

The impact of employment flexibility on UK Unemployment[#]

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Abstract

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Keywords: Employment flexibility, regional unemployment, persistence, NAIRU

JEL codes: E12, E24, J64, R11, R38

[#] I am thankful to S. Nickell, M. Baddeley, E. Stockhammer, I. Gordon, S. Destefanis, B. Hancke, W. Schelkle and conference participants at the 2005 AHE conference and various DTI/EMAR Labour Market Flexibility meetings in London for useful comments. Financial support by the DTI/EMAR Labour Market Flexibility Small Grants and the ESRC (ref.: T026271203) is acknowledged. Special thanks to Yiannis Kaplanis for his assistance with data and bibliographical research and for commenting extensively on earlier drafts of this paper. The LFS/QLFS data used are Crown Copyright and have been used under permission. All errors and omissions remain with the author.

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1. Introduction

There is now a large literature on the link between labour market institutions and unemployment focusing especially on the role of institutions in explaining the persistently high unemployment in Europe, compared at least to the USA, over the last two decades or so. The literature follows largely the macroeconomic framework of the NAIRU theory of unemployment that sees labour market rigidities as contributing adversely on the frictionless operation of the labour market thus raising the structural element of unemployment. A number of influential empirical studies provide supportive evidence for this relationship (Grubb and Wells, 1993; Scarpetta, 1996; Nickell, 1997 and 1998; Elmeskov et al, 1998; Nickell and Layard, 1999; Belot

and Van Ours, 2000). Although their results are not uniform, a general consensus appears to prevail that institutional rigidities (especially weak coordination in wage bargaining, long duration of unemployment benefits and, less so, strict employment protection legislation) significantly explain the observed patterns of persistently high unemployment in many of the large European economies. More recently, the focus in the literature has shifted from the structural to the cyclical element of unemployment and on unemployment adjustment to macroeconomic shocks. In this vein, the work of Blanchard and Wolfers (2000), Adsera and Boix (2000), Fitoussi et al (2000), Bertola et al (2002) and Amisano and Seratti (2003) has shown that labour market institutions significantly impact on unemployment adjustments to adverse shocks, thus raising unemployment.¹

In an interesting extension of this literature, Stockhammer (2004a and 2004b) builds on the work of Rowthorn (1995) and Arestis and Biefang-Frisancho Mariscal (1998 and 2000) and develops an accumulation-augmented NAIRU model to examine jointly the role of monetary (price) adjustments and patterns of accumulation, as well as of labour market rigidities, for European and US unemployment. The emphasis on accumulation links this work to a Keynesian view of the world where unemployment is seen as a disequilibrium condition which results from the disparity between physical expansion (capital growth) and the rate of growth of the workforce. Stockhammer's results suggest that labour market rigidities have only a weak effect on unemployment and that the slowdown of accumulation in Europe is by far the most significant determinant of European unemployment.²

¹ On the other hand, Nickell et al (2002) and Nunziata (2002) find conflicting evidence, suggesting that labour market rigidities impact mainly on the structural rather than the cyclical element. Baker et al (2002) and Howell (2006) have provided strong criticism on both sets of results.

² See Davidson (1998) for a detailed exposition of the Post-Keynesian analysis of the relation between slowdown in accumulation and unemployment, with particular emphasis on European unemployment.

Despite some differences in their policy prescriptions, the aforementioned studies share three main limitations. First, they rely almost exclusively on subjective measures of the quality / strictness of labour market institutions. Besides questions as to how successfully these measures reflect the actual quality and meaning of the institutional settings of the countries concerned,³ the direct association between labour market institutions and actual levels of labour market flexibility is problematic both conceptually and empirically (Solow, 1998; Monastiriotis, 2003). Second, they rely on the assumption that the institutions – unemployment relationship is the same across the sample countries, an assumption that has been extensively (albeit implicitly) questioned in the European Political Economy literature (Esping-Andersen, 1999; Hall and Soskice, 2001). Clearly, countries differ not only in their labour market institutions, but also in the framework in which key macroeconomic (fiscal, monetary) and microeconomic (housing, education, redistribution) policies are conducted and thus also in the impact that labour market institutions have on unemployment. Third, and quite crucially for this paper, they tend to overlook within-county differences in both unemployment performance and labour market flexibility. Such differences are in general large and often more pronounced than cross-country differences, thus deserving a closer and more systematic examination.

This paper aims at addressing these limitations while remaining with the macroeconomic framework of this literature. Flexibility is defined as a directly observable outcome rather than a set of regulations and institutions; the labour market is defined at the sub-national level, its boundaries identified with those of the administrative region; the focus shifts to a single country – the UK – and thus government regulations and other institutional differences are held constant across the

³ Howell and Schmitt (2006) for example provide a critique of the suitability of the OECD measure of Employment Protection Legislation to capture actual fire-and-hire constraints in France and other OECD countries.

cross-sectional dimension of the sample; and a fixed set of flexibility indicators are used, relating to the internal, external, numerical, and functional elements of the organisation of the labour relationship in the production process. These theoretical categories of flexibility are directly related to the types of flexible labour use that have been identified in the early literature (Atkinson, 1984; Atkinson and Meager, 1986) and are empirically measured on the basis of survey data (aggregated at the regional level) from the annual and quarterly series of the UK Labour Force Survey, covering the period 1985-2004.

Based on this unique set of flexibility indicators, the paper first seeks to establish what is the relative importance of a number of macroeconomic variables, relating to alternative theoretical explanations of unemployment, for regional unemployment in the UK. It then examines the impact that, controlling for these macro-determinants, observed levels of flexible employment arrangements have on UK regional unemployment, as well as on unemployment persistence and adjustment to macroeconomic shocks. Finally, it examines the role that more disaggregate categories of flexibility, and their mix, play for regional unemployment and unemployment persistence / adjustment. The regional labour markets of the UK exhibit very high degrees of unemployment persistence, notable temporal synchronicity, and comparatively low levels of inter-regional adjustment. While addressing the relationship between unemployment and flexibility, the paper also helps identify some macroeconomic influences on these characteristics.

The next section discusses some theoretical issues regarding the conceptualisation and measurement of flexibility and presents the indicators used in the empirical analysis. Section 3 elaborates on the theoretical explanations of unemployment and develops an estimating model that nests the simple NAIRU and

Keynesian models. The empirical analysis is presented in section 4, while the last section summarises the results and discusses their policy implications.

2. The measurement of flexibility

Despite the vast interest and research into the issue, a universal working definition of flexibility is notably lacking in the literature. The macroeconomic literature focuses predominantly on the strictness of labour market institutions, implicitly (and sometimes explicitly) assuming a one-to-one relationship between institutions and flexibility. In a similar fashion, labour economics studies focus on few measurable characteristics of labour relations (minimum wages; union density; unemployment benefits; dismissal practices), which are assumed to reflect directly labour market flexibility. In contrast, much of the research in the broader area of labour studies looks at specific labour market arrangements that are more directly related to flexible employment practices, like part-time and temporary work, unpaid overtimes, annualised hours, multi-tasking and the like.

This diversity of working definitions of flexibility is partly due to the relative ambiguity of the concept, in relation to its substance and area of reference. Thus, alternative views see flexibility as a set of relationships describing either (but rarely all) the production process; the operation of demand and supply mechanisms; the treatment of unemployment; or the employment contract (wages, benefits, promotion structures, etc). Moreover, flexibility is sometimes seen as a *potential* (available to the actors involved in the labour process, but only utilised when and as required); as a *framework* (regulations that set the limits within which employer-employee relationships can be established); or as an *outcome* (of the interaction between regulations, institutions, economic structures and labour market conditions).

