Chapter C) The wage curve

C1) Introduction
In the last chapter we have given a brief overview about major developments in macroeconomics and introduced in some detail the “European Labour Market Model (ELMM)”. This macro approach is distinguished from others by its explicit use of imperfect competition on the labour market (and usually also on the product market). In many respects, the wage curve literature (Blanchflower/Oswald, 1990, 1996) is directly build upon this macroeconomic approach. The wage curve can actually be seen as a regional pendant of the WS curve that was derived in the ELMM.

Why are regions considered instead of nations? This is by and large due to the fact that the research focus of B/O is mainly an empirical one. It has been argued in chapter A that the use of regions is a good strategy, because one can “gain variance” for empirical research. B/O have gathered and compiled a great deal of empirical evidence about regional wages and unemployment rates from various, European and non-European, countries. The authors themselves describe as their main achievement that they have distilled from this data an “empirical law of economics” (B/O, 1996:1). This law, which seems to hold for virtually all countries and time periods under consideration, can be formulated as follows:

"Doubling the regional unemployment rate will drive down the regional wage level by roughly 10 per cent."

Within any country for which a wage curve exists, there are regions that have both low unemployment and high wages as well as regions that have high unemployment and low wages. This empirical evidence is hard to bring in accordance with standard neoclassical theory of competitive labour markets. This theory would rather predict that unemployment is high where wages are high and vice versa. However, the observed empirical evidence is consistent with the theoretical implications of the ELMM, which B/O have applied and partly reformulated to serve for a regional context.

In this chapter, we want to briefly introduce the empirical research strategy of B/O and contrast their empirical findings with neoclassical regional models in section C2. Afterwards, we discuss in greater detail the theoretical part of the wage curve literature. We introduce one original approach of B/O in section C3, and one more recent approach by Blien (2001) in section C4. This theoretical work is useful for our purposes, since the wage curve literature is concerned with the regional dimension of unemployment in relation to the spatial structure of other important
economic variables. However, we will argue that the current state of the wage curve theory alone is not sufficient to understand the geography of unemployment in the EU, most importantly because it fails to account for the highly relevant feature of spatial agglomeration of economic activity. The problems and shortcomings of the current wage curve literature will be comprehensively summarized in section C5. From this critique we derive the motivation to extent and modify this string of theory.

C2) The wage curve as an empirical regularity

B/O have worked with large scale microeconomic datasets (e.g. the "International Social Survey Programme"). They used the available individual earnings data and ran in principle standard wage equations à la Mincer (1974), only with the regional unemployment rate as an additional explanatory variable.\(^2\) The basic wage curve equation has the following form

\[
\ln (\text{wage}_{ir}) = \beta_0 + \beta_1 \ln (\text{unemployment}_{ir}) + \beta_2 x_{irt} + \text{other terms} \quad (C.1)
\]

The indices i,r,t represent single individuals, regional units and the time period respectively. It is well understood that the earnings level of an individual i (\(\text{wage}_{ir}\)) will depend on personal characteristics (\(x_{ir}\)), like his or her level of education, the work experience, the gender etc. Other factors that influence individual earnings can stem from time factors, e.g. the state in the business cycle, or other forms of fixed effects.

The main finding of B/O is that, when controlling for all these characteristics, the estimator \(\beta_1\) is significantly negative for virtually all OECD countries and time periods under consideration. Even more surprising, the magnitude of the effect seems to be roughly identical for all countries, -0.10. The estimator \(\beta_1\) captures the partial effect of the unemployment rate of region of residence on the individual earnings level. The best way to think about the observed significantly negative effect is the following: take two observationally equivalent individuals with the same formal skill and experience level who live in different regions of a given country. The individual living in a low-unemployment region will earn a higher wage than the individual in the high-unemployment area. The magnitude of the partial wage effect of unemployment is given by the coefficient \(\beta_1\).

In an aggregate sense, the wage curve observation implies that regional wage levels and regional unemployment rates within any given country are robustly negatively correlated. At any point in time, there exist regions with both high wages and low unemployment rates, and regions with low wages and high unemployment rates. Frequently this relationship is graphically represented. Qualitatively

\(^2\) Econometric issues, how to estimate wage curves etc. are intensively discussed in Blien (2001:129 ff.)
The wage curve is a non-linear downward sloping curve in the real wage/unemployment rate-space as presented in fig. C1.

**Figure C1: The wage curve**

This implication stands in sharp contrast to those models that were dominating research about the relation of wages and unemployment across space all over the 1970s and 1980s. The literature that descended from the work of Harris/Todaro (1970) and Hall (1970, 1972) implies that regional wage levels and regional unemployment rates are positively correlated. The basic intuition for this result is quite simple and clearly stems from neoclassical considerations: individuals living in regions with high unemployment rates must be compensated with a relatively high regional wage level.

