

# Immigration, Monopsony and the Distribution of Firm Pay

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## Abstract

We argue that immigration can fuel the rise of a low-pay sector that negatively impacts native labor. Firms can exploit migrants' low reservation wages by reducing pay, but only at the cost of forgoing native hires, in a classic monopsonistic trade-off. Wider adoption of this low-pay strategy leads to greater workplace segregation, increased dispersion in firm pay, and large negative effects on native employment – which can exceed those in competitive models. We validate these predictions using evidence from a large immigration wave in Germany. These adverse effects are not inevitable and may be mitigated through policies that constrain firms' monopsony power over migrants. *Keywords:* immigration, monopsony, firms.

## 1 Introduction

The labor market impact of immigration is traditionally interpreted in a competitive framework, where workers earn their marginal product. The effects depend entirely on how immigration shifts the relative supply (and hence prices) of different factors of production, whether labor or capital. However, if firms have monopsony power (i.e. the ability to set

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wages below marginal products), the impact of immigration will depend additionally on the reservation wages of migrants. In this paper, we demonstrate conceptually how this mechanism shapes the distribution of firm pay, workplace segregation and employment; and we test our claims empirically. We argue that our framework has important implications for the design of effective policy, and can help reconcile conflicting results in the empirical literature.

Our basic argument is simple. Suppose firms in a frictional labor market face an influx of migrants with low reservation wages. If firms can set native and migrant wages entirely independently, they will respond by extracting greater rents from migrants – while leaving native wage mark-downs unchanged. But if firms cannot easily differentiate pay internally, they face a classic monopsonistic trade-off: if they wish to employ migrants at low wages, they must forgo those native hires who demand higher pay. As immigration increases, this low-pay strategy becomes profitable for a growing share of firms.

The character of these wage effects differs markedly from the canonical competitive model. Under perfect competition, any distributional effects are tied to the marginal products of heterogeneous *workers*. But in our framework, the focus shifts to wage differentials between *firms*. As more firms adjust their pay strategies, a low-pay sector emerges which disproportionately employs migrant labor. Notably, this workplace segregation does not preclude – but rather reflects – labor market competition between natives and migrants.

Our framework also permits large negative effects on native employment, which can greatly exceed those in competitive models. By adopting a low-pay strategy, firms are implicitly rejecting native labor in favor of cheaper migrants. This amounts to a movement down firms’ (imperfectly elastic) labor supply curves. In principle, firms may even profit by reducing their employment overall. This surprising implication mirrors the well-known insight that, under monopsony, a minimum wage may *increase* employment: just as a wage floor can raise employment by pushing firms up their labor supply curves, an influx of low-reservation migrants can reduce employment by pulling firms down those same curves.

The essential role of small and low-paying firms in this story may appear surprising, as “monopsony power” is commonly associated with large dominant firms, sustained by barriers to entry. But in our model, the increase in wage-setting power is driven by changes on the other side of the market (i.e. in labor force composition), and this has very different implications.<sup>1</sup> The growth of a low-pay sector may also be amplified by selective firm entry, as immigration allows small unproductive firms to operate profitably (and create “bad jobs”, in the language of Acemoglu, 2001).<sup>2</sup>

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<sup>1</sup>Firm size is ultimately an outcome, and its relationship with market power (whether positive or negative) depends on the model and source of variation (Syverson, 2019; Manning, 2021).

<sup>2</sup>This resembles Hsieh and Klenow (2009), who argue that labor in developing countries is inefficiently concentrated in a long tail of low-quality firms. Here, such a tail is sustained by low-reservation migrants.

These results hinge on firms’ inability to flexibly differentiate pay between natives and migrants. If firms could instead set their wages entirely independently (e.g. through unconstrained individual bargaining), they could extract large rents from low-reservation migrants without sacrificing access to native labor. However, recent work has identified significant constraints on internal pay differentiation – among employees with different outside options (Caldwell and Harmon, 2019; Lachowska et al., 2022; Di Addario et al., 2023; Jäger, Schoefer and Zweimüller, 2023), in different cities (Hazell et al., forthcoming), of different ages (Giupponi and Machin, forthcoming) or education (Amior and San, 2025) – and between natives and migrants (Amior and Manning, 2026; Townsend and Allan, 2024). These internal pay constraints are commonly attributed to equity concerns<sup>3</sup>, and we show how these same forces can shape the equilibrium effects of immigration – by enforcing the classic monopsony trade-off.

The trade-off is most pronounced if firms cannot wage discriminate at all; but more generally, it arises whenever there are constraints on the extent of discrimination. The tighter the constraints, the narrower the native-migrant wage gap *within* firms, and the more this gap manifests *between* firms – as more firms adopt a low-pay strategy and prioritize migrant recruitment. These results are fully consistent with the existence of internal wage discrimination (as in Dodini and Willén, 2025), provided there are limits on its magnitude.

**Empirical implementation.** To test our model’s predictions, we study a large and sudden influx of predominantly young and low-educated migrants to Germany, triggered by the collapse of the Iron Curtain.<sup>4</sup> This influx is well-suited to exploring the implications of low reservation wages, as it was accompanied by a fierce debate on firms’ alleged exploitation of cheap migrant labor. As Figure 1 shows, public concerns about *Lohndumping* and *Sozialdumping* (“wage and social dumping”) surged at precisely this time. Such concerns are difficult to reconcile with perfect competition, but are better accommodated (rhetoric aside) in the model we describe here.

New migrants earned 10% less than observably similar natives, and we show this is mostly explained by their over-representation in low-paying firms – consistent with low reservations and constrained internal pay differentiation. Indeed, despite migrants’ apparent willingness to accept lower wages, firms that paid natives well offered migrants similarly high returns

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<sup>3</sup>See Akerlof and Yellen, 1990; Bewley, 1999; Weil, 2014; Giupponi and Machin, forthcoming; Brochu et al., forthcoming. As Card et al. (2012), Breza, Kaur and Shamdasani (2018) and Dube, Giuliano and Leonard (2019) show empirically, perceived pay inequity or unfairness can undermine group morale, effort and retention.

<sup>4</sup>While this event has been studied before (e.g., Angrist and Kugler, 2003; D’Amuri, Ottaviano and Peri, 2010; Brücker and Jahn, 2011; Dustmann and Glitz, 2015; Bruns and Priesack, 2019), we pose new questions, study new outcomes (informed by our model), and rely on different empirical variation.

Figure 1: References to *Lohndumping* or *Sozialdumping* in printed German sources



Foreign employment share (SIAB, description below) and appearances of the words *Lohndumping* and *Sozialdumping* (“wage and social dumping”) in German printed sources (Google Ngram), as share of total words in database and indexed to 1 in 1988.

(as in Arellano-Bover and San, 2020; Dostie et al., 2023; Aslund et al., 2021). This opens the door to the monopsonistic trade-off at the heart of the model: firms can secure “cheap” migrant labor, but only at the cost of forgoing those natives who demand higher pay.

To estimate the impact of the shock, we exploit spatial variation in migrant inflows across West German labor markets, identified by pre-existing migrant enclaves (as in Card, 2001). Administrative data on firms and workers allow us to address selection, compositional changes and other potential threats to identification, such as the concurrent inflows of ethnic and East Germans after German reunification.

As the model predicts, affected regions saw significant wage and employment losses for natives, concentrated among low-paying firms (where new migrants clustered). These effects were primarily driven by migrant origin groups with low reservation wages. Moreover, native crowd-out was so substantial that firms became smaller on average (a pattern we also find in US data). These results are difficult to rationalize in a competitive model, where impacts should depend on the relative supply of migrants rather than on their reservations, and where lower wages should encourage *more* hiring as firms move down their labor demand curves. Instead, the evidence points to firms moving down their supply curves, sacrificing native employment to exploit cheaper migrants – in a classic monopsonistic trade-off.

Consistent with this interpretation, the wage declines appear to reflect changes in firms’ *wage policies* and not in workers’ skill prices: they cannot be explained by the concentration of particular skill types (with larger exposure to the migration shock) in low-paying firms, nor by compositional shifts in employment (Bratsberg and Raaum, 2012; Ortega and Verdugo,

2022; Borjas and Edo, 2026; Dustmann et al., 2023). Rather, they reflect genuine reductions in firm wage premia (identified by an augmented “AKM” specification, building on Abowd, Kramarz and Margolis, 1999) *independent* of worker type. Consistent with our model, these effects were driven by both existing firms and the entry of new low-paying firms.

The simple mechanism of imperfectly discriminating monopsony can therefore account for a broad range of findings, some shared with other work (e.g., large declines in native employment) and some that are novel (e.g., simultaneous reductions in pay and firm size, the concentration of employment and wage effects in low-paying firms, and the role of low-reservation migrants in driving these effects). Our focus on the firm pay distribution is not arbitrary: it is guided by foundational wage-posting models (Albrecht and Axell, 1984; Burdett and Mortensen, 1998), whose key assumption of imperfect wage discrimination is supported by our data and the modern wage-setting literature. We do not argue that this offers the only possible explanation for each individual finding, but rather that it provides a simple and plausible rationale for our full set of results<sup>5</sup>; and that a workhorse model of labor economics has important, previously unexplored implications for the impact of immigration.

One cannot conclude that immigration is generally harmful for native workers. Instead, its impact depends heavily on migrants’ reservation wages (not just their skill mix, as in competitive models) and on labor market institutions, which vary significantly by context. Our finding that low-reservation migrants generate more negative wage and employment effects may help explain why crowd-out of native employment is often largest in settings with *low-paid* migrants: see Angrist and Kugler (2003) on Western Europe; Dustmann, Schoenberg and Stuhler (2017) and Bruns and Priesack (2019) on Germany; Amior (forthcoming), Burstein et al. (2020), Monras (2020) and Doran, Gelber and Isen (2022) on the US; Muñoz (2023) on France and Belgium; and Delgado-Prieto (2024) on Colombia.

Moreover, since the wage effects arise from monopsony power, our framework has very different policy implications. In a competitive model, wage effects reflect shifts in relative factor supplies, and this limits policy to interventions that manipulate these supplies (such as border controls, visa skill criteria or training programs). Here however, adverse effects of immigration can be mitigated by targeting firms’ monopsony power over migrants, rather than by restricting immigration itself. This includes policies that curb firms’ wage-setting power, such as well-enforced minimum wages (e.g. Edo and Rapoport, 2019), collective bargaining agreements (Jäger, Noy and Schoefer, 2022), or the “prevailing wage” requirement in US visa programs (Clemens and Lewis, forthcoming; Doran, Gelber and Isen, 2022; Amuedo-

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<sup>5</sup>For example, a competitive model with heterogeneous firms and workers (and productive complementarities between them) could explain why migrants sort into (and crowd out natives from) low-paying firms – but not why both firm size *and* pay fall, nor why AKM firm premia decline (*independently* of worker type) at the bottom of the firm distribution, and nor why these effects vary with migrants’ reservation wages.

Dorantes et al., 2023); and also policies that improve immigrants’ outside options, such as regularizations (e.g. Amior and Manning, 2026; Borjas and Edo, 2023; Elias, Monras and Vázquez-Grenno, 2025), relaxing job mobility restrictions (Townsend and Allan, 2024), or investing in labor market integration (Foged, Hasager and Peri, 2024).

**Related literature.** This paper is closely related to Amior and Manning (2026), who show how immigration can affect the optimal wage mark-down of a representative firm – and then test this claim using wage variation across US skill cells.<sup>6</sup> Conceptually, our point of departure is to abandon the representative firm assumption: we show that immigration can sustain *differential* pay strategies in equilibrium and the creation of a low-pay sector, as firms *trade off* low pay against access to native labor. This new insight underpins all our key propositions – on the distribution of firm pay, workplace segregation, and crowd-out of native employment. We test our predictions using matched administrative data, exploiting a well-defined natural experiment.

Our hypothesis rests on new migrants having low reservation wages, a claim supported by a large and growing literature.<sup>7</sup> These low reservations have been rationalized in different ways, though the precise mechanism is not important for our argument.<sup>8</sup> Low reservations in turn can help explain why migrants often concentrate in small and/or low-paying firms (Aydemir and Skuterud, 2008; De Matos, 2017; Arellano-Bover and San, 2020; Aslund et al., 2021; Dostie et al., 2023; Dustmann, Ku and Surovtseva, 2024): we offer a story for this phenomenon, based on imperfectly discriminating monopsony. More broadly, our interpretation can help account for workplace segregation of migrants, as documented by Glitz (2014), Ansala, Åslund and Sarvimäki (2021) or Willis (2025).

We also contribute to a growing literature on the firm-level effects of immigration, e.g. Dustmann and Glitz (2015); Beerli et al. (2021); Mahajan (2024). Some work focuses on the technological implications of high-skilled immigration: in particular, Mitaritonna, Orefice

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<sup>6</sup>Both this paper and Amior and Manning (2026) subsume elements of an earlier unpublished paper, Amior (2017).

<sup>7</sup>Consistent with this claim, several studies have found that firms have greater market power over migrant than native labor (Winter-Ebmer and Zweimüller, 1996; Nanos and Schluter, 2014; Hirsch and Jahn, 2015; Costas-Fernández and Lodato, 2024; Caldwell and Danieli, 2024).

<sup>8</sup>Migrants may face greater liquidity constraints and restricted access to welfare. Their reference point may relate to their origin country, whether due to remittances or habit (Dustmann, Ku and Surovtseva, 2024). Poor information or undocumented status may inhibit job search (Hotchkiss and Quispe-Agnoli, 2013; Albert, 2021; Borjas and Edo, 2023) and cause migrants to underestimate their outside options (as in Jäger et al., 2024). Migrants may discount their time more heavily due to return intentions (Amior, 2017; Adda, Dustmann and Görlach, 2022), visa limits, or deportation risk. Finally, visa-related restrictions on job mobility may increase firms’ market power (Naidu, Nyarko and Wang, 2016; Wang, 2021; Doran, Gelber and Isen, 2022; Townsend and Allan, 2024). Low migrant reservations may manifest not only in lower wages, but also in workplace amenities: e.g. migrants are more likely to work outside regular hours (Edo, 2015).

and Peri (2017) explore productivity effects across heterogeneous firms. Others study sorting of workers across firms (Brinatti and Morales, 2021; Gyetvay and Keita, 2023; Silliman and Willén, 2024; Orefice and Peri, 2024). Closer to our story, Malchow-Moller, Munch and Skaksen (2012) find that migrant employees depress native wages within Danish firms due to low reservation wages; Edo (2015) makes a similar argument using skill cell variation; and Dodini, Løken and Willén (2022) show that an inflow of Swedish commuters with low reservations decreased labor costs in Norwegian firms. Using calibrated job search models, Chassamboulli and Palivos (2014), Battisti et al. (2017) and Albert (2021) explore how migrants’ reservations affect wage bargaining and job creation. Finally, Delgado-Prieto (2023) finds that immigration effects in Colombia are concentrated in small firms, though the mechanism there is a technological constraint (only small firms hire informal labor).

Our findings also speak to the distributional consequences of immigration. Prior work – Dustmann, Frattini and Preston (2012) on effects along the native wage distribution, and Card (2009) and Gould (2019) on residual wage inequality – shows that adverse impacts fall mainly on low-paid natives, a pattern we also find in our setting. However, we highlight the role of firms in shaping these distributional effects, independently of changes in worker productivity. This focus aligns with work stressing the contribution of firms to growing earnings inequality (Card, Heining and Kline, 2013; Song et al., 2019): we also explore changes in the distribution of AKM firm wage premia (which control for unobserved worker heterogeneity); but we interpret these premia as pay policies determined in equilibrium, and show that they are malleable to aggregate economic shocks. This is not a trivial finding, as Lachowska et al. (2023) show that firm premia are very persistent over time.

In the next section, we set out our theoretical model. Section 3 describes our natural experiment, and Section 4 explores the role of firms in wage-setting for natives and migrants. In Section 5, we describe our empirical strategy, which exploits spatial variation in immigration. We estimate aggregate labor market effects in Section 6, and effects across the firm pay distribution in Section 7. In Section 8, we address compositional bias in our wage estimates, by tracking firm premia – from an augmented AKM specification. Finally, Section 9 explores heterogeneous effects by migrants’ reservation wages and by local labor demand conditions.

## **2 Stylized model with imperfect wage discrimination**

In recent years, the migration literature has seen growing interest in non-competitive frameworks, which relax the restriction that wages equal marginal products. The most popular are individual bargaining models, where firms negotiate pay independently with each employee. Building on Amior and Manning (2026), we relax the assumption that firms can perfectly

wage discriminate between employees in this way — but unlike Amior and Manning, we allow firms to adopt *distinct pay strategies*. This between-firm differentiation is the source of all our key results. The model presented here subsumes elements of an earlier unpublished paper (Amior, 2017).

Our key insight is that migrants with low reservation wages can sustain a low-pay sector in equilibrium, to the disadvantage of native workers. Intuitively, if firms cannot easily discriminate wages between native and migrant employees, they must trade off lower pay against access to native labor. As the migrant workforce grows, more firms will adopt this low-pay strategy. This hypothesis is not derived from an arbitrary set of assumptions: rather, it follows directly from standard wage-posting models. For our main exposition, we build from the equilibrium framework of Albrecht and Axell (1984), which has the minimum ingredients we require: search frictions, monopsonistic wage-posting, and heterogeneous reservation wages. Unlike Albrecht and Axell though, we do not rule out discrimination entirely, but allow for a variable constraint on internal pay gaps.

We have purposefully chosen a stylized and parsimonious model, to illustrate the equilibrium implications in the simplest possible way. We do not seek to quantify a structural model. Rather, our aim is to introduce novel (and crucially, testable) *qualitative* predictions that are distinct from the existing migration literature. To this end, we strip away any complexity not essential to the results. After presenting the baseline model, however, we explore the robustness of its predictions to several extensions, including heterogeneous (and imperfectly substitutable) skills, heterogeneous firms, heterogeneity in native reservation wages, on-the-job search, endogenous offer rates, a labor force participation margin, co-ethnic networks, and idiosyncratic job preferences.

With these caveats in mind, we turn to the baseline model. Suppose there are  $n$  workers (of whom a fraction  $\mu$  are migrants) and  $k$  firms. Firms produce a homogeneous good whose price is normalized to 1, with labor the sole factor input. Labor productivity is fixed at  $p$  in all firms<sup>9</sup>, and natives and migrants differ only in their reservation wages<sup>10</sup> (we explore the implications of relaxing these restrictions later on). In the baseline model, we attribute this difference to unemployment utility flows: natives receive  $b_N$ , and migrants  $b_M < b_N$ .<sup>11</sup>

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<sup>9</sup>This eliminates labor market effects which materialize through changes in factor proportions. The importance of this channel is already well documented, but our aim is to highlight a second channel – the monopsony trade-off – and to illustrate its unique equilibrium implications.

<sup>10</sup>If natives and migrants are distributed (potentially differently) across heterogeneous skill types, the baseline model can be interpreted as the labor market for a particular skill type (see Section 2.4). At the aggregate level though, skill segregation between natives and migrants will moderate the extent of labor market competition between them – unless firms are unable to perfectly discriminate by skill, as in Akerlof and Yellen (1990) or Amior and San (2025).

<sup>11</sup>In most countries, workers without prior contributions to unemployment insurance receive no or limited benefits. Of course, some natives may fall into this category: we address heterogeneous native reservations

High discount or low meeting rates may also contribute to migrants’ low reservations; but our focus is on the *implications* of low reservations, not their origin. In the baseline model, only the unemployed search for work: they meet firms at rate  $\lambda$ , and accept offers which exceed their reservations. Workers exogenously separate to unemployment at rate  $\delta$ .

Firms may post distinct wages  $w_N$  and  $w_M$  for natives and migrants, but they are constrained in the extent of discrimination: they must offer migrants at least  $\zeta \leq 1$  times the native offer (where  $\zeta$  is an exogenous parameter). If  $\zeta = 1$ , firms must pay natives and migrants equally. But our model also allows for partial discrimination (if  $\zeta < 1$ , and the constraint still binds) or perfect discrimination (if  $\zeta$  is sufficiently small so that it does not bind<sup>12</sup>). This constraint can be microfounded by workers’ internal equity concerns, as in Akerlof and Yellen (1990)<sup>13</sup>, and is consistent with growing empirical evidence on wage-setting (cited above). Crucially though, the  $\zeta$  parameter only constrains pay differentials *internally*: firms are free to adopt distinct pay strategies. As we will show, a tighter pay constraint (i.e. larger  $\zeta$ ) reduces wage variation *within* firms but increases wage variation *between* them.

## 2.1 Equilibrium in baseline model

Let  $U_X$  denote the present discounted value of unemployed workers, with  $X = \{N, M\}$  for natives and migrants respectively. This can be expressed in recursive form as:

$$rU_X = b_X + \lambda \int \max \{E_X(w) - U_X, 0\} dF^X(w) \quad (1)$$

where  $r$  is the discount rate, so  $rU_X$  is the flow value. This consists of a basic utility flow  $b_X$  plus the expected return to job finding (the  $E - U$  term), where  $E_X(w)$  is the employment value of jobs paying  $w$ . New offers arrive at exogenous rate  $\lambda$ , and are drawn from (endogenous) native and migrant-specific offer distributions  $F^X$ . Workers only accept offers which yield (weakly) positive returns. This condition defines the reservation wage  $w_X^r$ , which satisfies  $E_X(w_X^r) = U_X$  for  $X = \{N, M\}$ . The employment values are given by:

$$rE_X(w) = w + \delta [U_X - E_X(w)] \quad (2)$$

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in Section 2.4. In the on-the-job search extension (Appendix B), native-migrant differentials in reservation wages diminish over time as migrants move up the firm pay distribution (see Appendix F.4 for evidence).

<sup>12</sup>Note that perfect discrimination arises implicitly in random matching frameworks where wages are bargained ex post (after contact occurs) between individual firms and workers (as in e.g. Chassamboulli and Palivos, 2014, Battisti et al., 2017): this protects natives from any direct competition with migrant labor. But see Albert (2021) for a more complex bargaining model which does allow for direct competition.

<sup>13</sup>Suppose migrants have productivity  $e_M p$ , where effort  $e_M$  is supplied according to  $e_M = \min \{w_M / \tilde{w}_M, 1\}$ , and where  $\tilde{w}_M = \zeta w_N$  is a “fair wage” norm (which depends on the wage of their native co-workers). That is, migrants only supply full effort ( $e_M = 1$ ) if their wage exceeds the norm  $\tilde{w}_M$ . Under these conditions, firms will never pay migrants less than  $\tilde{w}_M$ : otherwise, the profit earned from each migrant would be  $e_M p - w_M = (p / \tilde{w}_M - 1) w_M$ , which is *increasing* in the wage offer  $w_M$ . Therefore, offers below  $\tilde{w}_M = \zeta w_N$  cannot be optimal: any savings on labor costs cannot justify the output losses.

which consists of the wage  $w$  plus the loss from random separations, which occur at rate  $\delta$ .

Each firm chooses a native wage  $w_N$  and migrant wage  $w_M$  to maximize profit:

$$\max_{w_N, w_M} \pi(w_N, w_M) = (p - w_N)l(w_N) + (p - w_M)l(w_M) \quad (3)$$

subject to the pay constraint:

$$w_M \geq \zeta w_N \quad (4)$$

where  $l_X(w)$  is the supply of native or migrant labor to the firm, which can be derived from the value functions above: see Appendix A.2.

The nature of equilibrium depends on whether the pay constraint (4) binds. If it does not, the equilibrium is trivial: all firms offer natives and migrants their reservation wages,  $w_N^r$  and  $w_M^r$ . Intuitively, firms cannot recruit workers below their reservations, and there is no benefit to paying above them (as this does not increase employment<sup>14</sup>). Using (1) and (2), the reservations (and hence the equilibrium offers) must then collapse to workers' unemployment utility flows,  $b_N$  and  $b_M$ .<sup>15</sup> So all firms will offer natives  $b_N$  and migrants  $b_M$ .

But if  $\zeta$  is sufficiently large, such that  $\zeta b_N > b_M$ , this equilibrium is no longer feasible; and the pay constraint will bind. In words, firms would like to pay natives  $b_N$  and migrants  $b_M$ , but the pay constraint does not permit this level of discrimination. It remains true that natives never earn more than their reservation wage, which again collapses to  $b_N$ . But some firms may now be tempted to undercut natives entirely. In equilibrium, firms may then adopt one of two strategies:

1. **High-pay strategy ( $w^h$ ).** Offer natives their reservation wage, which collapses to  $b_N$  as before; so  $w_N^h = b_N$ . If the pay constraint binds, offer migrants  $\zeta b_N > b_M$ . Otherwise, offer migrants their reservation wage (which, in the unconstrained case, collapses to  $b_M$ ). So, the high-pay migrant offer can be summarized as:  $w_M^h = \max\{\zeta b_N, b_M\}$ .
2. **Low-pay strategy ( $w^l$ ).** Undercut natives' reservations and recruit only migrants. Since there is no ambition to recruit natives, there is no reason to offer migrants more than their reservation; so the optimal low-pay offer is  $w_M^l = w_M^r$ . Intuitively, the pay constraint enforces the classic monopsony trade-off on firms: by adopting the low-pay strategy, firms extract greater rents from migrants; but they then lose access to natives.

Since firms are ex ante identical, the strategy of any given firm cannot be pinned down. But in equilibrium, the *share* of firms which adopt the low-pay strategy (the “low-pay sector share”) is uniquely determined: we denote this share by  $\phi$ .

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<sup>14</sup>This is because we have ruled out on-the-job search (for simplicity), so there is no direct competition between firms. But see Appendix B for an extension with on-the-job search, where workers earn more than their reservation wages: the key results are otherwise preserved.

<sup>15</sup>Imposing  $w_X = w_X^r$  on (1) and (2), we have  $rU_X = b_X$  and  $rE_X(w_X^r) = w_X^r$  for  $X = \{N, M\}$ . But by definition of the reservation wage,  $E_X(w_X^r) = U_X$ ; so it then follows that  $w_X^r = b_X$ .

In equilibrium, the migrant reservation wage (and hence the low-pay offer  $w_M^l$ ) is then:

$$w_M^r = \frac{(r + \delta) b_M + (1 - \phi) \lambda w_M^h}{r + \delta + (1 - \phi) \lambda} = \frac{(r + \delta) b_M + (1 - \phi) \lambda \max \{\zeta b_N, b_M\}}{r + \delta + (1 - \phi) \lambda} \quad (5)$$

i.e. a weighted average of (i) the migrant unemployment flow  $b_M$  and (ii) the high-pay migrant offer  $w_M^h$  (which equals  $\zeta$  times the native offer  $b_N$ , if the pay constraint binds). Intuitively, the migrant reservation  $w_M^r$  can exceed  $b_M$  due to the opportunity cost of forgoing high-pay offers  $w_M^h = \zeta b_N$ , which arrive at rate  $(1 - \phi) \lambda$ . If the pay constraint does not bind however, i.e. if  $\zeta b_N \leq b_M$ , migrants are paid  $b_M$  by all firms. See Appendix A.1 for a derivation.

