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THE PACE OF STRUCTURAL CHANGE AND LABOUR MARKET DYNAMICS:
simulations using an empirical flow model

by F.A.G. den Butter and M. van Dijk*



Summary

A sensitivity analysis using an empirical model of labour market dynamics shows that an increase in the pace of structural change, which leads to an outward shift of the UV-curve, may have substantial effects on employment and unemployment especially when the initial pace of structural change is low. It suggests that not only the size of the shocks but also the initial conditions can be a major cause for the labour market turbulence in economies in transition. The model simulations also display large differences in the size of the impulse responses and of recognition lags depending on the specification of the flow model and on the characteristics of the matching process.

Keywords: *Structural change, job destruction, job creation, UV-analysis, impulse-response effects, matching process*

1. Introduction

The process of structural change is one of the major causes of labour market dynamics. Technological progress, combined with preference shifts, forms the origin of structural change. This leads to the creation of new jobs, but also to the destruction of jobs associated with techniques that become obsolete and unproductive. Changes in labour demand are the net result of these processes of job creation and job destruction. Empirical evidence shows that the observed changes in labour demand, and the ensuing changes in employment and in vacancies, are rather small as compared to the underlying flows which result from labour market dynamics. Job destruction also causes workers to lose their jobs and become unemployed. On the other hand, part of the newly created jobs are taken by unemployed, who become employed. And again these flows into and out of unemployment may be much larger than the net effect of structural change on unemployment.

Recently these processes of structural change and of the resulting labour market dynamics have been investigated using the flow approach to labour markets (see e.g. Blanchard and Diamond, 1992, Pissarides, 1990). Unlike the traditional models of the labour market, which only describe net changes in stocks, the flow models of the labour market take account of the reallocation process, which concurs with structural change. There are both theoretical arguments and empirical evidence that reallocation mainly takes place during

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recessions (see Davis and Haltiwanger, 1990, 1992, Caballero and Hammour, 1994, Gautier and Broersma, 1995). Then the opportunity costs of reallocation are lower than during cyclical upswings, when all productive capacity is needed for production. Hence the pace of structural change and of the resulting labour market dynamics may change over the phases of the cycle. But the analysis of structural change is also warranted for economies, such as in Eastern Europe, which are in transition from a command to a market economy (see e.g. Burda, 1993). That is another reason for the recent uprise of research on the flow approach.

Table 1. Keynote figures on structural change and labour market dynamics in The Netherlands

	1970-1980	1981-1991	1985-1991
<i>Annual averages of net absolute changes; $\times 1000$ persons/jobs</i>			
Employment	37	89	103
Unemployment	22	69	42
Vacancies	29	15	14
<i>Annual averages; $\times 1000$ persons/jobs</i>			
Inflow into unemployment	335	465	473
Outflow out of unemployment	314	437	495
Job creation	497	627	727
Job destruction	488	578	615
Job turnover	985	1205	1341
Labour turnover	1802	1987	2247

Source: Broersma and Den Butter (1994)

This paper analyses the dynamics of structural change by a simple empirical flow model of the Dutch labour market. The emphasis is on the consequences of changes in the pace of structural change for labour market dynamics. In UV-analysis, where the UV-curve is a reduced form of the model of labour market flows, an increase in the pace of structural change leads to an outward shift of the UV-curve. (See e.g. Den Butter and Abbring, 1994). That is because larger flows imply that more matches are to be made, so that, given the efficiency of matching, faster structural change may cause a rise in both unemployment and in vacancies due to congestion. This paper gives, by means of a sensitivity analysis, an impression of the empirical relevance of this phenomenon under various circumstances.

Table 1 shows some stylized facts on structural change and labour market dynamics in The Netherlands over the period 1970-1991. The main lesson from the table is that net changes in labour market stocks, such as employment, unemployment and vacancies, have been very small indeed as compared to the gross flows. Moreover, there is some evidence that the pace of structural change, as measured by total job turnover (job creation plus job destruction), has increased during the period under consideration. The same holds true for labour turnover, which includes job mobility for other reasons than creation and destruction of jobs. The table shows that about 60% of total labour mobility can directly be ascribed to structural change. Of course, much labour mobility is also connected indirectly with structural change, as some job movers will take newly created jobs and leave vacancies in case their old jobs are not destroyed. Finally we learn from the table that job creation and job destruction should not solely be associated with outflow from and inflow into unemployment. The empirical flow model of this paper gives a numerical description of all relationships between the keynote variables of the table.

