Labor Supply Shocks, Native Wages, and the Adjustment of Local Employment

Online Appendix

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Appendix A: Model

A.I: Derivation of the Firm's Demand Curve

From $K = h(r, \boldsymbol{r}')$, and $\frac{1}{\lambda} = \frac{\partial h}{\partial r}\frac{r}{h}$, we obtain

$$dlogr = \lambda\, dlogK. \tag{A.1}$$

Totally differentiating Equation (1b) and plugging in Expression (A.1) for $dlogr$ yields

$$dlogK = -\frac{\alpha-1}{1-\alpha+\lambda} dlogL. \tag{A.2}$$

Totally differentiating Equation (1a) and substituting for $logK$ using (A.2) then yields

$$dlogw_g = \varphi dlogL + (\beta - 1)\left(dlogL_g - dlogL\right), \tag{A.3}$$

where

$$\varphi = -\frac{\alpha\lambda}{1-\alpha+\lambda} \tag{A.4}$$

is the slope of the aggregate labor demand curve.

Starting from $L_g = L_g^I + L_g^N$ and assuming that there are no immigrants at baseline, we obtain $dlogL_g = \frac{dL_g^I}{L} + dlogL_g^N$. Letting $\pi_g^N = \frac{L_g^N}{L_U^N + L_S^N}$ and $\pi_g^I = \frac{L_g^I}{L_U^I + L_S^I}$ to denote the employment shares of natives and immigrants in skill group g (in head count), the expression above can be rewritten as

$$dlogL_g = \frac{\pi_g^I}{\pi_g^N} dI + dlogL_g^N. \tag{A.5}$$

Totally differentiating $L = \left[\theta_U L_U^\beta + \theta_S L_S^\beta\right]^{\frac{1}{\beta}}$ results in $dlogL = s_U dlogL_U + s_s dlogL_S$, where $s_g = \frac{\theta_g L_g^\beta}{\left[\theta_U L_U^\beta + \theta_S L_S^\beta\right]}$ are the contribution of labor type g to the total labor aggregate. Substituting for $dlogL_U$ and $dlogL_S$ using expression (A.5) results in

$$dlogL = \Pi dI + s_U dlogL_U^N + s_S dlogL_S^N, \tag{A.6}$$

where $\Pi = s_U \frac{\pi_U^I}{\pi_U^N} + s_S \frac{\pi_S^I}{\pi_S^N}$ is the weighted average of the relative density of immigrants across skill groups. Plugging in expressions (A.5) and (A.6) for $dlogL$ and $dlogL_g$ in expression (A.3) and rearranging results in

$$dlogL_g^N = \frac{dlogw_g - \big(\varphi - (\beta-1)\big)s_{g'} dlogL_{g'}^N, - \left(\big(\varphi - (\beta-1)\big)\Pi + (\beta-1)\frac{\pi_g^I}{\pi_g^N}\right)dI}{\varphi s_g + (\beta-1)(1-s_g)} \tag{A.7}$$

and a corresponding equation for the other skill group g'. Plugging these equations into each other leads to equation (2) in the text.

A.II: Derivation of the Equilibrium Wage and Employment Responses under Flexible Wages

The equilibrium wage and employment responses are determined by the two skill-specific labor demand curves (see equation A.3)

$$dlogw_U = \varphi dlogL + (\beta - 1)(dlogL_U - dlogL) \tag{A.8}$$

$$dlogw_S = \varphi dlogL + (\beta - 1)(dlogL_S - dlogL) \tag{A.9}$$

and the two skill-specific supply curves

$$d\text{log}L_U^N = \eta_U d\text{log}w_U \tag{A.10}$$

$$d\text{log}L_S^N = \eta_S d\text{log}w_{S,} \tag{A.11}$$

where $dlogL$ is given by Equation (A.6). By plugging (A.10) and (A.11) into (A.8) and (A.9), we obtain

$$dlogw_U = \varphi\big((s_U\eta_U dlogw_U + s_S\eta_S dlogw_S) + \Pi dI\big)$$
$$+(\beta - 1)\left(\eta_U dlogw_U - (s_U\eta_U dlogw_U + s_S\eta_S dlogw_S) + \left(\frac{\pi_U^I}{\pi_U^N} - \Pi\right) dI\right) \tag{A.12}$$

$$dlogw_S = \varphi\big((s_U\eta_U dlogw_U + s_S\eta_S dlogw_S) + \Pi dI\big)$$
$$+(\beta - 1)\left(\eta_S dlogw_S - (s_U\eta_U dlogw_U + s_S\eta_S dlogw_S) + \left(\frac{\pi_S^I}{\pi_S^N} - \Pi\right) dI\right). \tag{A.13}$$

