The Long Run and Real Effects of the Working Hours Restriction: Evidence From France

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Abstract

This paper uses a theoretical and empirical approach to examine the long run effects of working hours restrictions on the natural rate of unemployment. We estimate a French NAIRU using the Kalman filter applied to a Phillips curve model with French quarterly data between 1987 and 2009. The resulting profile of the NAIRU is then analysed around the introduction of these restrictions and suggests a fall in the NAIRU greater than that reflected in the actual unemployment series alone. The Bai-Perron multiple break point test, adds further evidence of real effects from this policy by predicting regime change around the announcement and implementation of this policy.

Keywords: Work Sharing, Unemployment, NAIRU, Phillips Curve, Kalman Filter, Multiple Break Point Test

JEL Classification: C32; E24; E31

1. Introduction

Few labour market policies have attracted such qualified criticism as that of the working hours restriction (WHR). This policy legally limits the number of hours an employee can work in any given week. The immediate aim of this labour market policy is to reduce unemployment or to share the available work in the economy between a greater number of employees. The intuition follows the argument that there is a fixed amount, or lump of output, within the economy and by reducing/rationing the number of hours an individual can work should, in turn, increase the number of employees required by firms to carry out the available work, see Layard et al. (1991) for an in depth discussion. Proponents of this kind of policy also point out that there will be an efficiency gain as the implication of working hour restrictions is an increase in relative productivity.

Amongst a handful of European countries, France in particular has experienced the consistent implementation of the WHR since 1974, in contrast to employing an active labour market policy (ALMP) approach to reducing unemployment. Whilst we are yet to see conclusive evidence of the success of this policy it could be argued that this demand management through legislation approach is less complicated and avoids the sort of unforeseen distortions caused by some of the ALMPs employed by other governments, for example the UK's 'New Deal', introduced in 1997. In 1974 the french working week was 48 hours but by 1981 had been lowered via the WHR to 40 hours by the left wing coalition, the Popular Front. In 1982 Francois Mitterrand announced an unexpected working hours restriction from 40 hours to 39 hours. After the consequential rise in unemployment, the socialist government gave full debate and preannouncement to the following restrictions to 35 hours enacted by the laws of Aubry I (June 1998) and Aubry II (January 2000). Firms employing more than 20 employees would have to comply with this restriction by 2000; small firms by 2002. Employees required to work longer than 35 hours, as a result, became entitled to a premium hourly rate for overtime. With hindsight, Aubry II was introduced to help small firms adapt to the regime change, effectively watering down Aubry I. The decision to provide smaller firms time to adjust to the policy announcement is a central issue discussed work by Crépon and Kramarz (2002) who highlighted the importance of anticipation in policy announcements. This history of adoption of the WHR in France provides us with a natural experiment and enables a more viable analysis of this labour market policy, much debated in recent literature. This study, therefore, will make use of French quarterly data for the period between 1987 and 2009.

In order to consider the long run employment effects of WHRs we utilise a measure of unemployment called the non accelerating inflation rate of unemployment (NAIRU) which can be thought of as a slowly evolving trend from which the short run observation of this variable can deviate. To estimate the NAIRU we employ a multivariate statistical approach introduced by Kalman (1960) and Kalman and Bucy (1961), known as the Kalman filter process to estimate the French NAIRU as an unobserved stochastic process using French unemployment, inflation and labour productivity data between 1987 and 2009. This method is convenient in that it allows the simultaneous estimation of the time varying NAIRU and the Phillips curve together meaning that inferences can be drawn from an empirical analysis that makes use of a theoretical framework. Information can be drawn from the whole sample to create a smooth estimate of this unemployment series which is updated from information as it becomes available. The approach enables us to examine the long run real effects of working hour restrictions on the NAIRU for France, rather than the immediate effects on the level of unemployment, or the scope of the literature to date. As far as the author is aware this is a first attempt to control for shocks from the supply side and utilize tests for regime change in a long run study of the impact of the working hours restriction. In this vein, we estimate a NAIRU for France using a Kalman filter process, within the theoretical and structurally specified inflation equation of the accelerationist Phillips curve, with labour productivity acting as a proxy variable for supply side shocks. The resulting profile of the French NAIRU is then analyzed for an endogenously determined structural break around the announcement and ultimate implementation of the Aubry law working hour restrictions over the following ten year horizon. The construction of a UK NAIRU, within a theoretical framework is comprehensively covered by Chouliarakis (2009) for the UK and we follow from this as a basis for constructing the French NAIRU, rather than other common estimates of this series that make use of univariate filters.

