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Franz, Wolfgang; Smolny, Werner

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## The measurement and interpretation of vacancy data and the dynamics of the Beveridge-curve: The German case

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## Forschungsschwerpunkt "Internationale Arbeitsmarktforschung"

Center for International Labor Economics ( CILE )

Fakultät für Wirtschaftswissenschaften und Statistik Universität Konstanz

Wolfgang Franz Werner Smolny

The Measurement and Interpretation of Vacancy Data and the Dynamics of the Beveridge-Curve: The German Case

Postfach 5560 <D 139> 78 434 Konstanz Deutschland / Germany

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# The Measurement and Interpretation of Vacancy Data and the Dynamics of the Beveridge-Curve: The German Case

Wolfgang Franz

Werner Smolny

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## Abstract:

This paper is devoted to an interpretation of both vacancy data and the Beveridgecurve. Officially reported vacancy data are critically reviewed. The theoretical foundation and empirical application of the Beveridge-curve is examined. We find that the Beveridge-curve is everything but a straightforward tool to analyze structural unemployment. More insights especially in the dynamics of the Beveridge-curve are obtained by integrating this relationship into a macroeconomic disequilibrium framework.

Keywords: Disequilibrium model, Beveridge-curve, dynamic labour demand

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## 1 Introduction

Classicists do not know whether Homer really existed but they claim to know that he was blind. Economists are uncertain of the existence of a Beveridge-curve but it is conventional wisdom that it is negatively sloped.

In due course of the lively debate on the magnitude and development of what is called structural unemployment the Beveridge-curve, i.e. the relation between unemployment and vacancies, has experienced a resurrection in economic analysis. At first glance, its simplicity gave rise to the expectation that the Beveridge-curve can serve as a straightforward tool to evaluate structural unemployment. However, this euphoria turned out to be misplaced. It was soon recognized that the Beveridge-curve was anything but a stable relationship thus requiring a careful distinction between dynamic loops around a stable (?) long-run Beveridge-curve and possible shifts.

This paper attempts to make an additional step towards a settling of this controversy although much remains on the research agenda. Section 2 highlights the measurement of vacancies and offers some possibilities to mitigate serious shortcomings of vacancy data. Theoretical underpinnings and econometric evidence of the Beveridge-curve constitute the issue of section 3. Section 4 contains an attempt to integrate the Beveridge-curve into a macroeconometric disequilibrium model. Such a framework seems almost natural since both unemployment and vacancies indicate some type of rationing. The static matching function of such a model is then extended to a dynamic version in order to distinguish loops around the Beveridge-curve from possible shifts. Section 5 concludes.

## 2 Vacancy Data: Facts and Problems

This section is devoted to an overview of the measurement and interpretation of vacancy data in Germany and the problems associated with these aspects.<sup>1</sup>

## 2.1 The Measurement of Vacancies

In Germany the main source for data on vacancies is the Federal Labor Bureau (Bundesanstalt für Arbeit) which collects and publishes monthly vacancy data.

In the absence of mandatory registration of vacancies these data convey information only on those unfilled workplaces which are voluntarily reported to the labor office by private and governmental employers. More precisely, the labor office registers vacancies as such if<sup>2</sup>

- (i) they are announced to the labor office as workplaces to be filled,
- (ii) the unfilled workplace is located in Germany or, if it is located abroad, has been reported by a German employer,
- (iii) the vacancy is not reserved for a known person,<sup>3</sup>
- (iv) the job tenure is expected to exceed seven days.

While job openings in the context of job creation measures are counted as vacancies this does not hold for unfilled apprenticeship training positions. With rare exceptions

<sup>&</sup>lt;sup>1</sup>Unless stated otherwise all data and institutional regulations refer to West Germany.

 $<sup>^2</sup>$ Source: Anleitungen für die Statistik der Arbeitsvermittlung und Arbeitsberatung, Nürnberg 1991.  $^3$ An exception of this rule is the recruitment of guestworkers.

New Hires Method Additional resort to labor office Total Advertisements by the firm 50 59 Service by the labor office 42 100 Information given by the firm's own staff 29 27 Applications by the job seeker 20 14 Internal advertisements in the firm 13 16 9 Reply to advertisements of the job seeker 13

Table 1: Methods of Recruitment by Firms

See text for explanations; the percentages are the shares of firms who gave affirmative answers to the method in question, multiple answers were allowed; the percentages are the averages from two surveys in the fourth quarter of 1989 and the first quarter of 1990, respectively. Source: Reyher, Spitznagel and Kretschmer (1990), p. 368; calculations by the authors.

the announcement of vacancies to the labor office does not incur any  $costs^4$  and the labor office does not check the appropriateness of the informations given such as the number of the reported vacancies and the requirements concerning the abilities of potential applicants.

It should be clear from this short description that official vacancy data reflect anything but the correct number of unfilled workplaces. To begin with, not all firms report their vacancies to the labor office. <u>Table 1</u> provides casual information on how firms search for applicants to fill vacancies. The percentages are affirmative answers to the method in question out of a number of some 4,400 firms which responded to a questionaire carried out 1989/90. For example, 50 percent of all firms recruited new personell by advertisements in, say, newspapers, and 59 percent of all firms, in addition to their advertisements, contacted the employment service of the labor office. The questionaire allowed for the possibility of multiple methods of recruitments, hence, the percentages exceed hundred percent.

As can be seen from table 1, only some 40 percent of all new hires are managed by the help of the labor office according to this study. By and large, this result is confirmed by other studies as reported in v. Rosenbladt (1990), for example. This partial involvement of the labor office in new hires would be less a problem if the ratio of officially published vacancies among all vacancies were constant over time. In this case dividing official vacancies by that ratio would correct fairly adequately for this shortcoming of official vacancy data. Unfortunately, there is every reason for fluctuations and, moreover, it is not even straightforward to calculate this ratio.

This can be seen more clearly by the following definition, where fv denotes the

<sup>&</sup>lt;sup>4</sup>Again this exception refers to the recruitment of guestworkers.

fraction of vacancies V reported to the labor office among all vacancies VC:

$$fv = V/VC \tag{1}$$

Usually, fv is approximated by

$$fv \approx OV/H^* \tag{2}$$

where OV stands for the cumulated outflow of officially reported vacancies per time period and  $H^*$  denotes cumulated new hires for the same period as desired by the firms. We know, however, only actual new hires H. As has been pointed out by Schettkat (1992) what we really measure is, therefore:

$$fv \approx \frac{OV}{H} \cdot \frac{H}{H^*} \tag{3}$$

Only if H equals  $H^*$  eq. (2) is a correct formula, i.e. when firms can fill all their vacancies within the time period under consideration. Moreover, since firms often fail to notify the labor office when they have filled a vacancy otherwise, OV may not be a reliable measure and should be replaced by the cumulated inflow of official vacancies per time period IV which is more reliable.

