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Effects of cultural diversity on individual establishments

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Abstract

International immigration affects the degree of cultural diversity present in a labour force. This paper focuses on the consequences of immigration with respect to the level of cultural diversity by estimating employment functions for individual establishments. The theory behind the empirical analyses is based on a "turned around" New Economic Geography model. The data basis used is a linked employer – employee data set generated by a fusion of the IAB Establishment Panel with the Employment Statistics of Germany, which provides very detailed information about individual workers and establishments. In the empirical analyses it is shown that employment is lower when the degree of diversity is higher, regarding the revenue of an individual establishment as given. From this result it can be derived under the conditions of monopolistic competition (implying elastic product demand) that the establishment is able to occupy a relatively large part of the market. Finally this implies relatively high labour demand.

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1 Introduction

The effects of immigration on labour markets have been explored in many papers. Most studies have concentrated on employment and wages and relate immigration flows to these crucial variables. Recently, Ottaviano and Peri (2005, 2006) chose a different perspective in two seminal papers. They related regional labour market outcomes, i.e. wages and employment, to the cultural diversity of the labour force. They were able to demonstrate for American metropolitan areas that diversity is a production amenity for a region and therefore has favourable labour market effects.

This result is interesting since the developed nations show an increasingly heterogeneous labour force due to both legal and illegal immigration. A further increase can be expected in the future because of the changing demographic composition of the population and the shrinking of the younger cohorts in many countries. It is therefore important to observe the effects of this heterogeneity on society and the economy. The fractionalization of the labour force may imply excessive transaction costs for communication and, in fact, lower productivity. It is important to see whether this "Babylon effect" prevails among people who are not able to understand each other. On the other hand workers with different cultural backgrounds may possess complementary skills and problem-solving abilities. When these workers interact, productivity may rise due to these complementarities or because of other forms of externalities. If this is true, heterogeneity leads to new productive solutions.

Ottaviano and Peri found for American cities that the latter effect prevails. Their results, however, cannot easily be transferred to other countries owing to the many institutional and legal differences. Immigration traditions and general attitudes towards immigrants are very different. Some countries have a history of immigration and others have not. Studies about other countries are therefore most helpful to determine whether Ottaviano and Peri's results could be generalized. There are some corresponding papers available at the moment. Suedekum, Wolf and Blien (2010) conducted research into the German economy and also found favourable labour market effects. Bellini et al. (2008) used data on several European countries. Niebuhr (2010) related the regional frequency of patents in Germany to cultural diversity and found a positive relationship.

In this paper we intend to narrow the focus and identify the effects of cultural diversity at the level of individual establishments, whereas Ottaviano and Peri (and Suedekum et al.) looked at the regional level. The advantage is that the link between the composition of the work force and a potential productive amenity can be studied more closely. With this approach a "turned around" model of New Economic Geography can be applied directly to derive the level of employment within individual establishments. It is also possible to control for possible endogenous effects in an effective way.

We are able to follow this approach since we can use very detailed information in a linked employer-employee data-set. The IAB Establishment Panel for Germany has the advantage of being a representative panel for a large economy which has been surveyed in annual waves for over 16 years now. The data of this panel are fused with data from the employment statistics providing very detailed information on the active work force. This data basis reveals over 215 nationalities, which are used as proxies for the respective cultural backgrounds.

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2 Literature and theoretical model

There are various channels via which cultural diversity affects economic outcomes. Ottaviano and Peri discuss two basic mechanisms: diversity could be a consumption amenity or a production amenity of a region. Starting with the latter point, cultural diversity could lead to a more diversified production. A tolerant population could enjoy speciality restaurants and many different products available under the conditions of regional diversity. With respect to the production amenity mentioned in the introduction, the fragmentation of the labour force can lead to new complementarities in the production process. New variants of labour division can be explored and productivity increased. Besides this, diversity could matter in research activities. Bringing together people with different cultural backgrounds could generate many innovative ideas, which could in turn increase productivity levels.

As announced in the introduction we concentrate not on the regional but on the establishment level. In our case it is therefore not of interest whether a region could offer a differentiated product to its inhabitants. The case of the consumption amenity could be excluded in our analysis. Whereas Ottaviano and Peri need the Roback (1982) model to identify the exact effects of diversity, in our case the assumptions of this model are not required. These are rather strong, especially for the European case, since complete and cost-free mobility of workers and capital are assumed in the Roback model.

We intend to measure directly the effects of diversity on labour demand via production advantages by focusing on individual establishments, i.e. productive plants, which represent the lowest level which can be affected by diversity in production. At higher levels one can not be sure whether the effect of diversity is due to productivity gains of individual establishments or because of externalities emerging from aggregation. In existing empirical literature externality measures add to the regression equation to control for Jacobs or Marshall-Arrow-Romer externalities (see Glaeser et al. (1992) for the identification of this

kind of externalities). The inclusion of those measures in a model on firm level is possible as long as they influence (total) factor productivity. However, factor productivity on plant level might not necessarily change because of appearing externalities at higher levels of aggregation when externalities affect other variables. For example, those factors are regional wages or product demand which are partially exogenous for an individual firm. We therefore explicitely control for the presence of externalities, especially those derived by the New Economic Geography (agglomeration and competition forces). As it will be shown, agglomeration and competition effects influence demand and do not affect labour productivity.

