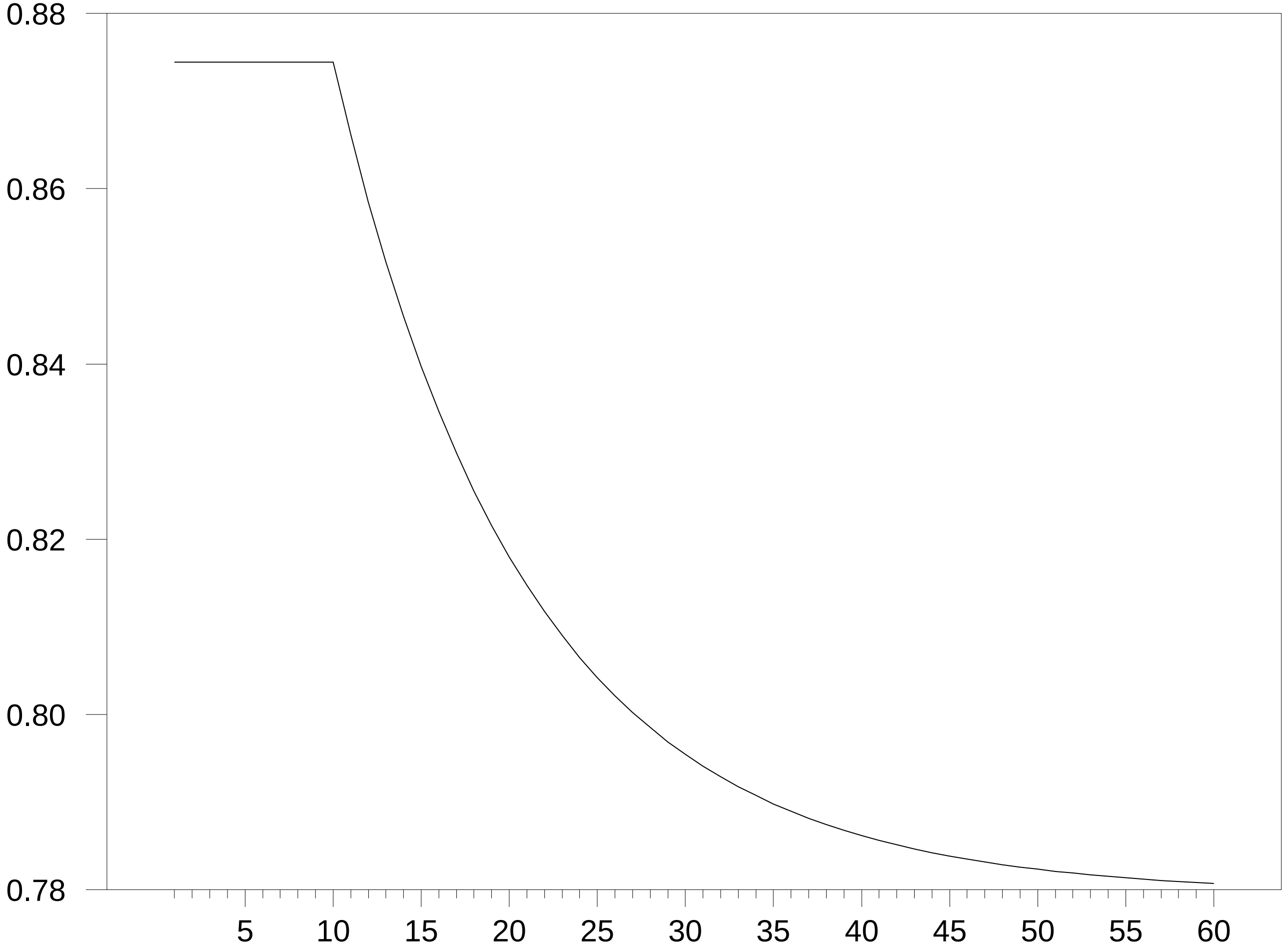

Figure 4

Fixed Weight Analysis: EU15 Aggregate

Figure 5

Level and Change in Labor Share