RECONCILING THE WAGE CURVE AND THE PHILLIPS CURVE

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Abstract. The wage curve is the negative relationship that links wage *levels* to the unemployment rate. It fits accurately with modern non-competitive labour-market models, but goes against a Phillips-curve modelling, because the latter ties wage *growth* to the unemployment rate. In this article, we present a comprehensive review of these non-competitive models, highlighting recent contributions that try to eliminate the possible 'gap' that exists between the concepts of the wage curve, on the one hand, and the Phillips curve, on the other.

Keywords. Involuntary unemployment; Phillips curve; Wage curve

1. Introduction

The wage curve is the term used to describe the negative relationship between the levels of unemployment and wages that arises when these variables are expressed in local terms. According to Blanchflower and Oswald (1994, p. 5), the wage curve summarizes the fact that '*A worker who is employed in an area of high unemployment earns less than an identical individual who works in a region with low joblessness*'.

Blanchflower and Oswald (1994) show the existence of a wage curve for a dozen countries, including Canada, Italy, the UK and the US. They also find that this relationship is rather similar across countries and, thus, can be represented by:

$$w_{ir} = -0.1u_r + other\ terms$$

where w_{ir} is the log of the wage of an individual living in region r, u_r is the log of the regional unemployment rate and the *other terms* are control variables for worker and sector characteristics. Hence, the coefficient -0.1 is the elasticity of wages with respect to unemployment, indicating that, for a given region and a given point in time, a 20% increase in the unemployment rate is associated with a 2% decrease in wages, *caeteris paribus*. According to this specification, the wage

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curve can be represented graphically as a strictly convex negatively sloped curve.[1] This common result for the different countries analysed can be interpreted as a signal that the degree of wage rigidity is almost the same across countries, which contradicts, in a sense, the conclusions of recent theoretical works on the labour market (for instance, Layard *et al.*, 1991). However, as we will try to show in this paper, this 'empirical general rule' of a −0.1 elasticity of wages with respect to unemployment is not as uniform as it might seem. Thus, some recent detailed studies have obtained estimated values for this elasticity that differ significantly across countries.

Empirical evidence on the wage curve might represent a significant contribution to Labour Economics if, as highlighted by Card (1995), this curve represents the new wage-setting curve implied by the most recent labour-market theories. Non-competitive theoretical models of the labour market find a positive relationship between wages and the level of employment, one that differs from the neo-classical labour-supply schedule. The works of Layard and Nickell (1986), Lindbeck and Snower (1989), Layard *et al.* (1991), Lindbeck (1993) and Phelps (1992), (1994) (see Woodford, 1994, for a survey) depict a labour-market diagram in which wages and employment are positively related to each other. Woodford (1992) points out that this new curve has a lower slope than the classical labour-supply schedule, being located at its left. Hence, when confronting the wage-setting curve with the labour-demand schedule, we obtain a 'quasi-equilibrium' characterized by the existence of involuntary unemployment and a level of wages above that which clears markets. This wage-setting curve has a positive slope in the wage/employment space and will have its counterpart in the wage/unemployment space characterized by a negative slope. In this way, the wage curve might constitute indirect empirical evidence of the wage-setting schedule and would not only show the response of wages to the rate of unemployment, but also helps to explain the existence of equilibrium unemployment.

At the same time as pointing to the great importance of the wage curve, we must also note that it presents, at least, two difficulties. First, a negative relationship between wages and regional rates of unemployment seems to contradict the compensating differentials theory. According to this, in a context of free mobility, people will live in a less attractive region only if they receive a compensation for doing so. In the case of the labour market, this means that a worker will remain in a place with a higher rate of unemployment only if he/she is 'compensated' with a higher wage. This theory, first stated by Smith, (1976, Book I, Chapter 10), was formalized by Harris and Todaro (1970) and empirically supported for the US by several studies carried out during the 1970s and 1980s (see, for instance, Hall, 1970, 1972; Marston, 1985, among others). However, since the late 1980s, most studies have customarily found empirical evidence in favour of a negative relationship between wages and the rate of unemployment (see Chapter 2 of Blanchflower and Oswald, 1994 for a review).

This contradictory result has led some authors to take into account the possibility of a different behaviour among agents, depending on the time interval being considered. Thus, Blackaby and Manning (1992) and Blanchard and Katz (1992), using dynamic models, find that a positive relationship between wages and the rate of unemployment (as predicted by the compensating differentials theory) is satisfied in the long term, whereas the negative relationship (represented by the wage curve) is valid in the short term. The study by Blanchflower and Oswald (1994) supports this fact. When using temporary data (annual values) for wages and rates of unemployment and including regional fixed effects in the regression equation, the relationship between both variables tends to be negative, which indicates the existence of a wage curve. In turn, when permanent values (computed as the mean of all values in the period) of the unemployment rate are taken instead of the fixed regional effects, the relationship between both variables is positive. The explanation for this different pattern of behaviour lies in the fact as to whether or not migration is considered as costless. After a shock, it is likely that, in the short run, the benefits of migrating are smaller than the costs, especially when it is not known whether the shock is transitory or permanent. As the period widens and the uncertainty about the effects of the shocks reduces, the benefits from migration may become larger than the costs, and then migration occurs. Therefore, this view provides support for the existence of a positive long-term relationship between the permanent values of wages and unemployment rates, which may be affected by transitory shocks, generating a negative relationship in the short term.

The second difficulty arises from the static character of the wage curve. The changes experienced by the local rate of unemployment translate fully into real wages in only 1 year. When relating the level of wages to current rates of unemployment, Blanchflower and Oswald (1994) find the negative relationship known as the wage curve. When they also include lagged wages as an additional independent variable, the autoregressive coefficient is not statistically significant. This result is considered as indicating that the Phillips (1958) curve is no longer valid. Nevertheless, a unanimous conclusion about this aspect has not been reached by subsequent literature, as we discuss below. One branch of research has produced evidence confirming the existence of a wage curve using microdata, according to the predictions of modern non-competitive theories of the labour market and, thus, in favour of the wage curve. Other authors have proved that aggregate data of the US economy provide empirical evidence in support of the Phillips curve. Finally, the most recent and successful works seem to analyse the question from an eclectic point of view, using a dynamic specification of the relationship between wages and unemployment. This constitutes an intermediate position between the wage curve and the Phillips curve in which both possibilities are nested, in such a way that, from this perspective, they can be viewed as extreme cases.

Against this background, the aim of this paper is twofold: first, to present a systematic approach to what recent findings on the wage curve imply when studying the relationship between wages and unemployment; second, to offer a survey on the literature that has followed the appearance of the wage curve and, in particular, the efforts to relate this concept and the Phillips curve. We believe that this paper is a good complement to the recent article by Nijkamp and Poot

(2005). While the latter authors synthesize the wage-curve literature taking a quantitative approach by means of meta-analysis techniques, our work is more narrative in nature and, in addition, presents a comprehensive review of the 'wage curve versus the Phillips curve' issue. The paper is structured as follows. Section 2 briefly introduces the theoretical models that justify the existence of a wage curve. Section 3 analyses the relevant empirical evidence about the wage curve, focusing on the estimation procedure habitually applied and the associated technical problems. The 'gap' that might exist between the wage curve and the Phillips curve is considered in Section 4, where emphasis is placed on the recent findings that try to reconcile both hypotheses. Section 5 closes the paper with a review of the main conclusions.

2. The Wage Curve. Theoretical Framework

The wage curve can be theoretically justified by various representative models of the labour market, save for the competitive model. Blanchflower and Oswald (1995) provide two reasons for the inadequacy of the competitive framework. First, the existence of unemployment in the classical model arises as a consequence of labour-supply excess generated by higher wages than those that clear markets. In this context, unemployment will decrease only when wages fall to reach the equilibrium level. Thus, the relationship between both variables is positive, in contrast with the idea of a wage curve.

The second reason is based on the interpretation that the level of unemployment in an economy is computed as the difference between the size of the labour force and the population that effectively works (determined by the intersection between labour supply and labour demand). Under these circumstances, the negative relationship between wages and unemployment predicted by the wage curve is represented by the aggregate supply curve. As pointed out by Blanchflower and Oswald (1995), this reasoning is not accurate for two reasons. First, the level of unemployment computed is the voluntary unemployment, that is, composed by people who do not actually enter the labour supply, given that they are not willing to work at the given wage. Thus, official employment statistics do not include them as unemployed, but rather as non-active population. Second, the wage curve does not represent the labour-supply curve in the wage/unemployment space. Instead, as these authors show, it represents the wage-setting curve. Accepting then that the competitive model cannot generate a wage curve, we turn our attention to non-competitive theories of the labour market. In what follows we consider a number of them, highlighting those which enjoy the highest degree of consensus in the literature.

