The Effect of Immigration on Native Workers: Evidence from the US Construction Sector

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Abstract

This paper provides new estimates of the short-run impacts of immigration on the employment opportunities of US-born workers. We focus on the constructor sector, a primary employer of immigrant workers in the US and one of the economic sectors with the highest share of immigrants, about 29% in 2016 according to the Bureau of Labor Statistics. Using panel data at the metropolitan area-year level of aggregation constructed from US Census and American Community Survey data, we find that a 10 percentage point increase in the share of immigrant workers reduces annual earnings of US-born construction workers by at least 4.1%, with workers in immigrant-prone trades experiencing earnings reductions in excess of 7.2%. These bounds are derived using a so-called "imperfect instrument approach" (Nevo and Rosen, 2012), whereby the share of immigrant workers is instrumented by the share of immigrants across all sectors of the economy. Our partial identification strategy relies on the assumptions that the share of immigrants across all economic sectors in a market is positively correlated with construction-specific labor demand shocks about location and year effects, but less so than the share of immigrants in construction. Our results further indicate that US-born workers experience lower annual wages through reduced employment (fewer weeks worked per year) rather than lower weekly wages.

1 Introduction

The impact of immigration on the labor outcomes of native-born citizens is, or last least ought to be, a key element of the debate on immigration policy (Borjas, 2017). There is a long tradition of empirical work on this issue in labor economics, starting with the seminal work of Grossman (1982), followed by influential contributions by Card (1990), Altonji and Card (1991), Friedberg and Hunt (1995), Borjas et al. (1997), Card (2001), Borjas (2003), Card (2009), Peri and Sparber (2009), and Ottaviano and Peri (2012), to name a few.

Although the textbook model of labor demand and supply predicts that an exogenous influx of immigrants decreases the wage rate, there is little agreement among empiricists about the magnitude, or even the sign of the effect of increased immigration on the labor market outcomes, including wages, of native-born workers (Basso and Peri, 2015).

Indeed, the empirical identification of the immigration-native-outcome relationship is riddled with difficulty. In an ideal experiment, one could observe two identical but otherwise disconnected cities, one of which would receive an influx of immigrants and the other not. By comparing labor outcomes across these two cities, one could deduce the impact of (additional) immigration on the employment opportunities of native-born workers. Such exogenous influxes of immigrants rarely occur in practice. First of all, immigrants sort into locations, usually following employment opportunities. The problem is that locations with better opportunities for immigrant workers are plausibly those where demand for labor is higher, confounding the effect of immigration on native wages or employment. That is, a positive estimate of the impact of immigration on native labor outcomes might simply reflect unobserved demand pulls that increase both immigration and native employment and/or wages.

This omitted variable bias is perhaps the main threat to identification encountered by researchers. It affects studies based on a cross-sectional approach and time-series/panel approaches alike: just like cities with relatively high native wages might also attract immigrants, periods of time where native wages are high ("booms" driven by factors other than immigration) might coincide with times of increased immigration. Studies based on city comparisons may suffer from an additional problem: to the extent that native-born workers are displaced into areas less affected by immigration, they will depress local wages, possibly until wages are equalized across cities: comparing native wages between immigration-affected and immigration-free areas will then reveal an absence of a wage effect. Of course, this does not necessarily mean that natives are not negatively affected by immigration: in addition to the costs of relocation, the new equilibrium wage, while equalized across space, might still be lower than it would have been without immigration.

The literature has resorted to various instrumental variables approaches in order to correct the bias identified above. In a first-difference panel model with two periods, Altonji and Card (1991) use the share of immigrants in a city in the baseline period as an instrument for the increase in the immigrant share in that city, based on the idea that immigrants are attracted to places with large concentrations of previous immigrants.

This approach can be extended to long panels by interacting the share of immigrants in the baseline period by national growth rates of the immigrant population (perhaps differentiated by country of origin), an approach sometimes referred to as the "shift-share" instrument (e.g., Card (2001) and Basso and Peri (2015)).

