

# Does assimilation shape the economic value of immigrant diversity?

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## Abstract

A growing literature has shown that greater diversity among immigrants offers material benefits in terms of higher wages and productivity. One limitation of existing work is that it has considered immigrants from a given country to be homogenous. However, immigrants differ in various ways, not least in their level of assimilation. This paper considers how assimilation might shape diversity's economic effects. Intuition suggests two conflicting dynamics. Assimilation could lower barriers immigrants and natives face in interacting with one another, and thus enhance benefits. Equally, however, it could reduce heuristic differences between immigrants and native-born workers, dampening spillovers from diversity. We use Linked Employer-Employee Data from Norway to test these ideas. We construct diversity indices at the regional and workplace scale to capture different aspects of assimilation, and observe how these are related to worker productivity, proxied using wages. We find that assimilation dampens externalities from immigrant diversity. Diversity among second-generation or childhood migrants offers smaller benefits than diversity in teenage or adult arrivals. Immigrants' cultural proximity to Norway, and their experience of tertiary education in Norway each also reduce the social return to diversity. While assimilation processes may benefit society in various ways, these findings are consistent with the idea that, by diminishing the heuristic gaps between migrants and native-born, integration reduces the productivity externalities derived from immigrant diversity.

**Keywords:** Immigration, Diversity, Assimilation, Productivity, Wages

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# 1 Introduction

Immigration has rendered a large number of Western countries increasingly birthplace-diverse. Researchers seeking to explore the economic effects of this change have considered that immigrants could substitute for, or complement, native workers in host countries. One potential source of complementarity is immigrants' and natives' differing heuristics and perspectives. If individuals from different backgrounds conceptualize issues in different ways, their interaction may lead to improved problem solving and creativity (Hong and Page, 2004). This implies that diversity is associated with knowledge spillovers that also benefit natives. From an economic geography perspective (e.g., Audretsch and Feldman, 1996), it is worth noting that these spillovers are not limited to the firm level, as interactions between immigrants and natives also take place at the regional scale external to the firm. Researchers have found evidence consistent with this hypothesis. A wealth of studies document positive relationships between firm and regional immigrant diversity and worker productivity (e.g., Ottaviano and Peri, 2006; Bakens et al., 2013; Alesina et al., 2016; Kemeny and Cooke, 2018). Others trace links between diversity and innovation (Ozgen et al., 2013; Lee, 2014; Solheim and Fitjar, 2018), and other positive economic outcomes (e.g., Nathan, 2014; Rodríguez-Pose and von Berlepsch, 2019), even over the very long run (Rodríguez-Pose and Von Berlepsch, 2014). However, the rewards from diversity need not be automatic. If their realization depends on interaction across cultural divides, then benefits should vary with the costs of that interaction (Kemeny, 2017). Supporting this idea, recent work shows that the latent benefits of heterogeneity can be entirely choked off in locations marked by anti-immigrant attitudes (Kemeny and Cooke, 2017).

In a diverse society, one likely factor regulating the cost of interaction is immigrants' level of integration or assimilation into their host society<sup>1</sup>. Using Norway as a setting, this paper investigates whether and how assimilation processes affect the relationship between diversity and worker productivity. Theory offers two contrasting predictions. One possibility is that interactions with more integrated immigrants will produce larger positive externalities, as assimilation has reduced the cost of those interactions. Another possibility is that the act of assimilation itself reduces immigrants' heuristic distinctiveness – the very source of diversity's hypothesized benefits. If this is true, greater integration might actually reduce diversity's social return. To the best of our knowledge, no paper has directly measured the role of assimilation in shaping the economic value of immigrant diversity. Indeed, other than considering variation in immigrants' human capital and other more narrowly 'economic' factors, extant research has considered all individuals from a given country to be identical in terms of their potential to generate spillovers, regardless of

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<sup>1</sup>Throughout this article, we use the terms assimilation and integration interchangeably, with the exception of Section 2.2, which discusses a particular Norwegian historical forced assimilation policy aimed at the indigenous Sami population. Although these terms have different meanings, as we will discuss in Section 2.2, they cannot be distinguished in the data. The overall interest in the paper is in examining the implications for spillovers of natives and immigrants becoming more similar, which can be a result of both assimilation and integration.

their level of integration. The ambiguity in theoretical predictions and the scant existing empirical evidence motivate the present study.

The primary information used to test these ideas comes from the Norwegian Linked Employer-Employee data (LEED). These data offer detailed information linking the full population of employers and employees in the private sector on an annual basis between 2001 and 2011. Building on the basic approach in Kemeny and Cooke (2018), this paper estimates a series of models in which the analytical sample is limited to individuals with spells of work within the same workplace and local labor market. Variation in these models comes from annual changes in workers' wages, as a proxy for productivity, which we relate to changes in the amount of immigrant diversity in their surrounding context – both in workers' workplace and their region. This approach offers several advantages in identifying the relationship of interest. By following the same workers over time, we obviate potential bias that could arise from unobserved individual selectivity issues. It also accounts for the effects of a host of distinguishing features of workplaces and regional economies. To deal with potential bias from local idiosyncratic shocks and other factors, we conduct a variety of robustness checks, including instrumental variables estimates.

Aside from applying this approach to the Norwegian context, the novelty of this paper rests upon its examination of the role of assimilation in shaping the social return to immigrant diversity. We capture diversity using standard measures of birthplace fractionalization, but subsequently also compare this to fractionalization measures that exclude more assimilated immigrants. Assimilation is a multidimensional process, interacting with language, culture, identity, social, and economic factors (Alba and Nee, 1997; Brown and Bean, 2006; Abramitzky et al., 2014; Hainmueller et al., 2017; Jimenez, 2017), as well as spatial factors, as noted in a growing area of geographical research (Connor, 2020; Gilmartin and Dagg, 2020; Goodwin-White, 2008, 2016; Iskander et al., 2013; Vogiazides and Mondani, 2020). Nonetheless, several likely contributors to assimilation processes are observable in public registers. With the aim of approximating immigrants' level of assimilation, we use information on the time they have spent in the country; their age at arrival; second generation status; school attendance in Norway; their naturalization through citizenship; and the cultural and linguistic distance between Norway and their country of birth. We believe these indicators offer meaningful, if incomplete, insights into immigrants' level of assimilation.