This point has been made first by Harris/Todaro (1970) in the field of development economics. The authors tried to understand the process of ongoing rural-to-urban migration in Africa despite the high rates of urban unemployment. They construct a two-sector model with a rural agricultural and an urban industrial sector. The wage in the rural labour market is flexible, whereas the urban wage is exogenously given by some parameter w. The urban wage by assumption exceeds the rural level. Industrial firms are price-takers under a neoclassical technology and demand workers up to the point where the value marginal product of labour is equal to the exogenous wage. Jobs are contracted for a fixed time period, after which workers again enter the pool of unemployed and look out for the next industrial job. Rural migrants also have to enter the pool of urban unemployed and can only apply for industrial jobs after they have migrated to the urban area. Any unemployed person has a certain chance of entering a job at the exogenous wage w. This probability can be approximated by the employment rate (1-U), and is
The wage curve

decreasing in w. With probability U, the worker remains unemployed and has zero income.
Under this quite restrictive model construction, the endogenous variable U, the unemployment rate, is positively correlated with the parameter w. Rural workers keep on migrating until the expected urban income (1-U)w is equal to the agricultural income. Put differently, agricultural workers are constantly employed at a low wage, whereas urban industrial workers are only employed for some time spells, but then at a higher urban wage. The high urban wage level compensates for the urban unemployment rate.

In the context of modern industrialized economies, the regional "compensating differentials" equilibrium has been introduced by Hall (1970, 1972). He considers a multi-location economy subject to unemployment, populated with mobile workers who choose in which location to settle. In equilibrium, all migration incentives must have vanished and therefore all locations must offer the same expected income to workers, which similarly is given by the regional wage times the regional employment rate. An area with high unemployment must therefore offer higher regional wages. Other papers that subscribe to the idea of a compensating equilibrium between unemployment rates and wages are e.g. Reza (1978), Adams (1985), Marston (1985) and Roback (1987).

This string of theory, which implies a positive correlation between regional wage levels and unemployment rates, is inconsistent with the empirical findings of B/O. The authors go as far as to point out that "this hypothesis [of a positive correlation] is as decisively rejected by the international microeconomic data as it is possible to imagine" (B/O, 1994:9). Matters, however, are not quite as clear as B/O have put it. There is still an ongoing debate, ambiguous empirical findings, or even some evidence in favour of the Harris-Todaro-Hall hypothesis (Patridge/Rickman, 1997). These debates notwithstanding, it seems safe to conclude that today the majority of studies concludes that a wage curve in fact exists in most OECD countries. Unfortunately, there is no wage curve estimate for the European Union as a whole. This is due to the fact that the estimation would require consistent and huge scale microeconomic datasets on the basis of European regions (like the Microcensus or the Socio-economic panel for the case of Germany). To our knowledge such data does not yet exist, which rules out a rigorous estimation. The descriptive evidence presented in chapter A, however, seems to suggest that a wage curve will also exist in the EU. High unemployment and high per capita income (which should be highly positively correlated with wage levels) coincide geographically to an extent that supposedly does not simply reflect the degree of heterogeneity in individuals' underlying characteristics.

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3 An overview is provided by Elhorst (2000). The main ideas of the most famous models of this class are also comprehensively introduced in B/O (1996:15 ff.).
4 See e.g. the overviews of Blien (2001: ch.8 ), Buettner (1999: ch. 5-6) or Card (1995).
C3) Wage curve theory: The Blanchflower/Oswald-model

If one accepts the wage curve empirically, one has to think about a consistent theoretical model. Competitive models of the labour market seem inapplicable to rationalize a wage curve, which is interpreted by B/O as a long-run equilibrium curve in regional labour markets. However, theoretical rationale for a downward-sloping labour market equilibrium curve in the real wage/unemployment rate-space is readily available from the macroeconomic “imperfect competition” approach, the ELMM.

We now turn to the theory of the wage curve as introduced by B/O (1996). It will be shown at first that the wage curve is actually equivalent to the WS curve from the ELMM and describes a partial labour market equilibrium relation. We will derive one particular wage curve based on efficiency wages in section C3.1.). The next step is to integrate this partial equilibrium relation with a description of the regional product markets. Essentially, this is the same as deriving a PS curve in the ELMM, and will be done in section C3.2.). However, since the wage curve is concerned with the regional dimension of an economy, some further issues do now arise. Namely, on a regional level one must take factor mobility into account. In section C3.2.) we will therefore introduce the full interregional general equilibrium model of the two-region economy. The section C3 ends with a critical discussion of the wage curve model of B/O in C3.3.).

C3.1) The partial equilibrium foundations of the wage curve

The wage curve in figure C1 looks similar to the WS curve that was introduced in the last chapter (figure B1). With a fixed and perfectly inelastic labour force (which we will continue to assume), the two concepts of a WS curve and a wage curve are analytically equivalent. Saying that the equilibrium wage in the labour market positively depends on the employment rate is the same as saying that it negatively depends on the regional unemployment rate.

In the theoretical part of their work, B/O present three plausible stories why in partial equilibrium a higher regional unemployment rate might depress the regional wage level. The first approach is based on the idea of implicit contracts. This approach will not be introduced here, because it is the most complicated but the least convincing of the three (see Card, 1995:796; Blien, 2001: 84). The other two are already familiar from the last chapter. The foundation of the wage curve can either be a collective bargaining model, or an efficiency wage model. The underlying logic for either of the two is identical with the underlying intuitions of the WS curve that was provided in section B3.2., only that one has to think now on a regional level. If regional unions bargain about regional wages, their power relative to employers will likewise depend positively on the regional employment rate, i.e. negatively on the regional unemployment rate.
a) **What is the appropriate micro-foundation of a wage curve?**

To be more explicit, we derive a wage curve based on one particular efficiency model, namely the shirking-approach of Shapiro/Stiglitz (1984) in the slightly modified version of B/O (1996:64 ff.). The reason why we use this particular model is mostly its analytical simplicity. However, there is also another reason for considering an efficiency wage-model instead of a union model, given the institutional background e.g. of the German labour market.