Solving (A.12) and (A.13) for $dlogw_U \; and \; dlogw_S$, respectively, gives

$$dlogw_U = \frac{\big(\varphi - (\beta - 1)\big)s_S\eta_S dlogw_S + \varphi\Pi dI + (\beta - 1)\left(\frac{\pi_U^I}{\pi_U^N} - \Pi\right)dI}{1 - \varphi s_U\eta_U - (\beta - 1)s_S\eta_U} \tag{A.14}$$

$$dlogw_S = \frac{\big(\varphi - (\beta - 1)\big)s_U\eta_U dlogw_U + \varphi\Pi dI + (\beta - 1)\left(\frac{\pi_S^I}{\pi_S^N} - \Pi\right)dI}{1 - \varphi s_S\eta_S - (\beta - 1)s_U\eta_S}. \tag{A.15}$$

Plugging (A.15) into (A.14) and placing all terms over a common denominator then yields

$$dlogw_U = \frac{\big(\varphi - (\beta - 1)\big)^2 s_U s_S \eta_U \eta_S dlogw_U + \big(\varphi - (\beta - 1)\big)s_S\eta_S\left(\varphi\Pi + (\beta - 1)\left(\frac{\pi_S^I}{\pi_S^N} - \Pi\right)\right)}{(1 - \varphi s_U\eta_U - (\beta - 1)s_S\eta_U)(1 - \varphi s_S\eta_S - (\beta - 1)s_U\eta_S)}dI$$
$$+ \frac{(1 - \varphi s_S\sigma_S - (\beta - 1)s_U\eta_S)\varphi\Pi + (1 - \varphi s_S\eta_S - (\beta - 1)s_U\eta_S)(\beta - 1)\left(\frac{\pi_U^I}{\pi_U^N} - \Pi\right)}{(1 - \varphi s_U\eta_U - (\beta - 1)s_S\eta_U)(1 - \varphi s_S\eta_S - (\beta - 1)s_U\eta_S)}dI.$$

Solving for $dlogw_U$ gives

$$dlogw_U = \frac{\big(\varphi - (\beta - 1)\big)s_S\eta_S\left(\varphi\Pi + (\beta - 1)\left(\frac{\pi_S^I}{\pi_S^N} - \Pi\right)\right)}{(1 - \varphi s_U\eta_U - (\beta - 1)s_S\eta_U)(1 - \varphi s_S\eta_S - (\beta - 1)s_U\eta_S) - \big(\varphi - (\beta - 1)\big)^2 s_U s_S \eta_U \eta_S}dI$$
$$+ \frac{(1 - \varphi s_S\eta_S - (\beta - 1)s_U\eta_S)\varphi\Pi + (1 - \varphi s_S\eta_S - (\beta - 1)s_U\eta_S)(\beta - 1)\left(\frac{\pi_U^I}{\pi_U^N} - \Pi\right)}{(1 - \varphi s_U\eta_U - (\beta - 1)s_S\eta_U)(1 - \varphi s_S\eta_S - (\beta - 1)s_U\eta_S) - \big(\varphi - (\beta - 1)\big)^2 s_U s_S \eta_U \eta_S}dI.$$

Simplifying both the numerators and the denominator and using $\phi = \frac{\varphi}{\beta-1} - 1$ then leads to the equilibrium wage and employment responses given by equations (4) and (5) in the text.

A.III: Wage and Employment Responses for Three Skill Groups

In the case of two types of labor, perverse effects will only emerge when capital is not perfectly elastic (i.e., $\varphi < 0$) because given a perfectly elastic capital supply, the aggregate wage effect of a migration-induced supply shock is zero and the wage decreases for the skill group having a higher migrant share and increases for the other skill group regardless of the relative magnitude of the group-specific local labor supply elasticities. By extending the model to three types of labor we show that perverse effects are possible even when capital is fully elastic (i.e., $\varphi = 0$).

