Which firms benefit from cultural diversity?

Ceren Ozgen [1,2] Thomas de Graaff [1]

[1]Department of Spatial Economics, VU University Amsterdam, The Netherlands
[2]Tinbergen Institute, Amsterdam, the Netherlands

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Research question

Does firms' innovativeness benefit from the cultural diversity of the workforce? And if so, which types of firms actually benefit from cultural diversity?

We find that:

1. Cultural diversity of the foreign workforce significantly increases the probability to innovate at the firm level. . .
2. but only for large capital intensive firms (e.g., in manufacturing and R&D sectors),
3. which are not necessarily located in urban areas.

Previous research

Small number of papers discussing within firm effects of migrants (e.g. Lee & Nathan 2010). The available literature offers 2 main streams of research:

1. Effect of foreign entrepreneurs/students/inventors on innovations (Faggian and McCann 2009; Kerr 2009; Kerr and Lincoln 2008; Hunt and Gauthier-Loiselle 2008; Zucker and Darby 2007)
2. Effect of migrant externalities from diverse regions on innovations/productivity (Ozgen et al. 2011; Niebuhr 2010; Mazzolari and Neumark 2009; Sudekum 2009; Ottaviano and Peri 2005)

Our contribution

- We focus on both observed observed and unobserved heterogeneity of firms
- Instead of instrumental variables we employ a multivariate finite mixture model to tackle unobserved heterogeneity (more of less conform the mass-point approach advocated by, e.g., Heckman and Singer (1984) and Abbring and van de Berg (2003) and Svarer et al. (2006))
- Finite mixture models mostly used in marketing (Wedel and Kamakura, 2000) and labour economics (Lancaster, 1990); received more attention recently (Baum-Snow and Pavan, 2012)

Description of the data

- 3 confidential firm/individual micro datasets:
  1. Tax Records—10 million obs.
  2. Community Innovation Survey (CIS 3.5–CIS 4.5) about 11,000 obs in each period.
  3. Dutch Municipality registrations—16 million obs.
- CIS is a regular snapshot of infrastructure /inputs /outputs /obstacles for innovation and firms
- Our Dataset is a linked employee-employer dataset:
  1. Firstly, the actual number of employees per firm per location
  2. Secondly, the actual number frg. of employees per firm + their charac.

Sample information

- Total number of firms: 5,590
- Total number of employees: $\sim$ 1 Mio employees
- Total number of foreign employees: 105,587 ($\sim$ 11% of employees in the sample)
- A 3-wave panel data of a sample from 2000 to 2006
- Pr(Innovate) (P_{it}):
  - Firm is an innovator
  - New products/services are introduced
  - New processes are introduced
- Diversity is measured as $D_{it} = 1 - \sum_{j=1}^{6} s_{jit}$ (Ozgen et al., 2012)

Model

- System of equations for firm's i 'innovativeness' P_{it} and diversity D_{it}:

$$\begin{aligned} f_P(P_{it}) &= X_{it}\beta_{\delta_i} + f(D_{it})\gamma_{\delta_i} + \epsilon_{it} \\ f_D(D_{it}) &= Y_{it}\alpha_{\nu_i} + \mu_{it} \end{aligned}$$

- Empirical strategy to control for unobserved heterogeneity is to integrate δ_i and ν_i out as follows.

$$f(P_{it}, D_{it}) = \int_{\delta}\int_{\nu} f_P(P_{it}) f_D(D_{it}) dG(\delta_i, \nu_i)$$

Econometric specification

- Assumption: δ_i and ν_i homogeneous within (a finite number of) S subsets.
- Finite mixture approach:

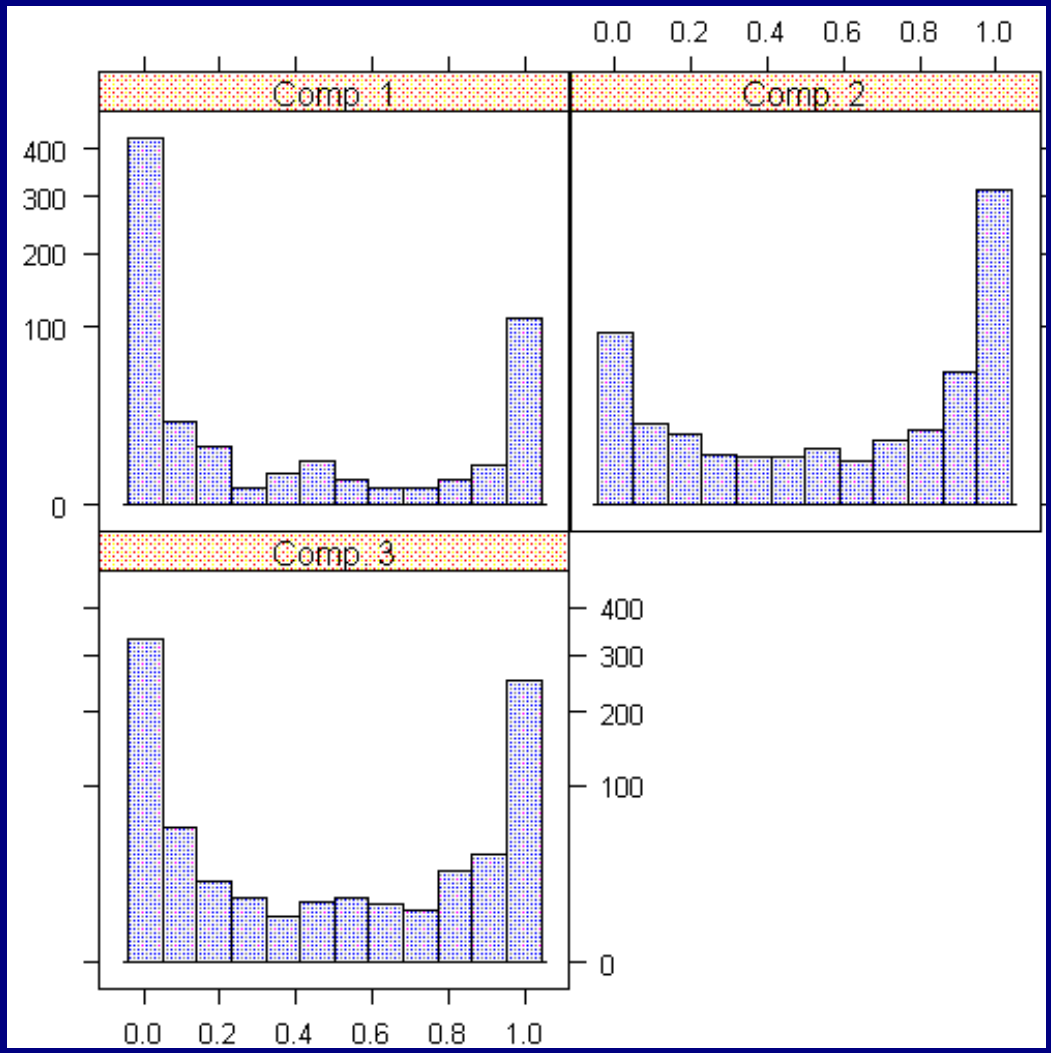
$$f(P_{it}, D_{it}|X_{it}, Y_{it}, \alpha, \beta, \gamma) = \sum_{s=1}^{S} \pi_{is} \left[f_P(P_{it}|X_{it}, \beta_s, \gamma_s) \times f_D(D_{it}|Y_{it}\alpha_s) \right],$$