The estimated profile of the NAIRU suggests a fall in the long run measure of unemployment from policy implementation up and until the end of 2009 with a spike in 2008 due to a period of infation volatility around the same time. Even though the actual rate of unemployment also fell over this period the NAIRU reflects this more markedly than the observed unemployment series alone. The Bai and Perron (2003a) multiple break point test, given the endogenous choice of break point, predicts two of the five structural changes in 1998Q2 and 2001Q3 offering some evidence that the WHR may have had real long run effects in France around the announcement and consequential implementation of this policy. We should remain mindful, however, of what inferences we can draw from a series which is essentially estimated or inferred by this methodology, though the evidence presented certainly challenges the literature to date and those that might advocate demand side policies with the same aim.

Section 2 gives more background to the work sharing/hours restriction debate via a literature review. Section 3 sets out the theoretical framework and empirical methodology involved in the construction of the NAIRU series, followed by some preliminary discussion of the data used and finally presents the results from the estimation. Section 4 analyses the constructed NAIRU using an endogenous test for multiple structural breaks where the time of the break points are unknown, introduced by Bai and Perron (1998, 2003a). The resulting break points are compared to the dates around the introduction of French working hours restrictions enacted from the Aubry laws to investigate the long run impact and real effects of this labour market policy. Section 5 concludes.

2. Working hour literature

The literature on WHRs to date has offered little on the long run impact of this legislation, instead focussing on the immediate effect on unemployment after the imposition of these labour market restrictions. By contrast, our contribution to this debate is to offer a measurement of the long run effects by utilising the natural rate of unemployment inside a Phillips curve model. Layard et al. (1991) criticise the legislation in terms of a 'lump of output fallacy', the policy aim implying a model of the labour market where the labour supply schedule is vertical. More is depth studies, discussed below, seem to offer a general consensus that there is little evidence to support the intended outcome of this policy in the short run, one of a significant reduction in unemployment.

Wolff et al. (2004) Bouabdallah et al (2004) use a theoretical model based around the Solow condition to show that the resulting effect on unemployment depends on the elasticities of production and cost, whereas Crépon and Kramarz (2002) use an empirical analysis on French data to highlight an immediate increase in unemployment which, they suggest, was caused by the insufficient compensation, offered by way of a 50% reduction in employer social contributions for the increase in costs of hiring additional labour, estimated at 11%. Interestingly Schreiber (2008) argue the opposite case, with empirical evidence to suggest that the employment boom from 2000 was caused not by the reduction in working hours, but by the increase in employment subsidies paid to compensate employers. It is the author's view that there will inevitably be an increase in costs to firms facing regime change but these effects will, intuitively, wash out in the long run.

Huang et al. (2002) derive a shirking type efficiency wage model to show that the effects of working hour restrictions must be ambiguous. Productivity is the decisive factor that will affect the firm's demand for labour. How shorter working hours affect productivity will determine the net employment effect. Importantly, they stress that the long run effect of shorter working hours will intensify the short run effect. Any increase in productivity will inevitably bring about a positive result to a working hour restriction depending on the magnitude of the increase in productivity. Kapteyn et al. (2004) and Hunt (1999) show an insignificant increase or reduction in the level of unemployment immediately after the restriction.

Kapteyn et al. (2004) in a paper titled 'The myth of work sharing' produce an empirical study across 16 OECD countries and find an insignificant increase in employment as a result of WHRs. Their conclusion is that governments should find other ways to reduce unemployment, but including 16 countries with such immense differences, in terms of dynamics, raises questions on the validity of a study which is essentially highly specific in labour policy. Hunt (1996) uses a panel data approach and notes an insignificant increase in the demand for labour and a large fall in the hours worked, hence possible output losses.

Estevao and Sa (2006) offer a first investigation of WHRs that encompasses welfare implications, albeit by two different methodologies; a theoretical argument and a randomised control trial using heterogeneous survey data. They find that the WHRs in France failed to achieve its immediate objective of raising employment and describe an arguable reduction in welfare caused by the frictions, to firms and employees, of regime change. Another interesting finding, other than the ambiguous effect of the WHRs on unemployment, is that of hours worked. Estevao and Sa (2006) note that, by investigating the distribution of weekly hours worked in France, until 1998 a majority of workers worked 39 hours, but by 2002 more than 45% of workers in large firms worked only 35 hours. Estevao and Sa (2006) have highlighted; with a significant reduction in hours worked, an insignificant effect on output, and unemployment remaining largely unchanged, then an obvious question arises with respect to productivity gains in France. Skuterud (2007) produces empirical data from the Quebec working hours restriction at the turn of the millennium to suggest that the potential for work sharing as a job creation strategy is limited at best. Other authors consider the implications beyond the employment effect, for instance Alvarez-Cuadrado (2007) suggest that where distortions in consumption are caused by envy, or peer comparison, working hours restriction may replace politically infeasible remedial fiscal policy. The welfare gains of limitations on working time are almost as large as the gains derived from optimal fiscal policy.