The contents of this paper is as follows. The next section discusses our stylized empirical model of labour market flows, which allows for heterogeneous unemployment and in which the flows of unemployed through the various duration classes are described explicitly. This enables us to analyze how changes in the pace of structural change affect the escape probabilities from unemployment. The next section also examines the construction of the dynamic unemployment equilibria, which act as central projections in various alternative versions of the model. These projections are used in the impulse analysis of section 3. This impulse analysis shows the quantitative effects of various autonomous shocks to job destruction and job creation on labour market dynamics. In this way variations in the pace of structural change are implemented in the model. A sensitivity analysis compares the effects according to the alternative versions of the model. Finally section 4 concludes.

2. The Model

Our model distinguishes three labour market positions for the working age population: the *employed* (E), the *unemployed* (U) and the (*voluntary*) *non-participants* (= outside the labour force) (see the list of symbols). In addition to the relevant flows of persons between these stocks (see also Marston, 1976), the model also describes the stock of *vacancies* (V) and the consequent flows of jobs. Obviously these flows of jobs are linked to the flows of persons: the model explicitly takes account of these relationships. The disaggregation of the various duration classes of unemployment enables us to consider the escape probabilities and the resulting flows out of unemployment of several categories of unemployed separately. The version of the model used in the simulation experiments is specified on a monthly basis, which proves to approximate the continuous time character of the theoretical model sufficiently. In case of longer time intervals, e.g. an annual model, in some versions the net outflow of vacancies became larger than the stock of vacancies, so that in the next period the stock of vacancies was negative. The model uses annual time series data, constructed by

Broersma and Den Butter (1994), on all different flows of persons and jobs between the stocks at the macro level.

In our simulation model we distinguish between short term unemployment (U_s ; < 1 year) and long term unemployment (U_L ; > 1 year) in a Cobb Douglas specification of the matching function with constant returns to scale:

$$(1) \quad F_{uev} = c V^{1-\alpha} (U_s + \theta U_L)^\alpha$$

Here c represents the efficiency of the matching process, α is the parameter of the Cobb Douglas function and θ is a measure of duration dependence of the escape probability of the unemployed ($0 < \theta < 1$ in case of negative duration dependence).

The escape probabilities from short term (π_s) and long term unemployment (π_L) are respectively:

$$(1b) \quad \pi_s = UO / (U_s + \theta U_L)$$

$$(1c) \quad \pi_L = \theta \pi_s$$

where $U_{1,t} = UI^1$

is the inflow into the first duration class of unemployment and for the following duration classes holds:

$$U_{k,t} = (1-\pi_s) U_{k-1,t-1} \text{ for } k = 2, 3, \dots, 12$$

$$U_s = U_1 + U_2 + \dots + U_{11} + U_{12}$$

$$U_L = U - U_s$$

$$(\text{and } U_L = (1-\pi_L) U_{L,t-1} + (1-\pi_s) U_{12,t-1}).^2$$

¹ As our simulation model is specified with discrete time intervals, we have also experimented with a model version which accounts for the outflow from unemployment within the first duration class (month) in the following way:

$$U_{1,t} = (1-0.5\pi_s) UI$$

This change in specification does not, however, alter the simulation results very much.

² As the model is based on discrete time intervals, this identity only approximately holds in the simulation experiments.