In order to obtain an estimate of magnitudes, one possible procedure could be to estimate  $H^*$  by regressing H, after normalizing by employment (*LT*), on the degree of capacity utilization cu and lagged H:

$$\left(\frac{H}{LT}\right)_{t} = a_{o} + a_{1} \cdot cu_{t} + a_{2} \left(\frac{H}{LT}\right)_{t-1}$$

$$\tag{4}$$

where the partial adjustment mechanism captures the gap between actual and desired H given the capacity utilization rate.  $H^*$  are then given for t = t - 1, i.e.

$$H_t^* = \left[ \left( a_0 + a_1 \cdot c u_t \right) \cdot L T_t \right] / (1 - a_2) \tag{5}$$

It goes without saying that the calculation of  $H^*$  according to eq. (5) is an oversimplification since the partial adjustment model may also reflect expectations and the like. However, estimating eq. (5) by annual data gave unsatisfactory results probably because the adjustment period falls short considerably of one year. Monthly or quarterly data are, however, not available to us.

As an alternative measure of fv, figure 1 displays also the ratio of new hires obtained through the employment service of the labor office (regardless whether these new hires were employed, unemployed or out of the labor force before) among all new hires, i.e. HL/H. A comparison of IV/H and HL/H reveals the strong similarity of both series. For comparability with previous work we therefore stay with IV/H to calculate corrected vacancies. Figure 2 displays both official and corrected vacancy rates, vr and vrc, respectively.

Whatever the merits of this correction, the aformentioned serious caveats remain. Therefore, in our subsequent econometric analysis we shall use both actual and corrected vacancy data in order to check for the robustness of our results.

The unknown amount of underreporting is not the only flaw of official vacancy data. Vacancies of a job tenure of less than eight workdays are not reported such as day-laborers. In addition, official vacancies do not provide information whether the vacancy should be filled now or in the future. Firms anticipate search time for adequate hirings and a vacancy today may therefore reflect future rather than current labor demand. In the study mentioned before it is reported that 20 percent of all



Figure 1: Measures of underreporting







official vacancies are to be filled "later" (a term which is not specified more precisely). Moreover, underreporting is higher for this type of vacancies compared with those to be filled immediately.<sup>5</sup>

## 2.2 The Development and Structure of Vacancies

It is well-known that if the development of vacancies is stationary over time quarterly averages of vacancies can be decomposed into the duration of vacancies (months) times the cumulated inflow of vacancies per quarter. Figure 3 gives an impression of both dimensions employing official vacancy data. The duration of vacancies peaks in the boom phase in the beginnings of the seventies and again in 1980 with a sharp decline afterwards. Since 1983 a steadily increase of the duration of vacancies took place despite high and persistent unemployment. This observation has been used as empirical evidence in favor of a higher choosiness of employers in selecting applicants for available jobs. Indeed, the following regression which is a crude attempt to disentangle cyclical and trend movements of duration cannot reject the hypothesis of a significant positive time trend, where ur denotes the unemployment rate and dv the duration of vacancies (standard errors in parentheses):

$$dv_t = \begin{array}{cc} 0.704 - 11.492 \cdot ur_t + & 0.004 \\ (0.03) & (0.92) \end{array} \cdot time + seas. \tag{6}$$
$$\overline{R}^2 = 0.767 \qquad DW = 0.55$$

<sup>5</sup> Ibidem.

The significance of the positive time trend does not change, if eq. (6) is corrected for first order autocorrelation. Taken together, the four times higher yearly averages of vacancies in 1990 compared with 1983 is the result of a 1.8 times higher inflow and a 2.3 times higher duration of vacancies.

The next obvious question is whether the increased duration refers to vacancies which are filled by a person or cancelled otherwise. <u>Table 2</u> shows that both types of vacancies are subject to an increased duration but that those which are filled are lagging behind those which are cancelled otherwise.

What are the reasons for an unsuccessful search seen from the firm's viewpoint and how does a firm react when a vancancy cannot be filled? <u>Table 3</u> displays answers of firms why they turned down people showing up for a job. This survey of firms was carried out in 23 employment offices in mid-1989 and covers nearly 400 firms. Lack of trustworthiness and experience were the most important reasons followed by too high wage demands. Interestingly, firms were considerably more sceptical about the applicant's willingness to work if the interview was arranged by the labor office. Many of the applicants suggested by the labor office did not even show up for an interview. Hence, other applicants not placed by the labor office were given hiring preference. Further results of this study show that those positions which could not be filled where only to a very small amount extremely unattractive, but to a much greater range intended for people with specialized skills.

Reactions of firms which could not fill a vacancy include (in the order of importance) internal job changes, overtime work or switch from part-time to full-time work of the personell, and rejection of incoming order.<sup>6</sup>

## 3 The Relation between Unemployment and Vacancies

The U/V-curve or Beveridge-curve, i.e. the relation between unemployment and vacancies, is used frequently as an analytical instrument to identify the extent and the causes of a possible increase of structural unemployment. In order to provide a prerequisite for the subsequent analysis of the dynamics of the Beveridge-curve, this section very briefly comments on the theory and empirial evidence of a static Beveridge-curve for Germany.<sup>7</sup>

## 3.1 Theoretical Issues

As is well known, three elements form the basis of a theoretical foundation of the Beveridge-curve:<sup>8</sup>

(i) The search process seen from the viewpoint of the firm with a vacancy. It is assumed that the firm is uncertain about the abilities of each applicant (which determine the worker's efficiency). The firm knows, however, the density function of these abilities prevailing on a suitably defined labor market. Moreover, there is a minimum hiring standard to be met by the applicant due to specific requirements or legal restrictions for the job under consideration. The firm is allowed to train workers but it has to incur training costs. In sorting out workers, the firm sets its minimum hiring standard endogenously, then evaluates expected

<sup>&</sup>lt;sup>6</sup>See Reyher, Spitznagel and Kretschmer (1990), p. 370.

<sup>&</sup>lt;sup>7</sup>A collection of recent work can be found in Franz (1992), see also Franz (1991).

<sup>&</sup>lt;sup>8</sup>See Franz and Siebeck (1992)

Year	Filled vacancies	Cancelled vacancies
1983	15.5	47.1
1984	16.0	46.1
1985	16.5	48.4
1986	15.2	72.3
1987	17.1	73.0
1988	18.6	72.9
1989	24.6	81.4
1990	30.5	101.2
	1	

v

**Table 2: Duration of Reported Vacancies** 

In days.

