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SECTORAL SHIFTS, UNEMPLOYMENT and VACANCIES in the NETHERLANDS

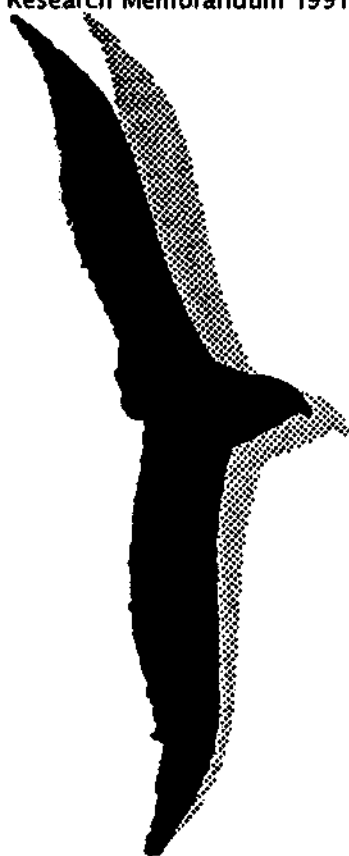
by

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Summary In this paper the correlation between sectoral dispersion of employment growth and unemployment is separated in three causes. The correlation may be caused by correlation between dispersion of employment growth and aggregate demand factors, by a decreasing efficiency of the labour market matching process, or by a change in the number of newly created vacancies and unemployment. These are equivalent to a shift along the Beveridge curve, a change in the efficiency of the matching process and a shift of the Beveridge curve, without a change in the efficiency of the matching process, respectively. Empirical results for the Netherlands indicate that sectoral dispersion does not cause unemployment. The correlation between the sectoral shift and unemployment is explained by correlation of sectoral shifts with aggregate demand factors.



1 Introduction

In earlier business-cycle literature it is commonly assumed that changes in aggregate demand are the major cause of cyclical swings in unemployment. See, for instance, Barro (1977), Tobin (1980), Baily and Okun (1982).

In an important article, Lilien (1982) argued that cyclical changes in unemployment are mainly caused by shifts in sectoral demand for labour. In articles written shortly after Lilien's, his evidence was widely accepted (See a.o. Grossman, Hart and Maskin (1983)) but later his theory has been severely attacked by among others Abraham and Katz (1986). Their main concern is the interpretation of a positive correlation between the dispersion of sectoral growth rates with unemployment as a causal relationship between the two. They show that the positive correlation between unemployment and sectoral shifts may be caused by positive correlation between aggregate demand and sectoral shifts, combined with a negative correlation between aggregate demand and unemployment. Therefore, the observed (and widely reproduced) correlation between sectoral shifts and unemployment need not prove that there exists a causal relationship.

In this article, we investigate the influence of sectoral shifts on the functioning of the Dutch labour market. Following a suggestion of Yellen when commenting an article of Blanchard and Diamond (1989) we analyzed the influence of sectoral shifts in the context of a matching function of the labour market. A matching function describes the relationship between the number of vacancies and unemployed and the flow of filled vacancies. With a constant flow of filled vacancies, the traditional Beveridge curve is obtained. The use of a matching function enables us to make a distinction between a shift of the Beveridge curve without a shift in the efficiency of the matching process, and a change in the efficiency of the matching process itself.

This article is set up as follows. In section two, we briefly describe Lilien's theory which includes a measure of the dispersion of sectoral employment growth in an equation for unemployment. It was pointed out by Abraham and Katz that the interpretation of a correlation between unemployment and this measure is not straightforward. We'll show that the theoretical basis for including the measure of dispersion in an unemployment equation is weak too. In section three, we set about to find a new basis, based on the concept of the matching function, for including a measure for sectoral shifts in an equation for unemployment. We'll show the possibility of two types of influences of sectoral shifts on unemployment. In section four we present the results of an empirical analysis for the Netherlands. Section five concludes.

2 Lillien's Cyclical Unemployment Theory

Lilien assumes that the hiring rate h_t of a firm equals the aggregate hiring rate H_t plus a disturbance term ϵ_t .

$$h_t = H_t + \epsilon_t \quad (1)$$

ϵ_t has the familiar property of a normal distribution with expectation 0 and standard deviation σ_t . h_t is defined as net hiring, the difference between accessions to and layoffs from the firm.