Building upon Card's seminal insights regarding the effects of the Mariel boatlift on employment in Miami (Card, 1990), other researchers have tried to exploit assumingly exogenous variation in the timing or the geographical implementation of policies that directly affect immigration (e.g., recently, Beerli and Peri (2015) and Foged and Peri (2016)). A criticism of such event studies may be the lack of external validity associated with the often anecdotal nature of the variation used in identification.

Here we leverage a novel partial identification method formalized by Nevo and Rosen (2012) to address the effect of increased immigration on native-born employment opportunities. Our partial identification strategy relies on the use of a series of so-called "imperfect instruments:" instruments for the share of immigrants in a given city and year that, although still potentially correlated with the error term (unobserved demand pulls about city and year averages), are plausibly less correlated with it than the regressor itself. In this sense, they represent imperfect instrumental variables or IIVs. Because of the remaining correlation, which violates the exclusion restriction, the IIV estimate is still biased. However, Nevo and Rosen (2012) show that under certain conditions, the IIV estimate can be used as a lower or upper bound to the coefficient of interest. They further show that when more than one IIV is available, one may be able to derive two-sided bounds. We use their insights to derive lower and upper bounds for the effects of immigration on native employment.

The cost of implementing this new technique is not zero, however. The dual requirement to implement the IIV approach is that the correlation between the IIV and the error term must be of the same sign as, but of a lower magnitude than, the correlation between the regressor (the immigrant share) and the error term (the unobserved demand pulls). While the shift-share instrument discussed above could arguably meet the first condition, it is much less clear that it meets the second one. To circumvent this problem, our approach focusses on one sector of the economy, construction, and uses as the IIV the share of immigrants in a city and year *across all industries*. Such a variable is plausibly correlated with demand pulls that affect native employment/wages in the construction sector in the same direction as the immigrant share in construction: economic booms attract immigrants across all sectors, and they increase employment opportunities for natives in construction. However, since the immigrant share pertains to the entire economy, rather than the construction sector itself, it is likely that it will be less correlated with the construction-specific demand pulls than the immigrant share in construction.

2 Data

The data used for this analysis was obtained from the Integrated Public Use Microdata Series provided by the University of Minnesota at `ipums.org`. Our data includes US Census data from 1990 and 2000 as well as American Community Survey (ACS) data between the years 2001 and 2011. Due to a missing geographic variable, the years 2001, 2002, and 2004 are excluded from our data set. The master data file includes approximately 48 million surveyed individuals across all years. Once non-construction occupations are excluded, the data set includes over 1.3 million construction workers.

The data we use is a repeated cross section of individual-level data that includes the annual earnings of the individual during the preceding year, the number of weeks worked in the previous year, the usual number of hours worked per week, the Metropolitan Statistical Area (MSA) where the individual lives (taken to be the relevant labor market), and their birthplace (which is used to generate the immigrant variable). We aggregate our data at the MSA-year level by generating variables that include the average (log) earnings of native-born construction workers, the proportion of native-born workers who work full time, and proportions of immigrant workers who work in construction and other sectors of the economy.

Table 1: Summary statistics

	mean	s.d.
log annual earnings (all construction workers)	9.93	0.25
log annual earnings (immigration-exposed workers)	9.70	0.31
log weekly wage (all construction workers)	6.33	0.19
log weekly wage (immigration-exposed workers)	6.19	0.21
unemployment rate (all construction workers)	0.88	0.06
unemployment rate (immigration-exposed workers)	0.87	0.08
share of immigrant workers in construction	0.14	0.14
share of immigrant workers in top-5 immigrant industries	0.14	0.13
share of immigrant workers in top-10 immigrant industries	0.11	0.09
share of immigrant workers in all industries	0.09	0.07

Table 1 summarizes our data. Note that the mean and standard errors are calculated across MSAs and years. Since MSAs have different sizes, the mean values may not be representative of national averages. In particular, our average measure of immigrant share in construction (14%) is well below the one computed at the national level (about 28.5% across the years in our sample).