Source: Buttler and Cramer (1992), p. 84.

Tab)	le 3:	Reasons	Why	Firms	Turned	Down	Applicants	1989
------	-------	---------	-----	-------	--------	------	------------	------

Reasons	Applicants provided by the labor office	Other applicants
Lack of trustworthiness	28.4	18.5
Lack of professional experience	20.0	21.9
Lack of experience in the firm's branch	18.6	18.5
Did not really want to work	17.4	1.2
Too high wage claims	13.0	17.7
Too many job turnovers	11.3	9.5
Too long unemployed	6.4	2.5

See text for details; the percentages of firms which gave an affirmative answer to the aspect in question; multiple reasons were possible.

Source: Cramer (1990), p. 252.

training costs, and makes finally a wage offer. From this viewpoint two aspects are important for the matching process. First, the minimum hiring standard which may or may not be met by the job seeker, and second, the wage offer made by the firm shich may or may not be accepted by the applicant.

- (ii) The search process seen from the viewpoint of the job seeker: The applicant's decision is based on a conventional job search model. The job seeker maximizes expected wealth by accepting a wage offer which is not lower than the reservation wage. The individual contacts several employers submitting wage offers. The distribution of wage offers is the source of uncertainty: although its parameters are known to the searcher, each offer is a realization of a random variable. Determinants of the reservation wage are the search costs, the unemployment benefits, the density function of wage offers, and the discount rate.
- (iii) The matching technology governing the labor market: The probability that a vacancy is filled can be decomposed into two probabilities, namely that an unemployment person contacts an employer with a vacancy, and the probability that a match is formed conditional on a contact between both searchers (contact and contract probability, respectively). Factors influencing the first probability are the number of unemployed persons and vacancies and the availability of information about both groups. The probability that a match is formed depends on the probability that the applicants meets the minimum hiring standard and that the reservation wage does not exceed the wage offered by the firm.

The Beveridge-curve can then be derived by making use of the identity that the change in the number of unemployed persons equals the difference between (exogenous) inflows into and outflows from unemployment which is the number of vacancies times the probability that a vacancy is filled with an unemployed applicant. These relationships constitute the Beveridge-curve and various sources for possible shifts of the U/V-curve can be identified:

- (i) The Beveridge-curve shifts unambiguously outwards if the probability that a contact is made decreases. This may be due to a lower search itensity of the job seeker induced by higher unemployment benefits.<sup>9</sup>
- (ii) On the other hand, persons with a long duration of unemployment may run out of unemployment benefits and, therefore, intensify searching (the contact probability increases) and lower their reservation wage (the contract probability increases). From this one would conclude that a higher share of long-term unemployed causes an inward shift of the U/V-curve. If, however, firms use unemployment as a screening device in order to identify the unknown productivity of the applicant, then a higher share of long-term unemployed lowers the contract probability, i.e. we face an outward shift of the Beveridge-curve. Hence, the total effect of the variable: share of long-term unemployed on the U/V-curve is ambiguous.<sup>10</sup>
- (iii) The contact probability decreases when the regional dispersion between unemployed persons and vacancies increases because the concomitant greater information gap causes a malfunctioning of the matching process. On the other hand,

<sup>&</sup>lt;sup>9</sup>These results are also obtained by Jackman, Layard and Pissarides (1983) and Jackman and Roper (1985).

<sup>&</sup>lt;sup>10</sup>See also Budd, Levine, Smith (1987) for this argument.

the effect of such higher imbalances on the contract probability may be ambiguous. Consider the following example with two regions, "south" and "north" for short, where south is a nice region with high standards of living and north is just the opposite. If the unemployed are located in the north and now vacancies are also opened in the south rather than only in the north this may ceteris paribus facilitate matching because the attractiveness can be viewed as a higher wage offer. Of course, the opposite may hold for the unemployed who are in the south. Moreover, a greater regional dispersion may imply higher (non-pecuniary) costs of changing location for the unemployed which lowers his or her willingness to accept a wage offer from a firm in a far distant region. Therefore, in contrast to the previous literature, it is not necessary that the U/V-curve always shifts outwards if the regional dispersion increases although that effect may be more likely than an inward shift.

(iv) An existing vacancy may not be filled even if an applicant shows up. The job seeker may not have the profession required for the job in question, or his or her work experience is too short or is evaluated badly by the former employers. In short, this is called a "qualifications mismatch". However, higher qualifications (acquired, for example, by some training programs organized by the labor office) do not necessarily mean a higher contract probability: On the one hand, they increase the probability that the applicant meets the requirements set by the firm but, on the other hand, they raise the applicant's reservation wage. Hence, the effect of higher qualifications on the location of the U/V-curve is ambitious, too.

## 3.2 Econometric Exercises

The empirical investigation starts with figures 4 and 5 which display Beveridge-curves for Germany 1962 to 1990 based on registered and corrected vacancy data, respectively. As has been discussed in section 2.1, corrected vacancies are calculated by multiplying officially registered vacancies with the inverse of an estimated ratio of cumulated inflows of vacancies among cumulated new hires. A rough inspection of both figures reveals a negatively sloped U/V-curve where possible outward shifts are more obvious for corrected vacancy data. It has been shown elsewhere, however, that the U/V-curve based on official data exhibits outward shifts, too [Franz (1987a)]. More specifically, the data analysis contained in cols. (1) and (2) of <u>table 4</u> suggests that the fit of the Beveridge-curve can be improved by adding two slope dummies D74 and D83 which are unity since 1974 and 1983, respectively, but zero before these years. After some experimentation we found that the following loglinear relationship is most suitable to form the basis of the Beveridge-curve:<sup>11</sup>

$$\ln ur_t = a_0 + a_1 \cdot \ln vrc_t + \varepsilon_t \tag{7}$$

<sup>&</sup>lt;sup>11</sup>One might wish to correct data of unemployed persons, too, because official data contain only those unemployed who register as such at the labor office. It is not clear, however, to what extent people such as discouraged workers are really looking for a job as required by the theoretical underpinning of the Beveridge-curve (see section 3.1). See Franz (1987a) for an analysis with corrected unemployment data.