First, bargaining models, where the existence of frictions (hiring and firing costs) in the labour market is the source of agents' negotiation power, leading to a sharing of the income generated between employers and employees (see Creedy and McDonald, 1991, for a synthesis of these models). In regions with a high rate of unemployment, the workers' bargaining power is restricted, because there are fewer outside opportunities for a job, resulting in lower negotiated wages. From an alternative viewpoint, this theory allows for the possibility that unions care not only about their members' wages, but also about reducing the number of unemployed workers, which would also lead to lower wages. A negative relationship between wages and the rate of unemployment in a region is established under both interpretations. In this context, the models proposed by De Menil (1971), Carlin and Soskice (1990) and Lindbeck (1993), within a Nash-bargaining procedure, are usually advocated (see Blanchflower and Oswald, 1994). The bargaining view combined with a matching process is studied in Mortensen and Pissarides (1994). A model of Insiders–Outsiders (Lindbeck and Snower, 1989) may also generate a wage-curve relationship.

In models starting from the efficiency wage hypothesis (e.g. Shapiro and Stiglitz, 1984), unemployment acts as a mechanism that prevents workers from shirking when the cost of monitoring is too high for the employer. In regions with high unemployment rates, wages can be lower, because incentives to shirk are reduced by the lower probability of finding a job if detected and fired. By contrast, in places where unemployment is low, incentives to shirk are higher, given the higher probability of finding a new job. Other efficiency wage schemes, following the effort/discipline approach, are derived from Solow (1979) and Ramaswamy and Rowthorn (1991), such as, for example, Amadeo and Camargo (1997), Buettner (1999) and Bellmann and Blien (2001). Another view of the efficiency wage hypothesis is shown in a model of wage aspirations or 'fairness' (Akerlof and Yellen, 1990; Agell and Lundborg, 1995).

In recent years, some alternative views have gained acceptance in providing theoretical support to the wage curve, with the efficiency wage modelling of the endogenous labour turnover being the most prominent. In this line, Campbell and Orszag (1998) generalize the specification proposed by Phelps (1994) in a dynamic context.[2] Also, the existence of monopsonistic competition in labour markets predicts the inverse relationship between wages and unemployment (Bhaskar and To, 1999; Manning, 2003), which may be reinforced by agglomeration effects (Sato, 2000). Currently, the geographical aspects of unemployment have become an important issue when trying to explain wage curves and their spatial dimension. From this viewpoint, local labour markets should no longer be considered as unconnected 'islands' in a national economy, but must be put in relation to each of the other neighbouring regions. Thus, while in García and Montuenga (2003) and Suedekum (2005), the existence of a wage curve is related with the increasing dispersion in unemployment rates across regions, the geographical aspects are taken into account by means of spatial autocorrelation in Elhorst *et al.* (2002), Iara and Traistaru (2004) and Longhi *et al.* (2004).

Summarizing, only non-competitive models of the labour market yield a wage curve in which involuntary unemployment arises as a consequence of the fact that the prevailing wage is higher than the one which clears markets. Although they differ in the theoretical background, all these models have a basic common feature (see Blanchard and Katz, 1997, p. 54), expressed by the fact that the tighter a market is (the lower the unemployment rate), the greater will be the real wage, given the reservation wage. It can be represented (see also Bell *et al.*, 2002) by

$$w/p = Rh(u, Z_s) \text{ with } h_u < 0 \quad (1)$$

where w/p stands for the real wage, R is the reservation wage, u is the rate of unemployment and Z_s stands for all the other supply factors that influence the wage-setting process. This negative relationship provides a theoretical support to the wage curve, with the relationship turning positive when we consider wages and employment, reflecting the idea of a wage-setting curve. Equation (1) includes the equilibrium combinations from the optimization problem of all the agents that take part in the wage-setting process. At the same time, such a relationship differs from the classical labour supply generated by the aggregation of individual labour-supply curves. Having considered the theoretical framework on which the wage curve relies, in the next section, we will discuss the estimation process and the existing empirical evidence.

3. The Wage Curve. Estimation and Empirical Evidence

In this section, we will show how the wage curve can be estimated. To that end, we adopt the reasoning followed in Blanchflower and Oswald (1994) for the US, which is the same as they apply to the rest of the countries analysed (the UK, Canada, West Germany, Italy, the Netherlands, Switzerland, Norway, Austria, Ireland, Australia and South Korea) and the one generally followed by subsequent studies. We will then describe several technical and econometric aspects to be taken into account when estimating the wage curve. Finally, we will present the evidence on new wage curves for different countries.

3.1 *The Estimation of a Wage Curve*

The wage-curve hypothesis is based on including local unemployment rates in the typical wage equation by Mincer (1974). Blanchflower and Oswald (1994) conjecture that wages earned by a worker are negatively influenced by the unemployment rate at his job place. Hence, the local unemployment rate can be defined in a regional, state, sector or even industrial context. The more precise the context in which the wage setting takes place, the more consistent will be the evidence on the negative relationship between wages and unemployment. The authors use data collected by the US Current Population Survey (CPS) corresponding to the month of March of each year during the period 1964–1991. These data supply information about individual details, yearly earnings and state unemployment rates. March was chosen, because in this month individuals know their yearly earnings, given that this is when they have to file their tax return.

Blanchflower and Oswald (1994) estimate typical wage equations, adding the state unemployment rate:

$$w_{irt} = a + bX_{irt} + \beta u_{rt} + \varepsilon_{irt} \quad (2)$$

where the subindex i denotes the individual, r the region (state) and t the year. X_{irt} is a vector of workers' personal aspects including, among others, race, marital status, gender, level of education, as well as other variables related to the specific job place, such as working experience, type of contract, occupation, activity, etc. Finally, w_{irt} and u_{rt} stand, respectively, for the yearly earnings and the regional unemployment rate (both in logs). The authors work with data for 50 states from 1964 to 1991 and estimate considering a pool for all the observations. They include fixed-time effects in (2) to take into account the influence of variables such as productivity or the level of prices, which are supposed to be time varying but constant across states (a point that has been criticized in later studies). Additionally, fixed regional effects are included to capture each state's structural features. These fixed regional effects constitute the key element of the wage curve, because, by reflecting permanent features of the environment, the unemployment rate is basically affected by the transitory aspects of the relationship between wages and unemployment. It is, indeed, the fixed regional effects that assign the attribute of wage curve (negative relationship between current values of wages and unemployment) to the compensating differentials theory (positive relationship between permanent values of wages and unemployment).

Including both effects gives us the following equation:

$$w_{irt} = a + f_r + d_t + bX_{irt} + \beta u_{rt} + \varepsilon_{irt} \quad (3)$$

where f_r and d_t are, respectively, the fixed regional and time effects. Our focus is on the coefficient β. A wage curve exists when the estimate of β is negative and statistically significant. The existence of a wage curve implies that wages fall when unemployment rises in a region, other things being equal. The log specification of the unemployment rate is the result of a model selection analysis carried out in a previous work (Blanchflower and Oswald, 1990 and reported in Blanchflower and Oswald, 1994). The estimate of the coefficient β is -0.1 in most of the cases. This result was obtained for the US, but applies for almost all the countries analysed (a summarized review of the coefficients estimates can be found in Blanchflower and Oswald, 1995), which has led to the value -0.1 being considered as an almost 'empirical general law'. Additionally, Blanchflower and Oswald (1994) interpret the value of the coefficient β as a measure of the degree of wage flexibility. The greater the value of β, the greater the response of wages to unemployment-rate fluctuations, and hence, a higher wage flexibility (or lower wage rigidity).[3]

3.2 *Some Comments on Estimating the Wage Curve*

Having considered the standard estimation process of the wage curve, it is appropriate to draw attention to some of the comments and criticisms it has provoked (see Blanchflower and Oswald, 1995; Card, 1995 for detailed comments).