Since only migrants can access low-paying firms (which represent a fraction  $\phi$  of the market), the steady-state native and migrant unemployment rates are given by:

$$u_N = \frac{\delta}{\delta + (1 - \phi) \lambda}, \quad u_M = \frac{\delta}{\delta + \lambda} \quad (6)$$

As Rogerson, Shimer and Wright (2005) show, this type of model has a unique equilibrium. The equilibrium takes one of three forms, depending on the parameter values:

1.  $\pi^h > \pi^l$ , and all firms adopt the high-pay strategy (i.e. the low-pay sector share  $\phi = 0$ )
2.  $\pi^h = \pi^l$ , and firms adopt different strategies<sup>16</sup> (i.e.  $0 < \phi < 1$ )
3.  $\pi^h < \pi^l$ , and all firms adopt the low-pay strategy (i.e.  $\phi = 1$ )

where  $\pi^h$  and  $\pi^l$  are the equilibrium profits of the high- and low-pay strategies. Corresponding to these three cases, the equilibrium low-pay sector share  $\phi$  is:

$$\phi = \begin{cases} 0 & \text{if } \tilde{\mu} \leq \frac{r + \delta + \lambda}{r + \delta} \\ \frac{\delta + \lambda}{\lambda} \left[ 1 - \frac{r}{(r + \delta) \tilde{\mu} - (\delta + \lambda)} \right] & \text{if } \tilde{\mu} \in \left( \frac{r + \delta + \lambda}{r + \delta}, \frac{\delta + \lambda}{\delta} \right) \\ 1 & \text{if } \tilde{\mu} \geq \frac{\delta + \lambda}{\delta} \end{cases} \quad (7)$$

where

$$\tilde{\mu} = \frac{\mu}{1 - \mu} \cdot \frac{\max \{\zeta b_N - b_M, 0\}}{p - b_N} \quad (8)$$

See Appendix A.3 for a derivation. Equation (7) shows that the equilibrium low-pay sector share  $\phi$  is increasing in the exogenous  $\tilde{\mu}$  parameter. In turn, (8) shows that  $\tilde{\mu}$  is increasing in (i) the migrant share  $\mu$ <sup>17</sup>, (ii) decreasing in the migrant unemployment utility  $b_M$  (relative to the native utility  $b_N$ ), and (iii) increasing in the tightness of the internal pay constraint,  $\zeta$ . If  $\zeta$  is sufficiently small, the pay constraint does not bind; so  $\zeta b_N < b_M$ , and  $\tilde{\mu}$  and  $\phi$  collapse to zero, with all firms paying  $b_N$  to natives and  $b_M$  to migrants.

<sup>16</sup>Note that  $\pi^h = \pi^l$  is not a knife-edge case: it arises for a discrete range of parameter values, as the low-pay sector share  $\phi$  serves to equalize profits in equilibrium.

<sup>17</sup>If there are very few migrants, such that  $\tilde{\mu} \leq \frac{r + \delta + \lambda}{r + \delta}$ , the low-pay strategy is never profitable (so  $\phi = 0$ ). With sufficiently many migrants, such that  $\tilde{\mu} \geq \frac{\delta + \lambda}{\delta}$ , all firms will adopt the low-pay strategy (so  $\phi = 1$ ). In between these values, the  $\tilde{\mu}$  parameter (and hence  $\phi$ ) are increasing continuously in the migrant share  $\mu$ .

## 2.2 Comparative statics

We now consider the impact of immigration. Our strategy is to study changes in the migrant share  $\mu$ , holding  $\frac{n}{k}$  (the ratio of workers to firms) fixed: this allows us to abstract from scale effects, and focus entirely on the implications of labor force composition. Of course, one might expect  $\frac{n}{k}$  to change in response to immigration, and we consider this possibility in an extension below. In practice though, the  $\frac{n}{k}$  ratio changes little in our empirical application.

**Proposition 1.** *If the internal pay constraint binds, firms adopt differential wage strategies, and migrants concentrate in low-paying firms.*

If the pay constraint (4) does not bind, there is no wage differentiation between firms and no workplace segregation: all firms offer  $b_N$  to natives and  $b_M$  to migrants, and hire all workers they meet. However, if the constraint is sufficiently tight ( $\zeta$  sufficiently large), the  $\tilde{\mu}$  parameter in (8) will exceed the threshold in equation (7), and the low-pay sector share  $\phi$  will exceed zero: i.e. a low-pay strategy (which undercuts natives) becomes profitable. This generates heterogeneous pay strategies, even among ex ante identical firms: “high-pay” firms appeal to all workers, and “low-pay” firms only to migrants.

Proposition 1 thus has two broader implications for interpreting native-migrant disparities. First, workplace segregation can emerge *endogenously* from firms’ wage policies, even without homophily or ethnic networks. Second, the locus of the native-migrant wage gap – whether it manifests *within* or *between* firms – depends on the stringency of internal pay constraints. A tighter constraint (larger  $\zeta$ ) narrows differentials within firms, but enlarges gaps between them – as more firms adopt low-pay strategies and prioritize migrant recruitment.

**Proposition 2.** *A larger migrant share  $\mu$  induces firms to reduce offers at the bottom of the pay distribution. In our stylized model, this manifests through a larger low-pay sector share  $\phi$  and a smaller low-pay migrant offer  $w_M^l$ .*

When the pay constraint binds, firms face a trade-off when setting their wage: the low-pay strategy increases profit per worker, but denies firms access to natives. As the migrant share  $\mu$  increases however, this trade-off becomes more attractive – so more firms reduce their offers at the bottom of the pay distribution, where migrants are concentrated.

In our stylized model, these wage effects manifest in two ways. First, as equations (7) and (8) show, a larger migrant share  $\mu$  increases the low-pay sector share  $\phi$ . Second, as (5) shows, the larger  $\phi$  causes the migrant reservation  $w_M^r$  (and hence the low-pay offer  $w_M^l$  itself) to decrease. Intuitively, since the larger  $\phi$  reduces the quality of migrants’ outside options, firms can now recruit them at lower pay. See Appendix A.4 for a proof.

**Proposition 3.** *As firms adopt the low-pay strategy (in response to a larger migrant share  $\mu$ ), they reduce their native employment.*

This follows directly from the binding pay constraint: as the low-pay sector share  $\phi$  grows, those firms which adopt the low-pay strategy must forgo access to high-reservation workers (i.e. natives). At the aggregate level, a larger low-pay sector reduces native employment: as equation (6) shows,  $u_N$  is increasing in  $\phi$ . Among natives who remain employed, there is an implicit reallocation towards those (fewer) high-pay firms which continue to recruit natives.

**Proposition 4.** *A larger migrant share  $\mu$  may potentially reduce average firm size.*

Average firm size can be expressed as  $\bar{l} = \phi l_M^l + (1 - \phi) (l_M^h + l_N^h)$ , where  $l_M^l$  and  $l_M^h$  are migrant employment in low/high-pay firms, and  $l_N^h$  is native employment in high-pay firms. As Appendix A.5 shows, holding the worker-firm ratio  $\frac{n}{k}$  fixed, the effect of migrant share  $\mu$  on  $\bar{l}$  is:

$$\frac{d\bar{l}}{d\mu} = \underbrace{\frac{n}{k} \left[ \frac{\lambda}{\delta + \lambda} - \frac{\lambda(1 - \phi)}{\delta + \lambda(1 - \phi)} \right]}_{\text{Composition effect}} - \underbrace{\frac{n}{k} \cdot \frac{(1 - \mu)\lambda\delta}{[\delta + \lambda(1 - \phi)]^2} \cdot \frac{d\phi}{d\mu}}_{\text{Wage-setting effect}} \quad (9)$$

The sign of  $\frac{d\bar{l}}{d\mu}$  is ambiguous, as it reflects two opposing forces. The first is a positive “composition effect”: for a given offer distribution, a larger migrant share  $\mu$  increases the size of low-pay firms, since only migrants accept their offers. The second is a negative “wage-setting effect”: a larger  $\mu$  induces more firms to adopt the low-pay strategy, which reduces native employment. Depending on parameter values, either effect may dominate (see Appendix A.5 for proof). And depending on how the number of firms  $k$  changes (see Section 2.4 below), *total employment* may also decrease – not just average firm size.

Finally, these wage-setting effects are mediated by two key sources of heterogeneity:

**Proposition 5.** *Firms are more likely to adopt the low-pay strategy and reduce native employment when: (i) migrants have lower unemployment utility  $b_M$  (and hence lower reservation wages) or (ii) productivity  $p$  is lower.*

This follows directly from equations (7) and (8): reductions in both  $b_M$  and  $p$  increase the  $\tilde{\mu}$  parameter, and hence the low-pay sector share  $\phi$ . Intuitively, immigration is more likely to induce firms to undercut native workers if migrants can be recruited more cheaply: i.e. if  $b_M$  is small relative to  $b_N$ . These effects are further amplified if productivity  $p$  is low relative to the native reservation  $b_N$ : this reduces the rents from employing natives, so a low-pay strategy becomes more attractive. Both results are important for our empirical application, as migrants were reported to work for unusually low wages (see Figure 1), and as Germany fell into recession in the latter half of our analysis period. We test these predictions

in Section 9. Moreover, the pivotal role of migrants’ reservation wages has significant policy implications (discussed next). Note that our model does not provide clear predictions on the effect of other sources of heterogeneity, such as labor market concentration.

### 2.3 What is new here?

The labor market impacts differ markedly from competitive models. They also diverge from nascent work linking monopsony and immigration (notably, Amior and Manning, 2026), as we allow firms to adopt *distinct pay strategies*: this drives our core results on segregation, inequality and employment. Moreover, the model delivers important insights for policy.

**Distributional effects.** If the pay constraint binds, immigration can affect the offer distribution across *firms*, even for workers of identical skill. As the migrant share  $\mu$  grows, more firms adopt a low-pay strategy and reduce native employment. High-wage jobs become scarcer, and workers who miss out must either accept low offers or remain unemployed. Thus, native-migrant wage gaps manifest increasingly *between* firms, rather than within them. This contrasts with conventional models, where effects vary only across the *worker skill* distribution, due to differential changes in marginal products. We do not rule out this channel, but our model highlights important distributional effects which empirical research might otherwise miss. In particular, wage effects should be concentrated among low-paying firms – a novel empirical implication we test below.

**Firm size and employment.** Our model allows for large negative effects on firm size and employment, which are otherwise difficult to justify. In competitive frameworks, wages can of course fall due to diminishing marginal products. But since we are restricted to movements along the labor demand curve, any wage reduction must be accompanied by employment growth – and for plausible parameterizations, by large employment growth.<sup>18</sup> In contrast, in our model, firms adopting a low-pay strategy move down their labor *supply* curves, which may *reduce* employment overall (so crowd-out exceeds one-for-one). This mirrors the classic insight that minimum wages need not reduce employment under monopsony. The converse applies here: wage declines need not raise employment.

**Policy implications.** Our model attributes these effects not to immigration per se, but to migrants’ low reservation wages – and firms’ ability to exploit this. This leads to distinctive policy implications. In competitive models, wage impacts stem from shifts in relative factor supplies, limiting policy responses to measures that alter these supplies (e.g.,

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<sup>18</sup>Consider a pessimistic case for native labor, where native and migrant workers are perfect substitutes, in a two-factor model with labor and capital. Even here, assuming Cobb-Douglas technology (with a  $\frac{2}{3}$  labor share), a 1% immigration-driven reduction in wages would generate a 3% increase in total employment (with capital fixed) or more (if capital is elastic).

training programs or visa skill criteria). But here, the key margin is firms’ wage-setting behavior *conditional* on productivity – so adverse effects can be mitigated by policies that constrain it. These include measures which directly restrict wage flexibility, such as minimum wages, collective bargaining, or “prevailing wage” requirements<sup>19</sup>, as well as measures that strengthen migrants’ outside options, such as regularization or integration programs.<sup>20</sup>

## 2.4 Theoretical extensions

The baseline model clarifies our basic story, but it is very stylized. We now consider various theoretical extensions: some amplify the effects described above, and others attenuate them.

**(i) Heterogeneous native reservations.** In the baseline model, the wage and welfare effects fall entirely on migrants: natives earn their reservation wage in equilibrium, so they lose nothing from exiting employment. But this is not true if natives have heterogeneous reservation wages. If *some* natives have the same unemployment utility flow as migrants (i.e.  $b_M$ ), immigration will reduce natives’ *realized* wages – and not just the *offers* they receive.

**(ii) On-the-job search.** In Appendix B, we introduce on-the-job search, as in Burdett and Mortensen (1998). Rather than a single wage  $w_M^l$ , the low-pay sector now contains a distribution of offers (between  $b_M$  and  $b_N$ ), as firms compete directly for employees; and the high-pay sector contains a distribution of offers exceeding  $b_N$ . The propositions above are unaffected. But since natives now receive positive rents in employment, immigration will reduce native wages – just as in the previous extension. Intuitively, when firms drop into the low-pay sector, this reduces high-pay competition; so native wages converge towards  $b_N$ .<sup>21</sup>

**(iii) Other reservation wage stories.** In the baseline model, we attribute differences in native and migrant reservations entirely to out-of-work utility,  $b_N$  and  $b_M$ . But in principle, these differences may be amplified by high migrant discount rates  $r$  or low contact rates  $\lambda$ .<sup>22</sup>

**(iv) Endogenous  $\frac{n}{k}$  and contact rate  $\lambda$ .** In the baseline model, we take the ratio of workers  $n$  to firms  $k$  as given. But there are reasons why it may change. First,  $\frac{n}{k}$  may

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<sup>19</sup>The requirement for firms to meet “prevailing” market wages is found in many visa programs, e.g. the US’s H-1B and H-2B. This makes little sense in a competitive market, where wages merely reflect marginal products; but it is very relevant in the imperfectly discriminating monopsony model we describe here.

<sup>20</sup>Notably, Townsend and Allan (2024) show that easing visa-related restrictions on migrants’ job mobility can raise wages for natives and migrants alike.

<sup>21</sup>This extension also implies some interesting transitory dynamics: on arrival, migrants begin at the bottom of the job ladder, and gradually work their way up. This speaks to empirical evidence which documents an important contribution of job mobility to migrant wage assimilation (Lehmer and Ludsteck, 2015; Dustmann, Ku and Surovtseva, 2024; Arellano-Bover and San, 2020); and see also Appendix F.4.

<sup>22</sup>For example, migrants may discount their time in the host country more heavily (larger  $r$  in the model) due to return intentions or deportation risk (Amior, 2017; Adda, Dustmann and Görlach, 2022). Alternatively, Caldwell and Danieli (2024) find that migrants have fewer outside job options than natives (lower  $\lambda$ ). As equation (5) shows, if  $b_M < b_N$ , a low  $r$  or low  $\lambda$  will reduce the migrant reservation wage  $w_M^r$  further.

contract if the number of firms  $k$  remains fixed, and immigration causes the labor force  $n$  to expand. Alternatively, larger profits may encourage large firm entry, such that  $k$  grows relative to  $n$ ; and this may also shift the contact rate  $\lambda$ . In Appendix C, we show the wage and employment effects (in Propositions 2-4) are preserved in this scenario: intuitively, new firms will only enter in equilibrium if they can offer lower wages.

**(v) Heterogeneous firms.** The baseline model predicts dispersion in firms’ pay and hiring strategies, even if firms are identical. In Appendix D, we show that firm heterogeneity (by productivity  $p$ ) amplifies these effects. Low- $p$  firms offer lower wages in equilibrium (as in Albrecht and Axell, 1984), and they also drop into the low-pay sector more readily in response to immigration. Immigration may also induce Melitz-type (2003) selective entry of low-quality firms, which cannot operate without low-reservation labor. This result mirrors Dustmann et al. (2021), who show how a minimum wage forces low- $p$  firms out of the market.

**(vi) Native exit.** If natives lose job opportunities, some may choose to exit the labor force (e.g. early retirement) or relocate elsewhere (if the shock is spatially concentrated, as in our empirical application). This will cause the migrant share  $\mu$  to grow further, encouraging more firms to adopt low-pay strategies, so even more natives exit; and so on. This process makes the labor market ever less competitive – and amplifies the effects we describe.

**(vii) Heterogeneous skills and endogenous marginal products.** We have assumed that natives and migrants do not differ in skill. But suppose they are distributed (potentially differently) across multiple skill types  $j$ , and that firms can set wages of different skill types independently. The baseline model can then be interpreted as the labor market for a particular skill type  $j$ , whose constituent natives and migrants are productively identical. Wages in market  $j$  will depend on both  $p_j$  (the skill-specific marginal product, which is affected by immigration in the usual way) and firms’ wage-setting choices. If migrants are distributed differently to natives across types  $j$ , this would partially shelter natives from direct labor market competition – and hence from wage-setting effects. As Amior and Manning (2026) show, the implications of skill segregation are then analogous to wage discrimination: in both cases, natives are partially sheltered from direct competition with migrants.<sup>23</sup>

**(viii) Co-ethnic networks.** If migrants concentrate in different firms due to ethnic preferences or networks, this will moderate labor market competition with natives: see Gyetvay and Keita (2023). Note this “exogenous” form of segregation (i.e. determined outside the model) has very different implications to segregation which arises *endogenously* through firms’ wage policies (as in Proposition 1). While exogenous segregation *precludes* labor market competition between natives and migrants, endogenous segregation is an *outcome* of this

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<sup>23</sup>However, internal pay constraints between *skill types* (due to “vertical” equity concerns, as in Bewley, 1999; Amior and San, 2025) may undermine this sheltering effect.

same competition – as firms trade off cheaper migrant labor against access to natives.

(ix) **Idiosyncratic job preferences.** In the baseline model, we attribute wage-setting power to job search frictions. But in Appendix E, we show the key results are robust to an alternative framework with idiosyncratic job preferences, akin to Card et al. (2018).

## 3 Description of data and immigration shock

### 3.1 Data sources

Our main datasets are weakly anonymized versions of the Sample of Integrated Labour Market Biographies (SIAB) and the Establishment History Panel (BHP) from the Institute for Employment Research (IAB), accessed by remote execution. We additionally use district-level population counts and bilateral flows from the Federal Statistical Office, the Federal Office for Building and Regional Planning, and the 1987 Census (GESIS ZA2472). Our analysis covers 204 local labor markets (*Arbeitsmarktregionen*) in the SIAB, or 203 in the BHP (which merges two districts). Locations are defined by place of work, and “migrants” by nationality (naturalizations were infrequent in our analysis period).

**Sample of Integrated Labour Market Biographies (SIAB).** For our worker-level analysis, we use the SIAB-v7510 (Vom Berge, Burghardt and Trenkle, 2014), a 2% panel of dependent employees subject to social security contributions, and representative of over 80% of the workforce.<sup>24</sup> We focus on individuals aged 16-65 in West Germany (excluding West Berlin), and construct an annual panel using records from June 30 of each year. We include both full- and part-time workers in our employment analysis, but restrict the wage sample to full-time only (using average gross daily wage in the employment spell containing the reference date).<sup>25</sup> We also merged pre-compiled AKM firm effects (estimated by Card, Heining and Kline, 2013, on the universe of employment records) to our SIAB sample.

**Establishment History Panel (BHP).** To study effects across the firm distribution, we use the BHP-v7510 and BHP-v7519<sup>26</sup> (Gruhl, Schmucker and Seth, 2012), which contain establishment-level data on employment and wages for 50% of all establishments. For presentational purposes, we use the terms “establishments” and “firms” interchangeably.

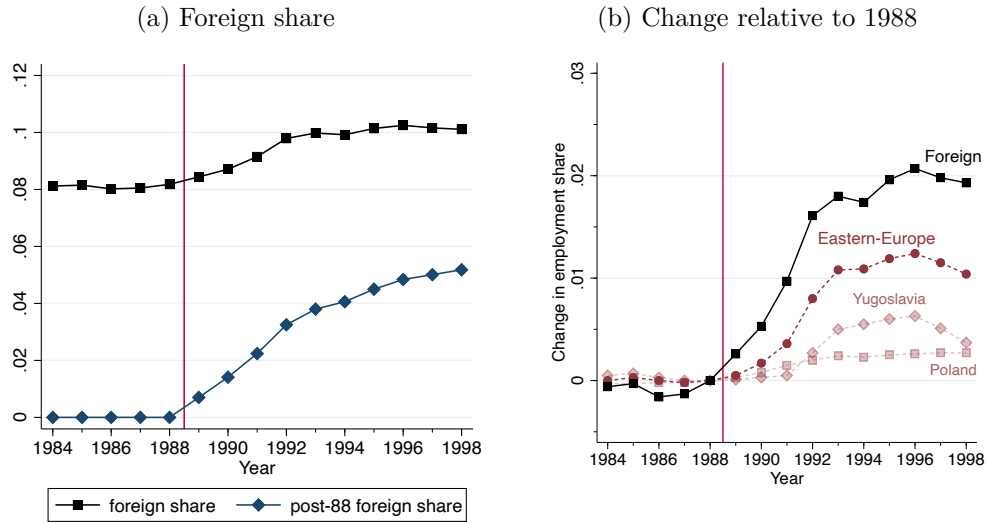
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<sup>24</sup>The SIAB excludes civil servants, the self-employed, full-time students, and the military. The native self-employment rate was fairly stable during our analysis period, and migrant arrivals are unlikely to displace civil servants due to legal restrictions (Brücker and Jahn, 2011).

<sup>25</sup>Wages are right-censored at the social security contribution ceiling (less than 6% of observations): we impute censored wages by following the method of Dustmann, Ludsteck and Schönberg (2009), and missing educational information following Fitzenberger, Osikominu and Völter (2006).

<sup>26</sup>We use BHP-v7510 to construct local migrant shares and the enclave instrument (as it reports employment by nationality), and BHP-v7519 for all other analysis, as it contains more detailed wage data and AKM firm effects (estimated by Bellmann et al. 2020 on the full sample).

Figure 2: Foreign share of employment



SIAB, foreign share of employment (Panel a) and change in employment shares of selected nationalities (Panel b).

### 3.2 National trends in immigration

The early 1990s saw a large and sudden immigration wave, triggered by the fall of the Iron Curtain and Yugoslav War. As Figure 2a shows, between 1988 and 1993, the share of foreign nationals in regular employment grew from 8 to 10% (black line). By 1997, over 5% of the workforce consisted of foreigners who entered after 1988 (blue line), equal to about 1 million workers. Panel b shows that much of the shock originated from Eastern Europe, especially Yugoslavia and Poland. In addition, there was an influx of subcontracted “posted workers” from foreign firms who are not subject to social security (and therefore not listed in our data): these numbered about 90,000 in 1993, mostly employed in construction (Werner, 1996).

### 3.3 Observable characteristics of new migrants

Table 1 shows that the new (post-1988) migrants had less education than natives, and were also much younger: 62% were under 30. They also tended to work in smaller firms: their average establishment size is half that of natives’. The contrast is even more striking when comparing them to previous migrants (which includes the “guest worker” generation), who often worked in large manufacturing firms (Brinatti and Morales, 2021).

The influx was heavily concentrated sectorally, as Table A1 shows. Foreign share increased nearly 11pp in hospitality, and also grew strongly in agriculture, food manufacturing, household services and construction. Few migrants entered the public sector or shrinking industries such as mining. While previous migrants were overrepresented in tradable industries (a legacy of the guest worker program), new arrivals were not (column 9). Social security data exclude the self-employed, but external sources indicate that self-employment

Table 1: Characteristics of natives and migrants

	Female share (1)	Education shares			Age shares			Estab. size ( $\emptyset$ ) (8)	Tradable share (9)
		Low (2)	Mid (3)	High (4)	16-29 (5)	30-49 (6)	50-65 (7)		
Natives	0.420	0.164	0.754	0.082	0.294	0.487	0.219	1,336	0.378
Previous migrants	0.303	0.462	0.492	0.046	0.160	0.599	0.241	2,204	0.540
New migrants	0.354	0.620	0.340	0.040	0.625	0.347	0.028	718	0.349

Notes: SIAB, mean values for 1990-96, for individuals aged 16-65. "Previous" migrants entered employment before 1989, "new" migrants in or after 1989. "Mid" education is upper secondary or vocational degree, and "high" is university or technical college. Sample in millions is 2.064 for natives, 0.161 for previous migrants, and 0.073 for new migrants.

rates were slightly lower for migrants than natives in the 1990s (Liebig, 2007).

## 4 Firm effects in native-migrant wage differentials

Our premise is that firms enjoy significant flexibility in setting their overall pay level, but may be constrained in their ability to discriminate *internally* between native and migrant employees. Such internal constraints, which can be rationalized by workers' equity concerns (e.g. Bewley, 1999), open the door to the monopsonistic trade-off and endogenous workplace segregation at the heart of our model. Moreover, the stringency of these constraints determines whether native-migrant wage gaps manifest *within* versus *between* firms (Proposition 1). Before estimating the impact of the shock, we assess this question empirically. We first decompose *average* native-migrant wage differentials into their between- and within-firm components, and then explore how these gaps vary across the firm pay distribution.

### 4.1 Average wage differentials

In Table 2, we use Mincer equations (for log wages) to estimate native-migrant wage differentials. On average, pre-1989 migrants earned slightly more than natives (4 log points), but new migrants were paid 44 log points less (column 1). Though columns 2-3 show that much of this differential can be explained by age, education, gender and occupation (12-group classification), new migrants still earned 10 points less conditional on these characteristics.

The residual gap may be rationalized by low migrant reservation wages in many non-competitive frameworks, not just ours. But as we now show, it is mostly driven by migrants *sorting into* low-paying firms (consistent with Proposition 1), and not wage discrimination *within* firms. We first restrict our sample to firms containing both natives and migrants: the coefficients remain similar (cf. columns 3 and 4), with a -0.12 new migrant effect. In column 5, we then introduce firm fixed effects: remarkably, this eliminates most of the gap,

Table 2: Average migrant wage differentials

	Basic sample			Firms with natives and migrants		
	(1)	(2)	(3)	(4)	(5)	(6)
Previous migrants	0.041*** (0.003)	-0.005* (0.003)	0.021*** (0.003)	-0.010*** (0.003)	-0.006*** (0.002)	-0.005** (0.002)
New migrants	-0.440*** (0.004)	-0.085*** (0.003)	-0.098*** (0.003)	-0.120*** (0.004)	-0.037*** (0.003)	-0.026*** (0.003)
Year fixed effects	Y	Y	Y	Y	Y	Y
Edu × age × sex FEs		Y	Y	Y	Y	Y
Edu × age × sex × occ FEs			Y	Y	Y	Y
Firm FEs					Y	Y
Firm × occ FEs						Y
Observations (mil.)	2.583	2.583	2.583	1.022	1.022	1.022
$R^2$	0.023	0.512	0.583	0.629	0.755	0.805

Notes: SIAB, mean values for 1990-96, for individuals aged 16-65. "Previous" migrants entered employment before 1989, "new" migrants in or after 1989. Standard errors clustered at establishment level, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

which falls below 4%. Conditioning on interacted firm-occupation effects (column 6) shrinks it further.<sup>27</sup> Consistent with these results, Appendix F.4 confirms that new migrants are concentrated in low-paying firms (with low median wages and AKM premia).<sup>28</sup> Our claim here is not that workplace sorting can account for *all* the residual variation (i.e. that  $\zeta$  in the model is exactly 1), but rather that workplace sorting (of observably similar natives and migrants) contributes significantly to native-migrant wage differentials. This merely requires that the internal pay constraint in (4) binds in equilibrium.