It is often spelled out that union models have been used in the ELMM to reflect the institutional situation in continental Europe, whereas the efficiency wage models apply more to the “flexible” labour markets in the UK and the USA. Since we are mostly interested in the European Union, one might thus expect that a collective bargaining approach should be chosen when becoming explicit about the microeconomic foundations of the wage curve. However, recall that from now we are concerned with the regional dimension of an economy. It is true that e.g. the German labour market is highly unionised (e.g. Ochel, 2000). But at the same time the German labour market is also characterised by a very low degree of regional differentiation of union wages. Collective bargaining in Germany takes place at the sectoral level. Formally, the regional sub organizations of the nationwide unions and employers associations bargain on the level of the German Bundesländer in most sectors. De facto, however, this hardly means anything. Typically there is one pilot agreement in one region, which subsequently is applied without any notable modification all over the nation (see e.g. Buettner, 1999:99 ff.; Bispink, 1995; iwd 40/2002). Regional wage differentiation in Germany does not occur through regional differences in union wages, but mostly through differences in *effective earnings* (e.g. Schnabel, 1995).

In other words, an approach that bases a wage curve on regional differences in bargaining strength of inherently regional unions is not appropriate for the institutional structure of the German labour market. This does of course not imply that union wage setting is irrelevant for explaining unemployment in Europe. One can argue that it is precisely the low degree of regional differentiation of union wages that causes intra-national unemployment disparities. We will come back to this argument in chapter F. For the wage curve, however, efficiency wages seem to be the more appropriate micro-foundation. Regional wage differentiation occurs, because firms from different regions pay different effective wages above the (uniform) contracted level. The reasons for this behaviour presumably may be found in efficiency wage considerations (Blien, 2001:86).

b) **A wage curve based on efficiency wages**

In their monograph, B/O use a modified version of the shirking approach of Shapiro/Stiglitz (1984). We will use an even more simplified version of the Shapiro/Stiglitz-model in this paper. We consider an economy in continuous time consisting of two regions $r = \{1,2\}$, and we assume risk-neutral workers, who gain
utility from wage income $w_r$, but disutility from work-effort $e_r$. Utility $V_r$ is assumed to be linear.

$$V_r = w_r - e_r. \quad \text{(C.2)}$$

Effort at work is assumed to be a technologically fixed number $e_r > 0$. Individuals can choose to "shirk" at work and spend zero effort $e_r = 0$. Shirking individuals run the risk of being detected and then fired. The exogenous detection and firing probability $(1 - \gamma_r) < 1$ is less than perfect. Once fired, an individual enters the pool of the unemployed. Yet, following Shapiro/Stiglitz (1984), there is also some exogenous destruction rate of firms $R_r > 0$ that likewise leads to an inflow from employment to unemployment. For simplicity, we assume that unemployed persons have no source of income.\(^5\)

The unemployed have a chance $\alpha_r$ of re-entering into a job. This endogenous variable depicts the flow from unemployment back into the pool of the employed. In the steady state equilibrium, the two labour market flows must be equal. Given that nobody will shirk in equilibrium, we can write this condition as $R_r \alpha_r = \gamma_r (L_r - E_r)$, where $L_r$ is the labour force and $E_r$ is employment. The definition of the unemployment rate is $U_r = 1 - E_r / L_r$. This determines the function $\alpha_r$ to be $\alpha_r = (R_r / U_r) - R_r$. Thus, the outflow probability from unemployment is decreasing in the regional unemployment rate $U_r$. With these assumptions, the (expected) utility of an unemployed individual ($V_{ur}$) is given by

$$V_{ur} = \alpha_r (w_r - e_r). \quad \text{(C.3)}$$

Non-shirking employed workers and shirkers have utility levels $V_{enr}$ and $V_{esr}$ respectively

$$V_{enr} = w_r - e_r \quad \text{(C.4)}$$
$$V_{esr} = \gamma_r w_r + (1 - \gamma_r)(\alpha_r(w_r - e_r)). \quad \text{(C.5)}$$

The firm has an interest to prevent shirking and will thus pay efficiency wages that are just sufficient to ensure equal utility for shirkers and non-shirkers, i.e. $V_{esr} = V_{enr}$. Equating (C.4) and (C.5) yields after some manipulations the following expression

\(^5\) In most parts of the efficiency wage framework of B/O, they assume that regions might differ with respect to the level of unemployment benefits. We do not consider these cases, because it is irrelevant for most continental European countries. Unemployment benefits are generally not differentiated across regions. We therefore have assumed that unemployment benefits $b_r$ are equalized on the level $b_r = 0$. This normalization, however, is only for analytical simplification.
Equation (C.6) is the regional wage curve and can be interpreted as the aggregate non-shirking condition in region $r$. It shows the efficiency wage that is sufficient to prevent shirking for any given unemployment rate, and given the structural parameters $e_r$ and $\gamma_r$. The graphical representation of (C.6) qualitatively looks like in figure C1: the required efficiency wage is lower, the higher is the regional unemployment rate $U_r$. The intuition for this result is clear. At any given shirking detection probability, individuals become more reluctant to shirk when the unemployment rate is high. Becoming unemployed is perceived to be a strong penalty. Consequently, firms do not have to rely on a wage premium to prevent their incumbent workforces from shirking. As the regional unemployment rate decreases, becoming unemployed is less of a threat for single workers, and shirking becomes a more viable option. To prevent shirking, firms pay efficiency wages $w_r > e_r$, since workers then put stronger value on their specific, well-paid jobs and abstain from shirking. The required efficiency wage is higher at any level of $U_r$ the higher is the disutility of effort $e_r$ and the lower is the shirking detection rate $(1-\gamma_r)$.

