

Stops, Michael

**Conference Paper**

## Job Matching on non-separated Occupational Labour Markets

51st Congress of the European Regional Science Association: "New Challenges for European Regions and Urban Areas in a Globalised World", 30 August - 3 September 2011, Barcelona, Spain

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* Stops, Michael (2011) : Job Matching on non-separated Occupational Labour Markets, 51st Congress of the European Regional Science Association: "New Challenges for European Regions and Urban Areas in a Globalised World", 30 August - 3 September 2011, Barcelona, Spain, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/119981>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Job Matching on non separated Occupational Labour Markets\*

Michael Stops (IAB Nuremberg)

27th February 2011

## Abstract

This paper refers to analyses of matching processes on occupational labour markets. Up to now, all studies in this field are based on the crucial assumption of separate occupational labour markets. I outline some theoretical considerations that occupational markets are probably not completely separated. By using information about similarities of occupational groups I constructed an "occupational topology" and I tested my hypothesis of non separated occupational labour markets with a restricted version of the Spatial Durbin Panel Model that includes "spatial" lags for regressors. The results show considerable dependencies between similar occupational groups in the matching process. Particularly, the results indicate occupational specific set-up and set-down processes in "similar" occupational groups. This has important implications for estimating the matching efficiencies of unemployed and vacancies, because the matching process is not only determined by the unemployed and vacancies in the same occupational group but also by those in other occupational groups.

**JEL classification:** C21, C23, J44, J64

**Keywords:** Unemployment; Vacancies; Matching Model; Panel data; Occupational Labour Markets.

## Contact:

Michael Stops  
Institut für Arbeitsmarkt- und Berufsforschung/Institute for Employment  
Research  
Weddigenstraße 20-22  
90478 Nürnberg  
GERMANY  
Tel.: 0049 (0) 911 179 4591  
Email: Michael.Stops@iab.de

---

\*Preliminary and not completed version - please do not circulate or cite without permission by the author.

# 1 Introduction

Modern labour market policy exhibits an increasing interest in determinants for matching labour demand and labour supply to create new jobs. But it is difficult to observe the processes behind on the micro level. Nevertheless it is possible to observe the number of (job-seeking) unemployed, vacancies, and new hires. Therefore the relationship between the number of new hires on the one hand and the number of job-seekers and vacancies on the other hand can be modelled without considering every individual meeting of both market sides.<sup>1</sup>

Numerous studies deal with the empirical estimation of macroeconomic matching functions, compare the surveys of Petrongolo and Pissarides (2001), Rogerson et al. (2005) or Yashiv (2006). The estimation results shed light on the efficiency of matching processes on the labour market. This is important for aggregated labour market and partial labour markets as well. So matching functions have been estimated for particular sectors (Broersma and Ours, 1999), regions (Anderson and Burgess, 2000; Kangasharju, Aki et al., 2005), different skill levels or occupational groups (Entorf, Mai 1994; Fahr and Sunde, 2004; Mora, John James and Santacruz, Jose Alfonso, 2007; Stops and Mazzoni, 2010). The central assumption of most studies is that partial labour markets are completely separated from each other, what means that there are no flows of job-seekers from one partial labour market to another partial labour market and no correlations between the newly created jobs or the number of job vacancies. Exemptions are studies for regional labour markets (e.g. Dauth et al., 2010). These consider the penetrability of the partial markets. Currently there is no study for occupational labour markets that consider dependencies between these partial labour markets. However, several studies deal with employees' change of occupations (Fitzenberger and Spitz, 2004; Seibert, 2007; Kambourov and Manovskii, 2009; Schmillen and Möller, 2010).

Therefore, in this paper I show that the assumption of separate occupational labour markets is theoretical and empirical not appropriate. I outline theoretical reasons why occupational markets are not separated. I test my hypotheses with a special case of the *Spatial Durbin Model* (restricted SDMP LeSage and Pace, 2009; Beer and Riedl, 2010) that include "spatial" lags for regressors. The estimators consider interaction between cross-sectional units and unobserved heterogeneity. For that purpose I construct an empirical based "occupational topology".

In the following section I describe the theoretical framework of my estimation approach for the matching function. In section 3 I present the data and the empirical estimates follow in section 4. Section 5 summarizes the main results and discusses several questions for future research.

## 2 Theoretical framework

The starting point of the matching process are the decisions of firms to create a new job or to fill a vacancy (job creation decision) and the decision of (unemployed) persons about their intensity to search for a new job (job search decision) (Pissarides, 2000, p. xi). Firms spend time, financial, and personal resources for job advertisements, screening, training, and vocational adjustments. Job seekers spend resources for job search and application procedures. Unemployed and firms are randomly matched and start to bargain about the wage.

---

<sup>1</sup>There is a considerable body of literature, compare e.g. the early papers of Pissarides (1979, 1985); Diamond (1982a,b); Mortensen (1982).