Assume that labor L is a CES aggregate of low (L), medium (M), and high (H) skilled labor, such that

$$L = \left[\theta_L L_L^{\beta} + \theta_M L_M^{\beta} + \theta_H L_H^{\beta}\right]^{\frac{1}{\beta}}. \qquad \text{(A.16)}$$

As before, $dlogL_g = \frac{\pi_g^I}{\pi_g^N} dI + dlogL_g^N$ (see Equation A.5), while Equation (A.6) becomes

$$dlogL = \Pi dI + s_L dlogL_L^N + s_M dlogL_M^N + s_H dlogL_H^N, \qquad \text{(A.17)}$$

with $s_g = \frac{\theta_g L_g^{\beta}}{\left[\theta_L L_L^{\beta} + \theta_M L_M^{\beta} + \theta_H L_H^{\beta}\right]}$. Since $\varphi = 0$, Equation (A.3) simplifies to

$$dlogw_g = (\beta - 1)\left(dlogL_g - dlogL\right). \qquad \text{(A.18)}$$

Plugging in the expressions for $dlogL_g$ and $dlogL$, exploiting that with fully flexible wages $dlogL_L^N = \eta_L dlogw_L$, and solving for $dlogw_g$, we obtain the following for skill group $g = L$

$$dlogw_L = \frac{(\beta-1)\left(\left(s_M(1-(\beta-1)\eta_H)\left(\frac{\pi_L^I}{\pi_L^N}-\frac{\pi_M^I}{\pi_M^N}\right)+s_H(1-(\beta-1)\eta_M)\left(\frac{\pi_L^I}{\pi_L^N}-\frac{\pi_H^I}{\pi_H^N}\right)\right)dI\right.}{1-(\beta-1)\#1+(\beta-1)^2\#2}, \quad \text{(A.19)}$$

where

$$\#1 = \left((1-s_L)\eta_L + (1-s_M)\eta_M + (1-s_H)\eta_H\right)$$

$$\#2 = \left((1-s_L-s_M)\eta_L\eta_M + (1-s_M-s_H)\eta_M\eta_H + (1-s_L-s_H)\eta_L\eta_H\right).$$

The employment response follows from

$$dlogL_L^N = \eta_L dlogw_L.$$

The wage and employment responses of the other skill groups follow accordingly.

Perverse wage effects are thus possible. Supposing that migrant concentration is high in skill group *L*, medium in skill group *M*, and low in skill group *H*,

$$\frac{\pi_L^I}{\pi_L^N} > \frac{\pi_M^I}{\pi_M^N} > \frac{\pi_H^I}{\pi_H^N}$$

if the local labor supply elasticity of the medium skilled is large relative to that of the low skilled, the wages of the former can still decline more than the wages of the latter (i.e., $dlogw_M < dlogw_L$). It is, however, not possible that wages of the high skilled (which must increase if capital is fully flexible) decline relative to wages of the low skilled (which decline).

Appendix B: The Commuting Policy

After World War II, the border between West Germany and former Czechoslovakia became heavily fenced, allowing no movement of goods, capital, or people across. The first opening of the border occurred in November 3, 1989, when Czechoslovakia allowed East Germans—who had gathered in great numbers in West Germany's embassy in Prague—to travel to West Germany. Shortly after, in November 17, the border opened up also for Czechs and Slovakians to travel. Beginning on December 11, the Czechoslovak fortifications on the West German border were dismantled, and from July 1990, any visa requirements for cross-border travel were abolished.

Against this backdrop, various schemes for the legal employment of foreign nationals in Germany were extended or introduced with effect on January 1, 1991.[1] The overall policy comprised a locally constrained scheme that received little public attention, the *Grenzgängerregelung* commuting scheme, which granted foreign nationals from neighboring countries the right to work in dependent employment in German border regions without granting them residency rights. These workers were required to commute daily from their country of origin *or* to work for a maximum of two days per week. Since the movement of labor was in principal unrestricted within the European Economic Community (bilateral agreements already covered tax and other issues on the western borders), this policy had consequences only on the eastern German borders with Poland and Czechoslovakia (from 1993, the Czech Republic).[2] The intended implementation of the policy along the Czech-German border was first reported in September 1990, only shortly before the scheme came into effect.[3] The initial provision specified only 18 districts, but a revision lists three