This pivotal role of between-firm variation aligns with the institutional setting: Germany had no minimum wage at the time; and though there is collective bargaining at the industry-region level, individual firms can choose to opt out. Small firms are especially likely to do so, and coverage eroded significantly in the 1990s (Jäger, Noy and Schoefer, 2022). Importantly, workplace segregation of migrants was not merely a byproduct of “skill sorting” (i.e., assortative matching between productive workers and firms): in line with Swedish evidence from Aslund et al. (2021), Appendix F.4 shows that new migrants were much more concentrated in low-paying firms than natives of the same education, gender and age.

<sup>27</sup>Native-migrant differentials were significantly larger for older workers, both between and within firms (unlike the younger migrants who dominate our sample). This may reflect institutional regulations or limited transferability of work experience. Moreover, wages were even lower for “posted” workers, who are outside our sample: Cyrus and Helias (1993) report that Polish posted workers received less than half the going rate. See also Muñoz (2023) on posted workers in France.

<sup>28</sup>These findings align with Aydemir and Skuterud (2008), Dustmann, Ku and Surovtseva (2024), Arellano-Bover and San (2020) and Dostie et al. (2023), who show that migrants sort heavily into low-pay firms in other contexts. But like Arellano-Bover and San (2020), we also show in Appendix F.4 that migrants gradually move to higher-paying firms over time, consistent with an on-the-job search extension: see footnote 21.

Table 3: Migrant wage differentials across firm pay distribution

	Previous migrant premium			New migrant premium		
	OLS (1)	IV (2)	EB (3)	OLS (4)	IV (5)	EB (6)
Native firm premium	0.549*** (0.014)	1.005*** (0.037)	0.969*** (0.020)	0.586*** (0.018)	0.969*** (0.045)	1.011*** (0.032)
Observations	10,810	8,176	10,810	7,648	5,450	7,648

Notes: Establishment-level regressions, based on SIAB data over 1990-96. "Previous" migrants entered employment before 1989, "new" migrants in or after 1989. Standard errors clustered at establishment level, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 4.2 Wage differentials across firm pay distribution

Table 2 focuses on *average* wage differentials. We next show that wage gaps vary little across the *firm pay distribution*. That is, despite migrants' apparent willingness to accept lower wages, firms that paid natives well tended to offer migrants similarly high returns – relative to other firms. This result is consistent with a binding internal pay constraint, which lies at the heart of our model.

We begin by estimating firm wage premia, separately for natives, new migrants and previous migrants. For each group, we estimate Mincer equations with interacted education-age-gender effects, year effects, and firm effects (which we save). We then regress the estimated firm premia for migrants on those of natives, across those (typically larger) firms which contain both natives and migrants.

We present our estimates in Table 3. The OLS coefficients in columns 1 and 4 are 0.5 or 0.6: i.e. firms which pay natives 10% more (conditional on observables) tend to pay migrants 5-6% more. However, these coefficients are attenuated by measurement error in the native firm premia. This bias can be corrected using "split-sample" IV as in e.g. Drenik et al. (2023), or empirical Bayes (EB) as in Walters (2024): see Appendix F.2 for details. Using either correction, the coefficients are close to 1 for both new and previous migrants.

In principle, these estimates may still be conflated by unobserved worker heterogeneity across firms. But following a strategy akin to Aslund et al. (2021), we show in Appendix F.3 that natives and migrants who *transition* from firms with low to high AKM premia enjoy similar wage gains. Moreover, while the split-sample estimates in Table 3 are based on a sample of larger firms, the evidence in Appendix F.3 covers the full sample.

In summary, even though new migrants are more likely to accept jobs at low-pay firms (Table 2), high-pay firms appear unable or unwilling to discriminate differentially against them (Table 3). This matches evidence from other countries<sup>29</sup>, and we offer a new interpre-

<sup>29</sup>Dostie et al. (2023) find similar results in Canada; Arellano-Bover and San (2020) estimate that migrants

tation rooted in imperfectly discriminating monopsony. More broadly, our results align with growing evidence that wages are not typically tailored to individual workers in low-skilled markets (Caldwell and Harmon, 2019; Lachowska et al., 2022; Di Addario et al., 2023).

## 5 Empirical strategy

We now describe our empirical strategy, which exploits regional variation in immigrant arrivals across West German labor markets, using a past-settlement instrument. We also discuss potential confounders related to German reunification and sectoral shifts.

### 5.1 Regional variation and estimating equation

We implement a generalized difference-in-differences model, allowing for dynamic treatment effects. Separately for each year  $t \in \{1985, \dots, 1996\}$ , we estimate:

$$\Delta y_{rt} = \alpha_t + \beta_t \Delta m_r + \gamma_t X_{rt} + \varepsilon_{rt} \quad (10)$$

where  $\Delta y_{rt} = y_{rt} - y_{r88}$  is the change in some outcome  $y_{rt}$  (such as wages or employment) in region  $r$  between the base year 1988 and year  $t$ ,  $\Delta m_r$  measures the regional immigration shock between 1988 (when the migrant share began to expand) and 1993 (when it stabilized), and  $X_{rt}$  is a vector of region  $r$  controls. We describe the shock variable and controls below. Observations are weighted by base year employment. As (10) is expressed in differences, we implicitly control for pre-treatment regional differences in outcome  $y$  (region fixed effects).

We estimate (10) separately for each year  $t$ : this allows the impact of both immigration ( $\beta_t$ ) and controls ( $\gamma_t$ ) to vary by year. For post-treatment years  $t > 1988$ , the  $\beta_t$  capture the dynamic (reduced-form) impact of the immigration shock  $\Delta m_r$  in year  $t$ . For pre-treatment years  $t < 1988$ , the  $\beta_t$  represent falsification tests on the existence of pre-trends to support the validity of our research design. These tests are informative in our setting, as the sudden onset of the shock allows for a sharp distinction between pre- and post-treatment periods. Moreover, our estimates are not subject to dynamic spillovers from earlier shocks, which can be sizable in other settings (Amior and Manning, 2018; Jaeger, Ruist and Stuhler, 2018).

We use the same shock  $\Delta m_r$  for every year  $t$ , irrespective of whether the outcome  $\Delta y_{rt}$  is defined over the entire region  $r$  or for particular firms or workers. Since we rely on “pure”

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receive 85% of the rents of natives in higher-pay firms in Israel (i.e. there is some differential discrimination, but limited); and in Sweden, Aslund et al. (2021) find that migrants benefit somewhat *more* than natives from working in productive firms. Interestingly, the pattern appears very different for other, non-regular forms of labor: outsourced workers only receive half the premium paid by firms to their regular employees (Drenik et al., 2023), and posted workers receive just 10% (Muñoz, 2023).

spatial variation, we identify the “total” effect of the particular immigration event we study (Dustmann, Schoenberg and Stuhler, 2016).

## 5.2 Identifying the immigration shock

We identify regional immigration shocks  $\Delta m_r$  with the enclave instrument of Card (2001). This instrument predicts local changes in foreign shares based on the distribution of foreign nationals at baseline, motivated by migrants’ preference to settle in large enclaves. The aim is to isolate variation which is orthogonal to omitted demand shocks. Formally:

$$\Delta m_r = \frac{\sum_o s_{or80} (n_{o93} - n_{o88})}{n_{r80}} \quad (11)$$

where  $n_{o93} - n_{o88}$  is the national 1988-93 change in origin  $o$  migrant stock,  $s_{or80} = \frac{n_{or80}}{n_{o80}}$  is the share of origin  $o$  migrants located in region  $r$  in 1980, and  $n_{r80}$  is total local employment in 1980. We purposely choose a fixed time interval for the enclave shock, as both the treatment intensity and response are plausibly dynamic (and difficult to disentangle).

We use the enclave shock  $\Delta m_r$  directly as an explanatory variable, interpreting the coefficients  $\beta_t$  in (10) as “reduced-form” effects. This allows us to avoid taking a stance on whether the relevant endogenous variable is the overall or post-1988 foreign share (see Figure 2a). As with all shift-share instruments, identification may be motivated by the exogeneity of the initial local origin shares (Goldsmith-Pinkham, Sorkin and Swift, 2020) or the origin-specific migrant inflows (Borusyak, Hull and Jaravel, 2022).<sup>30</sup> A key piece of evidence supporting instrument validity is the falsification tests for years  $t < 1988$  (i.e. parallel pre-trends), and we demonstrate robustness to key confounders related to local demographics and industry structure (see Section 5.3 and Appendix Table A5).

We also exploit this structure to test for heterogeneous labor market effects by migrants’ reservation wage. We divide migrant origins  $o$  into two groups, according to their predicted reservation wages; and we construct distinct enclave shocks for each group. In Section 9, we show this variation offers sufficient power to disentangle group-specific immigration shocks.<sup>31</sup>

Figure 3 maps the spatial distribution of the enclave shock  $\Delta m_r$  (Panel a) and changes

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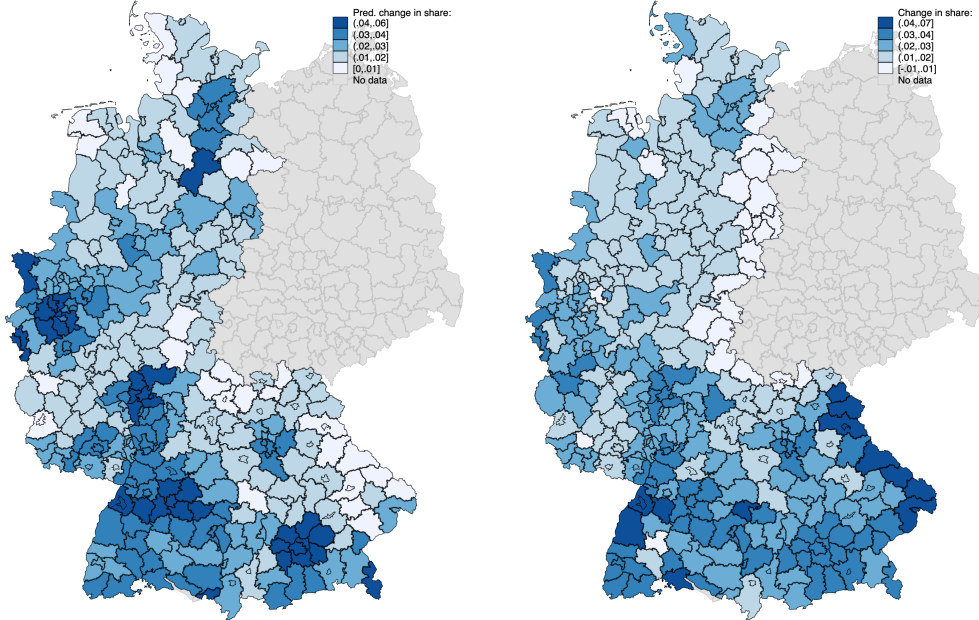
<sup>30</sup>However, such motivation is less straightforward in the migration literature. The assumption of exogenous immigration “shifts” is plausible here, as they were triggered by external political events (Section 3.2); but as is typical, these shifts were concentrated in a few origin groups (with high “Rotemberg weights”), violating the “many uncorrelated shocks” requirement of Borusyak, Hull and Jaravel (2022). Conversely, an exogeneity-of-shares assumption may be contested, as migrant shares often correlate with other local characteristics. These concerns motivate our use of falsification (pre-trend) and robustness tests.

<sup>31</sup>As Goldsmith-Pinkham, Sorkin and Swift (2020) note, the shift-share instrument effectively aggregates many different instruments (here, corresponding to individual origin groups). If treatment effects are hypothesized to be constant, this implies testable overidentifying restrictions (see Apfel, 2024). If treatment effects are instead expected to vary (as here), we can exploit this structure to test for the predicted heterogeneity.

Figure 3: Changes in foreign employment share (1988-93)

(a) Predicted: enclave shock  $\Delta m_r$

(b) Actual change in foreign share



Notes: BHP. Panel a shows predicted changes in foreign employment share between 1988 and 1993 (i.e. the enclave shock  $\Delta m_r$ ), across local labor markets in West Germany. Panel b shows actual changes in foreign employment share.

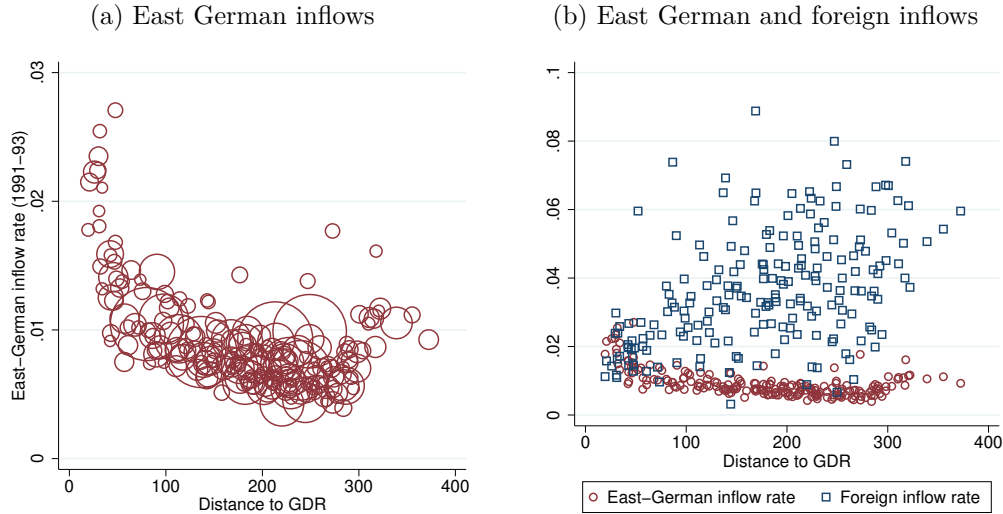
in foreign employment share (Panel b) between 1988 and 1993. Visually, the enclave shock appears to predict immigration well: both are clustered in similar places. In Appendix Figure A3, we plot the variables against each other: the correlation is 0.55, and is driven by both high and low-population regions. In two regions however, the enclave shock  $\Delta m_r$  lacks predictive power. First, foreign shares grew sharply near the Czech border (southeast) due to cross-border commuting (see Dustmann, Schoenberg and Stuhler, 2017). Second, very few migrants settled near the East-West German border, likely to avoid labor market competition with East Germans after reunification. See Appendix G.2 for details.

### 5.3 Potential confounders and controls

Our setting offers several advantages: external triggers of migrant inflows (“push factors”), their size and spatial dispersion, their abrupt onset (yielding a clean distinction between pre- and post-treatment periods), and high-quality panel data on workers and firms. But contemporaneous events may confound our results: we discuss each in turn, and explain how they motivate our baseline controls. Our results remain similar when including no or additional controls (see Appendix Table A5).

(i) **Reunification.** Reunification led to large inflows of East Germans to the West, but we argue its effects can be captured by a distance control. As Figure 4a shows, these inflows

Figure 4: Comparing East German and foreign inflows



Notes: Destatis and SIAB. Panel a plots inflow rates of East Germans between 1991 and 1993 in West German districts, against distance to the inner German border. Panel b compares East German and foreign inflows between 1989 and 1993.

are strongly predicted by distance to the inner German border (correlation with log distance is  $-0.67$ ).<sup>32</sup> In contrast, distance is uncorrelated with foreign inflows (Panel b), except for regions closest to the border (which attract very few migrants: see above). Once we condition on log distance, actual and predicted changes in foreign share are uncorrelated with East German inflows (Appendix G.3). We therefore include this control in all regressions; it also captures other (time-varying) distance-related consequences of reunification, such as changes in the spatial distribution of trade.

**(ii) Repatriation of ethnic Germans.** The fall of the Iron Curtain also triggered a return of ethnic Germans (who are coded as German nationals) from the Eastern Bloc. But in Appendix G.4, we show that ethnic German and foreign inflows are only weakly (negatively) correlated spatially; so their repatriation is not a concern for our analysis.

**(iii) Other demand and supply shocks.** As in most migration studies, foreign shares are spatially correlated with sectoral and demographic structure, which can be problematic if these attributes predict future wage or employment growth. One particular concern is the 1993 recession, which led to large manufacturing employment losses shortly after immigration arrivals peaked.<sup>33</sup> To address this, we control for two Bartik-type shift-shares that predict employment and wage growth using each region’s 1980 industrial composition.<sup>34</sup> On the

<sup>32</sup>While East Germans are not reliably identified in the SIAB, the Federal Statistical Office reports inter-district population flows from 1991.

<sup>33</sup>The recession is only a confounder if its intensity covaries spatially with the immigration shock. But it may also amplify its effects: as Proposition 5 shows, these become more acute if productivity  $p$  is low.

<sup>34</sup>The “employment Bartik” weights national-level industry employment growth with initial local composition (see Bartik, 1991). The “wage Bartik” applies these weights to national wage growth (as in Beaudry, Green and Sand, 2012). We use 94 (two-digit) industry codes.

supply side, a potential concern is that declines in fertility in the 1960s–70s differentially affected local population growth across West German regions in subsequent decades (Basten, Huinink and Klüsener, 2011). To exclude this variation, we control for projected working-age population growth based on 1987 census population pyramids (aging each local cohort year-by-year) in all regressions.

## 6 Aggregate region-level effects

We begin by studying aggregate effects on local labor markets, following the example of much of the literature. Though not the heart of our analysis, this provides important context for what follows. We find large crowd-out of native employment, consistent with imperfectly discriminating monopsony. In Sections 7 and 8, we will probe this interpretation by estimating wage and employment effects across the firm pay distribution.

In Figure 5a, we plot effects of the enclave shock  $\Delta m_r$  on the foreign employment share, as estimated by equation (10). The black line shows the effect on the overall foreign share, relative to 1988: there is no pre-trend, and the  $\beta_t$  coefficient peaks at 0.3 in 1993. The blue line traces the share of post-1988 foreigners: this is zero by construction before 1988, and reaches 1 by 1995. This coefficient makes it simple to interpret the reduced-form estimates below: *a 0.01 change in  $\Delta m_r$  corresponds to a 1 pp foreign inflow* (i.e., the first-stage coefficient is one). In Appendix H.2, we show that this response is robust to different controls and regression weights. Note the post-1988 arrivals correspond most closely to the “migrants” of our model, as Section 4 suggests they have significantly lower reservation wages (based on how they sort across firms).

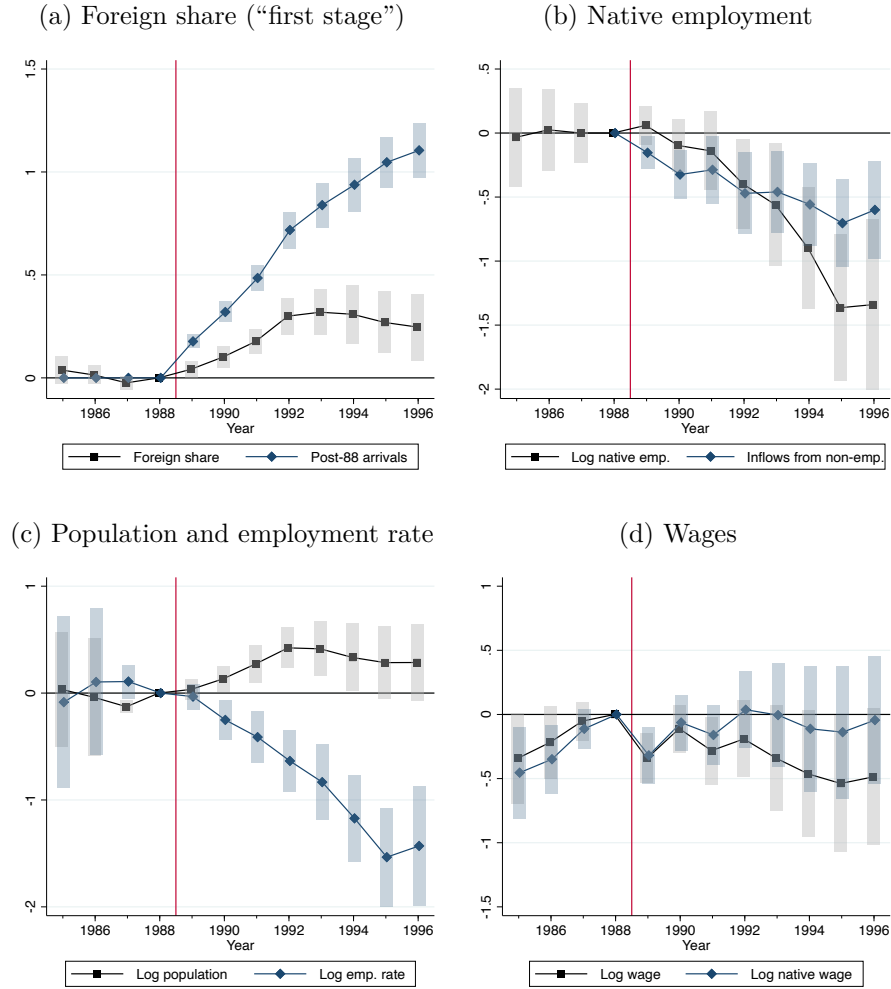
Figure 5b shows the impact on log native employment. This is large and negative, reaching -1.3% by 1995 for a 1 pp foreign inflow. It varies somewhat with controls and regression weights, but remains large in all specifications (Appendix H.2). Consistent with Dustmann, Schoenberg and Stuhler (2017), it is partly driven by reduced native *inflows* from non-employment, especially in the first years after treatment (see Appendix H.1 for details).

Our hypothesis does not rest on whether crowd-out exceeds one-for-one: as Proposition 4 shows, the model is ambiguous on this point. However, the model can help justify a large effect, even exceeding one-for-one.<sup>35</sup> According to Proposition 5, crowd-out is larger when migrants have low reservation wages and when productivity is low; note the coefficients in Figure 5b become more negative following the 1993 recession. We test explicitly for this

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<sup>35</sup>Crowd-out here is large compared to the literature, but not uniquely so. Dustmann, Schoenberg and Stuhler (2017) find that Czech commuters in Germany (in the same period) induced large crowd-out; and see Muñoz (2023) on posted workers in France, and Delgado-Prieto (2024) on Venezuelan refugees in Colombia.

Figure 5: Aggregate regional impacts



SIAB, regression estimates based on equation (10) across 204 regions, with 95% CIs. Dependent variable is regional change in some outcome between 1988 and year  $t$ . Panel a focuses on foreign employment shares (overall and post-1988 arrivals), Panel b on log native employment and the contribution of inflows from non-employment, Panel c on log population (of 15-64s) and employment-to-population rate, and Panel d on mean log wage of all full-time workers and natives.

heterogeneity in Section 9, where we show the employment effects are (i) driven by migrant origin groups that sort into lower-paying firms (consistent with lower reservation wages) and (ii) are more pronounced in regions suffering more negative demand shocks. In Appendix H.4, we show that crowd-out occurs in all sectors, but is largest in tradable industries.

Figure 5c shows a moderate increase in working-age population, smaller in magnitude than the post-1988 migrant inflow. At the same time, the employment-to-population rate fell significantly: a 1.5% decline by 1995, for a 1 pp foreign inflow. Again, this effect is robust to different controls and regression weights (Appendix H.2). Overall then, the shock led to large crowd-out of native employment, and more modest crowd-out of population.

Finally, Figure 5d shows that average regional wages declined (black line), reflecting

the arrival of low-paid migrants, but remain more stable if migrants are excluded (blue).<sup>36</sup> However, these wage effects are contaminated by compositional shifts in native employment, as low-paid workers were disproportionately displaced. We address this challenge in Section 8 using a “movers” design, which reveals large negative effects on regional wage premia.

## 7 Effects across the firm pay distribution

To test our key predictions (and specifically Propositions 1-4), we next study the impact on the *distribution of firm pay* – and on native and migrant employment across this distribution. We rely primarily on the Establishment History Panel (BHP), and use the terms “establishments” and “firms” interchangeably. Note that our model describes the impact on the market-level equilibrium *distribution* of firms, not on the behavior of *individual* firms – and this is reflected in our approach.

### 7.1 Firm quartile definitions

We split firms into four quartiles according to their median wage, separately by region and year.<sup>37</sup>: this allows us to track quartiles of the firm pay distribution over time. Our approach is analogous to tracking percentiles of the *worker* distribution (as in Dustmann, Frattini and Preston, 2012), except we do so for firms. We track quartiles rather than percentiles to simplify the estimation of employment effects.<sup>38</sup> The shock has no discernible effect on the number of firms (relative to workforce): we return to this point in Section 7.4, where we discuss effects on firm size.

In our baseline model, the quartiles reflect ex ante identical firms adopting distinct (but equally profitable) pay strategies. In practice though, firms in different quartiles likely vary in productivity. As shown in Section 2.4 (and Appendix D), this firm heterogeneity will *amplify* the wage-setting effects we describe. Intuitively, low-quality (and hence low-paying) firms will benefit disproportionately from sacrificing native labor in favor of cheaper migrants.

Table 4 reports baseline (1988) summary statistics by quartile. Firms in Q1 pay 60 log

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<sup>36</sup>Taking the visible pre-trend into account, Figure 5d suggests that native wages may also have declined. But we provide a more thorough analysis of wage effects in Section 8.

<sup>37</sup>One might alternatively rank firms by their AKM wage premia: we adopt this approach in Section 8.3. As we explain there, each approach offers advantages. Unlike the AKM premia, we observe median wages year-by-year, which allows us to estimate annual effects. And though the AKM premia condition on worker effects (a valuable benefit), they are also estimated with substantial error.

<sup>38</sup>The identity of firms within quartiles changes over time, but this is by intent: our model is informative about how the distribution responds, rather than about individual firms. Tracking individual firms is also challenging given vast churn: 38% of 1995 firms were not present in 1988. Still, our results are robust to restricting the sample to incumbent firms (see below).

