



# Cultural diversity and plant-level productivity<sup>☆</sup>

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## ABSTRACT

Using comprehensive data for German establishments, we estimate plant-level production functions to analyze if “cultural diversity” affects total factor productivity. We distinguish diversity in the establishment’s workforce (the micro level) and in the aggregate labor force of the region where the plant is located (the macro level). We find that a larger share of foreign workers – either in the establishment or in the region – does not affect productivity. However, there are spillovers associated with the degree of fractionalization of the group of foreigners into different nationalities. Regional diversity is at least as important for productivity as micro-level diversity.

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## 1. Introduction

What are the economic effects of “cultural diversity”? This question has recently attracted vast attention in the economics literature and in related disciplines, as the populations in modern advanced societies became substantially more heterogeneous along such dimensions as national origin, ethnicity, race or native languages. Some of this research is conducted at a very micro level. Those studies investigate, for example, if the overall performance of a team of individuals is fostered by the heterogeneity of the team members’ cultural backgrounds.<sup>1</sup> Other studies look at macro units – cities, regions, or even countries –

and address if growth and welfare are fostered by the cultural diversity in the respective aggregate populations.<sup>2</sup>

While the current literature has so far addressed the micro and the macro level impacts of diversity only separately, we consider them jointly in this paper in order to study which level is more important. To do so, we use comprehensive and highly disaggregated German plant-level data, and analyze if a culturally more diverse mix of workers affects plant-level productivity. Quite recently, economists have indeed started to investigate this impact of cultural diversity on the productivity of firms (see Parrotta et al., 2014; Boenheim et al., 2012). Yet, those papers have so far only investigated diversity at the workplace level. We explicitly distinguish diversity among the workers within the establishment (the micro level) and in the labor force of the region where the respective plant is located (the macro level), thereby bridging two separate lines of research in one approach.

This distinction between micro and macro diversity matters a lot in the data: We observe heterogeneous plants, employing a diverse mix

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<sup>1</sup> A recent example is Kahane et al. (2013), who study the performance of hockey teams and focus on the impact of the team members’ diversity. Further examples include Watson et al. (1993), Richard (2000), Hamilton et al. (2003, 2012), Hoogendoorn and van Praag (2012), Ellison et al. (2014), and others. Horwitz and Horwitz (2007) provide a meta-study on the impact of diversity on team performance.

<sup>2</sup> Ottaviano and Peri (2005) and Ottaviano and Peri (2006) have studied the impact of cultural diversity across US metropolitan areas. Sparber (2009, 2010), Audretsch et al. (2010), Nathan (2011), or Suedekum et al. (2014) have conducted related analyses at the regional or city level, also for other countries. At an even higher level of aggregation, Spolaore and Wacziarg (2009) and Easterly and Levine (1997) address if diversified countries tend to grow faster, while Ortega and Peri (2014) show that the positive impact of diversity on income mainly stems from increasing TFP. Alesina and La Ferrara (2005) present a survey about the impact of ethnic diversity on economic outcomes at different aggregation levels.

of foreign workers from different countries, which are located in regions with a rather homogeneous aggregate labor force; vice versa, we observe rather homogeneous plants located in highly diverse regional environments. The main aim of this paper is then to shed light on two important questions: does cultural diversity matter for plant-level productivity in Germany, and in particular, at which level – the micro or the macro one – does cultural diversity matter more?

Theory makes ambiguous predictions about the direction of the impact. In the managerial literature, which traditionally emphasizes the micro level, diversity is sometimes called a “double-edged sword” (Horwitz and Horwitz, 2007). On the one hand, diversity among a team of co-workers may raise productivity because of skill complementarities. When workers from different backgrounds interact at the workplace, they bring along various experiences and problem-solving abilities, which in turn can give rise to synergies and innovative new ideas (Lazear, 1999). On the other hand, diversity may also give rise to difficulties: Misunderstandings due to language problems may raise transaction costs, incompatible expectations or cultural traditions may reduce team performance, and so on. This trade-off is also studied by Berliant and Fujita (2008), who provide a micro-founded economic model of learning and show that it is fostered if the knowledge overlap between individuals (i.e., their diversity) is neither too large nor too small. Although they do not explicitly refer to “cultural diversity” we can expect a similar trade-off to arise in this respect.

The economic geography literature has traditionally emphasized effects at the metropolitan or regional level. The key idea here is that the productivity of a firm may not only be affected by interactions within the own boundaries, but that other firms in the city or, more generally, the local business environment also matter. Plant-level productivity may thus also depend on cultural diversity at the macro level via different types of technological or pecuniary externalities. On the positive side, local cultural diversity may be productivity enhancing via communication and knowledge spillovers, for example due to more frequent face-to-face interactions among a diverse set of people in the city. Berliant and Fujita (2012) again provide micro-foundations for these localized spillovers across firms, essentially referring to the knowledge overlap of firms in the same city, and relate them to the micro-diversity effects discussed in their earlier work. Moreover, productivity may also increase due to deeper specialization, if different cultural groups provide complimentary inputs as in Ottaviano and Peri (2005). On the negative side, however, macro diversity may also induce excessive transaction costs, for example if it induces social conflicts between hostile nationalities or if communication barriers hamper supplier relationships.