Adding to this ambiguity is the empirical emphasis on institutions, which equates flexibility to the inverse of regulation, practically failing to acknowledge that flexibility is conditioned on a range of factors outside regulation and, thus, that the two are not equivalent (Pollert, 1991, Solow, 1998). Flexibility can increase without changes in regulation (i.e., if other rigidities are removed, including those targeted by some government regulations, like monopsony and insider power), while deregulation can occur without subsequent changes in observed levels of flexibility (Brosnan and Walsh, 1996; Ozaki, 1999). Addison and Hirsch (1997) discuss such an empirical case for mandatory advance dismissal notices in the USA, where deregulation did not lead to an extension of dismissal practices, with the implication that apparently the pre-deregulation arrangements were closer to optimal at least from a firm, if not a social, perspective. A fundamental question thus arises, about what is it that describes flexibility best: the regulators' rules, the employers' perceptions, or the workers' attitudes and actions?⁴

Against such questions, the paper adopts a rather pragmatic (although arguably ad hoc) definition of labour market flexibility, which draws a distinction between flexibility and government regulations. This approach helps us move from associating attributes of flexibility with specific labour market institutions to, instead, examining directly the revealed levels of flexibility in the labour market. Following, flexibility is defined as a set of directly observable employment arrangements that deviate from the standard employment relations that had come to characterise the era of Keynesian regulation (expansion of waged labour and the welfare state). This set of arrangements can cover a seemingly endless list, including arrangements on *working*

⁴ This ambiguity is evidently reflected in the HM Treasury's 2004 Pre-Budget Report, where a typical example of 'rigidity' (the extension of paid maternity leave) is instead presented as a step towards greater "choice and flexibility" (HMT, 2004, p.93), which is meant to increase female labour force participation and thus remove a potential labour market bottleneck.

time (length of working day/week, annualised hours contracts, overtime, variable or irregular hours), *working structures* (based on shifts, covering weekends or performed from home; seasonal, occasional, task-related, or fixed-term contracts; part-time employment; multi-tasking; team-working; sub-contracting), *employment conditions* (absences, breaks, paid and unpaid leave, minimum benefits, working standards, pace of work, provision of childcare facilities), *wage determination* (employee participation, union recognition, wage bargaining and strikes, unemployment benefits), and *labour adjustability* (mobility across jobs, labour markets, occupations and industries; skill-acquisition and re-training).

A number of approaches have been offered in the literature to organise this long list into various groups and domains of flexibility (for example, Atkinson, 1984; Pollert, 1991; Dawes, 1993; Ozaki, 1999; Burchell et al., 1999; Weiss, 2001). In a previous study on UK flexibility, Monastiriotis (2003) synthesised the classifications produced by such approaches into three aggregate domains. The production function or *employment flexibility* domain included elements relating to the production process, e.g., arrangements on working time, work content, and the employment relationship (temping, part-timing, etc). The *labour costs* domain included aspects relating to the determination of wage and non-wage labour costs, e.g., unionism, the wage elasticity of unemployment and the relationship of non-wage costs to overall labour costs. The third domain captured individual or *labour supply flexibility*, incorporating the quantitative and qualitative elements of labour supply adjustments, i.e., measures of worker mobility and skills acquisition respectively.

The present study focuses on the first of these domains (production function flexibility) and provides a further classification of its elements, based on an adaptation of the traditional distinctions introduced in the early literature of the ‘flexible firm

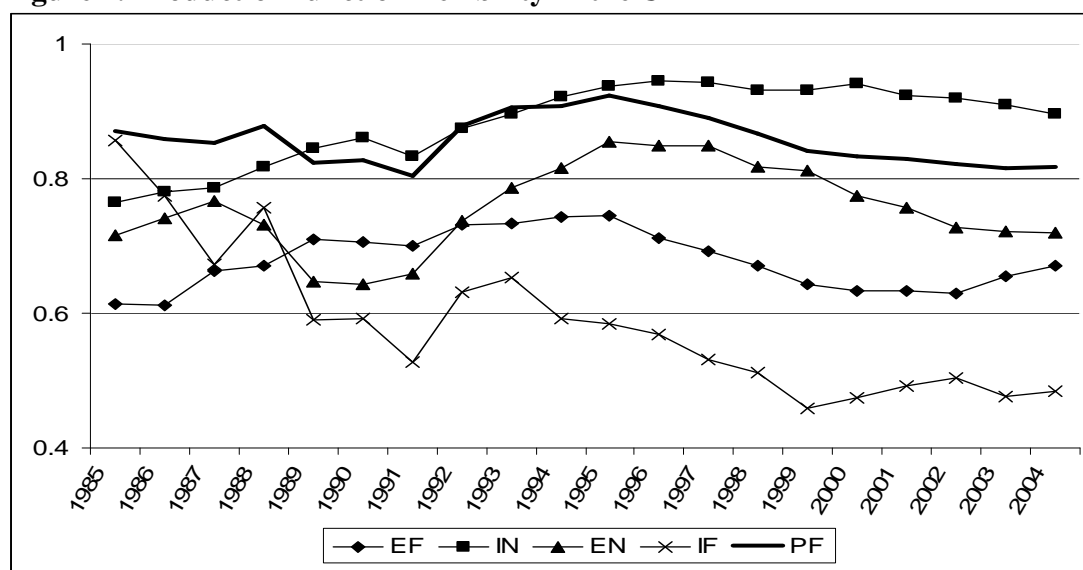
model' (Atkinson, 1984; Atkinson and Meager, 1986; see also Weiss, 2001). Four types of production function flexibility are identified: internal-numerical, external-numerical, internal-functional, and external-functional flexibility. Internal numerical flexibility is measured by the proportions of employees working shifts, weekends, and variable or irregular hours; the share of overtime to normal hours; and the share of involuntary part-timing or involuntary over-employment to total part-timing and total employment respectively. Internal functional flexibility is captured by the proportion of workers changing occupation while remaining with the same employer (within-job occupational mobility). External numerical flexibility combines the proportion of temps and part-timers in the employed workforce and the share of involuntary temping. External functional flexibility is proxied by the share of self-employment. See the Appendix for further details about the data sources and the construction of these indexes.

This classification allows us to distinguish between, e.g., the adjustability of the labour input (numerical) and the adaptability of labour to changing tasks and methods of production (functional). Further, it allows us to account for the fact that numerical – functional aspects produce different types of 'flexibilities' when applied to a structurally (internal) or only contractually (external) integrated workforce. In the remainder of this section we review the picture concerning the geographical distribution and temporal evolution of flexibility as revealed by these indexes.

Figure 1 depicts the temporal evolution of the aggregate measure of flexibility and its four sub-categories and shows that flexibility has remained relatively constant over the period (albeit with some fluctuations) while its constituent elements do not follow identical trends. Flexibility seems to have contracted in the beginning of the

early-1990s recession and again decline or stabilise since the mid-1990s.⁵ Although much of this pattern can be attributed to the significant decline in internal functional flexibility, other elements, namely those related to external flexibility also exhibited a downward trend around the turn of the century. Numerical flexibility has been increasing faster (and then declining more slowly) over the period and thus its relative importance to overall production function flexibility increased.

Figure 1. Production function flexibility in the UK



Interestingly, the evolution of all elements of flexibility does not exhibit any apparent structural breaks that could be associated to changes in labour market regulations, although the declining trend after the mid-1990s could be related to the introduction of a number of more rigid employment regulations by the Labour governments (e.g., maternity leave, working hours, minimum wage). It follows that, to the extent that regulations actually have a direct impact on flexible employment arrangements, this impact operates through a gradual adaptive process and not

⁵ Unemployment has been declining in the UK since the late 1980s, with the notable exception of the 1990-1993 recession, when unemployment almost doubled.

contemporaneously, in line with the earlier observation that flexibility is not identical to labour market deregulation.