The basic model assumes homogeneous unemployed and homogeneous jobs and the activities of both market sides can be described as matching technology. The processes behind are not explicitly modelled, so the matching process can be compared with a black box (Petrongolo and Pissarides, 2001). The variables  $U$ ,  $V$  and  $M$  stand each for the number of unemployed, vacancies and new hires. The matching function  $f(U, V)$  is often specified by a Cobb-Douglas form:

$$M = AU^{\beta_U} V^{\beta_V}, \quad (1)$$

whereas  $A$  describes the "augmented" matching productivity. Constant returns of scale imply  $\beta_U + \beta_V = 1$  with  $\beta_U, \beta_V > 0$ .

Now I relax the assumption of homogeneous vacancies and unemployed and separated partial labour markets. I distinguish between occupational groups and it is plausible that there could be differences for example between matching processes in the construction sector and in the health sector, because of the different job requirements, apprenticeships and so on (for empirical evidence compare with Fahr and Sunde, 2004; Stops and Mazzoni, 2010). Nevertheless the occupational markets are probably not separated because unemployed and employed persons change their vocation during their employment biography (Fitzenberger and Spitz, 2004; Seibert, 2007; Kambourov and Manovskii, 2009; Schmillen and Möller, 2010). Another important point is that a high demand for certain jobs could lead to a reduced demand in other because of structural changes (occupational specific substitution processes). And finally it is possible that the creation of new employment in a certain occupation could lead to the creation of new employment in other (occupational specific set-up or set-down processes respectively). So the number of new matches in a certain occupation could be determined in a way by the number of new matches, unemployed, and vacancies in other occupations.

### 3 Data

I use a panel data set with 81 occupational groups and 26 (yearly) measuring times for the years 1982 to 2007. The groups result from the German occupational classification Scheme 88 (Kldb88<sup>2</sup>), compare table 3 in appendix. Data for unemployed and vacancies stem from operative data of the Federal Employment Agency (Bundesagentur für Arbeit, Federal Employment Agency, and Data Warehouse). They are disaggregated and available for the reference date September 30th of each year. I used the IAB Sample of Integrated Labour Market Biographies 1975-2008 (SIAB 1975-2008) for the calculation of new hires from October 1st of a year to September 30th of the following year. The SIAB 1975-2008 contains information about each individual's history of employment subject to social insurance contributions, since 1999 minor employment, and periods of receiving unemployment benefits (Dorner et al., 2010).

The number of new hires in the occupational groups is equal to the sum of flows to employment from unemployment, employment or non-employment<sup>3</sup>.

I calculated the number of new hires in the national economy by using the relationship between the new hires to the employment level of SIAB 1975 - 2008 multiplied with the employment levels taken from the employment statistics of the Federal Employment Agency<sup>4</sup> (ratio estimator, see Cochran, 1977, pp. 150

<sup>2</sup>*Klassifizierung der Berufe 1988.*

<sup>3</sup>That means that a person was neither employed nor registered as unemployed.

<sup>4</sup>I used the number of employed who are subject to social insurance contributions.

f.). The level of employment and the number of new hires are highly positive correlated, that is why the ratio estimator is more exact than a simple extrapolation. I had to consider that there are only 40 occupational sections in the employment statistics of the Federal Employment Agency. Nevertheless I used the information: I assigned the 82 occupational groups to the 40 occupational sections (see table 4 in the appendix):

$$M_{i,t} = \frac{E_{o|i \in o,t}}{e_{o|i \in o,t}} \cdot m_{i,t}, \quad (2)$$

whereas variables have following definitions:

- $M_{i,t}$  is the interpolated number of new hires by the occupational groups  $i = 1, \dots, 82$  and the measuring time  $t$ ,
- $m_{i,t}$  is the number of new hires  $m$  from the SIAB 1975-2008 by occupational groups  $i = 1, \dots, 82$  and years  $t$ ,
- $e_{o|i \in o,t}$  is the number of employed person from the SIAB 1975-2008 by the occupational groups  $i \in o$  assigned to the occupational sectors  $o = 1, \dots, 40$  at September 30th of each year  $t$  and
- $E_{o|i \in o,t}$  is the level of employment at September 30th of each year  $t$  in the occupational groups  $i \in o$  assigned to the occupational sectors  $o = 1, \dots, 40$  at September 30th of each year  $t$ .

I have solely taken data for Western Germany, because data for Eastern Germany have been available only since 1992. Therefore I have to accept a constraint: Western German job seekers who took up employment in Eastern Germany and Eastern German unemployed were not considered. Stocks of Western German unemployed and registered vacancies as explanatory variables shall explain the flows in employment in Western Germany as dependent variable. This has to be heard in mind for interpreting the results.

Table 1 shows some descriptive statistics for the aggregated stocks and flows from the data.

Table 1: Descriptive statistics

		Average 1982-2007 (in persons)	Share (in per cent)
<b>Labour market stocks</b>			
<b>Labour force</b>	$E + U$	25 436 839	100.00%
Employed	$E$	23 172 935	91.10%
Unemployed	$U$	2 263 904	8.90%
Vacancies	$V$	277 831	1.09%
<b>Flows in employment</b>	$M$	4 593 855	

Note: Own calculation of averaged stocks by years, source: data centre of the statistic department of the Federal Employment Agency, SIAB 1975-2008.

