

Fedorets, Alexandra; Lottmann, Franziska; Stops, Michael

Article — Published Version

Job matching in connected regional and occupational labour markets

Regional Studies

Provided in Cooperation with:

German Institute for Economic Research (DIW Berlin)

Suggested Citation: Fedorets, Alexandra; Lottmann, Franziska; Stops, Michael (2019) : Job matching in connected regional and occupational labour markets, Regional Studies, ISSN 1360-0591, Taylor & Francis, London, Vol. 53, Iss. 8, pp. 1085-1098, <http://dx.doi.org/10.1080/00343404.2018.1558440>

This Version is available at:

<http://hdl.handle.net/10419/202037>

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.



<http://creativecommons.org/licenses/by/4.0/>

Supplemental File – Job Matching in Connected Regional and Occupational Labor Markets

ARTICLE HISTORY

Compiled December 4, 2018

Appendix A. Model of Non-sequential Search

The ‘bulletin board’ model proposed by Hall (1979) and Pissarides (1979) describes non-sequential job search. In the following, we combine the version by Burda and Profit (1996), which incorporates the influence of the unemployed and vacancies from nearby local labor markets, with the version by Stops (2014), which considers mobility between different occupational markets. Thus, our model is able to explain the possible direct and indirect effects of the number of unemployed and vacancies in other regions, other similar occupations, and other similar occupations in other regions.

Consider an economy that is divided into L regions, where it is possible to be employed in one of I occupations. The regions and occupations are indexed by $l = 1, \dots, L$ and $i = 1, \dots, I$. Within each region l and occupation i there are u_{il} identical unemployed workers and v_{il} identical firms. Each firm searches for one worker to employ. In the center of each region, there is an employment office that gathers information on all vacancies in all occupations and regions, which then brings workers and firms together. All offices receive and publish the same information at the same time, due to, e.g., the existence of supra-regional Internet-based information services. The unemployed workers apply for jobs in their occupation i or in another occupation $j \neq i$, the application can be sent either to the employment office in their residence region l or to another region $m \neq l$. Moreover, the workers decide about their search intensity N_{ijlm} , which can be measured by the number of applications sent for each occupation to each regional employment center.

Each application is a random draw and is associated with search costs $c + aD_{lm} + bD_{ij}$, where c , a and b are positive constants. D_{lm} is the distance between the employment offices in the regions l and m . D_{ij} is the content dissimilarity between the current occupation of the unemployed and the occupation she applies for. Thus, the search costs linearly depend both on the net costs of applying to different regions, as well as on the costs of gathering information to apply to another occupation. The search costs are minimum ($= c$) if an application is made within the current region of residence and the current occupation, i.e., $D_{lm} = 0$ and $D_{ij} = 0$.

Following a successful search, the worker is employed in region m in occupation j and receives wage w adjusted by the interest rate r .

Given the current geographical location of the worker l and her current occupation i , she decides on the number of interviews in each region m and occupation j . The worker knows about the probability, f_{jm} , of getting a job in region m and occupation j . The decision on the optimal number of interviews is yielded from maximization of net total expected benefit from the search:

$$\underbrace{\left[1 - (1 - f_{jm})^{N_{ijlm}}\right] \frac{w}{r}}_{\text{total expected benefit}} - \underbrace{N_{ijlm}(c + aD_{lm} + bD_{ij})}_{\text{costs}} \xrightarrow{N_{ijlm}} \max \quad (\text{A1})$$

The first term in equation (A1) refers to the total expected benefit of a job match between a worker in region l and occupation i and a vacancy in region m and occupation j . For simplicity, we assume that unemployment does not yield any income. Furthermore, workers' search costs are assumed to be relatively small compared with expected returns to search. This implies that income effects from searches for jobs in the other local labor markets can be neglected and, therefore, workers can separately fix their optimal search intensities for each local labor market.

Solving for the optimal search intensity N_{ijlm}^* yields:

$$N_{ijlm}^* = \begin{cases} f_{jm}^{-1} \cdot \ln\left(\frac{f_{jm} \frac{w}{r}}{c + aD_{lm} + bD_{ij}}\right) & \text{if } f_{jm} \frac{w}{r} \geq c + aD_{lm} + bD_{ij}, \\ 0 & \text{otherwise.} \end{cases} \quad (\text{A2})$$

Thus, the optimal search intensity is a positive function of the ratio of expected gains and the search costs $f_{jm} \frac{w}{r} / (c + aD_{lm} + bD_{ij})$. Further derivations show that the optimal search intensity is increasing in wages, while decreasing in interest rate, in application fixed costs, and in the introduced distance parameters.