This paper relates broadly to the growing research on the relationship between immigrant diversity and productivity. While there is no direct evidence on a moderating role for assimilation in extant studies, some previous papers provide suggestive clues. For instance, without discussing assimilation, several papers consider whether diversity among both first and second generation immigrants generate spillovers (Móhlmann and Bakens, 2015; Alesina et al., 2016), while others consider the effect of where immigrants have gone to school (Docquier et al., 2020). The present paper complements these and other puzzle pieces in two ways: by offering an explicit conceptualization of the potential role of assimilation; and by providing a deliberate, focused empirical investigation of the resulting

hypotheses.

We find a robust positive association between worker productivity and immigrant diversity in Norwegian regions. There is also relatively consistent evidence that immigrants' integration into Norwegian society reduces the size of these benefits. Diversity spillovers for native Norwegians are largest when measures of regional diversity exclude the most assimilated immigrants – defined in terms of their age at arrival; experience of the Norwegian educational system; cultural proximity; naturalization; or second-generation status. We conclude that while immigrant diversity offers economic benefits, past a certain point immigrants' assimilation into Norwegian culture appears to dampen these spillovers.

## 2 Background

### 2.1 The literature on immigrant diversity and productivity

When individuals with diverse perspectives and heuristics interact, they may collectively be better able to solve complex problems (Hong and Page, 2001, 2004). This improved problem solving should be reflected in higher productivity.<sup>2</sup> While individual variation in heuristics and perspectives arises for various reasons, country of birth is widely considered to affect the way people understand the world (Nisbett et al., 1980; Clearwater et al., 1991; Thomas and Ely, 1996; Page, 2008). As growing and diversifying immigration flows render societies more immigrant-diverse (Özden et al., 2011), diversity could generate prosperity-enhancing spillovers.

These spillovers may arise from interactions at the scale of work teams, organizations, regional economies, and even countries. However, much of the empirical research – especially in economic geography – considers the regional scale. While findings are not universally consistent, researchers mainly detect a robust, positive and statistically significant relationship between immigrant diversity and productivity (Ottaviano and Peri, 2006; Nathan, 2011, 2015; Suedekum et al., 2014; Kemeny, 2012; Bellini et al., 2013; Lee, 2014; Trax et al., 2015; Nijkamp et al., 2015; Kemeny and Cooke, 2018; Delgado Gómez-Flors and Alguacil, 2018; Roupakias and Dimou, 2018). Contrasting findings include Bakens et al. (2013) Longhi (2013), and Elias and Paradies (2016).

A particular strand of this research explores why the relationship between diversity and productivity varies across locations. One reason is that certain work activities or skills may be more likely to generate diversity spillovers (Suedekum et al., 2014; Cooke and Kemeny, 2017). Another is that human interaction can be costly, both in general and in particular across cultural divides. These costs vary across local contexts, with implications for the size of diversity spillovers. Attempts to test this idea at the regional scale support the notion that local institutional features that regulate the costs of interaction shape the association between diversity and productivity (Alesina and La Ferrara, 2005; Kemeny, 2012; Kemeny and Cooke, 2017).

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<sup>2</sup>For further-reaching reviews at multiple scales, see Nathan (2014) and Kemeny (2017).

It is plausible that assimilation is a distinct factor shaping the cost of interaction. Assimilation, by definition, is “the process by which members of immigrant groups and host societies come to resemble one another” (U.S. National Academies of Sciences, Engineering, and Medicine, 2015, p. 2). If intercultural interaction is especially costly, then assimilation should reduce those costs. This could have two potential impacts on the association between diversity and productivity. Lower interaction costs could raise the spillovers garnered from immigrant diversity. Alternately, assimilation might narrow the socioeconomic and cultural distance between immigrants and the host society, thereby reducing immigrants’ cultural distinctiveness. If this also reduces their heuristic distinctiveness, then assimilation could dampen spillovers from immigrant diversity.

Very few studies in the economics of diversity literature have touched on this dynamic at all; none with the kind of motivating theory described here. Moreover, what few hints we do get from existing evidence on childhood arrivals, the second generation, naturalisation, and cultural proximity are inconclusive on the potential role of assimilation. Largely as robustness tests, a few papers have examined the impacts of excluding childhood arrivals from and/or including second-generation immigrants in their diversity measures. The logic behind this is that childhood arrivals are primarily socialized in the host country and thus may be ‘too assimilated’ to be considered truly different from native-born residents. From the opposite logic, assimilation is a lengthy process that can extend across several generations, justifying the inclusion of second-generation migrants in the study of diversity. At the cross-country scale and for the Netherlands respectively, Alesina et al. (2016) and Möhlmann and Bakens (2015) each find that the positive relationship detected between diversity and productivity does not depend on the inclusion of immigrants that are likely to be more assimilated – whether childhood, teen, or young adult arrivals, or second-generation immigrants. Meanwhile, several papers offer hints of some kind of ‘Goldilocks’ principle around the effects of assimilation. Docquier et al. (2020) find larger spillovers from immigrants who arrive later in their lives, and the largest estimates from immigrants who were educated in their home country through secondary school, but received tertiary education in the destination country. Alesina et al. (2016) document a different kind of optimal cultural middle ground, showing that the association between birthplace diversity and per capita GDP appear largest for immigrants originating from countries at intermediate levels of cultural proximity to the host country, defined by colonial relationships and languages.

## 2.2 Immigration and Integration in Norway

It is important to distinguish social processes of immigrant integration from the longer and darker histories of forced assimilation policies. In Norway, such policies were largely targeted at the minority indigenous Sami population (e.g., Minde, 2005). As Alba and Nee (1997, p. 827) write:

As a state-imposed normative program aimed at eradicating minority cultures, assimilation has been justifiably repudiated. But as a social process that occurs spontaneously and often unintentionally in the course of interaction between majority and minority groups, assimilation remains a key concept for the study of intergroup relations.

It is the latter that we engage with in this paper, understood as the

...process by which members of immigrant groups and host societies come to resemble one another. That process, which has both economic and sociocultural dimensions, begins with the immigrant generation and continues through the second generation and beyond...[and] ...implies movement toward parity of critical life opportunities with the native-born [...] majority. (U.S. National Academies of Sciences, Engineering, and Medicine, 2015, p. 2)

Until recently, Norway had experienced only very limited immigration. A small stream of European refugees entered following World War II, but even then, rates of immigration remained very modest until the late 1960s and early 1970s when workers from Pakistan, Turkey, and Morocco were among the early arrivals of labor migrants (Brochmann and Hagelund, 2012). Since then, the extent and diversity of migrants have grown. Contemporary migration streams include highly skilled workers from Western Europe and North America, filling jobs in the burgeoning oil industry; those seeking family reunification; and refugees or asylum-seekers. In 1970, the Norwegian immigrant population consisted of less than 60,000 people, of which more than 80% were European. By 2018, the migrant population had swelled to more than 900,000, equivalent to 14% of the population. Less than half the migrant population is now European in origin (Statistics Norway, 2018). Migration rates grew especially in response to the 2004 expansion of the European Union, which opened Norway to increased flows of workers from Central and Eastern Europe. The largest foreign-born population is currently from Poland, followed by Lithuania, Sweden, Somalia, and Syria.

