"MODELLING EXITS FROM UNEMPLOYMENT IN EASTERN GERMANY: A MATCHING FUNCTION APPROACH"

by

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Modelling Exits from Unemployment in Eastern Germany: A Matching Function Approach

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Abstract

A matching function approach is applied to unemployment exit data from a panel of Eastern German labor office districts since monetary union. With comparable West German data, such a matching function exhibits constant returns, is stable and can account for at least three-quarters of the variance of exits from unemployment. In contrast, the Eastern German matching function exhibits increasing returns and vacancies enter the function insignificantly or with incorrect sign. These estimates also differ significantly from those for the Czech Republic, discounting explanations related to the transformation *per se*. When the effects of special labor market measures introduced since monetary union are accounted for, Eastern German estimates resemble those of the Czech Republic, i.e. they exhibit constant to mildly decreasing returns.

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1. Introduction

The dynamic nature of labor markets in market economies is now a well-established fact. For example, despite its moderately low unemployment rate, 4 million new cases of unemployment were registered in Western Germany over the year 1992, or more than twice the unemployment stock at mid-year. Even in countries in which the rate of unemployment and long term unemployment are high, such as France and Italy, large numbers of workers change labor market state each month.[1] As the stock itself remains relatively stable in all countries, this implies a large number of workers are *leaving* unemployment at the same time. To be sure, a great diversity of experience among workers has been well-documented (see for example, Hall 1990). Yet it is largely incorrect to think of European unemployment as Eurosclerotic: most of these workers exit unemployment into employment.

The radical transformation of East Germany and other ex-socialist countries of Central and Eastern Europe has confirmed the inherently dynamic aspects of labor markets, much earlier than one might have imagined.[2] This is especially true of the ex-GDR, which was subjected to the most violent of labor market transformations. **Table 1** displays the evolution of unemployment stocks and inflows into and out of registered unemployment in the new German states. The economic "shock treatment" of unification has induced flows into and out of unemployment that are largely comparable to those in the Western *Bundesländer*. All the same it poses an interesting set of questions: given that East Germany has adopted the institutions of the Federal Republic, do its labor market institutions function like those of the established West? Or do they still resemble those of an ex-socialist economy? Or is the process by which workers leave unemployment in the ex-GDR different from both?

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[1]In France, roughly 350,000 workers enter unemployment each month, compared with a stock of unemployment of between 2.5 and 3 million in recent years. See Gavosto and Sestito (1992) for similar evidence on employment dynamics in Italy.
[2]See Burda (1993) for data on the Visegrad countries and in particular, on the Czech and Slovak republics.

Table 1. Monthly Unemployment Stocks and Gross Flows in Eastern Germany (000s)

	Period					
	Jul 90	Dec 90	Jul 91	Dec 91	Jul 92	Dec 92
Registered Unemployment	272.0	642.2	1068.6	1037.7	1188.2	1089.0
Inflows into Unemployment	132.0	95.4	324.9	91.1	179.3	104.5
Of which:from employment	118.3	93.7	318.7	87.2	163.7	88.0
Outflows from Unemployment	NA	59.3	98.7	84.1	114.3	107.3
memo: Reported Vacancies	27.7	22.6	40.3	35.4	31.2	32.9

Seasonally unadjusted, rounded to nearest hundred. Stocks refer to end of month figures.
Source: Bundesanstalt für Arbeit.

This paper attempts to answer these questions. I begin by briefly reviewing the *matching function* as a behavioral relationship, as first formulated in the 1960s and subsequently revived in the recent literature on the interface between labor markets and aggregate economic activity. Next I examine empirically the *Western* German matching function. Although data on exits from unemployment *into employment* is currently unavailable on a monthly basis, a "pseudo-matching" or exit function of the stock of vacancies and unemployment can explain a remarkable fraction of the variance of unemployment exits at the local labor market level, even before allowing for fixed observation unit and time effects. Next I examine similar data gathered in the Eastern states by the Federal Labor Office (Bundesanstalt für Arbeit) since economic and monetary union went into effect. The matching function estimated with these data is markedly different, exhibiting increasing returns and zero or negative coefficients on vacancies.

The rest of the paper explores the source of these differences. The suspicion that ex-socialist transforming economies might function fundamentally differently is not supported by estimation results from the Czech Republic (CR), where these data have been collected since late 1990. The CR possessed similar industrial structure to the old GDR and has faced similar -- when perhaps not as severe -- difficulties in restructuring. Upon comparison with the Czech results, I conclude that the mere fact that Eastern Germany has moved rapidly to a market economy is not sufficient to account for differences with the West, with which it shares virtually all legal and economic institutions. A second candidate explanation is the generous "helping hand" extended to Eastern Länder by the federal government in the form of active labor market programs. In Section 5, I present some evidence that these programs are significant and can explain a large amount of variation in outflows. After "partialling out" the effects of the stocks and net changes of these variables, I am able to recover a matching function with the characteristics of those estimated in the Czech Republic. Section 6 concludes with some speculation as to why matching functions estimated heretofore in the transforming economies tend to exhibit roughly constant to diminishing returns to scale after controlling for time and regional effects.

2. The Matching Function: History, Micro-foundations, and Estimates of a "Pseudo-Matching Function" in Western Germany

2.1. The Matching Function: A Literature Review

The matching function literature had its origins in the period surrounding the Phelps (1970) volume, amidst growing dissatisfaction with the lack of microeconomic foundations of labor market behavior, and the recognition that labor markets involve

more uncertainty and private information than product markets.[3] A recent revival of interest in gross flows of workers and jobs has given rise to the matching or "flow approach" to labor market analysis (see Pissarides 1990 and Blanchard and Diamond 1992 for surveys).[4] The matching function relates the aggregate flow of new employment relationships (or more generally, exits from unemployment) during the measurement period that arise from stock of unemployment U and vacancies V:

$$X(U,V) \tag{1}$$

where $X_u>0$, $X_v>0$, $X_{uu}<0$, $X_{vv}<0$, and $X_{uv}>0$. The matching function is thus analogous to the production function in microeconomics: it is often assumed to have properties such as constant returns to scale (ie $X(tU,tV)=tX(U,V)$), which can only be verified empirically. Despite its black box nature, the matching function exhibits remarkable stability and can serve as a building block for macroeconomic theory.