Figure 4: Beveridge-curve, official data for vacancies

Figure 5: Beveridge-curve, corrected data for vacancies



#### Table 4: Estimates of the Beveridge-Curve 1966.1-1990.4

Explanatory Variables	(1)	(2)	(3)
ln vrc <sub>t</sub>	-1.843 (0.13)	-1.119 (0.13)	-1.360 (0.12)
$D74 \cdot \ln vrc_t$		0.419 (0.18)	0.616 (0.16)
$D83 \cdot \ln vrc_t$	-	0.471 (0.18)	0.456 (0.16)
ln <i>slu</i>		ζ, γ	0.338 (0.06)
intercept	-10.098 (0.45)	-8.271 (0.40)	-9.723 (0.42)
<i>D</i> 74	()	2.390 (0.63)	2.766
D83		2.398 (0.70)	2.059 (0.59)
$\overline{R}^2$	0.695	0.950	0.965
DW	0.13	0.75	0.89
SEE	0.546	0.225	0.190

Dependent variable:  $\ln ur_t$ 

<sup>a)</sup> See text for details and definitions.

Standard errors in parentheses

where ur = official unemployment rate,

vrc = corrected vacancy rate, i.e. corrected vacancies divided by employed persons,

 $\varepsilon$  = residual.

It goes without saying that the estimates carried out so far are merely data analysis and should be viewed with considerable care. For example, since 1983 the sum of regression coefficients associated with  $\ln vrc$  is not significantly different from zero. If so, this would indicate an absence of a negative relationship between unemployment and vacancies in this subperiod.

Taken at face value, however, the dummy variables give rise to an outward shift as well as a rotation of the Beveridge-curve. What has caused this motion of the U/V-curve? From the preceding theoretical analysis three candidates emerge namely the share of long-term unemployed persons  $slu^{12}$  and various proxies for a regional and qualifications mismatch. With respect to slu the time pattern of this variable follows rather closely that of the unemployment rate as is evidenced by figure 6. In some sense this coincidence may stem from the hysteresis phenomenon in unemployment.<sup>13</sup> Firms may use unemployment experience as one of their screening devices and/or the skills of the unemployed person may indeed the more deteriorate the longer the spell of unemployment. Be that as it may, the significant positive coefficient of the slu

<sup>&</sup>lt;sup>12</sup>More precisely, *slu* is the share of unemployed persons with a duration of unemployment of one year and longer among all unemployed.

<sup>&</sup>lt;sup>13</sup>See Franz (1990) for an overview.

Figure 6: Unemployment rate and share of long-term unemployed



variable in col (3) of table 4 does not come as a surprise given the close relationship between ur and slu.

Even less mileage can be obtained from various mismatch indicators. Franz and Siebeck (1992) report on various attempts to construct such measures of regional and professional mismatches or turbulences. The upshot of this rather frustrating story is that adequate mismatch indicators are difficult to calculate due to data deficiencies. Furthermore, those proxies could barely contribute to an explanation of the movements of the U/V-curve. At best, one can guess that some higher imbalances in terms of qualifications and a greater choosiness on the part of employers may have interfered with a smooth balancing of labor demanded and supplied.

This view so far discounts the Beveridge-curve as a straightforward tool to analyze the nature and causes of structural unemployment. In addition to the aforementioned flaws it is unclear to what extent the observed movements of the U/V-curve, if there are any at all, are simply (anti-)clockwise loops around a stable relationship. Indeed, in a recent study Börsch-Supan (1992) concludes that augmenting the Beveridge-curve regression by a set of cyclical variables, stemming from an underlying theoretical labor market equilibrium model in the spirit of Pissarides (1985), causes the outward shifts to vanish almost completely. These findings by Börsch-Supan (1992) are of high interest. Therefore, a more detailed analysis of the dynamics of the Beveridge-curve is warranted. The remainder of our paper attempts to carry out such a study based on a macroeconometric disequilibrium model. The choice of such type of a model seems to be natural because both variables, vacancies and unemployment, may, within limits, indicate the absence of market equilibrium as has been pointed out already by Hansen (1970). What are then the lessons from a disequilibrium model?



Figure 7: Employment curve

## 4 The Matching Function in a Disequilibrium Model and the Dynamics of the Beveridge-Curve

This section is devoted to an integration of the Beveridge-curve into the framework of a disequilibrium model and an analysis of the dynamics of the Beveridge-curve. The presentation is carried out in two steps. We firstly give a very brief overview of the disequilibrium model and introduce the static version of an employment function. Section 4.2 extends this analysis by allowing for a dynamic employment function and a discussion of the dynamics of the Beveridge-curve.

## 4.1 Micro-Markets and the Matching Function

Since a more detailed description of the rationing model is presented elsewhere we only very briefly outline the basic philosophy of this approach here.<sup>14</sup>

In its simplest form the model recognizes that employment is either determined by labor demand LD if the real wage rate is beyond its market clearing level or by labor supply LS if the real wage rate falls short of its equilibrium level. Moreover, as has been pointed out already by Hansen (1970) the employment curve LT is located below the LD-curve and beyond the LS-curve (see figure 7). Hence, at a real wage rate  $w_0$ , we observe both vacancies V and unemployment U at the same time. The reason for this coincidence of unemployment and vacancies is a maladjustment on the labor market because matching is neither timeless nor perfect. Neglecting measurement problems of U and V, the preceding argument suggests that the following definitions hold:

<sup>&</sup>lt;sup>14</sup>For more detailed descriptions see e.g. Entorf, Franz, König and Smolny (1990), Franz and Heidbrink (1992), Franz and König (1990), and Smolny (1992, 1993).

$$LD \equiv LT + V$$
 and  $LS \equiv LT + U$  (8)

The first generation of macroeconometric disequilibrium models have applied a minimum condition at the aggregate level:

$$LT = \min(LS, LD) \tag{9}$$

This procedure has become under severe attack both for theoretical and econometric reasons. From a theoretical viewpoint such a methodology implies that the entire economy is either completely subject to an excess demand situation or an excess supply situation on the labor market, combined with sudden changes of the whole economy from one regime to another. Given many branches with different economic conditions this outcome is extremely unlikely (except perhaps in centralized command economies). Moreover, in an econometric analysis the choice of the switch point in the likelihood function turned out to be fairly arbitrarily.