In the Norwegian policy context, ‘assimilation’ is understood to mean full adoption of Norwegian identification. Conversely, ‘integration’ implies full participation in social and economic life, but maintenance of home country cultural identities by immigrants (Brochmann and Hagelund, 2012, p. 163). (Though note that we use these terms effectively as synonyms, which is common (U.S. National Academies of Sciences, Engineering, and Medicine, 2015, p. 19), partly because we lack access to self-reported identity markers that would allow us to make the distinction meaningfully.) The earliest post-WWII refugees were expected to fully assimilate, but there was relatively little formal policy intervention regarding how this process would unfold (Brochmann and Hagelund, 2012, p. 157, 198). Since the 1970s, integration, including respect for cultural differences and ideals of multiculturalism, has been the more dominant strain of Norwegian policy thinking. It has developed alongside a growing programmatic and bureaucratic involvement in

this process (Hagelund, 2002). This has also occurred alongside growing restrictions on who can immigrate. For example, similar to other European countries, Norway introduced a temporary ban on immigration in 1975, essentially limiting migration to highly-skilled specialists, as well as asylum-seekers and refugees. The temporary ban was renewed several times until 1991, when it was replaced by a more restrictive permanent immigration law. However, membership of the European Economic Area created a new opening for labor migration under the terms of the Single Market, which became particularly relevant following the EU expansion in the mid-2000s.

Immigration and integration policy remain contentious policy issues, in particular as pertains to asylum policy. Norway has had a significant anti-immigrant party since the 1970s, and mainstream parties have also become increasingly restrictive on immigration. This has also been reflected in growing criticism of the multicultural ideals from anti-immigrant movements (Eriksen, 2016), although Norwegian integration policy remains fundamentally anchored in multiculturalism.

### 3 Empirical approach

The first aim of this paper is to describe the relationship between immigrant diversity and worker productivity in the Norwegian economy. The second aim is to investigate whether any estimated diversity spillovers are moderated by immigrant integration into Norwegian society.

To satisfy these aims, we make use of linked employer-employee data from Norwegian individual and establishment registers. The annual data spans the period 2001 to 2011, and covers all inhabitants in Norway over the age of 16 who are employed in the private sector, and all establishments located in Norway. The registers provide a range of information about individual workers, such as their place and year of birth, mothers' place of birth, sex, educational background, place of residence and employment, employer, working hours, and annual wage. For immigrants, the registers provide information on when they first entered the country, their age and if they have any education from schools in Norway. At the establishment level, the registers include information on location, industry, and number of employees. Additional establishment-level variables are calculated from the individual registers based on the composition of each establishment.

We adapt approaches used in recent studies that leverage matched employer-employee data in other country contexts (e.g., Trax et al., 2015; Kemeny and Cooke, 2018). Though workers may appear in the data in numerous jobs in different places and times, we limit attention to each worker's single longest work spell, defined as a period of employment in a workplace and region lasting at least two consecutive calendar years. We further limit the analytical sample by excluding those registered as working part-time and earning very low wages<sup>3</sup>. We also drop establishments with fewer than 10 employees, to ensure that measures of diversity in establishments are sensible.

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<sup>3</sup>We exclude earnings that are below 100,000 Norwegian Kroner (NOK).

Like several existing studies, we use individual earnings as a proxy for productivity. Since individuals in the analytical sample are fixed in locations and workplaces for the entirety of their spell, variation in the models arises from the panel structure of the data. The estimates are based on how workers' earnings respond to changes in the immigrant composition of the region in which they live, as well as in the establishment in which they work. The basic estimating equation is described as follows:

$$\ln(w)_{ipjt} = \beta_1 d_{jt} + \beta_2 d_{pjt} + X'_{ipjt} + E'_{pjt} + C'_{jt} + \mu_{ipjt} \quad (1)$$

In this equation,  $\ln(w)$  is the log annual wage of an individual worker  $i$  in establishment  $p$  located in region  $j$  at time  $t$ . The two independent variables of interest are  $d_{jt}$  and  $d_{pjt}$ , which measure diversity among the immigrant population at the scale of the region and the establishment, respectively. The vectors  $X'$ ,  $E'$ , and  $C'$  capture time-varying characteristics of workers, establishments and regions. The standard error term is denoted by  $\mu_{ipjt}$ . In estimation, we decompose this error term, adapting a two-way fixed effects error components model (Baltagi, 2013), such that:

$$\mu_{ipjt} = \mu_{ipj} + \lambda_t + v_{ipjt} \quad (2)$$

The first error component represents a key feature of our approach. In a conventional two-way fixed effects model, this term would represent a fixed parameter capturing stationary unobservable individual-level factors. However, as the sample is limited to spells of 'stayers',  $\mu_{ipj}$  absorbs bias not just from individual-level unmeasured characteristics, but also time-invariant unobservables at the workplace and regional scales. At the individual level, these might include differences in workers' innate ability, intelligence, or motivation. Establishment-specific features could include enduring differences in capital intensiveness or product quality. And at the level of regions, deep-rooted variation in specialization and agglomeration could be relevant (Kemeny and Storper, 2015). The remainder of the error term is decomposed in the standard manner, with  $\lambda_t$  being a time fixed effect that absorbs bias from unobserved time-specific shocks, such as recessions and other business cycle effects. Finally  $v_{ipjt}$  represents the remaining stochastic disturbance term. The primary identifying assumption is that pertinent nonstationary unobserved factors are uncorrelated with changes in regional or establishment-level diversity. We seek to validate this assumption through various robustness checks.

We contend that an equivalent equation predicting rents is not required in order to identify the relationship of interest. As Acemoglu and Zilibotti (2001) argue, in regions that contain tradeable sectors, earnings unadjusted for cost-of-living differences will reflect underlying productivity, as such firms are faced with national, and not regional prices. Nonetheless, though wages are commonly used as an (imperfect) proxy for productivity in more market-oriented economies like the US, one potential challenge in the present context is that, under the Norwegian system of collective bargaining, wages are set annually through a combination of central and local negotiations. The result is a relatively

compressed wage structure that will not fully reflect individual productivity. One possible risk, then, is that we underestimate the true productivity impacts of diversity. Seeking to mitigate potential bias from this source, we exploit the fact that wage-setting processes are more important in some sectors than others. In the analysis, we probe the sensitivity of the results to a focus on a subset of industries in which we can expect closer links between productivity and wages.