In the following we outline a new theoretical model to show how cultural diversity in production might influence the factor productivity of a single production unit. We treat diversity in a way similar to the one chosen by Ottaviano and Peri (2005). They regard diversity in analogy to agglomeration forces. Before we turn to the effect of cultural diversity in production, we derive product demand based on household utility maximisation to work out the impact of externalities. This helps to understand the effect of regional externalities on an individual firm and makes it possible to introduce additional (external) instruments for partially endogenous variables. In contrast to Ottaviano and Peri (2005) we do not aggregate industries to a regional production function since we wish to focus on the firm level. In this respect, our model is more general.

For simplicity we assume that firms' customers are households. A representative household in region s spends its money E_s on a variety of consumables X_{si} provided by sector i. For simplicity we assume that utility U_s is of the Cobb-Douglas type. Each X_{si} is a composite commodity of x_{in} products of distinct producers where N_i labels the mass of firms in that sector. The aggregation of x_{in} is done with the aid of a CES -utility function with a sector-specific elasticity of substitution $\sigma_i > 1$,

$$U_s = \prod_i^I X_{si}^{\mu_i}, \qquad X_{si} = \left(\sum_n^{N_i} \left(x_{in}^s\right)^{\frac{\sigma_i - 1}{\sigma_i}} \right)^{\frac{\sigma_i}{\sigma_i - 1}}. \tag{1}$$

We are interested in the total demand of $\bar{x}_{in} = \sum_s^R x_{in}^s$, where x_{in}^s is the consumption good in region s of firm n which could be located in any region. All other things being equal, utility increases the more diverse the supply of products is, which implies N_i rising. Calculation of the Marshallian demand of each region and summing up across all regions gives the gross demand of a single firm,

$$\bar{x}_{in} = \left(q_{in}\right)^{-\sigma_i} \sum_s^R \mu_i \frac{\phi_{rs} E_s}{\sum_k^N \left(p_{ik}^s\right)^{1-\sigma_i}}, \tag{2}$$

where p_{ik}^s is the consumer price in region s firm k of sector i. q_{in} is the mill price of the $n-th$ producer, ϕ_{rs} are trade costs of the iceberg type. We can express demand in terms of revenue when we multiply

both sides of (2) by a firm's mill price. This gives

$$revenue = q_{in}\bar{x}_{in} = (q_{in})^{1-\sigma_i} \sum_{s}^{R} \mu_i \frac{\phi_{rs} E_s}{\sum_k^N (p_{ik}^s)^{1-\sigma_i}} = (q_{in})^{1-\sigma_i}\, RMP \tag{3}$$

The sum term is called the real market potential (RMP) of a single firm (see Head and Mayers (2004) for a discussion). The nominator refers to household expenditure and its regional distribution, whereas the denominator is a measure of the price level of the sector under consideration in any region s. Despite the assumption that the CES index represents household utility, the key implication is that the RMP features agglomeration and dispersion forces based on a microeconomic foundation; see e.g. Redding and Venables (2004). Thus, from equation (3) it can be seen that within the *revenue* measure $q_{in}\bar{x}_{in}$ home market magnitudes and competition effects are implicitly controlled for. Using a revenue proxy therefore automatically controls for agglomeration forces and (regional) competition effects. We should also bear in mind that a firm's revenue is an endogenous variable depending on expenditure and the distribution of firms.

Now we focus on firms' maximisation problem to provide this quantity $\bar{x}_{in}$. With market clearing, the total output $\bar{x}_{in}$ is produced under constant returns to scale with respect to labour L_n and capital K_n. The workforce might be culturally diverse, where s_{mn} is the share of workers belonging to nationality m and M_n is the total number of nationalities employed. In the following we assume a Cobb-Douglas production function with

$$\begin{aligned} \bar{x}_{in} &= K_n^{1-\alpha_i} \left(L_n(1-\tau_n) \underbrace{\left[\sum_{m}^{M_n} (s_{mn})^{\frac{\delta_i - 1}{\delta_i}} \right]^{\delta_i/(\delta_i - 1)}}_{DIV_n} \right)^{\alpha_i} \\ &= K_n^{1-\alpha_i} L_n^{\alpha_i} (1-\tau_n)^{\alpha_i} DIV_n^{\alpha_i}, \quad \tau_n \in (0,1)\,, \end{aligned}$$

where δ_i is the sector-specific elasticity of labour substitution. τ_n and DIV_n are variables that affect labour productivity and are introduced in the following.

Suppose that all labour is of the same nationality i, implying $s_{in} = 1$ and thus $DIV_n = 1$. In the case of a heterogenous workforce, however, an additional positive effect on output occurs. If there are more than one cultural groups employed, DIV_n exceeds the value 1 and increases factor productivity. This in turn raises $\bar{x}_{in}$ for a given L_n and K_n. Conversely, a higher degree of fragmentation of the employed workforce needs less employment L_n to produce a given $\bar{x}_{in}$. From an empirical point of view the $DIV_n - term$ is hard to grasp because it contains an additional parameter within the sum. It is clear

however, that the more culturally diverse a workforce L_n is, the higher output is. For $\delta_i \to \infty$, a positive impact of diversity on output disappears.