Table 4: Descriptive statistics by firm wage quartile (in 1988)

	Q1	Q2	Q3	Q4
Establishments (#)	162,313	162,484	162,455	162,606
Mean wage (log)	3.023	3.622	3.899	4.217
Employment	474,204	1,180,779	2,668,530	5,477,851
Shares in each quartile	0.048	0.119	0.269	0.552
Edu shares				
Low	0.293	0.266	0.248	0.186
Middle	0.672	0.702	0.707	0.707
High	0.016	0.021	0.035	0.096
Establishment size				
mean (firm-weighted)	2.9	7.3	16.4	33.6
mean (worker-weighted)	16.8	72.8	401.0	1873.6
share small (emp<5)	0.845	0.645	0.466	0.417
share large (emp>=100)	0.001	0.007	0.026	0.053
Tradable industry share	0.189	0.306	0.357	0.475
Share foreigners	0.093	0.073	0.075	0.067
Destination shares of job movers (rows sum to 1)				
Movers originating from Q1	0.291	0.306	0.219	0.185
Movers originating from Q2	0.101	0.374	0.295	0.230
Movers originating from Q3	0.032	0.148	0.419	0.403
Movers originating from Q4	0.020	0.065	0.209	0.705

Notes: BHP in 1988, by quartiles of the median establishment wage within region and year. Shares of job movers computed using SIAB, 1985-1988. Skill, industry and foreign shares are worker-weighted.

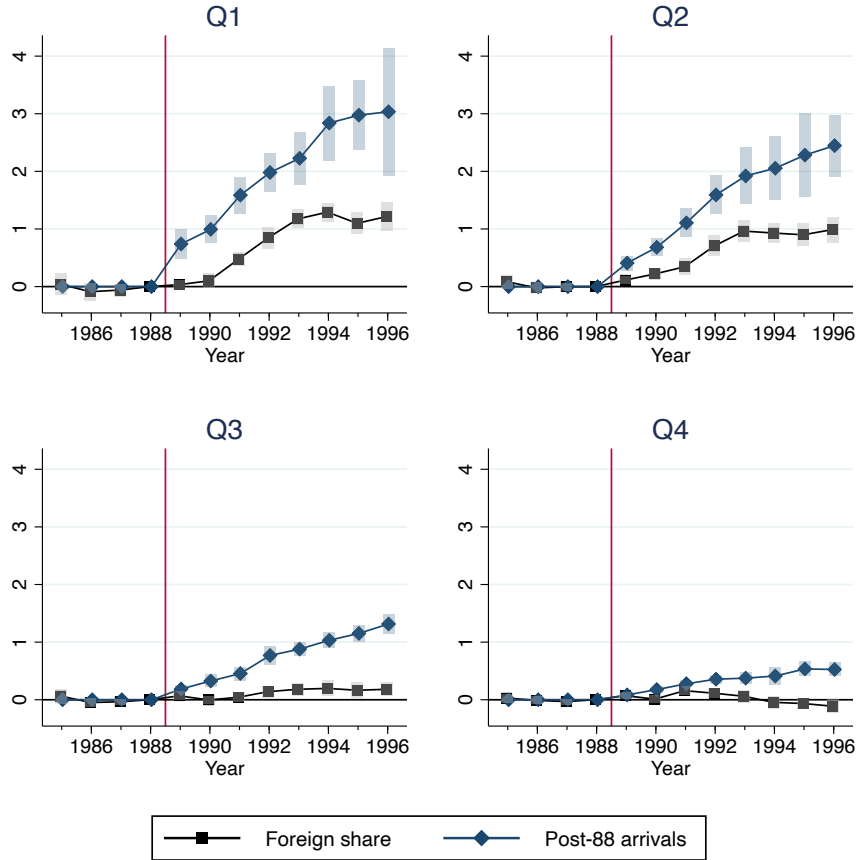
points less than Q2, and 120 less than Q4. Consistent with standard monopsony models, low-paying firms tend to be smaller: Q1 firms average 2.9 workers, compared to 33.6 at the top. Indeed, Q4 firms account for 55% of all employment. They also employ fewer low-skilled and foreign workers (at baseline), but these differences are less pronounced.

The final panel shows that job movers frequently switch between quartiles, with upward mobility much more common than downward. This is indicative of a job ladder sustained by search frictions (see the on-the-job search extension in Section 2.4 and Appendix B), and suggests that firms in different quartiles compete over similar workers – just as in the model.

## 7.2 Changes in foreign share by firm quartile (Proposition 1)

Figure 6 estimates changes in foreign shares across the firm distribution. Using equation (10), separately for each quartile, we regress changes in (i) the foreign share and (ii) the post-1988 foreign share on the regional enclave shock  $\Delta m_r$ . The post-1988 share (blue line) rises in all quartiles, but much more in low-pay firms: the expansion is six times larger in Q1 than Q4. This finding aligns with **Proposition 1**: *Migrants concentrate in low-paying firms*. As Appendix F.4 shows, this sorting is not merely a byproduct of assortative matching between low-skilled workers and low-paying firms. Instead, we argue that migrants' low reservation wages are the driving force: this is key to interpreting firms' wage and hiring responses.

Figure 6: Impact on foreign share by firm wage quartile



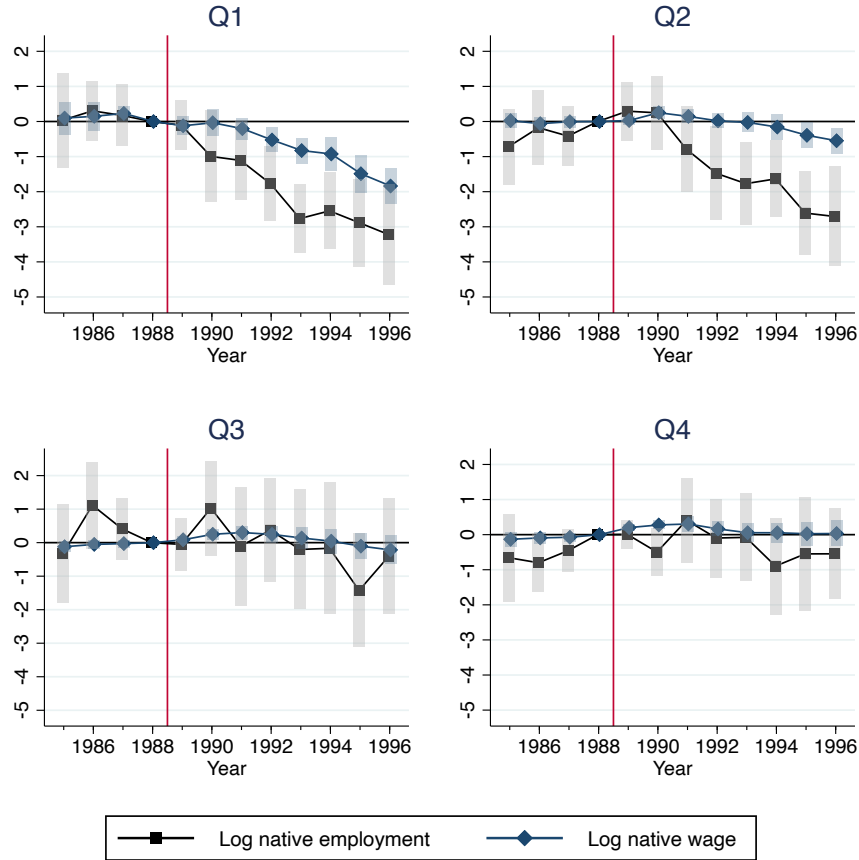
Regression estimates based on equation (10) across 203 local labor markets with 95% CIs. Dependent variable is regional change in foreign employment share (black line, measured in the BHP) or post-1988 arrivals shares (blue line, SIAB) in the respective quartile of the firm wage distribution, between base year 1988 and indicated year.

### 7.3 Wage and employment effects by quartile (Propositions 2-3)

Figure 7 traces the impact on mean native wages and employment, separately by quartile. The blue line shows a large wage reduction in Q1 (where the new migrants are most heavily concentrated), a milder effect in Q2, and no significant effect at the top of the distribution. As Table 5 shows, wage effects are similar for natives and migrants: i.e. they are not merely driven by changes in migrant composition. This is consistent with **Proposition 2**: *A larger migrant share induces firms to reduce offers at the bottom of the pay distribution.*

In magnitude, a 1 pp foreign inflow reduces the Q1 native wage by 1.5% by 1995. Since the national-level inflow was nearly 5% by 1995 (Figure 2), this coefficient implies a 7.5% average reduction in Q1 across all regions. This is a large effect, but Q1 firms only account for 5% of employment (Table 4). The wage effects are therefore heavily concentrated in a small corner of the labor market. Previous studies have explored distributional effects on local wages within observable skill groups (e.g. Card, 2009; Dustmann, Frattini and Preston,

Figure 7: Wage and employment effects by firm wage quartile



BHP, regression estimates based on equation (10) across 203 local labor markets with 95% CIs. Dependent variable is regional change in log native employment (black line) or mean log establishment wage (blue line) in the respective quartile of the firm wage distribution, between base year 1988 and indicated year.

2012; Gould, 2019); our estimates highlight the role of firms in generating these effects.

In Appendix H.3, we present these same effects across firm pay percentiles, rather than by quartile. We also show that restricting the sample to incumbent firms (present in both 1988 and 1995) does not affect the basic patterns. And we show that these distributional effects manifest mostly within detailed industries, not between them.

We next turn to native employment. Consistent with **Proposition 3**, Figure 7 shows a large and rapid reduction in native employment, which manifests among low-paying firms: a 1 pp immigration shock reduces Q1 native employment in 1995 by 2.9%. We see similarly large native employment losses in Q2, mild losses in Q3, and no significant effect in Q4. Since migrant workers replace natives (in low-paying firms), total employment declines less than native employment (Table 5); note our model does not make predictions about how *total* employment effects are distributed across firms.

It follows that workplace segregation increases sharply; and we confirm this in Appendix H.5, using a dissimilarity index. Workplace segregation is typically attributed to ethnic

Table 5: Wage and employment effects by firm quartile (1988-95)

	By firm wage quartile			
	Q1 (1)	Q2 (2)	Q3 (3)	Q4 (4)
<i>Panel A: Firm log wage effects</i>				
all	-1.675*** (0.278)	-0.569*** (0.187)	-0.239 (0.195)	-0.040 (0.161)
natives	-1.488*** (0.273)	-0.393** (0.184)	-0.104 (0.193)	0.026 (0.172)
foreign	-2.193*** (0.444)	-0.417 (0.302)	0.089 (0.287)	1.026*** (0.259)
<i>Panel B: Log employment effects</i>				
natives	-2.882*** (0.639)	-2.608*** (0.607)	-1.423* (0.861)	-0.548 (0.827)
total	-0.851 (0.725)	-1.122* (0.665)	-1.160 (0.761)	-0.458 (0.840)

BHP, estimates based on equation (10) across 203 local labor markets. Panel A: Dependent variable is regional change in mean log establishment wage in indicated firm quartile between 1988 and 1995. Bottom panel: Dependent variable is regional change in log native or total employment in quartile.

preferences or networks. But our model shows how it can also arise endogenously from imperfectly discriminating monopsony: if firms choose to hire migrants at low wages, they may lose access to natives. Workplace segregation may then not mitigate but rather *reflect* labor market competition between natives and migrants. By limiting the scope of migrants' coworker networks, such (endogenous) segregation may in turn impede the long-run integration of migrants in the host economy (Glitz, 2014; Ansala, Åslund and Sarvimäki, 2021; Willis, 2025).

## 7.4 Impact on firm size (Proposition 4)

The reduction in native employment is so large that even *total* employment contracts (Panel B of Table 5). As we now show, this manifests in smaller firm size, a possibility highlighted by **Proposition 4**: *A larger migrant share may potentially reduce average firm size.*

To interpret these effects, it is useful to first study what happens to the *number* of firms ( $k$  in the model). Column 1 of Table 6 shows this grows somewhat, but not significantly.<sup>39</sup> The growth in working-age population (i.e.  $n$ ) in Figure 5c is in fact very similar, implying that the  $\frac{n}{k}$  ratio is unaffected (as we assume in our baseline model).

However, column 2 shows a large reduction in mean firm size, which is robust to specification (Appendix H.2). It is driven by a larger share of small firms (below 5 workers) and a

<sup>39</sup>Though there is no significant effect on the *number* of firms, we do find evidence of selective firm entry (in line with our model): see Section 8.2 below.

Table 6: Impact on number of firms and firm size (1988-1995)

	Log number	Log mean firm size		$\Delta$ Log share of firms with # employees			
	of firms (1)	All firms (2)	Incumbents (3)	1-4 (4)	5-19 (5)	20-99 (6)	100+ (7)
Enclave shock $\Delta m_r$	0.277 (0.218)	-1.020*** (0.287)	-0.798** (0.321)	0.329*** (0.103)	-0.473** (0.232)	-1.364*** (0.289)	0.188 (0.605)

BHP, estimates based on equation (10) across 203 local labor markets. Incumbent firms are those present in both 1988 and 1995. Dependent variable in columns 4-7 is regional change in log share of firms of indicated size. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

smaller share of medium-sized firms (5-99). Column 3 shows a similar effect when restricting the sample to “incumbent” firms (present in both 1988 and 1995). This finding appears inconsistent with conventional factor demand theory: firms should *expand* their employment as more labor becomes available. But as Proposition 4 shows, it can be rationalized by monopsonistic firms trading off native employees for cheaper migrant labor.

Though firm size is an unusual outcome in the migration literature, it is a natural focus of our model – and simple to measure in many contexts. For comparison, we estimate firm size effects in the US in Appendix I, exploiting spatial variation in enclave shocks over 1980-2010. As in our German setting, we find negative effects on firm size, though smaller in magnitude. This may reflect a larger “wage-setting” effect in our German setting (see Proposition 4), due to lower migrant reservations and the onset of recession (Proposition 5).

## 8 Interpretation of firm wage effects

In Figure 7, we reported negative wage effects which are concentrated at the bottom of the firm pay distribution. In line with our model, we argued that these effects represent differential changes in firm wage policies, for workers of given productivity.

There are two potential challenges to this interpretation. The first is composition bias: if native employment effects are selective (e.g. concentrated among the low-paid), wage changes may partly reflect shifts in worker *composition*, rather than the impact on any particular worker (Bratsberg and Raaum, 2012; Ortega and Verdugo, 2022; Borjas and Edo, 2026; Dustmann et al., 2023). The second is assortative matching: if low-paying firms disproportionately employ low skilled workers who compete more heavily with the new migrants, the distributional effects may simply reflect a general reduction in the price of these skill types.

However, both challenges can be addressed by studying changes in AKM firm premia – and augmented versions thereof, which partial out local changes in skill prices. Unlike most papers in this field, our aim is not to decompose wage variation in the *cross-section*, but rather to study how the premia *change* in response to local shocks. We begin by explaining how the premia are identified (Section 8.1), and then estimate how they respond to immigration

shocks: first, average changes in Section 8.2; and then distributional changes in Section 8.3.

## 8.1 Estimation of firm premia

We rely on pre-compiled AKM firm premia, which are attached to our BHP establishment data. Bellmann et al. (2020) estimate these premia separately for different time intervals, including 1985-92 and 1993-99 (which we treat as our “pre-” and “post-treatment” periods). For each interval, they extract the premia from the following model for log wages:

$$\log w_{it} = \alpha_t + \eta_{j(i,t)} + \theta_i + \gamma X_{it} + \varepsilon_{it} \quad (12)$$

where  $w_{it}$  is the wage of worker  $i$  at year  $t$ ,  $\alpha_t$  are year effects,  $\eta_{j(i,t)}$  are firm effects (for the firm  $j$  employing worker  $i$  in year  $t$ ),  $\theta_i$  are worker effects (which capture skill differentials), and the vector  $X_{it}$  includes interactions between education and a cubic in age. Given the worker effects, the firm premia  $\eta_j$  are identified by workers moving between firms.<sup>40</sup>

These pre-compiled AKM estimates are useful for two reasons. First, they are based on full count data, reducing the “limited mobility bias” from observing few movers between firms. Second, using estimates from *other* researchers imposes discipline on our specification (Kline, 2024).

## 8.2 Impact of immigration on average firm premia

We first study how immigration affects regional averages of firm premia. Just as individual firm premia are identified by movers between *firms*, regional variation in these premia are identified by movers between *regions*. By tracking movers, we can eliminate composition bias from estimates of wage effects.<sup>41</sup> Card, Rothstein and Yi (2025) explore spatial variation in these regional averages, but we estimate how they *change* in response to local shocks.

In Table 7, we estimate the impact of the enclave shock  $\Delta m_r$  on the average premia, using equation (10). Let  $\bar{\eta}_{r,0}$  denote the mean firm premium in area  $r$ , estimated in the 1985-92 interval (i.e. the “pre-period”); and  $\bar{\eta}_{r,1}$  the mean firm premium in the 1993-99 interval (“post-period”). In column 1, we use the change  $\bar{\eta}_{r,1} - \bar{\eta}_{r,0}$  as the dependent variable: the average premia contract by over 0.7% for a 1 pp immigration shock, i.e. a large wage

<sup>40</sup>Identification relies on an “exogenous mobility” assumption: the sequence of  $\varepsilon_{it}$  must be orthogonal to the sequence of worker  $i$ ’s firm choices (Card, Heining and Kline, 2013). In support of this claim, Appendix H.6 shows that the wage trends of workers switching between low- and high-premia firms are parallel before the move: this suggests these transitions are uncorrelated with other individual determinants of wage growth.

<sup>41</sup>An alternative way to eliminate composition bias is to track wage changes for *incumbent* workers, over the full sample period. But this rules out any changes in worker fixed effects, in response to the shock. Instead, we estimate (12) separately for pre- and post-treatment intervals (i.e. tracking movers *within* each interval): this implicitly allows the worker effects to differ between the pre- and post-periods.

Table 7: Mean changes in firm wage premia

	Mean change in AKM premia	Contributions		
		firm incumbents	firm entrants	firm exiters
	(1)	(2)	(3)	(4)
Enclave shock $\Delta m_r$	-0.723*** (0.134)	-0.376*** (0.037)	-0.405*** (0.042)	0.058 (0.097)

BHP, estimates based on equation (10) across 203 local labor markets. Firm AKM premia are estimated by Bellmann et al. (2020) on universe of employment records, for the intervals 1985-92 and 1993-99. Column 1 shows impact on regional average between the two intervals. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

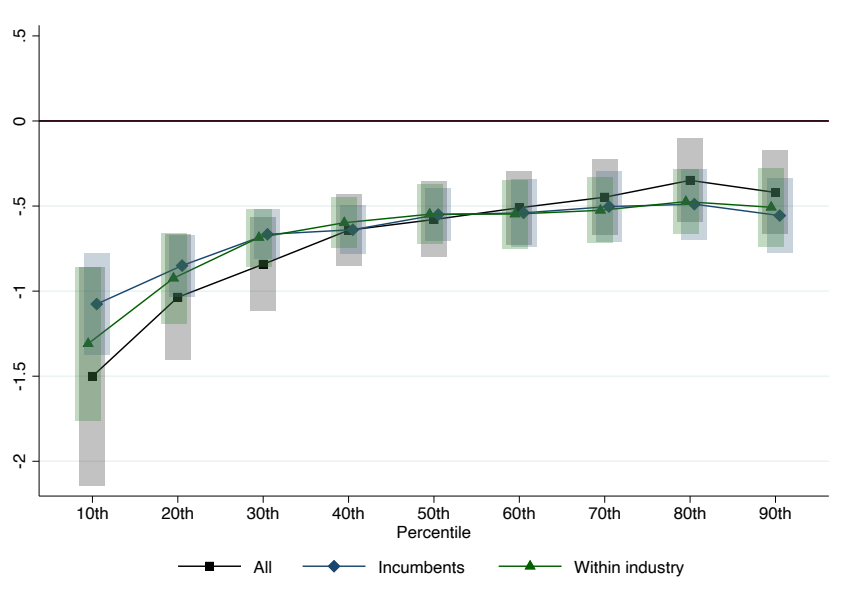
reduction for *individuals of fixed characteristics*. This contrasts with Figure 5d, which shows milder effects on unconditional mean wages: the difference can be attributed to selective crowd-out of low-paid native workers, as we confirm empirically in Appendix H.8.

The effect on average firm premia can be decomposed into (i) wage cuts by incumbent firms (present in both the pre- and post-period) and (ii) shifts in firm composition due to selective entry or exit: see Appendix H.7 for a derivation. The incumbent effect can be motivated by our baseline model, and the compositional effect by the “heterogeneous firm” extension in Section 2.4: low-reservation migrants sustain the entry of low-paying (potentially less productive) firms. Columns 2-4 show that incumbents account for half the effect, and new entrants the remainder. In Appendix H.4, we show that average wage premia decrease in all broad sectors, and most strongly in construction.

For the analysis above, we rely on pre-compiled AKM premia. But regional premia can also be estimated in our 2% SIAB worker sample, by replacing the firm fixed effect  $\eta_j$  in equation (12) with a region fixed effect: see e.g. Combes, Duranton and Gobillon (2008). Card, Rothstein and Yi (2025) note that this strategy can introduce biases, due to regional movers changing their position in the local firm hierarchy. But for our purposes (estimating responses to local shocks), the bias appears not to be consequential: as Appendix H.8 shows, this strategy produces very similar results, closely matching the estimates of column 1 in Table 7. It also allows us to define our own subsamples, and to show that: (i) dropping migrants makes little difference to the wage effects, (ii) the enclave shock has no effect on (pre-treatment) changes in wage premia before 1988, and (iii) the negative wage effect vanishes if we use simple regional means of log wages instead of mover-identified premia (i.e. if we do not control for composition). In Appendix H.9, we also apply this “regional premia” method to study heterogeneous effects across worker types.<sup>42</sup>

<sup>42</sup>Wage effects fall mostly on young and low-paid natives, with the latter also experiencing the largest employment losses. In competitive models, this may be attributed to differential changes in marginal products, with the most adverse impacts borne by “similar” natives. We do not rule out such effects; but interestingly, the heterogeneity is most pronounced when grouping workers by their *wage* rather than education or age.

Figure 8: Changes in AKM firm wage premia by percentile



Notes: BHP, regression estimates based on equation (10) across 203 local labor markets.

### 8.3 Impact of immigration on distribution of firm premia

Above, we studied how the shock affects regional *averages* of firm premia. We next consider how it affects their *distribution*. In Figure 8, we estimate effects on percentiles (within regions) of the firm premia distribution, between the 1985-92 and 1993-99 intervals. Consistent with Figure 7, the effects are largest at low percentiles. For a 1 pp immigration shock, the 10th percentile AKM falls by 1.5%, and the 90th percentile by only 0.4%. Given the measurement error in AKM estimates, these distributional effects are likely to be conservative.<sup>43</sup> The blue line shows effects for incumbent firms only (present in both the pre- and post-period): the patterns are qualitatively similar, though the decline in wage premia is moderated at the bottom (this reflects the exclusion of low-wage entrants, as in column 2 of Table 7). Finally, the green line shows the impact on residualized AKM premia, purged of detailed industry effects (97 categories) interacted with time effects. This makes little difference: the distributional effects manifest mostly *within* industries, not between them.

By conditioning on worker fixed effects, the AKM analysis eliminates compositional bias in wage changes – an important advantage. But if firms differ in skill mix, one might still worry that the distributional effects in Figure 8 merely reflect differential changes in local skill prices. For example, low-paying firms may disproportionately employ low-skilled

This is consistent with an important role for firms, which we now address more explicitly.

<sup>43</sup>AKM firm premia are estimated with substantial error – especially in smaller firms, where new migrants are most heavily concentrated. This will bias our distributional estimates towards the mean, understating the magnitude of the negative effects at low percentiles, and overstating them at the top (where wage effects may in reality be negligible, as Figure 7 suggests).

Table 8: Relative changes in firm wage premia (Robustness)

	By firm AKM quartile: Diff. vs. Q4		
	Q1 (1)	Q2 (2)	Q3 (3)
$\Delta \log$ native wage (movers) 1994-96 v 1986-88	-2.267*** (0.694)	-0.610 (0.489)	-0.386 (0.309)
$\Delta \log$ native wage (w/ region x educ. FEs) 1994-96 v 1986-88	-2.348*** (0.727)	-0.696 (0.476)	-0.445 (0.293)
$\Delta \log$ native wage (w/ region x worker FEs) 1994-96 v 1986-88	-3.052*** (1.102)	-1.066 (0.793)	-0.459 (0.507)

SIAB, regression estimates based on equation (10) across 204 local labor markets. The dependent variable in column 1 (2 or 3) is the Q1 change (Q2 or Q3 change) in region-by-firm quartile wage premia of natives between the periods 1986-88 (pre-treatment) and 1994-96 (post-treatment), net of the change in Q4. The premia are estimated separately for each period using a "movers" design (Appendix H.8), controlling for worker fixed effects and interactions of age, education, sex, and year (all columns), and region-by-education effects (second row) or region-by-worker effects (third row). Firm quartiles are defined using pre-compiled AKM firm premia from Card, Heining and Kline (2013), separately by region and period. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

natives, who compete more heavily with the new migrants – and are thus subject to larger reductions in wages, independently of the firm which employs them.

To address this challenge, we use an augmented AKM specification which partials out the influence of local skill prices. To implement this exercise in our limited SIAB worker sample, we first aggregate individual firms to firm quartile bins (within regions); and we then replace the firm effects in equation (12) with region  $\times$  firm bin effects.<sup>44</sup> Using this specification, we then study the implications of partialing out region  $\times$  skill effects from the regional firm bin premia.

We report the results in Table 8. In the top row, we replicate the main findings from Figure 8, but using our self-estimated bin premia (from the SIAB) instead of the pre-compiled firm premia – and reporting wage impacts *relative* to the top quartile. Consistent with our estimates above, pay premia decline more in the bottom firm bin. In the second row, we net out region  $\times$  education interactions from the estimated pay premia, separately for the pre- and post-period. This abstracts from any region-wide wage impacts related to observable education, but we still find larger pay reductions in the bottom bin. Finally, in the third row, we identify pay premia from those workers who switch firms *within* region, by conditioning on interacted region  $\times$  worker fixed effects. This specification abstracts from any region-wide changes in skill prices, for both observable and unobservable skills. While the precision of our estimates declines, the point estimates become more rather than less pronounced.

<sup>44</sup>This builds from the movers design in Appendix H.8, again relying on the SIAB worker sample. But instead of estimating regional wage premia, we now estimate returns to firm quartile bins *within* regions. We assign firms to within-region quartiles using the pre-compiled AKM firm premia.