## 4 Empirical strategy and results

### 4.1 An occupational "topology"

The basic idea that cross-sectional units interact with others has recently received considerable attention, as evidenced in the development of theoretical frameworks to explain social phenomena (Manski, 1993). The interaction effect means that the average behaviour in a group influences the behaviour of the individuals that comprise the group. In this study I examine if new hires are influenced by exogenous regressors in other particular occupational groups. The number of unemployed of "nearest neighbouring" occupational groups should have a positive impact on the matches in a certain occupational group. The impact of vacancies is not clear: Both directions could be conceived. On the one hand more hirings in certain occupational groups could induce more hirings in other "nearest neighbouring" occupational groups and vice versa (occupational specific set-up/set-down processes). On the other hand because of substitution processes it is possible that the more hiring could be observed in an occupational group the less are observed in certain others (occupational specific substitution processes). Analogous to a regional topology that regularly depends on the distance of the regions I need an "occupational group topology" to estimate the dependencies. I constructed a  $N \times N$  "spatial" weight-contiguity-matrix  $\mathbf{W}$  that refers to the similarities of occupational groups according to Matthes et al. (2008), compare table 5 in appendix. The basic idea of Matthes et al. (2008) was to aggregate somewhat "similar" or "homogeneous" respectively occupational groups according to the *KldB 88* to occupational segments (*Berufssegmente*). According to this, occupational groups on the 3-digits level are similar if they are alternatives for each other for recruitment decisions from the firms' perspective or for job search decisions from the employees' perspective. These information are available from the Federal Employment Agency and its Central Occupational File (*Zentrale Berufedatei*, Bundesagentur für Arbeit, Federal Employment Agency). To identify the similarities between certain occupational groups the Federal Employment Service analysed specific skills, licences, certificates, and knowledge needed as well as typical tasks and techniques for every occupational group (Matthes et al., 2008).

I transformed the results for occupational groups on the 3-digit level to occupational groups on the 2-digit level. Results are summarized in table 5 in the appendix. On the base of this information I constructed a symmetric  $81 \times 81$  first-order contiguity weight matrix consisting of ones reflecting similarity of occupational groups. The diagonal elements are set to zero by assumption, since an occupational group can not be similar to itself.

Thereby one restriction has to be beard in mind: some of the 2-digit groups are not assigned to only one occupational segment, because they contain some 3-digit groups belonging to one segment and some belonging to another segment<sup>5</sup>. However, these occupational groups could be handled as occupations that are similar with more than one segment (e.g. segment A and segment B), because they consist of some tasks or qualifications that are only found in segment A and some other that are only found in segment B. Therefore, segment A and segment B are not necessarily similar.

---

<sup>5</sup>To give an example compare table 5 and occupational group 63 "technical specialist": This group is assigned to "Miner/chemical occupations", "Glass, ceramic, paper production" as well as "Constructing".

## 4.2 Estimation approach and Results

For examining the influences by exogenous regressors in other occupational groups I use a restricted *Spatial Durbin Model for panel data* (SDMP)<sup>6</sup>:

$$\log \mathbf{M} = \alpha_{itNT} + \beta^U \log \mathbf{U} + \beta^V \log \mathbf{V} + \mathbf{W}(\log \mathbf{U} \quad \log \mathbf{V})\gamma + \epsilon \quad (3)$$

Parameters can be estimated by an OLS type regression that includes a spatial lag on the regressors  $U$  and  $V$ . Table 6 presents results for some variations of the restricted SDMP approach, namely pooled OLS, with fixed effects (FE), and random effects (RE) versions<sup>7</sup>.

Table 2: Estimations for four further variations of the restricted SDMP model ("occupational segments" based matrix)

		Dependent variable: log M			
	rSDMP-Pooled 1	rSDMP-FE 1	rSDMP-FE 2	rSDMP-RE 1	
<i>Constant</i>	3.654 *** (29.885)	-	-	-	
$\beta^U$	0.475 *** (28.556)	0.123 *** (6.995)	0.164 *** (10.431)	0.123 *** (6.994)	
$\beta^V$	0.354 *** (26.192)	0.185 *** (13.935)	0.180 *** (13.491)	0.185 *** (13.932)	
<i>Trend</i>	-0.022 *** (-12.172)	-0.020 *** (-19.954)	-0.020 *** (-19.518)	-0.020 *** (-19.949)	
$GDP_{cyc}$	0.467 (0.371)	1.399 ** (2.037)	0.137 (0.213)	1.399 ** (2.036)	
$\gamma^U$	-0.123 *** (-5.616)	0.155 *** (4.999)	-	0.155 *** (4.997)	
$\gamma^V$	0.131 *** (5.049)	0.180 *** (8.884)	0.199 *** (9.981)	0.180 *** (8.881)	
$n = NT$	2106	2106	2106	2106	
$R^2$	0.826	0.956	0.956	0.956	
$R^2_{adj}$	0.826	0.956	0.956	0.956	
$\sigma^2$	0.323	0.081	0.082	0.081	

*t*-statistics in parantheses.

\* significant on 10 percent level.

\*\* significant on 5 percent level.