At the heart of the matching or flow approach is the recognition that the labor market is a *trading economy*. Locating opportunities, generating contacts, and processing data on potential employers and employees are costly activities in both terms of time and tangible resources. The quantitative efficiency of the matching process can be affected by preferences, policies and labor market institutions. Second, information is imperfect and the quality of trades is heterogeneous, depending on both sides of the market. At the same time the label "search" poorly

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[3]The Phelps (1970) volume contained several pathbreaking essays on the role of information and search, among which are Alchian (1969) and Mortensen (1970). See also Holt and David (1966), and Hansen (1970).

[4]This development was driven by several empirical observations, one of which was the size of gross turnover in modern labor markets, which dwarfs net changes in the stocks (which tend to be rather stable). Put another way, gross unemployment flows are positively correlated (Blanchard and Diamond 1990, Burda and Wyplosz 1990); surges of inflows into unemployment associated with recessions are accompanied by an *increase* in outflows from unemployment, most of which are into jobs. These facts render questionable the extent to which aggregate behavior can be adequately proxied by a "representative agent."

captures the essence of the trading activity and contains connotations that unemployed workers are choosy, or content ex post.

The following example from **Hall** (1979) shows that search and job rejection are *not* a necessary condition for the existence of a matching function. Assume that firms post V vacancies which can be filled by U unemployed workers. Firms are assumed to work equally productively with all workers, and that workers supply their labor inelastically. In this case the "demand for labor" is discontinuous around the point at which wage equals productivity, infinite above and zero below. Diminishing returns would be required in order to obtain a well-behaved aggregate demand schedule for labor in such a world. Now suppose that workers and firms cannot communicate directly, but have access to a bulletin board on which unemployed workers post their names. Firms select randomly workers they would like to hire, without coordinating their actions with their competitors (i.e. with replacement). Since workers supply labor inelastically and are sufficiently productive, any "match" will lead to employment. The probability that any particular worker leaves empty handed (no offers) is $(1-1/U)^V = [(1-1/U)^{-U}]^{-V/U}$, which for large U approaches $e^{-V/U}$, and takes the form of (1) above. The probability of finding a job (getting at least one offer) is $1-e^{-V/U}$. Thus even if V=U, the probability of landing a job is roughly 0.63.

Matching functions can be derived from models with multiple job contacts and job rejection, heterogeneity and two-sided search. They can also be related to geographic, occupational or industrial mismatch. The common insight is that the opacity of the labor market has less to do with the veil of nominal wages and prices, but rather the imperfect availability of information about economic opportunities, or the absence of the Walrasian auctioneer in a decentralized market economy.[5] Empirically, matching functions have been estimated in Britain by Pissarides (1986)

[5]In the context of the transformation of Central and Eastern Europe, the flow or matching approach would associate the collapse of production with a one-off conversion from a rigid lattice of trading connections to a system in which decentralized business contacts and marketing play a central role.

and Layard et al. (1991) with elasticities of matches or exits from unemployment with respect to vacancies and unemployment at roughly 0.3 and 0.7, respectively. Similar results have been obtained by Burda (1993) for data from the Czech Republic and Slovakia. In contrast, Blanchard and Diamond (1989) estimate elasticities with somewhat different US data of about 0.55 and 0.35 on vacancies and unemployment.

It is worth noting that the matching function should be distinguished from the so-called Beveridge Curve, named after Lord Beveridge (1944). The Beveridge curve refers to the empirical relationship between unemployment and vacancies, while the matching function only implies an inverse relationship between vacancies and unemployment under extra assumptions about how job matches affect the stock of unemployment. Under particular assumptions, a stable U-V curve might allow insight about the underlying matching technology. This is the argument of Franz (1987), but see also Dow and Dicks-Mireaux (1958), Hansen (1970), and Bowden (1980), and more recently, Courtney (1992). *Without knowing more about how vacancies and unemployment are determined in equilibrium, however, there are no clear links between the matching function and the Beveridge curve.*[6]

2.2. Specification of a West German "pseudo matching function"

The matching function approach applied to exit data (as opposed to job finds) presumes a stable relationship between exits of unemployed from the labor force and the state of the labor market. Theoretically, "out of the labor force" can be defined as another type of employment, extending the concept of job match to transitions from unemployment to home production, childbearing, the underground economy, human capital formation, leisure or other nonmarket activities. Naturally, if exits from the labor force are countercyclical (perhaps due to the discouraged worker effect) this would

[6]This point has been stressed by Börsch-Supan (1991a,b). An appropriate analogy might be the association of empirical capital and labor combinations with an isoquant!

overstate the amount of actual job finding in downturns (when U is rising); indeed, Burda and Wyplosz (1990) find an elasticity of unemployment exits to out-of-labor-force status in Germany of roughly -2.1 with respect to capacity utilization in manufacturing. Yet spurious exits are less likely than in continental Europe than in the US (see Clark and Summers 1979). In Germany, roughly 60-70% of exits from unemployment are into employment and this proportion is not very cyclical (Burda and Wyplosz 1990); leaving the registry means giving up subsidized pension contributions and health insurance as well as the right to unemployment benefits themselves (either the contribution-based insurance scheme *Arbeitslosengeld* or the means-tested, less generous, but potentially infinite-duration *Arbeitslosenhilfe*). See Bellman (1993) for more details. Arguably, exit or pseudo-matching functions should strongly resemble actual matching functions in Germany. In any case, for purposes of comparison I shall only consider total exits from unemployment in the analyses that follow.

Flexible specification of the matching function poses an interesting theoretical exercise but generally yields relatively little in practice. Functions such as the constant elasticity of substitution (CES), while allowing for nonunitary elasticity of substitution in matcing between vacancies and unemployment, have no additional explanatory power to add to the following the simple Cobb-Douglas specification:[7]

$$O_t = A_t U_{t-1}^{\alpha} V_{t-1}^{\beta} \tag{2}$$

where O_t are total exits from unemployment in t, U_t and V_t are unemployment and vacancy stocks recorded at the end of period t, and A_t measures "total factor productivity" in matching. Taking logarithms of (2), we obtain the following estimating equation:

[7]Pissarides (1986), Blanchard and Diamond (1989), Layard et al. (1991), and Burda (1993) cannot reject the Cobb-Douglas form against a more general CES alternative.