3 Methodology

The main difficulty in measuring the effect of immigration on the labor market outcomes of native-born construction workers is that increases in immigration are correlated with unobserved demand-pull factors in the construction industry which also affect natives' income and employment. In order to estimate the effect of immigration on the labor market outcomes of native-born construction workers, we use an instrumental variable approach described below.

3.1 Model specification and IV

Our dependent variables include the average of the natural log of the annual earnings of native-born construction workers in each MSA in each year ($\overline{\ln(I_{m,t})}$) and the proportion of native-born construction workers who are working full time in each MSA in each year ($F_{m,t}$). Our main regressor is a measure of immigration defined as the proportion of immigrants working in construction in each MSA in each year ($S^C_{m,t}$). In order to identify the effect of immigration on the distribution of native construction workers across occupational levels, we use several definitions of full-time workers: workers who worked 48 weeks or more, 40 weeks or more, 27 weeks or more, and 1 week or more.

Our preferred instrument is a variable that measures the proportion of immigrants across all occupations in the economy, including construction ($S^A_{m,t}$). Although this instrument is likely still correlated with unobservable construction labor demand-pull factors, it is likely less correlated with the error term than the endogenous regressor. Following Nevo and Rosen (2012), this allows us to establish an upper bound for the negative effects of immigration on native-born workers' income and employment. We also use two variants of the instrument $S^A_{m,t}$, constructed using either the 5 or the 10 industries with the highest proportion of immigrants (construction belongs to these two groups).

$$
\begin{aligned}
m &= \text{Metropolitan Statistical Area} \quad (MSA)\\
t &= 1990, 2000, 2003, 2005, 2006, 2007, 2008, 2009, 2010, 2011\\
Imm^A_{m,t} &= \text{Number of immigrant workers across all occupations}\\
Imm^C_{m,t} &= \text{Number of immigrant construction workers}\\
Nat^A_{m,t} &= \text{Number of native workers across all occupations}\\
Nat^C_{m,t} &= \text{Number of native construction workers}\\
Nat^{CF}_{m,t} &= \text{Number of native construction workers working full time}\\
S^A_{m,t} &= \frac{Imm^A_{m,t}}{(Nat^A_{m,t} + Imm^A_{m,t})}\\
S^C_{m,t} &= \frac{Imm^C_{m,t}}{(Nat^C_{m,t} + Imm^C_{m,t})}\\
F_{m,t} &= \frac{Nat^{CF}_{m,t}}{Nat^C_{m,t}}\\
\overline{\ln(I_{m,t})} &= \text{Average of the natural logarithm of annual income of native construction workers}
\end{aligned}
$$

We first estimate the effect of immigration on the annual income of native workers:

$$\overline{\ln(I_{m,t})} = \beta S^C_{m,t} + \phi_t + \alpha_m + \epsilon_{m,t} \tag{1}$$

where ϕ_t is a year fixed effect, α_m is a MSA fixed effect, and our coefficient of interest is β. The regressor $S^C_{m,t}$ is instrumented using the share of immigrants across all occupations, $S^A_{m,t}$. The coefficient β is interpreted as follows. A 10 percentage point increase in the share of immigrants working in construction causes a $10 \times \beta_1$ percent change in the annual income of native-born construction workers.

We also run a model with weekly income, that is, annual income divided by the number of weeks worked, conditional on being employed. Finally, we estimate a model where the dependent variable is the share of full-time workers amongst natives, $F_{m,t}$ (with variations regarding the actual definition of full-time workers).

$$F_{m,t} = \gamma S^C_{m,t} + \phi_t + \alpha_m + \epsilon_{m,t} \tag{2}$$

The coefficient of interest in this model is γ. The interpretation is that a 10 percentage point increase in the proportion of immigrants working in construction causes a $0.1 \times \gamma$ change in the share of native workers working full time. In all regressions, standard errors are clustered at the MSA level.