Figure 2. Elements of production function flexibility, 2001-2004

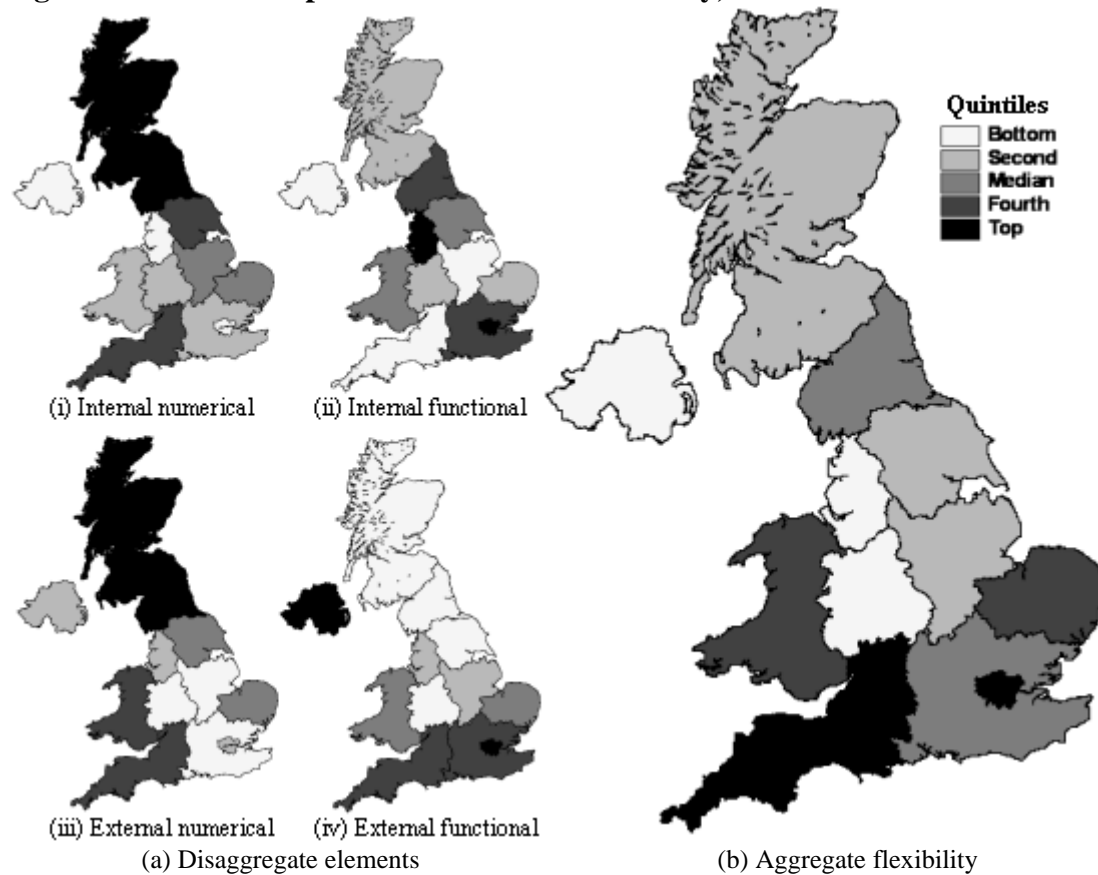


Figure 2 depicts the regional variation of the four types of employment flexibility and of the aggregate measure. A pattern of North-South differentiation in both levels and types is apparent. Numerical elements (Figures 2a(i) and 2a(iii)) are more prominent in the north of the UK while the southern regions show higher shares of external functional flexibility (Figure 2a(iv)). Internal functional flexibility (Figure 2a(ii)) exhibits a more mixed pattern, being more prominent in the north of England as well as in the southeast. The end result of these disaggregate patterns (Figure 2b) is a mixed picture of geographical differentiation, where the middle and western parts of the country appear as the areas with lowest levels of flexibility. The south exhibits

relative specialisation in elements of functional flexibility, while internal elements are more pronounced in the northern parts of the country, so that the Midlands have on aggregate the lowest levels of flexibility.⁶

This regional differentiation is not uncharacteristic of the UK geography. Regional unemployment rates in the north of the country are consistently higher to those of the south. With the exception of London (which, since the recession of the early 1990s, has also exhibited above-average unemployment rates) this disparity has been substantially stable, with the rank correlation of regional unemployment rates taking a value of 0.83 for the twenty-year period. The next section considers the theoretical explanations of unemployment (and of how the latter relate to flexibility) thus providing a framework for the empirical examination of the relation between flexibility and the observed temporal and geographical patterns of unemployment.

3. Theoretical considerations and estimating model

Mainstream economic theory provides a strong rationale for the negative association between flexibility and unemployment. Flexible labour markets are characterised by lower frictions and adjust faster to economic shocks. Both of these factors contribute to lower structural, frictional and overall unemployment rates. Although this analysis is not incompatible with the standard neoclassical view, it more emphatically reflects the predictions of the NAIRU model, where an equilibrium level of unemployment compatible with price stability (i.e., non-accelerating inflation) exists and is determined by the degree of frictions operating in the labour market. Deviations from the equilibrium are due to unanticipated macroeconomic shocks but adjustment to equilibrium is itself adversely affected by labour market

⁶ Monastiriotis (2004) examines in more detail the temporal evolution of the geography of these elements, obtaining evidence of relative convergence (divergence) in terms of internal (external) flexibility.

frictions.⁷ Labour market rigidities are a significant part of such frictions and thus the actual and equilibrium rates of unemployment are both inversely related to labour market flexibility.

Such a theoretical understanding of unemployment is in stark contrast to the Keynesian approach, which sees unemployment as a disequilibrium condition. In the simple Keynesian approach unemployment is due to the disparity between effective and equilibrium demand. This disparity leads to a rate of accumulation that cannot maintain a rate of output and employment growth in line with the natural rate of (population) growth. In this setting, labour market frictions in the form of labour market rigidities can play only a minor part in explaining unemployment: to the extent that rigidities do not impact on the rate of accumulation, unemployment should be unrelated to labour market flexibility.

Thus, in the simple Keynesian approach the unemployment rate changes according to the distance between the natural and actual rates of growth. While the former is treated as exogenous, the latter depends on the rate of capital accumulation. It follows that the level of unemployment at each point in time will depend on the (exogenous) natural rate of growth, past unemployment and the rate of accumulation. If we assume the natural rate of growth to be constant, a stochastic formulation of this relationship can be written as follows:

$$u_t = a_0 + a_1 u_{t-1} + a_2 \Delta k_t + \varepsilon_t \quad (1)$$

where u is the unemployment rate (in logs), t indexes time, Δk is the rate of growth of capital (accumulation) and ε is an error term.

Although equation (1) does not allow for a role of labour market rigidities in determining unemployment, a possible link between the two can be provided by

⁷ See, among others, Pissarides (1990), Hoon and Phelps (1992), Phelps (1994) and Scarpetta (1996).

assuming that rigidities impact on the effect that accumulation has on employment growth and thus on unemployment. In other words, it can be reasonably assumed that accumulation is a stronger driver of employment growth the more rigid the labour market; alternatively, that in flexible labour markets unemployment should respond less to changes in the rate of accumulation. Algebraically this implies that

$$u_t = a_0 + a_1 u_{t-1} + a_{21} \Delta k_t + a_{22} (\Delta k_t F_t) + \varepsilon_t \quad (1')$$

where we have substituted $a_2 = a_{21} + a_{22} F_t$ and F is a variable measuring labour market flexibility. In equation (1') $a_{21} < 0$ and $a_{22} > 0$ reflecting the assumption that accumulation reduces unemployment but less so in flexible labour markets.