(3) $$\ln O_{it} = \ln A_{it} + \alpha \ln U_{it-1} + \beta \ln V_{it-1} + u_{it}$$

where the subscripts i and t indicate the ith observation unit and time respectively. The error term u_{it} is assumed to fulfill the Gauss-Markov conditions. Alternative specifications include a fixed effects model:

(4) $$\ln A_{it} = d_{it}$$

where d_{it} is constant which is specific to time and observation unit, or the random effects specification which models $\ln A_{it}$ as

(5) $$\ln A_{it} = a + \varepsilon_t + \nu_i$$

and ε_t and ν_i are mean zero random variables which are orthogonal to the regressors and to u_{it}. The model under (4) can be estimated using dummy variables; (5) can be estimated by generalized least squares.

2.3. Data and estimation results

Unfortunately, the number of job matches at a high sampling frequency and at the the level of local employment office districts are unavailable in Western Germany.[8] Consistent data are however available for both stocks of unemployment and vacancies and on all new entries into unemployment at the level of local labor office districts (*Arbeitsamtsbezirke* or AABs). Since stocks are measured at the end of the month, outflows can be computed simply from the stock-flow identity. It should be stressed

[8]In principle, the social insurance statistics contain information on all regular employment and registered unemployment, but these data are generally unavailable to researchers outside the Federal Labor Office. Twice annually this agency publishes a complete account of all labor market gross flows during a particular calendar week.

that these outflows consist both of exits into new jobs and exits from the labor force (deaths, retirement, reentry into school or training, or discouragement).[9] **Table 2** displays means, standard deviations, maxima and minima for Western German AAB level data.

Table 2. Descriptive Statistics, West German AABs, February 1990-December 1992

Variable	Mean	Std Dev	Minimum	Maximum
Monthly Outflows (O)	2159.7	1393.5	107	14528
Registered Unemployment (U)	12238.0	9157.8	1810	83881
Registered Vacancies (V)	2224.7	2220.8	284	25714

The matching function was estimated for the period February 1990 to December 1992. This sample was chosen to match roughly those for the two transforming economies evaluated below. The results are presented in **Table 3.** This simple equation estimated without group or time-specific fixed effects is capable of explaining about three-quarters of the variance of the West German outflow rate. Estimated residuals exhibit heteroskedasticity, however, and constant returns to scale can be rejected at low significance levels. In a two-way fixed effects specification (line 5), 92.5% of the variance can be accounted for by the model. Heteroskedasticity and serial correlation of the estimated residuals is negligible. Random effects specifications were rejected on the basis of the Hausman test.[10] Replacing fixed time effects by a linear time trend (which implies constant exponential growth of matching efficiency) did not improve the overall fit. In the preferred specification (line 5), subsample stability α and β estimated over randomly chosen districts cannot be rejected ($F(2,4923)=1.862$).[11] Finally, the hypothesis of constant returns ($\alpha+\beta=1$) is easily

[9]Layard, et al. (1991) have estimated a matching function with gross exit data in the UK.

[10]The Hausman test exploits the assumption in random effects models that the error term, which includes time and individual components, is uncorrelated with the regressors. Under the null that it is, the random effects estimator is more efficient estimator than a fixed effects estimator; under the alternative, it is inconsistent, while the fixed effects estimator consistent in either case.

[11]This is not true however of geographically proximate or contiguous districts. The

accepted.

Table 3. Exit Equations, Western German Arbeitsamtsbezirke (AAB), Feb 1990-Dec 1992

No.	Sample/Method	$\hat{\alpha}_1$	$\hat{\alpha}_2$	time	R^2	Hausman†	F-test†
1.	Pooled, OLS, N=5108	0.621 (107)	0.200 (33.7)	--	0.785	--	786.0*
2.	Pooled, OLS, time trend, N=5108	0.618 (108)	0.203 (34.7)	-0.0043 (-12.9)	0.792	--	786.2*
3.	Pooled, OLS, fixed AAB effects, N=5108	0.996 (46.2)	0.247 (16.1)	--	0.857	200.3*	73.6*
4.	Pooled, OLS, fixed AAB effects, time trend, N=5108	0.960 (45.0)	0.256 (17.0)	-0.0038 (-13.6)	0.863	0.00	60.0*
5.	Pooled, fixed AAB and time effects, N=5108 **(preferred)**	0.879 (42.7)	0.114 (9.2)	--	0.925	99.9*	0.07
6.	Pooled, first diffs fixed AAB and time effects, N=4962	2.248 (39.7)	0.209 (7.0)	--	0.556	5.45	27.09

Left hand side variable is the logarithm of exits from unemployment over the month; (two observations were deleted). t-statistics in parentheses.
†Hausman test of random effects specification against a fixed effects alternative; F-test of H_0:$\alpha+\beta=1$ (asterisks denote significance at the 0.01 level).

An issue that arises frequently in time series analyses is the possibility of spurious results resulting from unit roots in one or several of the series.[12] Since the sample period spans less than three years, it seemed unreasonable to subject the data to the usual Dickey-Fuller tests for unit roots, the power of which are positively related to their length in calendar time. A more credible test is to estimate (3) in first differences; if the resulting coefficients on unemployment and

implications of this finding (ie external effects) will be left for future research.
[12]Entorf (1993) has raised this issue with respect to the time series literature on matching functions and Beveridge curves.

vacancies are statistically insignificant from zero, the matching function is spurious. The last line of Table 3 does not support refute the spurious-regression hypothesis. Not only are both coefficients statistically significant, but the coefficient on unemployment is significantly higher than in the levels regression, which is consistent with overdifferencing and the fact that O_t and U_t are negatively correlated.[13]

3. The Matching Function in Eastern Germany

The real test for any theory comes in times of stress and strain -- ie structural change. The "trial by fire" for the matching function must be the turbulent period of economic transformation of the ex-socialist economies. Burda (1993) has successfully estimated a matching function which explains a large fraction of variance of job finds (as opposed to exits) over time for the Czech and Slovak republics. The task of this section is to ascertain if the matching function can account for the behavior of exits from unemployment in the Eastern states. First, however, I briefly review the economic shock which hit Eastern Germany after monetary union and how the labor markets have reacted.