### 3.1 Measuring diversity and assimilation

In the baseline model, we include workplace- and region-specific measures of diversity in which immigrants are considered to be heterogeneous in terms of their birthplace only. To do so, we use a variant of a standard fractionalization index, which we estimate specifically across all in-sample members of the non-native population. The fractionalization index is apt as it captures both the breadth of countries from which individuals originate, as well as the relative sizes of these different country groups. Though region-focused researchers have sometimes used other indicators to describe diversity, the fractionalization index remains by far the most common, and results across different measures tend toward consistency.<sup>4</sup> At the regional scale, the baseline index is calculated as follows:

$$d_{jt} = 1 - \sum_{r=1}^R s_{rjt}^2 \quad (3)$$

where  $s$  is the proportion of all immigrants in region  $j$  who were born in country  $r$  at time  $t$ ; and  $R$  is the maximum number of countries captured in the immigrant population of the region. The index ranges between a low of zero, meaning all immigrants come from a single country, and a maximum diversity value nearing one (more specifically  $(1 - 1/R)$ ), reflecting a situation where each immigrant group occupies the same proportion of the total immigrant population<sup>5</sup>. We exclude native Norwegians from Equation 3 because to do otherwise would render the measure almost perfectly correlated with the simple share of all foreign born in the population. This would conflate effects from overall immigration with effects from diversity, defined in terms of the mix of countries from which immigrants hail. At the same time, in all models, we include the simple share of foreign-born as a control, to ensure we can separately account for effects that derive from aggregate flows of immigration.

In addition to measuring diversity in a way that treats all immigrants equally, we consider that the presence of differently assimilated immigrants may influence the social return from heterogeneity. Exploring this empirically demands measures of assimilation. Assimilation includes a component of individual migrant experience that changes over time. It is partly a function of time spent in the country, but also depends on factors such

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<sup>4</sup>For a wider discussion of measurement, consult Dawson (2012); Kemeny (2017); Nijkamp and Poot (2015).

<sup>5</sup>The index can be thought of as summarizing the probability that two immigrants who meet at random in a particular context were born in two different countries.

as language proficiency (Daley et al., 2019), inter-ethnic marriage (Furtado and Trejo, 2013) and social networks (Majerski, 2019). It also captures a collective experience shared by waves of migrants and their descendants, which becomes inscribed into the host society itself. Measuring the gaps between immigrant and native-born populations involves a wide range of relevant indicators (e.g., Borjas, 1994). As one comprehensive review for the US put it, relevant issues include:

...attitudes toward social issues, citizenship, crime, education, family structure, health, income, language, occupations, political participation, religion, and residence. Of course this is a complicated process to measure, in part because immigrants are very diverse themselves and have very different starting points in all of these domains when they arrive and because immigrants change at different paces across domains and individuals, but also because Americans are also changing. (U.S. National Academies of Sciences, Engineering, and Medicine, 2015, p. 20).

Such a multifaceted understanding of this dynamic social process means that any single indicator will be incomplete. There are also aspects of this process that resist quantification, especially at scale. For example, Jimenez (2017) argues that assimilation needs to be understood as a relational process which at least partly involves developing a “working consensus around ethnic, racial, and national belonging” and “interpreting the details of daily living” (p.10-11).

Register data are not structured to capture such a nuanced and meaning-laden phenomenon. However, the basic nature of this process suggests some ways in which administrative data sources may be useful:

By its very nature, integration is a process that unfolds over time. The pace of integration may be sped up or slowed down by individual characteristics, contexts of reception, or one’s structural position in society, but it always also depends on the duration of exposure to the host country’s culture and society. (U.S. National Academies of Sciences, Engineering, and Medicine, 2015, p. 413).

This quotation highlights the importance of time spent in the host country, suggesting meaningful dimensions of assimilation may be captured with immigrants’ year of arrival and age at arrival. It also suggests the relevance of background characteristics, such as the cultural proximity between the origin and host culture, and exposure to host country societal institutions, such as its educational system. Immigrants’ naturalization status is another useful and measurable indicator of assimilation. Most countries in Europe – Norway included – premise the acquisition of citizenship on minimum periods of residence, and facility with the host country language, customs, culture and political system. Meanwhile, naturalization confers upon immigrants the ability to participate in society with the

same rights as native-born citizens. Naturalisation thus signals one form of assimilation, indicating that the immigrant has become a full member of the host society (Gathmann and Keller, 2018; Peters et al., 2019).

Equation 3 presumes that all immigrants from country  $r$  are homogenous, contributing equally to the overall measure of diversity. However, the discussion thus far suggests that immigrants’ different levels of assimilation into their host society might shape the effects of diversity on productivity. We operationalize this idea by measuring diversity while gradually narrowing – or in some cases, extending – the definition of immigrants by considering the most assimilated as natives. This allows us to examine how this influences the size of the spillovers estimated from diversity<sup>6</sup>. We do so for a wide range of potential indicators of assimilation: length of stay; age at arrival; educational background; second generation status; naturalization; and cultural and linguistic proximity between the native country and Norway. We assume that immigrants are more likely to have been assimilated if they have stayed in Norway for an extended period; were very young when arriving in the country; are part of the second generation; have studied at a Norwegian university; have been naturalized through citizenship; or were born in a culturally similar society or initially immigrated from a country with linguistic proximity to the Norwegian language<sup>7</sup>.

The Immigration Database provides information on time of arrival in Norway and of naturalization through citizenship, if relevant. The National Educational Database (NUDB) records the educational experience of individuals – including immigrants – at Norwegian universities. We capture second generation status using each individual’s mother’s country of birth. Cultural proximity is measured in two ways: The simplest measure excludes immigrants from neighboring countries – Sweden, Denmark, and Iceland – which share many cultural similarities with Norway. The more sophisticated measure estimates the linguistic proximity between each immigrant’s native language and Norwegian, exploiting CEPII data that describe such proximity for 90 country pairs<sup>8</sup>. Building on work by Desmet et al. (2009) and Ferrucci and Lissoni (2019), we adapt Equation 3 to create weighted diversity measures, where more linguistically proximate cultures contribute less to diversity than those which are more distant<sup>9</sup>.