Taking partial derivative with respect to f_{jm} yields:

$$\frac{\partial N_{ijlm}^*}{\partial f_{jm}} = f_{jm}^{-2} \left[1 - \ln\left(\frac{f_{jm} \frac{w}{r}}{c + aD_{lm} + bD_{ij}}\right) \right]. \quad (\text{A3})$$

It follows from equation (A3) that the optimal search intensity N_{ijlm}^* is decreasing in the probability to find a job in another region f_{jm} if the expected benefits are much higher than the costs of search:

$$\frac{\partial N_{ijlm}^*}{\partial f_{jm}} < 0 \quad \text{if } f_{jm} \frac{w}{r} \gg c + aD_{lm} + bD_{ij}. \quad (\text{A4})$$

With the optimal intensity of search N_{ijlm}^* , the unconditional job finding probability for a local labor market in any region and occupation can be defined. In the 'bulletin board' type of model, the vacancy is filled if it is chosen by at least one worker. We assume that all vacancies in all regions and occupations are known by all job searchers, due to the bulletin board (here, it is allowed that $i = j$ and $l = m$):

$$V_{jm} = V = \sum_{j=1}^J \sum_{m=1}^M v_{jm}. \quad (\text{A5})$$

If at least one worker chooses a vacancy, then, according to the 'bulletin board' type of model, this vacancy is filled. After all unemployed make their optimal num-

ber of applications in each occupation and region ($U_{jm} \equiv \sum_{i=1}^I \sum_{l=1}^L N_{ijlm}^* u_{il}$), the probability of a particular vacancy not being chosen is equal to:

$$\prod_{i=1}^I \prod_{l=1}^L \left[\prod_{k=1}^{N_{ijlm}^*} [1 - (V_{jm} - k + 1)^{-1}] \right]^{u_{il}} \approx \prod_{i=1}^I \prod_{l=1}^L \left[\prod_{k=1}^{N_{ijlm}^*} e \right]^{-\frac{u_{il}}{V_{jm}}} = \exp\left(-\frac{U_{jm}}{V_{jm}}\right). \quad (\text{A6})$$

Consequently, the unconditional job finding rate for each interview that is held in the targeted occupation j and the targeted region m , is defined as the number of vacancies per job seeker weighted by their job finding probabilities:

$$f_{jm} = \frac{V_{jm}}{U_{jm}} \left[1 - \exp\left(-\frac{U_{jm}}{V_{jm}}\right) \right]. \quad (\text{A7})$$

Based on the previous calculations, a matching function that returns the number of flows from unemployment to employment in an occupation i and in a region l can be described:

$$x_{il}(\mathbf{u}, \mathbf{v}) = u_{il} F_{il} = u_{il} \left[1 - \prod_{j=1}^J \prod_{m=1}^M (1 - f_{jm})^{N_{ijlm}^*} \right], \quad (\text{A8})$$

where \mathbf{u} and \mathbf{v} are the vectors of stocks of unemployed and vacancies in all regions and all occupations. F_{il} is the probability that an unemployed individual in occupation i and region l receives at least one job offer.

This function of matches involves the unemployed and vacancies in all occupations and all regions. Therefore, we can compute regional, occupational, and combined regional-occupational spillover terms as we present it in section 2.1 in the main text.

Appendix B. Construction of the occupational segments

Table B1.: Assignment of the occupational orders to the occupational segments
(according to Matthes et al., 2008)