3.1. East Germany: A Brief History of the Big Shock

Monetary union was truly a "cosmic" shock for East German firms.[14] Unification precipitated an onslaught of "foreign" (West German) competition associated with the fourfold revaluation of the region's exchange rate; the collapse of demand from partner COMECON countries, to which East Germany exported heavily; and the near-

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[13]Suppose the true model is (3) and u_t is distributed iid. Differencing (3) induces positive correlation between the new error term (u_t-u_{t-1}) and ΔU_{t-1}, since $U_{t-1}=U_{t-2}+I_{t-1}-O_{t-1}$ and O_{t-1} contains u_{t-1}. As $\alpha>0$, its estimate is biased upwards.
[14]The words of Siebert (1991) seem well chosen after all. See Akerlof et al. (1991) Siebert (1991) and Sinn and Sinn (1991) for early accounts.

complete obsolescence of the physical, human, and network capital accumulated by socialist firms. As a result, industrial production has declined by roughly two-thirds since 1990, total gross domestic product by one-half.[15] While the shock was felt by labor markets immediately, the impact was smoothed by a variety of supporting measures taken by the Federal Labor Office, and described in Section 5. While the open unemployment rate seems to have peaked around 16-17%, effective unemployment rate including hidden unemployment is well above 30%. Short time work prevented inflows into unemployment initially but in late 1991 this policy was reversed and firms began laying off workers. The data from Table 1 show that roughly 85-90% of all new cases of unemployment involve workers who were employed, compared with a rate of a comparable rate of 54.3% in 1992 for the West.

It is instructive to examine the East German inflow rate into unemployment compared with other countries. Since monetary union, roughly 2.5 million new cases of unemployment have been registered, or about 125,500 per month; on the basis of an employment level of roughly 6.3 million employed, this yields a rate of inflow into unemployment of roughly 2% per month (and 2.1% for 1992 alone). This remains below estimated rates in the United States, but well above those in West Germany (about 1.1% over the past three years). It is also higher than rates observed recently in Bulgaria or the Czech and Slovak republics, which are still in the early stage of restructuring.

3.2. Data from the Eastern AAB

Unification gave rise to a system of AAB in the new East German states, which had tasks similar to their Western counterparts: gathering data, supervising unemployment caseloads, administering benefits, and job matching. As in the old Bundesländer, transitions in Eastern Germany are unlikely to be spurious, where

[15]Franz (1993) compares this collapse with that in Germany during the Great Depression (1928-1933), during which industrial output fell by "only" 40%!

leaving the registry means giving up access to benefits. Arguably, as in the West, matching functions based on total exits should strongly resemble matching functions corresponding to job finds.[16]

The data were obtained from the Federal Labor Office, ie from the same source as that for the Western states, on a monthly seasonally unadjusted basis since July 1990, the first month of monetary union (but before political union). Using the stock-flow identity, it is possible to calculate outflows for all 35 districts of the ex-GDR.[17] For the data set of 770 observations spanning August 1990-May 1992, eleven observations with negative values were deleted.[18] The means, standard deviations, maxima and minima of these data are displayed in **Table 4.**

Table 4. Descriptive Statistics, Eastern German AABs, August 1990-May 1992

Variable	Mean	Std Dev	Minimum	Maximum
Outflows per month (O)	2483.6	1776.9	14	15426
Registered Unemployment (U)	24947.0	15780.0	2147	117360
Registered Vacancies (V)	2224.7	728.3	77	6875

3.3. Estimation Results

Equation (3) was estimated with fixed and random effects in both one and two-way classifications. As with the West German data, a Hausman test was employed to determine the appropriate model of time and AAB effects. As an alternative to fixed time effects, I estimate the model with a deterministic time trend, yielding a monthly growth rate of matching productivity. The results are displayed in **Table 5.**

The results can be summarized as follows. As with the Western AABs, between 75%

[16]This view is supported by Steiner (1993), who finds that 85-90% of exits in the Arbeitsmarktmonitor in East Germany are into employment, either private or make-work programs. Similarly, Bellman (1993) argues that underreporting is less likely in the East, where 80% of unemployed in the East receive benefits (70% in the West).
[17]Due to the lack of some data, the four AABs comprising former East Berlin were aggregated into a single district.
[18]How this occurred is hard to know, but presumably multiple registrations may explain it, as might occasional purging of the rolls in the early months due to migration.

and 85% of variance in log outflows can be explained by the matching function. The level of explanatory power without fixed effects is 75%, slightly less than the R^2 of 0.79 found in the West. This is remarkable in light of the significant differences in labor market situations of the two regions. After adding fixed effects by AAB and time, the R^2 rises to 83%. As with the Western states, the data seem satisfied with a fixed effects specification; the Hausman test militates in favor of a fixed effects specification in both one and two-way variants. Breusch-Pagan tests revealed no heteroskedasticity in the fixed effects models.

Table 5. Exit Equations, Eastern German Arbeitsamtsbezirke (AAB), Aug 1990-May 1992

No.	Sample/Method	$\hat{\alpha}_1$	$\hat{\alpha}_2$	time	R^2	Hausman†	F-test†
1.	Pooled, OLS N=759	1.207 (37.6)	-0.439 (-1.7)	--	0.748	--	41.8*
2.	Pooled, OLS, time trend	0.987 (25.3)	0.174 (0.69)	0.0277 (9.07)	0.773	--	0.021
3.	Pooled, fixed AAB effects	1.449 (41.8)	0.060 (1.6)	--	0.817	88.1*	167.4*
4.	Pooled, fixed AAB effects, time trend	1.569 (21.0)	0.0759 (2.00)	-0.0093 (-1.81)	0.818	58.2*	57.8*
5.	Pooled, fixed AAB and time effects	1.750 (10.7)	0.091 (2.2)	--	0.833	19.0*	24.1*

Left hand side variable is the logarithm of exits from unemployment over the month. (11 observations were deleted). t-statistics in parentheses.
†Hausman test of random effects specification against a fixed effects alternative; F-test of H_0:$\alpha+\beta=1$ (asterisk denotes significance at the 0.01 level).