The present prototype of a disequilibrium model applies the strong minimum condition (8) only to a micro-market. Put differently, a micro-market is defined as a market (a firm, for example) which is rationed only from one side, demand or supply. The core of the model is the aggregation procedure "smoothing by aggregation" put forward by Lambert (1988). It can be shown that under reasonable assumptions about the magnitudes of the disturbances on each micro-market the statistical distribution of the micro-market follows a lognormal distribution [Smolny (1993)]. Then aggregation over all micro-markets yields the following aggregate employment function as an approximation:

$$LT = \left\{ LS^{-\rho} + LD^{-\rho} \right\}^{-1/\rho}$$
(10)

The parameter of interest is  $\rho$ , the mismatch parameter. For  $\rho \to \infty$  eq. (10) collapses to eq. (9), i.e. we are back to the strong minimum condition which can be viewed as a special case if matching is perfect. Otherwise we have:

$$LT = \left\{ LS^{-\rho} + LD^{-\rho} \right\}^{-1/\rho} < \min(LS, LD)$$
(11)

The mismatch parameter  $\rho$  itself is derived from:

$$\rho = -1 + \frac{2}{\sigma} \frac{f(-\sigma/2)}{F(-\sigma/2)}$$
(12)

where  $\sigma$  denotes the dispersion of disturbances on the micro-markets and  $f(\cdot)$  and  $F(\cdot)$ are the standard normal density and cumulated distribution function, respectively. Hence,  $\rho$  is inversely related to the dispersion parameter  $\rho$  so that  $\rho \to \infty$  when  $\sigma \to 0$ . By straightforward algebra eq. (11) can be rearranged to:

$$1 = \left(\frac{LS}{LT}\right)^{-\rho} + \left(\frac{LD}{LT}\right)^{-\rho}$$
(13)

Recall that  $ur \equiv (LS - LT)/LS$  and  $vr \equiv (LD - LT)/LD$ . Hence, eq. (13) can be rewritten as

$$1 = (1 - ur)^{\rho} + (1 - vr)^{\rho}$$
(14)

which constitutes a relation between unemployment and vacancies, i.e. eq. (14) is a Beveridge-curve with a negative slope which is the steeper the smaller  $\rho$  is.

The link with "structural unemployment" can be easily illustrated for a hypothetical situation of a macroeconomic equilibrium, i.e. for LS = LD. Then in eq. (14) vrequals ur and solving for ur yields

$$ur \equiv sr = 1 - 2^{-1/\rho} \tag{15}$$

where sr denotes the structural rate of unemployment at macroeconomic equilibrium. The lower  $\rho$ , i.e. the greater the maladjustment on the labor market, the higher sr.

#### 4.2 Dynamics of the Matching Function

The static version of the CES-function presented so far fails to contribute to an analysis of possible loops versus shifts and/or rotations of the Beveridge-curve. As has been pointed out at the end of section 3.2, this confusion about the nature of observed dynamics constituts a major flaw in the literature on the U/V-curve. Therefore, we attemp to make a step to remove these shortcomings.

One advantage of the CES-function approach of the Beveridge-curve is that it allows an easy introduction of dynamic aspects. We first offer a more intuitive interpretation and then turn to a more technical description. From the argument that the current employment level depends not only on labor demand and labor supply, but also on the past employment level, a simple extended employment function can be derived:<sup>15</sup>

$$LT_t = LT(LD_t, LS_t, LT_{t-1})$$
<sup>(16)</sup>

Assuming linear homogeneity of the employment function, the following implicit Beveridge-curve results,

$$1 = LT\left(\frac{LD_t}{LT_t}, \frac{LS_t}{LT_t}, \frac{LT_{t-1}}{LT_t}\right)$$
(17)

$$1 = LT\left(\frac{1}{1 - vr_t}, \frac{1}{1 - ur_t}, \frac{1}{1 + \Delta lt_t}\right)$$
(18)

where  $\Delta lt$  stands for the growth rate of employment. In this model the location of the Beveridge-curve depends on the growth rate of employment. If the past employment level has a positive effect on current employment, a higher growth of employment leads to an outward shift of the Beveridge-curve. Put differently, vacancies and unemployment which exceed their long-run (i.e. for  $LT_t = LT_{t-1}$ ) values should cause an increase of employment. For example, in case of an increase of labor supply or labor demand employment increases slowly, and the adjustment path depicted in an ur - vr-diagram should lie to the right of the long-run Beveridge-curve.

The relevance of these aspects for the discussion of the Beveridge-curve in Germany especially in the eighties can be seen in figures 8 and 9, by comparing them with the Beveridge-curves, figures 4 and 5. In figure 8, the actual employment level LT is displayed, together with labor demand (employment + official vacancies) and labor supply (employment + unemployed). As has been shown, figure 4 suggests a shift or a rotation of the Beveridge-curve starting about 1983. On the other hand, from figure 8 it can be seen that these years are also years of increasing labor supply, labor demand and employment. If employment adjusts slowly as decribed above, these observations (i.e. since 1983) can also be explained in terms of an dynamic adjustment of employment,

<sup>&</sup>lt;sup>15</sup>Theoretical and empirical work which emphasizes the importance of a dynamic adjustment of employment are e.g. Nickell (1986) and Palm, Pfann (1990).

where the unemployment rate and the vacancy rate are located temporarily above those values implied by the long-run Beveridge-curve. The same story can be told from the corrected vacancy data shown in figures 5 and 9. These figures also allow a similar interpretation of the other possible shift of the Beveridge-curve in the second half of the seventies. Employment, labor supply, and labor demand increased, and the model of dynamic adjustment of employment can contribute to an explanation of high unemployment and vacancy figures.

A more detailed analysis concerning shifts versus temporary loops of the Beveridgecurve can be carried out only by an econometric analysis of an explicit model. In Smolny (1993), a disequilibrium model of dynamic employment adjustments is developed which can also be applied here.<sup>16</sup> The basic constraint to adjustment can be outlined as follows. In the disequilibrium approach, employment on appropriately defined micro-markets *i* is determined by:

$$LT_{i,t} = \min(LD_{i,t}, LS_{i,t})$$
<sup>(19)</sup>

This results on the aggregate level in the CES-function for employment, eq. (10). An obvious way to allow for constraints on the adjustment of employment is to augment this minimum condition by past employment. The following minimum condition displays such a constraint for the increase of employment:

$$LT_{i,t} = \min \left[ LD_{i,t} , LS_{i,t} , (1+\delta_i) \cdot LT_{i,t-1} \right]$$
(20)

This formulation implies that the current employment level cannot be higher than  $1+\delta$  times the past employment level, i.e. the growth rate of employment is restricted to be less or equal than  $\delta$  on the micro level. This adjustment constraint can be justified, for instance, by constraints in hiring and training capacities or by a limited mobility of firms or workers. Using the same aggregation procedure as outlined above, aggregate employment can be approximated by the following three-factor CES-function

$$LT_{t} = \left\{ LD_{t}^{-\rho} + LS_{t}^{-\rho} + \left[ (1+\delta) \cdot LT_{t-1} \right]^{-\rho} \right\}^{-1/\rho}$$
(21)

where LT, LS, and LD are the aggregate counterparts of the firm level variables, and  $1 + \delta$  is the average adjustment constraint for employment. In the presence of mismatch, aggregate employment will always grow slower than with a rate  $1 + \delta$ , because some firms' employment will be constrained by labor supply or labor demand. The Beveridge-curve inherent in eq. (21) can be derived from:

$$1 = \left(\frac{LS_t}{LT_t}\right)^{-\rho} + \left(\frac{(1+\delta) \cdot LT_{t-1}}{LT_t}\right)^{-\rho} + \left(\frac{LD_t}{LT_t}\right)^{-\rho}$$
(22)

$$1 = (1 - ur_t)^{\rho} + \left(\frac{1 + \Delta lt_t}{1 + \delta}\right)^{\rho} + (1 - vr_t)^{\rho}$$
(23)

It can be seen that this equation yields the same features as the general model above. A positive growth rate of employment is associated with an unemployment rate and a vacancy rate higher than those implied by the long-run Beveridge-curve. Stated as

<sup>&</sup>lt;sup>16</sup> In Smolny (1993), a different concept of labor demand is employed. It is derived from the number of working places which depend on the capital stock and labor productivity, and from "Keynesian" labor demand depending on the expected demand for goods. See also Smolny (1992).