In this model the matching function is a structural equation which describes search behaviour. Hence, search theory provides the micro-economic foundation of the model. In order to account for feedback mechanisms we need to close the models using simple definition equations. The second equation says that the outflow of vacancies (VO_u), associated with the successful matches described by the matching function, is equal to the flow to employment of those who find a job by filling a vacancy (F_{uev}):

$$(2) \quad VO_u = F_{uev}$$

Next we have the equations of motion which set the stocks of the model equal to the respective stocks in the previous period plus the inflows (VI , UI , EI) minus the outflows (VO , UO , EO):

$$(3) \quad \begin{aligned} V &= V_{-1} + VI - VO \\ &= V_{-1} + VI - VO_u - VO_{ex} \end{aligned}$$

$$(4) \quad \begin{aligned} U &= U_{-1} + UI - UO \\ &= U_{-1} + F_{eu} + UI_{ex} - F_{uev} - UO_{ex} \end{aligned}$$

$$(5) \quad \begin{aligned} E &= E_{-1} + EI - EO \\ &= E_{-1} + F_{uev} + EI_{ex} - F_{eu} - EO_{ex} \end{aligned}$$

Here VI , VO_{ex} , F_{eu} , UI_{ex} , UO_{ex} , EI_{ex} , and EO_{ex} are exogenous flows. The five equations above constitute the flow model used in the simulation experiments. In these calculations impulses to the autonomous flows VI and F_{eu} represent job creation and job destruction. A concurrent increase in job destruction and in job creation mimics an increase in the pace of structural change.

The central projections of the simulation experiments are constructed as dynamic equilibria based on average monthly values in the last year of observation from the consistent data set by Broersma and Den Butter (1994), and are calculated given the equilibrium values of the stocks. The list of symbols shows the annual amounts for the respective equilibrium values of the flows (in numbers of persons/jobs $\times 1000$) in parentheses. Rather than estimating the matching function we calibrate our model and base its empirical specification on estimates by Van Ours (1991) for The Netherlands (see also Blanchard and Diamond, 1989). In the basic version of our model we set $\alpha = 0.5$ and $\theta = 0.5$, but these parameter values will be subject of a sensitivity analysis. The constant term c of the matching function is determined by the dynamic equilibrium, given the other parameter values of the matching function, and given the data on F_{uev} . Hence, generally the value of c differs in each alternative central projection. The basic projection assumes 400,000 unemployed, 50,000 vacancies and a total employment of 6 million, which mirrors the present situation in The Netherlands. According to this projection the share of long-term unemployed in total unemployment amounts to 40%. This is in accordance with the actual percentage in the early 1990's, which indicates

that the dynamic unemployment equilibrium and the escape probabilities from unemployment of our basic version of the model adequately describe the actual situation in that period.

The main characteristic of the basic specification and of the alternatives used in the sensitivity analysis are given in table 1. The alternative projection 1 represents the situation with an equal number of vacancies and unemployed³. This projection yields a dynamic unemployment equilibrium in which, given the specification of the matching function, the effects of shocks which affect U' ($= U_s + \theta U_L$) and V are symmetrical. Alternative projection 2 illustrates a situation of low labour market dynamics: in the central projection all data on labour market flows are set to 1/3 of their original value in the basic projection. Now, in equilibrium, the share of long-term unemployment in total unemployment is 72.6%. In this case U' is smaller than U' of the basic projection so that, according to the matching function, an increase in job creation which enhances the stock of vacancies, is expected to have a smaller effect on employment in this situation of low labour market dynamics than in the basic projection. Alternative projection 3 has the same low labour market dynamics as alternative 2 but also a lower escape probability for long-term unemployed: $\theta = 0.2$ instead of 0.5. Additionally, in alternative projection 4 unemployment obtains a high weight in the matching function (0.8 instead of 0.5), which will again reduce the relative employment effect of an increase in job creation as compared to the effect according to the basic simulation.

Table 2. Numerical values for baseline models

Specification	U (x 1000)	V (x 1000)	α	θ	U_L/U (in %)	Flows
Basic	400	50	0.5	0.5	39.9	according to data set
Alternative 1	100	100	0.5	0.5	1.1	according to data set
Alternative 2	400	50	0.5	0.5	72.6	1/3 of flows data set
Alternative 3	400	50	0.5	0.2	76.4	1/3 of flows data set
Alternative 4	400	50	0.8	0.2	76.4	1/3 of flows data set
Alternative 5	400	50	0.6 ¹	0.5	39.9	according to data set

¹ Increasing returns to scale in the matching function with $F_{uv} = c V^{\beta} U'^{\alpha}$, where $\alpha = 0.6$ and $\beta = 0.6$.