There are, however, sharp contrasts between East and West. First, all but one set of

estimates rejected constant returns to scale, ranging from 1.15 to 1.84. Second, the coefficient on unemployment is unusually high; α_1 in excess of one implies that a 1% increase in the stock of unemployment leads to a greater than 1% increase in exits from unemployment. The coefficient on vacancies is small (even negative) and not always precisely estimated. Surprisingly, there is little autocorrelation of residuals within observation units (ρ=0.06), and estimates of the matching function across an arbitrary division of the 35 AABs revealed no evidence against the hypothesis of subsample stability of the coefficients, including fixed time effects (F(25,643)=0.86).

These results suggest deep differences in behavior between the two regions. One obvious suspicion is that the transformation has led to disruption or distortions of the matching process, perhaps to a large number of discouraged workers, or that the matching function is fundamentally different in periods of transformation. In the next section I will evaluate this hypothesis by looking at the Czech Republic, a country which has also been afflicted by the transformation shock and for which data are readily available.

4. Another Transforming Economy: the Czech Republic

4.1. The Czech situation

As is well known, the Czech republic was subjected to a similarly severe transformation shock. GDP in the CSFR (i.e. still including Slovakia) fell by 16% in 1991, and is expected to fall in 1992 before a recovery takes hold. State employment has declined by more than 30% since 1989.[19] Unemployment remains remarkably low in the Czech Republic, but the worst may be on the horizon still, as newly privatized firms have more freedom to shed excess labor.

[19]A disproportionate share of this shock has been borne by Slovakia, but Burda (1993) finds that the job matching functions across the two regions are remarkably similar.

4.2. Data

The Czech data originate with the Czech Ministry of Labor and Social Affairs.[20] As with German data, they are gathered by local labor offices which administer benefits, provide job information, and support local public works employment projects. These data are summarized in **Table 6.**

Table 6. Descriptive Statistics, Czech Employment Office Districts, November 1990-May 1992

Variable	Mean	Std Dev	Minimum	Maximum
Outflows per month (O)	370.8	404.2	1	3423
Registered Unemployment (U)	1874.3	1770.5	39	10787
Registered Vacancies (V)	644.8	1258.2	37	16530

4.3. Estimation Results

Equation (3) was estimated for Czech local labor offices (76, including Prague) for the period November 1990-May 1992. The results are presented in Table 7. These results are similar estimated matching functions for job finds estimated by Burda (1993), indicating that the two are closely related in the CR. (Indeed job finds account for roughly two-third of all exits from unemployment on average). The coefficients of the matching are stable, including fixed effects, over an arbitrary division of the data by geographic location ($F(22,1352)=1.14$).

Overall, the Czech matching function for exits resembles that of West Germany rather than Eastern Germany. Again, roughly 75% of the variance of log exits can be explained by the stocks of unemployment and vacancies; this rises to 87% for the preferred two-way fixed effects specification. While the ratio of α to β is close to that in Western Germany, constant returns is resoundingly rejected in favor of *decreasing returns* ($\alpha+\beta<1$), a result also found for job matching functions estimated in Burda (1993).

[20] I am grateful to the Czech Minister of Labor, Milan Horalek for his cooperation in giving me these data.

Table 7. Exit Equations, Czech Local Labor Offices, November 1990-May 1992

No.	Sample/Method	$\hat{\alpha}_1$	$\hat{\alpha}_2$	time	R^2	Hausman†	F-test†
1	Pooled, OLS N=1444	0.817 (59.6)	0.283 (18.6)	--	0.752	--	28.6*
2.	Pooled, OLS, with time trend	0.631 (38.3)	0.303 (21.8)	0.051 (17.3)	0.795	--	11.3*
3.	Pooled, OLS, fixed AAB effects	0.980 (63.4)	0.336 (12.9)	--	0.833	82.4*	93.7*
4.	Pooled, OLS, fixed AAB effects and time trend	0.628 (18.3)	0.163 (5.6)	0.053 (11.4)	0.848	0.00	14.1*
5.	Pooled, fixed AAB and time effects **(preferred)**	0.697 (14.1)	0.085 (3.0)	--	0.874	29.6*	13.0*

Left hand side variable is the logarithm of exits from unemployment over the month.
t-statistics in parentheses.
†Hausman test of random effects specification against a fixed effects alternative; F-test of H_0:$\alpha+\beta=1$ (asterisks denote significance at the 0.01 level).

5. Explaining the results?

5.1. Summary

It is useful at this point to summarize our findings. Western Germany, with an established labor market, exhibits a well-behaved matching function with constant returns to scale. Roughly three-quarters of the variance of log exits can be explained by variation in the levels of log unemployment and log vacancies at the end of the preceding period. The AABs of the ex-GDR, which now share the institutional, legal, and economic framework of the West, exhibit increasing returns with a low estimated impact of vacancies on exits. This cannot be solely an artifact of a transforming economy, because the Czech republic was hit by a similar shock yet has a matching function similar to that of West Germany and other European countries, save

for the fact that it exhibits decreasing returns to scale.

5.2. Peculiar Aspects of the East German Labor Market since Unification

The collapse of production and economic activity was not associated with a commensurate increase in open unemployment in the Eastern German states (open unemployment is roughly 1.1 million, or about 14% of the labor force). Rather it has coincided with massive state intervention in the labor market. First, the collapse in production in the summer of 1990 resulted in an explosion of short time working (*Kurzarbeit*) in the Eastern states. Designed in the first instance as relief for businesses in cyclical downturns, this program functioned over the period of roughly eighteen months much like the wage subsidy policy endorsed by Akerlof et al. (1991); combined with a liberal credit policy of the Treuhand, it allowed firms to pay wage increases that ensued. These generous provisions were extended until December 1991. In the meantime, the number of short time workers in in the Eastern states has been scaled back dramatically from a peak of 1.7 million at yearend 1990 to roughly 230,000 at yearend 1992 (Franz 1993).