In contrast to the Keynesian model, as stated already, the NAIRU approach is an equilibrium one and thus the rate of accumulation does not play a role in the determination of unemployment. Instead, actual unemployment depends on the structural rate of unemployment, u^* , and on cyclical factors and exogenous shocks. Formally, the structural element of unemployment can be represented as a function of labour market rigidities while, as is standard in the relevant literature, cyclical influences and macroeconomic shocks are approximated with the change in the inflation rate ($\Delta\pi$) and the rate of growth of productivity (Δv) respectively. Thus, a formal representation of the NAIRU model can be given by

$$u_t = b_0 + b_1 u_{t-1} + b_2 \Delta\pi_t + b_3 \Delta v_t + b_4 F_t + \eta_t \quad (2)$$

As was mentioned earlier, relatively recent works in the field, mainly empirical but also theoretical, have also highlighted the impact on unemployment and unemployment persistence of the interaction between macroeconomic shocks and labour market institutions (Scarpetta, 1996; Blanchard and Wolfers, 2000; Adsera and Boix, 2000; Fitoussi et al., 2000; Bertola et al., 2002; Amisano and Seratti, 2003). Following, equation (2) can be amended to include the other possible influences of

labour market rigidities on unemployment, namely through its impact on unemployment persistence as well as on macroeconomic and cyclical adjustment:

$$u_t = b_0 + b_{11}u_{t-1} + b_{12}(u_{t-1}F_t) + b_{21}\Delta\pi_t + b_{22}(\Delta\pi_t F_t) + b_{31}\Delta v_t + b_{32}(\Delta v_t F_t) + b_4 F_t + \eta_t \quad (2')$$

with flexibility reducing unemployment ($b_4 < 0$) and persistence ($b_{12} < 0$) and smoothing cyclicalities ($b_{21} < 0$ and $b_{22} > 0$) and adjustment ($b_{31} < 0$ and $b_{32} > 0$).⁸

Despite the fact that the Keynesian and NAIRU explanations of unemployment have significant ontological differences (i.e., in the way they understand the nature of unemployment), they share a similar epistemology, in that they both provide a macroeconomic framework for the analysis of unemployment. Empirically this implies that the two approaches can be tested simultaneously within an econometric model that nests models (1') and (2'). We can write this model as:

$$u_t = c_0 + c_1 u_{t-1} + c_2 (u_{t-1} F_t) + c_3 \Delta k_t + c_4 (\Delta k_t F_t) + c_5 \Delta \pi_t + c_6 (\Delta \pi_t F_t) + c_7 \Delta v_t + c_8 (\Delta v_t F_t) + c_9 F_t + \xi_t \quad (3)$$

Equation (3), which merges the two competing theories of unemployment, formally applies to dynamics operating within closed national economies, with no interactions across units of observation. Intuitively, however, there is no reason to expect that either of the proposed mechanisms should not apply in the case of open economies and in particular of regional economies within a single country. In a regional setting capital and labour mobility can be additional equilibrating factors (or, dis-equilibrating factors if cumulative causation processes dominate) but both labour market frictions and the rate of accumulation (as well as macroeconomic shocks and

⁸ The role of flexibility on unemployment adjustment is not very well elaborated in the empirical macroeconomic literature. For example, Blanchard and Wolfers (2000) state that flexibility should reduce the adverse effect on unemployment of negative shocks. Under the assumption of symmetry, however, this implies that flexibility also weakens the beneficial effect of positive shocks. From a theoretical viewpoint, flexibility should soften the impact of adverse shocks but its impact in the case of positive shocks is ambiguous (either intensifying or weakening the impact of positive shocks).

unanticipated price movements) remain unambiguously a large part of the unemployment story.⁹

In the UK this is even more so the case, as the country exhibits very high degrees of unemployment persistence, both over time and in terms of regional unemployment differentials. A number of studies have shown that, although cross-regional linkages exist (Roberts, 2004; Monastiriotis, 2006), they run short of achieving regional convergence (Hart, 1990; Chapman, 1991; McCormick, 1997; and others). Rather, regional differences in unemployment rates appear to be an equilibrium condition (Gray, 2004), with the implication that persistent unemployment differentials are due to regional differences in economic and institutional structures (Martin, 1997; McCormick, 1997).¹⁰ Moreover, the UK regions appear to follow largely the same business cycle (Martin, 1997). Although this ‘cyclical synchronicity’ is not sufficient to explain region-specific unemployment evolutions (Chapman, 1991; Buyers, 1991), it suggests that the UK regions are largely subject to common (symmetric) shocks.

In a macroeconomic setting, these observations regarding the regional economies of the UK can be reflected in the following empirical formulation:

$$u_{i,t} = \alpha_i + \beta_t + du_{i,t-1} + \psi_{i,t} \quad (4)$$

where α_i proxies for fixed regional (economic and institutional) differences, β_t controls for common (national) unemployment fluctuations, and the temporal lag of log unemployment ($u_{i,t-1}$) reflects the observation about the significant unemployment

⁹ Further, of course, the closed economy assumption has little validity also in the case of the OECD countries and especially the countries of the Eurozone, where much of the macroeconomic literature has focused, applying different versions of equation (3). The inconsistency is less notable at the regional level, where balance-of-payments constraints on employment growth do not apply (see Davidson, 1994).

¹⁰ Among such structural characteristics, the literature identifies technological and skills mismatches (Hart, 1990), demand hysteresis (Buyers, 1991), elements of the wage setting process (Blanchard and Oswald, 1994) and labour supply deficiencies (Blackaby and Murphy, 1995; Beatty et al., 2000).

persistence in the UK regions; while i and t index regions and time, respectively, to account for the panel formulation of the model.

In the empirical analysis that follows we use equation (4) as the reference model, allowing no influence on unemployment from the NAIRU and Keynesian variables. We then extend the model to include these influences, but restricting the coefficients on flexibility to zero. Thus, we estimate

$$u_{i,t} = \alpha_i + \beta_t + d_1 u_{i,t-1} + d_2 \Delta k_{i,t} + d_3 \Delta \pi_{i,t} + d_4 \Delta v_{i,t} + \xi_{i,t} \quad (4')$$

Following, we amend the estimating model to include direct and interaction effects from flexibility, as in equation (3), while we later also replace the flexibility indicator with the disaggregate measures that capture the elements of internal numerical, internal functional, external numerical, and external functional flexibility. Thus, our final estimating relationship becomes

$$\begin{aligned} u_{i,t} = & m_1 u_{i,t-1} + m_2 (u_{i,t-1} \sum_{\kappa} \rho_{1,\kappa} F_{i,t,\kappa}) + m_3 \Delta k_{i,t} + m_4 (\Delta k_{i,t} \sum_{\kappa} \rho_{2,\kappa} F_{i,t,\kappa}) \\ & + m_5 \Delta \pi_{i,t} + m_6 (\Delta \pi_{i,t} \sum_{\kappa} \rho_{3,\kappa} F_{i,t,\kappa}) + m_7 \Delta v_{i,t} + m_8 (\Delta v_{i,t} \sum_{\kappa} \rho_{4,\kappa} F_{i,t,\kappa}) \\ & + m_9 \sum_{\kappa} \rho_{5,\kappa} F_{i,t,\kappa} + m_{10} \sum_{\kappa, \lambda} \rho_{6,\kappa, \lambda} (F_{i,t,\kappa} F_{i,t,\lambda}) + \alpha_i + \beta_t + \xi_{i,t} \end{aligned} \quad (4'')$$

where κ and λ index the flexibility indicators, F is now a vector of the four disaggregate indicators of flexibility, and the term for m_{10} represents the set of interactions between pairs of the flexibility indicators with $\kappa \neq \lambda$.

Some final theoretical considerations can be made about the relationship between flexibility and unemployment. Although in the preceding discussion the direction of causation runs from flexibility to unemployment, it is also true that unemployment can exert an impact on flexibility through a number of channels. First, from a demand-side, high levels of unemployment representing slack labour markets (low labour demand) imply reduced pressures for non-standard forms of labour use. Inversely, in tight labour markets (high pressure of demand) employers have to

resolve increasingly to temporary or part-time employment and increased working hours. Thus, episodes of high unemployment should lead to relative declines in flexible labour use resulting in an inverse relationship between the two aggregates. On the other hand, from a supply-side rationale unemployment could be positively related to flexibility. With high unemployment the bargaining power of the labour force is weakened and thus employees are more willing to accept non-standard employment contracts and are more conducive to greater duration and intensity of work (i.e., overtime and functional flexibility). In the empirical analysis that follows we do not explicitly consider this direction of causation but rather focus on the macroeconomic impact that flexible labour use has on unemployment, accounting however for the possible endogeneity of flexibility in the estimating relationships.