[1] See "Anwerbestoppausnahme-Verordnung", Bundesgesetzblatt, Jahrgang 1990, Teil I.
[2] A summary of the existing commuting schemes within the European Community is given in IAB (1993).
[3] See *Süddeutsche Zeitung* (1./2.9.1990). Implementation of the scheme along the Czech-German border occurred shortly before its general introduction on January 1, 1991 (see Hönekopp, 1991). A detailed examination of daily employment records confirms that the inflow of Czech nationals had already begun by September 1990.

additional districts (*Straubing*, *Deggendorf*, and *Straubing-Bogen*), leading us to consider all 21 districts as treated units, although our results are robust to exclusion of the additions. As explained in the text, we exclude 8 districts located within about 80 kilometers of the former border between East and West Germany because external data on regional commuting flows from the late 1990s show that areas directly adjacent to that border received a high share of commuters.[4]

Czech commuters pay taxes in the Czech Republic—their country of residence—according to the Czech tax law. They pay social security contributions according to the German law. Yet, in case of a job loss, they are entitled to unemployment benefits only in the Czech Republic, but not in Germany. Because the commuting scheme had little effect on the West German labor market as a whole, it received little attention in national newspapers. In local newspapers, however, the increase in Czech commuters in the border region was perceived as having negative consequences for native workers.

Appendix C: Matching and the Synthetic Control Method

Matching of Control Units in Baseline Specification

To account for differences in district size, for each treated district, we match one or multiple control unit(s) until their employment levels sum to at least proportion x of employment in the treated unit. The choice of x is subject to a trade-off between bias and precision: choosing a higher value results in the matching of more but potentially less suitable control areas. For our baseline specification, we choose $x = 1.5$ but, to ensure that our findings are not driven by the particular choice of control units, we repeat the analysis for alternative sets of matched characteristics using other values of x. Doing so has little effect on our baseline findings.

Synthetic Control Approach

When applying the synthetic control method, we construct a comparison unit from all West-German districts located in rural regions or regions with intermediate agglomerations, and not neighboring the former border between East and West Germany, according to the following procedure:

- First, we define the pre-intervention periods as between 1985 and 1990.

[4] See, for example, Kropp (2010) and IAB (1992).

- Second, we define a vector $\boldsymbol{X_1}$ of pre-intervention characteristics and outcomes for the exposed region. In our case, $\boldsymbol{X_1}$ consists of the value of the outcome variable in each pre-intervention period and the average over the entire pre-intervention periods of (1) the employment growth among natives, (2) the wage growth among native incumbents, (3) the employment share of unskilled workers, (4) the share of foreign workers, and (5) the share of four age groups. We similarly define $\boldsymbol{X_0}$ as a matrix containing the same variables for the unaffected region.
- Third, we choose a weighting vector $\boldsymbol{W}^*$ to minimize the distance $\| \boldsymbol{X_1} - \boldsymbol{X_0}\boldsymbol{W} \|_{\boldsymbol{V}} = \sqrt{(\boldsymbol{X_1} - \boldsymbol{X_0}\boldsymbol{W})'\boldsymbol{V}(\boldsymbol{X_1} - \boldsymbol{X_0}\boldsymbol{W})}$, where $\boldsymbol{V}$ is selected from among the positive definite and diagonal matrices such that the mean squared prediction error of the outcome variable is minimized for the pre-intervention periods.[5] The synthetic control method thus sets both a weight for each predictor (via $\boldsymbol{V}$) and a weight for each available control district (via $\boldsymbol{W}$).

Appendix D: Additional Results

D.I Plausibility of Identifying Assumptions

In Table O.I, we provide support for the assumption that in the absence of a Czech inflow, the evolution of subgroup-specific local wages and employment is uncorrelated with distance from the border, by analyzing whether prior to the introduction of the commuting policies, municipalities in the border region closer to the border experienced differential trends in subgroup-specific outcomes from municipalities further away from the border. Reassuringly, the table shows that distance to border is, with one exception, uncorrelated with pre-policy trends in outcomes.

[5] See Appendix B in Abadie and Gardeazabal (2003). For implementation, we use the Synth software package provided by Abadie, Diamond, and Hainmueller at http://www.stanford.edu/~jhain/synthpage.html.