What B/O essentially do is to bring this aggregate non-shirking condition in a two-region context. They assume that both regions are structurally identical, meaning that $R_r$, $e_r$, and $\gamma_r$ are the same in both regions. This implies that both regions face the same wage curve, i.e. the same labour market equilibrium curve given by equation (C.6).

B/O then analyse what happens if one region is intrinsically more attractive than the other, e.g. because of climatic and cultural circumstances. This region offers an utility supplement $\xi$ to each individual who lives and works there. They show that regardless of $\xi$, both regions will still face exactly the same equilibrium locus with respect to unemployment and wages, the identical wage curve fig. C1. This

\[ w_r = e_r + \frac{\gamma_r e_r}{(1-\gamma_r)(1-\alpha_r(U_r))} \]

(C.6)

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6 With perfect information on workers effort ($\gamma_r=0$), the firm would only need to pay $w_r=e_r$ for any unemployment rate to prevent shirking. Note further that with imperfect monitoring ($\gamma_r>0$), full employment is not possible in equilibrium, since $\alpha_r<1$ requires that $U_r>R_r/(1+R_r)$. Put differently, the required efficiency wage would have to become infinite.

7 One might potentially introduce differences in the structural parameters $e_r$ and $\gamma_r$ across regions. These differences might e.g. be thought of as differences in labour market institutions, although the disutility level of effort or shirking detection rates are typically not the kind of institutions that seem directly relevant labour market comparisons. Model extensions are conceivable where $\gamma_r$ is influenced by regional employment protection laws, or $e_r$ is some sort of reservation wage dependent on regional welfare state arrangements. But the same argument as for unemployment benefits applies: usually the degree of institutional variation across regions within the same country is very little in continental Europe.
can be seen by considering the equilibrium condition (value of shirking equal to value of non-shirking) for the intrinsically attractive region.

\[ w_r - e + \xi = \gamma (w_r + \xi) + (1 - \gamma_r) \{ \alpha_r (w_r - e) + \xi \} \]

In the process of substitution, the term \( \xi \) will cancel out, and the attractive region will face the same labour market equilibrium locus (C.6) as the unattractive region.

But, as will be become more clear in the next section, B/O also assume mobile workers. If the "economic variables" \( w_r \) and \( U_r \) were the same in both regions, workers would want to move to the intrinsically more attractive area, since here they are rewarded with an utility bonus \( \xi \). B/O (1996:69) show that in an inter-regional equilibrium, which is characterized by a situation where there is no incentive for further migration, the attractive region will exhibit a higher expected unemployment rate and a lower expected wage. In other words, the intrinsically unattractive region has to compensate for its missing amenities by offering better "economic" values. The unattractive region will thus be located on the upper left part of the wage curve in fig. C1. The attractive region on the other hand will find itself on the lower right tail of the wage curve. In observable regional data, a negative correlation between regional unemployment rates and wages is visible, since both areas are located on the same wage curve.

C3.2) General equilibrium in the Blanchflower/Oswald-model

This notion already gives an idea of how B/O will establish the stability of the wage curve as a long-run equilibrium curve. But these implications will only become fully visible when moving to a general equilibrium characterization of this economy. The wage curve in figure C1 only represents "one half" of equilibrium, analogous to the WS curve in the ELMM. It needs to be determined exactly where on the wage curve the single regions \( r=1 \) and \( r=2 \) will end up. This will be a matter of goods market equilibrium. So, the full equilibrium in the B/O-model is also determined by joint equilibrium on labour and goods market, in full analogy to the ELMM.

B/O assume that each of the two regions produces a distinct tradable commodity under constant returns to scale and perfect competition. The product market equilibrium they derive is therefore qualitatively identical to the case from section B3.3a). They assume that the production function for the regional tradable good \( Y_r \) is given by \( Y_r = f(N_r,K_r) \). Capital \( (K_r) \) is assumed to be an essential input of production, for which the price \( i \) is determined on world markets. Labour and capital in both regions have to be used in fixed proportions. Firms in both regions will thus face the following minimum cost function \( C_r \)

\[
C_r(Y_r,w_r,i) = \min_{N_r,K_r} \{ w_r N_r / Y_r + i K_r / Y_r \} = Y_r c_r(w_r,i) \quad (C.7)
\]
Under this limitational production function with constant returns to scale, total minimum costs are simply the product of minimum unit cost \( c_r \) times the quantity of output \( Y_r \). Perfect competition implies that minimum unit costs \( c_r(w_r, i) \) need to equal the product price \( p_r \) in order for profits to be zero. The goods market equilibrium is given by the condition \( p_r = c_r(w_r, i) \).