4. Empirical analysis

(i) Macroeconomic determinants

The empirical analysis uses the twelve UK Standard Statistical Regions (SSRs) as the spatial unit and covers a period of 20 years (1985-2004), for which data on flexibility were possible to construct.¹¹ As stated above, we start with an exploratory regression (equation 4) in order to evaluate the significance of the temporal and regional fixed effects and the degree of unemployment persistence. The first two columns of Table 1 present the results from this equation (column 1 restricts the persistence coefficient to zero while column 2 presents the unrestricted model). As expected, temporal and regional effects are very significant, confirming the view that

¹¹ The use of administrative regions, instead of a more meaningful economic unit (e.g., travel-to-work areas) is a necessary evil in this analysis, due to data availability. Nevertheless, the UK regions are sufficiently large and have rather self-contained labour markets and thus the possible problems of aggregation bias should be minimal. Moreover, they will be further minimised (and, if the bias is constant over time, completely eliminated) by the inclusion in the estimating relationships of regional fixed effects.

both regional structures and national cycle effects impact significantly on UK regional unemployment. In the unrestricted model the significance of the fixed effects – especially the regional– naturally declines and the model returns a very strong persistence coefficient, which indicates that three quarters of regional log-unemployment at any time can be explained by unemployment in the previous period, even after controlling for national and regional effects.

Table 1. Specification of the unemployment relationship

Dependent: ln(U)	(1)	(2)	(3)	(4)	(5)	(6)
Lag of log-U (persistence)		0.755* (11.84)	0.759* (14.90)	0.733* (12.15)	0.738* (14.80)	0.726* (14.86)
Productivity growth			-1.841* (-3.65)		-1.513* (-3.17)	
Change in inflation (lagged)			-0.654* (-3.70)		-0.526* (-3.10)	-0.474* (-2.67)
Capital growth (accumulation)				-3.061* (-5.31)	-2.507* (-4.49)	-2.086* (-3.71)
Positive productivity shock						-2.410* (-3.24)
Negative productivity shock						0.406 (0.92)
F-test for fixed effects	120.90* <i>0.000</i>	33.09* <i>0.000</i>	28.05* <i>0.000</i>	33.18* <i>0.000</i>	34.36* <i>0.000</i>	35.17* <i>0.000</i>
F-test for regional effects	81.86* <i>0.000</i>	2.24+ <i>0.014</i>	3.23* <i>0.001</i>	2.62* <i>0.004</i>	3.38* <i>0.000</i>	3.87* <i>0.000</i>
F-test for time effects	136.40* <i>0.000</i>	48.77* <i>0.000</i>	43.02* <i>0.000</i>	46.94* <i>0.000</i>	51.68* <i>0.000</i>	49.78* <i>0.000</i>
Observations	240	240	216	240	216	216
R-squared	0.928	0.966	0.972	0.970	0.975	0.976

Notes: #, + and * show significance at the 10%, 5% and 1% levels, respectively. Robust t-statistics are in parentheses; p-values in *Italics*. All regressions have been estimated with OLS using White's correction for heteroskedasticity.

The remaining columns of Table 1 report the results from a number of alternative specifications of equation (4'). Column 3 presents a simple NAIRU specification, where log-unemployment is made a function of lagged log-unemployment (proxying for structural unemployment), productivity growth (proxying for macroeconomic shocks) and the change in the rate of inflation.^{12,13} The

¹² The inflation variable has been calculated from data on regional prices collected from the Croner database (<http://www.croner.co.uk>). All other data come from the ONS (various sources).

NAIRU approach is supported by the results, with both productivity and inflation returning significant and negative signs. Column 4 tests a simple version of the Keynesian model, replacing the NAIRU variables with the rate of accumulation (capital growth).¹⁴ Again, the sign of the estimated coefficient is in line with theory and is highly significant. Moreover, accumulation remains a strong determinant of unemployment also in the next model, where we combine the two theoretical mechanisms. All coefficients are highly significant and appear stable across the different specifications,¹⁵ but accumulation seems to be the strongest of the macroeconomic drivers of unemployment (in terms of standardised coefficients the effect of accumulation is three times larger than the productivity and inflation effects).

The last column of Table 1 examines an interesting extension allowing for asymmetric effects on unemployment from positive and negative productivity shocks. Positive shocks, defined as episodes of productivity growth exceeding rates one standard deviation above the sample average, have a strong impact reducing unemployment, thus suggesting significant unemployment adjustments during upswings. In contrast, negative productivity shocks, similarly defined, do not appear to be as important in their impact on unemployment. Although the effect is positive (as expected), the estimate fails to be significant at conventional levels, highlighting another possible source of rigidity across the regional labour markets of the UK. Overall, the models corresponding to equation (4') explain as much as 98% of the variation of regional UK unemployment over the last twenty years. Comparing this with the fit of the regression in column 1 suggests that the structural variables in the

¹³ We use the time lag of this variable to improve the performance of the estimations but also to account for the role of inflation expectations in shaping unemployment.

¹⁴ The capital growth variable has been calculated from data on regional gross fixed capital formation assuming a rate of depreciation of 5%.

¹⁵ They are also very stable across alternative estimation methods. See Table A1 in Appendix for a summary of results from alternative estimation methods on the model of column 3 of Table 1.

model explain around 67% $(=(0.976-0.928)/(1-0.928))$ of the variability not explained by the temporal and regional fixed effects. Unemployment is found to exhibit strong persistence and to respond significantly to macroeconomic shocks (especially positive ones) and changes in the rate of inflation, but the main driver of unemployment appears to be the rate of accumulation.

(ii) The impact of flexibility

We now turn to the examination of the role of employment flexibility for unemployment levels, adjustment and persistence. Similar to the approach followed above, Table 2 presents the results from a number of alternative specifications of equation (4''), where we restrict different coefficients to zero and we only include one aggregate indicator of employment flexibility (so that $\kappa = 1$ in the notation of equation (4'')).¹⁶ In column 1 we restrict all interaction terms to zero (i.e., $m_2 = m_4 = m_6 = m_8 = m_{10} = 0$) and thus amend the last of the models in Table 1 with the aggregate flexibility term. The results for the structural variables are largely the same as before but, counter to expectations, flexibility returns a strongly positive coefficient. This clearly appears to refute the NAIRU approach to labour market flexibility and is very robust across different specifications of the model. When controlling for structural and macroeconomic regional differences, flexibility is associated to higher unemployment. A further exploration of the relationship between unemployment and flexibility is warranted.¹⁷

¹⁶ In all models we use the lag of the flexibility term to account for the possible endogeneity of flexibility, as discussed in the previous sub-section. Further experimentation showed that the flexibility estimates are very robust to alternative specifications, including various IV formulations, where the flexibility indicator was made a function of a number of instruments including gender and industrial employment compositions, levels of education and unionisation.