Ottaviano and Peri (2005) introduce τ_n with the aim of including also a negative effect of diversity. τ_n is restricted between 0 and 1 and is an increasing function of the number of cultures present. Up to same degree it works in the opposite direction compared to DIV_n. Due to language barriers, coordination and transaction cost gains of diversity could melt away such that the overall effect of diversity gets lowered, insignificant or even negative. Then, the higher τ_n is the lower is labour productivity and consequently the lower $\bar{x}_{in}$ has to be, for a given L_n and K_n.

It is not clear whether firms know about the positive or negative effect of a culturally diverse workforce. If they did know, then every firm would employ a culturally diverse workforce that maximises the DIV_n- term and which keeps τ_n as small as possible. At this stage of modelling we assume that a firm does not know about productivity gains and DIV_n is a part of the (unobservable) factor productivity.

We can minimise costs with respect to capital and labour. For a given wage level w, a capital price r and the unknown productivity effect of cultural diversity we derive the conditional demand functions

$$\begin{aligned} L\left(r, w, Y_n, DIV_n\right) &= \left(\frac{\alpha_i}{1-\alpha_i}\right)^{1-\alpha_i} \left(\frac{r}{w}\right)^{1-\alpha_i} (1-\tau)^{-\alpha_i} DIV_n^{-\alpha_i} \bar{x}_{in}, \quad \text{and} \\ K\left(r, w, Y_n, DIV_n\right) &= \left(\frac{\alpha_i}{1-\alpha_i}\right)^{-\alpha_i} \left(\frac{w}{r}\right)^{\alpha_i} (1-\tau)^{-\alpha_i} DIV_n^{-\alpha_i} \bar{x}_{in}. \end{aligned}$$

An increase in r raises employment because capital becomes relatively more expensive. A rise in wages, on the other hand, lowers employment because labour becomes relatively more expensive. Now focus on the effect of diversity. The more diverse the hired workforce is, the lower employment is. The second effect relates to capital input. Furthermore, because of a diversity effect, less capital is necessary to produce a given output. The labour-capital relation is, however, unaffected by a culturally diverse workforce, since the L/K ratio depends only on relative prices and parameters of the production function. If we now write a cumbersome $1 = P/P$ where P is the exogenous price, and because $P * \bar{x}_{in} = revenue$, we derive

$$L_n = \left(\frac{\alpha_i}{1-\alpha_i}\right)^{1-\alpha_i} \left(\frac{r}{w}\right)^{1-\alpha_i} (1-\tau_n)^{-\alpha_i} DIV_n^{-\alpha_i} \frac{revenue_n}{P_n}.$$

Taking the logarithm yields

$$\begin{aligned} \ln L_n &= (1-\alpha_i) \ln\left(\frac{\alpha_i}{1-\alpha_i}\right) + (1-\alpha_i) \ln r - (1-\alpha_i) \ln w \\ &\quad -\alpha_i \ln DIV_n - \alpha_i \ln\left(1-\tau_n\right) + \ln revenue_n - \ln P_n. \end{aligned}$$

This equation can be considered in empirical terms. The price of a good produced by a single firm is unobservable, so $\ln P_n$ is included in the error term. Since there are no data on capital and its price, $\ln r$ is also included in the error term. Both variables are partially absorbed by a) the fixed effects transformation and b) the inclusion of time dummy variables. Then the empirical model becomes

$$\ln L_n = \alpha_{0i} + \alpha_{1i} \ln w + \alpha_{2i} \ln DIV_n + \alpha_{3i} \ln (1 - \tau_n) + \alpha_{4i} \ln revenue_n + \beta x_n + u_n + \varepsilon \tag{4}$$

In the following section we introduce the data set and motivate further control variables x_n.

3 Estimation issues and hypothesis

The data are taken from the German Establishment History Panel (Betriebshistorik-Panel - BHP) which is generated from the Employment Statistics and the representative survey, the IAB Establishment Panel, both provided by the Institute for Employment Research (IAB).

The parameters of (4) are industry specific and there are further regional and firm-specific effects. For this reason we conduct a fixed-effects transformation at establishment level to eleminate these and other time-constants variables. We apply an industry classification on a 3 digit level (wz93) and consider 215 distinct industries. We only consider industries which achieve revenues, so non-profit organisations, the public and the financial sectors are not taken into consideration.

The dependent variable is an establishment's employed workforce. We use the average daily employment in full-time equivalents in order to control for part-time workers.

The theoretical model outlined above shows the impact of cultural fragmentation on the employment level. There, the DIV-measure relates to the labour distribution between nationalities and is mixed with the total number of employed nationalities. To measure the cultural background of an employee we use her or his nationaltiy as a proxy as Suedekum et al (2010) do, whereas Ottaviano and Peri use language as a proxy. To capture the fragmentation effect we use two steps. First, we focus on the share of employed foreigners, $s_{foreign}$. This measure relates to the general presence of foreigners and answers the question of whether an increase of employed non-German increases or reduces employment. However, as outlined in the theoretical discussion, the distribution between different cultures (respectively nationalities) within the workforce might matter as well. For this reason, the second variable used is the Herfindahl-Hirschman index, defined as

$$DIV_n = 1 - \sum_{m}^{M_n} s_{mn}^2. \tag{5}$$

It is worth noting that the DIV_n is zero for firms that only employ Germans. It rises the more nationalities are employed and the more uniformly distributed the s_{mn} are. With regards to content, it might be that an increase in M_n leads to negative diversity effects (such as the Babylon effect). We therefore add another variable $\ln M_n^{foreign}$ to the model which is the number of employed non-German nationalities. The indicator is zero when no or at least one non-German nationality is employed. The BHP considers 215 distinct foreign nationalities, so the maximum of M could theoretically be 215.