Occupational segment		Occupational group (KldB 88)	
Code	Name	Code	Name
101	"Green" occupations	11	Farmers
		12	Winegrowers
		21	Livestock farmer
		22	Fish farmer
		31	Agricultural production manager
		32	Agricultural engineers and advisors
		41	Mixed crop and livestock farm laborers
		42	Livestock and dairy producers
		44	Pet groomers, animal care workers and related occupations
		51	Gardeners, horticultural and nursery growers
		52	Garden and landscape architects and administrators
		53	Florists
		61	Forestry production managers, foresters and hunts-persons
		62	Forestry laborers
		421	Wine coopers and other wine-processing operators
		422	Brewers, maltsters and other brewer machine operators
		423	Other beverage makers, coffee-processing-machine operators, tasters and graders
424	Tobacco preparers, products makers		
201	Miner/chemical occupations	71	Miners
		72	Mining shot firers and blasters
		81	Stone crushers
		82	Earth, gravel and sand quarry workers
		83	Gas and crude oil quarry workers
		91	Mineral and stone processing plant operators
		141	Chemical products plant and machine operators
		142	Chemical laboratory workers
		143	Rubber products machine operators
		144	Tire vulcanizers
		151	Plastic products machine operators
		464	Shot firers and blasters except mining shot firers
		541	Power production plant operators
		542	Winding-, conveyor- and ropeway-machine operators
		547	Machine maintenance operators, machinists' assistants
		548	Boilerpersons, incinerators and related plant operators
		604	Cartographers and survey engineers
		605	Mining, metallurgy, foundry engineers
		624	Survey engineering technicians
625	Mining, metallurgy, foundry engineering technicians		
626	Chemical and physical engineering technicians		
631	Agronomy, forestry and life science technicians		
632	Physical and mathematical science technicians		
633	Chemical science technicians		
202	Glass, ceramic, paper production	111	Brick-maker and other stoneware makers
		121	Ceramics plant operators
		131	Frit makers, glass vitrifiers
		132	Hollow glassware makers

continued on the next page

Occupational segment		Occupational group (KldB 88)	
Code	Name	Code	Name
		133	Flat glass makers
		134	Gaffer
		135	Glass cutters, grinders and refiners
		161	Pulp and cellulose plant operators
		162	Packaging makers
		163	Bookbinding workers
		164	Other paper products machine operators
		171	Type setters, pre-press workers
		172	Stereotypers and electrotypers
		173	Book printers, letterpress
		174	Flat screen, gravure and intaglio printers
		175	Special, silk-screen printers
		176	Hecto- and mimeo-graphers
		177	Printer's hands
		514	Glass, ceramics and related decorative painters, glass engravers and etchers
		634	Photo laboratory technicians
		837	Photographers, camera and retouching operators
203	Textile, leather production	331	Spinner, fibre-preparer
		332	Spoolers, twisters, rope-makers
		341	Weaving- and knitting-machine preparers
		342	Weavers and weaving-machine operators
		343	Tufted textile-, fur- and leather-products makers
		344	Knitters and knitting-machine operators
		345	Felt and hat body makers
		346	Textile braiders
		351	Tailors and dressmakers
		352	Sewers and sewing-machine operators
		353	Lingerie tailors and sewers
		354	Embroiderers
		355	Hatters and cap makers
		356	Sewer and sewing-machine operators otherwise undisclosed
		357	Other textile-products makers
		361	Textile dyer and dyeing-machine operators
		362	Textile bleaching-, cleaning-machine operators and other finishers
		371	Tanners, cutgut string makers and other leather-preparing-machine operators
		372	Shoe-makers
		373	Shoemaking-machine operators
		374	Saddlers, truss makers and other coarse-leather-products makers
		375	Purse, hand bag and other fine-leather-products makers
		376	Leather garment makers and other leather-products machine operators
		377	Leather glove makers
		378	Pelt dressers, furriers and other fur-products makers
		543	Pump-, compressor-, assembly line-, boring and other machines operators
		549	Machine-tool setters and setter-operators no further specified
		627	Other production technicians
		629	Forepersons and other operations managers
		931	Launderers and ironers
		932	Textile cleaner, dyers, chemical purifiers
204	Metal producer	191	Ore and metal furnace operators, metal melters
		192	Rolling-mill operators
		193	Metal drawers and extruders
		201	Moulders and coremakers