¹⁷ A possible interpretation of this finding is that higher levels of flexibility (especially internal flexibility elements) lower firms' external demand for labour thus reducing job creation and increasing unemployment. Relevant evidence for such a mechanism has been offered in studies that examine the

Table 2. Flexibility effects on unemployment, persistence and adjustment

Dependent: $\ln(U)$	(1)	(2)	(3)	(4)	(5)	(6)
Lag of log-U (persistence)	0.693* (13.81)	-0.149 (-0.49)	0.679* (13.26)	0.693* (13.76)	0.694* (13.75)	-0.189 (-0.59)
Change in inflation (lagged)	-0.501* (-2.95)	-0.543* (-3.16)	-0.487* (-2.93)	-0.550 (-0.38)	-0.493* (2.92)	-0.535 (-0.37)
Capital growth (accumulation)	-1.851* (-3.43)	-1.923* (-3.42)	-1.613* (-3.07)	-1.851* (-3.41)	-4.468# (-1.69)	-1.075 (-0.38)
Positive productivity shock	-2.186* (-3.08)	-1.912* (-2.81)	12.249# (1.78)	-2.188* (-3.09)	-2.079* (-2.94)	12.365# (1.89)
Negative productivity shock	0.428 (0.99)	0.531 (1.24)	-1.308 (-0.27)	0.427 (0.99)	0.451 (1.05)	-0.461 (-0.10)
Lag of flexibility	0.506* (2.76)	-1.800+ (-2.14)	0.449+ (2.52)	0.506* (2.74)	0.160 (0.41)	-1.845+ (-2.20)
Lag of flexibility * Lag of log-U		1.025* (2.81)				1.057* (2.73)
Lag of flexibility * Positive shock			-17.997+ (-2.11)			-17.818+ (-2.17)
Lag of flexibility * Capital growth					2.943 (1.03)	-0.696 (-0.22)
Flexibility * Change in inflation (lagged)				0.059 (0.04)		0.003 (0.00)
Lag of flexibility * Negative shock			1.998 (0.37)			1.132 (0.21)
F-test for fixed effects	33.31* <i>0.000</i>	30.21* <i>0.000</i>	30.36* <i>0.000</i>	32.82* <i>0.000</i>	32.06* <i>0.000</i>	27.49* <i>0.000</i>
Observations	216	216	216	216	216	216
R-squared	0.977	0.977	0.977	0.977	0.977	0.978

Notes: see notes in Table 1.

In column 2 we explore further the impact of flexibility by relaxing the restriction on m_2 thus allowing flexibility to impact on unemployment persistence. The coefficients on the structural variables are again very stable. Introducing the interaction effect reveals a very interesting finding. While the overall effect of flexibility on unemployment is positive (see Table A2 in Appendix for the estimated partial and total effects), in line with expectations the direct effect is negative. However, rather counter-intuitively, flexibility is found to significantly enhance unemployment persistence (see first row of Table A3).¹⁸ This finding has a very

efficiency effects of cost-saving strategies related to flexible labour use (Burchell et al., 1999; Michie and Sheehan, 2003), but this assertion is not supported by our later findings (first column of Table 3).

¹⁸ This finding implies that flexibility increases unemployment more the higher past unemployment is. It follows that flexibility is probably beneficial in periods and regions of low unemployment (less than

interesting implication as it suggests a degree of inherent rigidity in flexible labour markets. At the regional level where labour markets adjust at least partially through cross-regional movements (e.g., migration, wage spillovers, firm relocation), a reasonable interpretation of this finding is that flexibility reduces (the incentives to) cross-regional adjustment and thus leads to higher unemployment persistence within each regional economy (controlling for national business cycle effects). We discuss the implications of this finding further in the concluding section.

The remainder of Table 2 looks at the flexibility impact on macroeconomic adjustments. The results appear much more in line with theoretical expectations. The inclusion of the interaction terms does not alter the results obtained earlier and all estimates on the structural NAIRU and Keynesian variables remain remarkably stable. Flexibility is found to reinforce adjustment to positive and negative productivity shocks (although for the latter the estimated effect is also insignificant – see column 3 and Table A3), while it makes unemployment less responsive to changes in inflation (column 4) and to capital accumulation (column 5).¹⁹ The economic interpretation of these results is very interesting. From the results of column 3 we see that in more flexible labour markets adjustment to positive shocks is more favourable while in very rigid labour markets (values below the sample minimum of flexibility) unemployment does not adjust at all to positive productivity shocks. Furthermore, the results of columns 4 and 5, read in conjunction, imply that the role of accumulation is more important in rigid labour markets, while in their more flexible counterparts more

5.75% according to the estimates of column 2 in Table 2) but for high-unemployment regions/periods it fails to reduce unemployment as its impact on strengthening unemployment persistence dominates.

¹⁹ Although the estimates on accelerating inflation have very low t-values, their joint significance is high (<1%) and thus their differences are also statistically significant. In economic terms, however, this effect is very small (see Table A1). For example, for an initial unemployment rate of 5%, it suggests that a 20% increase in flexibility will raise unemployment to 5.70% if inflation is accelerating and to 5.67% if inflation decelerates. Also, that if inflation increases by five points (say, from 2% to 7%) unemployment will drop to 4.80% in a flexible labour market and to 4.79% in a rigid labour market.

important is price stability. More intuitively, the implication is that in a context of stagnating investment and price stability (like the current situation in much of the Eurozone), flexibility is more conducive to employment growth; while labour market rigidity appears more beneficial in economies with monetary and physical-capital expansion. In a sense, these two conclusions seem to be in line with the observed regularity, of Keynesian policies (e.g., to boost investment) being more relevant in rigid employment relations settings and monetarist policies (i.e., for price stability) suiting best more flexible labour markets. Nevertheless, further analysis shows that the estimated interaction effect for accumulation and flexibility is sensitive to the inclusion of the flexibility effect on persistence (interaction between flexibility and lagged unemployment). In the last column of Table 2, which presents the estimates for the full equation (4'') (for $\kappa = 1$), the interaction of flexibility with accumulation returns a negative coefficient suggesting that, controlling for the effect of flexibility on unemployment persistence, accumulation reduces unemployment more in more flexible (rather than in more rigid) labour markets. This implies that the adverse effect of flexibility on the impact of accumulation is solely due to its effect on unemployment persistence.

(iii) The role of the disaggregate elements of flexibility

Before concluding the empirical analysis it is important to report on the examination of the direct and indirect effects on unemployment of the disaggregate indicators of flexibility. That is, we relax the restriction $\kappa = 1$ and estimate the full version of equation (4''). A summary of the obtained results is presented in Table 3.²⁰

²⁰ Table 3 deviates from the standard format and presents the regression coefficients in tabular form and without their associated t-statistics (instead, the last column reports the p-value for the joint significance of the linear and interaction terms of each of the variables). The first column reports on a version of equation (4'') where $\kappa = 4$ and $m_2 = m_4 = m_6 = m_8 = m_{10} = 0$. The next five columns present

As can be seen in the first column of Table 3, the estimates for the structural variables are not sensitive to the inclusion of the disaggregate indicators of flexibility. Unemployment persistence is still substantial, albeit somewhat smaller than before, while accumulation, changes in inflation, and productivity growth are all found to significantly reduce unemployment. Three out of the four flexibility indicators are positively associated to unemployment (as was the case for aggregate flexibility) but, interestingly, internal numerical flexibility appears to reduce unemployment, returning a statistically significant negative coefficient. Thus, labour-saving employment arrangements do not appear to be a cause of unemployment, counter to some findings in the literature (as discussed in footnote 18).

When the full interaction model is considered, the interpretation of the estimates on the structural variables changes. Here we are mainly concerned with the direct and interaction effects of the flexibility indicators. As is shown in column 2, in the full model the direct effect of all elements of flexibility is to reduce unemployment, as was the case with the aggregate indicator. The adverse impact on unemployment is for all elements of flexibility concentrated on their effect on unemployment persistence (see first row of Table 3). Concerning the impact of flexibility on adjustment to productivity shocks, the next two rows of Table 3 suggest that this is largely in line with the neoclassical expectations (as was the case in Table 2). However, the external numerical element exhibits a different behaviour. Hence, more extensive use of part-timing and temping appears to be associated to more moderate adjustments to positive shocks and stronger adjustments to negative shocks, thus in both cases leading to higher rates of unemployment, *ceteris paribus*.

the results for the full regression ($\kappa = 4$, $m_j \neq 0 \forall j$). The direct effect is depicted in the first column while the interaction effects for each of the flexibility indicators are presented in the successive columns.