Although the hypothesis of constant returns to scale in the matching function is maintained in most empirical studies, the theory provides arguments for a matching function with

³ This alternative version of the model needs a monthly specification (or a specification with smaller intervals) because in a quarterly specification the escape probability of the short term unemployed ($\pi_s = UO / (U_s + \theta U_L)$) exceeds unity.

increasing returns to scale (see Burdett *et al.*, 1994). For that reason alternative projection 5 assumes increasing returns to scale in the matching function. In this alternative the specification of the rest of the model is the same as that of the basic specification.

3. Effects of increases in the pace of structural change

In order to get insight in the working of the model by means of an impulse-response analysis we start by assessing the impact of an autonomous increase in job destruction. We consider a temporary increase in job destruction with 50,000 jobs which is implemented as an autonomous additional outflow from employment to unemployment of 4,167 in each month of the first year of the simulation period. According to the data set constructed by Broersma and Den Butter (1994) the standard deviation of F_{eu} is 69,000 on an annual basis so that the simulated temporary shock of 50,000 is in conformity with actual developments. Yet, the main purpose of the model simulations is to illustrate the relative effects of changes in the pace of structural change so that the specific size of the shock is rather irrelevant. Table 3 gives the effects of these simulations according to the basic version of the model and according to the version with an equal number of unemployed and vacancies (alternative 1). The impulse-response effects in this table, and in the tables to come, are measured at the end of the year - i.e. the 12th month of the year.

Table 3. The effects of an autonomous increase in job destruction implemented as an impulse to the outflow from employment to unemployment (F_{eu})

Effects on	Basic version of the model			Version with equal number of vacancies and unemployed (alternative 1)		
	after 1 yr.	3 yrs.	6 yrs.	after 1 yr.	3 yrs.	6 yrs.
employment	-46.2	-45.9	-46.0	-36.1	-29.0	-28.8
vacancies	-3.8	-4.1	-4.0	-13.9	-21.0	-21.2
unemployment (x 1,000)	46.2	45.9	46.0	36.1	29.0	28.8
% unempl. > 12 months (% points)	-2.9	3.9	3.9	-3.1	3.0	2.9

Explanatory note: shocks are represented by an autonomous change of 4,167 in each month of the first year of the simulation period.

Table 3 shows that according to the basic version of the model the loss of jobs leads to a fall in employment, and hence to an increase in unemployment of almost the same size. Yet, some additional vacancies are filled, because the probability of filling a vacancy has become

somewhat larger due to the increase in unemployment. About 8% of those whose job is additionally destroyed, find a new job by filling an existing vacancy. Table 3 also demonstrates that in this case there is no much difference between the short term and the long term effect. However, reaction lags are somewhat longer in the case of alternative 1. Now the negative effect of job destruction on employment is larger in the short run than in the long run. Although the baseline of alternative 1 has as many vacancies and unemployed as the baseline of the basic version of the model, the effects are not completely symmetric: more than a half of the employed who now loose their job become unemployed and only less than half of these job losers find a new job by filling an existing vacancy.

Table 4. The effects of an autonomous increase in the pace of labour market dynamics implemented as simultaneous impulses to the outflow from employment to unemployment (F_{ew}) (job destruction) and to the inflow of new vacancies (VI) (job creation)

Effects on	Basic version of the model			Version with low labour market dynamics (alternative 2)		
	after 1 yr.	3 yrs.	6 yrs.	after 1 yr.	3 yrs.	6 yrs.
employment	-19.4	-0.4	-0.0	-34.3	-8.6	-1.1
vacancies	19.4	0.4	0.0	34.3	8.6	1.1
unemployment (x 1,000)	19.4	0.4	0.0	34.3	8.6	1.1
% unempl. > 12 months (% points)	-3.1	0.2	0.0	-6.6	0.8	0.1

Explanatory note: shocks are represented by an autonomous change of 4,167 in each month of the first year of the simulation period.