The first point is to confirm that the wage curve actually reflects the wage-setting schedule and not the neo-classical aggregate labour-supply curve. Given that both have a positive slope in the wages/employment diagram, one has to be sure of the meaning of the wage curve.[4] Blanchflower and Oswald (1994) include representative variables of the labour-market conditions which reflect the labour supply rather than the unemployment rate, such as the ratio of employed to total population. If these variables are statistically significant and explain more than the unemployment rate, then the wage curve will represent the aggregate labour-supply curve. When carrying out this exercise, the added variables are not, however, found to be significant, but, because the unemployment rate remains significant, this confirms that the wage-setting curve is, in fact, the wage curve.

The second point is that, in the estimation of equation (3), it has to be noted that the level of wages might also have an influence on the unemployment level, and therefore an endogeneity bias may appear. Blanchflower and Oswald (1994) find that, for the US, the unemployment rate behaves as a predetermined variable, in such a way that the bias is not present. By contrast, Baltagi and Blien (1998) find that, in the case of Germany, the bias can be important. In this latter case, as is commonly known, the estimation should be carried out using instrumental variables.

A third point is that in equation (3), the dependent variable is expressed in individual terms, whereas the unemployment rate is expressed in aggregate (sector or regional) terms. This can lead to the possibility of errors in the individual regressions belonging to the same group being correlated. The reason is that individuals may, in addition to the same regional or sector unemployment rate, have certain unobservable features in common, which are not captured by individual or labour characteristics. Thus, even low correlation levels may cause the standard deviation of errors to be underestimated, which leads us to spuriously accept the level of significance of the aggregate variable (the unemployment rate). This bias is known as the 'common group effect' (Moulton, 1986, 1990). To eliminate this intragroup correlation, individual variables are aggregated to construct the regional or sector values ('cell-means estimation'), which are used to estimate the following equation (see Blanchflower and Oswald, 1994; Baltagi and Blien, 1998; Baltagi *et al.*, 2000; Kennedy and Borland, 2000):

$$w_{rt} = a + f_r + d_t + bX_{rt} + \beta u_{rt} + \varepsilon_r \tag{3'}$$

However, this simple method may lead to non-accurate coefficient estimates (Card, 1995, p. 795). For this reason, Bell (1996), Nickell and Bell (1996), Blanchard and Katz (1997) and Canziani (1997), among others, follow an alternative two-stage procedure described in Solon *et al.* (1994) and Card (1995). In the first stage, the regression equation (2) is estimated by including dummy variables that pick up the relationship between the fixed regional effects and the fixed yearly effects and by excluding the unemployment rate. With the estimates of these parameters, a regression on the fixed yearly effects, the fixed regional effects and the local unemployment rate is carried out. Thus, although the coefficients of individual variables are estimated with microdata, the second stage yields standard deviations that fully capture the correlation between individuals in the same group.

Another inconvenience arises when estimating the wage curve with pool data, in that some of the existing distinctions between different population groups cannot be collected by directly observable variables (e.g. the motivation of the worker). If we estimate with grouped cross-section data, the unobservable heterogeneity is not controlled for, and a composition bias is generated (Card, 1995). If it is the case that we have information on the same individual for a lot of periods, the composition bias may even hide the movement of the real wage along the cycle, as described in Solon *et al.* (1994). As a consequence, Bratsberg and Turunen (1996) and Baltagi and Blien (1998) suggest the need to include individual effects in the estimation. Their inclusion also helps to control for the group-effect bias, and hence, when panel data are available, it becomes a good tool to alleviate both such biases (Turunen, 1998; Montuenga *et al.*, 2003).

The probably unlike response of different population groups to unemployment-rate fluctuations may be reflected by different elasticities in the wage curve. Blanchflower and Oswald (1994) and Card (1995) suggest the estimation of different wage curves for the diverse population groups to assess such a possibility. The procedure would be identical to the one described above, with the difference being that the estimated equation is applied separately to each population group (the young, adults, men, women, whites, nonwhites, skilled, etc.). Intuitively, the payment will be more flexible, the weaker the bargaining power of each group. In this sense, a higher coefficient β, in absolute value, is expected when a specific wage curve is estimated for women, the young, non-whites, low-skilled workers, non-unionized workers, part-time workers, etc.[5] Most of the results obtained confirm such a hypothesis, that is, the risk of unemployment does vary across groups of individuals.

An additional problem exists when using earnings as a measure of payment, given that an increase in these can be due to a higher wage, as well as to a higher number of hours worked. In view of the fact that working more hours is negatively correlated with the local unemployment rate, the estimate of the interest parameter will be upwardly biased in absolute value (Card, 1995, p. 791). Bratsberg and Turunen (1996) suggest that the most accurate measure for payment would be the direct information of wage per hour, because the computation from more aggregate data could lead to measurement errors. However, a further problem arises in the definition of the hourly wage, because, in most of the cases, statistics of wages are expressed in a composite way that includes standard wages and premium rates. Consequently, wages can respond to unemployment through changes in standard rates, overtime rates or the proportion of overtime to total hours (see Hart, 2003b). This has an important influence when measuring the wage–unemployment elasticity, as Black and FitzRoy (2000) and Hart (2003a) have highlighted. Given that overtime is typically remunerated at a premium rate, a change in the proportion of overtime to total hours will cause average hourly earnings to change even if hourly standard rates of pay remain constant. Thus, average hourly earnings might not be good proxies for studying the relationship between wages and unemployment. The marginal cost of labour that is independent of hours worked is the standard hourly wage that is paid for the working period. Data sets providing separate information for standard and overtime rates would ideally help to distinguish between the hours–unemployment and the wage–unemployment elasticities.

Furthermore, Blanchflower and Oswald (1994) consider that the impact of prices and productivity on wages will be reflected by the fixed-time effects, because they assume that both variables are constant across states. By contrast, Blackaby *et al.* (1991) point out that regional prices must be taken into account to compute real wages when using cross-sectional data. Also, Bell (1996) shows that US wages may exhibit different trends across states, bearing in mind the different evolution of prices or productivity. Generally speaking, it would be convenient to evaluate the influence that regional prices and productivity might have on individual wages (Blanchard and Katz, 1997). However, spatial variation in prices has been widely ignored by most estimates of the wage curve and has been considered only in recent contributions, for instance, in Montuenga *et al.* (2003), where individual wages are deflated by the corresponding regional price index.

In concluding, we present two final considerations. First, given that the unemployment rate does not change across individuals, the true number of degrees of freedom of the estimation is not the number of individual observations, but rather the product of the number of regional markets and the number of time periods. To overcome this problem, measures of the unemployment rates disaggregated by the characteristics of the workers (gender, age, education level) are commonly used (Canziani, 1997; Kennedy and Borland, 2000; Montuenga *et al.*, 2003). Second, if the theoretical model underlying the wage curve is the negotiation model and a variable for the firm profits or the firm sector in the region profits is not included in (3), there might be a problem with omitted variables (Blanchflower *et al.*, 1996).

3.3 *International Wage Curves*

Let us now briefly review the literature that deals with estimating the wage curve in different countries. Blanchflower and Oswald (1994) is the most comprehensive and well-known work; it is not the first dedicated to the subject of the wage curve. At the end of the 1980s, several works (Freeman, 1988; Blackaby and Manning, 1990, among others) had already found a negative relationship between wages and unemployment using microdata, although no label was used to identify such a relationship. A negative relationship between the level of wages and the level of unemployment (and between their growth rates) was also derived from a time-series perspective when measuring the cyclicality of real wages (see Bils, 1985; Solon *et al.*, 1994). To the best of our knowledge, it is in Blanchflower and Oswald (1990) where the term 'wage curve' is used for the first time. Shortly thereafter, two early works estimated the wage curve for the Netherlands (Groot *et al.*, 1992) and for Germany (Wagner, 1994). However, the literature on the wage curve increased notably following Blanchflower and Oswald (1994). Some countries have been comprehensively studied, such as Germany (Wagner, 1994; Baltagi and Blien, 1998; Buettner, 1999; Pannenberg and Schwarze, 2000; Bellmann and Blien, 2001), the Nordic countries (Wulfsberg, 1997; Johansen, 1999; Albaek *et al.*, 2000; Barth *et al.*, 2002; see Dyrstad and Johansen, 2000, for a summary) and, most recently, the UK (Black and FitzRoy, 2000; Collier, 2000;

Cameron and Muellbauer, 2001; Bell *et al*., 2002; Hart, 2003a,b). Some evidence has been presented for other OECD countries, such as Austria, Italy, Spain, Australia, New Zealand and Belgium, as summarized in Table 1. Estimates of the wage curve for Canada, Japan and South Korea are reviewed in Blanchflower and Oswald (1994).