Table 3. Types of flexibility and their effects on unemployment

Variable	No inter- actions	With interactions (full model)					
	Direct effect	Direct effect	Interaction with				F-test <i>p-value</i>
			Internal num/cal	External num/cal	Internal func/nal	External func/nal	
Lag of log-U (persistence)	0.659 (12.11)	-1.482	1.133	0.568	0.438	0.624	25.70 <i>0.000</i>
Positive shock of productivity	-2.116 (-4.02)	25.725	-25.818	7.113	-1.356	-14.599	4.87 <i>0.000</i>
Negative shock of productivity	0.548 (1.25)	-0.187	-5.096	13.502	-6.626	-2.015	1.16 <i>0.332</i>
Change in inflation (lagged)	-0.489 (-3.13)	0.437	-0.529	1.109	-0.185	-1.173	1.21 <i>0.306</i>
Capital growth (accumulation)	-1.217 (-2.39)	4.267	-9.470	2.639	-0.908	1.974	1.37 <i>0.239</i>
Lag of internal numerical flex/ty	-0.555 (-2.27)	-4.624	-	1.713	0.635	1.797	2.32 <i>0.018</i>
Lag of external numerical flex/ty	0.238 (1.58)	-1.213	-	-	-0.492	-1.983	2.88 <i>0.004</i>
Lag of internal functional flex/ty	0.187 (2.09)	-0.347	-	-	-	-0.757	1.66 <i>0.104</i>
Lag of external functional flex/ty	0.299 (1.96)	-0.844	-	-	-	-	3.57 <i>0.001</i>

Notes: Robust t-statistics in parentheses (first column). Standard p-values in *Italics* (last column). The F-test is a test for the joint significance of the linear and interaction terms of each of the variables. Estimation is with OLS using White's correction for heteroskedasticity. Fixed time and regional effects are included and are jointly significant. The overall fit of the regression is $R^2=0.978$.

Similarly, external numerical flexibility leads to a steeper Phillips curve, with unemployment declining by less during periods of monetary expansion where external numerical flexibility is high (although the implication of this is that during disinflationary periods external numerical flexibility helps contain unemployment). This disparity in the behaviour between external numerical flexibility and the other elements is also observed in the case of the unemployment effects of capital growth. In contrast to the two internal elements of flexibility (as well as the aggregate indicator), higher levels of external flexibility (including this time also the functional element, i.e., self-employment) tend to reduce the beneficial effects of accumulation. Thus, it appears that the conclusion drawn earlier, in relation to flexibility's impact on the accumulation effect as estimated in the last column of Table 2, is driven mainly by the behaviour of the internal flexibility elements (especially the internal numerical).

The last part of Table 3 (last four rows) presents the individual (partial) impacts on unemployment of the interaction between various forms of flexibility. As can be seen, the combination of internal numerical flexibility with any of the other elements is detrimental, as it tends to raise unemployment. In contrast, all other combinations considered seem to contribute towards lower unemployment. Thus, *ceteris paribus*, combinations of external numerical flexibility with the functional elements as well as combinations of internal functional flexibility with the external elements appear to be beneficial with regards to employment.

5. Concluding remarks

Presented in this paper is an extensive analysis of the unemployment impact of some key macroeconomic factors and of employment flexibility in the UK regions over the period 1985-2004. A working definition of flexibility was adopted that focuses on the workings of the production process and, following the theoretical literature on the issue, differentiates between internal, external, numerical and functional aspects of flexible employment arrangements. The role of employment flexibility was examined in relation to the key determinants of unemployment as identified by two competing explanations of unemployment, namely the NAIRU and Keynesian approaches.

For the NAIRU explanation flexibility helps reduce both the structural and cyclical elements of unemployment, by making the Phillips curve flatter and moving it to the left. For the Keynesian approach flexibility has a much more moderate role, influencing unemployment only through its effects on capital accumulation. At the regional level these macroeconomic explanations have only partial validity, as regions represent small open economies within a relatively closed (national) economic system

and thus cross-regional adjustments play an important role in determining actual and equilibrium levels of unemployment. In the context of the UK regions, however, where such adjustments have been shown to be rather weak and unemployment differentials rather stable, the macroeconomic explanations are relevant, especially in explaining the part of unemployment that is net of fixed regional and temporal influences.

Given these observations, the focus of the empirical analysis was on the macroeconomic determinants of regional unemployment in the UK and on how the impact of these is affected by the observed levels and types of flexibility in the country. To that objective, the present study addressed three inter-related issues for the UK regions: the macroeconomics of the unemployment relationship; the unemployment impact of flexibility (quantity effect); and the unemployment impact of the composition of flexibility (quality effect). The analysis produced a plethora of results, which are summarised below.

Productivity growth, monetary expansion (accelerating inflation) and capital growth (accumulation) significantly reduce unemployment. The accumulation effect is the strongest, and thus it appears that the Keynesian explanation of unemployment receives the firmer support from our data. This conclusion is further supported by the fact that employment flexibility (which is a NAIRU variable) is actually found to increase unemployment. A key finding in understanding this apparently counter-intuitive effect for flexibility is the estimate for a very robust adverse effect on unemployment persistence. The logical implication of this finding, given that a tendency for flexibility to facilitate (intra-)regional adjustments has indeed been found, is that flexibility tends to weaken inter-regional adjustments (cross-regional equalisation of unemployment rates) and that this effect dominates over the beneficial

internal (within-regions) adjustment effect.²¹ Controlling for its unemployment persistence effect, flexibility also appears to play an important role in relation to accumulation, again in consistence with the Keynesian view. A tendency for flexibility to reduce unemployment further under episodes of fast accumulation and to increase unemployment by less in episodes of slow accumulation is found, although this tendency is indeed cancelled by the adverse unemployment effect through unemployment persistence, which dominates. Given this, it appears that flexibility is more appropriate in cases of monetary stability and slow accumulation, while labour market rigidity is preferable in more expansionary periods.

Based on these results, it appears that under-investment is a key macroeconomic explanation for the poor unemployment performance of some UK regions.²² Given the high degree of unemployment persistence, which is apparently related to region-specific structural microeconomic characteristics and the weak role of cross-regional adjustments, in order to help improve economic performance in the more vulnerable areas (i.e., the north of England and the other countries of the UK) policy should seek to take measures that will support capital accumulation (both indigenous and inward investment) in these areas. This would appear to be more important than increasing the degree of flexibility in these labour markets, although some elements of flexibility would indeed make accumulation more effective in reducing unemployment.

The overall effect of three of these elements is to raise unemployment. While internal numerical flexibility appears robust in reducing unemployment, all other

²¹ Interestingly, this allows for the possibility that in cross-country analysis, where cross-sectional adjustment are already limited, flexibility can be found to have an overall beneficial effect with regards to unemployment.

²² Under-investment in this context means investment that leads to slower capital accumulation and employment growth compared to population growth. The microeconomic mirror image of this is that migration is substantially below its market-clearing levels.

elements are associated, *ceteris paribus*, to higher unemployment rates. Nevertheless, as was the case with the aggregate index, the direct effect of all elements of employment flexibility is to reduce unemployment and thus the overall adverse effect is largely due to the fact that all elements robustly increase unemployment persistence. Among these elements, external numerical flexibility appears to be most harmful, as it plays an adverse role also with regards to adjustment to productivity shocks, monetary expansion and capital accumulation. All other elements and especially internal numerical flexibility have mostly beneficial effects. Critically, however, internal numerical flexibility appears less effective when combined with other elements of flexibility; instead, combinations of functional and of external elements appear beneficial (reducing unemployment, *ceteris paribus*). A simulation from the results of Table 3 suggests that internal numerical flexibility is most effective in lowering unemployment when it is the only significant flexible arrangement in the labour market – but when other elements of flexibility are widespread the internal numerical element is best to be minimised.