The product prices \( p_1 \) and \( p_2 \) for the two regional commodities \( Y_1 \) and \( Y_2 \) again ground out from a Walrasian tâtonnement process, and are thus given to any single firm. Without loss of generality, B/O normalize the given product price for the good that is exclusively produced in region 1 to unity. The price of the product from region 2 is denoted \( p \). Equilibrium in goods markets then requires that \( 1 = c_1(w_1, i) \) and \( p = c_2(w_2, i) \).

General equilibrium in either region is reached when product and labour market are jointly in equilibrium. Since both regions face the same wage curve locus, the graphical representation of the general equilibrium in both regions can be illustrated in only one diagram, fig. C2.

**Figure C2: Full equilibrium in the Blanchflower/Oswald-model**

The horizontal curves represent the product market equilibrium conditions for region 1 and 2 at the given output prices 1 and \( p \). Full equilibrium in either region is obtained at the intersection points with the wage curve, i.e. at points A and B. At point A, firms make zero super-normal profits and shirking is deterred in region 1. The same is true for region 2 at point B.

If the parameter constellation is such that \( p_2 < p_1 \) (\( p < 1 \)), nominal wages are higher and unemployment is lower in region 1. Note that with freely tradable goods, workers from both regions face the same consumer price index, and nominal wage differences are thus equal to real wage differences. Hence, for this constellation of exogenous product prices in fig. C2, region 1 is advantaged over region 2 along
two dimensions: the real wage is higher in region 1, and the unemployment rate is lower.

But for a full interregional equilibrium, also all migration incentives must have vanished. In the situation depicted in the diagram, this is not yet the case. Individuals from region 2 have an incentive to move to region 1.

B/O (1996:81) are not very explicit about the technological effects on labour productivity and wages if migration occurs. This will of course crucially depend on the properties of the underlying production function. If firms can adjust the essential capital input proportionally with the additional stock of workers, the MPL, and ultimately the zero profit curves in fig. C1 would remain unchanged. The incentive for migration would remain constant, as the regional wage gap is independent of the number of migrants and only depends on the exogenous product prices. Matters are different if the capital stock can not be adjusted. Under this circumstance, every additional worker has a marginal productivity of zero, since the technology is limitational. However, the total amount of labour (measured e.g. in working hours) that is technologically efficient for the given capital stock can simply be shared among a higher number of workers. The total wage income in both regions would thus remain constant, but the wage per worker in region 1 and 2 would converge through labour migration.

Migration would thus lead to convergence of per capita remunerations and ultimately to an erosion of the wage curve relation. However, B/O partly avoid these discussions about technological effects of migration by going back to their construction with intrinsic regional characteristics that was mentioned earlier. Recall that they have developed the implications of differences in the intrinsic attractiveness of regions. In partial equilibrium, these intrinsic differences were exogenous. Now they endogenise the utility supplement $\xi$ and make it negatively proportional to the population density of a region. In other words, as workers move into region 1 because of the better economic situation, the place becomes gradually crowded and thereby unattractive.

With this construction of congestion, it is possible to construct general equilibria with the zero-migration condition satisfied. These will look like figure C2. Regions one the “bad side” of the wage curve will compensate individuals with inherent regional amenities, in this case by the fact that there is little congestion. In terms of the observable economic variables $w$ and $U$, however, a wage curve is visible in the data. The regional values of $w$ and $U$ do not collapse into one point, because the compensating amenities make up for the regional differences in wages and unemployment. The wage curve is thus seen as a long-run equilibrium phenomenon, because single regions are placed at different points along the labour market equilibrium schedule. Regional wages and regional unemployment are

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8 A more detailed discussion about the effects of migration in a model with a neoclassical production function is provided in chapter F.
negatively correlated in equilibrium, and these regional disparities persist and show no tendency to vanish.

C 3.3) Critique of the Blanchflower/Oswald-model

Even though B/O intended to depart from the work of Harris/Todaro (1970), both models share some important common characteristics. Both subscribe to the idea of an equilibrium with compensating differentials, which is reached when incentives for migration have vanished. In the Harris/Todaro-world, unemployment rates and wages together form an equilibrium of compensating differentials and therefore are positively correlated. In the world with a wage curve, intrinsic regional amenities make up for the combination of unemployment and wages, which now are negatively correlated.

The first critique against the Blanchflower/Oswald-model is that the substantial origin of regional differences remains an open issue. Regions are assumed to produce different final goods and sell them at different exogenous product prices under perfect competition. Thus, two principally identical regions still manufacture different commodities, which consequently leads to disparate regional development. The whole analysis is incapable of pointing to the very reason for regional differences in depth. Why can regions with low selling goods not switch over and manufacture better commodities? What is the reason that one local entity produces a “better” good than the other, which ultimately is rewarded with a lower unemployment rate and a higher wage? These questions remain unanswered.

The second problematic aspect with exogenously given product prices is the apparent identification of regions with sectors, or at least with specific products. Because this identification is much more explicitly developed in the Blien-model that will be discussed in the next section, this critique will be postponed to a later point.