D.II Alternative First Stages

Our results are robust to alternative ways of estimating the first stage. In these robustness checks, we restrict the sample to the border region only and exclude the matched inland control districts (as all control districts are far from the border). For simplicity, we report estimates based on long differences instead of estimating annual regressions and adding up coefficients as in our baseline specification in the manuscript. These modifications have a negligible effect on the point estimates, but wage impacts are less precisely estimated.

First, we use different functional form assumptions for our distance measure, comparing our baseline estimate based on a quadratic of distance to border with estimates based on a third order polynomial and a spline function with 5, 10 or 20 knots in distance to border. The corresponding first-stage and 2SLS results for both employment and wages are reported in Panel A of Table O.II. 2SLS estimates hardly change when we use a polynomial of order 3 in distance to border to predict the inflow of Czech workers into the area (column (2)). Based on the Akaike information criterion we reject in particular a linear specification, and select the quadratic as our baseline specification. 2SLS estimates are also very similar when a spline function with 5 knots is used to predict the inflow (column (3)). However, employment effects become less negative when more knots are included. We attribute this to an endogeneity problem: if we allow more flexibility in the first stage, it will increasingly capture that Czechs prefer to enter areas with strong labor demand; that is, labor demand in a band 20km from the border may have been somewhat higher than demand 25km away from the border.

Second, we use alternative distance measures (see Panel B of Table O.II). We computed driving distances in both km and time between all municipalities and the closest border crossing, using the Google Maps API. The correlation between airline distance (what we used so far) and driving distances is very high (about 0.97) and accordingly, the 2SLS employment and wage estimates are similar to our baseline estimates (column (2) in Panel B). The correlation between airline distances and driving times is slightly smaller (slightly less than 0.9), but once again the 2SLS wage coefficient differs only slightly from our baseline. As distances are computed based on the current (2015) road networks, it might be a worse proxy for actual driving time than simple airline distances. Moreover, the current road network may be endogenous to past differences in local labor conditions in general and the spatial distribution of Czech commuters in particular. For these reasons we prefer airline distance as our baseline measure.

D.III Alternative Computations of Standard Errors

In Table O.III, we report additional estimates for the standard errors in the 2SLS wage and employment effects. As in Table O.II, the specification refers to the long difference (1990 to 1993) regression. The sample consists of the border region and matched inland control districts. In column (1), we report standard errors clustered on the district level, as in our baseline specification. In columns (2) to (4), we report standard errors based on Spatial Heteroscedasticity and Autocorrelation Consistent (SHAC) variance estimator (Conley 1999), which allows for correlation between areas that are geographically close but belong to different administrative units, using three different bandwidth choices and ignoring uncertainty in the first stage. The bandwidth choice has little impact on the standard error estimates, and the SHAC standard errors are very similar to estimates which allow for clustering on the district level.

To get an idea how ignoring uncertainty in the first stage affects standard error estimates, we report in column (5) standard errors clustered on the district level which do not take into account the uncertainty in the first stage. Estimates are not much smaller than the standard error estimates presented in column (1).

In column (6), we present standard errors clustered at the municipality level. Estimates are once again similar to those clustered at the district level.

D.IV Synthetic Cohort Results by Skill

In Figure O.I, we depict employment and wage gaps separately for unskilled and skilled workers between the highly exposed inner border region and their respective synthetic control (in bold).

To compare these outcomes with our baseline estimates, we must scale the differences in employment growth (about -0.086 for unskilled natives and -0.048 for skilled natives by 1993) and wage growth (about -0.016 for unskilled natives and -0.008 for skilled natives by 1993) by the share of Czech workers who entered the treatment region (5.8%). The results, about -1.49 (unskilled) and -0.82 (skilled) for employment, and -0.28 (unskilled) and -0.13 (skilled) for wages, are in the same ballpark as our baseline coefficients.

To test precision, we computed permutation tests in which we apply the synthetic control method to every potential control in our sample (as in Abadie, Diamond, and Hainmueller 2010). For unskilled workers, only one employment gap and five wage gaps are more negative than the treatment gap, indicating statistical significance at (at least) the 5% and 10% level. For skilled workers, 4 employment gaps are more negative than the treatment gap, indicating statistical significance at (at least) the 10% level. The treatment wage gap is however not exceptionally large in the treated inner border region compared to placebo districts. It should be noted that this permutation test is conservative, as the placebo districts are substantially smaller (and thus noisier) than the inner border region, which spans over multiple districts.