\*\*\* significant on 1 percent level.

The results for the fixed effects and random effects model are quite similar. The results of a *Haussman* test to compare the equivalent FE and RE models (FE1 and RE1, FE2 and RE 2, a.s.o.) show that for every model pair the Null of

<sup>6</sup>Actually the SDMP approach is  $\log \mathbf{M} = \alpha_{itNT} + \rho \mathbf{W} \log \mathbf{M} + \beta^U \log \mathbf{U} + \beta^V \log \mathbf{V} + \mathbf{W}(\log \mathbf{U} \quad \log \mathbf{V})\gamma + \epsilon$ . Here the model is restricted by  $\rho = 0$  (LeSage and Pace, 2009; Beer and Riedl, 2010).

<sup>7</sup>Further results are presented in appendix A.2.

preferring the random effects model can not be rejected.

Due to the high number of fixed effects and random effects parameters the (overall) coefficients of determinants are very high compared with the OLS estimator. The matching elasticities of the unemployed and vacancies respectively are significantly positive and robust in all model variations, nevertheless they are quite small in the FE and RE models. The positive coefficient of the cyclical component of the real GDP and the negative parameter of the trend are - except for the pooled OLS version - robust. The parameters for the impact of the regressors from other occupational groups  $\gamma^U$  and  $\gamma^V$  are both significant positive and robust for the FE and RE models, but not for the pooled version. The results of the FE and RE estimations indicate a positive relationship between the new hires of an occupational group and the vacancies and unemployed in the "nearest neighbouring" occupational groups. This has important implications for estimating the matching efficiencies of unemployed and vacancies - they are each not only determined by the unemployed and vacancies in the same occupational group but also by those in - similar - occupational groups.

## 5 Conclusions

This paper refers to analyses of matching processes on occupational labour markets. Up to now, all studies in this field are based on the crucial assumption of separate occupational labour markets. I outlined some theoretical considerations that occupational markets are not separated. By using information about similarities of occupational groups I constructed an "occupational topology" and finally I tested my hypothesis of non separated occupational labour markets with a restricted version of the Spatial Durbin Model that includes "spatial" lags for regressors.

The results show that there are considerable dependencies between "neighbouring" occupational groups in the matching process. One result is the positive relationship between the new hires of an occupational group and the vacancies and unemployed in other "neighbouring" occupational groups. The (preliminary) results indicate occupational specific set-up and set-down processes respectively in neighbouring occupational groups. This has important implications for estimating the matching efficiencies of unemployed and vacancies - they are each not only determined by the unemployed and vacancies in the same occupational group but also by those in other occupational groups. Nevertheless, to complement this study it is necessary to shed more light on the reasons for the different results of the pooled OLS and the RE/FE models.



# A Appendix

## A.1 Further information tables

Table 3: Occupational groups according to the German occupational classification scheme (*KldB 88*)

Code (KldB 88)	Occupational group
1	farmer, fisher
3	agricultural administrator
4	helper in the agricultural sector, agricultural workers, stockbreeding professions
5	gardener, florist
6	forester and huntsman
7	miner and related professions
8	exhauster of mineral resources
(9	mineral rehasher, mineral burner )*
10	stone processor
11	producer of building materials
12	ceramicist, glazier
13	glazier, glass processor, glass refiner
14	chemical worker
15	polymer processor
16	paper producer
17	printer
18	woodworker, wood processor
19	metal worker
20	moulder, caster, semi-metal cleaner
21	metal press workers, metal formers
22	turner, cutter, drilller, metal polisher
23	metal burnisher, galvanizer, enameler
24	welder, solderer, riveter, metal gluter
25	steel smith, copper smith
26	plumber, plant locksmith
27	locksmith, fitter
28	mechanic
29	toolmaker
30	metal precision-workers, orthodontists, opticians
31	electricians
32	assemblers and metal related professions
33	spinner, ropemaker
34	weaver, other textile producer
35	tailor, sewer
36	textile dyer
37	leather and fur manufacturers, shoemaker
39	baker, confectioner
40	butcher, fishworkmansi and related

continued on the next page

<b>Code</b>	<b>Occupational group</b>
(KIdB 88)	
41	cooks, convenience food preparatory
42	brewer, manufacturer for tobacco products
43	milk/fat processor, nutriments producer
44	bricklayer, concrete builder
45	carpenter, roofer, spiderman
46	road/track constructors, demolisher, culture structurer
47	helper in the construction sector
48	plasterer, tiler, glazier, screed layer
49	interior designer, furniture supplier
50	joiner, modeler, cartwright
51	painter, varnisher and related professions
52	goods tester, consignment professions
53	unskilled worker
54	machinist and related professions
60	engineer, architect
61	chemist, physicist
62	technician
63	technical specialist
68	merchandise manager
69	banking professional, insurance merchant
70	merchant/ specialist in conveyance, tourism, other services
71	conductor, driver, motorist
72	navigator, ship engineer, water/air traffic professions
73	mail distributor
74	storekeeper, worker in storage and transport
75	manager, consultant, accountant
76	member of parliament, association manager
77	accounting clerk, cashier, data processing expert
78	clerk, typist, secretary
79	plant security, guard, gate keeper, servant
80	other security related professions, health caring professions
81	law related professions
82	publicist, translator, librarian
83	artist and related professions
84	physician, dentist, apothecaries
85	nurse, helper in nursing, receptionist and related
86	social worker, care taker
87	professor, teacher
88	scientist
89	helper for cure of souls and cult
90	beauty culture
91	guest assistant, steward, barkeeper
92	domestic economy, housekeeping
93	cleaning industry related professions

\*Note: Occupational group 9 contains some missing values for vacancies. That's why it has to be dropped out for the estimations.