In the meantime, the Federal Labor Office has implemented a number of active labor market programs (ALMPs). The recent history of these programs can be seen in **Table 8**. Four major categories can be distinguished. First, extensive retraining programs have been implemented (*Weiterbildungsmaßnahmen* or WBM), often at the site of moribund enterprises. While so-called *Beschäftigungsgesellschaften* (literally, "employment societies") and other WBM programs have been criticized for inefficiency and lack of market orientation, they currently enroll roughly 500,000 participants.[21] Recent federal initiatives to restrain spending as well as to forestall the exhaustion of available funds may lead to cutbacks in these programs in the near

[21]For better or worse, the government clearly rejected proposals to let the market influence the supply of training. See Klodt (1991) for a compelling case for training and education vouchers in East Germany.

future, however. An equally important role has been played by make-work programs or *Arbeitsbeschaffungsmaßnahmen* (ABMs), which have grown rapidly in the past two years to a level of roughly 450,000 participants.

Table 8. Participation in Active Labor Market Programs in Eastern Germany (000s)

	Period				
	Oct90	Jan91	Jul91	Jan92	May92
Labor Market Policies:					
ABM	8.4	34.4	209.9	393.5	404.9
WBM	48.4	113.2	313.2	446.5	510.5
VoG	-	253.6	360.4	328.5	301.3
AÜG	-	-	183.6	443.2	478.6
Total ALMP	56.8	401.2	1067.1	1611.7	1695.3

ABM= Arbeitsbeschaffungsmaßnahmen; WBM= Weiterbildungsmaßnahmen; VoG=Vorruhestandsgeld; AÜG=Altersübergangsgeld. WBM numbers are estimated by the BfA.
Source: Bundesanstalt für Arbeit. Stocks refer to end of month figures.

Two early retirement programs have had significant impact on labor market developments in Eastern Germany. These are *Vorruhestandsgeld* (implemented under by the GDR government before monetary union and grandfathered in the state treaty) and *Altersübergangsgeld* (a special program for Eastern state provided for in the state treaty after unification).[22] Both currently allow job losers aged 55 and above to enter pre-retirement, drawing benefit at 65% of their previous net wage. These programs are designed to create room at the bottom for new labor market entrants who have the most to gain from and to contribute to the transformation process. This program has removed almost one million workers from the labor force as of mid-1992

[22]See CEC (1992) for a more detailed description of these programs.

(about 12%); attrition via retirement as well as budgetary pressures will lead to a scaling back of these programs over time.

Taken together, the ALMPs in East Germany accounted for roughly 1.8 million persons in mid-1992. When full-time equivalents of these and short time workers are taken together, the corrected unemployment rate in the East is well in excess of 30%.

5.3. Controlling for the effects of ALMPs in the new Bundesländer

Unfortunately, data on gross flows into and out of ALMP programs are currently unavailable. It is not straightforward to deduce the effects of ALMPs on exits from unemployment, since net changes in participation in these programs may have little direct association with gross outflows. Indeed, net changes in ALMP stocks often exceed gross unemployment exits, because inflows also occur from employment or non-participation. In addition, programs do not influence outflows in the same way. For example, ABM affects unemployed individuals in the first instance, whereas WBM and the early retirement arrangements are directed at currently employed (helps avoid inflows into unemployment). **Table** 9 presents OLS regressions showing that large proportion of outflows behavior can be "explained" by the stocks and flows of ALMP programs, but with wide variation of magnitude or sign. They do support the claim, however, that increases in outflows have been associated with large increases in ALMPs. The estimates suggest for example, that a 1% increase in the stock of ABM leads to a .5% increase in outflows from unemployment. The positive sign on the lagged *level* of WBM (retraining) implies that the past existence of large scale WBM programs in a district help workers exit unemployment. The large negative effect of the VoG early retirement ~~is most~~ probably related to the shunting of older individuals away from an unemployment spell and reducing associated outflows that normally follow. Naturally, these interpretations are highly speculative.

Table 9. OLS Projections of AAB Unemployment Outflows, Unemployment Stocks and Reported Vacancies on ALMP Measures in Eastern Germany (May 1991-May 1992)

Explanatory ALMP variable	ln O	ln U	ln V
$\ln ABM_{t-1}$	0.056	0.164	0.059
	(1.4)	(7.1)	(0.7)
$\Delta \ln ABM_t$	0.509	0.308	-0.171
	(3.5)	(3.8)	(-0.6)
$\ln WBM_{t-1}$	0.532	0.263	0.821
	(8.8)	(7.7)	(6.8)
$\Delta \ln WBM_t$	0.186	0.184	-0.309
	(1.1)	(2.0)	(-0.9)
$\ln VoG_{t-1}$	0.116	0.564	0.371
	(2.2)	(19.2)	(3.5)
$\Delta \ln VoG_t$	-5.070	0.467	0.905
	(-4.1)	(0.7)	(0.4)
$\ln AÜG_{t-1}$	0.155	0.139	-0.527
	(2.5)	(3.9)	(-4.2)
$\Delta \ln AÜG_t$	-0.061	-0.392	-0.152
	(-0.4)	(-4.3)	(-0.5)
R^2	0.731	0.892	0.488

ABM= Arbeitsbeschaffungsmaßnahmen; WBM= Weiterbildungsmaßnahmen;
VoG=Vorruhestandsgeld; AÜG=Altersübergangsgeld
N=455. t-statistics in parentheses.