continued on the next page

Occupational segment		Occupational group (KldB 88)	
Code	Name	Code	Name
		202	Casters
		203	Casters of semi-finished products and other mold casters
		211	Sheet metal pressers, drawer and puncher
		212	Wire moulder, cable splicers
		213	Other metal moulders non cutting deformation
		221	Metal lathe operators
		222	Metal milling cutters
		223	Metal planers
		224	Metal borers
		225	Metal grinders
		226	Other metal-cutting occupations
		231	Metal polishers
		232	Engravers, chasers
		233	Metal finishers
		234	Galvanizers, metal colorers
		235	Enamelers, zinc platers and other metal surface finishers
		241	Welder, oxy-acetylene cutters
		242	Solderers
		243	Riveters
		244	Metal bonders and other metal connectors
		251	Steel-, black-, hammer-smiths and forging press workers
		252	Tank and container builders, coppersmiths and related occupations
		261	Tinsmiths
		262	Plumbers
		263	Pipe and tube fitters
		270	Locksmiths and fitters, not further specified
		271	Building fitters
		272	Sheet metal worker, plastics fitters
		273	Engine fitters
		274	Plant and maintenance fitters
		275	Steel construction fitters, steel ship builders
		281	Motor vehicle repairers
		282	Agricultural machinery repairers
		283	Aircraft mechanics
		284	Precision mechanics
		285	Other mechanics
		286	Watch-, clock-makers
		291	Toolmakers, instrument mechanics
		301	Precious fitters otherwise undisclosed
		302	Precious metal smiths
		303	Dental technicians
		304	Ophthalmic opticians
		323	Metal plant operators no further specification
		502	Pattern and mold carpenters
		601	Mechanical and automotive engineers
		621	Mechanical engineering technicians
		686	Filling station attendants
205	Electricians	311	Electrical fitters, mechanics
		312	Telecommunications mechanics, craftsmen
		313	Electric motor, transformer fitters
		314	Electrical appliance fitters
		315	Radio, sound equipment mechanics
		321	Electrical appliance and equipment assemblers
		322	Metal-, rubber-, plastic-, paperboard-, textile and related products assemblers
		602	Electrical and electronics engineers
		622	Electrical, electronics and telecommunications engineering technicians
		774	Computer scientists, equipment operators, computing and data processing professionals
206	Wood occupations	181	Wood-processing-plant operators

continued on the next page

Occupational segment		Occupational group (KldB 88)	
Code	Name	Code	Name
		182	Woodworking machine setters and setter-operators, and appropriate occupations
		183	Wood products, brush-, cork-maker
		184	Basketry weavers and wicker worker
		305	Musical instrument makers
		306	Doll, model makers, taxidermists
		485	Glaziers
		501	Cabinetmakers, carpenters and joiners
		503	Cartwrights, wheelwrights, coopers and tubbers
		504	Other wood-products makers, Boat-, glider- and wooden sports-equipment-building experts
		512	Goods painters and varnishers
		513	Wood surface finishers, veneers
207	Construction	112	Cement and concrete block makers
		441	Bricklayers and masons
		442	Steel fixers, concreters
		451	Carpenters
		452	Roofers
		453	Scaffolders
		461	Paviors, pavers
		462	Road building experts
		463	Track building experts
		465	Land improvement, maintenance and hydraulic structure building experts
		466	Well, duct and other civil engineering building experts
		471	Earth-moving laborers
		472	Building construction labourers and other construction and maintenance laborers otherwise undisclosed
		481	Stuccoers, plasterers
		482	Insulators and proofers
		483	Tile setters
		484	Stove setters and air heating fitters
		486	Composition floor and terrazzo layers
		491	Interior decorators, carpet and parquet layers
		492	Upholsterers, mattresses makers
		511	Construction painters, wall-paperers, varnishers
		544	Crane and hoist plant operators
		545	Earth-moving and related plant operators
		546	Construction plant operators
		603	Architects, civil and structural engineers
		623	Civil engineering technicians
		635	Draftspersons
		716	Construction and maintenance laborers: roads, dams, bridges and similar constructions
		836	Interior architects, visual merchandiser
301	Hotel/restaurant occupations	391	Bakers and baked-goods, cereal- and chocolate-products machine operators
		392	Pastry-cooks and confectionery makers
		401	Butchers and stickers
		402	Meat- and sausage-processing-machine operators
		403	Fish-processing-machine operators
		411	Cooks
		412	Ready-made meals-, fruit- and vegetable-processing-machine operators
		431	Dairy-products machine operators, butter-, lard- and margarine makers
		432	Grain- and spice-milling-machine operators
		433	Sugar-production machine operators, chocolate, sweets and ice-cream makers