3. Methodology

This section introduces the methodology utilised in the estimation of the French NAIRU time series, a discussion of the procedure for estimation and an overview of the data.

3.1. The Phillips curve and the NAIRU

The non accelerating inflation rate of unemployment (NAIRU) could be described as a rate of unemployment which displays some threshold. If observed unemployment exceeds that predicted by the NAIRU then unemployment may decrease without imposing inflationary stress on the economy. If, however, observed unemployment falls back to the NAIRU then there will be inflationary pressure in the economy and any further reduction in unemployment can only be achieved by supply side polices, perhaps policies that lower the NAIRU itself.

To estimate the natural rate of unemployment we make use of two theoretically structured equations, commonly found in the macroeconomic literature; one specifying the relationship between inflation and the unemployment rate and another describing the evolution of the natural rate of unemployment, more specifically here the NAIRU as a autoregressive process of order one. The specification of the Phillips curve estimated borrows from a version known as the 'triangle' model, see Gordon (1997), which itself is an interpretation of the accelerationist Phillips curve model discussed below:

A common specification for the inflation equation, or the Phillips, curve can be written:

$$\Pi_t = \Pi_{t-1} - \Theta(u_t - u_t^*) \tag{1}$$

where Π_t is actual inflation, u_t is the unemployment rate, u_t^* is the natural rate of unemployment and Θ describes the degree to which the unemployment gap affect the dynamics of inflation, rather than the output gap or any other proxy for excess demand. In order to control for supply side shocks we can employ a 'triangle' version of the 'accelerationist' Phillips curve where inflation depends on inertia, demand and supply side factors as in Gordon (1997) and Gordon and Stock (1998):

$$\Pi_t = \alpha(L)\Pi_{t-1} - \beta(L)(u_t - u_t^*) + \gamma(L)' z_t + \varepsilon_t \tag{2}$$

where $u_t - u_t^*$ represents the demand side influence on inflation, L the lag operator, is employed to capture the dynamics in the model and z_t represents a set of supply side variables, for which this study uses labour productivity as a proxy. The specification is admittedly ad-hoc but also convenient in that it allows a multivariate approach so that the supply side shocks can be taken into account in the determination of inflation. Equation (2) describes the effects on the dynamics of inflation caused by a change in the unemployment rate which captures demand pressure or other supply side factors which capture push cost inflation. The supply side variables included in the specification control for shocks which can affect the NAIRU and thus the NAIRU has greater consistency with stable inflation. These shocks are assumed to revert to zero after a short period allowing the more permanent shocks hitting the economy to be reflected in the NAIRU itself. The lag of inflation π_{t-n} captures inflation inertia or any other form of price stickiness.

3.2. A Kalman filter approach

In order to estimate the New Keynesian Phillips curve described by (2) we use a a statistical approach introduced by Kalman (1960) and Kalman and Bucy (1961), known as the Kalman filter method. This technique allows the joint estimation of the theoretical model and unobserved stochastic process that is the NAIRU. The procedure is recursive using updated information in each period for the maximum likelihood estimates of the state space parameters. For our analysis we have chosen the NAIRU, which can be thought of as the natural rate of unemployment, modelled as an unobserved stochastic time varying process which will follow a random walk. The time varying NAIRU is modelled separately to the Phillips curve to allow its inference from the data using the Kalman filter algorithm. A major benefit of this methodology is that it allows the simultaneous estimation of these two structural equations together, see Harvey (1990) for an in depth discussion on the many alternative applications of this algorithm. Information can be drawn from the whole sample to estimate a smooth estimate of the NAIRU which is updated from information as it becomes available during the estimation. This approach allows the inclusion of the Phillips curve theory and other variables to derive the NAIRU and allows us to neglect the micro aspect of the make up of unemployment, such as union power and labour market flexibility, which would have to be considered otherwise in some empirical explanation of unemployment. Our set up follows Chouliarakis (2009) and accordingly we estimate versions of the following macroeconomic model.