The third critique concerns the analysis of labour mobility. As noted before, all individuals have a principle interest to move to the region with the “better” final product, which has both lower unemployment and higher real wages. If nothing else is added, the wage curve relation in the B/O-model would erode, and it would not be a stable long-run equilibrium relation as the authors imply. But B/O assume, in an “ad-hoc” way, that regional preferences are operating as an opposing factor. The critical point with this ad-hoc-construction is that the long-run stability of the wage curve (the main contention of B/O) crucially hinges on it. From a theoretical point of view, this does not seem fully convincing.

Blien (2001:96ff.) points to another critical aspect: within the general equilibrium model, the original causality of the wage curve running from unemployment to wages suddenly has changed without explicit notice. The wage curve theory meant to provide rationale for negative wage effects of unemployment. But in the model of B/O, now exogenous product prices determine a wage rate via the zero profit condition for firms. Only in a secondary step is unemployment determined,
but in an unusual way such that high wages are now associated with low unemployment. We subscribe to the critique of Blien, even though one can think of regional wages and unemployment rates as being simultaneously determined. It is still one more representation of the fact that essentially everything is driven by the exogenously given product prices in the model of B/O.

C 4) The model of Blien (2001)
To cope with several critical aspects of the B/O-model, Blien (2001) presents an own approach to wage curve theory. This concerns both the partial equilibrium foundations of the wage curve, and the integration of the wage curve into a full model with a product market.

C4.1.) Partial labour market equilibrium in the Blien-model
Blien's motivation to base the wage curve on different micro-foundations are unrealistic features of the Shapiro/Stiglitz-world. Individuals in reality do not decide just whether to shirk completely or to provide full work effort. Moreover, strict legislation on dismissal policies often prevent firms from firing shirking individuals in Europe, specifically because the definition of shirking is difficult to formulate in reality. Therefore Blien's main idea is that firms do not try to solve an "information problem" stemming from imperfect monitoring possibilities. Instead, they solve an "enforcement problem" and try to use efficiency wages to motivate employees to spend more work effort. His partial equilibrium model of the wage curve is inclined by the labour turnover approach of efficiency wage theory, and specifically builds on work by Schlicht (1978). The core idea of this approach is that individuals do not simply decide whether to supply full work effort or to shirk completely, but that the chosen effort level is a continuous function. Consider some individual worker, who has a job at some firm j. The worker's effort is given by the following function

\[ A = A\left(\frac{w_j}{\bar{w}}, U_r\right) \] (C.8)

with \( \frac{\partial A}{\partial w_j} > 0, \frac{\partial A}{\partial U_r} > 0 \). The worker will spend more effort the higher is the wage of firm j relative to some exogenous market wage \( \bar{w} \), and the higher is the unemployment rate is the respective region of residence. The intuition for the derivatives is straightforward: The penalty of loosing the particular job is greater for the worker the better she is paid at the particular firm j, and the worse are the outside prospects approximated by the regional unemployment rate. Work effort is an insurance for the worker against an individual lay-off. Therefore, the worker will spend more effort the higher is her interest in remaining employed at this particular firm.
The firm’s problem is to maximize profits, taking into account the effects of efficiency wages on workers’ performance. When aggregating over the wage setting decisions of identical firms in region r, Blien (2001) ultimately also arrives at a wage curve relation. We just present the analytical expression of the wage curve that is given by equation (C.9)

\[ \ln w_r = \ln \bar{w} - \beta \ln U_r + \beta \ln \bar{U} \]

or

\[ w_r = \frac{\bar{w} \bar{U}^\beta}{U_r^\beta} \]  (C.9)

\( U_r \) and \( w_r \) are regional values of unemployment rate and wages, whereas \( \bar{U} \) and \( \bar{w} \) are exogenously given values of national averages. Equation (C.9) is also a negatively sloped (non-linear) wage curve that can be graphed like in fig.C1. It analogously provides the labour market equilibrium relation for every region.

**C4.2.) The product market and general equilibrium in the Blien-model**

To move towards a full interregional general equilibrium model, Blien needs to specify the product market conditions. He assumes that each region is specialised in a single, distinct product or industry, just like B/O. But he adds a dynamic component to the product markets, by applying the idea of product cycles. Let demand and supply for the good of region r be given by the following two simple equations

\[ P_r = a - b Y_r \]  (demand curve)  (C.10)
\[ P_r = M w_r / D_r \]  (supply curve)  (C.11)

\( a, b \) are exogenous parameters for the demand side. \( M \) is also exogenous and captures a mark-up of prices over wages to pay for the rental rate of capital. \( Y_r \) is regional income, \( D_r \) is labour productivity, defined as \( D_r = Y_r / N_r \), where \( N_r \) is employment. Upon substitution, one can obtain the following expression.

\[ N_r = \frac{a}{bD_r} - \frac{M}{bD_r^2} w_r \]  (C.12)

Under the use of the definition of the unemployment rate \( U_r = (L_r - N_r) / L_r \) this expression can be rewritten as

\[ U_r = 1 + \frac{Mw_r}{bL_rD_r^2} - \frac{a}{bL_rD_r} \]  (C.13)
If we think of the wage $w_r$ as being exogenously given, equation (C.13) could be used to analyse the impacts of productivity improvements on unemployment.\(^9\) This type of analysis has been introduced by Appelbaum/Schettkat (1995). Their main result can be summarized as follows: A productivity improvement leads to an increase in employment, if the elasticity of demand on the product market is greater than one. Similarly, unemployment will increase in response to productivity improvements if product demand reacts inelastic.\(^10\)

The idea of product cycles enters in the following way. New products tend to face largely unsatisfied demand, and their price elasticity therefore is high. But specific products age over time, demand becomes largely satisfied. Price elasticities decline, and productivity improvements and lower prices do not translate any longer into an increase in total production.