3.2 The IIV strategy

We use the results contained in Propositions 2 and 5 of Nevo and Rosen (2012). The first proposition provides us with a one-sided bound given by the IIV estimate. The second proposition provides us with a bound in the other direction. To ease the reader's understanding of our application of IIV theory, let us adopt the same notation as in Nevo and Rosen (2012). We write the DGP underlying models (1) and (2) as

$$Y = X\beta + \mathbf{W}\boldsymbol{\gamma} + U \tag{3}$$

where Y is the dependent variable, X is the immigrant share in construction (S^C), W is a vector of covariates comprising dummy variables for each MSA and dummy variables for each year, and U is the error term, which satisfies $\mathbb{E}[\mathbf{W}'U] = 0$. We denote by Z (or Z_1, when necessary to avoid confusion) our preferred instrument S^A. We denote by Z_2 (resp. Z_3) the alternative instrument constructed as the share of immigrant workers in the industries with the 10 highest (resp. 5 highest) shares of immigrant workers.

For two random variables, say X and Y, σ_{xy} denotes the covariance between X and Y. We use σ_x to denote the standard deviation of X. We denote the correlation between X and Y as ρ_{xy}. We further denote by β^{OLS} (resp. β^{IV}_z) the probability limits of the OLS estimator (resp. the IV estimator using instrument Z) of β.

We denote by $\tilde{X}$ (resp. $\tilde{Y}$) the residuals from the OLS regression of X (resp. Y) on $\mathbf{W}$, that is,

$$\begin{cases} \tilde{X} = X - W\mathbb{E}[W'W]^{-1}\mathbb{E}[W'X] \\ \tilde{Y} = Y - W\mathbb{E}[W'W]^{-1}\mathbb{E}[W'Y] \end{cases} . \tag{4}$$

Nevo and Rosen (2012) show that $\tilde{Y} = \tilde{X}\beta + U$. Using the Frisch-Waugh-Lovell theorem (Frisch and Waugh, 1933; Lovell, 1963) and its extension to IV estimation (Giles, 1984), it is straightforward to show that

$$\begin{array}{l} \beta^{\text{OLS}} = \beta + \frac{\sigma_{\tilde{x}u}}{\sigma^2_{\tilde{x}}} \\ \beta^{\text{IV}}_z = \beta + \frac{\sigma_{zu}}{\sigma_{\tilde{x}z}} \end{array} . \tag{5}$$

To fix ideas, consider the case where the dependent variable is annual native income or the share of natives working full time, which implies that $\sigma_{xu} > 0$ since unobserved demand pulls would tend to increase native wages and native employment rate. Since U is uncorrelated with $\mathbf{W}$, then $\sigma_{\tilde{x}u} = \sigma_{xu} > 0$ and we would expect the OLS estimate to be asymptotically biased upwards. That is, $\beta \leq \beta^{\text{OLS}}$. We now make the following two-part assumption, referred to as Assumptions 3 and 4 in Nevo and Rosen (2012):

Assumption 1 $0 \leq \rho_{zu} \leq \rho_{xu}$.

Assumption 1 implies that the direction of correlation with the error term in (3) is the same for the regressor and the instrument, but the "intensity" of the correlation is lessened when using the instrument. In that sense, the instrument is "less endogenous" than the regressor. It also natural in our setting (and we systematically test this condition) to expect that $\sigma_{\tilde{x}z} = \sigma_{\tilde{x}\tilde{z}} > 0$, that is, the shocks in the immigrant share about city and year means are positively correlated across the construction sector and the rest of the economy.[1] Because $\sigma_{zu} \geq 0$ from Assumption 1, equation (5) implies that the IV estimate is also asymptotically biased, in the same direction as the OLS estimate, that is, $\beta \leq \beta^{\text{IV}}_z$. In addition, $\beta^{\text{IV}}_z < \beta^{\text{OLS}} \Leftrightarrow \sigma_{zu}\sigma^2_{\tilde{x}} - \sigma_{\tilde{x}u}\sigma_{\tilde{x}z} < 0 \Leftrightarrow \rho_{zu} < \rho_{\tilde{x}u}\rho_{\tilde{x}z} = \rho_{xu}\rho_{\tilde{x}z}$. Therefore, the fact that the instrument be less endogenous than the regressor in the sense of Assumption 1 is necessary for the IV estimate to improve on the OLS estimate.