Alesina and La Ferrara (2005), Glaeser et al. (2011) and Alesina et al. (2013) provide a broader discussion of why cultural diversity may affect productivity positively or negatively, and they discuss at greater length the different mechanisms and levels involved.<sup>3</sup> Ultimately, the economic effects of cultural diversity are thus an empirical question, and this paper specifically aims to address whether these externalities arise mainly within the firm or at the regional level. As in most of the literature, we cannot identify the precise channels *why* cultural diversity affects productivity. Yet, our paper takes an important first step in showing that diversity *does* matter at different levels, such that positive effects dominate on balance.

The main conceptual challenge for our empirical analysis is selectivity of firms and workers. At the macro level, if good firms and a diverse mix of foreign workers sort into particular cities for some other, unobserved reasons, this can lead to a spurious correlation and would not capture the causal effect of macro diversity on plant-level productivity. Moreover, at the micro level, there may also be selectivity in the matching of particular firms and foreign workers due to

unobservable characteristics. We consider different estimation approaches to address these concerns, mainly relying on dynamic panel estimation.

We obtain two main findings: First, the total share of foreign employees in the plant's own workforce has no significant impact on productivity. For a given size of the group of foreign workers, however, we find that stronger fractionalization into different nationalities induces notable productivity gains, particularly strongly within larger manufacturing plants and less so in service establishments. Second, a more diversified regional environment with foreigners from many different backgrounds (not with more foreigners per se) induces substantial productivity gains for the local firms, both in manufacturing and in services.

Stated differently, we find that additional foreign workers can have positive or negative overall effects on plant-level productivity, depending on whether they increase or decrease the degree of cultural diversity (fractionalization). This is true both at the establishment and at the regional level, and quantitatively it turns out that the latter level is at least as important as the former.

### 1.1. Related literature

Our paper adds to the economics literature on cultural diversity in various respects. First, previous studies have either emphasized the micro level impacts of diversity in small teams (e.g., hockey teams), or the macro impacts at the country, regional or city level. Our results show that plant-level productivity is affected by diversity on both levels: the workforce composition inside the establishment matters, but diversity also has productivity enhancing effects via an aggregate effect on local business environments. Studies that focus only on one level are thus likely to miss an important part of the overall picture.

Second, our paper adds to the new literature on the effects of cultural diversity on plant-level productivity. The related study by Parrotta et al. (2014) finds small negative productivity effects of ethnic workforce diversity among Danish firms (TFP decreases by 1,3% to 2,6% with a standard deviation increase in ethnic diversity for the manufacturing sample). The results are difficult to compare directly to ours, however, as they measure diversity and fractionalization somewhat differently. Boenheim et al. (2012) find positive productivity spillovers from worker heterogeneity within Austrian firms, using a similar fractionalization index as in this paper. They estimate that an increase of diversity by one standard deviation raises wages by about 22%. This is broadly in line with our findings, and if anything even larger than our estimates for Germany. Importantly, neither Parrotta et al. (2014) nor Boenheim et al. (2012) address spillovers from diversity at the regional level, but our results suggest that this dimension is quantitatively rather important. Other studies at the establishment or firm level mostly focus on other outcomes such as patenting activities (see Lee, forthcoming; Ozgen et al., 2011; Chellaraj et al., 2008), thereby contributing to the related discussion how diversity affects innovation (also see Niebuhr, 2010; Nathan, 2011).

Finally, our study emphasizes that productivity spillovers come from the *diversification*, not from the *size* of the group of foreign workers. A larger share of foreign employees – either inside the establishment or in the region – does not spur productivity gains, but what matters is the fractionalization into different nationalities. This finding is consistent with the previous aggregate-level studies by Alesina et al. (2013) and Suedekum et al. (2014) and shows that a similar conclusion emerges also with respect to disaggregate, plant-level productivity.

The rest of this paper is organized as follows. In Section 2 we discuss our empirical strategy, and in Section 3 we describe our data. Section 4 explains the specification of our variables, and Section 5 gives a descriptive overview. Our main empirical results are presented in Sections 6. In Section 7 we briefly discuss some robustness checks and extensions, and Section 8 concludes the paper.

<sup>3</sup> Recent work by Lee (forthcoming) is particularly noteworthy on the latter aspect. He explicitly distinguishes a firm-effect and a city-effect in his study on the impacts of diversity on innovation in Great Britain.

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