To summarize, we find large wage declines at the bottom of the firm pay distribution, which are attributable to changes in firm premia – and not to worker composition.<sup>45</sup> These effects are driven by both incumbent firms and entry of new low-paying firms. These results align with the model’s predictions, and can be attributed to the arrival of low-reservation migrants. In comparison, a competitive model may explain why wages decline more in firms employing certain types of workers (e.g., young or low-educated), but not why wage premia decline more at the bottom of the firm pay distribution *independently* of worker type.

## 9 Heterogeneity by $b$ and $p$ (Proposition 5)

Proposition 5 predicts that employment and wage effects should be larger when (i) migrants’ outside option  $b_M$  (and hence reservation wage) is low and (ii) productivity  $p$  is low. Both conditions apply to the 1990s wave, which brought migrants with low reservations and overlapped with a recession. In this final section, we test these predictions directly.

To test the first claim, we rely on heterogeneity in reservation wages across migrant origins (Dustmann, Ku and Surovtseva, 2024; Costas-Fernández and Lodato, 2024), as predicted by their employers’ mean AKM premia. Intuitively, our model indicates that low-reservation migrants are more likely to accept jobs at low-paying firms. We divide origins into two equally sized groups, by this metric: high-AKM origins ( $o \in H$ ) and low-AKM origins ( $o \in L$ ).<sup>46</sup> And we construct distinct enclave shocks to predict migrant inflows for each group:

$$\Delta m_{Hr} = \frac{\sum_{o \in H} s_{or80} (n_{o93} - n_{o88})}{n_{r80}} \quad \text{and} \quad \Delta m_{Lr} = \frac{\sum_{o \in L} s_{or80} (n_{o93} - n_{o88})}{n_{r80}} \quad (13)$$

where  $\Delta m_{Hr} + \Delta m_{Lr} = \Delta m_r$ . We then replace the aggregate shock  $\Delta m_r$  in (10) with the origin-specific shocks:

$$\Delta y_r = \alpha + \beta_H \Delta m_{Hr} + \beta_L \Delta m_{Lr} + \gamma X_r + \varepsilon_r \quad (14)$$

where  $\Delta y_r$  is the 1988-1995 change in some outcome, and  $X_r$  is our standard set of controls. This strategy is similar to Amior (forthcoming), who disaggregates an enclave shock into Latin American and non-Latin components using US data.

We present our estimates in Panel A of Table 9. Columns 3 and 4 show that the two

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<sup>45</sup>These results align with the agenda of Card, Heining and Kline (2013) and Song et al. (2019), who explore changes in the dispersion of firm premia at the aggregate level. Here, we do so at the regional level, in response to an *identifiable shock*; and with our estimates matching the predictions of economic theory. Interestingly, Card, Heining and Kline (2013) show that much of the aggregate increase in firm pay dispersion in Germany can be attributed to new entrants; we find the same in response to the immigration shock.

<sup>46</sup>To assign these groups, we rely on new (post-1988) migrants in the SIAB worker-level data between 1990 and 1996. The low-premia group consists of the Americas (excluding US and Canada), Asia, Czechoslovakia, Greece, Italy, Poland, Romania, Russia and Yugoslavia. The high-premia group consists of Africa, Spain/Portugal, Turkey, US/Canada/Australia, other EU, and other non-EU. The “Rotemberg weights” for these groups (Goldsmith-Pinkham, Sorkin and Swift) correlate strongly with the size of the respective shifts.

Table 9: Heterogeneity by migrant origin and local demand conditions

	Change in log	Change in mean	Post-1988 migrant shares	
	native emp (1)	AKM premia (2)	High-AKM (3)	Low-AKM (4)
<i>Panel A: Heterogeneity in immigrant origins</i>				
Enclave shock $\Delta m_{Hr}$	-0.020 (0.658)	-0.232 (0.206)	1.292*** (0.117)	-0.202 (0.127)
Enclave shock $\Delta m_{Lr}$	-1.691*** (0.330)	-0.887*** (0.148)	0.052 (0.047)	0.946*** (0.077)
<i>Panel B: Heterogeneity in local demand conditions</i>				
Enclave shock $\Delta m_r$ × high Bartik	-0.850*** (0.223)	-0.682*** (0.145)		
Enclave shock $\Delta m_r$ × low Bartik	-1.762*** (0.248)	-0.768*** (0.154)		

Estimates based on equations (14) and (15). In addition to our standard controls, Panel B includes the indicator for high/low Bartik. Column 1 reports effects on log native employment between 1988 and 1995 (SIAB: 204 regions). Column 2 reports effects on changes in mean AKM firm premia (computed by Bellmann et al., 2020) between the intervals 1985-92 and 1993-99 (BHP: 203 regions). Columns 3 and 4 report effects on post-1988 migrant shares in 1995, by origin group (SIAB). \* p<0.10, \*\* p<0.05, \*\*\* p<0.01.

enclave instruments offer sufficient power to disentangle the inflows from each origin group: the high-AKM instrument only predicts inflows from high-AKM origins (conditional on the low-AKM shock), and vice versa. We previously showed that native employment and firm pay premia respond negatively to the aggregate inflows  $\Delta m_r$ . But columns 1 and 2 show that the low-AKM origins account for most of these negative effects, consistent with our claim that low reservation wages drive the adverse impacts. This result has important policy implications: adverse effects can be mitigated by policies that curb firms' market power over migrants, rather than by restricting immigration itself.

To test the second prediction, we interact the standard enclave shock with an indicator for favorable labor demand. We classify regions by a median split of the employment Bartik (from our  $X_r$  controls), which predicts 1988-95 employment growth using initial industrial composition. We then estimate:

$$\Delta y_r = \alpha + \beta_h \Delta m_r I(\text{Bartik}_r > p50) + \beta_l \Delta m_r I(\text{Bartik}_r \leq p50) + \gamma X_r + \varepsilon_r \quad (15)$$

where we interact the aggregate enclave shock  $\Delta m_r$  with indicators for high/low Bartik.

As Panel B of Table 9 shows, immigration had twice the negative effect on native employment in low-growth compared to high-growth regions (column 1). Intuitively, firms are more likely to replace natives with cheaper migrant labor when profit per worker is low.<sup>47</sup> Column

<sup>47</sup>See also Michailat (2024) on how immigration effects may vary over the business cycle.

2 shows that wage effects are more similar across regions, perhaps because the employment Bartik is a weak predictor of local wage changes.

Overall, this evidence is in line with Proposition 5 – and can help explain why immigration had such large adverse effects on native employment in our setting. Our immigration episode consisted of migrants with particularly low reservations (see Figure 1), and it overlapped with a recession that made a low-pay strategy more attractive for firms.

## 10 Conclusion

We argue that the arrival of migrants with low reservation wages strengthens the monopsony power of firms. Firms can exploit “cheap” migrant labor by cutting wage offers, but they must forgo native hires who demand higher pay. Using a simple wage-posting model, we derive five propositions that characterize these effects along the firm pay distribution, and test them using spatial variation from Germany’s post-1988 immigration wave.

We show empirically that new migrants sort heavily into low-paying firms, consistent with low reservation wages and constraints on firms’ ability to wage discriminate (Proposition 1). Despite migrants’ apparent willingness to accept lower wages, firms that paid natives well also offered high returns to migrants. As a result, native-migrant wage differentials manifest more *between* firms than within them. In the presence of internal pay constraints, firms which adopt a low-pay strategy necessarily lose access to native workers – but this strategy becomes more attractive as the migrant workforce grows. Consistent with this story, we find large wage reductions at the bottom of the firm pay distribution (Proposition 2). By studying changes in AKM firm premia, we can attribute these distributional effects to the *wage policies* of low-paying firms, as opposed to changes in the skill prices of their particular employees.

Associated with these wage effects, we find reductions in native employment among these same low-paying firms (Proposition 3). The employment effects are so large that firm size declines overall (Proposition 4). This is difficult to reconcile with a competitive model – where lower wages should encourage *more* hiring, as firms move down their labor demand curves – but consistent with monopsonistic firms moving down their *supply* curves. This native crowd-out exacerbates the workplace segregation already implicit in the model. Importantly, this segregation does not preclude but rather *reflects* labor market competition between natives and migrants.

Finally, we show that these effects are significantly stronger when migrants have low reservation wages and when labor demand is weak (Proposition 5). This can help account for the particularly severe effects in our setting – and more broadly, for conflicting findings

on labor market impacts across different natural experiments. Importantly, such adverse effects are not inevitable – and can be mitigated by policies that curb firms’ monopsony power over migrants, rather than by restricting immigration itself.

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# Supplemental Appendices

<b>A</b>	<b>Equilibrium in baseline model</b>	<b>48</b>
A.1	Derivation of migrant reservation wage in equation (5)	49
A.2	Profit function	49
A.3	Equilibrium	50
A.4	Proof of Proposition 2	50
A.5	Proof of Proposition 4	51
<b>B</b>	<b>Model with on-the-job search</b>	<b>52</b>
<b>C</b>	<b>Model with endogenous contact rate</b>	<b>55</b>
<b>D</b>	<b>Model with heterogeneous firms</b>	<b>56</b>
<b>E</b>	<b>Model with idiosyncratic job preferences</b>	<b>58</b>
<b>F</b>	<b>Evidence on migrants' labor market integration</b>	<b>61</b>
F.1	Distribution of migrants across industries	61
F.2	Correcting firm wage premia for measurement error	62
F.3	Differential wage premia: Longitudinal evidence	63
F.4	Distribution of migrants across firm pay deciles	64
<b>G</b>	<b>First stage estimates and potential confounders</b>	<b>66</b>
G.1	First stage scatter relation	66
G.2	Prediction errors in first stage	67
G.3	Reunification and inflows from East Germany	68
G.4	Repatriation of ethnic Germans	69
<b>H</b>	<b>Additional evidence on impact of enclave shock</b>	<b>69</b>
H.1	Contribution of entrants to native crowd-out	69
H.2	Robustness of regional employment and wage effects	70
H.3	Firm wage effects by percentile	71
H.4	Employment and wage effects by industry	71
H.5	Impact on workplace segregation	73
H.6	Validation of firm and regional AKM wage premia	73
H.7	Decomposing the change in AKM wage premia	74
H.8	Direct estimates of regional wage premia	75
H.9	Effects across the native worker distribution	76
<b>I</b>	<b>US evidence on firm size effects</b>	<b>78</b>

## A Equilibrium in baseline model

In this appendix, we derive equations (7) and (8), which summarize the equilibrium low-pay sector share  $\phi$ . We begin by deriving the migrant reservation wage and firms' profits for each

strategy, and then solve for equilibrium. We also derive (9), which underpins Proposition 4.

## A.1 Derivation of migrant reservation wage in equation (5)

By definition of  $w_M^r$ , we have  $E_M(w_M^r) = U_M$ . Using equation (2), this implies  $w_M^r = rU_M$ . In equilibrium, as Section 2.1 explains, a fraction  $\phi$  of firms offer migrants a low wage  $w_M^l$ , and the remainder offer  $w_M^h$ . Imposing this on equation (1), we have:

$$rU_M = b_M + \lambda \left[ \phi E_M(w_M^l) + (1 - \phi) E_M(w_M^h) - U_M \right] \quad (\text{A1})$$

In equilibrium, both the migrant reservation wage  $w_M^r$  and low-pay offer  $w_M^l$  are equal to  $rU_M$  (see Section 2.1). Replacing the employment values  $E_M$  with (2), it then follows that:

$$w_M^r = \frac{(r + \delta) b_M + (1 - \phi) \lambda w_M^h}{r + \delta + (1 - \phi) \lambda} \quad (\text{A2})$$

Finally, as we argue in Section 2.1, the high-pay offer  $w_M^h$  is equal to  $\zeta b_N$  if the pay constraint binds (i.e. if  $\zeta b_N > b_M$ ), and  $b_M$  otherwise. This brings us to equation (5).

## A.2 Profit function

As Section 2.1 explains, if the pay constraint binds, firms will adopt one of two strategies in equilibrium: a low-pay strategy (undercutting natives, and recruiting only migrants) or a high-pay strategy (recruiting both natives and migrants). We consider each strategy in turn.

Low-pay firms offer migrants their reservation wage, i.e.  $w_M^l = w_M^r$ . Since they recruit only migrants, they face a labor inflow of  $\frac{\lambda}{k} u_M \mu n$  and an outflow of  $\delta l_M^l$ , where  $l_M^l = l_M(w_M^l)$  is the firm's steady-state labor force. Equating the two, and using (6), we have:  $l_M^l = \frac{n}{k} \cdot \frac{\lambda \mu}{\delta + \lambda}$ . The associated profit  $\pi^l$  is then:

$$\pi^l = (p - w_M^l) l_M^l = \frac{n}{k} \cdot \frac{\mu \lambda}{\delta + \lambda} \cdot \frac{(r + \delta)(p - b_M) + (1 - \phi) \lambda (p - \max\{\zeta b_N, b_M\})}{r + \delta + (1 - \phi) \lambda} \quad (\text{A3})$$

where the second equality follows from (5), since  $w_M^l = w_M^r$ .

High-pay firms offer natives their reservation wage  $w_N^r$  (which collapse to  $b_N$  in equilibrium) and offer migrants  $w_M^h = \max\{\zeta b_N, b_M\}$ . Since there is no on-the-job search (or direct competition between firms), high-pay firms will employ the same number of migrants as low-pay firms: i.e.  $l_M^h = l_M^l = \frac{n}{k} \cdot \frac{\lambda \mu}{\delta + \lambda}$ . In terms of natives, they face an inflow of  $\frac{\lambda}{k} u_N (1 - \mu) n$  and an outflow  $\delta l_N^h$ . Equating the two, and using (6), their steady-state native employment is:  $l_N^h = \frac{n}{k} \cdot \frac{(1 - \mu) \lambda}{\delta + (1 - \phi) \lambda}$ . So the associated profit  $\pi^h$  is:

$$\pi^h = (p - w_N^h) l_N^h + (p - w_M^h) l_M^h = \frac{n}{k} \left[ (p - b_N) \frac{\lambda (1 - \mu)}{\delta + \lambda (1 - \phi)} + (p - \max\{\zeta b_N, b_M\}) \frac{\lambda \mu}{\delta + \lambda} \right] \quad (\text{A4})$$

### A.3 Equilibrium

As Rogerson, Shimer and Wright (2005) show, this type of model has a unique equilibrium which takes one of three forms: (i)  $\pi^h > \pi^l$ , and all firms adopt the high-pay strategy ( $\phi = 0$ ); (ii)  $\pi^h = \pi^l$ , and firms adopt different strategies ( $0 < \phi < 1$ ); and (iii)  $\pi^h < \pi^l$ , and all firms adopt the low-pay strategy ( $\phi = 1$ ). To derive (7) and (8), we study each case in turn.

#### Case 1: $\pi^h > \pi^l$ and $\phi = 0$

Using equations (A3) and (A4), and imposing  $\phi = 0$ ,  $\pi^h > \pi^l$  implies:

$$\frac{\lambda(1-\mu)}{\delta+\lambda}(p-b_N) + \frac{\lambda\mu}{\delta+\lambda}(p-\max\{\zeta b_N, b_M\}) > \frac{\mu\lambda}{\delta+\lambda} \cdot \frac{(r+\delta)(p-b_M) + \lambda(p-\max\{\zeta b_N, b_M\})}{r+\delta+\lambda}$$

After rearranging, we have  $\tilde{\mu} < \frac{r+\delta+\lambda}{r+\delta}$ , with  $\tilde{\mu}$  defined by (8). This is the  $\phi = 0$  case of (7).

#### Case 2: $\pi^h = \pi^l$ and $0 < \phi < 1$

Using equations (A3) and (A4),  $\pi^h = \pi^l$  implies:

$$\frac{\lambda(1-\mu)(p-b_N)}{\delta+\lambda(1-\phi)} + \frac{\lambda\mu(p-\max\{\zeta b_N, b_M\})}{\delta+\lambda} = \frac{\mu\lambda}{\delta+\lambda} \cdot \frac{(r+\delta)(p-b_M) + (1-\phi)\lambda(p-\max\{\zeta b_N, b_M\})}{r+\delta+(1-\phi)\lambda}$$

After rearranging:

$$\phi = \frac{\delta+\lambda}{\lambda} \left[ 1 - \frac{r}{(r+\delta)\tilde{\mu} - (\delta+\lambda)} \right] \quad (\text{A5})$$

with  $\tilde{\mu}$  defined by (8). Since  $\phi$  lies between 0 and 1, it follows that:

$$0 < \frac{\delta+\lambda}{\lambda} \left[ 1 - \frac{r}{(r+\delta)\tilde{\mu} - (\delta+\lambda)} \right] < 1 \quad (\text{A6})$$

which implies that  $\tilde{\mu} \in \left( \frac{r+\delta+\lambda}{r+\delta}, \frac{\delta+\lambda}{\delta} \right)$ . This is the  $\phi \in (0, 1)$  case of equation (7).

#### Case 3: $\pi^h < \pi^l$ and $\phi = 1$

Using equations (A3) and (A4), and imposing  $\phi = 1$ ,  $\pi^h < \pi^l$  implies:

$$(p-b_N) \frac{\lambda(1-\mu)}{\delta} + (p-\max\{\zeta b_N, b_M\}) \frac{\lambda\mu}{\delta+\lambda} < \frac{\mu\lambda}{\delta+\lambda} \cdot \frac{(r+\delta)(p-b_M)}{r+\delta} \quad (\text{A7})$$

This implies  $\tilde{\mu} > \frac{\delta+\lambda}{\delta}$ , with  $\tilde{\mu}$  defined by (8). This is the  $\phi = 1$  case of equation (7).

### A.4 Proof of Proposition 2

As Proposition 2 explains, a larger migrant share  $\mu$  affects the firm pay distribution in two ways: (i) by increasing the low-pay sector share  $\phi$  and (ii) by reducing the low wage offer

$w_M^l$ . In this section, we set out the associated derivatives.

Using equations (7) and (8), the derivative of  $\phi$  with respect to the migrant share  $\mu$  is:

$$\frac{d\phi}{d\mu} = \begin{cases} 0 & \text{if } \tilde{\mu} \leq \frac{r+\delta+\lambda}{r+\delta} \\ \frac{\delta+\lambda}{\lambda} \cdot \frac{r(r+\delta)}{[(r+\delta)\tilde{\mu}-(\delta+\lambda)]^2} \cdot \frac{1}{(1-\mu)^2} \cdot \frac{\max\{\zeta b_N - b_M, 0\}}{p-b_N} & \text{if } \tilde{\mu} \in \left(\frac{r+\delta+\lambda}{r+\delta}, \frac{\delta+\lambda}{\delta}\right) \\ 0 & \text{if } \tilde{\mu} \geq \frac{\delta+\lambda}{\delta} \end{cases} \quad (\text{A8})$$

There is no effect at the two corner solutions, where the low-pay sector share  $\phi$  is 0 or 1 respectively. But in the interior,  $\phi$  is strictly increasing in the migrant share  $\mu$ .

Using equations (5) and (A8), the derivative of  $w_M^l$  with respect to  $\mu$  is:

$$\frac{dw_M^l}{d\mu} = \begin{cases} 0 & \text{if } \tilde{\mu} \leq \frac{r+\delta+\lambda}{r+\delta} \\ -\frac{(r+\delta)^2}{[r+\delta+(1-\phi)\lambda]^2} \cdot \frac{r(\delta+\lambda)}{[(r+\delta)\tilde{\mu}-(\delta+\lambda)]^2} \cdot \frac{1}{(1-\mu)^2} \cdot \frac{(\max\{\zeta b_N - b_M, 0\})^2}{p-b_N} & \text{if } \tilde{\mu} \in \left(\frac{r+\delta+\lambda}{r+\delta}, \frac{\delta+\lambda}{\delta}\right) \\ 0 & \text{if } \tilde{\mu} \geq \frac{\delta+\lambda}{\delta} \end{cases} \quad (\text{A9})$$

Since the entire effect of  $\mu$  on the low wage offer  $w_M^l$  is mediated through the low-pay sector share  $\phi$ , there is no effect at the corners. But in the interior,  $w_M^l$  is strictly decreasing in  $\mu$ .

## A.5 Proof of Proposition 4

We begin by deriving equation (9). Using the firm size expressions from Section A.2, mean firm size can be written as:

$$\bar{l} = \phi l_M^l + (1 - \phi) (l_M^h + l_N^h) = \frac{n}{k} \left[ \mu \frac{\lambda}{\delta + \lambda} + (1 - \mu) \frac{\lambda(1 - \phi)}{\delta + \lambda(1 - \phi)} \right] \quad (\text{A10})$$

Differentiating this with respect to migrant share  $\mu$ , holding the worker-firm ratio  $\frac{n}{k}$  fixed, yields equation (9) in the main text, where the derivative  $\frac{d\phi}{d\mu}$  is given by (A8). Proposition 4 states that the firm size effect may be positive (i.e. composition effect dominates) or negative (wage-setting effect dominates), depending on parameter values. To prove this proposition, it is sufficient to provide a single scenario which delivers each case.

A positive firm size effect is delivered in equilibria with  $\phi = 1$ . In this scenario, the composition effect in equation (9) is strictly positive. But the wage-setting effect is zero: since we are at the corner solution, marginal changes in the migrant share  $\mu$  will not affect the low-pay sector share  $\phi$  (see (A8)); so the derivative  $\frac{d\phi}{d\mu}$  in equation (9) will equal zero.

A negative firm size effect is delivered in equilibria where  $\phi$  is positive but arbitrarily close to zero. The composition effect in equation (9) will then be arbitrarily close to zero. But the derivative  $\frac{d\phi}{d\mu}$  does not converge to zero (see the interior case in (A8)), so the wage-setting effect in equation (9) will dominate.

## B Model with on-the-job search

Here, we allow for on-the-job search, as in Burdett and Mortensen (1998): *all* workers draw offers at rate  $\lambda$ , not just the unemployed. Unlike the baseline model, the low-pay sector contains a continuous distribution of wage offers (between  $b_M$  and  $b_N$ ), as firms compete directly for employees. Similarly, the high-pay sector contains a continuous distribution of offers exceeding  $b_N$ . However, the key propositions are unaffected. To simplify the exposition, we assume  $\zeta = 1$  for this exercise: i.e. firms offer natives and migrants identical wages.

### B.1 Wage distributions for native and migrant workers

Employed workers accept any offer which exceeds their current wage. And since the offer rate  $\lambda$  is invariant with employment status, the unemployed accept any offer which exceeds their current utility flow: i.e.  $b_N$  for natives, and  $b_M$  for migrants.

Let  $F(w)$  be the distribution of wage offers across firms. In equilibrium, no firm will pay less than the migrant unemployment flow utility  $b_M$  (as no workers would accept such an offer); but firms may potentially set wages below the native flow utility  $b_N$ . For the purposes of this appendix, let  $\phi$  denote the share of firms offering less than  $b_N$ : i.e.  $\phi \equiv F(b_N)$ .

Let  $G_N(w)$  be the wage distribution across employed natives, and  $G_M(w)$  across employed migrants. Consider the group of firms paying wages less than  $w$ . The inflow of workers to this group must equal the outflow in equilibrium. For natives, we have:

$$u_N \lambda [F(w) - F(b_N)] (1 - \mu) n = \delta (1 - u_N) G_N(w) (1 - \mu) n + \lambda (1 - F(w)) (1 - u_N) G_N(w) (1 - \mu) n \quad (\text{A11})$$

where  $\mu$  is the migrant share,  $(1 - \mu) n$  is the stock of natives, and  $u_N$  is their unemployment rate. The native inflow to this group of firms (on the left-hand side) consists of unemployed natives who meet firms offering between  $b_N$  and  $w$ . The outflow on the right-hand side is composed of: (i) natives employed at wages below  $w$  who are separated to unemployment (at rate  $\delta$ ), and (ii) natives employed at wages below  $w$  who meet firms offering wages exceeding  $w$ . The parallel expression for migrants is:

$$u_M \lambda F(w) \mu n = \delta (1 - u_M) G_M(w) \mu n + \lambda (1 - F(w)) (1 - u_M) G_M(w) \mu n \quad (\text{A12})$$

where we have imposed  $F(b_M) = 0$  (no firms offer below  $b_M$ ).

The steady-state native and migrant unemployment rates are identical to (6) in the main text. Substituting these into (A11) and (A12), and rearranging:

$$G_N(w) = \frac{1}{\phi} \cdot \frac{\delta [F(w) - \phi]}{\delta + \lambda [1 - F(w)]}, \quad G_M(w) = \frac{\delta F(w)}{\delta + \lambda [1 - F(w)]} \quad (\text{A13})$$

## B.2 Firms' employment

We now derive  $l(w)$ , the employment of a firm paying wage  $w$ . Let  $R(w)$  be the flow of workers recruited by this firm, and let  $S(w)$  be the flow of workers who leave. A steady-state equilibrium requires  $R(w) = S(w)$ , where  $S(w)$  is equal to:

$$S(w) = [\delta + \lambda(1 - F(w))]l(w) \quad (\text{A14})$$

i.e. workers can leave through exogenous separation (at rate  $\delta$ ) or by meeting a firm offering a wage exceeding  $w$ . The recruitment flow is given by:

$$R(w) = I[w \geq b_N] \left\{ \frac{\lambda}{k} u_N + \frac{\lambda}{k} (1 - u_N) G_N(w) \right\} (1 - \mu) n + \left\{ \frac{\lambda}{k} u_M + \frac{\lambda}{k} (1 - u_M) G_M(w) \right\} \mu n$$

The first term describes the native inflow, and the second the migrant inflow.  $I$  is an indicator function taking 1 if  $w \geq b_N$ : firms only recruit natives if their offer exceeds  $b_N$ .  $\frac{\lambda}{k} u_N$  and  $\frac{\lambda}{k} u_M$  are inflows of workers from unemployment, and  $\frac{\lambda}{k} (1 - u_N) G_N(w)$  and  $\frac{\lambda}{k} (1 - u_M) G_M(w)$  are inflows from firms paying less than  $w$ . Using (6) and (A13), this expression can be simplified to:

$$R(w) = \frac{n}{k} \cdot \frac{\delta \lambda \{(1 - \mu) I[w \geq b_N] + \mu\}}{\delta + \lambda(1 - F(w))} \quad (\text{A15})$$

Imposing the steady-state condition  $R(w) = S(w)$  then yields:

$$l(w) = \frac{n}{k} \cdot \frac{\delta \lambda \{(1 - \mu) I[w \geq b_N] + \mu\}}{[\delta + \lambda(1 - F(w))]^2} \quad (\text{A16})$$

## B.3 Equilibrium size of low-pay sector

As Burdett and Mortensen (1998) show, on-the-job search yields a non-degenerate distribution of wage offers. In our version, firms can either locate in the “high-pay sector” (offering  $w \geq b_N$ ) or “low-pay sector” (offering  $w < b_N$ ). If the high-pay sector exists (i.e.  $\phi < 1$ ), the lowest offer in that sector must be  $b_N$ : otherwise, the lowest-paying firm (in that sector) could increase their profit by cutting their offer to  $b_N$  (with no employment loss). Similarly, if the low-pay sector exists (i.e.  $\phi > 0$ ), the lowest offer must be  $b_M$ .