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<sup>6</sup>As a means of comparing the benefits from diversity across differently assimilated groups, we also considered building mutually exclusive sets of diversity measures capturing different assimilation levels. Ideally, one would include these in a single ‘horse race’ model, in which one could directly compare, say, any benefits of diversity derived from very recent immigrants to those that have remained in Norway for a long time. We ultimately discarded this idea, as it wrongly assumes that the productivity-enhancing interactions must occur within groups narrowly defined on the basis of their level of assimilation. Regardless of its statistical appeal, this does not make sense from a theoretical perspective.

<sup>7</sup>The previous quotation suggests a dynamic path to assimilation which we have tried to operationalize by describing immigrants’ length of stay. We would ideally have liked to capture other time-varying aspects of the process of assimilation, such as language acquisition and engagement in local social networks, but no data are available for these characteristics.

<sup>8</sup>The CEPII data measure linguistic proximity based on the lexical similarity scores between 40-item word lists drawn from different languages. For more information about the data, see [http://www.cepii.fr/CEPII/en/bdd\\_modele/bdd\\_modele.asp](http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele.asp).

<sup>9</sup>For each country-pair, we take the inverse of the original proximity scores, standardizing them to values ranging between (0,1).

### 3.2 Establishment-level and regional controls

Though the inclusion of individual-workplace-region and time fixed effects account for many potential drivers of changes in the dependent variable, in all models we additionally include controls to account for time-varying factors specific to regions and establishments. As described in the previous section, we control for the share of foreign-born at both the regional and establishment scale. When we limit attention in the diversity measures to immigrants at particular levels of integration, we also adjust proportions of foreign-born to the same subgroup. Additional control variables include establishment employment and regional population, accounting for internal and external economies of scale, respectively. As a means of capturing confounding effects from spillovers due to education, we additionally control for the share of employees with tertiary education in each region and establishment.

### 3.3 Descriptive Statistics

Table 1 provides summary statistics for the analytical sample. The dataset includes nearly 1.3 million individuals working in almost 35,000 establishments. Average earnings are around 440,000 NOK<sup>10</sup>.

The average age of the workers is 42 and the average spell in the same establishment and region is above 7 years in the period 2001-2011<sup>11</sup>. Economic regions correspond to local administrative units at level 2 (LAU 2) as defined by Statistics Norway. We additionally merge regions that are functionally integrated into the same labour market, following (Gundersen and Juvkam, 2013). This yields a total of 78 regions which are roughly equivalent to local labour markets<sup>12</sup>. The average region has around 21,000 employees, of which 6 percent have obtained a tertiary education. Jobs in tradable sectors account for 38 percent of total employment. High technology sectors account for 1 percent, while knowledge intensive services account for almost 20 percent of total employment. Norway experienced a large growth in immigration between 2001 and 2011, with the share of foreign-born expanding from 4.5 to 11 percent<sup>13</sup>. Figure 3 illustrates the relationships between mean wages, diversity and population in each region, averaging across all years. It highlights the positive association between fractionalization and wages, and between fractionalization and population.

## 4 Results

In this section, we first examine the overall relationship between immigrant diversity and wages. Subsequently, we examine how this relationship is influenced by assimilation

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<sup>10</sup>In 2011, 440,000 NOK was the equivalent of approximately US\$51,000.

<sup>11</sup>Because they are time-invariant, other individual level variables, such as gender and nationality drop out in estimation, but are included in Table 1 to better describe the sample.

<sup>12</sup>The same classification has been used in several previous studies at the regional scale in Norway (e.g. Herstad et al. (2014), Fitjar and Timmermans (2019), Haus-Reve et al. (2019)).

<sup>13</sup>For more information, see <https://www.ssb.no/en/befolkning>.

Table 1: Summary statistics, full analytical sample, 2001-2011

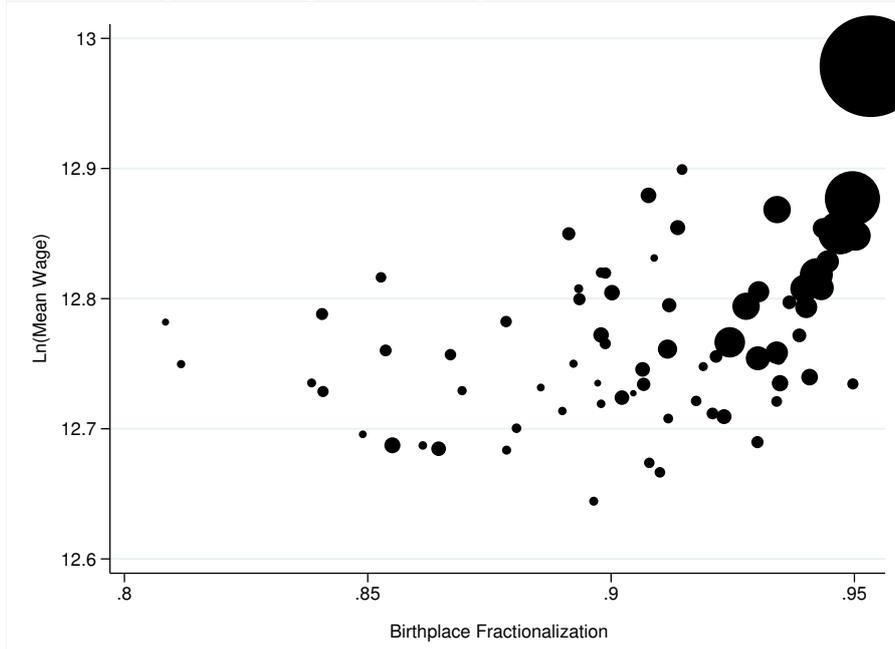
Variable	Mean	Standard deviation
<i>Individual characteristics</i>		
Age	42.08	11.43
Annual wage (NOKs)	439,280	285,249
Spell duration in years	7.20	3.03
Female	0.32	0.46
Norwegian born	0.90	0.29
<i>Establishment characteristics</i>		
Birthplace fractionalization	0.61	0.39
Share foreign-born	0.10	0.14
Firm size	35.2	301
Share of tertiary-educated employees	0.11	0.16
<i>Regional characteristics</i>		
Birthplace fractionalization	0.90	0.04
Share foreign-born	0.07	0.03
Regional size (10,000s)	21.37	56.68
Share of tertiary-educated employees	0.06	0.03
Tradeable sector	0.38	0.08
High Technology sector	0.01	0.01
Knowledge Intensive Services	0.19	0.05
Total observations	6,769,024	
Individuals	1,262,272	
Establishments	34,708	
Regions	78	

processes.