Figure 8: Employment, labor supply, and labor demand





a causal relationship, employment increases for ur and vr above long-run Beveridgecurve values. Finally, the structural rate for this dynamic CES-function can be calculated from:

$$sr = 1 - \left(\frac{1 - (1 + \delta)^{-\rho}}{2}\right)^{1/\rho}$$
 (24)

Despite the microeconomic foundation of this adjustment model, it places rather strong restrictions on the adjustment path of employment. For instance, in empirical data one often finds a strong autocorrelation in the growth rates of economic variables which cannot be easily implemented in this approach. Therefore, for the empirical applications below this model will be complemented by an error correction specification of employment adjustment. In some sense, the error correction model is an even more appropriate approach to capture the arguments above. It was argued above, that deviations of ur and vr from the long-run Beveridge-curve should drive employment changes. Another way to model the adjustment is therefore to estimate in a first step the long-run Beveridge-curve as a CES-function for employment, i.e. equation 11. In a second step it can be tested whether the deviations from this Beveridge-curve contribute to an explanation of employment changes by regressing  $\Delta lt$  on, among other variables, the residuals of eq. (11). From a policy viewpoint, this specification has the further advantage that it can directly be used to forecast employment changes from unemployment and vacancy data. This procedure requires that employment, labor supply, and labor demand are cointegrated variables. This will be tested in the next section.

#### 4.3 Empirical Results

The main focus of the following step is to test the relevance of the dynamic adjustment of employment for the Beveridge-curve. Therefore, an analysis of the determinants of mismatch is deliberately left out of consideration. It has been mentioned above that most mismatch indicators do not contribute very much to an explanation of the shifts of the Beveridge-curve. The only notable exception is the rate of longterm unemployment, but this is also related to the dynamics of employment and unemployment: long-term unemployment can be explained, to a large part, by the history of unemployment. In the analysis here, the development of mismatch is taken into account by a trend. In addition, we allow for a structural break in the Beveridgecurve in 1974. Given the poor quality of vacancy data, both official and corrected vacancy data are used, where the reporting rate for vacancies is calculated as the relation of inflows of official vacancies to total hires, IV/H. The data sample includes quarterly data from 1960.1 to 1990.4.

The results are documented in <u>tables 5</u> and <u>6</u>. All equations are estimated in logs of the dependent variable and the CES-function is estimated without a constant but including seasonal dummies:

static CES-function

$$\ln LT_t = (-1/\rho) \cdot \ln \left\{ LS_t^{-\rho} + LD_t^{-\rho} \right\} + \text{seas.}$$
(25)

dynamic CES-function

$$\ln LT_{t} = (-1/\rho) \cdot \ln \left\{ LS_{t}^{-\rho} + \left[ (1+\delta) \cdot LT_{t-1} \right]^{-\rho} + LD_{t}^{-\rho} \right\} + \text{seas.}$$
(26)

The mismatch parameter is specified as:

$$1/\rho = (c_1 + c_2 \cdot t)/100 \tag{27}$$

For some versions,  $c_2$  is restricted to zero.

Versions (1) and (3) in table 5 are static CES-functions which differ in the treatment of the mismatch parameter  $\rho$ . While version (1) restricts  $\rho$  to be a constant, version (3) introduces a trend in mismatch. All equations are estimated for the whole sample period and separately for 1960.1-1973.4 and for 1974.1-1990.4.

The appropriateness of these results depends on whether the variables included are cointegrated. Therefore it is firstly tested for the degree of integration of the variables. The results are contained in table 7. It can be seen that non-stationarity cannot be rejected for the level-variables even for the splitted sample with the exception of labor supply in the second sample as a borderline case. The first differences of the logs of the variables are probably stationary. The coefficients are significantly different from zero at least at the 10 percent level for the long sample, and their magnitude can be seen as another indicator for stationarity.

The results of the estimation of the static CES-functions give a first impression of possible shifts of the Beveridge-curve. Version (1) which implies a constant mismatch yields a structural rate sr of 1.3 percent for the sample 1960.1-1973.4 and a value of 2.1 percent for the second sample 1974.1-1990.4. The whole sample sr gives an average of 1.6 percent. However, these results should be read with care due to a possible specification error, because version (3) reveals a significant trend in mismatch. In these versions, sr increases from about 1 percent in 1960 to about 3 percent at the end of the sample. In addition, while the trend is rather flat in the first sample, it becomes more important in the second sample. A remarkable fact is the low standard error of estimate (SEE) which is about 0.4 percent for the version with constant mismatch for the whole period, but reduces to about 0.1 percent for the versions which include a trend and a structural break in mismatch. The CES-function fits the data rather well. With respect to the test of conintegration within the equations, the Dickey-Fuller tests do not allow to reject non-stationarity for the residuals.<sup>17</sup> This result, however, should be more viewed as an indicator of a low power of the Dickey-Fuller test. It will be shown below that another test for stationarity, i.e. the significance of the error correction terms in the dynamic regressions, will reveal stationarity.

Versions (6) and (7) are the dynamic counterparts of versions (1) and (3), where the CES-dynamic, i.e. eq. (26) is employed. The results for the mismatch parameter do not change very much, but the standard errors of the estimates decrease indeed. For instance, for the whole sample SEE declines from 0.793 percent to 0.380 percent for the version with a constant mismatch and from 0.276 percent to 0.182 percent for the version with trended mismatch. In addition, the trend is less important for the dynamic CES-functions especially in the splitted sample. Note also that a structural break in the eighties which is visible for the static Beveridge-curves, is not significant in the dynamic equations (not reported in the table).