- Estimated with 'FlexMix' package within R (Leisch, 2004)

Finite mixture performance

Segment	Size (1)	Posterior (2)	Ratio (3) = (1)/(2)
Innovativeness			
1	366	1,776	0.206
2	1,047	2,376	0.441
3	1,251	1,710	0.732
Product innovation			
1	366	1,803	0.203
2	1,047	2,376	0.441
3	1,251	1,707	0.733
Process innovation			
1	366	1,800	0.203
2	1,062	2,376	0.447
3	1,236	1,680	0.736

Rootogram 'Innovativeness'



Estimation results for 'Innovativeness'

	Segment 1		Segment 2		Segment 3	
	Coeff.	S.e.	Coeff.	S.e.	Coeff.	S.e.
Probability of innovativeness (P_{it})						
Diversity index (excl natives)	-0.623	(0.606)	0.642	(0.971)	3.586**	(1.608)
High-skill intensity of foreign empl.	0.922	(0.673)	1.302***	(0.409)	0.903***	(0.294)
Youthfulness of foreign empl.	0.332	(0.330)	0.563	(0.379)	0.769*	(0.402)
Other factors	Yes		Yes		Yes	
Diversity (D_{it})						
Log allochtoon population per municipality	-0,004	(0,008)	-0,002	(0,002)	-0,002*	(0,001)
Number of 2nd generation foreigners with both parents born abroad	-0,01***	(0,002)	0,001	(0,001)	-0,001	(0,001)
Constant	0,236***	(0,072)	0,569***	(0,023)	0,712***	(0,011)
N	2664		2664		2664	

Sectoral characteristics of segments

Sectoral distribution					
Segment 1	LQ	Segment 2	LQ	Segment 3	LQ
Agriculture & forestry	2.6	Low-skilled business services	1.7	Manufacturing	1.6
Transport & communication	2.1	Textile clothes & leather	1.6	R&D	1.5
Real estate & renting machinery	2.0	Financial intermediation	1.5	Mining & quarrying	1.4
Construction	1.9	Environmental services	1.4	Computer & related	1.3
Electricity, gas & water	1.8	Retail trade	1.3	Machinery & equipment	1.2

Size characteristics of segments

Size distribution					
Segment 1	LQ	Segment 2	LQ	Segment 3	LQ
>250	0.10	>250	0.34	>250	0.49
100–250	0.54	100–250	0.51	100–250	0.44
50–100	0.19	50–100	0.11	50–100	0.06
≤ 50	0.17	≤ 50	0.04	≤ 50	0.01

Spatial characteristics of segments

Spatial distribution					
Segment 1	LQ	Segment 2	LQ	Segment 3	LQ
Oost-Groningen	3.6	Delfzijl en omgeving	2.5	Noord-Drenthe	1.6
Noord-Friesland	3.4	Zaanstreek	1.5	Veluwe	1.4
Zuidoost-Friesland	3.2	Delft en Westland	1.5	Kop van Noord-Holland	1.3
Oost-Zuid-Holland	3	Groot-Amsterdam	1.3	Zuid-Limburg	1.2
Zuidwest-Drenthe	2.7	IJmond, Noord-Overijssel	1.2	Zuidoost-Zuid-Holland	1.2

Our findings

- Diversity has a positive impact of firms' innovativeness (35–50% higher chance when diversity increases with 10%);
- but only on a specific kind of firms: namely, firms that
- operate in the manufacturing, R&D, mining, computer and machinery related sectors;
- are amongst the largest (and most mature) firms in our dataset;
- and are located in non-urban regions.

Internal and external validity

1. Difficulty in explaining within firm diversity itself (firm versus region level)
2. Binary response of firms does not offer much variation
3. Our findings are robust
4. Our results coincides with previous research, in terms of the impact of diversity on firms' innovativeness but sheds more light on firms heterogeneity