

# Where do employees of MNEs come from? A social network analysis of labour mobility in Veneto

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# Overview

- 1 Introduction
- 2 Objectives & data
  - Descriptive statistics
    - Inter and intra sectoral flows
- 3 Methodology
- 4 Results
  - Network topologies
  - Cluster analysis
  - Empirical Analysis
- 5 Conclusion/further research

# Background to this research

- MNEs do not locate haphazardly; location decision is a function of cost factors, institutional settings but also the availability of skilled labour
  - positive externalities from a region's "industrial commons"
- Literature points to productivity improvements around foreign-owned firms (Lipsey, 2004)
- But less emphasis on knowledge flowing from the local industrial base to MNEs
- Well-documented impact of MNEs on local labour system: the wage effect and, in particular, the spillover effects
- but the latter studies remain inconclusive (Ebersberger et al., 2011)
  - they fail to link spillovers with the mechanism that diffuses knowledge, or the specific process of accessing knowledge (Tsai, 2001)

## Background: Mechanism that diffuses knowledge

- The main conduit of knowledge diffusion is labour mobility (Malmberg and Power, 2005)
  - Eriksson and Lindgren (2009): the extent of diffusion of knowledge is stronger through labour mobility than economies of co-location, diversity and scale
- Knowledge diffusion and its spatial dimension → clusters (Keilbach, 2012)
- But Malmberg and Power (2005) notes that much of firms' links are extra local
- Concentration of specialised skills inside clusters (Lissoni, 2001). Occupations with similar knowledge profiles tends to agglomerate (Gabe and Abel, 2012)

### Note

We depart from the traditional view of clusters: we do not impose a spatial boundary for clusters. We identify clusters based on their relations (in this case, labour flows)

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# Aims of this research

- The role of MNEs in the Made-in-Italy (MI) labour flow network
  - how they differ from non-MNEs in terms of mobile worker characteristics
  - whether they are incubators of “knowledgeable” pool of workers or not,
  - whether they locate in strategic labour clusters
  - how do network characteristics and MNE presence affect firm performance

*MI includes Ceramics, Eyewear, Food ind., Footwear, Glass, Jewellery, Marble, Other m.Italy, Tanning, Textile-clo., Wood-furn.*

# Data sources

## Worker mobility

Database maintained by the Osservatorio & Ricerca of the Veneto Lavoro Institute. It keeps track of all employment contract inside the Venetian region from the year 2008 onwards. Moreover, it holds basic information about the firms such as sector, type of incorporation, etc. We transform data into relational data to obtain the labour flow network (LFN)

## MNEs

We use the Reprint Italia Multinazionale database developed by R&P (Ricerche & Progetti) and the Politecnico di Milano

## MNEs

AIDA for measures of firm performance

Table: Labour flows: All firms and MNEs, by work contract and skills

All firms:47706								MNEs:227			
	sum	mean	sd	max	skew	%	flows/stock	sum	mean	%	flows/ stock
Flows	95356	1.2	1.5	155	32		12%	1808	1.2		9%
CONTRACTS											
Permanent	26586	0.3	1.1	54	16	28%	4%	356	0.2	20%	2%
Apprenticeship	4037	0.1	0.2	7	5	4%	14%	47	0	3%	14%
Fixed-term	25156	0.3	0.9	107	41	26%	32%	389	0.3	22%	43%
Staff-lease	24299	0.3	0.9	119	41	25%	206%	727	0.5	40%	107%
On-call	4793	0.1	0.3	14	7	5%	19%	71	0	4%	241%
Domestic	1462	0	0.1	2	7	2%	69%	16	0	1%	533%
Project-based	2081	0	0.2	15	19	2%	10%	64	0	4%	36%
Internships/stage	6942	0.1	0.3	9	6	7%	71%	138	0.1	8%	150%
SKILLS											
	sum	mean	sd	max	Skew	%	flows/ stock	sum	mean	%	flows/stock
High-skilled	9201	0.1	0.4	28	12	10%	5%	296	0.2	16%	5%
Medium skilled	23749	0.3	0.6	63	21	25%	9%	446	0.3	25%	13%
Low skilled	45263	0.6	1.4	106	22	47%	20%	706	0.5	39%	9%
Unskilled	16987	0.2	0.7	55	27	18%	15%	352	0.2	19%	16%
nd	156	0	0	2	23	0%	0%	8	0	0%	0%