One approach to account for the effect of ALMPs on outflows is simply to include lagged stocks and contemporaneous changes on the right hand side of (3). This approach may be problematic if these programs are highly correlated or even jointly endogenous with unemployment and vacancies. The results of such an approach appear in the first line of **Table 10**. An alternative is to "partial out" the correlation of both right and left and side variables on on the stocks and net flows into ALMP programs (i.e. the residuals from Table 9's first column). The results can be seen in

lines 2-4 of the table. In both cases the estimated coefficient on unemployment drops considerably below unity. Like the Czech Republic, the corrected matching function exhibits decreasing returns with coefficients of similar relative and absolute magnitudes.[23]

Table 10. Additional Exit Function Results, Eastern German Arbeitsamtsbezirke (AAB)

No.	Sample, Method	$\hat{\alpha}_1$	$\hat{\alpha}_1$	R^2	Hausman†	F-test†
1.	Pooled, OLS with ALMP levels, Δs	0.723 (9.1)	0.071 (3.0)	0.782	--	5.94*
	After partialling out ALMP levels, Δs					
2.	-OLS, No fixed effects, N=545	0.631 (8.0)	0.111 (5.0)	0.146	--	9.25*
3.	-Fixed AAB and time effects	0.703 (4.4)	0.083 (3.9)	0.479	0.67	1.53
4.	-Two-way random effects model	0.651 (5.6)	0.095 (3.2)	0.145	--	6.47*
	Cross-sectional regressions:					
5.	-October 1990 (N=30)	1.798 (3.9)	-0.233 (0.78)	0.521	--	3.94
6.	-April 1991 (N=35)	0.798 (8.5)	0.131 (2.0)	0.877	--	1.34
7.	-October 1991 (N=35)	0.815 (6.6)	0.061 (0.86)	0.733	--	1.76
8.	-April 1992 (N=35)	0.894 (9.5)	0.099 (1.7)	0.866	--	3.39
9.	-October 1992 (N=35)	0.874 (6.1)	0.046 (0.6)	0.659	--	0.47

Left hand side variable is the logarithm of exits from unemployment over the month.
†Hausman test of random effects specification against a fixed effects alternative; F-test of H_0:$\alpha+\beta=1$ (asterisks denote significance at the 0.01 level).

[23]I tested for coefficient homogeneity along the lines of the test for the uncorrected East German and Czech data, and was unable to reject the hypothesis that the matching function had stable α, β, and time fixed effects coefficients across an arbitrary geographic division (F(16, 357))=1.23.

5.4. Remaining Mysteries

Two mysteries remain which this paper can only begin to address. First, why is the marginal effect of vacancies on unemployment exits so low in the new Bundesländer? This might well be related to deficiencies in measuring vacancies, as described by Franz (1987), or to error in measuring vacancies, which would bias estimates of β towards zero. Low estimates of β may also be related to the incentives to take jobs early in the unemployment spell rather than waiting or searching. Second, why do both transforming economies -- the CR and the ex-GDR -- exhibit decreasing returns? Here there are two lines of reasoning. First, the flexible parametrization of "technical progress" in matching over time may be in fact picking up various left out variables.[24] Another explanation is linked to the point above, that the error term is serially correlated, which could lead to bias-inducing correlation with the regressors.

In any case, a robust finding of this analysis is that efficiency in matching is improving in both the Czech republic and the ex-GDR. Evidence on the evolution of matching technology can be obtained from the estimated fixed time effects (the dummy variable coefficients). These are plotted in Figure 1 for the two-way fixed effects analysis for Western Germany, Eastern Germany and the CR. It also shows the results for Eastern Germany after partialling out on ALMPs (line 3 of Table 10). Two conclusions follow. First, there is little evidence of trend in matching productivity in the West German data; if anything there is slight technical regress (more mismatch), as Blanchard and Diamond (1989) found for the United States. Second, both the CR and the corrected East German data show a positive trend.[25] The rate of

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[24]There are many alternative interpretations of the evolution of lnA besides this one. Layard et al (1991), attribute the marked decrease in log outflows in the United Kingdom relative to any possible linear combination of lnU and lnV to the effectiveness of job seekers and to "U/V mismatch" or the low correlation of jobs and workers across sectors, occupations, and geographic regions.

[25]Technical progress in matching can result from the introduction of new methods of

"technical progress" is roughly 2% per month in the CR; after the partialling exercise it is also positive in Eastern Germany, but more modest (1% per month). An increase in unobservable matching efficiency also explains increasing returns estimated in the absence of fixed time effects as omitted variable error, since u and v increased over the estimation period.

Decreasing returns in matching are an indication of congestion, which seems plausible *a priori* for transforming economies with poorly organized labor markets. Yet cross-sectional estimates of the matching function in East Germany presented in the last five lines of Table 10 belie this interpretation. While the modest number of observations (35 districts) renders these estimates less efficient, they are consistent estimates of matching function parameters at points in time are not limited by ignorance about the evolution of matching efficiency over time. A tentative conclusion on the basis of these results is that constant returns are thus likely to be a good first approximation to the world, even in a transforming economy.[26]

6. Conclusions

Almost three years since October 1990, the unification of the two labor markets of East and West Germany remains incomplete. Open unemployment in the East is high and hidden unemployment is even higher. This paper has exploited readily available and comparable data from the ex-GDR, the Western states and the Czech republic to assess the comparability of a function mapping registered unemployment and vacancies into a flow of exits from the state of unemployment. The large panel data set of more than 5000 observations on employment office district (AAB) level for Western Germany

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search; learning and accumulating experience about search methods over time; increased effectiveness of the local labor offices; the increased availability of telephones and other forms of low-cost or free communication.

[26]This was also the conclusion of Burda (1993) for the Czech Republic and Slovakia.

indicates that at least three-quarters of monthly exits from unemployment can be explained by variation in log stocks of local unemployment and vacancies, rising to 90% when fixed effects are included. Under the hypothesis that the underlying labor market structure was unified after unification, the same matching function should apply in the East.

This inference would be incorrect on the basis of the raw data from the new Eastern states. The estimated matching function exhibits increasing returns and excessive sensitivity of exits to unemployment. It is too simplistic however to attribute these differences with West Germany solely to the transformation. The explanation of the differences seems to be an extraordinary level of active labor market policies, which appear to affect the local labor market dynamics. When the effects of early retirement, public retraining and make-work programs are "removed," the matching process seems to behave like that of normal economies, although more like the transforming Czech economy than like that of the West German states. Needless to say, caution must be exercised when interpreting the results, until one knows more about the nature of the exact nature (ie exogeneity or endogeneity) of Federal Employment Office interventions.