Table 4 gives the effects of simultaneous job creation and job destruction, which represents a temporary increase in the pace of structural change. As before, job destruction is implemented as an autonomous impulse to the outflow from employment to unemployment, whereas job creation is implemented as an additional and autonomous inflow of new vacancies. These temporary increases are again evenly distributed over the 12 months of the first year of the simulation period. We note that the standard deviation of the annual inflow of new vacancies (VI), which represents autonomous job creation in this simulation, amounts to 166,000 according to the data set of Broersma and Den Butter. Apparently the fluctuations of this variable are much larger than those of job destruction measured by F_{ew} . Table 4 illustrates that the increase in the pace of structural change leads to an outward shift of the (reduced-form) UV-curve, as, after the shock, both the number of vacancies and the number of unemployed increase. Yet, in case of the temporary impulse, the model finally returns to

its original dynamic equilibrium. It appears that the outward shift of the UV-curve because of the congestion effect is much smaller and the return to the original equilibrium is much faster according to the basic version of the model than according to the version of alternative 2. with low labour market dynamics. Apparently the effects of a change in the pace of structural change heavily depend upon the initial pace of structural change itself.

Table 5. Effects of changes in the pace of structural change (simultaneous change of job destruction and job creation) on employment according to various versions of the flow models with duration dependence
(in % of the size of the shocks which are implemented as autonomous changes of F_{eu} and VI)

	Model specification					
	Basic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
increase in F_{eu} and VI;						
effect after						
1 yr.	-38.8	-41.0	-68.5	-65.5	-74.1	-33.0
3 yrs.	-0.8	-1.6	-17.2	-16.7	-36.2	-0.3
6 yrs.	-0.0	-0.0	-2.1	-2.4	-14.7	-0.0
10 yrs.	-0.0	-0.0	-0.1	-0.2	-4.2	-0.0
decrease in F_{eu} and VI;						
effect after						
1 yr.	36.0	41.0	64.8	63.0	71.8	31.7
3 yrs.	0.7	1.5	13.8	13.8	30.1	0.3
6 yrs.	0.0	0.0	1.6	1.9	11.0	0.0
10 yrs.	0.0	0.0	0.1	0.1	3.0	0.0

Table 5 summarizes the effects of changes in the pace of structural change on employment according to all alternative model versions of this paper. The speeding up of structural change invariably causes a temporary outward shift of the UV-curve, resulting in a loss of employment in the short run. The temporary shock has no permanent effect: according to all versions of the model the economy returns to its initial dynamic equilibrium path after the shock. Nevertheless, the speed of return to equilibrium appears to depend much on the specification of the model. Alternative 4, with low labour market dynamics, high duration dependence of unemployed and a large weight of unemployed in the matching function, has the longest recognition lag. This version of the model also yields the largest short run impulse-response to a concurrent increase in job destruction and job creation. A comparison with the time profile of impulse-responses according to alternatives 2 and 3 reveals that the relatively large short run effect can mainly be attributed to the initial low pace of labour

market dynamics, whereas the long recognition lag relates to the high weight of unemployment in the matching function. The return to baseline equilibrium is fast in the basic specification of the model and in alternatives 1 and 5. These three versions of the model assume an initial pace of structural change which is in conformity with the actual situation in the early 1990's in The Netherlands. It appears that both the initial position on the UV-curve (a high number of unemployed and a low number of vacancies versus an equal number of unemployed and vacancies) and the question whether the matching function has constant or increasing returns to scale do not change the working of the model very much in these simulation experiments.

The lower part of table 5 gives the impulse-response effects of a slowdown in the pace of structural change. For all versions of the models the impulse-responses are almost the mirror image of those in case of positive shocks to job creation and job destruction. Now there is a temporary increase in employment resulting from an inward shift of the UV-curve. Again the largest effects and the longest recognition lags are found for alternative version 4.