continued on the next page

Occupational segment		Occupational group (KldB 88)	
Code	Name	Code	Name
		702	Travel agency clerks, attendants, stewards, consultants, organizers and guides
		805	Disinfectors, morticians, meat and other health inspectors
		911	Hoteliers, innkeepers, restaurateurs and management assistants in hotels and restaurants
		912	Waiters, waitresses, stewards, stewardesses and busedpersons
		913	Porters, bartenders and other hotel and restaurant attendants
		921	Housekeepers and related workers
		922	Energy and other consumer advisors
		923	Valets, chambermaids and other housekeeping attendants
		933	Dishwashers, room and domestic cleaners
		934	Windows, frontages and buildings cleaners
		935	Sweepers, streets and sewerages cleaners, dustmen and other waste disposal workers
		936	Car washers, vehicle cleaners, car and vehicle carers
		937	Machinery, plant, tube and container cleaners
302	Storage/ transport occupations	521	Products testers, sorters otherwise undisclosed
		522	Product packagers, balers, wrappers, qualifiers and other loading agents
		701	Logistics managers and transport clerks
		711	Locomotive engine, tram and subway drivers
		712	Railway brake, signal and switch operators, shunters and railway guards and conductors
		713	Other brake, signal and switch operators, transport guides and conductors, fleet managers
		714	Car, taxi, bus, (heavy) truck and other motor vehicle drivers
		715	Cabby
		721	Navigators, nautical ships' officers and pilots
		722	Technical ship's officers, engineers, technicians and machinists
		723	Seagoing ships' deck crews
		724	Inland boatmen and related ships' decks crews
		725	Ferryman, lock-masters, coastguards and other water traffic occupations
		726	Aircraft pilots, flight engineers and other air traffic occupations
		732	Mail carriers, sorting clerks, porters and deliverers
		733	Radio operators
		741	Stocks administrators and clerks
		742	Lift, lifting-trucks and other materials handling equipment operators
		743	Longshoremen, furniture removers
		744	Stock, loading and other transport workers
303	Merchandise occupations	681	Wholesaler, retail salespersons and buying agents
		682	Shop, stall and market salespersons and demonstrators
		683	Publishers, management assistants in publishing and booksellers
		684	Chemists in drugstores
		685	Chemist's assistants in pharmacies
		687	Commercial sales representatives and sales agents
		691	Banking experts including tellers, finance clerks as well as finance dealers and brokers
		692	Building society experts including representatives as well as clerks

continued on the next page

Occupational segment		Occupational group (KldB 88)	
Code	Name	Code	Name
		693	Health insurance experts including representatives as well as clerks, not social security
		694	Life, property insurance experts including representative as well as clerks
		704	Finance, stock, trade, ship, real estate, insurance brokers
		705	Landlords, hirers, agents, bookers, auctioneers
		706	Cashiers, ticket agents, Debt- and vending-machine money collectors and ticket inspectors
		773	Cashiers and ticket clerks
		855	Dietitians, nutritionists and pharmacy technicians
		901	Hairdressers, barbers, wig-makers and related workers
		902	Beauticians, manicurists, pedicurists and related workers
304	White collar worker	703	Advertising and public relations experts
		734	Telephone switchboard operators
		751	Entrepreneurs, managing directors and division managers
		752	Management, personnel and other business consultants
		753	Financial, tax accountants and accounting clerks
		762	Senior and administrative state officials
		763	Senior and administrative officials of humanitarian and other special-interest organizations
		771	Calculators, calculating and counting clerks
		772	Bookkeepers
		781	Office clerks, otherwise undisclosed
		782	Secretaries, stenographers and typists
		783	Data entry operators
		784	Scribes and other office hands
		811	Judges and prosecutors
		812	Law officers
		813	Lawyers, notaries, legal representatives, advisors and other legal professionals
		814	Executory officers, prison guards
		863	Housemasters, social pedagogue, deacons
		881	Economists, psychologists, sociologists, political scientists, statisticians
305	Security occupations	607	Industrial and other operating engineers
		628	Industrial and other operating technicians
		791	Factories security offices, store, hotel and other detectives
		792	Watchpersons, custodians, attendants and related workers
		793	Door-, gatekeepers and caretakers
		794	Menials, bellmen, ushers and groundkeepers
		801	Soldiers, border guards, police officers
		802	Firefighters
		803	Safety inspectors, trade controllers, gauging, and environmental protection officers
		804	Chimney sweepers
306	Social/care occupations	861	Social work, welfare, health care professionals and workers; geriatric nurses
		862	Housemasters, social pedagogue, deacons
		864	Kindergarten teachers, child care workers and pediatric nurses
		891	Bishops, pastors, chaplains and other religious professionals
		892	Nuns, friars and other religious associate professionals
		893	Sextons, cantors and other religious assistants
307	Medical occupations	851	Non-medical practitioners, psychotherapists