Taken together, the dynamics do play an important role for the explanation of employment. On the other hand, the high and significant autocorrelation still indicates a dynamic specification which may be too restrictive. In versions (2) and (4) the dynamic adjustment is therefore modelled as an error correction mechnism. The

<sup>&</sup>lt;sup>17</sup>It should be noted that critical values for the test are only available for linear equations and not for the nonlinear CES-function. However, the empirical t-values are so low that non-stationarity could not be rejected even for the case that the series are not residuals of an least squares estimate.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
data samp	ole: 1960	.1-1990.4	4				
	ln LT	$\Delta \ln LT$	ln LT	$\Delta \ln LT$	$\Delta \ln LT$	ln <i>LT</i>	ln <i>LT</i>
<i>c</i> <sub>1</sub>	2.309 (0.06)	*	1.247 (0.05)	*	1.045 (0.53)	1.379 (0.07)	1.416 (0.03)
<i>c</i> <sub>2</sub>			0.021 (.0008)	*	0.022 (.006)		0.012 (.001)
$1 + \delta$						1.020 (.002)	1.061 (.006)
sr	1.6	*	0.9 - 2.7	*	0.8 - 2.6	1.3	1.0 - 2.5
$EC_{t-1}$		-0.999		-1.315	-1.357		
$\Delta \ln LT_{t-1}$		(0.25) 0.580 (0.07)		(0.28) 0.612 (0.07)	(0.30) 0.609 (0.07)		
AR(4)		(0.01) (0.842) (0.05)		(0.01) (0.813) (0.05)	0.811 (0.06)		
SEE	0.389	0.321	0.167	0.314	0.316	0.210	0.117
BP(8)	653.0	3.9	280.9	3.3	<b>3.8</b>	256.3	229.9
DF(8)	-0.132 (-2.51)		-0.118 (-2.45)				
data samp	ole: 1960	.1-1973.4	4				
$c_1$	1.918 (0.03)	*	1.700 (0.05)	*	2.507 (0.74)	1.858 (0.10)	1.612 (0.07)
<i>c</i> <sub>2</sub>			0.0067	*	0.0051	. ,	0.0068
$1+\delta$	·····		(		(* -)	1.081	1.073
<u></u>						(0.04)	(0.02)
sr	1.3	*	1.2 - 1.4	*	1.7 - 1.9	1.3	1.2 - 1.5
$EC_{t-1}$		-2.351 (0.51)		-2.548 (0.52)	$-2.738 \\ (0.53)$		,
$\Delta \ln LT_{t-1}$		$0.498 \\ (0.11)$		$0.506 \\ (0.11)$	0.469 (0.11)		
AR(4)		$\begin{array}{c} 0.631 \\ (0.14) \end{array}$		$0.567 \\ (0.14)$	$0.576 \\ (0.14)$		
SEE	0.122	0.318	0.101	0.313	0.313	0.121	0.090
BP(8)	95.1	2.6	38.7	2.3	2.4	106.8	46.2
DF(8)	-0.438		-0.424				
	(-2.27)		(-2.19)				
data samp	ole: 1974	.1-1990.4	4			1.0.17	
$c_1$	$3.114 \\ (0.08)$	*	0.667 (0.13)	*	1.275 (1.61)	1.947 (0.07)	1.407 (0.15)
$c_2$			0.028 (.001)	*	$\begin{array}{c} 0.028 \\ (0.02) \end{array}$		0.016 (.003)
$1 + \delta$						1.032 (.002)	1.088 (.02)
sr	2.1	*	1.7 - 2.9	*	1.1 - 2.4	1.8	1.7 - 2.7
$EC_{t-1}$		-0.556 (0.29)		-0.741 (0.36)	-0.960 (0.49)		
$\Delta \ln LT_{t-1}$		$0.549 \\ (0.10)$		$0.572 \\ (0.10)$	0.495 (0.12)		
AR(4)		0.729 (0.10)		0.739 (0.09)	0.731 (0.09)		
SEE	0.299	0.262	0.115	0.261	0.263	0.126	0.104
BP(8)	239.3	5.14	139.8	5.3	4.7	123.7	109.3
DF(8)	-0.189		-0.170	- • • •			
	(-2.49)		(-2.30)				

Table 5: Employment function: official vacancy data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
data samp	le: 1960	.1-1990.4	4	· · · · · · · · · · · · · · · · · · ·	····	<u></u>	<u>,                                </u>
	ln <i>LT</i>	$\Delta \ln LT$	ln LT	$\Delta \ln LT$	$\Delta \ln LT$	ln LT	ln LT
$c_1$	4.436 (0.12)	*	1.843 (0.11)	*	1.633 (0.76)	1.367 (0.12)	1.919 (0.07)
<i>c</i> <sub>2</sub>			0.037 (.001)	*	0.038 (.008)	. /	0.019 (.001)
$1 + \delta$						1.009	1.057
sr	3.0	*	1.4 - 4.5	*	1.3 - 4.4	2.0	$\frac{()}{1.5-4.3}$
$EC_{t-1}$		-0.438		-0.781	-0.789		
$\Delta \ln LT_{t-1}$		(0.12) 0.488		(0.16) 0.462	(0.17) 0.469		
AR(4)		(0.08) (0.820) (0.06)		(0.08) (0.780) (0.06)	(0.08) 0.777 (0.06)		
SEE	0.793	0.325	0.276	0.314	0.316	0.380	0.182
BP(8)	699.1	<b>3.8</b>	277.1	2.45	2.4	207.7	185.8
DF(8)	-0.093 (-1.89)		-0.111 (-1.92)				
data samp	le: 1960	.1-1973.4	4				
C1	3.229	*	3.092	*	2.880	2.694	2.478
	(0.04)		(0.09)		(0.60)	(0.13)	(0.12)
<i>c</i> <sub>2</sub>			0.0042 (.003)	*	$\begin{array}{r}0.0013\\(.01)\end{array}$		$\begin{array}{c} 0.0053 \\ (.001) \end{array}$
$1+\delta$						1.069	1.066
	2.2	*	21-22	*	20 - 20	$\frac{(.01)}{21}$	$\frac{(.009)}{19-22}$
$\frac{\mathbf{EC}_{t-1}}{\mathbf{EC}_{t-1}}$	<u> </u>	-1.603	2.1 - 2.1	-1.625	-1.659	2.1	1.0 . 4.4
		(0.39)		(0.40)	(0.41)		
$\Delta \ln LT_{t-1}$		0.262		0.268	0.301		
AR(4)		0.472		0.469	0.492		
	<u></u>	(0.16)		(0.16)	(0.16)		<u></u>
SEE	0.157	0.333	0.154	0.334	0.339	0.132	0.118
BP(8)	54.5	4.4	51.5	4.0	2.7	35.9	33.4
DF(8)	-0.442 (-2.14)		-0.450 (-2.16)				
data samp	le: 1974	.1-1990.4	4				
<i>c</i> <sub>1</sub>	5.301 (0.13)	*	0.584 (0.14)	*	4.045 (3.79)	2.077 (0.96)	1.828 (0.13)
<i>c</i> <sub>2</sub>			0.051 (.002)	*	0.039 (.02)		0.026 (.004)
$1+\delta$			······································			1.014 (.001)	1.088 (.02)
sr	3.6	*	2.5 - 4.8	*	4.4 - 6.1	2.9	2.6 - 4.6
EC <sub>t-1</sub>		-0.404	· · · · · · · · · · · · · · · · · · ·	-0.569	-0.606		
$\Delta \ln LT_{t-1}$		(0.15) 0.482		(0.18) 0.488	(0.19) 0.513		
		(0.10) 0.766		(0.10)	(0.11)		
AR(4)		(0.09)		(0.09)	(0.09)		
SEE	0.690	0.256	0.161	0.251	0.252	0.192	0.0156
BP(8)	273.0	5.5	64.0	4.5	5.6	35.9	54.2
DF(8)	-0.722 (-3.59)	,	-0.610 (-3.13)				