Table 4: Assignment of the occupational groups to the occupational section of the employment statistics of the Federal Employment Agency

Occupational groups		Occupational section	
in data		in employment statistics	
$i = 1, \dots, 82$		$o = 1, \dots, 40$	Name of the occupational section
1, 3	-5	1	Plant cultivator/stockbreeding/fisher
6		2	Forester/huntsman
7	-9	3	Miner/exhauster of mineral resources
10	-11	4	Stone processor/producer of building materials
12	-13	5	Ceramicist/glazier
14	-15	6	Chemical worker/polymer processor
16		7	Paper producer
17		8	Printer
18		9	Woodworker/wood-processor
19	-24	10	Metal worker
25	-30	11	Locksmith/mechanic
31		12	Electrician
32		13	Assembler/metal-related professions
33	-36	14	Textile-related professions
37		15	Leather and fur manufacturer
39	-43	16	Nutrition-related professions
44	-47	17	Construction-related professions
48	-49	18	Interior designer/furniture supplier/upholsterer
50		19	Carpenter/modeller
51		20	Painter/varnisher/related professions
52		21	Goods tester/consignment professions
53		22	Unskilled worker
54		23	Machinist/related professions
60	-61	24	Engineer/chemist/physicist/mathematician
62		25	Technician
63		26	Technical specialist
68		27	Merchandise manager
69	-70	28	Service merchants
71	-73	29	Transportation-related professions
74		30	Storekeeper/worker in storage and Transport
75	-78	31	Organization-/management-/office- related professions
79	-81	32	Security service-related professions
82		33	Publicist/translator/librarian
83		34	Artists and related professions
84	-85	35	Health care-related professions
86	-89	36	Social worker/pedagogue/science careers
90		37	Beauty culture
91		38	Guest assistant/steward/barkeeper
92		39	Domestic economy/housekeeping
93		40	Cleaning industry-related professions

Table 5: Assignment of the occupational groups to the occupational segments (Matthes et al., 2008)

Occupational segment		Occupational group	
Code	Name	Code	Name
101	"Green" occupations	1	farmer, fisher
		3	agricultural administrator
		4	helper in the agricultural sector, agricultural workers, stockbreeding professions
		5	gardener, florist
		6	forester and huntsman
		42	brewer, manufacturer for tobacco products
201	Miner/chemical occupations	7	miner and related professions
		8	exhauster of mineral resources
		9	mineral rehasher, mineral burner )*
		14	chemical worker
		15	polymer processor
		46	road/track constructors, demolisher, culture structurer
		54	machinist and related professions
		60	engineer, architect
		62	technician
63	technical specialist		
202	Glass, ceramic, paper production	11	producer of building materials
		12	ceramicist, glazier
		13	glazier, glass processor, glass refiner
		16	paper producer
		17	printer
		51	painter, varnisher and related professions
		63	technical specialist
83	artist and related professions		
203	Textile, leather production	33	spinner, ropemaker
		34	weaver, other textile producer
		35	tailor, sewer
		36	textile dyer
		37	leather and fur manufacturers, shoemaker
		54	machinist and related professions
		62	technician
93	cleaning industry related professions		
204	Metal producer	19	metal worker
		20	moulder, caster, semi-metal cleaner
		21	metal press workers, metal formers
		22	turner, cutter, driller, metal polisher
		23	metal burnisher, galvanizer, enameler
		24	welder, solderer, riveter, metal gluter
		25	steel smith, copper smith
		26	plumber, plant locksmith
		27	locksmith, fitter
		28	mechanic
		29	toolmaker