#### 4.1 Overall immigrant diversity spillovers in Norway

Table 2 shows the results for the overall relationship between diversity and wages in the Norwegian context, estimated using a panel fixed effects estimator with standard errors clustered at the level of the establishment. In column 1, we include only establishment-level predictors. Assuming a threshold of 0.05, the coefficient for establishment-level diversity is not statistically significant. As expected, the share of foreign-born, establishment size, and share of tertiary-educated employees are each positively and significantly related to earnings. The second model in this table adds regional predictors. The establishment-level measure of diversity remains unrelated to worker wages. Meanwhile, the coefficients for both regional birthplace diversity and the regional share of foreign-born are positive and statistically significant. These results are broadly consistent with findings from studies of diversity spillovers in other national contexts. However, the spillovers from diversity in the Norwegian case appear not to flow from the workplace scale, whereas, in the U.S.

Figure 1: Wages and Birthplace fractionalization.



Note: Points on the scatterplot reflect regional average values of wages and birthplace fractionalization among immigrants across all years, 2001 - 2011. Point size is scaled by regional population.

case, workplace effects are significant but small. We hereafter refer to this model as the baseline, to be compared against the results that follow.

Before turning to the question of assimilation, we probe the robustness of the overall relationship of interest. One strength of the analytical approach taken in this paper lies in its ability to account for a wide range of sources of stationary unobserved heterogeneity. Still, there remain various threats to validity that are worth addressing.

As discussed earlier, one possible concern with respect to internal validity is that the Norwegian system of collective bargaining could weaken or even sever the association between individuals' earnings and their productivity. We address this issue by limiting the analysis to tradable industries, where the link between wages and individual productivity should be strongest. We define tradable sectors following a classification set out in Mano and Castillo (2015). In these sectors, international competitive pressures mean that employers are more likely to have to pay wages that more closely reflect productivity. The first model of Table 3 presents results estimated over this subsample of workers. The relationship is consistent with the baseline estimates: a positive and significant coefficient for diversity at the regional scale, and no association between earnings and diversity at the workplace level. Hence, we do not find reason to believe that the baseline results are purely a function of the structure of collective wage bargaining in some Norwegian industries.

Instead of being driven by greater immigrant diversity, rising wages could also be the result of unobserved local shifts in labor demand. Indeed, local demand shocks could raise

Table 2: Baseline model, immigrant diversity and earnings for workers in Norway, 2001-2011.

<b>Dependent variable:</b> log of annual earnings		
	Estabs. Only (1)	Baseline (2)
<i>Establishment measures:</i>		
Diversity	0.001 (0.001)	0.001 (0.001)
Share foreign-born	0.016* (0.008)	0.001 (0.007)
Firm size ( <i>log</i> )	0.062*** (0.002)	0.059*** (0.002)
Share of educated employees	0.075*** (0.012)	0.072*** (0.011)
<i>Regional measures:</i>		
Diversity		0.065*** (0.017)
Share foreign-born		0.315*** (0.063)
Employment ( <i>log</i> )		0.167*** (0.013)
Share of tertiary-educated employees		0.054 (0.028)

*Note:* \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . Standard errors in parentheses, clustered by establishment. Year and individual-establishment-region fixed effects are included in both models. Sample consists of 6,769,024 observations nested in 1,262,272 individuals and 34,708 establishments. For both models, centered  $R^2$  is 0.236.

wages while shifting the supply of different types of workers. Due to the generally higher geographical mobility of immigrants compared to natives, this could stimulate greater inflows of immigrants, possibly, though not necessarily, producing an increase in immigrant diversity. In the Norwegian case, this is particularly pertinent for regions specializing in oil extraction, which may become ‘boom regions’ in periods of rising oil prices (Fitjar and Timmermans, 2019). We follow common practice in addressing this concern by using a method developed by Bartik (1991), in which the aim is to capture local demand in a manner that is unrelated to changes in local supply. The ‘Bartik’ measure applies industry-specific national employment growth rates to initial local industry employment shares, as follows:

$$Bartik_{jt} = \sum_{l=1}^L e_{jlt-1} (\ln E_{lt} - \ln E_{lt-1}) \quad (4)$$

where  $(\ln E_{lt} - \ln E_{lt-1})$  captures the growth in log national employment in industry  $l$  at time  $t$ , and the local employment share in this industry is indicated by  $e_{jlt-1}$ . We use data

Table 3: Robustness checks, immigrant diversity and earnings for workers in Norway, 2001-2011.

<b>Dependent variable:</b> log of annual earnings				
	Fractionalization coeffs.		Counts (millions)	
	Region	Establishment	Observations	Individuals
(1) Tradables only	0.086** (0.027)	XXXXX (XXXXX)	3.9	0.07
(2) With Bartik index	0.048*** (0.015)	0.000 (0.000)	6.7	1.3
(3) With unemployment	0.064*** (0.017)	0.000 (0.000)	6.7	1.3
(4) GMM-IV FE	0.154*** (0.026)	0.011*** (0.005)	4.2	0.8

*Note:* \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . Standard errors in parentheses, clustered by establishment. Each numbered row of this table represents results drawn from a distinct regression, containing regional- and establishment-level shares of tertiary-educated, shares of foreign-born and size as controls, as well as year and individual-workplace-region fixed effects. For all models,  $R^2$  is 0.236. For Model 4, Kleibergen-Paap LM (underidentification) is 5023 ( $p=0.000$ ) and Hansen's  $J$  is 0.380 ( $p=0.5375$ ).

on regional industry structure based on two-digit NACE codes to build this indicator<sup>14</sup>. The results in Table 3, Model 2 indicate that the inclusion of the Bartik index as a control variable does not materially change the relationship of interest.

A second approach to deal with a potential mismatch between demand and supply focuses on the aggregate supply side. The logic here is related to the situation described immediately above. A relative shortage in the supply of labor could spur greater immigration, and potentially greater diversity. A labor shortage would also put upward pressure on wage levels. In this situation, what in the preceding models would appear to be a relationship between diversity and earnings, would in fact be spurious. Model 3 in Table 3 presents coefficients on diversity variables for a model that includes annual measures of local unemployment, using official data from Statistics Norway on registered unemployment at the municipality level. While the sign on the unemployment variable is negative, as expected, the inclusion of this indicator does not meaningfully alter the nature of the estimated diversity coefficients. This suggests the observed link between diversity and earnings is not explained by labor shortages<sup>15</sup>.

Finally, we address lingering concerns regarding the potential endogeneity of the diversity measures through instrumental variables estimates. Finding suitably exogenous 'external' instruments for these variables is a major challenge, given both their finely

<sup>14</sup>Because of the change to NACE rev. 2 in 2007, we convert all NACE codes back to NACE rev. 1.1, allowing us to apply this index for the whole time period.