The data reveal that 95% of all firms employ ≤ 12 distinct nationalities and have a maximum share of foreign employees of 22.3%. 50% of culturally diverse firms employ up to 4 different nationalities. The regional maximum of represented non-German nationalities is 199 (Berlin) followed by Munich, Hamburg, Frankfurt and Cologne - Germany's biggest metropolitan cities.

The diversity problem can only be explored reasonably for a population including foreigners. The impact of DIV_n on employment is visualised in figure 1, employing at least one fulltime equivalent worker. The graph contains a linear univariate regression between DIV_n and $\ln L_n$. The upper part of the figure includes all cultural diverse establishments whereas the lower part considers the diversity for a given number of foreign nationalities. Here we only consider DIV_n for up to six employed non-German nationalities. All figures clearly show a negative trend, which gives first evidence that cultural diversity, and especially the distribution over nationalities, lowers total employment. However, these pictures do not account for the impact of other variables and therefore multivariate regression should be applied.

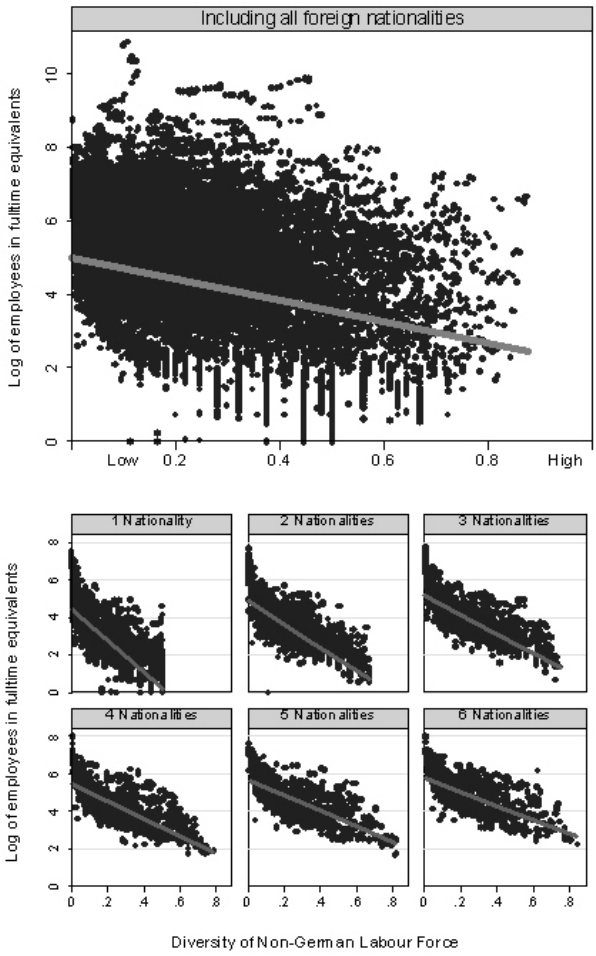
Figure 2 visualises the distribution of our diversity measure DIV_n for all establishments employing at least 5 workers (in full time equivalents). Note, that we restrict the figure and only consider DIV_n less or equal to the 99th percentile for the left panel and drop the first and last percentile in the right panel. The left part of the figure clearly shows that highly diverse establishments do not occure often, since the distribution exhibits a strong positive skew. Note, that 75% of all establishments employing non-Germans exhibit a value of DIV_n of less than 0.254. However, the figure shows the distribution of all firms. Therefore, in the right part we visualise the distribution of DIV_n after the fixed-effects (within) transformation. The values are quite equal distributed around zero. There is no pattern of discrete jumps or steps as it might occur considering changes in a Herfindahl-Hirschman index[1].

To summarize, there is variation of employed labour force with respect to cultural diversity on an establishment level. Does this variation lead to productivity gains?

Multiple regression is applied to separate the impact of cultural diversity from other effects which influence employment. We carry out further regressions in which only cultural diverse establishments are considered, i.e. $DIV_n > 0$. This is a simple check of the robustness of our findings. Finally we control

[1] A similar picture occurs for the first-difference operation.