The measurement, or observation, equation for the inflation rate:

$$\Pi_t = \alpha(L)\Pi_{t-1} - \beta(L)(u_t - u_t^*) + \gamma(L)' a_t + \varepsilon_t \quad (3)$$

where $\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$

and the transition, or state equation for the TV-NAIRU:

$$u_t^* = u_{t-1}^* + \eta_t \quad (4)$$

where $\eta_t \sim N(0, \sigma_\eta^2)$

Equation (3) is the triangle version of the accelerationist Phillips curve described above, where a_t is growth in productivity. The model actually estimated will be a first differences version of Equation (3) to avoid the need to impose a restriction that the lagged coefficients on inflation sum to unity. This provides us with theoretical consistency with the long run neutrality of inflation on unemployment, a common approach used to estimate the NAIRU, see Staiger et al. (1996). In our estimation results we report the estimated smoothed NAIRU based on the full sample for which the model is estimated. There is an assumption, as evident by the specification, that the expectation element of inflation is implicit in the dynamic evolution of prices and therefore is excluded in explicit form, though obviously expectations do play an important role in price determination, as recently modeled in many forward looking price evolution mechanisms. Here the NAIRU is assumed to encompass these frictions and expectations.

Equation (4) describes the NAIRU as a random walk, time varying process without drift, and as the transition equation within the Kalman filter set up. Both the measurement and transistion equations specified above can be written in state space form and estimated by maximum likelihood using the Kalman filter with a key feature that the variances for both equations are restricted in their relation. Note that for the case of $\sigma_\eta = 0$ we obtain a constant or flat NAIRU, whereas for $\sigma_\eta > 0$ the NAIRU is subject to fluctuations. The source of these fluctuations are not necessarily explained by the model, and may be explained by other labour market phenomena such as hysteresis effects. All structural parameters are assumed constant over the sample with exception to the time varying NAIRU itself. The ratio of the variance of the error term in this equation to the variance in the transition equation is known as the 'signal-to-noise' ratio. The higher the ratio of the variance of the transition to the measurement equation the more explanatory power is given to the unobserved process being estimated. This key variable is set constant in order to control the volatility of the estimated variable, without this restriction the estimated NAIRU would become extremely volatile, see Boone (2000) for a discussion. Inflation can be driven by a supply/demand shock or due to a change in the NAIRU itself. In order to make meaningful comparison across model specifications we estimate an unrestricted model and select nested restricted models based on the significance of the parameter estimates. This allows us to make use of the log likelihood functions of the estimated models calculated using the Kalman filter. To do this we rely on the assumption that the errors in the measurement equation, ε_t are normally distributed with mean, zero. Note that, in this set up, the shocks to the supply side of equation 1 are assumed to be contemporaneously uncorrelated with unemployment.

3.3. *The data*

Quarterly time series data is obtained from the IMF International Finance Statistics and OECD Main Economic Indicators. Data has been collected for French consumer price index, seasonally adjusted unemployment rate and labour productivity. The data is available from 1978 through to 2009 though we have used the sample from 1987 onwards to avoid the noisy inflation data from 1978 to 1986, the volatility from which leads to rather spurious regressions. The series have been plotted against time in Figure 1, below.

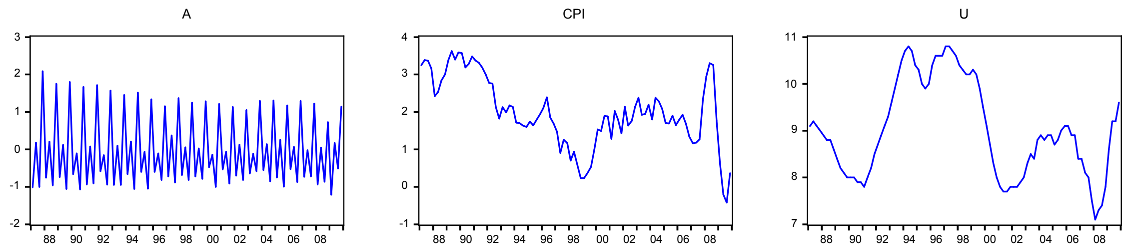


Figure 1: Productivity Growth, Inflation and Unemployment: France 1987-2009

French CPI inflation fell back from around 14% in the late 70s due to changes in monetary policy in the mid eighties and also moves to freeze prices and wages. Since 1987 inflation has been consistently between 0% and 4%, probably helped by the Banque de France gaining independence in 1993 and the subsequent entry to the Euro-system in 1998. There is a brief spell of deflation during the earlier part of the financial crisis in 2009. Unemployment has been persistently high since the mid 80s fluctuating around 9% although it is now declining from its peak in the late 90s when it reached nearly 11%. The profile for unemployment is not dissimilar to the Euro area as a whole which also suffers higher rates than elsewhere across the world. These persistently high rates may be due to the sclerotic nature of the labour market, the rigidity of which is also reflected in the relative smoothness of the unemployment data. From 2007 onwards we see the recent financial crisis reflected in the data for inflation and unemployment. The data for the percentage change in the OECD productivity index has been normalised around the mean for the series to better reflect supply side type shocks of a transitory nature. Permanent shocks are assumed to be captured by movements in the NAIRU itself.