Lilien assumes that all separations from jobs are either layoffs or quits. By quitting a vacancy emerges, which should be filled with a new hire. Any positive net changes in employment also gives rise to new hires, and therefore

$$h_t = \Delta e_t + q_t \quad (2)$$

With:

Δe_t = rate of change of employment

q_t = quit rate

Furthermore, it is assumed that no firm simultaneously hires and lays off workers. Then, the layoff (l_t) and accession (a_t) rates of a firm can be identified as

$$l_t = \max(0, -h_t) \quad (3)$$

$$a_t = \max(0, h_t) \quad (4)$$

The aggregate layoff (L_t) and accession (A_t) rates can now be obtained as a function of H_t and σ_t by integration:

$$L_t = -\int_{-\infty}^0 (H_t + \epsilon_t) f(\epsilon_t | \sigma_t) d\epsilon_t = g(H_t, \sigma_t) \quad (5)$$

$$A_t = H_t + g(H_t, \sigma_t) \quad (6)$$

With:

$$0 > \partial g / \partial H_t > -1 \quad (7)$$

$$\partial g / \partial \sigma_t > 0 \quad (8)$$

In the empirical analysis Lilien used as a proxy for σ_t , the observed

dispersion of industry employment growth rates¹:

$$\sigma_t = (\sum_i v_i [\Delta e_{it} + q_{it} - (\Delta E_t + Q_t)]^2)^{1/2} \quad (9)$$

With:

v_i = share of the industry in total manufacturing employment in 1968

ΔE_t = rate of change of manufacturing employment

Q_t = total manufacturing quit rate

Estimating a linearized version of (5) yielded highly significant coefficients for , so the model explaining layoff and accession rates in the manufacturing industry was taken to be valid.

Next, Lilien investigated the causes of changes in unemployment. By definition, the change of unemployment is equal to the difference of flows into and out of unemployment. The flow into unemployment is equal to the sum of layoffs, quits (which do not have found a job before leaving their old job) and flows from nonparticipation in unemployment. Lilien assumes that the flow from non-participation into unemployment is constant. Layoffs are determined by a linearized version of (5),

$$L_t = b_0 - b_1(\Delta E_t + Q_t) + b_2\sigma_t + \eta_{1t} \quad (10)$$

while the quit rate is assumed to depend on unemployment, quits being less attractive when unemployment is higher

$$Q_t = c_0 - c_1 U_t + \eta_{2t} \quad (11)$$

The flow out of unemployment FU_t depends on unemployment in the previous period, and also depends on the aggregate demand, measured by the unexplained money growth

$$FU_t = pU_{t-1} + \sum_i \varphi_i DMR_{t-i} + \eta_{3t} \quad (12)$$

Because the sum of the employment rate and the unemployment rate equals 1, the unemployment rate is given by:

$$U_t = \beta_0 - \beta_1\sigma_t - \sum_i \lambda_i DMR_{t-i} + \beta_2 U_{t-1} + \eta_{4t} \quad (13)$$

Lilien found the coefficient β_1 to be significant and positive. Essentially the same results were obtained by Samson (1985), using Canadian data and

¹ In his empirical analysis Lilien used monthly data on 21 two-digit manufacturing industries, for the period 1967-1980.

Kazamaki (1991), using Swedish data.

After initially being widely accepted, critics focused on the interpretation of the correlation Lilien and others found. As pointed out by Abraham and Katz it is not necessarily true that a positive correlation between unemployment and the dispersion term means that sectoral shifts rather than demand factors cause unemployment to fluctuate. More specifically, they show that it is possible that sectoral shifts are correlated with aggregate demand, and that therefore the correlation between the dispersion and unemployment is caused by aggregate demand, influencing both. There exist two situations which will cause this correlation between the dispersion term of employment growth and demand:

1) Industries trend growth rates and cyclical sensitivities are negatively correlated. (Abraham and Katz (1986))