continued on the next page

Occupational segment		Occupational group	
Code	Name	Code	Name
		30	metal precision-workers, orthodontists, opticians
		32	assemblers and metal related professions
		50	joiner, modeler, cartwright
		60	engineer, architect
		62	technician
		68	merchandise manager
205	Electricians	31	electricians
		32	assemblers and metal related professions
		60	engineer, architect
		62	technician
		77	accounting clerk, cashier, data processing expert
206	Wood occupations	18	woodworker, wood processor
		30	metal precision-workers, orthodontists, opticians
		48	plasterer, tiler, glazier, screed layer
		50	joiner, modeler, cartwright
		51	painter, varnisher and related professions
207	Constructing	11	producer of building materials
		44	bricklayer, concrete builder
		45	carpenter, roofer, spiderman
		46	road/track constructors, demolisher, culture structurur
		47	helper in the construction sector
		48	plasterer, tiler, glazier, screed layer
		49	interior designer, furniture supplier
		51	painter, varnisher and related professions
		54	machinist and related professions
		60	engineer, architect
		62	technician
		63	technical specialist
		71	conductor, driver, motorist
		83	artist and related professions
301	Hotel/restaurant occupations	39	baker, confectioner
		40	butcher, fishworkmansip and related
		41	cooks, convenience food preparatory
		43	milk/fat processor, nutriments producer
		70	merchant/ specialist in conveyance, tourism, other services
		80	other security related professions, health caring professions
		91	guest assistant, steward, barkeeper
		92	domestic economy, housekeeping
		93	cleaning industry related professions
302	Storage/ transport occupations	52	goods tester, consignment professions
		70	merchant/ specialist in conveyance, tourism, other services
		71	conductor, driver, motorist
		72	navigator, ship engineer, water/air traffic professions
		73	mail distributor
		74	storekeeper, worker in storage and transport
303	Merchandise occupations	68	merchandise manager

continued on the next page

Occupational segment		Occupational group	
Code	Name	Code	Name
		70	merchant/ specialist in conveyance, tourism, other services
		77	accounting clerk, cashier, data processing expert
		85	nurse, helper in nursing, receptionist and related
		90	beauty culture
304	White collar worker	70	merchant/ specialist in conveyance, tourism, other services
		73	mail distributor
		75	manager, consultant, accountant.
		76	member of parliament, association manager
		77	accounting clerk, cashier, data processing expert
		78	clerk, typist, secretary
		81	law related professions
		86	social worker, care taker
		88	scientist
305	Security occupations	60	engineer, architect
		62	technician
		79	plant security, guard, gate keeper, servant
		80	other security related professions, health caring professions
306	Social/care occupations	86	social worker, care taker
		89	helper for cure of souls and cult
307	Medical occupations	85	nurse, helper in nursing, receptionist and related
308	Physicians	84	physician, dentist, apothecaries
309	Teaching professions	87	professor, teacher
310	Artists/Athlets	10	stone processor
		83	artist and related professions
		87	professor, teacher
311	Natural scientists	60	engineer, architect
		61	chemist, physicist
		84	physician, dentist, apothecaries
		88	scientist
312	Humanists	82	publicist, translator, librarian
		88	scientist
999	Unskilled worker	53	unskilled worker

## A.2 Further empirical results

Table 6: Estimations for four further variations of the restricted SDMP model ("occupational segments" based matrix)

		Dependent variable: log $\mathbf{M}$			
	rSDMP-FE 1	rSDMP-FE 2	rSDMP-FE 3	rSDMP-FE 4	
<i>Constant</i>	-	-	-	-	
$\beta^U$	0.123 *** (6.995)	0.164 *** (10.431)	0.111 *** (6.232)	0.121 *** (6.875)	
$\beta^V$	0.185 *** (13.935)	0.180 *** (13.491)	0.251 *** (22.275)	0.187 *** (14.078)	
<i>Trend</i>	-0.020 *** (-19.954)	-0.020 *** (-19.518)	-0.017 *** (-17.573)	-0.020 *** (-19.907)	
$GDP_{cyc}$	1.399 ** (2.037)	0.137 (0.213)	3.149 *** (4.699)	-	
$\gamma^U$	0.155 *** (4.999)	-	0.208 *** (6.720)	0.132 *** (4.567)	
$\gamma^V$	0.180 *** (8.884)	0.199 *** (9.981)	-	0.191 *** (9.875)	
$n = NT$	2106	2106	2106	2106	
$R^2$	0.956	0.956	0.955	0.956	
$R^2_{adj}$	0.956	0.956	0.955	0.956	
$\sigma^2$	0.081	0.082	0.084	0.084	

*t*-statistics in parantheses.  
\* significant on 10 percent level.  
\*\* significant on 5 percent level.  
\*\*\* significant on 1 percent level.

Table 7: Estimations for four further variations of the restricted SDMP model ("occupational segments" based matrix)

	Dependent variable: log <b>M</b>			
	<b>rSDMP-FE 5</b>	<b>rSDMP-FE 6</b>	<b>rSDMP-Pooled 1</b>	<b>SDMP-Pooled 2</b>
<i>Constant</i>	-	-	3.654 *** (29.885)	3.485 *** (29.196)
$\beta^U$	0.163 *** (10.814)	0.104 *** (5.809)	0.475 *** (28.556)	0.447 *** (27.962)
$\beta^V$	0.180 *** (13.583)	0.265 *** (24.422)	0.354 *** (26.192)	0.383 *** (30.418)
<i>Trend</i>	-0.020 *** (-19.526)	-0.016 *** (-16.976)	-0.022 *** (-12.172)	-0.019 *** (-10.961)
$GDP_{cyc}$	-	-	0.467 (0.371)	2.670 (2.218)
$\gamma^U$	-	0.160 *** (5.443)	-0.123 *** (-5.616)	-
$\gamma^V$	0.200 *** (10.327)	-	0.131 *** (5.049)	-0.005 *** (-0.543)
$n = NT$	2106	2106	2106	2106
$R^2$	0.956	0.954	0.826	0.823
$R^2_{adj}$	0.956	0.954	0.826	0.823
$\sigma^2$	0.082	0.085	0.323	0.327

*t*-statistics in parantheses.