3.4. *Empirical results*

We estimate a version of model (2) of the following form:

$$\triangle\Pi_t = \alpha(L)\triangle\Pi_{t-1} - \beta(L)(u_t - u_t^*) + \gamma(L)\triangle a_t + \varepsilon_t \quad (5)$$

where $\triangle$ is the first difference operator, Π_t inflation rate, u_t the unemployment rate and a_t normalised labour productivity. We estimate five model specifications borne from an unrestricted model which includes four lags of CPI inflation and productivity; Models 1 to 3 account for a contemporaneous relationship between inflation and unemployment and Models 4 and 5, as consistent with other literature on NAIRU estimation, account for cyclical correlation, or demand side inertia between inflation and unemployment by including one lag of the unemployment gap as an alternative.

As discussed, the estimated NAIRU is restricted by the 'signal to noise ratio' in order to account for the presumption that this measure of unemployment evolves, essentially, from the steady state structural variables of the labour market. This methodology requires that this ratio is fixed in order to smooth out the unobserved variable which can jump about as much as it likes if unrestricted, see Gordon (1997). The qualification for this is that the restriction rules out sharp quarter to quarter volatility. Another reason to restrict our estimated unemployment series in the Kalman filter is to justify the assumption that this process is determined by structural factors which evolve over time. For our estimation this 'signal to noise ratio' is set at 0.04, a figure lower than the consensus in the literature on NAIRU estimation, (0.09). The lower figure is required to provide a NAIRU that displays more inertia than the observed unemployment series, given that the sclerotic nature of the labour market returns a smooth unemployment series already, and to provide a profile more consistent with the theory.

Table 1 shows the results from the estimation of an inflation equation for the period 1987-2009. The models include an unrestricted model (UR Model) and five further restricted models (Models 1 to 5). More complex models, i.e. those including other supply shock variables such as import price inflation are not being considered in this work due to the difficulty obtaining other supply shock type variables across the full range of our selected data sample for France, a problem exasperated by the introduction of the European Monetary union in 1999. As a result we assume that including productivity as a supply side variable is sufficient for our purposes towards measuring the direction of the natural rate of unemployment.

Table 1: CPI inflation Phillips curve estimated using the Kalman filter, 1987 - 2009

Dep. Var $\triangle\pi_t$	UR Model	Model 1	Model 2	Model 3	Model 4	Model 5
$u_t - u_t^*$	-0.317	-0.224*	-0.176*	-0.145*		
	(0.190)	(0.072)	(0.055)	(0.054)		
$u_{t-1} - u_{t-1}^*$	0.105				-0.192*	-0.126*
	(0.210)				(0.080)	(0.059)
$\triangle\pi_{t-1}$	-0.008	-0.006			0.013	
	(0.093)	(0.092)			(0.090)	
$\triangle\pi_{t-2}$	-0.215*	-0.214*	-0.160		-0.196*	
	(0.096)	(0.096)	(0.095)		(0.100)	
$\triangle\pi_{t-3}$	0.002	0.000			0.008	
	(0.101)	(0.096)			(0.093)	
$\triangle\pi_{t-4}$	-0.650*	-0.657*	-0.647*	-0.641*	-0.663*	-0.642*
	(0.085)	(0.076)	(0.076)	(0.078)	(0.078)	(0.081)
a_t	0.407*	0.437*	0.366*	0.347*	0.473*	0.390*
	(0.195)	(0.183)	(0.132)	(0.137)	(0.183)	(0.137)
a_{t-1}	0.324	0.365	0.380*	0.366*	0.441	0.406*
	(0.254)	(0.231)	(0.135)	(0.141)	(0.239)	(0.141)
a_{t-2}	0.314	0.356	0.370*	0.354*	0.433	0.396*
	(0.259)	(0.237)	(0.135)	(0.138)	(0.247)	(0.140)
a_{t-3}	0.288	0.331	0.346*	0.326*	0.412	0.370*
	(0.251)	(0.227)	(0.123)	(0.125)	(0.237)	(0.128)
a_{t-4}	-0.097	-0.084			-0.040	
	(0.263)	(0.259)			(0.266)	
LL	-33.061	-33.208	-32.019	-33.892	-34.462	–35.056