Think of the regional consequences of product cycles, if the single regions are completely specialized. The regional development is then driven by the dynamics of the market for the region-specific product. Blien (2001) assumes that improvements in labour productivity are exogenously given and identical for all regions. This has different effects on the single regions, depending on the state of the specific products within the cycle. Those who specialize in old products will be harmed, as higher productivity effectively leads to more unemployment. The opposite is true for regions with young products at the beginning of the cycle. There is a high elasticity of demand for the specific commodity, and productivity improvements (=falling prices) translate into higher employment.

Equation (C.13) is the “second half” of full equilibrium, since it characterizes the product market equilibrium and is a representation of labour demand. Graphically this is an upward sloping line in the $(U,w)$-space. For full equilibrium, equations (C.9) and (C.13) need to be integrated. Upon substitution, we obtain the following implicit function $Z$

$$Z = U_r - \frac{M \bar{w} \bar{U}^\beta U_r^{-\beta}}{b L_r D_r^2} + \frac{a}{b L_r D_r} - 1 = 0 \quad (C.14)$$

The central insight of the product market dynamics remains unchanged: Whether productivity improvements at given wages decrease or increase the regional unemployment rate depends on the elasticity of product demand. But now the wage curve comes into play. Changes in unemployment will have wage effects, which in turn will again influence labour demand. For example, if there are productivity improvements and inelastic product demand, unemployment will increase. Due to

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\(^9\) Be aware that since $M$ is a fixed number, the relative factor intensity is assumed to remain constant even with improved labour productivity.

\(^10\) See Blien (2001:120 ff.) for a formal elaboration.
the wage curve, the necessity to pay efficiency wages is relaxed to some extent and equilibrium wages fall. This drop in wages then stimulates labour demand and consequently lowers unemployment, but to a smaller extent than the initial loss.\footnote{One can see this argument more clearly by analysing the impacts of a demand shock on unemployment with and without wage reactions. The derivative $\partial U/\partial b$ in equation (C.13) gives the unemployment reaction if wages are fixed, the same derivative for (5) shows the reactions if wages are endogenously determined by the wage curve reaction. One can show that with fixed wages reactions are more drastic. The wage curve hence smooths out some effects, since wages move in the opposite direction as unemployment.} 

The final scope now is to integrate these ideas into a full interregional equilibrium. So far, Blien (2001) has shown how product market dynamics drive the equilibrium values of wages and unemployment rates for the single regions. In the long run, however, individuals from regions specialized in the production of commodities at the end of the product cycle do have an incentive to emigrate to booming areas.

Recall that B/O have argued that individuals in lagging locations are compensated by "non-economic" amenities, and that the wage curve is thereby stable over time. Blien pursues a different path here. He acknowledges that workers will move to those areas where wages are high and unemployment is low. But he rightly points out that migration is not an instantaneous reaction to small differences in economic variables. It is a costly and slow process. Blien argues that migration will gradually take place in response to regional inequalities. Because of this, the regional disparities will slowly fade away, other things being equal. The wage curve is thus not a long-run equilibrium curve in his model, but rather one of temporary short-run equilibrium. But he does not present a formal integration of this argument into his model. He just states the principal tendency of the wage curve to erode due to labour mobility. In regional data, however, wage curve relationship is visible, because the equilibrating forces are weak, and frequent impulses from product markets keep the labour market in motion permanently. A wage curve that is detected in the data is a representation of permanent disequilibrium and sluggish adjustment in the labour market.

C 4.3) Critique of the Blien-model

The main innovation of the Blien-model is the integration of a dynamic element, the product cycle, into the model. By this construction, a boom for a region has the same origin as a possible subsequent downturn: the state within the product cycle. This dynamic element has great merits compared to the rather static approach of B/O with exogenously given product prices. By inspection, one can think of various examples where the economic situation of a region was inevitably linked to one very characteristic product: shipbuilding in the German harbour cities in the North, coalmining in the Ruhr area, and so on. But the identification of
regions with industries that is inherent to the approaches of both Blien and B/O is problematic for two reasons, one empirical, one theoretical. 

On the empirical front one has to take into account that regions in Europe are far from being specialized in one or only a few products. By the same token, specific industries are not very much concentrated in only one region. Take the German example: car production is located not only around Stuttgart and Munich, but also in Wolfsburg, in Eisenach, in Leipzig and so on, let alone other sectors that are even more dispersed. Even if industries are very much concentrated in some regions, these regions in general host more than just one sector. For example, there is more than just car production in Stuttgart. There is more than just financial businesses in Frankfurt. And think of agriculture, the service sector, tourism. The regional concentration is not so high that one can really set regions equal with industries. Never mind, one could argue, regional unemployment rates could then be derived by using sectoral unemployment rates (that in principle could be obtained with Blien’s methodology), weighted with the sectoral shares of each region. This approach has been proposed for example by Armstrong/Taylor (1993). 