Just as in the baseline model, equilibrium can take one of three forms, identical to those specified in Section 2.1: (i)  $\pi(b_N) > \pi(b_M)$  with  $\phi = 0$ ; (ii)  $\pi(b_N) = \pi(b_M)$  with  $0 < \phi < 1$ ; and (iii)  $\pi(b_N) < \pi(b_M)$  with  $\phi = 1$ . Using (A16), the profit from offering  $b_N$  and  $b_M$  can be written as:

$$\pi(b_N) = (p - b_N) l(b_N) = \frac{n}{k} \cdot \frac{\delta \lambda (p - b_N)}{[\delta + (1 - \phi) \lambda]^2} \quad (\text{A17})$$

and

$$\pi(b_M) = (p - b_M) l(b_M) = \frac{n}{k} \cdot \frac{\mu \delta \lambda (p - b_M)}{(\delta + \lambda)^2} \quad (\text{A18})$$

The equilibrium  $\phi$  can then be derived by inserting (A17) and (A18) into the three cases listed above:

$$\phi = \begin{cases} 0 & \text{if } \tilde{\mu} \leq 1 \\ \frac{\delta+\lambda}{\lambda} \left(1 - \frac{1}{\tilde{\mu}}\right) & \text{if } \tilde{\mu} \in \left(1, \frac{\delta+\lambda}{\delta}\right) \\ 1 & \text{if } \tilde{\mu} \geq \frac{\delta+\lambda}{\delta} \end{cases} \quad (\text{A19})$$

where  $\tilde{\mu}$  is now defined as:

$$\tilde{\mu} = \left[ \mu \left(1 + \frac{b_N - b_M}{p - b_N}\right) \right]^{\frac{1}{2}} \quad (\text{A20})$$

## B.4 Equilibrium offers within high- and low-pay sectors

(A19) and (A20) summarize the equilibrium low-pay sector share  $\phi$ . For given  $\phi$ , we now derive the offer distribution *within* the high- and low-pay sectors. Since firms are identical, they must earn the same profit. In the high-pay sector, the bottom firm offers  $b_N$ ; so this implies  $\pi(w) = \pi(b_N)$  for all  $w \geq b_N$  in the support of  $F$ . Inserting (A16) into the profit functions, it follows that the share of offers between  $b_N$  and any given  $w \geq b_N$  is:

$$F(w) - \phi = \left(1 - \phi + \frac{\delta}{\lambda}\right) \left[1 - \left(\frac{p-w}{p-b_N}\right)^{\frac{1}{2}}\right] \quad (\text{A21})$$

We now apply the same logic to the low-pay sector. If it exists, its bottom firm offers  $b_M$ . Since firms earn identical profit, we have  $\pi(w) = \pi(b_M)$  for all  $w \geq b_M$  in the support of  $F$ . Applying (A16) and rearranging, the share of offers below  $w < b_N$  can be expressed as:

$$F(w) = \frac{\delta + \lambda}{\lambda} \left[1 - \left(\frac{p-w}{p-b_M}\right)^{\frac{1}{2}}\right] \quad (\text{A22})$$

Putting together (A21) and (A22), we have:

$$F(w) = \begin{cases} I[\phi > 0] \cdot \frac{\delta+\lambda}{\lambda} \left[1 - \left(\frac{p-w}{p-b_M}\right)^{\frac{1}{2}}\right] & \text{if } w \in [b_M, b_N) \\ I[\phi < 1] \cdot \left\{ \phi + \left(1 - \phi + \frac{\delta}{\lambda}\right) \left[1 - \left(\frac{p-w}{p-b_N}\right)^{\frac{1}{2}}\right] \right\} & \text{if } w \in [b_N, p) \end{cases} \quad (\text{A23})$$

## B.5 Implications for Propositions 1-5

This extended model reproduces the propositions of Section 2.2. Only migrants accept offers from firms offering less than  $b_N$  (Proposition 1). A larger migrant share  $\mu$  induces firms to reduce offers at the bottom of the pay distribution (Proposition 2): as (A19) and (A20) show, the low-pay sector share  $\phi$  is increasing in  $\mu$ . And consistent with Proposition 3, firms which drop into the low-pay sector necessarily reduce their native employment.

Proposition 4 states that a larger migrant share  $\mu$  may reduce average firm size. Equation (A16) shows that  $\mu$  has a positive ‘‘composition effect’’ on firm size in the low-pay sector, as

only migrants accept low offers. But (A16) also shows that  $\mu$  has a negative “wage-setting effect”: as more firms drop into the low-pay sector, they lose access to native labor. Just as in the baseline model, either effect may dominate – depending on the parameter values.

Finally, given the definition of the  $\tilde{\mu}$  parameter in (A20), variation in productivity  $p$  and migrant reservation  $b_M$  have the same implications as in the baseline model (Proposition 5).

The five propositions are therefore robust to on-the-job search. But unlike in the baseline model, immigration also has a negative effect on natives’ *realized* wages. As firms drop into the low-pay sector (i.e. as  $\phi$  increases), this reduces competition in the high-pay sector, so firms can extract greater rents from natives. This is visible in equation (A13): at any given wage  $w \geq b_N$ , the share of natives earning wages below  $w$  (i.e.  $G_N(w)$ ) is increasing in  $\phi$ .

## C Model with endogenous contact rate

### Matching function and free entry

In this appendix, we allow for free firm entry and an endogenous contact rate  $\lambda$ . To ensure that firms retain wage-setting power (despite free entry), we impose a fixed cost  $c$  which firms must pay to produce any quantity of output.

Suppose the total flow of worker-firm meetings is determined by a Cobb-Douglas matching function:

$$m(\bar{u}n, k) = \lambda_0 (\bar{u}n)^\alpha k^{1-\alpha} \quad (\text{A24})$$

where:

$$\bar{u} = \mu u_M + (1 - \mu) u_N \quad (\text{A25})$$

is the mean unemployment rate across natives and migrants (so  $\bar{u}n$  is total unemployment), and  $k$  is the (now endogenous) stock of firms. It is useful to define labor market tightness  $\theta$  as:

$$\theta \equiv \frac{k}{\bar{u}n} \quad (\text{A26})$$

Using the matching function, the contact rate for workers  $\lambda$  can then be written as:

$$\lambda = \lambda_0 \theta^{1-\alpha} \quad (\text{A27})$$

### Equilibrium

To simplify the exposition, we assume  $\zeta = 1$  for this exercise: i.e. firms offer natives and migrants identical wages, with the two wage strategies denoted  $w^h$  and  $w^l$ . Free entry ensures that  $\pi(w) = c$  in equilibrium, for any wage offer  $w$  (since firms are identical). Consider an equilibrium where at least some firms offer the high wage  $w^h$  (such that  $\phi < 1$ ): this must

be true if at least some natives are employed. Replacing profit with  $\pi^h$  from equation (A4), and imposing  $\zeta = 1$ , the free entry condition can then be expressed as:

$$\frac{n}{k} \left[ \frac{\mu\lambda}{\delta + \lambda} + \frac{(1 - \mu)\lambda}{\delta + (1 - \phi)\lambda} \right] (p - b_N) = c \quad (\text{A28})$$

Using (A25), (A26) and (A27), this can be re-written as:

$$\frac{\lambda_0}{\delta} (p - b_N) = c\theta^\alpha \quad (\text{A29})$$

(A29) shows that market tightness  $\theta$  is fully determined by  $\frac{\lambda_0}{\delta}$ ,  $p - b_N$  and the operating cost  $c$ . Intuitively, profits are increasing in  $\frac{\lambda_0}{\delta}$  (more hires relative to separations) and  $p - b_N$  (greater profit per hire). To ensure that profit equals  $c$  in equilibrium, these must be offset by larger tightness  $\theta$ , which increases competition over workers.

Notice however that market tightness  $\theta$  is independent of migrant share  $\mu$ : see (A29). This is because native wages are fixed at their reservation  $b_N$ . Consequently,  $\mu$  does not affect the profit of *individual* firms offering  $w^h$ ; and since all firms earn the same profit in equilibrium (firms are identical),  $\mu$  does not enter (A29). Since  $\mu$  does not affect market tightness  $\theta$ , it does not affect the contact rate  $\lambda$ ; so the implications for wage offers (Proposition 2) and native employment (Proposition 3) are identical to the baseline model.

Though the contact rate  $\lambda$  is insensitive to migrant share  $\mu$ , the stock of firms  $k$  is not. From equation (7) in Section 2.1, a larger  $\mu$  increases the low-pay sector share  $\phi$ ; and from (A28), this implies a larger  $k$ . Intuitively, immigration can sustain more firms in equilibrium, as profits increase. But this does not affect the contact rate  $\lambda$ , as the aggregate unemployment rate  $\bar{u}$  grows proportionally with  $k$ .

## D Model with heterogeneous firms

In this appendix, we permit firms to vary by productivity, building on Albrecht and Axell (1984). Let  $H(p)$  denote the share of firms with productivity below  $p$ : i.e. there is a limited stock of high-quality firms (e.g. constrained by the supply of entrepreneurial talent), similar in spirit to Melitz (2003). Firms are either active (if they can operate profitably) or inactive (if not). Firms can only operate profitably if their productivity  $p$  exceeds the migrant reservation wage  $w_M^r$ , so the active share of firms is  $1 - H(w_M^r)$ . To simplify the exposition, we assume  $\zeta = 1$  for this exercise: i.e. firms offer natives and migrants identical wages. It remains true that firms will offer one of two wages (a high wage  $w^h$  or low wage  $w^l$ ), for the reasons given in Section 2.1, with the low wage  $w^l$  equal to the migrant reservation  $w_M^r$ . In what follows, we restrict attention to equilibria with wage dispersion: i.e. at least some firms offer  $w^h$  and others offer  $w^l$  ( $0 < \phi < 1$ ).

## Equilibrium

Let  $p^*$  denote the productivity of the marginal firm (endogenous in the model) which is indifferent between offering  $w^h$  and  $w^l$ . That is,  $p^*$  satisfies:

$$\pi(w^l|p^*) = \pi(w^h|p^*) \quad (\text{A30})$$

where  $\pi(w|p)$  is the profit earned by a productivity  $p$  firm offering wage  $w$ . In equilibrium, all firms with  $p > p^*$  will offer the high wage  $w^h$ , and those with  $p < p^*$  will offer  $w^l$ . Intuitively, high- $p$  firms benefit disproportionately from offering higher wages, because they profit more from larger employment.

After inserting the profit functions (A3) and (A4), equation (A30) yields:

$$\phi = \frac{\delta + \lambda}{\lambda} \left[ 1 - \frac{r}{(r + \delta) \frac{\mu}{1-\mu} \cdot \frac{b_N - b_M}{p^* - b_N} - (\delta + \lambda)} \right] \quad (\text{A31})$$

We call this the “wage-setting equation”. It is identical to (7) in the main text, except productivity  $p$  has been replaced by  $p^*$ : since firms are no longer identical, only the marginal firm must satisfy equal profits. Equation (A31) describes a *negative* equilibrium relationship between  $\phi$  and  $p^*$ . Intuitively, if the marginal firm is more productive ( $p^*$  larger), it will care relatively more about employment (compared to profit per worker). All else equal, this will incline the firm to offer  $w^h$  instead of  $w^l$ . To ensure indifference,  $\phi$  must therefore be smaller in equilibrium: this diminishes the native unemployment pool, which makes recruitment harder for high-wage firms.

To solve for equilibrium, we require one more equation. This comes from the definition of  $\phi$ , the share of *active* firms which offer  $w^l$ :

$$\phi = \frac{H(p^*) - H(w^l)}{1 - H(w^l)} \quad (\text{A32})$$

We call this the “active firm condition”. Holding the migrant reservation  $w^l$  fixed, (A32) describes a *positive* relationship between  $\phi$  and  $p^*$ : if the marginal firm is more productive ( $p^*$  larger), the share of active firms offering  $w^l$  (i.e.  $\phi$ ) must mechanically be larger. However, this relationship is amplified through changes in the migrant reservation  $w^l$ . Based on (5), the migrant reservation wage  $w_M^r$  and hence  $w^l$  are decreasing in  $\phi$ , since a larger  $\phi$  reduces access to high-wage firms. If so, a larger  $p^*$  implies a smaller  $w^l$ : this causes  $H(w^l)$  to contract (there are more active firms, offering  $w^l$ ), so  $\phi$  in (A32) increases even more.

To summarize, the wage-setting equation (A31) describes a negative relationship between  $\phi$  and  $p^*$ , and the active firm condition (A32) describes a positive relationship. Putting these together, we have a unique equilibrium in  $\phi$  and  $p^*$ .

## Impact of immigration

A larger migrant share  $\mu$  induces a shift in the wage-setting equation (A31): the low-pay sector share  $\phi$  expands for any given marginal firm productivity  $p^*$ . But  $\mu$  does not enter the active firm condition (A32). Therefore, a larger  $\mu$  will increase both  $\phi$  and  $p^*$  in equilibrium. Since  $\phi$  expands, the low wage offer  $w^l$  and native employment will also contract; so the effects of immigration are *qualitatively* unchanged from the baseline model.

Quantitatively though, the effects of immigration are amplified in this model by the activation of low-quality firms. Intuitively, a larger supply of migrants with low reservations sustains the existence of low-quality firms (offering  $w^l$ ), which would otherwise be unable to operate profitably. These firms account for a growing share of wage offers to the labor force, and this reinforces the effect on  $\phi$ .<sup>48</sup>

## E Model with idiosyncratic job preferences

In the main text, we rely on a framework which attributes wage-setting power to job search frictions. In this appendix, we show the results are robust to an alternative framework with idiosyncratic job preferences, akin to Card et al. (2018) and Amior and Manning (2026).

Suppose the utility of worker  $i$  of type  $X = \{N, M\}$  in firm  $f$  takes the form:

$$u_{iXf} = \varepsilon \log(w_{fX} - b_X) + a_{if} \quad (\text{A33})$$

where  $w_f$  is the wage paid by firm  $f$  to type  $X$  workers,  $b_X$  is their reservation wage, and the  $a_{if}$  are idiosyncratic workplace amenity matches, distributed type-1 extreme value. Natives never accept offers below  $b_N$ , and migrants never below  $b_M$ . As in the baseline model, we assume  $b_N > b_M$ .

The supply of type  $X = \{N, M\}$  labor to a firm offering wage  $w$  is then:

$$l_X(w) = \Omega_X (w - b_X)^\varepsilon \quad (\text{A34})$$

where the  $\Omega_X$  are endogenous labor supply intercepts, which depend on the type-specific population  $n_X$  and competing wage offers:

$$\Omega_X = \left[ \sum_f (w_{fX} - b_X)^\varepsilon \right]^{-1} n_X \quad (\text{A35})$$

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<sup>48</sup>To see how this formally, consider the active firm condition (A32). In the baseline model, all firms have productivity above  $w^l$ , so the denominator of (A32) collapses to 1. The positive relationship between  $\phi$  and  $p^*$  in (A32) then becomes shallower; and therefore, the overall (positive) impact of migrant share  $\mu$  on  $\phi$  is smaller in the baseline model.

On the production side, firms choose wages  $w_X$  for  $X = \{N, M\}$  to maximize profit:

$$\max_{w_N, w_M} \pi(w_N, w_M) = \sum_X (p - w_X) l_X(w_X) \quad (\text{A36})$$

subject to a non-discrimination constraint:

$$w_N = w_M = w \quad (\text{A37})$$

where we have imposed  $\zeta = 1$  for simplicity (i.e. firms offer natives and migrants identical wages). Assuming there are many firms, they will take the  $\Omega_X$  intercepts of  $l_X(w_X)$  as given.

## E.1 Equilibrium

If firms were free to discriminate, optimal wages would be:

$$w_X^* = \frac{1}{1 + \varepsilon} b_X + \frac{\varepsilon}{1 + \varepsilon} p \quad (\text{A38})$$

But assuming they are unable to do so, firms will adopt one of two strategies:

1. **High-pay strategy ( $w^h$ ).** Firms set wages above  $b_N$ , and therefore employ both natives and migrants. As in Amior and Manning (2026), the optimal offer lies between the optimal discriminating wages:  $w_M^* < w^h < w_N^*$ . The optimal offer can be derived by solving for the first-order condition of (A36). After inserting the labor supply equation (A34) and rearranging, we reach the following implicit equation for  $w^h$ :

$$w^h = p - \frac{1}{\varepsilon} \frac{(w^h - b_N)^\varepsilon + \frac{\Omega_M}{\Omega_N} (w^h - b_M)^\varepsilon}{(w^h - b_N)^{\varepsilon-1} + \frac{\Omega_M}{\Omega_N} (w^h - b_M)^{\varepsilon-1}} \quad (\text{A39})$$

2. **Low-pay strategy ( $w^l$ ).** Firms offer wages below  $b_N$  (but above  $b_M$ ), and therefore employ only migrants. Note that Amior and Manning (2026) do not consider this possibility. Since firms employ only migrants, they offer the optimal discriminating migrant wage:

$$w^l = w_M^* = \frac{1}{1 + \varepsilon} b_M + \frac{\varepsilon}{1 + \varepsilon} p \quad (\text{A40})$$

Though firms in the baseline model are identical, they may choose different pay strategies in equilibrium if these yield equal profit: i.e. if  $\pi(w^h) = \pi(w^l)$ . Just as in the baseline model, such an equilibrium can be sustained through the standard monopsony trade-off: low-pay firms enjoy larger profit per worker, but at the cost of fewer hires (they recruit fewer migrants, and lose access to natives altogether). Using the labor supply equation (A34), the equal profit condition can be written as:

$$(p - w^h) \left[ (w^h - b_N)^\varepsilon + \frac{\Omega_M}{\Omega_N} (w^h - b_M)^\varepsilon \right] = (p - w^l) \frac{\Omega_M}{\Omega_N} (w^l - b_M)^\varepsilon \quad (\text{A41})$$

Let  $\phi$  denote the equilibrium share of firms which choose the low-pay strategy. The labor supply intercepts in (A35) then take the form:

$$\Omega_N = (1 - \mu) \left[ (1 - \phi) \sum_f (w^h - b_N)^\varepsilon \right]^{-1} \frac{n}{k} \quad (\text{A42})$$

for natives (who only work for high-pay firms) and

$$\Omega_M = \mu \left[ \phi \sum_f (w^l - b_M)^\varepsilon + (1 - \phi) \sum_f (w^h - b_M)^\varepsilon \right]^{-1} \frac{n}{k} \quad (\text{A43})$$

for migrants, where  $k$  is the number of firms.

Just as in the baseline model, equilibrium can take one of three forms:

1.  $\pi(w^h) > \pi(w^l)$ , and all firms offer  $w^h$  (i.e. the low-pay sector share  $\phi = 0$ ). There are three unknowns ( $w^h$ ,  $\Omega_N$  and  $\Omega_M$ ), which are pinned down by three equilibrium equations: (A39), (A42) and (A43).
2.  $\pi(w^h) = \pi(w^l)$ , and firms offer different wages ( $0 < \phi < 1$ ). There are five unknowns ( $w^l$ ,  $w^h$ ,  $\Omega_N$ ,  $\Omega_M$  and  $\phi$ ), which are pinned down by five equilibrium equations: (A39), (A40), (A41), (A42) and (A43).
3.  $\pi(w^h) < \pi(w^l)$ , and all firms offer  $w^l$  (i.e. the low-pay sector share  $\phi = 1$ ). There are three unknowns ( $w^l$ ,  $\Omega_N$  and  $\Omega_M$ ), which are pinned down by three equilibrium equations: (A40), (A42) and (A43).

## E.2 Impact of increase in migrant share $\mu$

Unlike in the baseline model, it is not possible to derive an analytical solution. But we offer a sketch of the implications here. These are very similar to the baseline model.

For sufficiently low migrant share  $\mu$ , the low-pay strategy is never optimal; so  $\phi = 0$ , and all firms adopt the high-pay strategy. But as  $\mu$  becomes larger, the migrant labor supply intercept  $\Omega_M$  increases relative to the native intercept  $\Omega_N$ ; and the low-pay sector share  $\phi$  eventually increases above zero. This will generate partial workplace segregation, with low-paying firms exclusively hiring migrants. The low-pay offer  $w^l$  remains unchanged, since it is fully determined by the exogenous parameters: see equation (A40). But as more firms adopt this strategy (i.e. as  $\phi$  increases), workers' outside options become worse, and firms therefore reduce the high-pay offer  $w^h$  in (A39).

Unlike in the baseline model, there is no effect on aggregate employment: all workers remain employed. However, natives do still suffer from an increase in migrant share  $\mu$ : since natives have fewer offers to choose from (as  $\phi$  increases), their expected amenity match

Table A1: Employment and immigrant shares by industry

Industry	Share of employment in 1988 (%)	Foreign share within industry		Change in foreign share 1988-95 (pp)	Post-1988 foreign share in 1995 (%)
		in 1988 (%)	in 1995 (%)		
	(1)	(2)	(3)	(4)	(5)
[1] Agriculture and forestry	0.9	7.6	14.6	7.0	10.1
[2] Energy	1.2	1.7	2.3	0.6	0.6
[3] Mining	1.0	14.2	14.3	0.0	1.8
[4] Chemical industry	3.0	8.0	8.7	0.8	2.4
[5] Plastics	1.8	16.1	16.8	0.7	5.6
[6] Pit and quarry	0.9	9.7	11.6	1.9	5.2
[7] Ceramic and glass	0.6	11.8	14.8	3.0	4.9
[8] Metal production and processing	3.8	15.5	17.1	1.6	5.5
[9] Manufacturing	4.9	9.1	9.8	0.7	2.5
[10] Vehicle manufacturing	6.4	12.3	12.4	0.1	3.8
[11] IT, electronics, optics	8.0	10.7	11.7	1.0	3.4
[12] Musical instruments, jewelry, toys	0.2	7.8	9.8	2.1	4.6
[13] Wood and wood products	1.9	7.4	9.4	2.0	4.4
[14] Printing and paper processing	1.8	10.3	11.8	1.5	3.5
[15] Leather and textile	2.6	12.8	14.4	1.6	4.8
[16] Food and tobacco	3.3	7.0	11.7	4.6	5.9
[17] Construction	6.7	11.0	14.4	3.3	7.7
[18] Trading	13.6	4.6	7.3	2.7	4.0
[19] Transportation, communication	4.7	7.4	9.9	2.4	4.0
[20] Credit and insurance	4.1	1.9	2.9	1.0	1.2
[21] Hospitality	2.2	21.7	32.4	10.7	21.8
[22] Healthcare and welfare	7.0	5.7	7.9	2.2	3.7
[23] Business-related services	5.0	6.9	10.5	3.6	6.1
[24] Educational services	3.0	5.4	6.4	1.0	2.9
[25] Recreational services	1.2	6.5	7.7	1.2	3.3
[26] Household services	1.2	9.3	14.8	5.5	9.6
[27] Social services	2.4	5.0	6.6	1.6	3.0
[28] Public administration	6.7	3.3	3.7	0.4	1.1

Notes: Shares computed using SIAB. Post-1988 migrants entered in or after 1989.

will become smaller. To generate an employment effect, we would need an additional “non-employment” choice in the utility model: as the value of work contracts (due to lower-quality amenity matches), natives would then be more likely to exit employment.

Though the implications are similar, we focus on the job search model in the main text – for reasons of simplicity. First, the search model has a simple analytical solution. And second, it yields an aggregate employment effect (a key result) even in its simplest specification.

## F Evidence on migrants’ labor market integration

### F.1 Distribution of migrants across industries

Column 1 of Table A1 reports the share of total employment in each of 28 industries in 1988, and column 2 reports foreign shares within these industries. Migrants were concentrated in

mining, plastics, metal, ceramic and glass, leather and textile production and processing, as well as vehicle manufacturing, construction and hospitality.

Column 3 reports foreign share by industry in 1995, and column 4 the change since 1988. It increased by 10.7 pp in hospitality, reaching more than 30% in 1995, and also grew strongly in agriculture and household services. Though it increased just 3.3 pp in construction, column 5 shows the share of post-1988 migrant arrivals was significantly larger (7.7% in 1995): i.e. new migrants replaced previous cohorts. Moreover, social security and other data sources exclude subcontracted “posted workers” from foreign firms: they numbered around 90,000 in 1993, of whom two thirds were employed in construction (Werner, 1996). The share of new arrivals was also high in many light manufacturing industries. As the sectoral distribution of migrants is potentially endogenous to demand, we do not use this variation for identification.

## F.2 Correcting firm wage premia for measurement error

In Section 4.2, we compare firm-specific wage premia for natives and migrants. However, measurement error may generate downward bias in the Table 3 estimates. To correct for this, we follow two approaches: (i) split-sample IV and (ii) empirical Bayes.

**(i) Split-sample IV.** We begin by splitting native workers into two random groups (“A” and “B”), and separately estimate firm wage premia for each: we denote these as  $\eta_j^A$  and  $\eta_j^B$  for firm  $j$ . A regression of  $\eta_j^B$  on  $\eta_j^A$  yields a coefficient of 0.50 (with a standard error of 0.02): this confirms that our premia estimates are noisy.