**Table:** Labour flows: By education, sex, work shift, nationality and employment duration

	All firms:47706				MNEs:227			
	Flows	mean	%	flows/stock	Flows	mean	%	flows/stock
EDUCATION								
No education	8493	0.1	9%	29%	27	0	1%	9%
Compulsory edu.	40842	0.5	43%	15%	603	0.4	33%	10%
Diploma	37412	0.5	39%	12%	863	0.6	48%	11%
Graduate	7741	0.1	8%	7%	296	0.2	16%	9%
SEX								
M	50276	0.6	53%	12%	1022	0.7	57%	8%
F	45080	0.6	47%	12%	786	0.5	43%	12%
WORK SHIFT								
full_time	59372	0.8	62%	11%	1344	0.9	74%	8%
part_time	29260	0.4	31%	18%	320	0.2	18%	36%
NATIONALITY								
Italian	67195	0.9	70%	10%	1504	1	83%	9%
Non-Italian	28161	0.4	30%	25%	304	0.2	17%	17%
EMPLOY. DURATION								
Less 1 year	69849	0.9	73%	40%	1345	0.9	74%	58%
1-3 years	11658	0.1	12%	8%	203	0.1	11%	7%
Over 3 years	75	0	0%	0%	2	0	0%	0%

Table: Where do mobile workers go? Inter/intra sectoral flows

From various sectors to MI			From MI to various sectors			
W %	Flows	%	Sector	%	Flows	W%
5%	1858	3%	Agriculture	4%	2590	3%
0%	20	0%	Extractive	0%	18	0%
43%	27324	47%	Made in Italy	42%	27324	49%
4%	4479	8%	Engineering	7%	4828	5%
2%	2138	4%	Other industries	4%	2360	2%
0%	169	0%	Utilities	0%	229	0%
5%	1732	3%	Construction	2%	1208	2%
21%	8490	15%	Leisure svs & retail	15%	9646	19%
7%	4536	8%	Logistics & wholesale	8%	4863	6%
0%	149	0%	Financial services	0%	161	0%
3%	1305	2%	Advanced tertiary	2%	1472	2%
5%	3706	6%	Health, edu., pers. svs	11%	7244	8%
4%	1982	3%	Clean., surveill., other	4%	2839	4%
	57888		Total		64782	

Where do different type of mobile workers go?

We expect workers with a stable contract, such as a permanent contract, to be more mobile within the MI sector than those without a stable contract, such as a fixed term contract or staff-lease contract

Table: Inter/intra sectoral flows by work contract

From various sectors to MI						From MI to various sectors							
Fixed-term contract			Permanent contract			Permanent contract				Fixed-term contract			
W %	flow	%	W %	flow	%	Sector	%	flow	W%	%	flow	W%	
10%	819	6%	1%	198	1%	Agriculture	1%	142	1%	13%	2170	10%	
0%	8	0%	0%	3	0%	Extractive	0%	11	0%	0%	4	0%	
30%	5052	37%	70%	13402	68%	Made in Italy	66%	13402	74%	30%	5052	32%	
5%	979	7%	2%	778	4%	Engineering	5%	952	3%	6%	960	5%	
2%	447	3%	1%	400	2%	Other industries	2%	380	1%	2%	380	2%	
0%	44	0%	0%	25	0%	Utilities	0%	54	0%	0%	74	1%	
7%	593	4%	2%	343	2%	Construction	2%	326	1%	3%	483	3%	
23%	2516	19%	10%	1651	8%	Leisure svcs & retail	9%	1797	9%	19%	3095	22%	
10%	1256	9%	5%	1081	5%	Logistics & wholesale	7%	1372	5%	11%	1754	9%	
0%	40	0%	0%	38	0%	Financial services	0%	45	0%	0%	31	0%	
4%	306	2%	1%	393	2%	Advanced tertiary	2%	313	1%	2%	366	2%	
5%	961	7%	4%	1123	6%	Health, edu., pers. svcs	3%	689	3%	7%	1180	8%	
4%	559	4%	1%	347	2%	Clean., surveill., other	4%	716	2%	6%	1078	6%	
13580			19782			Total	20199				16627		