D.V Employment Effects by Industry

Figure O.II shows that industries which experienced a larger inflow of Czech workers experienced a larger decline in native local employment between 1990 and 1993. Specifically, we estimated employment equations separately for each of 28 industries and by skill, pooling over the years 1987 to 1993 to estimate linear municipality-specific time trends using the pre-shock period (as in column (2) in Table V). The resulting slope coefficients reveal then the differential employment impact by industry. We then plot these coefficients against the industry's exposure to Czech workers, measured as the industry-specific share of Czech workers (relative to the mean share). The figures show that the employment decline in areas more exposed to Czech inflows tends to be concentrated in those industries in which the exposure to Czech immigrants is larger. Consistent with our analysis on the area level, this decline is larger among unskilled native workers. The slope of the corresponding regressions is equal to -1.78 (robust se .55) for unskilled and -.40 (se .26) for skilled workers. Reassuringly, employment declines are small in the public sector which hardly experienced any inflow in Czech workers and which may therefore be seen as a placebo check.

D.VI Impact on Firm Births and Native Job Creation

In the first two columns in Table O.IV, we investigate whether the Czech inflow leads to an expansion of the number of firms in exposed areas. We report both unadjusted and trend-adjusted estimates and our sample includes the border region and matched control districts.

We indeed find that the inflow of Czech workers increases the number of firms. The effect is however relatively modest: a 10-percentage point increase in the employment share of Czechs increases the number of firms by about 3%. Interestingly, native job creation in newly created firms (measured as the number of native workers in new establishments in 1993 divided by native employment in 1990) declines in response to an immigration-induced labor supply shock, suggesting that many of the new hires in these firms are Czech workers (columns (3) and (4)). Interestingly, the expansion in the number of firms is entirely driven by the non-tradable sector, possibly because firm size and thus fixed entry costs are smaller in the non-tradable sector than in the tradable sector.

Overall, although the immigration-induced labor supply shock expanded the number of firms, the shock reduced native job creation in new firms. We wish to stress that these are the short-term effects of the labor supply shock. It may well be that in the longer run these new firms expand, creating positive employment possibilities also for native workers.

D.VII Wage and Employment Effects by Gender

In Table O.V, we report results separately for men and women, distinguishing also between skill groups. The sample includes the border region and matched control districts, and we display both unadjusted and trend-adjusted estimates.

Generally, the results show that the employment and wage effects are roughly similar for men and women. They also reveal that accounting for municipality-specific time trends has generally a stronger effect for women than for men, especially among skilled workers.

D.VIII Alternative Specifications

In Table O.VI, we compare employment and wage results from our baseline specifications with those obtained from specifications more commonly adopted in the literature. Specifically, we follow Borjas, Freeman, and Katz (1996) and regress local native employment and wage growth of skilled and unskilled natives between 1990 and 1993 on the *skill-specific* change in the employment share of Czech workers (as opposed to the *overall* change, as in our baseline specification) in the area. The table has a similar structure as Table 2 in Borjas, Freeman, and Katz (1996).

Panel A corresponds to our 2SLS estimates, where we predict the skill-specific inflow of Czech workers (i.e., the change in the number of Czech workers from a specific skill group in the municipality between 1990 and 1993 divided by skill-specific local employment in 1990) by a quadratic function in distance to border, separately for skilled and unskilled workers. Without skill fixed effects in column (1), both the wage and employment coefficients are more negative than in our baseline specification. The reason is that the inflow of Czech workers was particularly high among the unskilled, who experienced lower employment and wage growth than skilled workers throughout Germany in the early 1990s. Controlling for skill fixed effects yields estimates that are closer to the baseline estimates reported in our manuscript (column (2)). Controlling for area fixed effects instead (column (3)) again yields more negative coefficient estimates, due to different secular trends for the two skill groups. If we include both area and skill fixed effects (column (4)), coefficient estimates are smaller than our baseline estimates, but still significantly negative.