\* significant on 10 percent level.

\*\* significant on 5 percent level.

\*\*\* significant on 1 percent level.



Table 8: Estimations for four further variations of the restricted SDMP model ("occupational segments" based matrix)

		Dependent variable: log M							
		rSDMP-Pooled 3		rSDMP-Pooled 4		rSDMP-Pooled 5		rSDMP-Pooled 6	
<i>Constant</i>		3.634	***	3.659	***	3.498	***	3.665	***
		(29.571)		(30.161)		(29.312)		(30.003)	
$\beta^U$		0.450	***	0.474	***	0.439	***	0.442	***
		(28.187)		(28.721)		(28.200)		(28.489)	
$\beta^V$		0.379	***	0.354	***	0.389	***	0.385	***
		(30.020)		(26.338)		(31.833)		(31.378)	
<i>Trend</i>		-0.019	***	-0.022	***	-0.019	***	-0.019	***
		(-11.081)		(-12.172)		(-10.737)		(-10.877)	
$GDP_{cyc}$		2.493	**	-		-		-	
		(2.079)							
$\gamma^U$		-0.020	**	-0.126	***	-		-0.020	***
		(-2.505)		(-6.034)				(-2.591)	
$\gamma^V$		-		0.134	***	-0.003		-	
				(5.453)		(-0.363)			
$n = NT$		2106		2106		2106		2106	
$R^2$		0.824		0.826		0.823		0.824	
$R^2_{adj}$		0.824		0.826		0.823		0.823	
$\sigma^2$		0.327		0.323		0.328		0.327	

*t*-statistics in parantheses.

\* significant on 10 percent level.

\*\* significant on 5 percent level.

\*\*\* significant on 1 percent level.

Table 9: Estimations for four further variations of the restricted SDMP model ("occupational segments" based models)

	Dependent variable: log M							
	rSDMP-RE 1		rSDMP-RE 2		rSDMP-RE 3		rSDMP-RE 4	
<i>Constant</i>	-		-		-		-	
$\beta^U$	0.123 ***	(6.994)	0.111 ***	(6.235)	0.111 ***	(6.235)	0.121 ***	(6.874)
$\beta^V$	0.185 ***	(13.932)	0.251 ***	(22.271)	0.251 ***	(22.271)	0.187 ***	(14.075)
<i>Trend</i>	-0.020 ***	(-19.949)	-0.017 ***	(-17.568)	-0.017 ***	(-17.568)	-0.020 ***	(-19.901)
$GDP_{cyc}$	1.399 **	(2.036)	3.148 ***	(4.696)	3.148 ***	(4.696)	-	
$\gamma^U$	0.155 ***	(4.997)	-		0.208 ***	(6.715)	0.132 ***	(4.565)
$\gamma^V$	0.180 ***	(8.881)	0.208 ***	(6.715)	-		0.191 ***	(9.873)
$n = NT$	2106		2106		2106		2106	
$R^2$	0.956		0.955		0.955		0.956	
$R^2_{adj}$	0.956		0.955		0.955		0.956	
$\sigma^2$	0.081		0.084		0.084		0.081	

*t*-statistics in parantheses.

\* significant on 10 percent level.

\*\* significant on 5 percent level.

\*\*\* significant on 1 percent level.

Table 10: Estimations for two further variations of the restricted SDMP model ("occupational segments" based matrix)

		Dependent variable: log M	
	rSDMP-RE 5	rSDMP-RE 6	
<i>Constant</i>	-	-	
$\beta^U$	0.163 *** (10.812)	0.104 *** (5.810)	
$\beta^V$	0.180 *** (13.580)	0.265 *** (24.417)	
<i>Trend</i>	-0.020 *** (-19.522)	-0.016 *** (-16.972)	
$GDP_{cyc}$	-	-	
$\gamma^U$	-	0.160 *** (5.440)	
$\gamma^V$	0.200 *** (10.324)	-	
$n = NT$	2106	2106	
$R^2$	0.956	0.954	
$R^2_{adj}$	0.956	0.954	
$\sigma^2$	0.082	0.085	

*t*-statistics in parantheses.  
\* significant on 10 percent level.  
\*\* significant on 5 percent level.  
\*\*\* significant on 1 percent level.