Figure 1: Impact of Diversity on Employment

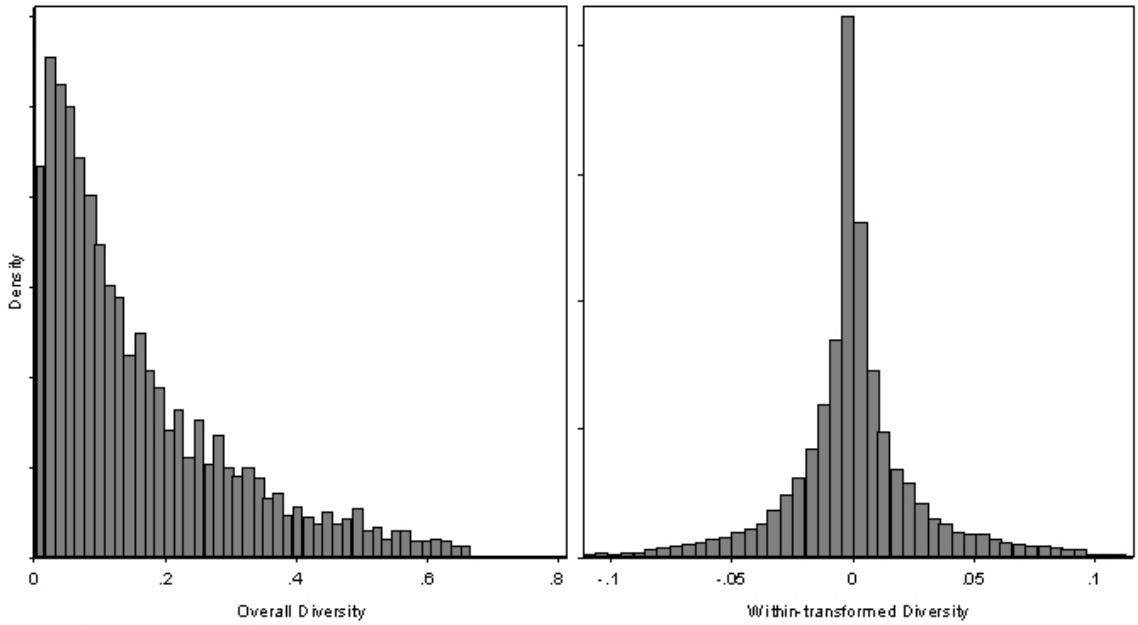


Note: Including only establishments with at least one fulltime equivalent employee

for the potential problem of endogeneity of the DIV_n and $\ln M_n^{foreign}$ measures and use its lagged values as instruments.

The inclusion of control variables can be derived in part from our theoretical model. This is so in the case of the real market potential, which is approximated by the establishment's revenue. The model suggests a positive effect of revenues on total employment. As was mentioned in the theoretical part, the *revenue* measure is endogenous and depends on competition and demand effects. For this reason we include the population density and the regional sector-specific establishment density in logs as instruments. Because we can observe all regionally established production units with the BHP, we can access a rather low level of the industry classification, i.e. we consider the 3-digit level. Both instruments

Figure 2: Distribution of the diversity index



Note: Cultural diversity of establishments with at least 5 fulltime equivalent employees.

are incomplete measures for the nominator and denominator of the real market potential because they do not control for the sum across regions. We therefore additionally incorporate the time lag of *revenue* as an instrument, which, however, leads to a loss of cases. We label the resulting model as IV and estimate it with 2SLS.

The wage rate is also an important variable from a theoretical perspective. We use the average daily wage per employee and expect a negative sign. The variable *monopoly* is a dummy indicator and is set to unity when the establishment has no regional competitor. Whereas *revenue* captures the demand side and therefore already includes the potentially higher demand due to the regional monopoly situation, the *monopoly* variable captures productivity effects. Because of a lack of competition a regional monopoly could operate less efficiently. We therefore expect a positive sign.

Another branch of literature highlights positive productivity effects appearing in exporting firms. Again, for given revenues an establishment faces international competition and has to be therefore relative more productive. To capture this effect we add the export share to EU countries to the regression model. The variable is labeled as $s_{export}\ EU$. We expect a negative sign.

We further control for the state of the technology and machinery. Within the IAB Establishment Panel this information is provided on an ordinal scale such that we use four distinct dummy indicators ranging

from state-of-the-art equipment to "out of date" equipment. As the reference category we chose the second best category of equipment age. There is also information on whether parts of the establishment have been in- or outsourced. This directly affects the employment level and should therefore been controlled for. Another variables are the share of human capital s_H, measured as the share of employees holding a university degree and the share of women employed s_{women}.

The observation period of the panel coverts the period from 1999 to 2008 with yearly waves. Time fixed effects are taken into account using dummy variables.

Table 1 contains the estimation results of a regression of the establishment's employment in full-time equivalents $\ln L_n$. The first columns contain the baseline model not controlling for employed foreigners. In the next three columns the regression results are presented which include the share of employed foreigners $s_{foreign}$ and the log of the number of employed foreign nationalities, $\ln M_n^{foreign}$. The last columns report the estimates where we consider the diversity of the workforce DIV_n instead of $s_{foreign}$. Establishment-specific effects are controlled for in each of the blocks. Besides fixed effects we also report random effects estimates for the sake of completeness although the Hausman test rejects the validity of the RE models. Another Hausman test based on non-robust standard errors indicates that pure FE is inconsistent and an IV estimator performs better with regard to the endogenous $\ln M_n^{foreign}$; $s_{foreign}$ and DIV_n measures and $\ln revenue$. The Davidson-MacKinnon test of exogeneity confirms this result, while obtaining a highly significant value for the FE model. It therefore also rejects the pure FE model in favour of the FE IV specification. Though the Sargan test rejects the validity of the chosen instruments, the Hansen's J-statistics supports these considering all establishments. Hansen's J test is robust against some misspecification and heteroscedasticity and should therefore be prefered over the Sargan test. The IV estimates can be severly biased if the chosen instruments are weak. In that case the correlation between instruments and endogenous variables is weak. We follow the procedure suggested by Stock and Watson (2003, Ch. 10) and conclude that the instruments have explanatory power and the estimates do not suffer from the weak instruments problem. Because the FE IV approach yields consistent estimates compared to the FE and RE and RE IV models, this model is the preferred one. The model selection procedure holds for both models, the one that considers $s_{foreign}$ and the other one including DIV_n.