2) Industries differ in their cyclical sensitivities and labour force adjustment costs are asymmetric, such that an increase in employment costs more than a decline of the equal magnitude (Weiss (1984))

The correlation that Lilien found between unemployment and sectoral shifts may therefore not be caused by sectoral shifts.²

Besides this point of interpretation, we find Lilien's results problematic on a more fundamental level. The flow into unemployment seems to be correctly, if a bit simplistic, modelled. It treats demographic factors rather mechanically by including a coefficient in the formula of flows into unemployment, so some adjustment and refinements should be possible. However, the main difficulties arise with the modelling of flows out of unemployment. This should theoretically equal the accession rate, minus the rate of accessions of non-participants, plus the flow out of unemployment into nonparticipation. The accession rate is linked to the layoff rate, according to (5) and (6), by the simple relation:

$$A_t = H_t + L_t \quad (14)$$

As the layoff rate L_t is modelled by (10), one should model the accession rate by:

$$A_t = b_0 - b_1(\Delta E_t + Q_t) + b_2\sigma_t + H_t + \eta_{5t} \quad (15)$$

with equal coefficients. Therefore the change in the unemployment rate equals:

²) But of course, as Lilien's equation contains a measure for aggregate demand, one should expect this variable to pick up aggregate demand fluctuations, rather than σ . Moreover, one can always regress σ on the measure for aggregate demand (Unexpected money growth), and see if there is some correlation. Lilien did this, and found almost no correlation between σ and the unexpected money growth (including lagged values).

$$\Delta U_t = \sigma_1(c_0 - c_1 U_t + \eta_{3t}) + U_{NPU} + A_{NP} - F_{UNP} - H_t + \eta_{6t} \quad (16)$$

In which:

U_{NPU} = flow from non-participation into unemployment,

A_{NP} = flow from non participation into jobs

F_{UNP} = flow from unemployment to non-participation

The first term of (16) contain those workers who quit into unemployment. The workers who quit and stop working altogether both figure in F_{UNP} and the first term of (16). Therefore, if there are no changes in the number of people who participate in the labour market, we have

$$U_{NPU} + A_{NP} - F_{UNP} = 0 \quad (17)$$

and we should be able to model the change in the rate of unemployment as

$$\Delta U_t = \sigma_1(c_0 - c_1 U_t + \eta_{3t}) - H_t + \eta_{7t} \quad (18)$$

The aggregate hiring rate H_t is possibly a function of unexpected money growth. This result does not contain σ , but assumes no change in participation. Allowing for changes in participation, we can easily imagine the influence of the unexpected money growth: The unexpected rise of wages consistent with unexpected money growth induces non participants to enter the labour market, thereby in part offsetting the influence on the aggregate hiring rate. However, it is not easy to see how σ fits in: To include σ in (16), there should be a relationship between σ and $U_{NPU} + A_{NP} - F_{UNP}$. Changes in the number of people participating are probably largely demographically determined³, however, and therefore the inclusion of σ is only very weakly supported by Lilien's model.

3 Sectoral shifts and the matching function

In this section we focus on an important relation for investigating the labour market: The matching function. It is an empirically well established fact that the flow of filled vacancies is well described by a Cobb-Douglas matching function with constant returns to scale (Blanchard and Diamond

³) Of course, sectoral shifts may cause non-participants whose skills become more valuable to participate, and workers whose skills become obsolete may turn into non-participation. Both these flows, however, are probably less important then the number of people attaining the retirement age, and the number of people leaving schools.

(1989), Jackman, Layard and Pissarides (1989), Pissarides (1990), Van Ours (1990)):

$$F = k U^{\sigma} V^{1-\sigma} \quad (19)$$

With:

F = Flow of filled vacancies in rate form

U = Unemployment rate

V = Vacancy rate

k = Efficiency parameter

Pissarides (1990) contains a argument for the existence of a matching function, in which he draws an analogy with a production function. Moreover, he advocates constant returns to scale, because in a economy with steady state growth this is the only assumption that yields a constant unemployment rate.