We also expect high-skilled workers to be more mobile compared to the unskilled

Table: Inter/intra sectoral flows by skill level

From various sectors to MI						From MI to various sectors							
high-skilled			unskilled			unskilled				high-skilled			
W %	flow	%	W %	flow	%	Sector	%	flow	W%	%	flow	W%	
3%	92	2%	11%	380	6%	Agriculture	14%	1685	13%	1%	38	1%	
0%	2	0%	0%	2	0%	Extractive	0%	1	0%	0%	7	0%	
24%	2066	38%	26%	2078	31%	Made in Italy	17%	2078	17%	36%	2066	30%	
7%	618	11%	7%	785	12%	Engineering	8%	957	7%	12%	725	10%	
2%	263	5%	3%	397	6%	Other industries	4%	475	3%	7%	379	6%	
0%	15	0%	0%	33	0%	Utilities	1%	86	1%	0%	27	1%	
4%	135	2%	9%	297	4%	Construction	2%	253	3%	2%	102	2%	
22%	826	15%	19%	918	14%	Leisure svs & retail	9%	1127	12%	8%	468	10%	
15%	607	11%	10%	695	10%	Logistics & wholesale	10%	1231	9%	10%	579	9%	
0%	36	1%	0%	10	0%	Financial services	0%	15	0%	1%	41	0%	
12%	371	7%	2%	117	2%	Advanced tertiary	1%	143	1%	9%	530	10%	
5%	249	5%	5%	507	8%	Health, edu., pers. svs	26%	3232	24%	12%	714	18%	
4%	171	3%	6%	403	6%	Clean., surveill., other	9%	1160	10%	2%	139	3%	
5451			6622			Total		12443			5815		

# Social network analysis SNA

## In the labour flow network (LFN)

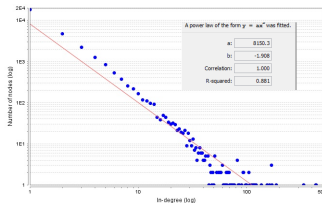
a link  $l$  is defined whenever a worker moves from firm  $i$  to firm  $j$  in time period  $t$ ,  $I_{ij}^t > 0$ . The degree  $k$  of a firm is the number of links it has

- We are able to observe worker flows not only from firm  $x$  to  $y$  but also to take into consideration firm  $z$  (and others) in the picture
- We observe flows to and from the **MI sector**, analyse the descriptive statistics and network statistics
- Flows within a single firm are excluded (self-loop), for example, if worker  $X$  obtains a promotion and signs a new contract with her current employer, she is excluded.

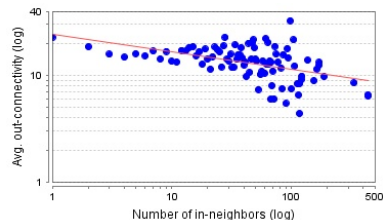
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# Degree distributions & neighbourhood conn.

Heavy-tailed distribution implies that a few firms have very high degrees while the majority of firms have very low degrees (Barabasi, 2009) **In-degree distribution**



Most social networks tend to be assortative, i.e., nodes tends to connect to similar nodes **Neighbourhood conn. and In-degree distribution**



MI LFNs are disassortative. Guerrero and Axtell (2013) shows that the Finnish LFNs were disassortative but only after 35 nodes