Table 6: Employment function: corrected vacancy data

Notes to Tables 5+6:

SEE	:	100 · standard error of estimate
BP(8)	:	Box-Pierce Q-statistik, 8 lags
DF(8)	:	augmented Dickey-Fuller Test, incl. constant and trend, 8 lags,
		reported are coefficients and <i>t</i> -values in parentheses
<b>AR(4)</b>	:	4 <sup>th</sup> -order autocorrelation coefficient
$\mathbf{EC}$	:	error correction term
Version	(1)	: static employment function with constant mismatch parameter
Version	(2)	: error correction specification of employment dynamics
Version	(3)	: (1) with trended mismatch parameter
Version	(4)	: error correction specification of (3)
Version	(5)	: one-step error correction specification of (3) and (4)
Version	(6)	: dynamic employment function with constant mismatch parameter
Version	(7)	: (6) with trended mismatch parameter
Standard	err	ors in parentheses.
The estin	nati	on is carried out in logs.
Coefficier	nts d	of seasonal dummies are not reported.

## Table 7: Tests on stationarity

ln <i>LT</i>	ln <i>LS</i>	ln <i>LD</i>	ln <i>LDC</i>	$\Delta \ln LT$	$\Delta \ln LS$	$\Delta \ln LD$	$\Delta \ln LDC$
data sa	mple 60	.1-90.4					
-0.031	-0.010	0.029	-0.054	-0.447	-0.421	-0.568	-0.545
(-1.14)	(-0.62)	(-1.21)	(-1.99)	(-3.24)	(-3.45)	(-3.53)	(-4.15)
			<u> </u>				
data sa	mple 60	.1- 73.4					
data sa -0.114	mple 60 0.077	<b>.1- 73.4</b> -0.129	-0.136	-0.708	-0.686	-0.616	-0.661

-0.031	-0.099	-0.024	-0.082	-0.475	-0.415	-0.638	-0.606
(-0.99)	(-3.36)	(-0.89)	(2.33)	(-2.73)	(-2.66)	(-3.23)	(-3.38)
Augmente	d Dickey-	Fuller test	with 8 lag	s including	r a constan	t and a tin	ne trend

Augmented Dickey-Fuller test with 8 lags including a constant and a time trend. Reported are coefficients and t-values in parentheses. corresponding long-run Beveridge-curves are versions (1) and (3), respectively, and the dynamic adjustment is modelled as

$$\Delta \ln LT_t = \beta_1 \cdot \Delta \ln LT_{t-1} + \lambda \cdot EC_{t-1} + \beta_2 \cdot AR(4) + \text{const.} + \text{seas.}$$
(28)

i.e. the changes of employment are related to deviations from the long-run Beveridgecurve and the lagged changes in employment. A fourth order autocorrelation process for the residuals is included to capture a changing seasonal pattern. The results are encouraging. They reveal that the deviations from a long-run Beveridge-curve can indeed be used to forcast employment changes. The error correction (EC) term is significant in all versions.<sup>18</sup> This can be seen not only as an indication for the stationarity of the error correction term, but also for the importance of employment adjustment for the discussion of the Beveridge-curve. Version (5) is the one-step error correction counterpart of version (3) and (4), where the dynamics and the long-run solution of employment are estimated in one equation. The results do not differ very much. This gives some confidence into the two-step estimation.

Finally, in table 7 the same regressions are carried out with the corrected vacancy data. While the structural rates calculated from these equations differ by about a factor 2 from those calculated with the official data, all other results remain virtually unchanged. The structural rate is lower in the first sample than in the second sample, it is probably increasing in the second sample, introducing dynamics increases the explanatory power of the equations, and finally, the error correction term is always significant in the dynamic regression.

## 5 Conclusion

The main message of this paper is the following. While several shortcomings such as data deficiencies and a difficult treatment of dynamics discount the Beveridgecurve as a straightforward tool for analyzing structural unemployment, the U/V-curve is not an hopeless case although some efforts are to be undertaken to get a grip on it. Our concern in the present study is mainly the dynamics of the Beveridgecurve. Employing a disequilibrium framework seems natural for situations of rationing indicated by vacancies and unemployment. As a major result we find that parts of the motion of the U/V-curve can be explained by employment dynamics. However, these dynamics fail to give a complete picture, hence, an investigation as to which other factors are responsible for the observed movement of the U/V-curve still remains on our research agenda.

<sup>&</sup>lt;sup>18</sup> The coefficient of the error correction term should be interpreted together with the autocorrelation coefficient. All dynamic equations are stable.

Table 8: List of symbols

LT	:	employment
U	:	unemployed persons
LS	:	labor supply, $LT + U$
V	:	official number of vacancies
VC	:	corrected number of vacancies, $V \cdot H/IV$
LD	:	labor demand, $LT + V$
LDC	:	corrected labor demand, employment + corrected vacancies
ur	:	unemployment rate
slu	:	share of long-term unemployed (more than 1 year)
vr	:	vacancy rate, official data
vrc	:	vacancy rate, corrected data
fv	:	reporting rate of vacancies, $IV/H$
sr	:	structural rate of unemployment and vacancies
dv	:	duration of vacancies
H	:	hires
HL	:	hires obtained through the employment service of the labor office
IV	:	inflows to vacancies
OV	:	outflows from vacancies
$\Delta lt$	:	growth rate of employment
cu	:	capacity utilization
t	:	trend

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