The familiar Beveridge curve may be obtained from the matching function as a steady state solution under certain conditions. For example, assuming that under steady state conditions per period n vacancies arise, while at the same time n persons become unemployed, then we can find a steady state solution in which both U and V remain constant:

$$F = n/L = k U^{\sigma} V^{1-\sigma} \quad (20)$$

With:

L = Labour force

Of course, this describes a set of possible combinations of U and V , for which no change will occur.

A large dispersion in employment growth between sectors means that in some sectors vacancies will be created, while in others workers become unemployed.⁴ A higher sectoral dispersion of employment growth will generate at the same time more new vacancies and new unemployed. Therefore, n is not fixed, but is depending on σ , as

$$\partial n / \partial \sigma > 0 \quad (21)$$

Substituting (21) in (20) we get an outward shift of the Beveridge curve, caused by an increase in dispersion of sectoral employment growth.

The positive correlation between the dispersion in sectoral employment growth and the number of newly created vacancies (and newly created unemployed) only depends on the absence of negative

⁴ Strictly, that is only if the dispersion of employment growth between sectors is not negatively correlated with employment growth between firms (intrasectoral).

correlation between the sectoral dispersion of employment growth and the intrasectoral dispersion of employment growth between firms. In fact, we can safely assume that both measures of dispersion of employment growth are positively correlated. Consider, for example, a change in oil prices. This will more severely effect the sectors with a high energy input, causing an increase in the dispersion of employment growth. However, on the intrasectoral level of firms, the firms with the higher energy input will be more effected. Thus, there will be an increase in dispersion of employment growth on both intersectoral and intrasectoral levels. This generally will hold for all dispersion caused from the supply side of the economy. So, both dispersion terms are positively correlated when changes in dispersion are caused by influences from the supply side of the economy.

Influences from the demand side are more difficult to analyze. It is useful to separate two causes: Changes in consumers preferences, and changes in number of total disposable income. Then changes in the indifference curve may cause changes in both (inter)sectoral and intrasectoral dispersion terms, but these are probably not correlated. A change in total disposable income will cause dispersion, both on intersectoral and intrasectoral level, because of differences in income elasticity on sectoral and intrasectoral level. Changes in total disposable income will therefore effect both dispersion terms in the same way.

We conclude that intersectoral and intrasectoral dispersion terms are completely positively correlated when caused by supply side influences, and partly positively correlated when caused by demand side influences. An relation between shifts in the Beveridge curve and sectoral shifts is therefore caused by general shifts in the economy, both on sectoral and intrasectoral level, and we may see the measure for sectoral shifts as an proxy for total dispersion between firms of employment growth in the economy.

Until now, we have not considered the matching process in detail. Here, we want to make an distinction between intrasectoral matching and intersectoral matching. Intrasectoral matching means that a vacancy in a certain sector is filled with unemployed from this same sector, while intersectoral matching means that a vacancy in a certain sector is filled with an unemployed from some other sector.

It is important to distinguish between those different types of matching. Matching within the same sector is easier, because it is more easy to evaluate the future productivity of an applicant, and the amount of training costs will be less, while the applicant knows probably more about non-wage characteristics of the job. From search theory it then follows that the search time will be less for matching within the same sector. For intersectoral and intrasectoral matching, we have therefore different matching functions:

$$F_{\text{same sector}} = \sum_i k_i U_i^\sigma V_i^{1-\sigma} \quad (22)$$

$$F_{\text{other sector}} = \sum_{i,0 \neq i} k_0 U_i^\sigma V_0^{1-\sigma} \quad (23)$$

We have assumed that the difference in both matching processes only shows up in different efficiency parameters k . As the efficiency of intersectoral matching is lower than the efficiency of intrasectoral matching, we have

$$k_0 < k_i^5$$

In an equilibrium situation in which unemployment rates and vacancy rates are equal in all sectors, it is possible to obtain from (22) and (23) the familiar aggregate Cobb-Douglas matching function. For the total flow of filled vacancies, we then obtain:

$$\begin{aligned} F_{\text{total}} &= \sum_i k_i (U/z)^\sigma (V/z)^{1-\sigma} + \sum_{i,0 \neq i} k_0 (U/z)^\sigma (V/z)^{1-\sigma} \\ &= k_i U^\sigma V^{1-\sigma} + (z-1) k_0 U^\sigma V^{1-\sigma} \\ &= (k_i + (z-1) k_0) U^\sigma V^{1-\sigma} \end{aligned} \quad (24)$$

with z = number of sectors

This is the Cobb-Douglas matching function, which an efficiency parameter equal to the weighted average of the intrasectoral matching efficiency parameter (with weight 1) and the intersectoral matching efficiency parameter (with weight $z-1$).