4 Results

We first report results for the effect of immigration on the annual income of native-born workers. Table 2 shows that the annual income of native construction workers is negatively affected by the share of immigrants in construction. Although the OLS estimate is not statistically significant, the IIV-All estimate (corresponding to the share of immigrants across all industries) is, and it is much larger in magnitude. Importantly, the move from the IIV constructed from the share of immigrants in immigrant-prone industries to that constructed from the share of immigrants across all industries has the expected effect on the point estimate: the effect becomes more negative as the correlation between the IIV and the error term is attenuated. The attenuation comes from the fact that in industries less prone to immigration, a positive shock in labor demand (which we assume is

[1]The fact that $\sigma_{\tilde{x}z} = \sigma_{\tilde{x}\tilde{z}}$ comes from the orthogonality of $\tilde{X}$ with $\mathbf{W}$. Here $\tilde{Z}$ denotes the residual from the regression of Z on $\mathbf{W}$.

positively correlated with a positive shock in the demand for construction labor) may not correlate as much with an increase in the share of immigrant workers as in industries with larger immigrant shares. In addition, since the correlation of interest is with demand pulls *in construction*, the fact that the share of immigrants is calculated across a broader set of industries mechanically "dilutes" the correlation with any construction-specific shock in labor demand.

Table 2: Effect of immigration on the annual earnings of native-born construction workers

	OLS	IIV-5	IIV-10	IIV-All
All construction occupations	-0.104	-0.110	-0.253	-0.413**
	(0.088)	(0.124)	(0.143)	(0.148)
Exposed construction occupations	-0.200	-0.210	-0.416*	-0.719**
	(0.131)	(0.177)	(0.186)	(0.206)

Note: All regressions include MSA and year fixed effects. Standard errors are clustered at the MSA level. Estimates correspond to coefficient β_1 in Equation (1). * (resp. **) denotes statistical significance at the 5% (resp. 1%) level.

The preferred point estimate, -0.41, should be interpreted as an upper bound according to the theory developed in Nevo and Rosen (2012). That is, the true underlying parameter is likely more negative. Our estimate implies that a 10 percentage point increase in the share of immigrants in construction is associated with at least a 4.1 percent decrease in the annual earnings of native workers. Table 2 further shows that the effect is greatly accentuated for workers in trades where the share of immigrants is higher (e.g., carpenters, painters, masons, roofers). For those workers, a 10 percentage point increase in the share of immigrants in construction is associated with at least a 7.2 percent decrease in annual earnings. If one adds to this the fact that, as argued by Borjas (2003), the location-year variation we exploit here masks part of the negative impacts of immigration due to spatial arbitrage (of capital towards labor-rich areas and native labor away from such areas), our upper bounds provide evidence of the negative effects of immigration on construction workers' employment conditions.

On balance, these upper bounds appear large relative to recent econometric estimates reported in the literature. Estimates obtained from location-year or location-year-skill comparisons of average wages across *all occupations* range from -0.22 (Borjas, 2003) to positive values (Basso and Peri, 2015). Admittedly, our upper bounds fall short of the larger effect on lower-skilled natives' earnings found in Altonji and Card (1991), a 12% decrease for each 10 percentage point increase in the immigrant share.

There are two essential channels by which the annual earnings of native-born workers may be impacted by immigration flows: their wage rate may decrease and/or they may work fewer weeks per year. The second channel is particularly relevant for the construction sector because construction workers are usually paid per "job." That is, they go from one job to the next and bill hours spent on each job. If they have difficulty filling in their schedule, perhaps due to increased competition from cheaper, abundant immigrant labor, they may end up with lower annual earnings even if their weekly wage has not changed. The "stickiness" of native wages in construction is a possibility since a large share of construction workers are unionized.

Our results supports this hypothesis: the effect of immigration on the weekly wages of natives is insignificant, however immigration triggers a clear redistribution of natives away from full-time and high-time work towards part-time work and unemployment.