## References

- Anderson, Patricia M. and Simon M. Burgess (2000): Empirical Matching Functions: Estimation and Interpretation Using State-Level Data. *Review of Economics and Statistics*, 82(1):93–102.
- Beer, Christian and Alexandra Riedl (2010): Modeling Spatial Externalities: A Panel Data Approach. *SSRN Working Paper Series*, <http://ssrn.com/abstract=1397106>.
- Broersma, Lourens and Jan C. Ours (1999): Job searchers, job matches and the elasticity of matching. *Labour Economics*, 6(1):77–93.
- Bundesagentur für Arbeit (Federal Employment Agency) (1985–2004): Strukturanalyse: Bestände sowie Zu- und Abgänge an Arbeitslosen und gemeldeten Stellen (Stocks and flows of unemployed and registered vacancies). *Amtliche Nachrichten der Bundesagentur für Arbeit (ANBA)*, (jeweils Sondernummern in den Jahren 1985 bis 2004 (special issues for the years 1985 to 2004)).
- Bundesagentur für Arbeit (Federal Employment Agency) (2010): Zentrale Berufedatei (Central occupational file). <http://berufenet.arbeitsagentur.de>.
- Cochran, William G. (1977): *Sampling Techniques*. Wiley series in probability and mathematical statistics. Wiley, New York, 3rd edn.
- Dauth, Wolfgang; Hujer, Reinhard; and Katja Wolf (2010): Macroeconometric Evaluation of Active Labour Market Policies in Austria. *IZA Discussion Paper*, (5217).
- Diamond, Peter A. (1982a): Aggregate Demand Management in Search Equilibrium. *The Journal of Political Economy*, 90(5):881–894.
- Diamond, Peter A. (1982b): Wage Determination and Efficiency in Search Equilibrium. *The Review of Economic Studies*, 49(2):217–227.
- Donner, Matthias; Jörg Heining; Peter Jacobebbinghaus; and Stefan Seth (2010): Sample of Integrated Labour Market Biographies (SIAB) 1975–2008. *FDZ-Datenreport*, (1).
- Entorf, Horst (Mai 1994): *Trending time series and spurious mismatch*. Beiträge zur angewandten Wirtschaftsforschung. Inst. für Volkswirtschaftslehre und Statistik, Mannheim.
- Fahr, René and Uwe Sunde (2004): Occupational job creation: patterns and implications. *Oxford Economic Papers*, 56:407–435.
- Fitzenberger, Bernd and Alexandra Spitz (2004): Die Anatomie des Berufswechsels: Eine empirische Bestandsaufnahme auf Basis der BIBB/IAB-Daten 1998/1999. *ZEW-Discussion Paper*, (04-05).
- Kambourov, Gueorgui and Iouri Manovskii (02 2009): Occupational Specificity Of Human Capital. *International Economic Review*, 50(1):63–115.
- Kangasharju, Aki; Pehkonen, Jaakko; and Pekkala, Sari (2005): Returns to Scale in a Matching Model: Evidence from Disaggregated Panel Data. *Applied Economics*, 37(1):p115 – 118.
- LeSage, James P. and Robert Kelley Pace (2009): *Introduction to spatial econometrics*, vol. 196 of *Statistics*. CRC Press, Boca Raton.
- Manski, Charles F. (1993): Identification of endogenous social effects: The reflection problem. *The Review of Economic Studies*, 60(3):531–542.

- Matthes, Britta; Carola Burkert; and Wolfgang Biersack (2008): Berufssegmente: Eine empirisch fundierte Neuabgrenzung vergleichbarer beruflicher Einheiten. *IAB-Discussion Paper*; <http://doku.iab.de/discussionpapers/2008/dp3508.pdf>, (35/2010).
- Mora, John James and Santacruz, Jose Alfonso (2007): Emparejamiento entre desempleados y vacantes para Cali: Un analisis con datos de panel. (Unemployment and Vacancies in a Matching Model for Cali: A Panel Data Analysis. With English summary.). *Estudios Gerenciales*, 23(105):p85 – 91.
- Mortensen, Dale T. (1982): Property Rights and Efficiency in Mating, Racing, and Related Games. *The American Economic Review*, 72(5):968–979.
- Petrongolo, B. and C. Pissarides (2001): Looking into the black box: a survey of the matching function. *Journal of Economic Literature*, XXXIX:S. 390–431.
- Pissarides, C. A. (1979): Job matchings with state employment agencies and random search. *The Economic Journal*, 89 (1979):818–833.
- Pissarides, Christopher A. (1985): Short-Run Equilibrium Dynamics of Unemployment, Vacancies, and Real Wages. *The American Economic Review*, 75(4):676–690.
- Pissarides, Christopher A. (2000): *Equilibrium unemployment theory*. MIT Press, Cambridge, Mass., 2nd edn.
- Rogerson, Richard; Robert Shimer; and Randall Wright (2005): Search-Theoretic Model of the Labor Market: A Survey. *Journal of Economic Literature*, XLIII:959–988.
- Schmillen, Achim and Joachim Möller (2010): Determinants of lifetime unemployment : a micro data analysis with censored quantile regressions. *IAB Discussion Paper*; <http://doku.iab.de/discussionpapers/2010/dp0310.pdf>, (3/2010).
- Seibert, Holger (2007): Wenn der Schuster nicht bei seinem Leisten bleibt ... *IAB-Kurzbericht*, (1).
- Stops, Michael and Thomas Mazzoni (2010): Job Matching on Occupational Labour Markets. *Journal of Economics and Statistics (Jahrbuecher fuer Nationaloekonomie und Statistik)*, 230(3):287–312.
- Yashiv, Aran (2006): Search and Matching in Macroeconomics. *CEPR Discussion Papers*, (5459):1–70.