<sup>15</sup>In all cases where information has been summarized, full estimates are available upon request.

granular and dynamic nature. Following others in this situation (i.e., Trax et al., 2015; Cooke and Kemeny, 2017), we rely on lags of workplace and regional immigrant diversity, applied using the general method of moments (GMM) fixed effects estimator. Based on exploration of which lags do not directly predict the outcome, we settle on an instrument matrix that includes 1- to 3-year lags of immigrant diversity at each scale. Estimates using these instruments pass basic tests – of underidentification, confirming sufficient instrument strength; and overidentification, suggesting instruments jointly satisfy the orthogonality condition. The estimates themselves, presented in Model 4 of Table 3, broadly support non-IV findings at the regional level. In this specification, establishment diversity also emerges as significantly related to earnings.

Summarizing, although we cannot fully eliminate the possibility that idiosyncratic shocks or other factors are driving the relationship of interest, the robustness checks using instrumental variables, a subset of traded sectors, and controlling for labor shortages and demand shocks produce evidence that confirm a significant positive association between regional immigrant diversity and earnings, consistent with the idea of spillovers.

## 4.2 Assimilation and diversity spillovers

Having confirmed a robust, positive association between regional immigrant diversity and wages in the Norwegian case, we now address the role of assimilation in mediating this relationship. We begin by using length of stay as a proxy for assimilation. Table 4 presents coefficients and standard errors for the key independent variables of interest: region- and workplace-level immigrant diversity. Each row in the table presents results from a unique model. While each model includes the full battery of control variables discussed in section 3.2, for simplicity we do not report coefficients for these variables, since they offer largely consistent predictions across models and are in line with expectations and the baseline findings. Models 1 to 4 progressively exclude migrants who have stayed in Norway for longer periods of time from workplace and regional calculations of immigrant diversity. Hence, Model 1 can be understood to capture the role of diversity in shaping earnings when diversity is measured only among the least-assimilated, while Model 4 is the most inclusive (and most similar to the baseline), excluding only those that have remained in Norway for more than 15 years.

At the establishment level, we find a modest but positive and significant effect of diversity among less assimilated immigrants with up to five years residence. When we include more assimilated immigrants who have stayed in Norway for more than five years, the diversity spillovers turn insignificant. Estimates at the regional scale indicate the consistent presence of a positive, statistically significant association between earnings and regional diversity, regardless of the level of assimilation. The raw coefficients themselves suggest that spillovers rise with assimilation. However, formal tests of differences between the coefficients across these different models, using the  $z$ -score approach described for large samples in Clogg et al. (1995), reveal that the only significant differences in the regional

length-of-stay estimates are between diversity among those staying 2 years or less, and 5 years or less. In other words, we detect that the association between regional diversity and earnings is larger when diversity includes immigrants who have stayed no more than five years as compared with no more than two years. No differences are measured between other models, including when compared against the baseline. Overall, this suggests that, when defined in terms of length of stay, there is only modest evidence that assimilation plays an important moderating role in the relationship between diversity and productivity.

Table 4: Diversity spillovers by assimilation, defined as length of stay.

<b>Dependent variable:</b> log of annual earnings		
Models	Diversity coefficients	
	Establishment ( $\beta_1$ )	Regional ( $\beta_2$ )
(Baseline)	0.001 (0.001)	0.065*** (0.017)
(1) 2 years or less	0.002* (0.001)	0.018*** (0.003)
(2) 5 years or less	0.002* (0.001)	0.047*** (0.007)
(3) 10 years or less	0.001 (0.001)	0.038*** (0.010)
(4) 15 years or less	0.000 (0.000)	0.043* (0.014)

*Note:* \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . Standard errors in parentheses, clustered by establishment. Each numbered row of this table represents results drawn from a distinct regression, containing regional- and establishment-level shares of tertiary-educated, share of foreign-born and size as controls, as well as year and individual-workplace-region fixed effects. Centered  $R^2$  values range from 0.236 to 0.276. All models estimated on 6,769,024 observations nested in 1,262,272 individuals.

Table 5 explores the results for other dimensions of assimilation. In the interpretation, we emphasize regional coefficients, as we find no significant relationships at the establishment scale. Models 1 and 2 consider two dimensions of assimilation that relate to immigrants' exposure to host country institutions: their age at arrival, and whether they attended a Norwegian university. Regarding age at arrival, we set a threshold of age 13 to differentiate earlier and later arrivals. This corresponds to the end of primary school enrollment and follows the findings from Chetty (2015) on differential neighborhood effects for U.S. families moving with children at different ages. Immigrants who arrived after age 13 are assumed to be less assimilated than those who arrived as children. In Model 1, we find a more pronounced positive coefficient than in the baseline for regional diversity among later arrivals. Formal testing indicates the coefficient is significantly larger than that estimated for all immigrants (the baseline). Similarly, in Model 2, we also find a seemingly more pronounced positive coefficient for regional diversity than in the baseline when diversity is limited to workers that did not attend university in Norway – those we consider to be less assimilated. However, in this case, the coefficient is not statistically

significant as the standard error is higher.

Table 5: Diversity spillovers by various dimensions of assimilation.

<b>Dependent variable:</b> log of annual earnings		
Models	Diversity coefficients	
	Establishment ( $\beta_1$ )	Regional ( $\beta_2$ )
(Baseline)	0.001 (0.001)	0.065*** (0.017)
<i>Exposure to host country institutions:</i>		
(1) Arrived after age 13	0.001 (0.001)	0.130*** (0.027)
(2) Did not attend university in Norway	-0.011 (0.007)	0.238 (0.138)
<i>Cultural proximity to native country:</i>		
(3) Excluding neighboring countries	0.001 (0.001)	0.204*** (0.032)
(4) Linguistically-weighted proximity	0.000 (0.001)	0.139*** (0.027)
<i>First and second-generation status:</i>		
(5) Including second-generation	-0.001 (0.001)	-0.016 (0.031)
<i>Naturalization:</i>		
(6) Not born with Norwegian citizenship	-0.008 (0.005)	0.220*** (0.060)
(7) Not naturalized	-0.004 (0.005)	0.175*** (0.039)

*Note:* \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . Standard errors in parentheses, clustered by establishment. Each numbered row of this table represents results drawn from a distinct regression, containing regional- and establishment-level shares of tertiary-educated, share of foreign-born and size as controls, as well as year and individual-workplace-region fixed effects. Centered  $R^2$  values range from 0.236 to 0.276. All models estimated on 6,769,024 observations nested in 1,262,272 individuals.