Table 3: Effect of immigration on the weekly earnings of native-born construction workers

	OLS	IIV-5	IIV-10	IIV-All
All construction occupations	-0.021	0.036	-0.014	-0.062
	(0.049)	(0.086)	(0.096)	(0.096)
Exposed construction occupations	-0.099	-0.002	-0.069	-0.139
	(0.069)	(0.106)	(0.111)	(0.117)

Note: All regressions include MSA and year fixed effects. Standard errors are clustered at the MSA level.

Evidence for this preferred channel is presented in Tables 3 and 4. Table 3 shows that the effect of immigration on the weekly wages of natives is small and not statistically significant. Here, the clear pattern of increasing sensitivity when moving towards the use of less correlated instruments disappears.

Table 4 presents the effects of the immigrant share on the share of native construction workers working at least a certain number of weeks per year. Effects are shown for all construction occupations and for immigrant-exposed construction occupations. IIV estimates are mostly significant, and the pattern of increasingly negative effect as the instrument becomes less endogenous is globally re-established. Overall, the estimates suggest that immigration has a negative effect on the level of employment of native construction workers. For instance, a 10 percentage point increase in the share of immigrants is predicted to result in a 2.1 percentage point decrease in the share of natives working more than 48 weeks. For exposed construction trades, the effect is more pronounced (3.5 percentage points). Similarly, a 10 percentage point increase in the share of immigrants is associated with a 1 percentage point increase in the share of unemployed natives, and a 1.6 percentage point increase in the share of unemployed natives in exposed construction trades.

To get a better idea of the effect of immigration on native employment, Figure 1 uses the estimates reported in Table 4 to depict the shift in the distribution of native construction workers across occupation levels, from unemployed to full-time workers, induced by a 20 percentage point increase in the share of immigrant workers in construction. (We choose 20 percent rather than 10 percent so that the change in the distribution is more legible.) Figure 2 depicts those effects for workers in immigrant-exposed construction trades.

Table 4: Effect of immigration on the distribution of weeks worked among native-born construction workers

		OLS	IIV-5	IIV-10	IIV-All
All construction occupations	share working 48 weeks or more	-0.022	-0.066	-0.138*	-0.208**
		(0.038)	(0.060)	(0.067)	(0.070)
	share working 40 weeks and more	-0.052	-0.123*	-0.221**	-0.284**
		(0.035)	(0.057)	(0.064)	(0.067)
	share working 27 weeks and more	-0.051	-0.105*	-0.195**	-0.250**
		(0.032)	(0.053)	(0.056)	(0.061)
	share employed	-0.004	-0.046	-0.097*	-0.096*
		(0.024)	(0.037)	(0.045)	(0.048)
Exposed construction occupations	share working 48 weeks and more	-0.045	-0.112	-0.232**	-0.348**
		(0.044)	(0.074)	(0.078)	(0.088)
	share working 40 weeks and more	-0.070	-0.160*	-0.317**	-0.415**
		(0.045)	(0.075)	(0.078)	(0.088)
	share working 27 weeks and more	-0.065	-0.155*	-0.304**	-0.387**
		(0.040)	(0.069)	(0.068)	(0.078)
	share employed	0.013	-0.060	-0.150**	-0.164*
		(0.033)	(0.049)	(0.056)	(0.065)