## Network topologies

# Are the structural properties of the LFN the result of a random process?

Table: Network statistics: all firms, MNEs, random network

Variable	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max	Mean
Links	3.31	10.5	1	792	12.87	26.2	1	186	3.31
Indegree	1.65	5.6	0	438	6.46	13.7	0	84	1.65
Outdegree	1.65	5.3	0	377	6.41	13.4	0	119	1.65
Neighborhood conn.	39.41	95.8	1	710	44.94	78.4	1	710	37.3
Av. shortest	3.67	3.2	0	15.6	4.7	2.4	0	10	3.23
Clustering coef.	0.010	0.1	0	1	0.02	0.1	0	0.83	0.001
Betweenness cent.	0	0.03	0	1	0	0	0	0.005	0
Closeness cent.	0.22	0.3	0	1	0.18	0.18	0	1	0.23
Eccentricity	8.63	7.7	0	25	12.05	6.1	0	19	6.77
Employees	21.5	135.8	-11	12074	114.3	152	0	1078	
Whole network: 47706 vertices					MNEs: 227 vertices				Random network

- The MI network is more clustered than its random counterpart and its average shortest path is slightly higher
- These two properties of the network, segregation and integration, make it a small-world network



# Are MNEs different?

Table: Network statistics: all firms, MNEs, random network

Variable	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max	Mean
Links	3.31	10.5	1	792	12.87	26.2	1	186	3.31
Indegree	1.65	5.6	0	438	6.46	13.7	0	84	1.65
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Av. shortest	3.67	3.2	0	15.6	4.7	2.4	0	10	3.23
Clustering coef.	0.010	0.1	0	1	0.02	0.1	0	0.83	0.001
Betweenness cent.	0	0.03	0	1	0	0	0	0.005	0
Closeness cent.	0.22	0.3	0	1	0.18	0.18	0	1	0.23
Eccentricity	8.63	7.7	0	25	12.05	6.1	0	19	6.77
Employees	21.5	135.8	-11	12074	114.3	152	0	1078	
Whole network: 47706 vertices					MNEs: 227 vertices				Random network

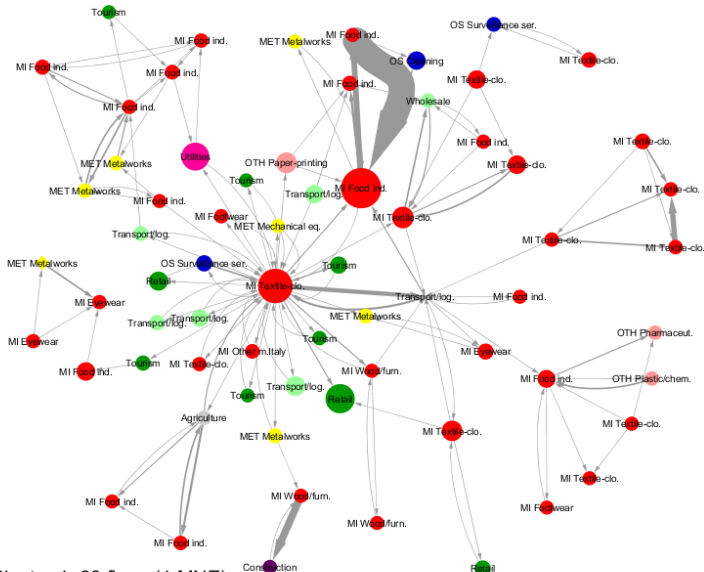
- more connections, neighbours are also well-connected
- Finding suggests one or a combination of the following: 1) MNEs select to locate near integrated groups of firms (to benefit from an existing pool of labour) 2), MNEs create an environment that facilitates the integration of firms through labour movements. Cluster analysis to investigate further

We use a sophisticated algorithm that detects highly interconnected regions in a network. It operates through a 3-stage process

- all nodes are assigned a score according to their local network density
- starting with the highest weighted node, other nodes are added recursively if they satisfy a given threshold; we do not score nodes of less than 2 degrees
- filters are applied to improve the quality of the clusters.
- we drop out clusters that are not maximally interconnected sub-clusters of at least 3 degrees; we drop out nodes that only have a single connection to the cluster, and; we set the algorithm to search for nodes as far as 100 steps away from the seed node. parameters.