We now turn to the influence of sectoral shifts. With sectoral shifts, we don't have the same distribution over sectors for vacancies and unemployment. Sectors with a high unemployment rate have a low vacancy rate and vice versa.

This means that the sum $k_i \sum_i U_i^\sigma V_i^{1-\sigma}$ is lowered by the sectoral shift, while the sum $k_0 \sum_{i,0 \neq i} U_i^\sigma V_0^{1-\sigma}$ is increased. In general, then, the efficiency of the matching process will be lower the higher the dispersion in employment growth.

We want to emphasise that this result depends on the selection of sectors. To be more specific, changes in intersectoral dispersion of employment growth will influence the efficiency parameter of the matching function only if the selection of sectors used to determine σ is such that real "borders" exist, requiring indeed larger training cost for applicants from other sectors.

This may be difficult to achieve in practice, because the statistics are not always desegregated in suitably defined sectors. However, the

⁵) All U and V are in rate form, with in the denominator total labor force.

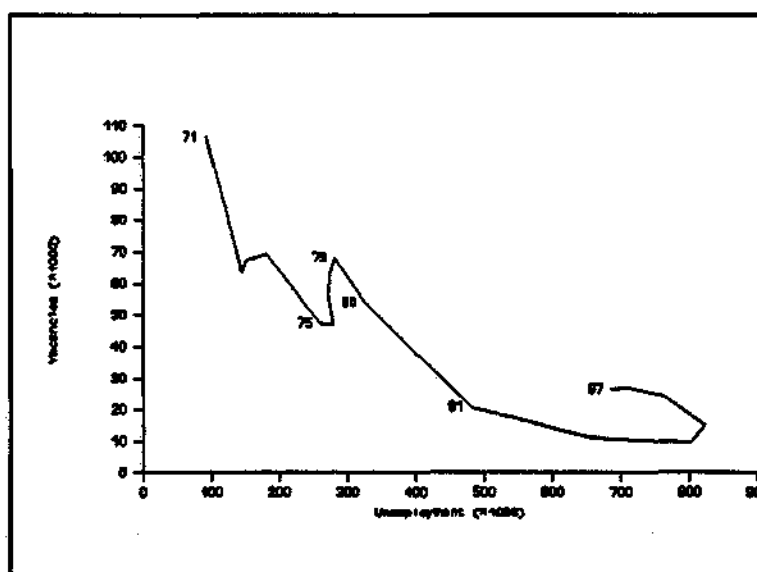
same analysis holds for regional shifts, and statistics on regional employment growth etc. may be easier to find.

Concludingly, there are three possible explanations for an empirical correlation between σ and U . Firstly, there may be no causal relation between σ and U if both depend on aggregate demand. Secondly, there may be an influence of sectoral dispersion as measured by σ on the unemployment rate by causing a change in the number of newly created vacancies and unemployment, thereby shifting the steady state solution (i.e. the Beveridge curve). Thirdly, changes in the dispersion may cause the efficiency of the matching process to change. A higher dispersion will decrease the efficiency of the matching process, from which follows that the duration of unemployment and the unemployment rate will increase.

4 An Empirical Analysis for the Netherlands

How can we empirically distinguish between the different causes of the correlation between σ and U ? First, it is possible to distinguish the aggregate demand explanation from the other explanations. An aggregate demand explanation assumes a negative correlation between aggregate demand and sectoral shifts. As the number of vacancies is positively correlated with aggregate demand, we should expect, according to the aggregate demand explanation, that sectoral shifts and the vacancy rate are negatively correlated. Both sectoral shifts explanations, however, have the vacancy rate negatively depending on the dispersion of unemployment growth.