Models 3 and 4 in Table 5 explore how cultural distance may factor in to assimilation proxies. Model 3 presents estimates when we define diversity excluding immigrants from neighboring countries, specifically Denmark, Iceland, and Sweden. This results in a greater positive coefficient than in the baseline, with the point estimate for regional diversity being relatively large. Based on a formal test, we conclude that the difference between this coefficient and the baseline model is statistically significant. Similar results are obtained in Model 4, where we capture assimilation by weighting more culturally distinct immigrants' contribution to diversity more strongly, using the measure of linguistic proximity. In this case, however,  $z$ -scores indicate no significant differences from the baseline.

Model 5 reports results when we additionally count the children of immigrants as sources of potential immigrant diversity. Unlike the analyses above, this measure expands rather than restricts the definition of diversity. The results show that the effects of both establishment and regional diversity disappear when including second-generation migrants. This corresponds to the results of Alesina et al. (2016), but contrasts with Möhlmann and Bakens (2015). In the context of our focus on how assimilation modulates diversity spillovers, we interpret this result to mean that the second-generation is sufficiently integrated into Norwegian society that they do not contribute to heuristic heterogeneity in the way their parents do.

The bottom panel of Table 5 considers a final dimension of assimilation: naturalization. We examine the impact of naturalization in two ways. First, in Model 6, we restrict the measure of diversity to include only those born as non-Norwegian citizens (i.e. excluding those who are foreign-born to Norwegian parents and thus qualify for citizenship from birth). The coefficient for regional diversity remains positive and significant. A second approach is to exclude from diversity measures all those immigrants that have been naturalized as Norwegians. In keeping with the overall pattern, regional diversity measured in this way returns more positive coefficients than for the baseline. Using the  $z$ -score method, we can be 95 percent confident that the relationship between diversity and earnings in both these models is stronger than in the baseline model. We take this as providing further evidence that less-assimilated immigrants are a more important source of potential spillovers.

## 5 Conclusion

This article makes two main contributions to the growing literature in economic geography and related fields on immigrant diversity spillovers. First, it examines whether greater immigrant diversity makes Norwegian workers more productive. Second, it asks whether any such spillovers are affected by immigrants' assimilation into their host society. Assimilation might help migrants to better share ideas with each other and with the native-born population, thereby enabling larger spillovers. On the other hand, highly assimilated migrants may offer perspectives and heuristics that are less distinctive than their less-assimilated peers. This paper is the first to explicitly investigate whether assimilation conditions the economic benefits from diversity that have been documented in other studies.

We find a consistently positive and significant relationship between rising earnings and rising immigrant diversity in Norwegian regions. Contrastingly, we find little evidence that greater immigrant diversity in Norwegian workplaces yields improvements in earnings. This latter finding, while not identical to comparably multiscalar work for the U.S. (i.e., Kemeny and Cooke, 2018), similarly suggests that the regional scale is the primary site of spillovers.

Assimilation does appear to shape the economic benefits from immigrant diversity.

Particularly at the regional scale, we find evidence consistent with the idea that, past a certain threshold, assimilation weakens or eliminates the existence of diversity spillovers. This story emerges fairly clearly across a wide range of distinct measures of assimilation. While assimilation defined in terms of length of stay does not seem important, as compared with the baseline we detect larger spillovers when regional diversity is estimated across subsets of immigrants that can be considered less assimilated: those that arrived after the age of 13; did not attend university in Norway; did not emigrate from other Nordic countries; were not born with Norwegian citizenship; and those that are not naturalized citizens. All of this evidence suggests that highly-assimilated immigrants are less of a source of spillovers from regional diversity. When we extend, rather than limit, the definition by also including diversity from second-generation immigrants, the spillovers from diversity disappear altogether, providing further evidence for the role of assimilation in dampening spillovers. At the establishment scale, changes in the diversity around workers remain largely unrelated to their productivity. Length of stay is somewhat of an exception, where rising diversity among less-assimilated immigrants is, albeit modestly, related to rising earnings.

Overall, the results in this paper provide further evidence of the existence of benefits that derive from living and working in immigrant-diverse contexts. Perhaps more importantly, they highlight that not all immigrants contribute equally to such benefits, and suggest a role for assimilation in shaping spillovers.

These findings do not produce unambiguous lessons for public policy. As an example, consider the finding that second-generation immigrants do not contribute to immigrant diversity. This might be because the children of immigrants are heuristically similar enough to citizens that have multigenerational Norwegian roots. But this does not imply that second-generation migrants do not contribute directly to productivity, only that they are not observably different from the rest of the Norwegian labor force in this respect. This is in fact indicative of successful integration, which is an important national policy goal in its own right (Brochmann and Hagelund, 2012), and one that could be fruitfully taken up at the regional policy scale as well (Connor, 2020; Gilmartin and Dagg, 2020; Vogiazides and Mondani, 2020). Immigration has complex effects on both natives and the immigrants themselves, even in narrow economic terms; it involves costs and benefits, with spillovers being only one part of a much more multidimensional picture.

Even with a narrow focus on spillovers, though, the findings in no way weaken policy incentives to integrate immigrants into host societies. Even if this were acceptable, the slightly smaller returns from the most recent immigrants suggest that some basic integration is useful for unlocking the potential of these spillovers. It does, however, suggest that finding ways of allowing immigrants to maintain and share their differing heuristics could allow for more unique and positive contributions to the economic performance of their adopted firms and regions. At a time when immigration and multiculturalism are increasingly contentious in many countries, this offers a word of caution. Introducing restrictions or barriers to immigrants' way of life in order to promote integration can come

at the cost of reducing the benefits of the diversity which these groups provide to their host societies. Furthermore, the attenuation of the spillovers with more time spent in the country suggests potential benefits from welcoming new immigrants every year, in order to continuously add to the heuristic diversity in society. Over time, assimilation processes will reduce this heuristic diversity, suggesting that societies – and especially those with economies premised on complex problem solving and innovation – need a mechanism for regenerating variety.

As always, the findings come with caveats. The use of linked employer-employee data provides information on the composition of the population, but ultimately gives only a birds-eye view of the assimilation process itself. Further studies are needed to give a more detailed account of how the assimilation process unfolds at the micro-level and how this affects diversity spillovers. Such research can also shed more light on individual, as well as geographical, variation in assimilation across different immigrants and different host societies. This paper represents a first venture into a topic that has received little attention in the literature on the costs and benefits of immigrant diversity. As the results show that assimilation is potentially an important mediator of diversity spillovers, further studies are needed to unpack these dynamics.

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