In the case of the US, the empirical evidence is even greater, given the richness of the statistical sources. Thus, Blanchflower and Oswald (1994) and Card (1995) use the CPS, Bell (1996) and Blanchard and Katz (1997) the merged Outgoing Rotation Group (ORG) in the CPS, Bratsberg and Turunen (1996) and Turunen (1998) the National Longitudinal Survey of Youth (NLSY) and Partridge and Rickman (1997) aggregates for 48 contiguous states and 20 years (1972–1991) from different sources. In the US, the estimation of the wage curve is habitually embraced in the controversy between it and the Phillips curve, as will be discussed in Section 4.

A general result emerges from most of these studies, namely, the approximately −0.1 elasticity of wages to unemployment. However, some evidence seems to go against this commonly held view. Albaek *et al*. (2000) show that no wage curve exists for five Nordic countries (Denmark, Finland, Iceland, Norway and Sweden). A similar result is obtained by Brunstad and Dyrstad (1997) for Norway and Partridge and Rickman (1997) for the US. Using a homogenous data set, Montuenga *et al*. (2003) prove that the elasticity varies across some European Union countries, ranging from a value of about −0.20 in the UK and France through to −0.05 in Portugal, with Spain and Italy in the medium range.

The disparity increases when developing countries are investigated. The studies for the Ivory Coast (Hoddinot, 1996), Brazil (Amadeo and Camargo, 1997), South Africa (Kingdon and Knight, 2001), Argentina (Galiani, 1999), Turkey (Ilkkaracan and Selim, 2002), Chile (Berg and Contreras, 2004) and some EU accesion countries (Iara and Traistaru, 2004) find evidence in favour of a wage curve with a similar behaviour to those of the OECD countries and an estimate for β around −0.1. By contrast, in the cases of China (Sabin, 1999) and Taiwan (van der Meulen Rodgers and Nataraj, 1999), the theory of compensating differentials seems to hold in the short term. Blanchflower (2001) presents evidence in favour of the wage curve in nine (of 11) of the analysed countries from Eastern Europe.[6] While there is significant variability in the results, it should be noted that they might be strongly influenced by the rapid increase in the unemployment rates experienced by these countries following the German reunification and the fall of the Berlin Wall. Svejnar (1999) and Iara and Traistaru (2004) survey some results for Central European and Baltic developing countries.

It should be noted that the bulk of the evidence presented above is difficult to compare directly. First, data statistics are specific to each country. Even when analysing the same country, data sources may be different. Second, some of the econometric problems discussed in subsection 3.2 are not dealt with properly in the literature. For example, the common-group bias is not controlled for when data from cross-sectional one period are used, as in Groot *et al*. (1992), Wagner (1994) and Winter-Ebmer (1996). Furthermore, applying different methods to

Table 1. The Estimated Value of Unemployment Coefficient

Author	Country	Data base	Period	Dependent variable	Method	Estimation	Reference
Groot *et al.* (1992)	Holland	OSA	1985–1988	Net weekly pay	Several cross sections	−0.09†	Table 2
Wagner (1994)	Germany	BIBB	1979–1985	Gross monthly earnings	Pooled cross section	−0.13 (0.05)	Table 1
Blanchflower and Oswald (1994)*	US	March CPS	1963–1990	Annual earnings	Pooled cross section	−0.10 (0.00)	Table 4.5
	UK	GHS	1973–1990	Monthly earnings	Pooled cross section	−0.08 (0.01)	Table 6.14
	Canada	SCF	1972–1987	Gross annual earnings	Pooled cross section	−0.09 (0.01)	Table 8.3
	Italy	ISSP	1986–1989	Gross monthly earnings	Pooled cross section	−0.12 (0.06)	Table 7.11
	Germany	ISSP	1986–1991	Gross monthly earnings	Pooled cross section	−0.13 (0.07)	Table 7.5
Card (1995)	US	March CPS	1979–1991	Adjusted hourly earnings	Pooled cross section + 2 steps	−0.08 (0.02)	Table 3
Bratsberg and Turunen (1996)	US	NYLS	1979–1993	Hourly wages	Regional panel data	−0.06 (0.01)	Table 2 (column 3)
Winter-Ebmer (1996)	Austria	Austrian Mikrozensus	1983	Hourly wages	Cross section	−0.03 (0.01)	Table 2 (column 11)
Bell (1996)	US	CPS ORG	1980–1991	Adjusted hourly wage	Pooled cross section + 2 steps + regional trends	−0.064†	Table 6 (column 3)
Blanchard and Katz (1997)	US	March CPS	1980–1991	Annual earnings	Pooled cross section + 2 steps	−0.083†	Table 2 (column 6)
	US	ORG CPS	1980–1991	Hourly earnings	Pooled cross section + 2 steps	−0.460†	Table 2 (column 3)
Partridge and Rickman (1997)	US	Regional statistics	1972–1991	Average annual earnings	Pooled cross section	0.00 (0.00)	Table 1 (column 4)
Canziani (1997)	Italy	Bank of Italy	1989–1993	Adjusted yearly wages	Pooled cross section + 2 steps	−0.06 (0.00)	Table 3 (column 1)
	Spain	ECBC	1991	Adjusted yearly wages	Pooled cross section + 2 steps	−0.13 (0.04)	Table 7 (column 1)
Turunen (1998)	US	NLSY	1979–1992	Hourly wage	Regional panel data	−0.07 (0.01)	Table 2 (column 3)
Baltagi and Blien (1998)	West Germany	IAB	1981–1990	Monthly earnings	Regional panel data + IV + cell means	−0.07 (0.01)	Table 1 (row 7)
Janssens and Konings (1998)	Belgium	UFSIA	1985–1992	Net monthly labour income	Individual panel data	−0.04 (0.02)	Table 2 (column 1)

Pannenberg and Schwarze (1998)	East Germany	GSOEP	1992–1994	Hourly wages	Individual panel data	−0.53 (0.20)	Table 2 (column 5)
Albaek *et al*. (2000)	Denmark	Statistics Denmark	1980–1991	Hourly wages	Regional panel data	−0.00 (0.01)	Table 2
	Finland	Statistics Finland	1989–1993	Hourly wages	Regional panel data	0.02 (0.02)	Table 2
	Iceland	Labour Force Survey	1992–1996	Hourly wages	Regional panel data	−0.01 (0.01)	Table 2
	Norway	Statistics Norway	1989–1993	Hourly wages	Regional panel data	0.00 (0.02)	Table 2
	Sweden	LNU	1981/1991	Hourly wages	Regional panel data	0.03 (0.03)	Table 2
Baltagi *et al*. (2000)	East Germany	IAB	1993–1998	Monthly income	Regional panel data + IV + cell means	−0.15 (0.03)	Table 1
Kennedy and Borland (2000)	Australia	IDS	1982–1994	Weekly earnings	Pooled cross sections (cell means)	−0.07 (0.02)	Table 5 (row 1)
	US	CPS	1963–1987	Annual earnings	Pooled cross sections	−0.10 (0.00)	Table 8 (row 1)
	UK	GHS	1973–1990	Monthly earnings	Pooled cross sections	−0.08 (0.01)	Table 8 (row 2)
Black and FitzRoy (2000)	UK	NES	1979–1995	'Standard' hourly wages	Dynamic panel data	−0.04†	Table 5
Bell *et al*. (2002)	UK	NES	1976–1997	'Standard' hourly wages	Individual panel data + 2 steps + regional trends	−0.05†	Table 2 (column 3)
Barth *et al*. (2002)	US	ORG CPS	1983–2000	Hourly wages	Pooled cross sections	−0.12†	Table 3
	UK	BHPS	1991–1997	Hourly wages	Pooled cross sections	−0.10†	Table 3
	Norway	Statistics Norway	1991–1997	Hourly wages	Pooled cross sections	−0.03†	Table 3
Papps (2002)	New Zealand	NZCPD	1986–1996	Hourly wages	Pooled cross sections	-0.13 (0.01)	Table 2 (column 2)
Montuenga *et al*. (2003)	France	ECHP	1994–1996	Hourly wages	Individual panel data + IV	-0.21 (0.02)	Table 1
	Italy	ECHP	1994–1996	Hourly wages	Individual panel data + IV	-0.07 (0.01)	Table 1
	Portugal	ECHP	1994–1996	Hourly wages	Individual panel data + IV	-0.05 (0.01)	Table 1
	Spain	ECHP	1994–1996	Hourly wages	Individual panel data + IV	-0.13 (0.02)	Table 1

*The results for the other seven countries can be seen in Blanchflower and Oswald (1994 and 1995). For studies on the Eastern European case, see Svejnar (1999), Blanchflower (2001) and Iara and Traistaru (2004).
†Stands for the unemployment elasticity.
Notes: Absolute standard deviations between parentheses. All the studies presented are based on individual data for OECD countries.

minimize this effect (the cell-mean estimation, the two-step procedure, etc.) may lead to different estimates of the unemployment coefficient (see Card, 1995; García and Montuenga, 2003). Similarly, very little attention has been paid to the description and choice of the wage measure. Although the hourly wage is the variable typically used in the estimation of wage curves, only in Black and FitzRoy (2000), Bell *et al.* (2002) and Hart (2003a,b) is the standard hourly wage (excluding overtime) explicitly defined.