Table 1: Estimation results of establishment employment

	Baseline Model			Share of foreigners			Diversity of workforce		
$\ln L_n =$	FE	FE IV	RE IV	FE	FE IV	RE IV	FE	FE IV	RE IV
$\ln w$	-0.343***	-0.345***	-0.372***	-0.328***	-0.334***	-0.353***	-0.328***	-0.335***	-0.354***
	(0.015)	(0.007)	(0.006)	(0.015)	(0.015)	(0.006)	(0.015)	(0.015)	(0.006)
$\ln revenue$	0.279***	0.556***	0.781***	0.264***	0.529***	0.699***	0.264***	0.530***	0.698***
	(0.009)	(0.012)	(0.003)	(0.009)	(0.022)	(0.004)	(0.009)	(0.022)	(0.004)
$monopoly$	0.038	0.055***	0.069***	0.032	0.049	0.072***	0.032	0.048	0.070***
	(0.029)	(0.021)	(0.02)	(0.029)	(0.032)	(0.019)	(0.029)	(0.032)	(0.019)
s_H	-0.561***	-0.545***	-0.348***	-0.517***	-0.507***	-0.315***	-0.517***	-0.504***	-0.315***
	(0.092)	(0.031)	(0.027)	(0.087)	(0.079)	(0.026)	(0.087)	(0.079)	(0.026)
s_{women}	0.009	-0.016	-0.059***	0.006	-0.019	-0.077***	0.006	-0.019	-0.078***
	(0.015)	(0.014)	(0.012)	(0.015)	(0.017)	(0.012)	(0.015)	(0.017)	(0.012)
$s_{export\ EU}$	0.001	-0.069***	-0.080***	-0.004	-0.074***	-0.104***	-0.004	-0.073***	-0.102***
	(0.023)	(0.019)	(0.02)	(0.021)	(0.024)	(0.019)	(0.021)	(0.024)	(0.019)
$\ln M_n^{foreign}$				0.305***	0.346***	0.398***	0.305***	0.359***	0.420***
				(0.019)	(0.047)	(0.012)	(0.019)	(0.049)	(0.013)
$s_{foreign}$				0.004	-0.679***	-0.839***			
				(0.065)	(0.231)	(0.086)			
DIV							0.003	-0.521***	-0.710***
							(0.049)	(0.162)	(0.068)
state-of-the-art equipm.	-0.002	0.003	0.002	-0.003	0.002	0.001	-0.003	0.002	0.001
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
rather old equipm.	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.003
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
oldest equipm.	-0.014	-0.011	-0.012	-0.012	-0.008	-0.011	-0.012	-0.008	-0.011
	(0.01)	(0.009)	(0.01)	(0.01)	(0.011)	(0.009)	(0.01)	(0.011)	(0.009)
$outsourcing$	-0.008	-0.007	-0.007	-0.007	-0.006	-0.007	-0.007	-0.006	-0.008
	(0.008)	(0.007)	(0.007)	(0.008)	(0.009)	(0.007)	(0.008)	(0.009)	(0.007)
$insourcing$	0.005	0.002	0.002	0.002	0.001	0.006	0.002	0.001	0.006
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)
Time Dummy's	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	78069	53244	53244	78069	53244	58126	78069	53244	53244
No. groups	17073	11670	11670	17073	11670	16552	17073	11670	11670
Sargan Test		3.224			6.963**			6.967**	
Hansen-J-Test		0.887			2.207			2.195	
within R2	0.193	0.139	0.17	0.233	0.172	0.201	0.233	0.171	0.2
between R2	0.794	0.83	0.834	0.81	0.847	0.85	0.81	0.848	0.851
overall R2	0.783	0.835	0.839	0.798	0.848	0.852	0.798	0.848	0.852
Corr(ui, xb)	0.782	0.601		0.751	0.527		0.751	0.525	

rob. s.e. in () except for RE IV; * p<0.1; ** p<0.05; *** p<0.01; FE.. fixed effects, RE.. random effects
IV.. instrumental variable estimation by 2SLS; Balestra and Varadharajan-Krishnakumar estimator for RE
internal instruments: lag of revenues, DIV, lnM and sforeigner; external instruments: population density and establishment density

Irrespective of the estimation strategy, the parameter estimates are jointly significant, indicating the general explanatory power of the model.

Before interpreting the results concerning the main variables, $s_{foreign}$, DIV_n and $\ln M_n^{foreign}$, we look at the effects of the controlling variables. In general, the results of the fixed effects (FE) models are fairly similar to those of the fixed effects instrumental variable models (FE IV). As expected, the impact of wages on employment is negative. An establishment's revenue exhibits a positive sign and a highly significant coefficient of 0.53. An increase in demand results in the necessity to increase the workforce. The parameter is far from one because the size effect is partly taken out by the fixed effects included in the model.

Other empirical studies based on the IAB Establishment Panel typically use the share of women employed to address the issue of part-time jobs. Not surprisingly, our estimate of s_{women} is insignificant because the explanatory variable is measured in full-time equivalents. Thus, an effect of part-time jobs is already controlled for. The insignificant result also indicates that women do not affect productivity in any direction compared to men. Establishments which use relatively more human capital have lower employment levels on average, given the revenue level. This is due to the fact that better educated workers are more productive. It is somewhat surprising that the state of equipment and machinery does not affect employment levels. A test of the joint significance of the equipment variables also yields an insignificant p-value. Again, this might be due to the fact that these variables show little variation over time and are therefore correlated with the fixed effects.