Figure 1 Unemployment and vacancies in the Netherlands: 1971-87



Therefore a simple analysis is to regress the vacancy rate on σ . A negative coefficient means that the aggregate demand explanations predominate; a positive coefficient means that the sectoral shift explanations predominate. To empirically separate both sectoral shifts explanations, we distinguish the effects on the Beveridge curve and on the matching process. The "more newly created vacancies and unemployment" explanation suggests no influence on the efficiency parameter of the matching process, while causing an shift of the Beveridge curve. The "efficiency of matching" explanation, tells us that shifts in both the efficiency parameter and the Beveridge curve will occur.

We started our empirical analysis with a replication of Lilien's analysis, for which we use Dutch yearly data of the period 1971-1987. The sixties were excluded from the analysis, because of a structural break in the performance of the Dutch labour market, at the end of the sixties (Van Ours (1991)). The developments in the numbers of unemployed and vacancies, as registered at the public employment offices, are shown in figure 1. From this figure it appears that the number of unemployed increased substantially in the Netherlands, especially over the period 1980-1983, in which unemployment rose with some 400.000 workers. The number of vacancies shows an opposite movement, from about 100.000 in 1971 to about 10.000 in 1983.

The sectoral dispersion parameter based on a 24 sector classification is shown in figure 2. In the seventies there is some decline in the sectoral dispersion, but in the beginning of the eighties when unemployment rose rapidly the dispersion parameter increases substantially, to decline after 1982.

Figure 2 Sectoral adjustment parameter: 1971-87

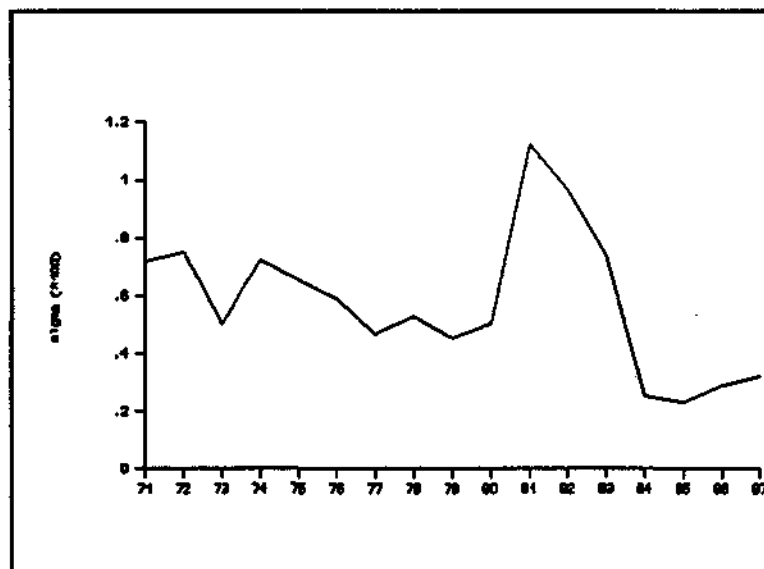


Table 1 Estimation results: 1971-1987^{a)}

U,V,F_v: logarithms of variables

Dependent variable	σ	U(-1)	V(-1)	V	σ	R ²	DW
U	0.53 (5.0)	0.95 (28.4)				0.982	2.17
V	-1.28 (6.5)		0.96 (15.0)			0.930	1.65
U	0.22 (1.5)	0.76 (9.8)		-0.20 (2.7)		0.987	2.36
F _v	0.13 (1.2)				0.32 ^{a)} (16.1)	0.875	1.39
Dependent variable	σ	∇V			σ	R ²	DW
∇U	0.59 (6.0)					0.690	1.99
∇V		-1.33 (7.3)				0.766	1.70
∇U	0.28 (1.4)	-0.23 (1.8)				0.730	1.41
∇F_v	0.07 (0.1)				0.41 ^{a)} (7.2)	0.653	2.01

^{a)} t-values between parenthesis; R² adjusted for degrees of freedom; DW = Durbin-Watson statistic, constant not shown.

^{b)} From an F-test it appears that the constant returns to scale hypothesis cannot be rejected.