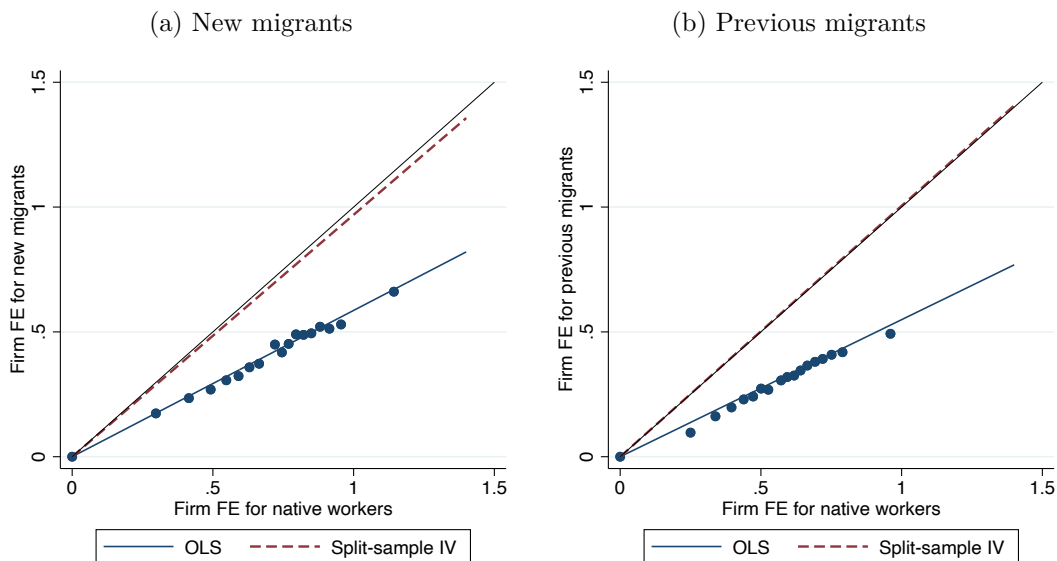
To correct for the bias, we regress the migrant firm premia on the native premia  $\eta_j^A$  from group A, using the group B premia  $\eta_j^B$  as an instrument. Figure A1 illustrates the results. The blue dots show the mean firm premia for new migrants (Panel a) or previous migrants (Panel b) across ventiles of the native firm premia distribution (with the bottom ventile normalized to zero for both groups), with the blue lines showing linear fits:  $\hat{\beta}_{new} = 0.586$  and  $\hat{\beta}_{previous} = 0.549$  (see Table 3). The dashed red lines show the split-sample IV estimates that adjust for measurement error:  $\hat{\beta}_{new} = 0.969$  and  $\hat{\beta}_{previous} = 1.005$ . We conclude that firm premia are similar for natives and migrants, once we account for measurement error.

**(ii) Empirical Bayes.** A more efficient approach is to shrink the variance of the native firm premia. This allows us to preserve the full sample, but we must assume the native firm premia are normally distributed:  $\eta_j \sim N(\mu_\eta, \sigma_\eta^2)$ . Given this restriction, the posterior mean for the firm  $j$  premium is:

$$\eta_j^* = \frac{\sigma_\eta^2}{\sigma_\eta^2 + s_j^2} \hat{\eta}_j + \frac{s_j^2}{\sigma_\eta^2 + s_j^2} \mu_\eta \quad (\text{A44})$$

This is a weighted average, which shrinks the premia estimates  $\hat{\eta}_j$  towards the mean  $\mu_\eta$ . The weights depend on the relative size of  $\sigma_\eta^2$  (the variance of the firm premia distribution)

Figure A1: Firm-level pay premia for natives and migrants



SIAB, 1990-96. Blue dots show mean firm premia for new migrants (Panel a) or previous migrants (Panel b) across ventiles of the native firm premia distribution (with the bottom ventile normalized to zero for both groups). Blue lines show linear fits:  $\hat{\beta}_{new} = 0.586$  and  $\hat{\beta}_{previous} = 0.549$  (see Table 3). Dashed red lines show split-sample IV estimates that adjust for measurement error:  $\hat{\beta}_{new} = 0.969$  and  $\hat{\beta}_{previous} = 1.005$ . To aid interpretation, we show a 45 degree line (in black). “Previous” migrants entered employment before 1989, and “new” migrants in or after 1989.

and  $s_j^2$  (the variance of the  $\hat{\eta}_j$  estimate). The expected premium  $\mu_\eta$  can be estimated as  $\hat{\mu}_\eta = \frac{1}{J} \sum_j \hat{\eta}_j$ , and its variance as  $\hat{\sigma}_\eta^2 = \frac{1}{J} \sum_j [(\hat{\eta}_j - \hat{\mu}_\eta)^2 - s_j^2]$ . Plugging these into (A44), we compute a posterior mean  $\eta_j^*$  for every firm  $j$ . We then regress the estimated migrant firm premia on the (shrunk) native posteriors. As Table 3 shows, this yields a coefficient close to 1, just like split-sample IV.

### F.3 Differential wage premia: Longitudinal evidence

In the analysis in Table 3, we cannot condition on worker fixed effects when estimating the native and migrant firm premia (as we do not have access to full count data). Consequently, one might worry the estimates in Table 3 are driven by correlations in unobserved heterogeneity between native and migrant employees, across firms.

To address this concern, similar to Aslund et al. (2021), we track the wages of *individual* workers (separately for natives and migrants) as they transition between low and high-paying firms (as proxied by the AKM firm premia estimates of Card, Heining and Kline, 2013). That is, we estimate simple models for log wages of individuals  $i$  in firm  $j$  at time  $t$ , of the form:

$$\log w_{ijt} = \beta AKM_j \cdot Migrant_i + X_{it}\beta_X + \beta_t + \beta_i + \varepsilon_{it} \quad (\text{A45})$$

where  $AKM_j$  is the firm-level AKM premium, and  $Migrant_i$  is an indicator taking 1 if

Table A2: Worker-level wage effects of AKM

	Basic estimates		Worker fixed effects	
	(1)	(2)	(3)	(4)
AKM	1.038*** (0.006)	1.043*** (0.006)	0.905*** (0.004)	0.897*** (0.004)
AKM $\times$ Previous migrant		-0.047*** (0.007)		0.105*** (0.012)
AKM $\times$ New migrant		-0.020** (0.008)		0.020 (0.015)
Year fixed effects	Y	Y	Y	Y
Edu $\times$ age $\times$ sex FEs	Y	Y	Y	Y
New/previous migrant FEs	Y	Y		
Worker FEs			Y	Y
Observations (mil.)	2.312	2.312	2.260	2.260
$R^2$	0.601	0.601	0.901	0.901

SIAB, 1990-96, for individuals aged 16-65. "Previous" migrants entered employment before 1989, "new" migrants in or after 1989. AKM firm fixed effects are estimated by Card, Heining and Kline (2013), using universe of employment records. Standard errors clustered at establishment level, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

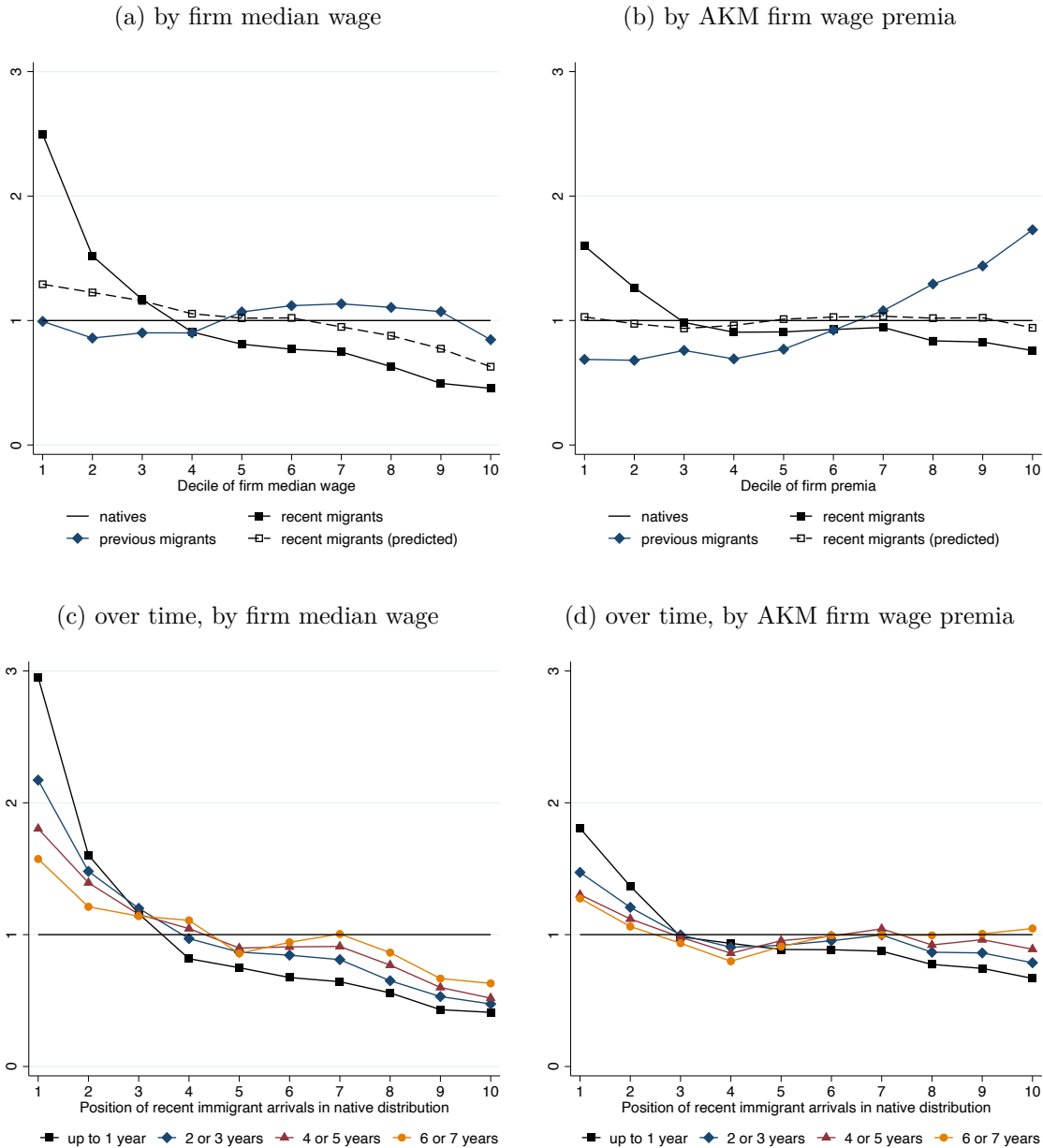
worker  $i$  is a migrant. In the  $X_{it}$  vector, we control for interactions between education, sex and age (as in Table 2). We rely on data between 1990 and 1996, the period for which our (time-invariant)  $AKM_j$  premia are estimated.

We present our estimates in Table A2. In columns 1-2, we control for previous/new migrant indicators instead of worker fixed effects  $\beta_i$ . The coefficient on the  $AKM_j$  premium in the first column is simply 1, unsurprisingly: the AKM premia are estimated with the same wage data. Of greater note, column 2 shows that natives and migrants benefit similarly from working in higher-AKM firms (consistent with Table 3). In columns 3 and 4, we now control for worker fixed effects  $\beta_i$ . That is, we study how individual wages change as workers *transition* from low to high-AKM firms. Column 4 shows that natives and migrants benefit similarly from these transitions; and if anything, migrants benefit slightly more.

#### F.4 Distribution of migrants across firm pay deciles

Figure A2 plots the density of new (post-1988) and previous migrants across the firm pay distribution, relative to natives, using SIAB data for the years 1990-6. In Panel a, we rank firms by their median wage. Firms are weighted by native employment, so the density of natives is fixed at 1 by construction. In comparison, new migrants are heavily overrepresented in low-wage firms, while previous migrants look similar to natives. The presentation of these figures is analogous to Dustmann, Schoenberg and Stuhler (2016), though the support here is firm pay rather than individual wages.

Figure A2: Distribution of migrants across firm pay deciles



SIAB, 1990-96, for workers aged 16-65. “Previous” migrants entered employment before 1989, “new” migrants in or after 1989.

The concentration of new migrants in low-wage firms cannot merely be explained by sorting on observable skills. For illustration, the dashed line in Panel a predicts the distribution of new migrants, based on how comparable natives (with the same age, education and gender) are allocated across the firm deciles.<sup>49</sup> Sorting on observable skills explains only

<sup>49</sup>We implement this exercise by re-weighting native employment within age-education-gender cells, to replicate the distribution of new migrants’ observables. The dashed line in Panel a shows how these re-weighted natives are allocated across the firm deciles.

a small fraction of migrants’ overrepresentation in low-wage firms: this is consistent with Swedish evidence from Aslund et al. (2021).

Panel b repeats this exercise, but ordering firms by pre-compiled AKM wage premia (from Card, Heining and Kline, 2013), which control for worker composition. New migrants are again overrepresented at the bottom of the distribution, though the pattern is less pronounced than for median firm wages. This can partly be attributed to measurement error in the AKM premia (especially in low-paying firms, which are typically small), which will blur any genuine distributional differences. As before, the dashed line shows these patterns cannot be attributed to sorting on observables. Previous migrants are now overrepresented at the top end, possibly because earlier “guest worker” cohorts often worked for large high-premium manufacturing firms.

Panels c and d illustrate how the migrant distribution changes with time in Germany. While new arrivals are heavily concentrated in low-pay firms, migrants transition to better-paying firms over time. By the 6th year, much of the gap with natives is eliminated. These patterns are in line with Lehmer and Ludsteck (2015), Arellano-Bover and San (2020) and Dustmann, Ku and Surovtseva (2024), and are consistent with the on-the-job search extension to our model (Section 2.4): new migrants do work their way up the firm distribution, but this process takes time.

## G First stage estimates and potential confounders

### G.1 First stage scatter relation

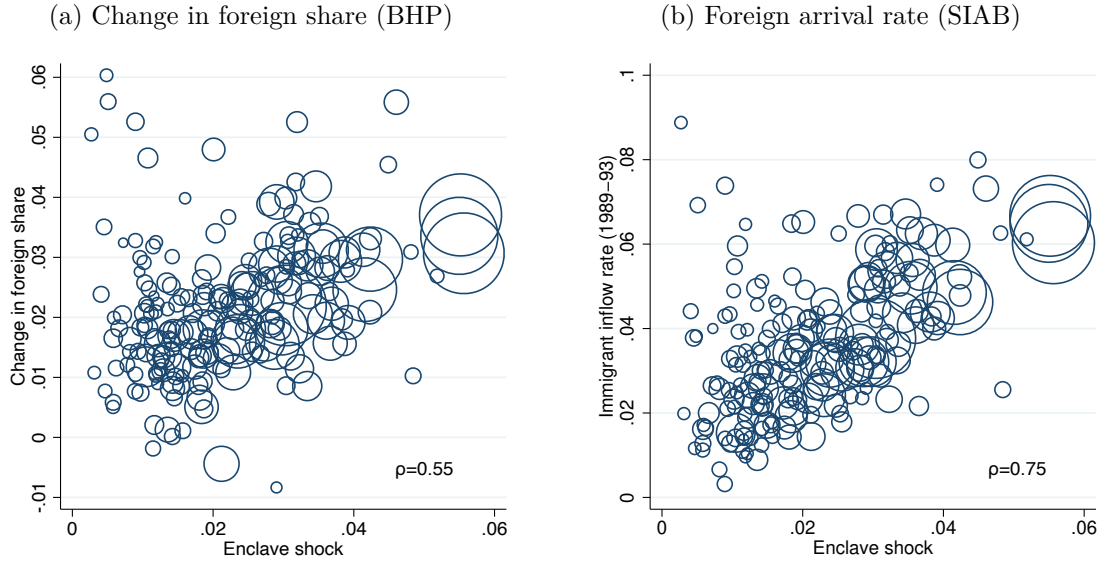
The maps in Figure 3 illustrate the predictive power of the enclave shock  $\Delta m_r$  for changes in foreign employment share. Figure A3a shows this relation in a scatter plot. The correlation is even tighter when the outcome is the migrant arrival *rate*<sup>50</sup> (i.e. the number of post-1988 foreign workers in 1993, relative to total regional employment in 1988), rather than changes in overall foreign shares: see Panel b. The difference between the two reflects the exit of previous migrant cohorts from the regional sample, whether due to reduced employment rates, out-migration, or retirement.

From the perspective of our model, the recent arrivals are likely to play the crucial role in any potential adverse wage-setting effects, as they appear to have significantly lower reservation wages than natives or previous migrants (see Section 4).

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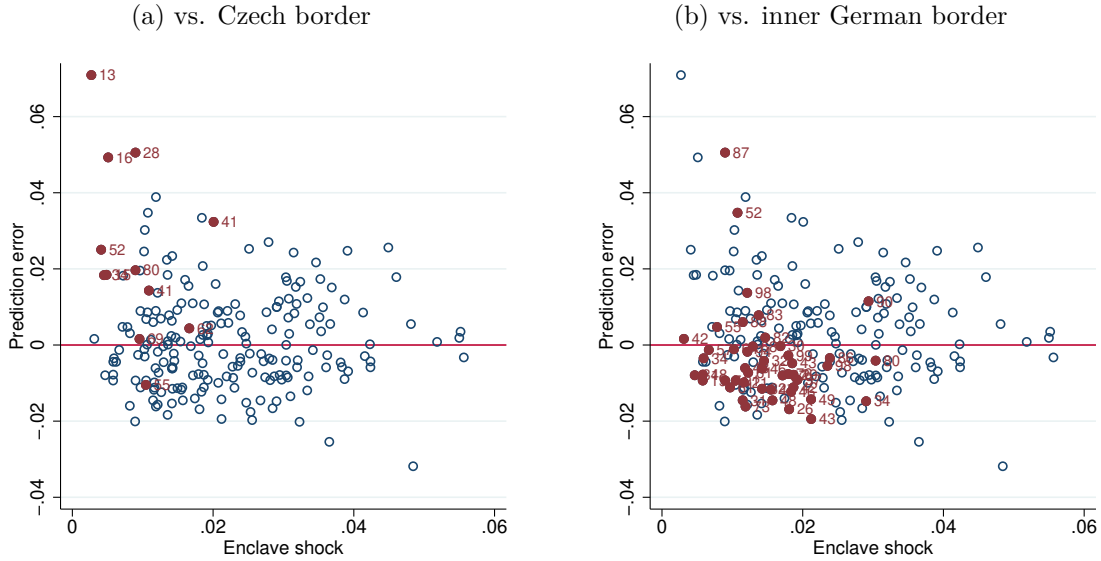
<sup>50</sup>Note we can only observe migrants’ year of arrival (and hence arrival rates) in the SIAB worker panel, and not in the BHP establishment panel.

Figure A3: First stage relation



Panel a shows local changes in foreign employment share between 1988 and 1993 against the enclave shock (i.e. the predicted change defined by (11)), using BHP data. Panel b shows the foreign arrival rate between 1989 and 1993 (using SIAB data), also against the enclave shock. Marker size is proportional to total regional employment in 1988.

Figure A4: Prediction error in first stage



SIAB. Both panels plot prediction errors from a regression of the 1988-93 foreign arrival rate on the enclave shock  $\Delta m_r$ , across local labor markets  $r$ . In Panel a, local labor markets in the German-Czech border region are marked in red and labeled with their distance to the German-Czech border (in km). In Panel b, local labor markets close to the inner German border are labeled with their distance to the inner German border (in km).

## G.2 Prediction errors in first stage

Figure A4 plots prediction errors from the first stage regression of the migrant arrival rate on the enclave shock. As Panel a shows, the most extreme under-predictions are in regions close to the Czech border, which are marked red and labeled with their distance from the

Table A3: East German vs. changes in foreign shares

	East German population inflows 1991-93			
	(1)	(2)	(3)	(4)
$\Delta$ foreign share 1988-93				
<i>actual</i>	-0.044*	0.011		
	(0.021)	(0.017)		
<i>predicted (enclave shock)</i>			-0.031	0.031
			(0.025)	(0.022)
Distance E/W border (log)		-0.004***		-0.004***
		(0.000)		(0.000)
$R^2$	0.029	0.463	0.019	0.478
N	204	204	204	204

SIAB, regression estimates across 204 local labor markets. Enclave shock is defined in (11). Distance E/W is the log distance to the inner German border. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

border (in km). This was due to a policy allowing Czech workers to commute to Germany: see Dustmann, Schoenberg and Stuhler (2017).

At the same time, Panel b shows that the enclave shock overpredicts foreign inflows to regions close to the former East-West German border (again, marked in red). As discussed in Section 5.2, new migrants likely avoided these areas to escape labor market competition with East Germans. To partial out this effect, we control for log distance to the former border in our empirical specification.

### G.3 Reunification and inflows from East Germany

A key challenge is the potential conflation of international migration with East German inflows. Our proposed solution is to control for log distance to the former inner German border, which predicts these inflows well (see Figure 4).

Table A3 provides additional empirical support for this strategy. The dependent variable is the local population inflow from East Germany between 1991 and 1993 (from the Federal Statistical Office), expressed as a share of population in 1988: since residents have to register by law, these are reliable statistics. Column 1 shows that East German inflows are negatively correlated with changes in foreign share, consistent with the pattern observed in Figures 3 and 4. However, this correlation is small and disappears when controlling for distance to the inner German border. Columns 3 and 4 confirm a similar pattern for *predicted* changes in foreign share, i.e. the enclave shock  $\Delta m_r$ . In estimates not reported here, we also find similar results when using East German employment (rather than population) inflows as the dependent variable. To summarize, the log distance control can successfully partial out the small negative correlation between East German and foreign inflows.

Table A4: Ethnic German (*Aussiedler*) vs. changes in foreign shares

	Change in <i>Aussiedler</i> share (1988-93)			
	(1)	(2)	(3)	(4)
$\Delta$ foreign share 1988-93				
<i>actual</i>	-0.111 (0.074)	-0.120 (0.074)		
<i>predicted (enclave shock)</i>			-0.173*** (0.065)	-0.200** (0.065)
Distance E/W border (log)		0.001 (0.001)		0.002 (0.001)
$R^2$	0.023	0.025	0.078	0.089
N	204	204	204	204

SIAB, regression estimates across 204 local labor markets. Enclave shock is defined in (11). Distance E/W is the log distance to the inner German border. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## G.4 Repatriation of ethnic Germans

A second potential concern is the repatriation of ethnic Germans. In 1990, nearly 400,000 ethnic Germans exercised their right to move to Germany from the USSR and Eastern Bloc; and 225,000 arrived annually in subsequent years (Glitz, 2012). This could prove a challenge if the spatial distribution of ethnic Germans (who are coded as German nationals in our data) correlates with foreign nationals. Though the government aimed to ensure an equal distribution of ethnic Germans across the country (relative to local population), these efforts were largely ineffective until 1996 when restrictions were tightened (Glitz, 2012).

Following Brücker and Jahn (2011), we identify recently arrived ethnic Germans by receipt of special language courses and other integration subsidies targeted at this group (reported in the SIAB). Using this information, we construct local changes in ethnic German employment shares between 1988 and 1993, and relate these to changes in foreign share in Table A4. The two variables are negatively correlated (columns 1-2), but the relationship is weak and statistically insignificant. The effect of the enclave shock is slightly more pronounced (columns 3-4), but it still explains less than 10% of the spatial variation in ethnic German inflows. Furthermore, this negative effect could be interpreted as part of the impact we aim to capture, if ethnic Germans avoided regions more exposed to foreign inflows.

## H Additional evidence on impact of enclave shock

### H.1 Contribution of entrants to native crowd-out

Figure 5b shows a negative effect of the enclave shock on native employment. One key margin of adjustment is the inflow from non-employment: i.e. natives who were employed

Table A5: Robustness of regional employment, firm size and wage effects

	Robustness to baseline controls			Additional controls		Sample and weighting	
	No controls (1)	+ Log distance to E/W border (2)	+ Bartiks and projected pop (3)	State FEs (4)	Density and manuf. share (5)	Excl. top 3 regions (6)	Unweighted estimates (7)
A. Post-1988 foreign share (1995)	1.073*** (0.056)	0.970*** (0.061)	1.019*** (0.063)	0.828*** (0.053)	1.025*** (0.064)	0.948*** (0.086)	0.846*** (0.108)
B. Change in log native emp (1995 v 1988)	-2.234*** (0.299)	-1.946*** (0.311)	-1.296*** (0.276)	-0.920*** (0.277)	-1.058*** (0.259)	-1.250*** (0.370)	-1.077*** (0.345)
C. Change in log emp rate (1995 v 1988)	-1.424*** (0.217)	-1.311*** (0.224)	-1.533*** (0.217)	-1.029*** (0.274)	-1.435*** (0.230)	-1.442*** (0.385)	-1.297*** (0.312)
D. Change in log firm size (1995 v 1988)	-1.292*** (0.362)	-1.287*** (0.390)	-1.020*** (0.287)	-0.714* (0.412)	-0.647** (0.254)	-1.411*** (0.464)	-1.351*** (0.437)
E. Change in mean AKM (1993-99 v 1985-92)	-0.625*** (0.085)	-0.764*** (0.115)	-0.723*** (0.134)	-0.646*** (0.104)	-0.709*** (0.135)	-0.703*** (0.112)	-0.654*** (0.121)

Robustness of estimated effects of enclave shock  $\Delta m_r$ , for various outcomes along table rows. Column 1 shows estimates with no controls. Column 2 includes only log distance to inner German border. Column 3 shows our baseline estimates, after including all remaining controls (employment and wage Bartiks, and projected population growth). Columns 4 and 5 add federal state fixed effects or the baseline manufacturing share and population density. Column 6 excludes the regions with the three largest enclave shocks (Frankfurt, Munich and Stuttgart) from the baseline specification. Column 7 estimates our basic specification without weighting observations by employment. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01.

in region  $r$  in year  $t$ , but not employed in any region in 1988. To assess this margin, we use the number of native entrants in year  $t$  (relative to native employment in 1988) as the dependent variable in equation (10). Though more exposed regions show similar pre-trends in total native employment (see Figure 5b), inflow rates do differ before treatment. To address this challenge, we control for average inflows in the pre-period (1985-88), in addition to our usual set of control variables.

We plot our estimates in Figure 5b: the inflow rate in exposed regions decreased significantly (relative to pre-treatment levels), and this effect explains most of the reduction in native employment in the initial years of the immigration wave.

## H.2 Robustness of regional employment and wage effects

In Table A5, we study the robustness of the enclave shock effects, for various outcomes along the rows of the table: the new (post-1988) migrant share in 1995 (from Figure 5a), changes in log native employment between 1988 and 1995 (Figure 5b), changes in the log native employment rate (Figure 5c), changes in log mean firm size (from column 2, Table 6), and changes in mean regional AKM firm wage premia (from column 1, Table 7). For the latter outcome, we rely on pre-compiled AKM premia from Bellmann et al. (2020).

Column 1 shows estimates with no controls. Column 2 includes only log distance to the inner German border. Column 3 shows our baseline estimates, after including all remaining controls (the employment and wage Bartiks, and projected population growth). Columns

4 and 5 add federal state fixed effects or the baseline manufacturing share and population density. Column 6 excludes the regions with the three largest enclave shocks (Frankfurt, Munich and Stuttgart) from the baseline specification. And in column 7, we estimate our basic specification without weighting observations by employment.

The estimates are mostly robust to these specification choices. In particular, controlling for distance to the inner German border (column 2) makes little difference. And reassuringly, the unweighted estimates (column 7) also look similar: this confirms that the effects are not merely driven by a small number of high-employment regions.