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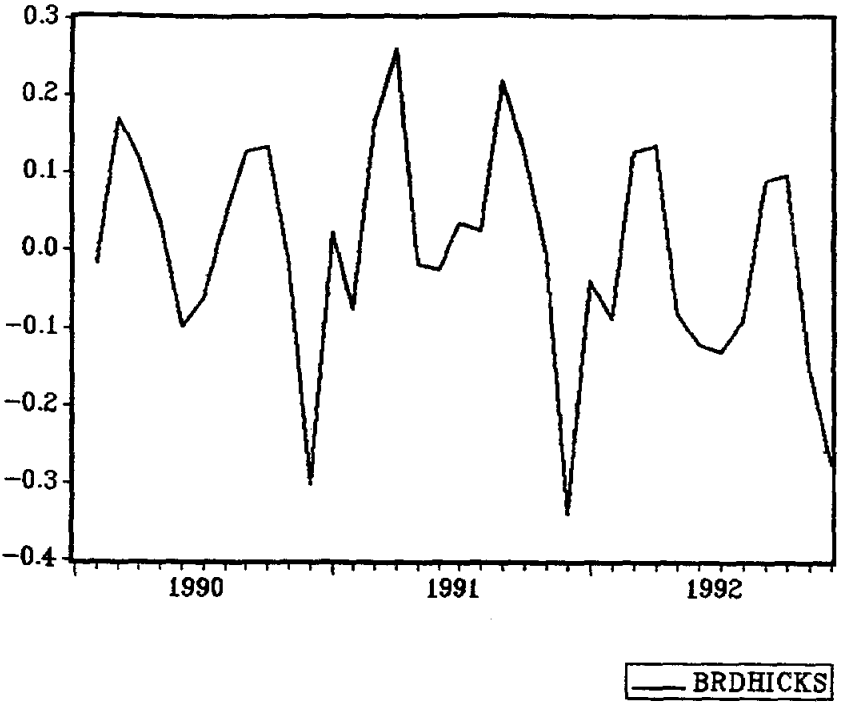
Figure 1

Estimated Fixed Time Effects, Western German Matching Function, February 1990–December 1992



Estimated Fixed Time Effects, Czech Republic Matching Function, November 1990–May 1992

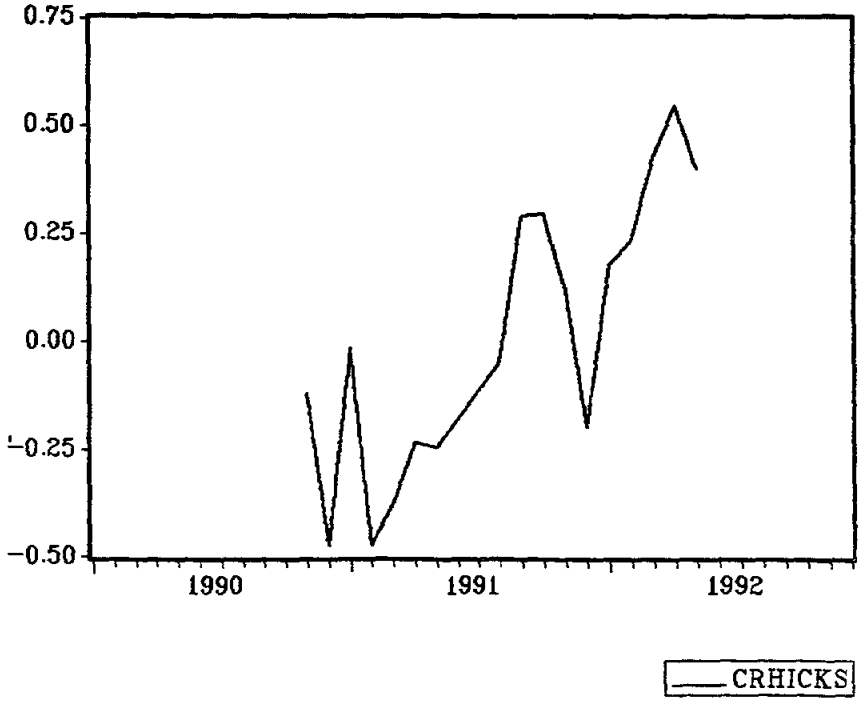
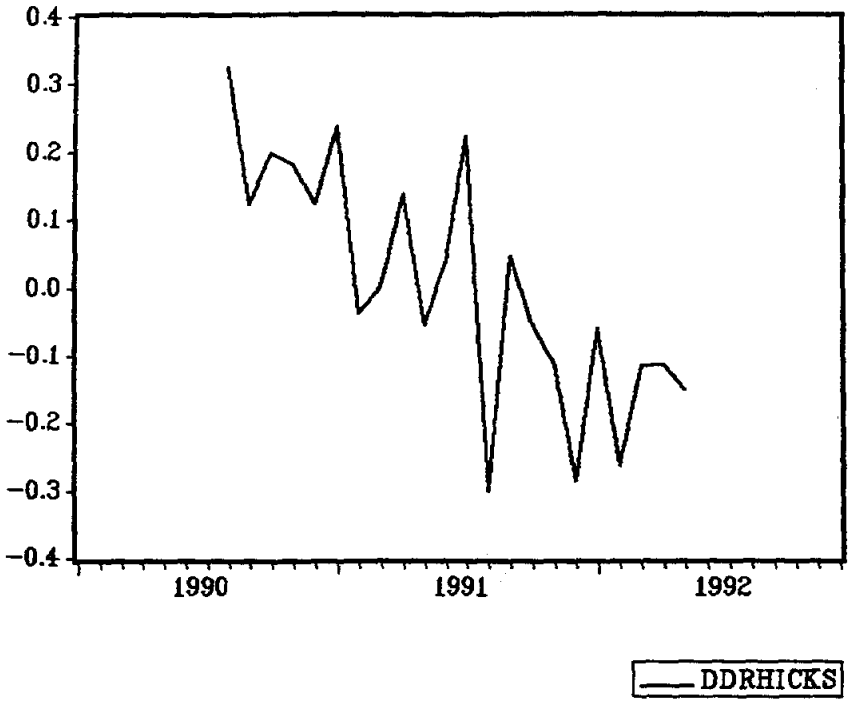


Figure 1
(continued)

Estimated Fixed Time Effects, Eastern German Matching Function, August 1990–May 1992



Estimated Fixed Time Effects, Eastern German Matching Function after Correcting for ALMPS, May 1991–May 1992