LL is the log-likelihood. Standard errors in parentheses, *Significant at 5% level

The regressors for the joint estimation procedure are lagged CPI inflation π_t, contemporaneous and lagged unemployment u_t and u_{t-1} and productivity a_t with up to four lags. We begin by estimating a general form, labelled as our unrestricted model, and then move to more specific forms by eliminating insignificant variables. On this model selection basis models 3 and 5 are globally significant with annually lagged inflation and current and lagged labour productivity important drivers. From the estimates in Table 1 we can see a statistically significant negative relationship between inflation and unemployment for all restricted models of between (-0.126) and (-0.224) following the intuition in our model, that should unemployment falls below the NAIRU, there would be an increase in inflationary pressure. The contemporaneous unemployment gap seems to play a bigger role in the evolution of prices than the lagged unemployment gap for France and the supply side parameter estimates suggest that productivity shocks matter in the determination of inflation up to three lags. It also appears that the estimates for productivity are reflecting a degree of seasonality in the data. As discussed above, the Kalman filter allows the calculation of the log likelihood functions of the models regressed. The final row of Table 1 reports these log-likelihoods, (LL). A log likelihood ratio test has suggested that Model 3 with the contemporaneous unemployment gap is preferred. Finally, we make a comparison between the parameter estimates we obtain for model three with that from a basic OLS regression. From the results presented in table 2 we can see that the OLS estimates are broadly consistent with those obtained using the Kalman filter, although the slope of the Phillips curve is flatter at -0.089 (-0.145) under OLS. As with the Kalman filter estimates for Model 3, all OLS estimates have the correct sign and are significant at the 5% level.

Figure 2 shows the profile of the estimated French NAIRU for Model 3 plotted with the unemployment rate. The NAIRU seems to have increased steadily from around 8.3% to its peak at 10.5% during the early 90's before dipping to 9.6% and back to 10.3% through the late 90's. Since 2000 the NAIRU has fallen back to 8.7%. The profiles of unemployment and the NAIRU are obviously correlated, however for the period 2000 to 2004 the NAIRU is decreasing while unemployment is climbing, showing that the NAIRU does not necessarily follow unemployment.

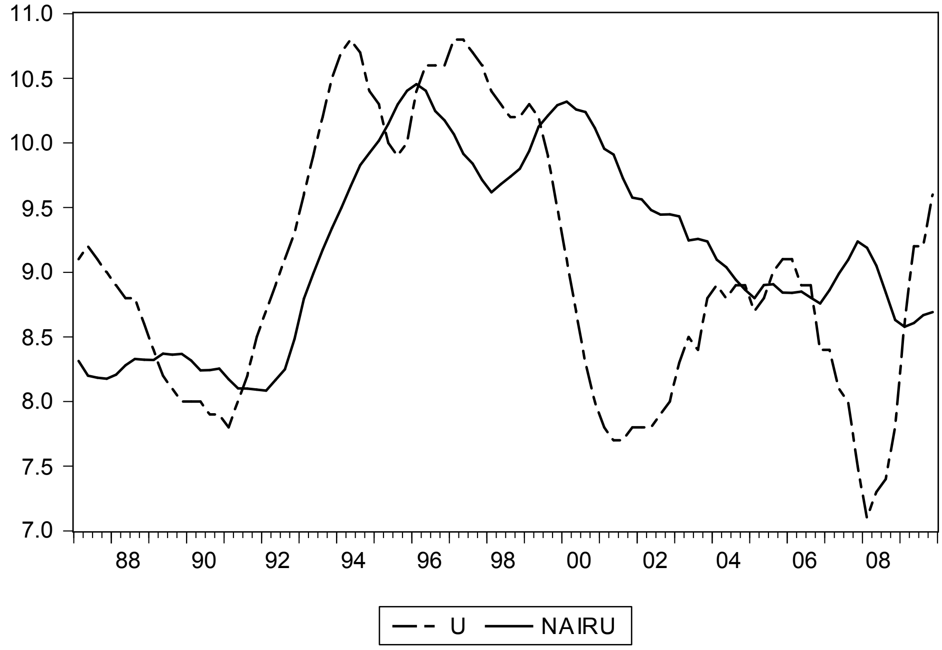
Table 2: OLS estimates for Model 3

Dep. Variable $\triangle\pi_t$	Model 3
u_t	-0.089*
	(0.034)
$\triangle\pi_{t-4}$	-0.609*
	(0.083)
a_t	0.252*
	(0.117)
a_{t-1}	0.270*
	(0.116)
a_{t-2}	0.260*
	(0.116)
a_{t-3}	0.234*
	(0.115)

*Signinficant at 5% level. Standard errors in parentheses

It is interesting to see that, at least up and until the turn of the century unemployment seems to 'lead' the long run NAIRU which is something that may be reflecting hysteresis in the French labour market.