Table 6. Effects of permanent changes in the pace of structural change (simultaneous change of job destruction and job creation) on employment according to various versions of the flow models with duration dependence
(in % of the size of the shocks which are implemented as autonomous changes of F_{eu} and VI)

	Model specification					
	Basic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
increase in F_{eu} and VI;						
effect after						
1 yr.	-37.7	-41.0	-67.4	-64.8	-73.6	-32.5
3 yrs.	-43.3	-50.1	-116.2	-111.1	-155.5	-35.6
6 yrs.	-43.4	-50.5	-130.8	-126.5	-215.0	-35.7
10 yrs.	-43.4	-50.5	-132.9	-129.0	-244.4	-35.7
decrease in F_{eu} and VI;						
effect after						
1 yr.	37.4	41.0	67.1	64.6	73.4	32.4
3 yrs.	42.7	50.0	113.5	109.1	152.6	35.4
6 yrs.	42.8	50.4	126.0	122.3	203.9	35.4
10 yrs.	42.8	50.4	127.4	124.0	224.4	35.4

Table 6 gives the corresponding results in case of a permanent change in the pace of structural change. Now the economy moves to a new dynamic equilibrium with less

employment when job destruction and job creation increases, and more employment when the pace of structural change slows down. In all simulation experiments the new equilibrium is reached monotonously: there is no overshooting. The transition to the new equilibrium is relatively fast according to the basic model specification and according to alternatives 1 and 5. These model versions also show rather moderate final effects of a permanent change in the pace of job creation and job destruction. The effects are about half the size of the shocks. Here increasing returns to scale (alternative 5) appear to dampen somewhat the adverse effect of more job destruction and job creation because the increase in the number of unemployed and of vacancies causes an additional increase in matches as compared to the basic version of the model with constant returns to scale. However, the working of the model appears to be much more sensitive to the initial pace of structural change than whether the matching function has constant or increasing returns to scale. Alternatives 2 to 4 yield long-term impulse-responses which considerably exceed the size of the shocks. This is especially true for version 4 where unemployment has a high weight in the matching function. The simulation also shows that it takes far more than 10 years before the new equilibrium is reached. This sensitivity analysis indicates that a proper specification and estimation of the matching function is especially important in case of low labour market dynamics. Finally, a comparison of the results in the upper and lower parts of table 6 reveals that the impulse-responses are again quite symmetric in case of positive and negative shocks.

Table 7 summarizes the results of a number of simulation experiments which mimic the cyclical pattern in job destruction and job creation. In the experiments of the upper part of the table a positive temporary shock to job destruction in the first year of the simulation period is followed by a temporary shock of the same size to job creation in the fourth year of the simulation period. Similarly, the experiments of the lower part of the table have a temporary increase in job creation followed after three years by an increase in job destruction. Hence, the former experiments represent a cyclical downswing followed by an upswing, whereas the latter experiments picture good times followed by bad times. The table shows that in all experiments the model finally returns to its initial dynamic equilibrium. Thus, according to these versions of the model, cyclical movements do not have permanent effects. In other words: cyclical movements do not explain hysteresis on the labour market.

Yet the sensitivity analysis shows large differences in responses to cyclical shocks according to the various versions of the model. Recognition lags are much longer when the initial pace of structural change is low, than with the normal structural dynamics in The Netherlands (basic version of the model and alternatives 1 and 5). The table also shows large asymmetries with respect to the phases of the cycle. The pattern of response to the sequence downswing-upswing appears to differ quite a lot from the response to the string of shocks in the opposite order. This is also true for alternative 1, which has an equal number of vacancies and unemployed so that one would expect symmetrical reactions to increases in unemployment and in vacancies in the matching function. The asymmetries enter through the

specification of heterogeneous unemployment and through the specification of the rest of the model.

Table 7. Effects of changes in the pace of structural change with different timing of increases in job destruction and job creation: effects on employment according to various versions of the flow models with duration dependence
(in % of the size of the shocks which are implemented as autonomous changes of F_{eu} and VI)

	Model specification					
	Basic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Increase in F_{eu} and after 3 years (starting in the first month of year 4) in VI (first job destruction and then job creation); effect after						
1 yr.	-92.4	-72.2	-95.1	-92.5	-86.1	-91.8
3 yrs.	-91.8	-57.9	-91.6	-91.5	-78.0	-91.8
6 yrs.	-1.0	-1.1	-17.0	-19.2	-37.3	-0.5
10 yrs.	-0.0	-0.0	-1.0	-1.4	-11.1	-0.0
Increase in VI and after 3 years in F_{eu} (first job creation and then job destruction); effect after						
1 yr.	51.2	25.5	25.0	24.6	10.0	56.0
3 yrs.	89.0	43.6	71.1	71.0	35.0	89.6
6 yrs.	0.1	-0.7	-2.9	-1.1	-16.9	0.1
10 yrs.	0.0	-0.0	-0.2	-0.1	-4.9	0.0