Summarizing, two main conclusions can be drawn from the analysis presented in this section. First, that there is a considerable body of evidence supporting the existence of a wage-curve relationship in a multitude of countries. Second, that the estimated elasticity varies in a wide range, from almost null (in the Nordic countries) to −0.50 (in some Eastern European countries), which challenges the hypothesized uniformity across countries obtained in earlier studies. A particularly appealing way to summarize all the information provided in the different studies that have estimated a wage curve is the meta-analysis approach. Nijkamp and Poot (2005), using this methodology, find that an overall elasticity of −0.07 synthetizes the full estimates about a wage curve in different countries.

In the next section, we will consider the problem of the incompatibility that may arise between the wage curve, obtained with microdata, and the Phillips curve, based on aggregate data. In particular, we will analyse whether or not the wage adjustment takes place in just one period, as predicted by the wage curve. In principle, there are several reasons to believe that the relationship between wages and unemployment is not static, but rather dynamic in nature. That is, there is no instantaneous adjustment of the wage level to shocks, which take some time to be absorbed.

4. The Wage Curve and the Phillips Curve

In this section, we will first compare the microeconometric-based wage curve with the macroeconometric-estimated Phillips curve, quickly reviewing the large body of evidence supporting both views (especially in the US case). We will then offer an analysis that aims to reconcile them. The section concludes by presenting a rather extended belief that the relationship between wages and unemployment lies in the medium between both extreme cases: the null wage persistence sustained by the wage curve and the total wage persistence claimed by the Phillips curve.

The idea of a wage curve in microeconomic terms can be opposed to the existence of a Phillips curve in aggregate terms. The reason is clear. The wage curve is a negative relationship between the wage *level* and the unemployment rate, whereas the Phillips curve captures the negative relationship between the *growth* of wages (wage inflation) and the unemployment rate. There are a number of other differences. The wage curve is obtained from disaggregated data of longitudinal household or individual surveys, whereas the Phillips curve is estimated with macroeconomic unemployment and wage-inflation data. A further difference lies in the economic meaning of each concept. The wage curve represents a *locus* of equilibrium points, the wage/unemployment-rate pairs that arise from the optimizing behaviour of economic agents in non-competitive models of the labour market. By contrast, the Phillips curve is a set of disequilibrium points that represent the adjustment process in a competitive model of the labour market.

To evaluate the validity of a Phillips curve using microeconomic data, a simple procedure consists of adding, as a regressor, the lagged log of nominal wages to (3), which gives

$$w_{irt} = a + \rho w_{irt-1} + f_r + r_t + bX_{ijrt} + \beta u_{rt} + \varepsilon_{ijrt} \quad (4)$$

With the estimate of the parameter ρ, the hypothesis of a Phillips curve can be tested in a straightforward manner. If its value is not significantly different from one, the null hypothesis cannot be rejected, whereas if its value is close to zero, then we would accept the alternative hypothesis of a wage curve. Blanchflower and Oswald (1994) obtain that, for the US and the UK, the estimate of ρ is not significant (the maximum value they obtain in their estimations is 0.29). This result suggests that wages adjust rapidly to the unemployment rate, which constitutes the starting point to claim the death of the Phillips curve. However, such a conclusion runs against the evidence shown by the aggregate studies for the case of the US, always favourable to the Phillips curve (see King and Watson, 1994; Roberts, 1995, 1997a for instance). Although the macroevidence for the US in the late 1990s led various researchers concerned with the estimation of the natural unemployment rate to criticize the existence of a Phillips curve (see Coen *et al.*, 1999, for a summary), some others argued that the Phillips curve had temporarily shifted inwards by fortuitous supply shocks and labour-market developments (Gordon, 1998; Katz and Krueger, 1999). More recently, the studies by Ball and Moffitt (2002) and Staiger *et al.* (2002) support the validity of the Phillips curve for the US in this period when univariate trends of unemployment rate and productivity growth are incorporated.

As a consequence, this contradictory evidence has prompted a significant growth in the literature devoted to a profound analysis of wage persistence. For example, Blanchard and Katz (1997), among others, have found that, using microdata for the US, the autoregressive coefficient in (4) is above 0.90, that is, nearly one. The first part of this section surveys some of the literature aiming at discriminating between a wage and a Phillips curve on the basis of an equation such as (4).

4.1 *Wage Curve or Phillips Curve?*

Focussing on the US case, and in contrast to the null autocorrelation found by Blanchflower and Oswald (1994) using CPS March data, Bell (1996) and Blanchard and Katz (1997) obtain estimates of ρ above 0.90 with data from the merged ORG in the CPS.[7] Is this difference only due to the difference in data sources, or are there additional economic explanations? Bearing this in mind, which result better fits the reality, $\rho = 0$ *or* $\rho = 1$? And, possibly a more relevant question, is it really important to determine whether ρ is closer to zero or one? We shall try to briefly answer the latter question now and leave the other two issues for later.

We start by noting that economic theory gives little help in deciding sensible values for ρ. Thus, a value of zero is consistent with the formulation of efficiency wages by Shapiro and Stiglitz (1984). By contrast, 'aspiration' or 'fair' wages justify a partial or even total (depending on the degree in rent sharing) autocorrelation in wages. Against this background, discriminating whether ρ is closer to either zero or one is relevant for the following reasons. First, to determine the dynamic effects, if such exist, of demand and supply wage variables on the natural rate of unemployment (NAIRU) (see Blanchard and Katz, 1999; Bårdsen and Nymoen, 2003). Second, it may help to ascertain the exact nature of the reservation wage and the dependence (again, if it exists) of current wages on lagged wages (Blanchard and Katz, 1997; Ball and Moffitt, 2002). Third, to provide an empirical guide for policy modellers to appraise the effects of shocks on the price inflation and on the inflation-unemployment trade-off (Fares, 2002). If unemployment is related to wage changes (Phillips curve), supply shocks will only temporarily affect price inflation, whereas if unemployment is linked to wage levels, then such shocks will continue to impact wage bargaining and price inflation in later periods.

Let us now analyse the value of ρ for the case of the US. The CPS microdata used by Blanchflower and Oswald (1994) yields an estimated value for ρ which is non-significant. The authors argue that the possibility of strongly autocorrelated unobservables that affect wages when using aggregate data may spuriously bias the effects of lagged wages on current wages. Consequently, '*the apparent autoregression in macro pay levels may be the result of aggregate error or measurement error or specification error or all three*' (p. 284), and then the use of microdata is considered as most appropriate.

A first evaluation of the results obtained by Blanchflower and Oswald (1994) can be found in Card (1995, p. 795) who, although not carrying out an empirical exercise, suspects that the reports on the death of the Phillips curve are still premature, because it is first necessary to obtain more empirical evidence on the dynamic relationship between wages and unemployment. Furthermore, the regression equation used to test the validity of the Phillips curve is criticized. In equation (4), the dependent variable is lagged, leading to an asymptotic correlation between the dependent variable and the error term. This generates a negative bias in the value of the estimated coefficient of order $1/T$ (Nickell, 1981), where T is the number of sample periods.[8] Additionally, the presence of fixed regional effects and the plausible autocorrelation in the residuals make a more adequate test necessary.