As was expected, a firm with a regional monopoly uses more labour in production compared to others, cetarus paribus, indicating that monopoly situations lead to inefficient production. However, the effect is insignificant. Focussing on exporting establishments reveals that these firms are on average smaller to produce a given amount. This effect disappears for the subsample of only cultural diverse establishments.

Let us now turn to the diversity issue. First, the effect of the variable $\ln M_n^{foreign}$ is positive, i.e. it is associated with higher employment levels. Without any further control variables about the foreign workers employed, potentially unfavourable properties of these workers are taken over by this variable. Relatively small proportions of higher education as well as matching problems with regard to education (possibly acquired in a foreign country) play a role in this respect. More work is required for a given level of revenues, as can be seen from the positive effect of the number of employed nationalities, which is highly significant in the FE and FE IV models. Even more, a higher level of employment is necessary if a further nationality is included to the existing ones for given revenues and wages. Since we focus on the change of the number of employed nationalities, this negative effect can be interpreted as Babylon-effect. As was shown in the theoretical part not only the absolute value of employed nationalities matters but

also the distribution of the workforce. This leads to the interpretation of $s_{foreign}$ and DIV_n.

Within the FE model the effect of of both variables is insignificant. However, controlling for their endogeneity while using lagged values as instruments gives a different picture: in the FE IV model cultural diversity lowers total employment significantly, which is in line with the expectation from the theoretical model. The effect exhibits a value of -0.521 for DIV_n and -0.679 for $s_{foreign}$. Thus, an increase in the share of employed foreigners increases productivity. To set the focus on DIV_n implies the concentration on the distribution of the workforce. Is it worth to employ a rather mixed workforce or to hire only workers from a specific non-German nationality? Following $M_n^{foreign}$, it would be better to employ only few different nationalities. However, according to the underlying approach, a more diverse workforce with respect to its distribution yields productivity gains. The estimate of DIV_n is highly significant, indicating that a distribution over nationalities matters. The more equal the distribution is, the lower is employment (and the higher is productivity). According to the model, the estimate of the diversity measure should be $-\alpha$ whereas the wage measure should be $1-\alpha$. Insofar, our estimates are only qualitatively in line with the theory at first sight. However, note that the DIV_n only approximates the theoretical CES -index. Especially the exponent of the outer bracket is also included in the estimated coefficient.

The indicator variables of cultural diversity should be considered together because they relate to different questions. For a given number of employed nationalities, a more uniform distribution between them is in favour of productivity gains. Adding a further nationality, on the other hand, lowers productivity. However, one should be aware of interpreting the result and conclude that the best strategy would be to employ only one foreign nationality. As shown in figure 1, different employed nationalities can achieve similar combinations between DIV_n and $\ln L_n$. It is important to note, that τ_n and DIV_n are partly independent of each other. Especially for a given number of nationalities, represented by τ_n, an increase of diversity will increase productivity.

How robust is this result of cultural diversity? As was stated above, in the next step we restrict the sample and consider only establishments which exhibit a value greater than zero for the diversity index ($DIV_n > 0$). The reason for this restriction is that there might be factors which are not captured so far. Especially the decision of employing foreigners or not might influence the results. The results obtained for the restricted population are shown in the regression table 2 in the appendix. Though the sample size and the number of establishments (groups) are reduced, the picture obtained for the full sample still holds, with differences in details. Interestingly, in the FE model of the smaller sample the $s_{foreign}$ and DIV_n measure are already significantly negative. The IV estimate exhibits almost the same value as that in the unrestricted model. The results obtained on diversity are therefore confirmed.

In the restricted sample wages do not affect employment to the same extent as before. There are

several explanations for this: first, we now consider larger establishments. These are more likely to have a works council and it is more complicated for them to lay off employees. Second, larger firms typically pay wages based on collective agreements.

The literature on labour demand typically argues that the recruitment decision of personnel is jointly determined with the payment decision. This decision raises the suspicion of endogeneity issues of wages. We therefore instrument wages as another robustness check. The estimates and significances are not affected indicating that the estimates of Table 1 do not suffer from an endogeneity bias. Thus, we can rely on the parsimonious model and the interpretation above.

The effect of employed human capital is also larger (in absolute terms) in the restricted sample.

This first evidence supports the hypothesis that the level of employment depends on cultural diversity.

4 Conclusions

This paper focuses on employment levels depending on a more or less culturally diverse workforce. Based on a production function we derive a small theoretical model which is close to those found in the New Economic Geography literature. We use this model to develop an empirical approach which enables us to identify the effect of a culturally diverse workforce. The main advantage of our data is that they include information about individual firms. To avoid problems of endogeneity a 2SLS method is used.

When a culturally diverse workforce is hired and there are productivity gains as a result of cultural interaction, it is to be expected that relatively less labour is needed. This hypothesis is supported by estimations based on the underlying model. We employ German data at establishment level, because this is the lowest level where a culturally diverse workforce could generate production gains. It is unaffected by possible effects at a higher level. We further control for market size and competition effects influencing agglomeration forces, which are implicitly included in revenues and thus also integrated into our models.