Interestingly, log native employment in row B does show some sensitivity. The column 3 controls reduce the coefficient on the enclave shock  $\Delta m_r$  from -1.95 to -1.30. This is mainly due to the population projection control, which predicts local population growth using regional variation in pre-treatment population pyramids (from the 1987 census). This control is strongly predictive of local employment growth, but it happens to correlate negatively with the enclave shock  $\Delta m_r$ . As Section 5.3 explains, there are good conceptual reasons to include this control (due to the fertility transition). In practice, it matters more for “scale” variables such as total native employment: the employment *rate* in row C is less sensitive.

### H.3 Firm wage effects by percentile

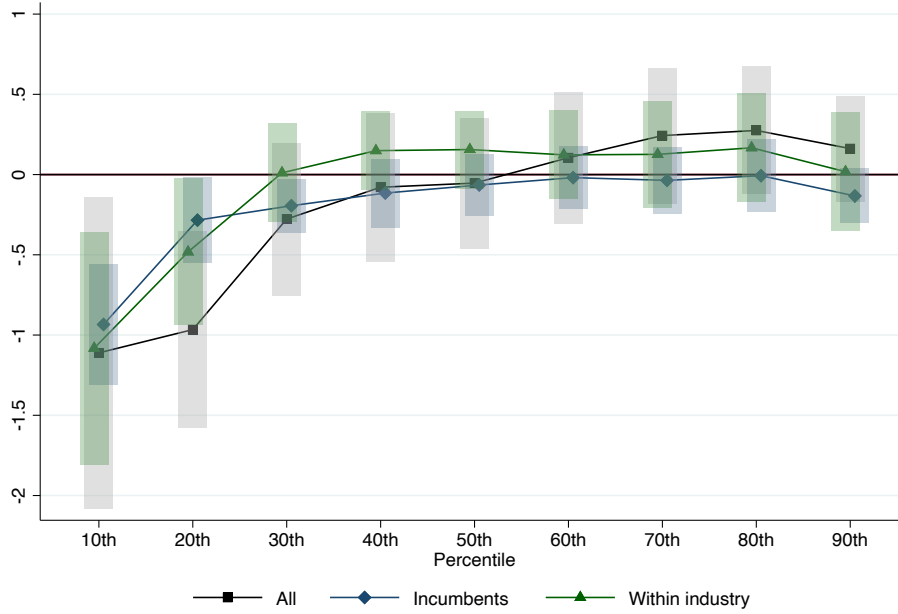
In Figure 8, we estimated the impact of immigration across the local distribution of AKM firm premia. In Figure A5, we repeat this exercise for firms’ median native wages, instead of AKM premia. Similar to the AKM evidence, the negative effects are concentrated at the bottom of the firm pay distribution.

The black line in Figure A5 shows effects across the full firm sample, and the blue line among incumbent firms (present in both 1988 and 1995): both look similar. The green line shows the impact on wage residuals, after purging detailed industry effects (97 categories) interacted with time effects. This too makes little difference: i.e. the distributional effects manifest mostly within industries, rather than between them.

### H.4 Employment and wage effects by industry

Table A6 explores sectoral heterogeneity in the impact of the shock. We study three outcomes: the new migrant share in 1995 (as in Figure 5a), changes in log native employment between 1988 and 1995 (Figure 5b), and changes in mean AKM firm premia (as in column 1, Table 7). Along the table rows, we show effects separately for four broad sectors. Row A (tradables) includes agriculture, energy, mining and manufacturing (codes 1-16 in Table A1), row B is construction (code 17), row C includes codes 18-20, and row D codes 21-28.

Figure A5: Changes in firm native median wage (by percentile)



BHP, regression estimates for 1988-95 interval, based on equation (10), across 203 local labor markets.

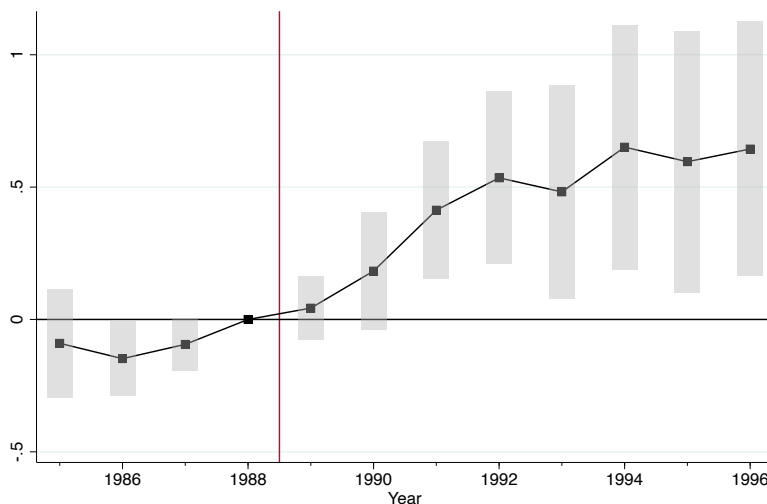
Table A6: Employment and wage effects by industry

	Post-1988 migrant share (1)	Change in log native emp (2)	Change in mean AKM premia (3)
A. Tradables	0.720*** (0.084)	-2.390*** (0.351)	-0.827*** (0.226)
B. Construction	2.453*** (0.303)	-1.580* (0.902)	-1.079*** (0.123)
C. Trade, transport, finance	1.039*** (0.063)	-1.080** (0.416)	-0.741*** (0.191)
D. Other services	1.154*** (0.076)	-0.432*** (0.357)	-0.474*** (0.115)

This table estimates effects of the enclave shock  $\Delta m_r$  on employment and wage outcomes (along the table columns), for different industry groups (table rows). Column 1 reports effects on post-1988 migrant share in 1995. Column 2 shows effects on log native employment changes between 1988 and 1995. Column 3 shows effects on changes in mean AKM firm wage premia (as computed by Bellman et al., 2020) between the periods 1985-92 and 1993-99. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Column 1 shows that the post-1988 migrants are well-represented across all four sectors, and especially construction. The native employment effects are consistently negative, but largest in tradables. The effects on wage premia are also consistently negative, though somewhat smaller in the “other services” category.

Figure A6: Impact on workplace segregation



BHP, regression estimates based on equation (10) across 203 local labor markets with 95% CIs. Dependent variable is regional change in index of dissimilarity between 1988 and indicated year.

## H.5 Impact on workplace segregation

Since low-paying firms hire migrant labor and forgo natives, workplace segregation grows. Figure A6 shows the impact of immigration on the index of dissimilarity, a popular measure of segregation:

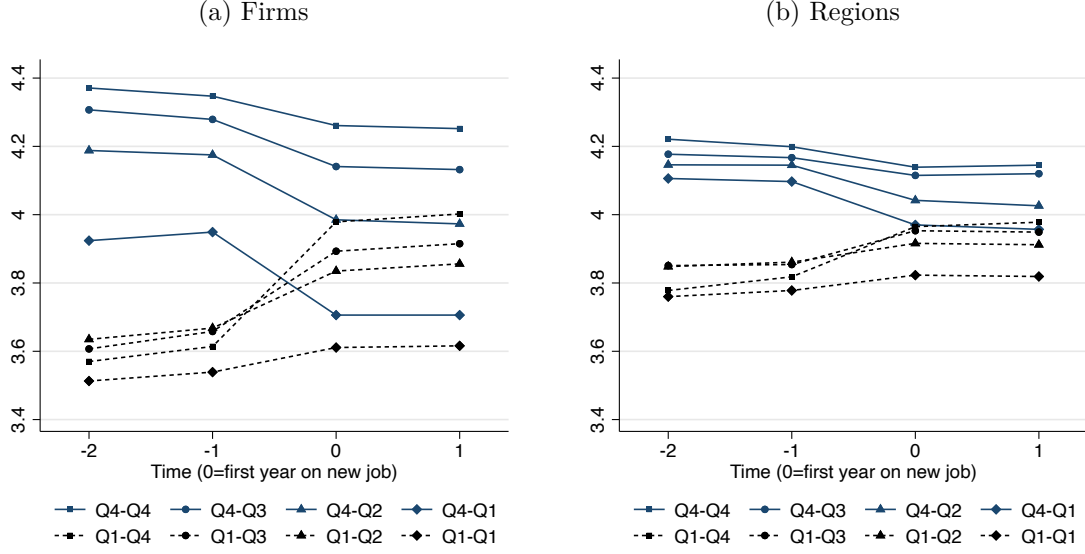
$$ID_r = \frac{1}{2} \sum_{j \in r} \left| \frac{\text{Migrants}_j}{\sum_{j \in r} \text{Migrants}_j} - \frac{\text{Natives}_j}{\sum_{j \in r} \text{Natives}_j} \right| \quad (\text{A46})$$

where  $j$  denotes firms in region  $r$ . The index compares shares of the migrant and native workforce (within region  $r$ ) employed in each establishment, and varies from 0 (no segregation) to 1 (perfect segregation). Segregation grew strongly in affected regions in the early 1990s, reflecting both the clustering of new migrants in low-pay firms (Figure 6) and crowd-out of native workers from those same firms (Figure 7).

## H.6 Validation of firm and regional AKM wage premia

To identify wage premia for firms (as in Section 8) and regions (Appendix H.8 below), we use a “movers design”. This requires an exogenous mobility assumption, that the sequence of wage innovations (the  $\varepsilon_{it}$  in equation (12)) is orthogonal to worker  $i$ ’s firm (or location) choices. Here, we offer evidence to support this assumption. Following Card, Heining and Kline (2013) and Card, Rothstein and Yi (2025), we group firms/regions into four quartiles, according to their estimated wage premia. And in Figure A7, we show that workers moving between low- and high-premium firms/regions have similar (close to flat) pre-trends before the move. These results support the claim that wage changes associated with a move capture firm or regional wage premia, rather than individual differences in wage trajectories.

Figure A7: Validation of firm and region wage premia



SIAB, mean wages of workers who change firms (Panel a) or regions (Panel b) during 1986-88 interval, and who do not change region (or firm) in previous or subsequent year. Each job is classified into quartiles based on estimated fixed effects for regions or firms, respectively.

## H.7 Decomposing the change in AKM wage premia

This section shows how mean changes in AKM firm premia (at the region level) can be decomposed into contributions from incumbent firms, entrants and exiters. We denote the pre- and post-treatment periods with the subscripts 0, 1, and define:

- $\bar{\eta}_{r,t}$ : mean firm premium in region  $r$  and period  $t$
- $\bar{\eta}_{r,t}^{inc}$ : mean firm premium in period  $t$ , among incumbent firms (active in both periods)
- $\bar{\eta}_{r,1}^{ent}$ : mean post-period firm premium, among entrant firms (active only in post-period)
- $\bar{\eta}_{r,0}^{ex}$ : mean pre-period firm premium, among exiting firms (active only in pre-period)
- $N_{r,t}$ : no. firms in region  $r$  and period  $t$
- $N_r^{inc}$ : no. firms in region  $r$  active in both periods

Using this notation, we can write the mean pre- and post-treatment wage premia as:

$$\bar{\eta}_{r,0} = \frac{N_r^{inc}}{N_{r,0}} \bar{\eta}_{r,0}^{inc} + \left(1 - \frac{N_r^{inc}}{N_{r,0}}\right) \bar{\eta}_{r,0}^{ex} = \bar{\eta}_{r,0}^{inc} + \left(1 - \frac{N_r^{inc}}{N_{r,0}}\right) (\bar{\eta}_{r,0}^{ex} - \bar{\eta}_{r,0}^{inc}) \quad (\text{A47})$$

$$\bar{\eta}_{r,1} = \left[ \frac{N_r^{inc}}{N_{r,1}} \bar{\eta}_{r,1}^{inc} + \left(1 - \frac{N_r^{inc}}{N_{r,1}}\right) \bar{\eta}_{r,1}^{ent} \right] \quad (\text{A48})$$

Table A7: Mean changes in regional wage premia

	Movers				Raw wage	Residualized
	1993-99 v 1985-92 (1)	1983-85 v 1986-88 (2)	1991-93 v 1986-88 (3)	1994-96 v 1986-88 (4)	1994-96 v 1986-88 (5)	1994-96 v 1986-88 (6)
All workers	-0.739*** (0.138)	-0.110 (0.334)	-0.326 (0.220)	-0.827*** (0.220)	-0.360 (0.301)	0.186 (0.230)
Natives only	-0.751*** (0.127)	-0.060 (0.340)	-0.301 (0.209)	-0.944*** (0.241)	0.121 (0.284)	0.264 (0.219)

SIAB, regression estimates based on equation (10) across 204 local labor markets. Columns 1-4 report estimated effects on (mover-identified) regional wage premia  $\eta_r$ , as described by Appendix H.8. Columns 5-6 report effects on raw wages and residualized wages (controlling for age-education-gender interactions, but not individual fixed effects). \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Putting these together, we have:

$$\bar{\eta}_{r,1} - \bar{\eta}_{r,0} = \underbrace{\frac{N_r^{inc}}{N_{r,1}} (\bar{\eta}_{r,1}^{inc} - \bar{\eta}_{r,0}^{inc})}_{\text{Incumbents}} + \underbrace{\left(1 - \frac{N_r^{inc}}{N_{r,1}}\right) (\bar{\eta}_{r,1}^{ent} - \bar{\eta}_{r,0}^{inc})}_{\text{Entrants}} - \underbrace{\left(1 - \frac{N_r^{inc}}{N_{r,0}}\right) (\bar{\eta}_{r,0}^{ex} - \bar{\eta}_{r,0}^{inc})}_{\text{Exiters}} \quad (\text{A49})$$

In Table 7, we estimate the response of each component of (A49) to the enclave shock.

## H.8 Direct estimates of regional wage premia

For Table 7, we compute regional wage premia using regional averages of pre-compiled firm AKM premia. An alternative approach is to replace the firm fixed effect  $\eta_{j(i,t)}$  in equation (12) with a region fixed effect  $\eta_{r(i,t)}$ :

$$y_{it} = \alpha_t + \eta_{r(i,t)} + \theta_i + \gamma X_{it} + \varepsilon_{irt} \quad (\text{A50})$$

where the  $r(i,t)$  subscript denotes the region  $r$  in which individual  $i$  worked in year  $t$ . This specification is similar to Combes, Duranton and Gobillon (2008), and we are able to estimate it ourselves in our 2% SIAB worker panel. The estimated  $\eta_r$  premia may be biased, if regional movers change their position in the local firm hierarchy (Card, Rothstein and Yi, 2025); but for our purposes (estimating responses to local shocks), the bias appears not to be consequential. Importantly, it gives us the flexibility to define our own subsamples – unlike the pre-compiled AKM premia.

Similar to the AKM premia, we require an “exogenous mobility” assumption: the sequence of  $\varepsilon_{it}$  innovations must be orthogonal to the sequence of worker  $i$ ’s location choices. We offer empirical support for this assumption in Figure A7b: as for firm movers, the wage trends of workers moving between low- and high-premia regions are parallel (and approximately flat) before the move.

In Table A7, we estimate the impact of the enclave shock  $\Delta m_r$  on changes in the regional

premia  $\eta_r$ , between various intervals (along the table columns), and for different worker samples (along the rows). For comparison with Section 8.2, column 1 shows changes in  $\eta_r$  between the same intervals as Bellmann et al. (2020), i.e. 1985-92 and 1993-99. This yields a coefficient of -0.74: reassuringly, this is very close to the column 1 estimate of Table 7. In row 2, we exclude migrants from our sample (when estimating the  $\eta_r$  premia): this makes little difference to the results.

Though the Bellmann et al. intervals do closely match our pre- and post-treatment periods, it is not a perfect fit. For the remaining columns, we re-estimate the  $\eta_r$  premia for finer three-year intervals, using 1986-88 as our baseline period. In column 2, to test for pre-trends, we compare our baseline period against 1983-85. Our estimates show no differential pre-trends for the full sample (row 1) or native workers (row 2): regional premia evolved similarly in more and less exposed areas before the shock.

We next turn to the post-treatment effects. Column 3 shows a negative impact for 1991-93, but not statistically significant. But the estimates become more negative and significant by 1994-96, with a 1 pp immigration shock decreasing native wage premia by 0.9%. This suggests that immigration did reduce wages for workers of fixed characteristics; but this effect is concealed by crowd-out of low-wage natives in standard wage regressions (such as in Figure 5d). To illustrate this problem more explicitly, column 5 shows what happens if we use simple regional means of log wages as our dependent variable (instead of mover-identified wage premia). And in column 6, we residualize wages using observable education-gender-age interactions in the  $X_{it}$  vector (a common strategy in studies which rely on cross-sectional data). As the results show, these “naive” specifications do not capture the negative wage effects: we conclude that they do not adequately control for compositional shifts.

## H.9 Effects across the native worker distribution

Guided by our model, the main text explores differential effects across the distribution of *firms*. In this appendix, we offer estimates by *worker type*, similar to the existing literature. In conventional models, this heterogeneity can be attributed to differential changes in workers’ marginal products. Though our model takes marginal products as given, we do not discount the possibility of such effects – and hence this analysis.

We present our estimates in Table A8. Each column reports wage and employment effects for different groups of workers. We focus on (i) changes in regional native wage premia, using the “regional movers” design from Appendix H.8, and comparing the periods 1994-96 (post-treatment) and 1986-1988 (pre-treatment), and (ii) changes in log native employment between 1988 and 1995.

Table A8: Native wage and employment effects across worker distribution

	Full	Gender		Age		
	sample (1)	Men (2)	Women (3)	16-29 (4)	30-49 (5)	50-65 (6)
$\Delta \log$ native wage (movers) 1994-96 v 1986-88	-0.944*** (0.241)	-0.991*** (0.265)	-0.742 (0.468)	-1.237*** (0.420)	-0.250 (0.293)	-0.079 (0.794)
$\Delta \log$ native employment 1995 v 1988	-1.364*** (0.292)	-0.808** (0.346)	-2.225*** (0.292)	-1.530*** (0.366)	-2.607*** (0.371)	0.229 (0.940)
	Education		Worker wage FE			
	Low (7)	Mid/high (8)	Q1 (9)	Q2 (10)	Q3 (11)	Q4 (12)
$\Delta \log$ native wage (movers) 1994-96 v 1986-88	-2.397* (1.292)	-0.659** (0.264)	-1.655*** (0.558)	-0.988** (0.475)	-0.677** (0.296)	-0.621 (0.417)
$\Delta \log$ native employment 1995 v 1988	-1.907*** (0.455)	-1.905*** (0.347)	-2.279*** (0.589)	-0.903** (0.419)	-0.273 (0.386)	-0.338 (0.701)

SIAB, estimates based on equation (10) across 204 local labor markets. Dependent variable in row 1 is changes in regional wage premia for natives between the periods 1986-88 (pre-treatment) and 1994-96 (post-treatment), estimated using a "regional movers" design (as in Appendix H.8). Row 2 shows log native employment changes between 1988 and 1995.\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

As a benchmark, column 1 shows effects for the full sample: as in the main text, we see large negative effects. Columns 2-3 estimate these by gender. The wage effects are slightly more negative (and more precisely estimated) for men. But the reduction in native employment is much larger for women, consistent with them having more elastic labor supply: see also Borjas and Edo (2026).

Columns 4-6 show the wage effects are largest for under-30s, among whom the new migrants are heavily concentrated (see Table 1); but employment effects are largest for 30-49s.<sup>51</sup> Both are close to zero for older workers (aged 50+), but these effects are estimated with vast standard errors – so should be interpreted with caution.

Columns 7-8 show the wage effects are more negative for low-educated workers, but employment effects are similar. Whether migrants compete with low or high-educated natives is not obvious in our setting, due to the young age of the migrant arrivals and the important role of vocational training in the German labor market: while most migrants have “low” education at arrival (see Table 1), many enter trainee positions that lead to a vocational qualification corresponding to “mid/high” education.

Until now, we have focused on observable characteristics. But in columns 9-12, we split natives into four quartiles by their individual fixed effects<sup>52</sup>: in practice, these fixed effects

<sup>51</sup>A natural interpretation is that 30-49s have higher reservation wages, so are less willing to accept the reduced wage offers. A similar pattern – with wage and employment effects showing inverse patterns across age groups – is reported by Dustmann, Schoenberg and Stuhler (2017).

<sup>52</sup>We regress log wages between 1980 and 2000 on regional fixed effects, individual fixed effects and

will identify a mixture of workers’ skill and the pay policies of their employers. The estimated wage effects are monotonically decreasing, from a peak of -1.7 in the bottom quartile to -0.6 at the top.<sup>53</sup> We also find large native employment effects at the bottom (reaching -2.3 in column 9). Both the wage and employment effects are statistically insignificant in Q4.

To summarize, wage effects fall mostly on young and low-paid natives, and the low-paid also face the largest employment losses. These results are broadly consistent with canonical factor proportions models, which predict that adverse effects of immigration are concentrated among “similar” natives. But interestingly, the differences are most pronounced when classifying workers by their *wage* rather than education or age – and this is consistent with an important role for firms. Unsurprisingly, we also find an increase in aggregate wage inequality in exposed labor markets: a 10 pp immigration shock increases the standard deviation of log native wages by 0.061 (s.e. 0.015).

## I US evidence on firm size effects

Firm size is an unusual outcome in the migration literature, but it is a natural focus of our model (see Proposition 4); and it is simple to measure in many contexts. In this appendix, we provide US estimates of firm size effects, as a point of comparison for our main analysis.

We rely on spatial variation between 1980 and 2010, expanding the analysis of Amior (forthcoming). Unlike our German setting, we do not exploit a one-off immigration event, but instead rely on decadal changes identified by an enclave shock. Amior (forthcoming) finds large crowd-out in population across commuting zones, and even more in employment, such that local employment rates contract. We keep the same data structure as Amior (forthcoming), but replace the dependent variable with changes in mean firm size. Just as in our German setting, we find negative effects on firm size; but the US effects are smaller in magnitude.

### Empirical specification

Similar to equation (10) in the main text, we rely on a “reduced form” specification:

$$\Delta y_{rt} = \alpha_t + \beta \Delta m_{rt}^{US} + \gamma_t X_{rt} + \varepsilon_{rt} \tag{A51}$$

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education-gender-age interactions. We then split workers into quartiles by their individual effects.

<sup>53</sup>This distributional pattern is similar to Dustmann, Frattini and Preston (2012), but our wage estimates are considerably more negative on average. This could reflect differences in the setting, or our use of panel data to eliminate the influence of compositional changes.

where  $\Delta y_{rt}$  is the change in some outcome of interest in area  $r$  corresponding to 722 commuting zones (CZs) between time  $t - 1$  and  $t$ . Time observations are each a decade apart (1980, 1990, 2000 and 2010), and  $\Delta m_{rt}^{US}$  is an enclave shock:

$$\Delta m_{rt}^{US} = \frac{\sum_o s_{ort-1} (n_{ot} - n_{ot-1})}{n_{rt-1}} \quad (\text{A52})$$

which predicts changes in migrant share between  $t - 1$  and  $t$ , based on local shares  $s_{ort-1}$  of 77 origin groups  $o$  at  $t - 1$ , similar to equation (11).  $X_{rt}$  is a vector of local controls, which includes current and once-lagged Bartik industry shift-shares, as well as various fixed amenities<sup>54</sup> interacted with time effects. The enclave and Bartik shift-shares are constructed using US census and American Community Survey samples.

## Establishment size data

To measure local establishment size, we rely on publicly accessible data from the Census Bureau’s County Business Patterns (CBP). This is an annual dataset, based on the Business Register. It covers all industries except agricultural production, railroad, public administration and household employment. For every county-industry cell, the CBP reports total employment and total establishments.

The CBP suppresses employment counts in some county-industry cells (1-3% of total employment each year) to preserve confidentiality, and it also changes industry classifications periodically. To create stable panels, we rely on the files created by Eckert et al. (2020). They impute suppressed employment counts by exploiting constraints implied by geographical and industrial hierarchies, and they use official industry crosswalks to produce consistent series.

## Empirical estimates

We present estimates of (A51) in Table A9. Columns 1-4 explore the effect of the enclave shock  $\Delta m_{rt}^{US}$  on the foreign-born population share: this can be interpreted as a “first stage”. In column 1, which conditions on year effects only, the coefficient is about 0.3; and this is little affected by amenity and Bartik controls (column 2). In column 3, we control for CZ fixed effects: since (A51) is already in first differences, this removes area-specific linear *trends* in amenities or labor demand. This is a demanding specification for such a short panel, but we still find a precise positive effect. Unlike our German setting (where we study a one-off immigration event), migrant inflows to US CZs are heavily serially correlated (Jaeger, Ruist and Stuhler, 2018), and this may bias our estimates if there is dynamic adjustment. To

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<sup>54</sup>Presence of coastline, climate (maximum January/July temperatures, mean July relative humidity), log population density in 1900, and an index of CZ isolation (log distance to closest CZ).

Table A9: US establishment size effects

	$\Delta$ Migrant population share				$\Delta$ Log mean firm size			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Decadal enclave shock	0.292*** (0.031)	0.233*** (0.034)	0.388*** (0.060)	0.574*** (0.047)	-0.154*** (0.054)	-0.213*** (0.037)	-0.404*** (0.113)	-0.414*** (0.091)
Enclave shock: Lag				-0.400*** (0.039)				0.235** (0.111)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bartik, amenity controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
CZ fixed effects	No	No	Yes	No	No	No	Yes	No
Observations	2,166	2,166	2,166	2,166	2,166	2,166	2,166	2,166

This table presents estimates of equation (A51), for three decadal observations (1980-2010) across 722 CZs. In columns 1-4, the dependent variable is decadal changes in migrant (foreign-born) population share; and columns 5-8 show changes in log mean firm size. Robust standard errors, clustered by state, are in parentheses. Observations are weighted by lagged local population share. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

address this concern, we control for a lagged enclave shock  $\Delta m_{rt-1}^{US}$  in column 4: the coefficient on the contemporaneous shock now increases to 0.57, offset by a (smaller) negative coefficient on  $\Delta m_{rt-1}^{US}$  (-0.40). Intuitively, local expansions in migrant share are diffused through the country in the decade following the shock.

In columns 5-8, we estimate the same specifications for changes in log mean firm size (i.e. a “reduced form” specification). Firm size responds negatively in column 5 (year effects only), and including the amenity and Bartik controls only strengthens the effect: the coefficient in column 6 is -0.21. CZ fixed effects in column 7 increase the impact still further. And in the dynamic specification (column 8), we see a mean reverting effect which perfectly reflects changes in migrant share in column 4: the initial local shock reduces firm size (with a coefficient of -0.41), but this effect is partly offset (0.24) in the subsequent decade as the shock diffuses nationally.

Though qualitatively similar, these firm size effects are smaller in magnitude than in our German setting: for comparison, we have a coefficient of -1 in Table 6. This is despite a similar response of the migrant share to the enclave shock: compare Table A9 to Figure 5a (black line) in the main text. One possible interpretation is that the “wage-setting” effect (in Proposition 4 of the model) is more dominant in our German setting, due to lower migrant reservation wages.