However, it seems to be a well established empirical fact that differences in regional unemployment rates can only weakly be attributed to the sectoral specialization patterns of regions. Evidence on this point is provided e.g. by OECD (2000), R.Martin (1997), Taylor/Bradley (1983), Dixon/Thirlwall (1975), or Elhorst (2000) who concludes that

"Most empirical applications have indicated that spatial differences in industry mix account for little, if any, of the variation in unemployment rates between regions. The same industry seems to experience different unemployment rates in different regions."

Hence, one should aim to develop a theory where regional disparities are not simply reflections of the sectoral structure. At least this empirical point should be seen as a caveat not to rely too exclusively on sectoral explanations.

But apart from this empirical critique, also a theoretical point needs to be stressed. Just like in the B/O-model, the sectoral specialization is completely exogenous in the Blien-model. It is unspecified why regions specialize in certain products and why they do not change their specialization patterns if products grow old and times go bad. Furthermore, why are there exogenous improvements in labour productivity that are independent of the stage in the product cycle? The appealing the idea of product cycles may be, the working of the model is very much driven by factors that are coming from outside the model and are assumed rather than explained.

Finally, the long-run implications remain an open issue. Blien argues that workers are in principal mobile across regions. Thereby the initial regional disparities along the wage curve locus would gradually erode over time. The visibility of a
wage curve in the data is attributed to the frequency of exogenous shocks and the slowness of the migration process. In a world without further shocks, regions would thus converge with respect to wages and unemployment rates. But unlike B/O, Blien does not specify the long-run equilibrium, maybe because he is not working with a production function. And he contradicts one of B/O's main conclusion, namely that the wage curve is more than just a representation of permanent disequilibrium. It has been central to the wage curve literature that regional disparities along the wage curve locus are stable over time. There is thus a dissent between B/O and Blien on this issue, and ultimately it will be a matter of further empirical research to determine who is right. But given that Blien does not tell why he does not believe in the long-run character of the wage curve, apart maybe from the fact that the theoretical explanation of B/O is not fully convincing, we feel more inclined with the original result from B/O. The persistence of regional labour market disparities has been so high in recent decades that sluggish migration in our view fails to be a convincing explanation.

C 5) Conclusion on wage curve theory and motivation for an own approach
In this chapter we have discussed in quite some detail (albeit mostly non-technical) the two main contributions to wage curve theory. The analogies with the macroeconomic ELMM were obvious. The micro-foundations of the wage curve as a partial labour market equilibrium locus were merely identical with those of the WS curve. We have argued above that in principle many suitable stories can be tailored to rationalize the characteristic slope of the wage curve in imperfectly competitive labour markets. We have pointed to several problematic aspects of the existing two wage curve approaches. These aspects all had to do with the specification of the product market, i.e. with the analogue of the PS curve. Our critique shall now be summarized in order to yield a schedule how to proceed in the next chapters of this book. The principal problem of the two approaches seems to be that they can not explain the endogenous emergence of regional disparities. Regions in both the B/O- and the Blien-model were identified with industries or sectors, and regional unemployment is merely compounded of the sectoral decomposition. More than that, the sectoral specialization in both models and thus the source of regional disparities only exist by assumption, as regions are simply assigned to the production of specific goods. This complete exogeneity is not even that critical. One can think of model extensions where regions are characterised by different factor endowments or different availability of natural resources. In this case, the sectoral specialization would shape because of comparative cost advantages in spirit of the neo-classical trade theory. Exogenous endowments would then be at the core of regional disparities, as they would determine the specialization patterns that in a secondary step drive
the regional development paths. However, such an approach would probably still be insufficient. The are both empirical and theoretical reasons for this proposition. On the empirical front we have indicated that spatial unemployment differences can not be explained well by the industry mix (OECD, 2000; Elhorst, 2000). There is a truly *regional* dimension. Moreover, it is most definitely so that the economic landscape in Europe is not only driven by comparative advantages. We have shown in chapter A that the reality in the EU-15 is characterised by a clear core-periphery structure of economic activity. Production is distributed very unevenly across space. The compelling evidence on this matter is inconsistent with the view that rich core regions have their status only because of underlying regional characteristics. Instead, it has become common to believe that today’s spatial configuration is also the result from endogenous cumulative processes and circular causation mechanisms.

Economic theory in recent years has seen a great revival of theories that analyse why economic activity in market economies seemingly tends to be organized unevenly across space, why there is a tendency for agglomeration, and why regional disparities can *endogenously* unravel and persist. As will be described in the next chapter, these theories have departed from traditional assumptions that are typical for neoclassical models, and that were also used by B/O and Blien. This namely concerns the assumptions that production is characterised by a technology exhibiting constant returns to scale and that goods are perfectly tradable across space. In the new trade and location approaches, one rather works with localized increasing returns to scale and transportation costs. Under this set of assumptions it is possible to explain the *endogenous* emergence and persistence of core-periphery structures.

Our plan is thus to reformulate the general equilibrium approach of the wage curve. We will leave the partial labour market equilibrium curve unchanged. But we will change the respective product market structure and work with a technology that takes the salient feature of regional agglomeration into account. At first, however, we will introduce the main ideas and features of the modern theories of regional agglomeration in the next chapter.