What are the conclusions concerning labour market effects based on the results received? At first sight it seems as if diversity is bad for employment. Establishments with a higher degree of diversity are more productive; given a specific level of revenues their employment level is lower. How is this result compatible with those obtained by Ottaviano and Peri and Suedekum et al., who state that the productive amenity which diversity represents for regions implies a higher level of employment? The answer is simple: our analysis treats the level of revenues as given and therefore concentrates on a productivity effect. Under the conditions of monopolistic competition (which we assume) firms operate in a market with elastic product demand. As can be shown under general assumptions, higher productivity is associated with higher labour demand if the firms face an elastic product demand (Appelbaum and Schettkat 1999,

Cingano and Schivardi 2004, Blien and Sanner 2006). There is a direct effect of high productivity on labour demand, which is the labour saving effect. There is also a compensating effect that works in the opposite direction, since it is profitable for firms to lower their prices to sell more, which increases not only their sales but also their labour demand. Under the condition of elastic demand on the product market this secondary effect prevails.

Therefore, the conclusion is that diversity is associated with favourable labour market effects. The results we obtain are in line with those of other literature on diversity. We are able to show the empirical microfoundations of the papers operating at a regional level.

5 Literature

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A Appendix

Table 2: Estimation results of establishment employment of only cultural diverse establishments

	Baseline Model			Share of foreigners			Diversity of workforce		
$\ln L_n =$	FE	FE IV	RE IV	FE	FE IV	RE IV	FE	FE IV	RE IV
$\ln w$	-0.219***	-0.211***	-0.268***	-0.168***	-0.127***	-0.160***	-0.164***	-0.132***	-0.157***
	(0.029)	(0.025)	(0.011)	(0.025)	(0.013)	(0.01)	(0.024)	(0.013)	(0.01)
$\ln revenue$	0.212***	0.432***	0.691***	0.174***	0.332***	0.493***	0.169***	0.323***	0.454***
	(0.013)	(0.03)	(0.005)	(0.01)	(0.017)	(0.008)	(0.01)	(0.017)	(0.008)
monopoly	-0.013	-0.009	0.011	-0.019	-0.014	0.028	-0.02	-0.017	0.026
	(0.027)	(0.023)	(0.025)	(0.024)	(0.023)	(0.022)	(0.024)	(0.022)	(0.022)
s_H	-1.148***	-1.212***	-0.527***	-1.081***	-1.144***	-0.536***	-0.998***	-0.999***	-0.487***
	(0.262)	(0.237)	(0.055)	(0.227)	(0.067)	(0.048)	(0.215)	(0.065)	(0.046)
s_{women}	0.036	0.033	-0.005	0.026	0.012	-0.049**	0.025	0.014	-0.064***
	(0.023)	(0.033)	(0.021)	(0.022)	(0.021)	(0.019)	(0.02)	(0.021)	(0.019)
$s_{export\ EU}$	0.009	-0.01	-0.035*	0.008	-0.013	-0.031*	0.007	-0.012	-0.025
	(0.023)	(0.022)	(0.02)	(0.02)	(0.017)	(0.018)	(0.019)	(0.017)	(0.018)
$\ln M_n^{foreign}$				0.274***	0.400***	0.500***	0.331***	0.459***	0.607***
				(0.015)	(0.025)	(0.014)	(0.017)	(0.026)	(0.015)
$s_{foreign}$				-1.242***	-2.151***	-2.617***			
				(0.12)	(0.211)	(0.092)			
DIV_n							-1.483***	-1.946***	-2.634***
							(0.108)	(0.159)	(0.073)
state-of-the-art equipm.	0.001	0	-0.003	0	-0.002	-0.006	-0.001	-0.002	-0.007
	(0.005)	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
rather old equipm.	0.002	0.006	0.004	0.005	0.009**	0.009*	0.005	0.008*	0.009*
	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)
oldest equipm.	-0.015	-0.014	-0.024*	-0.013	-0.009	-0.015	-0.012	-0.012	-0.017
	(0.012)	(0.014)	(0.013)	(0.01)	(0.011)	(0.012)	(0.01)	(0.011)	(0.012)
outsourcing	0.006	0.005	0.006	0.007	0.007	0.009	0.006	0.006	0.007
	(0.008)	(0.01)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)
insourcing	0.01	0.004	0.005	0.009	0.007	0.007	0.009	0.007	0.007
	(0.008)	(0.011)	(0.009)	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)
Time Dummy's	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	29268	17257	19587	29268	17257	19587	29268	17257	19587
No. groups	8071	4228	6558	8071	4228	6558	8071	4228	6558
Sargan Test		2.839			3.338			3.14	
Hansen-J-Test		1.12			1.496			1.392	
within R2	0.158	0.12	0.145	0.296	0.216	0.275	0.323	0.241	0.294
between R2	0.653	0.752	0.782	0.801	0.842	0.856	0.84	0.863	0.872
overall R2	0.654	0.767	0.794	0.794	0.843	0.858	0.827	0.86	0.87
Corr(ui, xb)	0.691	0.619		0.764	0.605		0.787	0.619	

rob. s.e. in () except for RE IV; * p<0.1; ** p<0.05; *** p<0.01; FE.. fixed effects, RE.. random effects
IV.. instrumental variable estimation by 2SLS; Balestra and Varadharajan-Krishnakumar estimator for RE
internal instruments: lag of revenues, DIV, lnM and sforeigner; external instruments: population density and establishment density