Figure 2: The profile of the estimated NAIRU against French unemployment rate 1987-2009



Looking at the profiles of unemployment and the NAIRU around the period of the change in legislation in working hours, there appears to be a marked fall in both unemployment and the NAIRU after initial implementation of the WHR in 2000 for larger firms. However from 2002 onwards, the date for full implementation which included smaller firms, unemployment begins to climb back. The NAIRU by comparison continues to decline up and until the beginning of the financial crisis. In the earlier part of the crisis there is divergence between the two measures caused by an episode of sudden inflation volatility. The increase in unemployment from 2008 onwards is reflecting the demand deficiency of the earlier part of the financial crisis; interestingly the NAIRU begins falling again during the same episode. From implementation to our sample end the fall in unemployment is more muted than that in the case of the NAIRU suggesting that the omission of a longer run analysis in the measurement of this legislation could be one that leads to miss-inference. Overall the profile of the NAIRU suggests a fall in the natural rate of unemployment after the introduction of the WHR.

Figure 3: The profile of the estimated NAIRU Model 3 vs Model 5: 1987-2009

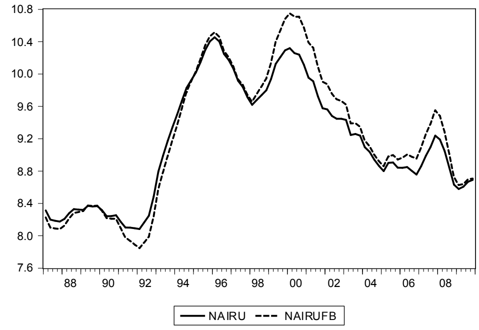


Figure 3 shows the profiles of the NAIRU extracted from both Model 3 (NAIRU) and

Model 5 (NAIRUFB) as a comparison. Model 5 differs from Model 3 by accounting for feedback instead of contemporaneous unemployment. We can see that the general profile is fairly robust to specification choice, at least in terms of unemployment lag. The profiles follow each other quite closely until 1998 Q1 when the profile of the NAIRU for Model 5 appears to predict a higher natural rate onwards before converging once more from 2008. Using the feedback specification the fall in the natural rate is more pronounced than for its contemporaneous counterpart.

4. Testing the NAIRU for structural breaks

Now that we have some long run estimation of unemployment in France we can carry out some test for a regime change in the NAIRU. Specifically we look for a structural break around the WHR announcement, or introduction, with the aim of measuring any real impact of the policy on the estimated series. Rather than testing the known dates surrounding the policy we can instead use a test for multiple structural breaks where the date of the break is unknown in order to add power to our test and to avoid any influence from priors caused by policy timings. This study uses a global maximiser test following a technique introduced by Bai and Perron (1998, 2003a) to determine the dates of any structural breaks in the estimated NAIRU series. Bai and Perron (1998, 2003a) use the following multiple linear regression model in T periods with m unknown structural breaks, and thus $m + 1$ regimes:

$$y_t = X_t'\beta + Z_t'\delta_j + \varepsilon_t \tag{6}$$

Note that X_t represents the set of regressors whose parameters are time invariant and Z_t the j regime specific variables. This study is only concerned with pure structural change and consequently we only consider the restricted model with no X_t variables. For a specific set of m breakpoints the test minimises the sum of squared residuals in the above linear regression model. A null hypothesis of no breaks, equivalent to $\delta_0 = \delta_1 = ... = \delta_{i+1}$ where $1 \leq i \leq m$ against an alternative of l breaks, where l is pre-specified as a maximum number of all possible breaks, which in our test is set at 5. The general form of the Bai-Perron test statistic is given as:

$$F(\hat{\delta}) = \left(\frac{T-(i+1)q-p}{Tk_q}\right)(R\hat{\delta})'(R\hat{V}(\hat{\delta})R')^{-1}R\hat{\delta} \tag{7}$$

where $\hat{V}(\hat{\delta})$ is the estimated covariance matrix of the optimal l break estimate and R a matrix such that $(R\delta) = (\delta_1' - \delta_2'.......\delta_k' - \delta_{k+1}')$. The distribution of the test statistics is non standard and so they are compared to the critical values provided by Bai and Perron (2003b). Table 2 presents the results from the Bai Perron global maximiser test on the estimated NAIRU from model 3 in our Phillips curve regressions.