To conclude, the findings of the present analysis point to an important warning: flexibility is not a panacea for economic performance. Flexibility can have positive effects under some contexts, but it will almost certainly increase unemployment in some other contexts. The analysis of the UK regional economies suggests that flexibility is more likely to lower unemployment in labour markets where unemployment is already relatively low and which experience price stability and moderate rates of investment. Nevertheless, further research through similar within- and cross-country studies is clearly needed to confirm the robustness of these results in different contexts before firm policy recommendations can be drawn. Further research could also examine the role of spatial interactions among the regional

or other economies under study, either formally or through the application of spatial econometric techniques. More importantly, it could seek to examine possible nonlinearities in the relationship between flexibility and unemployment (beyond the simple log-linear form assumed here) and how these could be affecting the more detailed effects identified here. Above all, however, future research should attempt to shed light on the black box of the regional and temporal fixed effects that appear to play an important role in enhancing unemployment and unemployment persistence in the country. Presumably, these effects are related to a host of microeconomic factors, including employment compositions, participation rates, geo-demographic conditions (urbanism), production structures (specialisations, firm-sizes), education and skill levels, openness to trade, and the like. In the absence of such analyses, however, a policy implication clearly emerges from the present study: to effectively target unemployment, policy should look at other areas of possible intervention beyond the realm of enhancing labour market flexibility.

APPENDIX

1. Data

All flexibility indicators are derived from individual-level data from the annual Labour Force Survey (1985-1991) and Quarterly Labour Force Survey series (spring wave, 1992-2004). Individual data were aggregated to regional proportions (UK Standard Statistical Regions) and standardised by their maximum sample value. The standardised measures were then aggregated into four composite indexes of flexibility using the linear scale transformation method and finally aggregated again into an index of production function flexibility. Alternative standardisation and aggregation methods produced qualitatively very similar results. All components have been assigned equal weights and no adjustments have been made for business cycle and regional effects (e.g., industrial compositions). Lack of business cycle controls is partly dictated by the need to avoid a definitional correlation between the dependent variable and the flexibility indicators but is also supported by further exploratory analysis suggesting that the measures of flexibility are not directly responsive to regional unemployment rates and, thus, that controlling for the latter could lead to over-adjustment bias. Lack of controls for industrial (and other) compositions differentiates the indicators presented here from similar ones constructed elsewhere (Monastiriotis, 2002) but improves the precision of measurement and avoids sample size problems. The table below presents the variables used and the corresponding questions asked in the LFS survey questionnaires.

Table. Survey-based proxies of production-function flexibility

Index	Variable	LFS question
Internal numerical	Preferred hours	Willing to work longer hours at basic rate (% total empl.)
	Variable hours	Whether working hours tend to vary (% total employment)
	Overtime hours	Share of overtime to normal hours
	Shift working	Whether work on shifts (% total employment)
	Weekend working	Whether work on weekends (% total employment)
	Involuntary part-timing	PT because could not find FT job (% total PT employment)
External numerical	Part-time work	Whether working part-time (% total employment)
	Temporary work	Whether job non-permanent in any way (% total employment)
	Involuntary temping	Temp because could not find permanent job (% total temping)
Internal functional	Within-job occupational mobility	Employees who changed occupation while remaining with the same employer (% of all employees who changed occupation)
External functional	Self-employment	Self-employed (% to sum of dependent and self-employment)

2. Tables

Table A1. Alternative estimation methods of the base model (column 3, Table 1)

	OLS	ABOND	GLS	GLS-i	PCSE
<i>Dependent</i>	<i>ln(U)</i>	<i>D.ln(U)</i>	<i>ln(U)</i>	<i>ln(U)</i>	<i>ln(U)</i>
Lag of log unemployment (persistence)	0.759 (14.90)**	0.728 (28.09)**	0.741 (17.33)**	0.720 (15.65)**	0.720 (8.23)**
Productivity growth	-1.841 (3.65)**	-1.825 (4.96)**	-1.259 (7.69)**	-1.529 (3.90)**	-1.529 (3.34)**
Change in inflation (lagged)	-0.654 (3.70)**	-0.652 (4.57)**	-0.310 (4.37)**	-0.565 (4.15)**	-0.565 (2.41)*
Constant	0.427 (5.02)**	-0.074 (5.05)**	0.795 (6.28)**	0.887 (6.40)**	0.000 (.)
Observations	216	204	216	216	216

Notes: Robust t-statistics in parentheses; * significant at 5%; ** significant at 1%. All models include fixed time and regional effects. OLS simply reproduces the results of column 3 in Table 1. ABOND is the Arellano-Bond estimator for dynamic panels (serial autocorrelation is rejected at 1%). This regression is specified in first-order differences and thus the rhs variables are also expressed in this form. GLS and GLS-i are Feasible Generalised Least Squares estimations (3-stage and iterative, respectively) that allow for 1st-order serial autocorrelation within regions and panel-heteroskedasticity. PCSE is a panel-corrected standard errors OLS estimation that allows for cross-panel autocorrelation and panel-specific heteroskedasticity. All estimations were in STATA.

Table A2. Estimated partial and total unemployment elasticity of flexibility, by interaction parameter (based on columns 2-5 of Table 2)

Impact of flexibility	Percentile values of structural variables					Change of effect (%)
	10%	25%	50%	75%	90%	
Direct effect	-1.800	-1.800	-1.800	-1.800	-1.800	-
Effect via persistence	1.402	1.729	2.105	2.350	2.617	86.62
Total effect	-0.398	-0.071	0.305	0.550	0.817	n/a
Direct effect	0.449	0.449	0.449	0.449	0.449	-
Effect via adjustment (+ve)	-0.466	-0.513	-0.587	-0.714	-0.891	91.04
Total effect	-0.017	-0.064	-0.138	-0.265	-0.442	2503.72
Effect via adjustment (-ve)	0.054	0.058	0.069	0.078	0.085	58.01
Total effect	0.503	0.507	0.518	0.527	0.534	6.20
Direct effect	0.506	0.506	0.506	0.506	0.506	-
Effect via inflation changes	-0.003	-0.001	0.000	0.001	0.003	n/a
Total effect	0.503	0.505	0.506	0.507	0.509	1.36
Direct effect	0.160	0.160	0.160	0.160	0.160	-
Effect via accumulation	0.210	0.243	0.288	0.469	0.594	182.93
Total effect	0.370	0.403	0.448	0.629	0.754	103.84

Note: Direct effects are the estimated flexibility coefficients derived in columns 2-5 of Table 2. Interaction effects are the product between the estimated interaction coefficients of Table 2 and the corresponding percentile values of the distribution of the structural variables (lagged unemployment, positive shock, negative shock, change in inflation and accumulation, respectively). Total effect is the sum of the direct and interaction effects. Read the table as follows: the estimated direct effect of flexibility on log-unemployment (based on column 2 of Table 2) is -1.800 (first row in this Table); the effect via unemployment persistence is 1.402 for regions/years with lagged unemployment close to the 10th percentile of this variable's distribution and 2.617 for cases with lagged unemployment close to the 90th percentile of the distribution. Moving from the 10th to the 90th percentile represents a change in the estimated interaction effect of around 86.62%. The total elasticity of unemployment to flexibility for the median region/year is 0.305.

**Table A3. Estimated total unemployment elasticity for the structural variables
(based on column 6 of Table 2)**

Variable	Percentile value of flexibility					Change of effect (%)
	10%	25%	50%	75%	90%	
Persistence	0.652	0.679	0.722	0.756	0.792	21.63
Adjustment (+ve shocks)	-1.801	-2.234	-2.911	-3.527	-4.145	130.14
Adjustment (-ve shocks)	0.440	0.467	0.510	0.549	0.588	33.89
Changes in inflation	-0.532	-0.532	-0.532	-0.532	-0.532	-0.08
Accumulation	-1.629	-1.647	-1.675	-1.697	-1.722	5.70

Note: The table reads as follows: a 1% increase in lag-unemployment will lead to a 0.652% increase in current unemployment in a region with flexibility levels close to the 10th percentile of the distribution of flexibility and to a 0.792% increase in current unemployment in a region with flexibility levels close to the 90th percentile. This represents a 21.63% change in the estimated total effect as we move from the 10th to the 90th percentile of the flexibility distribution.

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