In our first estimates we also used an unanticipated monetary growth variable, which was skipped from the analysis since it appeared to have no significant effects. The final estimation results are shown in table 1. The coefficients of the lagged endogenous variables in the first two estimates do not differ significantly from 1. Therefore, we also estimated with $\nabla \log(U)$ and $\nabla \log(V)$ as dependent variables. Because of the low

Durbin-Watson statistic in estimate 4 we tried first differences in this case. The estimates 5-8 do not differ substantially from the estimates 1-4. To correct for the possible endogeneity of σ and other explanatory variables, for estimates 5-8 we also used instrumental variables, but this did not influence our main conclusions (See Appendix 2 for these results).

The estimation results show a significant positive correlation between σ and unemployment, which seems to confirm Lillens' analysis. However, as in the analysis of Abraham and Katz (1986), we also find a significant negative correlation between σ and the number of vacancies. If we include σ in a Beveridge curve type estimate its influence disappears. In a matching function estimate σ has no significant coefficient. So, there is no influence of σ on the matching process on the Dutch labour market.

5 Conclusions

In this paper, we distinguish three possible explanations for the correlation between a measure for the dispersion in employment growth and unemployment. The first explanation is due to a.o. Abraham and Katz (1986): Aggregate demand and sectoral shifts are correlated. There seems to be a correlation between sectoral shifts and unemployment, while there is in fact a correlation between aggregate demand and unemployment. The other two are real sectoral shift explanations. The first sectoral shift explanation hinges on the influence of dispersion in employment growth on the Beveridge curve. The Beveridge curve is in fact an iso-flow matching function. Pure sectoral shifts, in which total demand for and supply of labour do not change, cause an increase in the flow of newly created vacancies and new unemployed. This causes an outward shift of the Beveridge curve. The second sectoral shift explanation investigates the matching process in more detail. Intrasectoral matching may have a higher efficiency than intersectoral matching. With increasing dispersion in employment growth the amount of intersectoral matching increases relative to the amount of intrasectoral matching. This may cause a decrease in the average efficiency of the matching process.

Our empirical analysis for the Netherlands shows a positive correlation between the dispersion of employment growth and unemployment. There is however also a significant negative correlation between the dispersion of employment growth and the number of vacancies. Furthermore we find no influence of the dispersion parameter on the Beveridge curve or on the matching function. All this suggests that fluctuations in unemployment are largely due to aggregate demand factors, with no substantial influence of shifts in sectoral demand.

Literature

Abraham, K.G. en Katz, L.F. (1986), Cyclical Unemployment: Sectoral Shifts or Aggregate Disturbances?, Journal of Political Economy, 94, 507-522.

Baily, M.N. and Okun, A.M. (1982), The Battle against Unemployment and Inflation. New York, Norton 1982.

Barro, R.J. (1977), Unanticipated Money Growth and Unemployment in the United States, The American Economic Review, 67, 101-115.

Blanchard en Diamond (1989), The Beveridge curve, Brookings Papers on Economic Activity, 1-76.

Grossman, S.J. Hart, O.D. and Maskin, E.S. (1983), Unemployment with Observable Aggregate Shocks, Journal of Political Economy, 91, 907-928

Jackman, R. Layard, R. en Pissarides, C.A. (1989), On Vacancies, Oxford Bulletin of Economics and Statistics, 51, 377-394.

Kazamaki, E. (1991), Firm Search, Sectoral Shifts, and Unemployment, Swedish Institute for Social Research, 1991, Stockholm.

Lilien, D.M. (1982), Sectoral Shifts and Cyclical Unemployment, Journal of Political Economy, 90, 777-793.

Ours, J.C. van (1991), The Efficiency of the Dutch Labour Market in Matching Unemployment and Vacancies, De Economist, 139, 309-327.

Pissarides C.A. (1990), Equilibrium Unemployment Theory, Basil Blackwell, Oxford.

Samson, L. (1985), A Study of the Impact of Sectoral Shifts on Aggregate Unemployment in Canada, Canadian Journal of Economics, 18, 518-530.

Tobin, J. (1980), Stabilization Policy Ten Years After, Brookings Papers On Economic Activity, 19-71.

Weiss, L. (1984), Asymmetric Adjustment Costs and Sectoral Shifts. Mimeographed. Chicago, University of Chicago, Department of Economics. .