Given our parameters we identify 32 clusters, robust to the use of different parameters

## Cluster analysis



## Cluster analysis

## Node Fill Color

## ateco2\_oss



a- Agricoltura



b- Estrattive



c- Made in Italy



d- Metallmeccanico



e- Altre industrie



f- Utilities



g- Costruzioni



h- Comm.-tempo libero



i- Ingrosso e logistica



l- Servizi finanziari



m- Terziario avanzato



n- Servizi alla persona



o- Altri servizi



## Cluster analysis

## Clusters identified: correlations

					skills			work contract			studies				network stats.			
Cl.	Firms	Flows	MNEs	Main sectors	Hi skill	Me skill	lo skill	perm	intern	no st	comp.	dip.	deg	clust	deg	asp	neig	
1	68	267	1	Food, Textile, Metalworks	11%	21%	50%	15%	2%	1%	33%	54%	12%	0.20	3.97	2.48	10.0	
2	46	218	4	Wood, Food, Footwear	25%	2%	57%	11%	1%	1%	43%	50%	5%	0.29	5.69	2.47	6.48	
3	39	243	0	Tanning	4%	2%	84%	4%	1%	4%	84%	10%	1%	0.33	5.79	3.15	8.31	
4	35	355	0	Tanning	1%	2%	90%	3%	1%	10%	72%	14%	1%	0.48	8.85	2.52	10.8	
5	33	99	0	Food, Footwear	2%	5%	61%	27%	2%	10%	45%	35%	5%	0.29	3.15	1.98	4.14	
6	32	73	3	Footwear	8%	7%	75%	44%	3%	15%	49%	32%	4%	0.14	3.13	1.39	3.11	
7	32	99	4	Food, Footwear, Textile	22%	15%	49%	18%	0%	2%	38%	28%	30%	0.20	3.44	2.23	2.89	
8	23	105	0	Textile, Transport	1%	11%	66%	16%	0%	23%	34%	30%	6%	0.11	4.09	2.35	6.98	
9	19	107	0	Tanning, Food	11%	12%	50%	7%	0%	10%	30%	49%	6%	0.54	4.74	1.95	5.66	
10	16	93	0	Tanning	1%	2%	87%	11%	0%	3%	70%	14%	0%	0.42	7.75	2.04	6.88	
11	14	60	0	Food, Cleaning svcs	15%	5%	55%	3%	0%	0%	67%	23%	10%	0.18	4.14	2.36	3.52	
12	14	33	2	Eyewear	18%	3%	39%	0%	0%	3%	24%	61%	12%	0.13	3.14	1.52	2.36	
"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
14																		
Correlation: MNEs					0.24	0.16	-0.21	-0.23	0.38	-0.23	-0.12	0.36	0.30	-0.46	-0.09	0.25	0.01	
Correlation: Firms					0.02	0.30	-0.13	-0.47	0.73	-0.35	0.10	0.36	0.13	-0.57	0.27	0.75	0.74	
Correlation: Flows					-0.07	0.12	0.07	-0.43	0.48	-0.30	0.34	0.16	-0.05	-0.38	0.62	0.74	0.90	

Acquiring knowledge from external sources benefits the firm as it prevents lock-in or inertia. Similarly, we contend that acquiring knowledge through hiring from *diverse* sources should benefit the firm

*H1 Firms' performance should be positively related to their indegrees*

Given that LFN clusters imply the concentration of specialised and related skills, we expect that firms located in such clusters to perform better

*H2 Firms in clusters should perform better*

Since MNEs provide exposure to unprecedented and rich knowledge that differs from the internal context (Ebersberger et al., 2011), firms that have access to such knowledge should benefit