continued on the next page

Occupational segment		Occupational group (KldB 88)	
Code	Name	Code	Name
		852	Masseurs, physiotherapists and health care professionals
		853	Nurses, midwives, nursing and midwifery associate professionals
		854	Paramedics and nursing auxiliary workers
		856	Doctor's receptionists and assistants
		857	Medical technical, laboratory, radiological assistants
308	Doctors	841	Medical doctors
		842	Dentists
		843	Veterinaries
309	Teacher	871	University, college professors and related teaching professionals
		872	Grammar school teacher and related teaching professionals
		873	Primary, secondary school, special education teachers and related teaching professionals
		874	Vocational, professional college teachers and related teaching professionals
		877	Driving, flying, hygienic and other instructors, otherwise undisclosed
310	Artists/Athletes	101	Stone splitters, cutters and carvers
		102	Precious-stone workers, jewel preparers
		831	Composers, music directors and musicians
		832	Film, stage and related directors, actors, singers and dancers
		833	Sculptors, painters, graphic and related artists
		834	Decorators, sign painters
		835	Set designer, light board, image and sound recording engineers, technicians and operators
		838	Clowns, magicians, acrobats, professional sports-persons, mountain guides and models
		875	Art, music and voice teachers and related teaching professionals, otherwise undisclosed
		876	PE teachers, related teaching professionals, skiing and other sports instructors
311	Natural scientists	606	Other production engineers
		611	Chemists, chemical engineers
		612	Physicists, physics engineers, mathematicians
		844	Pharmacists
		883	Biologists, geographers, meteorologists and other natural scientists, otherwise undisclosed
312	Humanities scholars	821	Authors, journalists, editors and announcers
		822	Interpreters, translators
		823	Librarians, archivists, documentalists, curators, library and filing clerks
		882	Philologists, historians, philosophers and other humanities scientists, otherwise undisclosed
999	Others	531	Helper no further specified
		982	Threshold workers, volunteers with occupation still to be specified
		983	Job-seekers with occupation still to be specified

Appendix C. Placebo Test of the Occupational Topology

As shown above, the usage of the (contiguity) occupational weights matrix adopted from Matthes, Burkert, and Biersack (2008) delivers robust and significant estimates for occupational spillovers. The estimation relies on the assumption that the constructed occupational topology has similar properties like regional topologies. However, one important difference is that regional topologies are in fact observable; their contiguity, distances and related measures between region pairs are physical.

Though as objective as possible, our occupational topology nevertheless relies on concepts of human perception and multidimensional definitions of tasks that cannot be mapped like it is possible for regions. This concerns cannot be fully eliminated, but we can at least test which estimation results would be produced by arbitrary defined occupational topologies as basis for the occupational spillover effects.

Analogous to the methodology in Stops (2014), we conduct an additional indirect validity test for our occupational weights matrix to verify that our estimated effects of occupational spillovers are non-random. In doing so, we construct 500 random matrices of ‘occupational topologies’ that fulfill the following conditions:

- contain the same amount of occupational segments (implying same size of segments as in the empirical ‘topology’);
- are symmetric;
- contain zeros at their main diagonal; and
- prevent occupations from the same empirical occupational segment to be in one random occupational segment.

Next, we re-estimate the fixed effects model of the occupational spillover effects in the matching function using our (contiguity) occupational weights matrix and the constructed random matrices. The regression equation is specified like specification (FE12) but without the regional-occupational spillover terms, because we prefer for this robustness check a specification that clearly disentangles the regional and the occupational spillover effect. The results of the estimation are displayed in figure C1. The horizontal lines in both charts of the figure correspond to the estimation result based on the empirical ‘occupational topology’ based on the classification of occupations into segments by Matthes et al. (2008). The solid line corresponds to the point estimates, whereas the dashed lines around correspond to the 95% confidence intervals.

The point estimates and confidence intervals for the random matrices are substantially and significantly different from the estimates based on (contiguity) occupational weights matrix. Although the size of the coefficients differs substantially, the coefficients from the estimations with random and empirical weight matrices exhibit same direction of influence on the matching technology. In particular, the sign of the coefficient of the randomly weighted unemployed is negative, whereas the sign of the coefficient of the randomly weighted vacancies is positive. Thus, we conclude that the estimation of occupational spillovers described in section 4 captures relationships due to tasks similarities within occupational segments that result in non-random occupational mobility.