Appendix 1 Sources of data

Constructing the unexpected money growth equation, we used the following money growth equation:

$$MG_t = 0.49 + 0.48 MG_{t-2} + 0.009 FED_{unexp, t-1} + 0.64 U_{t-1} + 0.70 MG_{t-3} +$$

(0.12) (2.07) (1.79) (2.14) (1.54)

$$0.49 ty - 0.011 FED_{r, t-1}$$

(1.54) (3.18)

$$R^{2adj} = 0.73, DW = 2.18$$

(t-values in parentheses)

With

MG_t = Money growth in percents from t-1 to t. (Calculated from data in International Financial Statistics)

ty = year

$FED_{unexp, t-1}$ Deviations from the normal level of real governments expenses in period t-1. The real normal level of governments expenditure is defined by averaging the real expenditure of the two periods before, so that

$$FED_{unexp, t-1} = FED_{r, t-1} - (FED_{r, t-2} + FED_{r, t-3})/2$$

in which: $FED_{r, t-1}$ Real government expenses

The unexpected money growth is equal to the residuals of this equation.

To construct a measure for dispersion of employment growth we used, following Lilien,

$$\sigma_i = (\sum_i c_i [\Delta L_i - \Delta L])^2)^{1/2} \quad (9)$$

With

ΔL_i employment growth in sector i (in rate form)

ΔL employment growth in the whole economy

Sectors are according to the 24 sector classification of the Dutch Central Planning Bureau.

Data : CPB. Period 1960-1988

Appendix 2 Estimation results using Instrumental variables^{a)}

U,V,F_v: logarithms of variables

Dependent variable	σ	∇V	α	R ²	DW
∇U	0.79 (4.9)			0.605	1.89
∇V	-1.14 (4.2)			0.751	1.64
∇U	0.47 (0.6)	-0.28 (0.4)		0.584	1.32
∇F_v	-0.04 (0.1)		0.33 (1.8)	0.618	2.20

b) Instruments: world trade, government deficit, gross national product

1990-1	B. Vogelvang	Testing For Co-Integration with Spot Prices of Some Related Agricultural Commodities
1990-2	J.C.J.M. van den Bergh P. Nijkamp	Ecologically Sustainable Economic Development Concepts and Model Implications
1990-3	J.C.J.M. van den Bergh P. Nijkamp	Ecologically Sustainable Economic Development in a Regional System: A Case Study in Agricultural Development Planning in the Netherlands
1990-4	C.Gorter P.Nijkamp P.Rietveld	Employers' Recruitment Behaviour and Re-Employment Probabilities of Unemployed
1990-5	K.Burger	Off-farm income and the farm-household the case of Kenyan smallholders
1990-6	H. Visser	Crowding out and the Government Budget
1990-7	P. Rietveld	Ordinal Data in Multicriteria Decision Making, a Stochastic Dominance Approach to Siting Nuclear Power Plants
1990-8	G. van der Laan P.H.M. Ruys D.J.J. Talman	Signaling devices for the supply of semi-public goods
1990-9	F.A.G. den Butter	Labour Productivity Slowdown and Technical Progress: An empirical analysis for The Netherlands
1990-10	R.W. van Zijp	Neo-Austrian Business Cycle Theory
1990-11	J.C. van Ours	Matching Unemployment and Vacancies: The Efficiency of the Dutch Labour Market
1990-12	B. Vogelvang	Hypotheses Testing Concerning Relationships between Spot Prices of Various Types of Coffee
1990-13	A.F. de Vos I.J. Steyn	Stochastic Nonlinearity: A Firm Basis for the Flexible Functional Form
1990-14	Y.H. van Emmerik D. de Jong W.W.A. Zuurmond D.N. Dukkers- van Emden	Opereren in overleg: geprotocolleerde samenwerking 1e-2e-lijn bij dagchirurgie
1990-15	T.J.J.B. Wolters	Mediation and Collective Bargaining: A Diagnostic Approach
1990-16	E.M.A. Scholten J. Koelewijn	Financieringsproblematiek van startende ondernemingen: een mogelijke verklaring op basis van empirisch onderzoek.