Table 3: Bai Perron Multiple break point test for NAIRU (Model 3)

Multiple Breakpoint Test Bai Perron: Global L breaks vs none.			
Breaks	F Statistic	BP(2003) c.v.	Estimated Break Dates
1	0.21	8.58	1993Q2
2*	10.08	7.22	1993Q3, 2003Q2
3*	18.91	5.96	1993Q3, 2001Q3, 2004Q4
4*	14.09	4.99	1993Q3, 1998Q2, 2001Q3, 2004Q4
5*	20.34	3.91	1990Q2, 1993Q3, 1998Q2, 2001Q3, 2004Q4
Trimming 0.15	Max breaks 5		*Significant at 5% level

The results presented in table 3, report the statistics for the globally maximised Bai-Perron test for *l* breaks against the null of no structural breaks. The test predicts five breaks and thus five regimes starting in 1990Q2, 1993Q3, 1998Q2, 2001Q3 and 2004Q4. The null hypothesis can not be rejected for just one break but is rejected in favour of two, three, four and five breaks; also that as the number of breaks increases so the significance of the test statistic increases. The number of breaks may seem surprising given the sample size (approximately one break every four years) but an identical test on the actual unemployment series also predicts five break points with no less than three, consistent with the results reported here. Given that the policy announcement of the planned reduction in working hours was in June 1998 we can see that the test also supports the beginning of a new regime in the long run measure of unemployment on the policy announcement (1998Q2). Secondly that the test also predicts a new regime commencing 2001Q3, about three months before the compliance date for firms with less than 20 employees. Given the employment share of this group of firms (around 60%) and the time required to make preparations, the date of 2001Q3 is consistent with the policy enforcement. What remains is to discover whether the slopes across the regimes are positive or negative. We do this by measuring the slope of the trend in the estimated NAIRU for the regimes to and from 1998Q2 and 2001Q3. The slope of the NAIRU from the beginning of the two regimes indicates that the long run level of unemployment was increasing up to 1998Q2 and decreasing onwards from this break point, further that the NAIRU continues to decrease from 2001Q3 onwards. These findings are consistent with Crépon and Kramarz (2002) who suggest that firms will react positively to a WHR if it is introduced in an expected rather than unexpected manner. The test also predicts regime change in 1990Q2, 1993Q3 and 2004Q4 which coincide with earlier labour market reforms enacted by Michel Rocard and the extension of exemptions for the WHR by Jean Pierre-Raffarin at the end of 2004, after which we see an increase in the NAIRU up and until 2007.

5. Conclusion

Working hours restrictions have been employed as a labour market policy in France since 1978, when the working week amounted to 48 hours. Alongside the consistent implementation of the restriction of hours, France has adopted a plethora of other labour market policies aimed at protecting those in work. Although these policies have attracted rightful criticism as growth limiters not many commentators have considered the longer run real effects or the possibility that they might dampen output fluctuations. This paper has paid particular attention to the legislation of hours restrictions and found evidence to suggest that, this policy may have had real and positive effects, especially from a long run perspective. By contrast the general consensus in the literature has found the employment effect of this policy as negative for growth or entirely ambiguous.

We have found that, whilst the actual rate of unemployment fell after the policy announcement in 2000 but rose again after the implementation of the WHR in 2002, our estimate of the natural rate suggests that long run unemployment also fell after the announcement but instead of rising again on implementation actually kept on falling right up and until the financial crisis. Further that the Bai and Perron (1998, 2003a) endogenous multiple break point test predicts regime change in the NAIRU around these two key dates and also coinciding with other important labour market reforms in France during the sample.

The possibility of real effects from the WHR provides us with a powerful implication that unemployment and consequently income can also be smoothed by legislation rather than solely through demand management policies. In light of the recent financial crisis with policymakers looking for further instruments to manage output fluctuations perhaps legislation could be considered as an extension for policymakers with an interest in output smoothing. Even though the economic performance of France might be described as rather lack lustre recently it is also true that this country suffered a great deal less than most developed economies during the financial crisis in terms of output loss; a fact almost certainly due to the economic structural characteristics of the French economy. Perhaps one of these characteristics is the working hours restriction of a maximum 35 hour week.

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