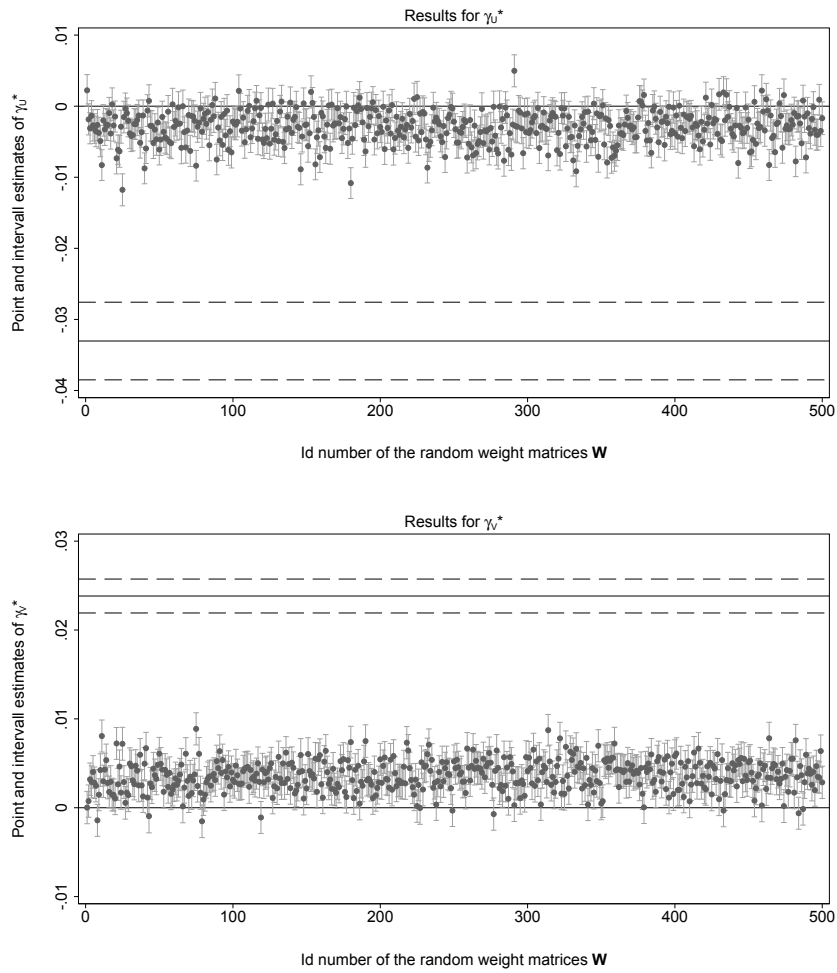


Figure C1. Test of 500 random ‘occupational topology’ matrices in the estimation of the effect of occupational spillovers on matching efficiency.

Notes: Estimates are based on the empirical weight matrix and 500 randomly selected weight matrices. The solid horizontal lines mark the point estimates and the dotted horizontal lines below and above mark the 95%-confidence interval estimates of the occupational spillovers γ_{U_o} and γ_{V_o} based on the empirical weights matrix. The dots and the vertical lines mark the point estimates and the 95%-confidence interval estimates of the occupational spillovers γ_{U_o} and γ_{V_o} based on randomly selected weight matrices of non-similar occupational groups.

References

- Burda, M. C., & Profit, S. (1996). Matching across Space: Evidence on Mobility in the Czech Republic. *Labour Economics*, 3, 255-278.
- Hall, R. E. (1979). A Theory of the Natural Unemployment Rate and the Duration of Unemployment. *Journal of Monetary Economics*, 5, 153-169.
- Matthes, B., Burkert, C., & Biersack, W. (2008). *Berufssegmente: Eine empirisch fundierte Neuabgrenzung vergleichbarer beruflicher Einheiten*. (IAB-Discussion Paper No. 35, IAB, Nuremberg)
- Pissarides, C. A. (1979). Job Matchings with State Employment Agencies and Random Search [Journal Article]. *The Economic Journal*, 89(356), 818-833.
- Stops, M. (2014). Job Matching Across Occupational Labour Markets. *Oxford Economic Papers*, 66(4), 940-958.