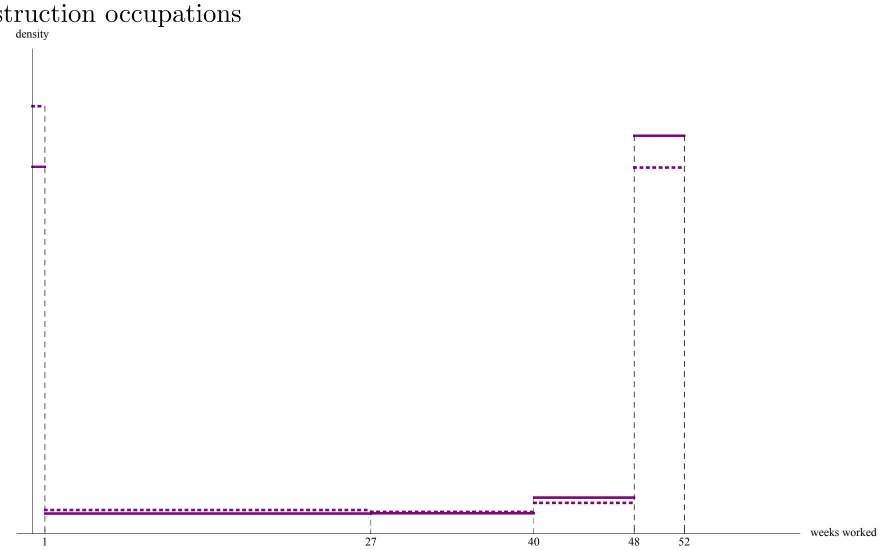
Note: All regressions include MSA and year fixed effects. Standard errors are clustered at the MSA level. Estimates correspond to coefficient γ_1 in Equation (2). * (resp. **) denotes statistical significance at the 5% (resp. 1%) level.

5 Conclusion

This paper estimates the effects of immigration on the employment conditions of natives, focussing on the US construction sector. The focus on this sector of the economy is necessary for the deployment of our IIV partial identification strategy.

We find strong evidence that immigration deteriorates the employment conditions of natives. We are not able to detect any significant effect on the weekly wage, however we find strong evidence that immigration displaces native construction workers towards lower employment levels, resulting in significantly lower annual earnings, at least minus 4.1 % per each 10 percentage point increase in the immigrant share, and minus 7.2% among construction trades most exposed to immigration. These figures should be interpreted as lower bounds for at least two reasons: first, the IIV strategy does not entirely correct for endogeneity bias, and second, the area-year variation we exploit may mask larger effects due to spatial arbitrage.

Figure 1: Effect of a 20 percentage point increase in immigrant share on native occupational levels, for all construction occupations



Note: The solid (resp. dashed) line represents the distribution of native workers across occupational levels before (resp. after) the increase in immigration.

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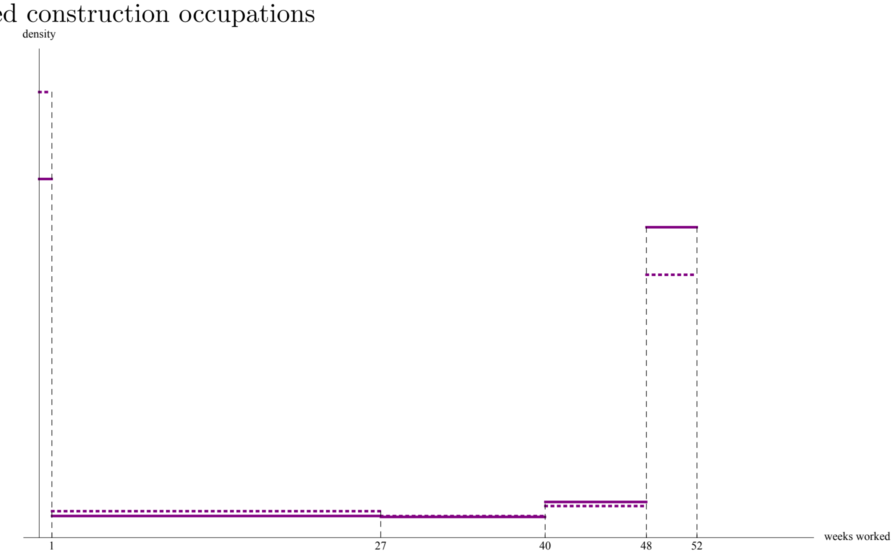
Figure 2: Effect of a 20 percentage point increase in immigrant share on native occupational levels, for exposed construction occupations



Note: The solid (resp. dashed) line represents the distribution of native workers across occupational levels before (resp. after) the increase in immigration.

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