*H3 Firms in clusters that include MNEs should perform better*

## Empirical Analysis

## Impact of LFN structure on firms' performance

	rev13	rev14	add_e13	add_e14	turn_e13	turn_e14	rev_sect
Indegree	0.0245*	0.0305*	0.0101*	0.00796*	0.0131*	0.0118*	0.0266*
Outdegree	-0.0232*	-0.0323*	-0.00776*	-0.00472*	-0.00647*	-0.00485 <sup>+</sup>	-0.0219*
ClusteringCoefficient	0.0410	0.234	-0.0922	0.0800	-0.216 <sup>+</sup>	-0.0959	-0.202
AverageShortestPathLength	0.0494*	0.0402*	0.00810*	0.00419 <sup>+</sup>	0.00350	-0.000858	0.0484*
NeighborhoodConnectivity	0.000382*	0.000437*	0.000209*	0.000257*	-0.00000614	-0.0000240	0.000258 <sup>+</sup>
BetweennessCentrality	-1.126*	-0.836	-0.372	-0.638*	-0.319	-0.344	-0.938*
mne	1.699*	1.640*	0.477*	0.546*	0.654*	0.607*	1.314*
cluster_dum	0.396*	0.392*	0.0127	-0.0444	-0.148	-0.167 <sup>+</sup>	0.422*
mne_clust	-0.390	-0.346	-0.496 <sup>+</sup>	-0.165	-0.269	-0.808*	-0.149
clust_mne	0.254	0.402*	0.142	0.202*	0.197	0.309*	0.232
stock_12_13	0.00603*	0.00597*	0.000430*	0.000349*	0.0000973	0.00000446	0.00569*
Ad. tert							-0.453*
Agric.							0.313*
Constru.							-0.264*
Fin. svs.							-0.579*
Lei.Ret.							-0.438*
Metalwk.							0.670*
Mining							0.267
Oth. ind.							0.832*
Oth. svs.							-0.617*
Hth. edu.							-0.566*
Utilities							1.018*
Who. Log							0.555*
Observations	14110	13022	13093	12135	13724	12610	14110
R <sup>2</sup>	0.176	0.170	0.017	0.021	0.011	0.010	0.242

<sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$



# Conclusions I

- Limitation: This research analyses only firm-to-firm labour mobility, that is, we do not observe mobility for first-time workers (that is, individuals that never worked before, such as, leaving students). Thus, we interpret our results with care
- Workers involved with the MI sector have a mobility of 12 out of 100 (MNEs 9 out of 100)
- Most mobile group was those on staff-lease contract pointing to the important role played by job agencies
- Low-skilled workers changed jobs more frequently than higher-skilled ones, workers with 3 years work-experience with an employer were immobile

## Conclusions II

- MI sector was shrinking (firing more than hiring), it was losing workers to Leisure services and retail sector, Health, edu, pers. services and Agriculture but it appears that MI sector was selecting into higher skilled workers rather than unskilled ones
- The MI LFN showed a hierarchical structure, i.e the presence of hubs
- Disassortative nature of the network: the lure of the diverse
- Clusters were quite heterogeneous sectorwise
- Hiring from many different firms benefit the firm
- Moreover, being within few steps of other firms in terms of worker mobility also benefits the firm
- Firms benefit in terms of increased revenue when they are inside clusters and particularly when such clusters include MNEs (though MNEs themselves do not benefit)

# Conclusions III

- MNEs tend to improve the quality of local labour clusters
- Hence, policy should aim at encouraging labour mobility to build resilience and facilitating MNEs in strategic regions
- Further research: industry relatedness index that builds on firm to firm labour mobility

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# The End

# The structural properties of the LFN

Note: av. shortest path is much smaller than total no. of nodes → each firm is connected to any other by  $< 4$  worker flows indicating easy reachability

**Table:** Network statistics: all firms, MNEs, random network

Variable	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max	Mean
Links	3.31	10.5	1	792	12.87	26.2	1	186	3.31
Indegree	1.65	5.6	0	438	6.46	13.7	0	84	1.65
Outdegree	1.65	5.3	0	377	6.41	13.4	0	119	1.65
Neighborhood conn.	39.41	95.8	1	710	44.94	78.4	1	710	37.3
Av. shortest	3.67	3.2	0	15.6	4.7	2.4	0	10	3.23
Clustering coef.	0.010	0.1	0	1	0.02	0.1	0	0.83	0.001
Employees	21.5	135.8	-11	12074	114.3	152	0	1078	
Whole network: 47706 vertices					MNEs: 227 vertices				Random network

- To better assess the relevance of the statistics, we compare the results to that of an Erdos-Renyi random network. See next slide
- We use recent algorithm that maintains the number of nodes and degree sequences of the original network while the links are reshuffled randomly (Maslov and Sneppen, 2002)