Accordingly, Nickell and Bell (1996) and Blanchard and Katz (1997) suggest a modified version of the test in two stages mentioned in Section 3. In the first stage, they regress each year's personal wages on both the individual worker characteristics and the fixed regional effects. In the second, the regional dummy coefficients so obtained may be used as a measure of average regional wages (corrected by the workers' characteristics), which are regressed on the fixed-time effects, the unemployment rate and lagged wages. In this way, the common group and the composition biases are minimized. Moreover, using instrumental variables, the likely existence of additional problems (such as the wage measurement error or the endogeneity in the unemployment rate) can be controlled for. The test works in a similar way to the previous one. If the estimate of the autoregressive parameter is close to one, the null hypothesis of a Phillips curve will not be rejected, whereas if it is close to zero, the hypothesis of a wage curve will not be rejected.

Thus, Blanchard and Katz (1997) follow this approach to argue that the zero value of the autoregressive parameter estimated by Blanchflower and Oswald (1994) is mainly due to the statistical source and the wage measure used. On the one hand, the CPS March samples are too small to adequately measure the yearly wage variations in each state. Hence, the wage variation that takes place each year observed in the sample is due to a sampling error, which biases the estimate of ρ downwards. On the other hand, there is also a measurement error in the estimates, because the use of annual earnings may be contaminated by the effect of worked hours. They check these biases by summarizing, in their Table 2, different estimates of the parameter ρ that depend on the sample used and the way that the dependent variable is defined. Thus, with the data used by Blanchflower and Oswald (1994), the estimate of the autoregressive coefficient is 0.26, similar to the one in Blanchflower and Oswald (1994). By contrast, when using data from the merged ORG in the CPS and hourly wages, the estimated value is above 0.90, close to one, leading to the conclusion that a US Phillips curve obtained with microeconomic data is totally compatible with the results obtained with aggregate data. Consequently, they argue that the null wage persistence found by Blanchflower and Oswald (1994) is only due to statistical problems and that when wages are measured appropriately, the Phillips-curve hypothesis still holds in the US. The results presented in Autor and Staiger (2001) and Staiger *et al.* (2002) confirm this view.[9]

An alternative test for discriminating whether a wage or Phillips curve applies is presented in Card (1995). This is a differenced version of (3),

$$\Delta w_{irt} = g_t + a_1 u_{rt} + a_2 u_{rt-1} + \Delta\varepsilon_{ijrt} \tag{5}$$

where the regional fixed effects have disappeared, and g_t stands for the redefined time fixed effects.[10] In this test, if $a_2 = -a_1$, we have a wage curve, whereas if $a_2 = 0$, we get a Phillips curve. Card and Hyslop (1997) use regional corrected wages from the merged ORG in the CPS and obtain that a_2 is nonsignificant. By contrast, Devereux (2001), with data from the PSID, presents evidence in favour of the wage-curve hypothesis, because $a_2 = -a_1$ is not rejected and a_2 is significant. However, his conclusion that 'the primary form of adjustment to the business cycle is in hours worked' calls our attention again to the behaviour of incentives and overtime payments, a question considered in detail, as mentioned in Section 2, in Black and FitzRoy (2000) and Hart (2003a) for the British case.[11]

Table 2. The Estimated Value of Lagged Wages in Several Articles

Author	Country	Data base	Period	Type of data	Dependent variable	Method	Estimation	Reference
Blanchflower and	US	March CPS	1979–1987	Individual	Annual earnings	LDV + OLS	0.29 (8.96)	Table 4.27
Oswald (1994)	UK	GHSS	1973–1990	Individual	Monthly earnings	LDV + OLS	0.07 (0.87)	Table 6.20
Bell (1996)	US	ORG CPS	1980–1991	Individual	"Usual" hourly wage	2-steps LDV + GMM + regional trends	0.56 (0.04)	Table 6
Blanchard and Katz (1997)	US	March CPS	1980–1991	Individual	Annual earnings	2-steps LDV + ECM	0.26 (0.04)	Table 2 (column 6)
	US	ORG CPS	1980–1991	Individual	Hourly earnings	2-steps LDV + ECM	0.91 (0.02)	Table 2 (column 3)
Card and Hyslop (1997)	US	ORG CPS	1977–1992	Individual	Adjusted hourly earnings	Card (1995)*	Phillips curve	Table 5
Partridge and Rickman (1997)	US	Regional statistics	1972–1991	Regional	Average annual earnings	LDV + OLS	0.83 (0.01)	Table 1 (column 8)
Buettner (1999)	West Germany	Regional statistics	1987–1994	Regional	Annual earnings	Card (1995) + ECM	0.57 (0.15)	Table 5
Galiani (1999)	Argentina	Household Survey	1990–1997	Individual	Monthly earnings	3-steps LDV + ECM + GMM	0.50 (0.12)	Table 4
Whelan (2000)	US	Regional statistics	1955–1998	Aggregate	Annual compensation per hour	ECM	0.83 (0.06)	Table 2
Albaek *et al.* (2000)	Denmark	Statistics Denmark	1980–1991	Individual	Adjusted annual earnings	2-steps LDV + OLS	0.52 (0.06)	Table 7
Dyrstad and Johansen (2000)	Norway	Regional Statistics	1970–1988	Regional	Annual earnings	ECM + GMM	0.46 (0.05)	Table 1
Pannenberg and Schwarze (2000)	West Germany	GSOEP	1985–1994	Regional	Average monthly earnings	ECM + GMM + panel data	0.32 (0.03)	Table 2
Black and FitzRoy (2000)	UK	NES	1979–1995	Regional	"Standard" hourly wages	Card (1995) + panel data	0.50 (0.04)	Table 5
Cameron and Muellbauer (2001)	UK	NES	1972–1995	Regional	Gross weekly earnings	ECM + VAR + GLS	0.45 (0.03)	Table 1
Devereux (2001)	US	PSID	1970–1991	Individual	Hourly earnings	Card (1995)[a]	Wage curve	Table 5
Bell *et al.* (2002)	UK	NES	1976–1997	Individual	Weekly earnings	2-steps LDV + OLS + regional trends	0.54 (0.01)	Table 2 (column 3)

Fares (2002)	Canada	Statistics Canada	1978–1999	Aggregate	Average hourly earnings	ECM	0.28 (0.09)	Table 3
		Statistics Canada + SCF	1977–1999	Individual	Average adjusted weekly earnings	ECM	0.33 (0.02)	Table 6
Barth *et al*. (2002)	US	ORG CPS	1983–2000	Regional	Hourly wage	2-steps LDV + OLS	0.72 (0.02)	Table 3
	UK	BHPS	1991–1997	Regional	Hourly wage	2-steps LDV + OLS	0.00 (0.04)	Table 3
	Norway	Regional statistics	1991–1997	Regional	Hourly wage	2-steps LDV + OLS	−0.28 (0.06)	Table 3
Hart (2003a)	UK	BEEF	1926–1966	Individual	"Standard" hourly wage	2-steps LDV + OLS	0.68 (0.04)	Table 3 (column 3)

*Card, 1995) test does not allow estimating the coefficient on the lagged value.
Notes: LDV is the lagged dependent variable (earnings). 2-steps is the methodology used in Blanchard and Katz (1997).

Bell (1996), using the same two-step procedure as Blanchard and Katz (1997), also points to the existence of sampling and measurement errors in the March CPS. He deals with such biases, first, by taking into account only the wages of those individuals who worked more than 50 weeks in the previous year and, second, by expressing earnings in wages per hour. He also presents generalized method of moment (GMM) estimates to control for the dynamic bias (Arellano and Bond, 1991; Kiviet, 1995). When taken together, this approach yields an estimated value for ρ of around 0.83, that is, below one. Moreover, the author shows how wages have evolved differently across states by the different behaviour of prices, productivities and many other reasons. If these wage differences across states are not explicitly controlled for, the autoregressive coefficient will be upwardly biased, because neither the fixed-state effects nor the time effects will capture them. Including these state trends and using the second lag of wages as an instrument for the first lag, the author estimates a value for ρ of around 0.56. This result leads him to consider that there exists a high autocorrelation in wages but that the autoregressive coefficient is significantly different from one. Therefore, it is not a Phillips curve; rather, it is better thought of as a relationship between wage levels and unemployment rate, in which there is a considerable sluggishness, and the adjustment to a new equilibrium is relatively slow. In other words, there is a wage curve with a partial adjustment towards the equilibrium, a fact that makes it similar to the Phillips curve.