4. Conclusions

This paper investigates the sensitivity of an economy for changes in the pace of structural change by means of a small macro model of labour market flows. The model allows for heterogeneous unemployment and it describes the flows of unemployed through the various duration classes explicitly. Search behaviour is modelled by means of a matching function for unemployed and vacancies. The reduced form of the model yields an UV-curve so that the model describes the sources of shifts of the UV-curve.

Simulation experiments using various versions of the models confirm that an increase in the pace of structural change results in an outward shift of the UV-curve, so that both the number of vacancies and of unemployed increase. According to all versions of the model the economy appears to return to its dynamic unemployment equilibrium of the baseline projection in case of a temporary shock. Hence, in spite of the fact that the model describes the

depreciation of human capital of unemployed through its modelling of unemployment heterogeneity with (negative) duration dependence, temporary shocks to the pace of structural change - which can be regarded as technology shocks - do not cause hysteresis on the labour market and have temporary effects only. Thus, the model does not reproduce 'cleansing' (see Caballero and Hammour, 1994), or, alternatively, unfavourable effects of cyclical movements. Yet the recognition lags, and consequently the persistence of the temporary shocks are shown to be rather large in an initial situation of low labour market dynamics.

The reaction to permanent changes in the pace of structural change differs considerably from that of temporary changes. A permanent increase in job destruction and job creation eventually leads to a new dynamic unemployment equilibrium with more unemployed and more vacancies, and hence, given total labour demand, less employment. This permanent outward shift of the UV-curve because of the congestion effect is rather large as compared to the size of the shock and much larger in the case of low labour market dynamics than in the case of a normal pace of structural change. It illustrates that enhanced structural change can have severe labour market repercussions for economies such as the Eastern European economies at the start of the transition process, which have low initial labour market dynamics. Countries accustomed to structural change will be less affected by such permanent increases in the pace of structural change. It may explain why the transition process in Eastern Europe brings about much turbulence at the labour market, even when the shocks are no larger than in Western Europe. The model also explains that the recent increase in the pace of structural change in The Netherlands during the last decade resulted in more unemployment without much reduction in the number of vacancies. This observed outward shift of the UV-curve does not necessarily imply that labour market efficiency has decreased.

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Annex. List of symbols

Flows of persons

EI	(420)	Inflow into employment
EI _{ex}	(220)	Autonomous inflow into employment (other than unemployed filling a vacancy)
EO	(420)	Outflow from employment
F _{eu}	(300)	Inflow into unemployment from employment
F _{uev}	(200)	Unemployed who find a new job by filling a vacancy
F _{nu}	(120)	Non-participants who register as unemployed (additional labour supply)
UI	(420)	Inflow into unemployment
UO	(420)	Outflow out of unemployment
UO _{ex}	(220)	Autonomous outflow out of unemployment

Flows of jobs

VI	(600)	New vacancies (additional labour demand)
VO	(600)	Outflow of vacancies
VO _{ex}	(400)	Autonomous outflow of vacancies
VO _u	(200)	Vacancies filled by unemployed

Stocks

E	Employment
U	Unemployment
U _s	Short term unemployment (< 1 year)
U _L	Long term unemployment (> 1 year)
V	Vacancies

Other symbols

$\pi_{1,t}$	Escape probability of unemployed from the first duration class
$\pi_{k,t}$	Escape probability of unemployed from the k-th duration class
π_s	Escape probability of short term unemployed
π_L	Escape probability of long term unemployed
$U_{k,t}$	Number of unemployed in the k-th duration class
θ	Duration dependence parameter

Explanatory note: *values in parentheses represent the annual size of the flows used in the basic projection (in 1000 persons)*