The results (summarized in Table 2) obtained for the UK (Cameron and Muellbauer, 2001; Bell *et al.*, 2002), for Germany (Buettner, 1999; Pannenberg and Schwarze, 2000) and for Norway (Dyrstad and Johansen, 2000) are all in this line. However, somewhat different evidence is found by Albaek *et al.* (2000). Analysing various Nordic countries, these authors obtain that the estimate of ρ is close to one, favourable to the Phillips curve, although β is non-significant, which leads to a rejection of both the wage and the Phillips-curve specifications. This result can be justified on the basis of the centralized type of negotiation that exists in these countries. Table 2 summarizes some of the results presented in different articles. The conclusion that can be derived from the above works is that the relationship between wages and unemployment is more appropriately determined by a dynamic specification, in which unemployment has an influence on wages that lingers on over time, opposite to the static relationship found by Blanchflower and Oswald (1994). In the next section, we present various arguments in favour of the dynamic specification and discuss several findings on the wage curve at the microeconomic level.

4.2 *Reconciling the Wage Curve and the Phillips Curve*

The existence of price and wage rigidities justifies a dynamic adjustment relationship between wages and unemployment, as argued in Layard *et al.* (1991), Blackaby and Manning (1992) and Blanchard and Katz (1992), of the error correction mechanism type (Sargan, 1964), at least when using aggregate data. However, a macroeconomic Phillips curve fits well to the US data, as we have just seen in the previous section. As a consequence, this contradicts not only the microeconomic evidence on the wage curve, but also (and more importantly) the theoretical basis of this relationship. As cited in Section 1, the recent non-competitive models of the labour market find a negative relationship between the level of wages and the unemployment rate. In the light of this, the objective of the works discussed below is, on the one hand, to reconcile the microeconomic wage curve and the aggregate Phillips curve and, on the other, to reconcile these concepts with the new theories of the labour market.

Whelan (2000) offers a first explanation about how to obtain an aggregate Phillips curve from a microeconomic wage curve. His reasoning is based on the fact that both low and high values of ρ can be totally compatible with an accelerationist version of the Phillips curve if we take into account the mark-up price-setting mechanism and the way in which expectations are formed. Let us start from an expression that represents a microeconomic wage curve in which a certain dynamic adjustment of wages is captured by ρ:

$$(w_{ir} - p^e)_t = \alpha_i + \rho(w_{ir} - p)_{t-1} + \beta u_{rt} + \varepsilon_{irt} \tag{6}$$

where $(w_{ir} - p^e)_t$ is the expected real wage, $(w_{ir} - p)_{t-1}$ is the lagged expected real wage and u_{rt} is the local unemployment rate (all variables expressed in log terms). α, ρ and β are coefficients and ε is the error disturbance. This equation can be estimated with microdata. Alternatively, if we aggregate for all individuals and regions and assume that the price setting rule is a constant mark-up μ over wages, $p_t = \mu + w_t$, we get

$$(w - p^e)_t = (\alpha - \rho\mu) + \beta u_t + \varepsilon_t \tag{7}$$

If we further consider that expectations on prices are adaptive to the last observation, $p_t^e - p_{t-1} = p_{t-1} - p_{t-2}$, and make use again of the mark-up price-setting rule (implying $\delta w_t = \delta \rho_t$), we obtain

$$\Delta w_t = \Delta p_{t-1} + (\alpha - \rho\mu) + \beta u_t + \varepsilon_t \tag{8}$$

The estimation of (8) yields a Phillips curve no matter the microeconomic estimate of ρ, because it is impossible to obtain an individual estimation of this parameter. Therefore, a microeconomic wage curve is totally compatible with an aggregate wage curve.

Using an alternative approach, namely the new Keynesian paradigm, Roberts (1997b) reaches a very similar conclusion. His argument relies on the staggered wage-contract assumptions (Taylor, 1979; Calvo, 1983) as a basis for price expectation, in such a way that he obtains an augmented Phillips curve with price expectations. As before, given that the aggregate Phillips curve can be derived from the wage curve, the exact microeconomic relationship is not relevant when deriving it. For a discussion on the issue of whether the Phillips curve should include backward- or forward-looking (rational) expectations, see also Fuhrer (1997).

Both of the above-mentioned works put to one side the important economic meaning of the autoregressive coefficient. By contrast, Blanchard and Katz (1999) offers an in-depth analysis of the theoretical arguments that allow for a dynamic specification of the relationship between wages and unemployment. Starting from (1), a common equation for several non-competitive models of the labour market, these authors obtain, in aggregate terms, the following expression (again in logs):[12]

$$(w-p^e)_t = \phi b_t + (1-\phi)y_t - \beta u_t + e_t \qquad 0 < \phi < 1 \tag{9}$$

where $(w-p^e)_t$ is the real expected wage, b_t is the reservation wage, y_t is the labour productivity and ϕ belongs to (0, 1), indicating that any bargaining or efficiency wage model can be equally valid to yield this expression. Hence, (9) can be interpreted as a similar expression to the wage curve.

To justify the dynamic specification, Blanchard and Katz (1999) provide a theoretical rationale for lagged wages to appear in the regression equation. Because the reservation wage is not directly observable, they argue that it is basically determined by two factors: (i) the unemployment subsidy (related to past earnings) and (ii) the worker's productivity, understood as the amount he/she could earn by home production or in the black market (see also the literature on aspiration wages, i.e. Akerlof and Yellen, 1990; Ball and Moffitt, 2002). Thus, equation (9) can be rearranged as[13]

$$b_t = \alpha + \xi(w-p)_{t-1} + (1-\xi)y_t, \qquad 0 < \xi < 1 \tag{10}$$

from where

$$(w-p^e)_t = \delta + \xi\phi(w-p)_{t-1} + (1-\xi\phi)y_t - \beta u_t + \varepsilon_t \qquad 0 < \xi\phi < 1 \tag{11}$$

where $\delta = \alpha\phi$. If $\xi\phi = 1$, then (11) is equivalent to the Phillips curve. From their viewpoint, this regression equation in aggregate terms is more adequate than the one with time-fixed effects used by Blanchflower and Oswald (1994). They note that the estimation of equation (4) in Blanchflower and Oswald (1994) is done implicitly assuming the lack of mobility across states, an assumption that does not seem reasonable in the US (see Blanchard and Katz, 1992). When this assumption is relaxed, the wage in one state will depend not only on the particular state-lagged wage, but also on the aggregate lagged wage. If this effect is not explicitly considered, it will remain hidden in the fixed-time effects, leading to a negative bias in the value of ρ. This source of bias, however, is expected to be unimportant in the European countries because of the lack of interregional mobility. As an alternative, instead of including fixed-time effects, explicitly aggregate variables may be used to properly model such influences, although a richer time dimension is required. Galiani (1999) uses aggregate variables to estimate wage flexibility in Argentina, while Bell *et al.* (2002) find that aggregate variables do not really influence the dynamic wage adjustment in the UK.

Equation (11) can be rewritten as

$$\Delta w_t = \delta + \Delta p_t^e - (1-\xi\phi)(w-p-y)_{t-1} + (1-\xi\phi)\Delta y_t - \beta u_t + \varepsilon_t \tag{12}$$

This expression captures the fact that the real wage will finally adjust to the level determined by the productivity and the unemployment rate, although it will take some time to do so. The expression is nothing more than a modified version of the error correction mechanism in Sargan (1964) that can also be estimated on the basis of individual and local data. The parameter $(1 - \xi\phi)$ indicates whether a deviation of the real wage from the equilibrium level determined by labour productivity and the unemployment rate causes a variation in wage inflation. With US data, Blanchard and Katz (1999) cannot reject the hypothesis $\xi\phi = 1$, which is equivalent to finding that the parameter ρ is close to unity in (6). Therefore, under this hypothesis, the situation in the US is that neither negotiated wages nor the reservation wage depends on productivity. A similar specification, including richer dynamics and variables, has been estimated in a multitude of OECD countries with aggregate data (see Grubb, 1986; Layard *et al.*, 1991; OECD, 1997). A common result emerges: for the US the coefficient $(1 - \xi\phi)$ is zero, whereas in European countries the estimated value is negative and significant. That is, the European case is characterized by a modified version of the Phillips curve with error correction but high autocorrelation. The interpretation, according to (12), indicates that at least one (if not both) of the components in $\xi\phi$ is, in Europe, less than one. This is a credible result, according to Blanchard and Katz (1999), if we consider that trade unions play a more relevant role in Europe when negotiating real wages ($\phi < 1$) and that the black economy is probably also more extended in Europe ($\xi < 1$) (see also Abowd *et al.*, 2001). According to this reasoning, the derivation of the Phillips curve for the US, starting from a wage curve, is only possible when the labour productivity does not influence either the wage-setting process or the subjective valuation of the reservation wage. Note, however, that recent contributions question such a restrictive assumption, providing specifications where productivity is explicitly included from the very beginning. In this respect, the inclusion, or not, of a productivity term in the Phillips-curve specification is a widely debated issue in the US (see Gordon, 1998; Whelan, 2000; Staiger *et al.*, 2002). More recently, Bårdsen and Nymoen (2003) also derive an error correction model, which encompasses both the wage curve and the Phillips-curve specifications, to test the NAIRU hypothesis for the Norwegian case. The results obtained, however, are non-conclusive in that the Phillips curve is rejected, but the wage curve is not supported. This leads them to claim that a more general framework (including an equation modelling unemployment) should be considered.

In summary, the debate is not closed. Using macrodata, a Phillips curve is supported in the US, whereas slightly modified error correction appears to well model the situation in Europe. By contrast, the microevidence casts doubts on even the Phillips-curve specification for the case of the US. We can conclude that the preferred choice currently seems to be a dynamic specification of the relationship between wages and unemployment, with a degree of adjustment that depends on the error-term coefficient. This specification appears to reconcile the extreme cases of the wage curve ($\xi\phi = 0$) and the Phillips curve ($\xi\phi = 1$). However, some points must be also noted before drawing general conslusions. First, most of the models discussed so far consider price expectations only in national terms, omitting the effects of regional variation in prices. Second, the wage curve and

Phillips-curve comparison should be made in a multiregional context in which non-competitive wage setting is combined with price expectations, neo-classical migration responses, trade and the determination of prices of traded and non-traded goods. Some steps have already been taken in this direction. Bell *et al.* (2002) has introduced a migration equation, while Bårdsen and Nymoen (2003) has distinguished between domestic and foreign prices. Further, the proper modelling of the dynamic relationship between wages and unemployment probably requires frequent and quite large sampling, which might be difficult to satisfy when individual panel data is used. Consequently, the need for more research is clear, because the theoretical and empirical contributions are not yet conclusive.

5. Concluding Remarks

The traditional role of the Phillips curve as the supply side of the economy has recently been challenged by the inception of the so-called 'wage curve'. This representation offers empirical support for the modern non-competitive theories of the labour market, which suggest a negative relationship between the level (and not the growth) of wages and the unemployment rate. It has also served to identify the equilibrium unemployment rate. This marks a departure from the neo-classical view of the labour market and of the economy as a whole, in favour of a more neo-Keynesian view, in the sense that whereas the Phillips curve represents an adjustment hypothesis whereby the nominal wage rate moves in the direction needed to eliminate the excess of demand for labour, the wage curve indicates the validity of an equilibrium unemployment concept. As a consequence of this wage-curve modelling of the supply side of the economy, supply shocks have persistent effects in output, unemployment and inflation. Since the influential work of Blanchflower and Oswald (1994), the use of microeconomic data has allowed for evidence to be adduced for many countries in favour of this negative relationship in level terms. In the first part of this paper, we have presented the theoretical, technical and empirical basis of the wage curve.

However, the wage-curve hypothesis has its limitations, in the sense that it supposes (i) the unemployment effect on wages takes place in just one period; and (ii) supply shocks have permanent effects on unemployment and on inflation. As regards the first aspect, the existence of price and wage rigidities, along with the processes of matching, bargaining and rent sharing, suggest that partial adjustment to shocks is more plausible. With respect to the second, substantial evidence, especially for the US, shows that aggregate adjustment in labour markets is still well represented by a Phillips curve, in a such a way that shocks have only temporary effects on unemployment and on inflation.

The literature offers numerous examples of attempts to take the Phillips curve, on the one hand, and the wage curve, on the other, as extreme cases and to reconcile them within one unifying model. Not surprisingly, what has emerged is an intermediate specification, which might be described as a generalization of the Phillips curve, as an appropriate strategy to represent wage–unemployment dynamics. This argument has recently provided an increase in the degree of interest shown by labour economists in these concepts, with the resulting debate reviewed in the second part of the paper. This lively and ongoing debate might well result in improving our understanding of the different labour market outcomes that can be appreciated both within the same country and across countries over time. To this end, it would be desirable for future work to bear in mind all the econometric problems enumerated throughout this paper. In particular, the definition of the wage measure should be carefully specified to allow for direct comparisons between the estimates obtained from different studies. Additionally, a promising line of research seems to be the joint consideration of wage adjustment and the regional dimension of unemployment.

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Notes

1. Nevertheless, the question about the shape of the wage curve is still under debate. After the controversy between Blanchflower and Oswald (1993) and Sessions (1993), see the recent discussions in Collier (2000) and Ilkkaracan (2001).
2. All these models allow for a different wage elasticity across different groups of workers, in the sense that a different wage curve for a group (women, young, low educated, for instance) reflects a different responsiveness to local labour-market conditions. This idea has been used to test which hypothesis of the wage curve is more adequate in each case.
3. It should be noted, however, that several authors doubt that the estimate of the coefficient actually measures the degree of wage flexibility in a country. On the one hand, Beaudry and DiNardo (1991) and Canziani (1997) consider that wage flexibility would be better determined by the elasticity of wages with respect to the minimum existing unemployment rate since the period in which the contract was set, the reason being that wages are upwardly flexible but generally present downward rigidity. Montuenga *et al.* (2005) follow this approach to appraise the issue of wage flexibility in five EU countries finding some differing behaviour across countries. On the other hand, Galiani (1999) raises the criticism that, in the elasticity estimation, the possibility of aggregate variables having an influence on the regional wage setting is being forgotten, and thus wage flexibility is inadequately calculated. However, Kennedy and Borland (2000) and Bell *et al.* (2002) do reflect these national variables in their estimates for Australia and the UK, respectively, and elasticity estimates are not markedly altered.
4. The idea that the wage-curve and the wage-setting schedule represent the same relationship is only true in the short term. Let us call LF the active labour force, EP the employed population and U the unemployed population; then $LF = EP + U$. If EP is increasing in wages, U should be decreasing, so that LF is constant (although both the additional worker and the discouraged worker effects may vary the LF even in the short run). However, in the long term, the active labour force may be growing, and

thus the relationship between both variables and wages could be increasing, supporting the Harris-Todaro model (compensating differentials theory).

5. However, wage curves appear to have smaller β for females in many studies, perhaps due to the greater wage elasticity of the labour supply of females as compared with males.
6. The estimate of the coefficient is greater than -0.20 in Latvia, Bulgaria, Poland, Russia and Estonia, -0.10 in East Germany and around -0.05 for the Czech Republic, Hungary and Slovakia. No evidence is found for the existence of a wage curve either in Slovenia or in Kirghizistan.
7. Compared with the CPS, the sample size from this source is almost twice as big. In addition, wage data belong to the last week before the survey and, thus, measurement error is much lower.
8. The value of the bias corresponds to the case in which the lagged endogenous variable is the only regressor. Besides, if there are other predetermined regressors, the bias will be even greater. However, when the sample size is large, the bias becomes negligible.
9. We thank David Autor for kindly providing us with estimates from his still in-progress work.
10. A specification such as this is habitually used in measuring the cyclicality of real wages (see Devereux, 2001; Hart, 2003b). Although this specification avoids some technical problems (the correlation between the lagged dependent variable with the regional fixed effects and the autocorrelation in the error term), the dynamic wage-curve hypothesis is, however, not nested in it.
11. With data from the New Earnings Survey in the UK, Black and FitzRoy, (2000) find that earnings behaviour is dominated by volatile hours in the short term, while wage growth is highly sensitive to the level of unemployment, as in the classical Phillips curve with macrodata. That is, the wage curve of rapid adjustment is rejected for 'standard' hourly wages. They estimate an equation like (5) considering panel-unit roots. A similar conclusion is obtained by Hart (2003a) with data from the British Engineering Employers' Federation. Their results are in accordance with the aggregate macroevidence of OECD countries presented in Madsen (1998).
12. Linearizing equation (1) $w/P = Rh(u, Z_s)$ and separating the labour productivity y_t, the wage reservation b_t and the unemployment measure u_t, we get (9) where e_t stands for other non-observable effects.
13. Here, it is assumed that the reservation wage is homogenous of degree one in the real wage and productivity in the long term. Otherwise, technological progress will lead to a persistent trend in the unemployment rate.

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