To summarize: specifications (1) and (3) which do not include skill fixed effects yield biased estimates in our context, due to the differential secular wage and employment growth of the two skill groups. It is important to emphasize that specifications (2) and (4) (which control for skill fixed effects) identify conceptually a different parameter than our specification based on the overall inflow of Czech workers. In particular, specification (4) can identify only relative wage and employment effects between skill groups. Our paper suggests that in the short run both skill groups were negatively affected by Czech inflows (possibly because of the imperfect elasticity of capital), such that relative comparisons between skill groups underestimate the overall labor market impact of migration. Specification (2), which does not include area fixed effects, comes closest to out specification (and also yields similar results), but nevertheless identifies a different parameter and lacks a straightforward interpretation. We prefer our specification, which uses *overall* rather than the skill-specific inflow of Czech workers for three main reasons. First, this specification is consistent with our experiment, as only the total inflow of Czechs into the border region can be considered as quasi-random. Second, the estimated parameters are clearly policy relevant in that it captures the total effect of the aggregate supply shock for specific groups of natives. And third, it avoids the problem of misclassification that arises when such observable characteristics are used to assign immigrants into skill groups in which they do not compete with natives.

For completeness, we report OLS estimates for specifications (1) to (4) in Panel B. Coefficient estimates are now much more positive in both the employment and wage regression. This suggests that the selection bias in migration destinations is large even if the outcome is differenced; that is, migrants systematically enter those areas which experience above-average wage and employment *growth*.

Table O.I: Placebo Regressions of Pre-Shock Employment and Wage Growth on Distance to Border

	employment growth			log wage growth		
	(1)	(2)	(3)	(4)	(5)	(6)
	all	unskilled	skilled	all	unskilled	skilled
Panel A: all						
	-0.023	-0.018	-0.081	0.005	-0.001	0.005
	(0.048)	(0.064)	(0.047)	(0.007)	(0.012)	(0.005)
Panel B: by age						
below 30	-0.013	0.016	-0.064	-0.001	-0.012	0.000
	(0.063)	(0.078)	(0.062)	(0.010)	(0.020)	(0.010)
30-49	-0.058	-0.074	-0.121*	0.010	0.004	0.013
	(0.049)	(0.076)	(0.049)	(0.008)	(0.017)	(0.007)
50 and above	0.031	0.011	-0.024	0.015	0.012	0.017
	(0.052)	(0.064)	(0.064)	(0.009)	(0.013)	(0.010)
# municipalities	291	291	291	291	291	291

Note: The table reports the slope coefficient from a regression of native employment and wage growth between 1987 and 1989 in the municipality on the municipality's airline distance to border (measured in km/100), separately for skill and age. The sample is restricted to municipalities in the border region, whose median (maximum) distance to the border is 33km (78km). Standard errors are clustered at the district level.

Table O.II: Alternative Functional Forms and Distance Measures for the First Stage

Panel A: Alternative Functional Forms					
Panel A	(1) Quadratic (Baseline)	(2) 3rd-order Polynomial	(3) Spline 5 knots	(4) Spline 10 knots	(5) Spline 20 knots
First Stage					
adj. R-sq	0.384	0.382	0.376	0.408	0.415
F	49.47	32.96	23.23	33.43	25.95
Second stage					
empl. Coef.	-0.947	-0.961	-0.961	-0.750	-0.652
	(0.380)	(0.380)	(0.380)	(0.390)	(0.365)
wage. Coef.	-0.124	-0.124	-0.127	-0.075	-0.102
	(0.103)	(0.103)	(0.102)	(0.104)	(0.091)
# municipalities	291	291	291	291	291

Panel B: Alternative Distance Definitions			
Panel B	(1) Airline distance (Baseline)	(2) Driving Distance	(3) Driving Time
First Stage			
adj. R-sq	0.384	0.387	0.347
F	49.47	48.45	40.02
Second stage			
empl. Coef.	-0.947	-0.838	-0.947
	(0.380)	(0.372)	(0.369)
wage. Coef.	-0.124	-0.118	-0.105
	(0.103)	(0.098)	(0.099)
# municipalities	291	291	291

Note: The table reports the adjusted R-squared and the F-statistic from alternative first stage regressions and the corresponding 2SLS estimates for the impact of the inflow of Czech workers into the municipality (measured as the increase in the number of Czech workers between 1990 and 1992 as a share of employment in 1990) on native employment and log wage growth between 1990 and 1993 in the municipality. The sample is restricted to the border region. Panel A displays results for alternative functional form assumptions. Column (1) refers to our baseline estimates and uses a quadratic in airline distance to the nearest border crossing as instruments. Column (2) uses instead a 3rd-order polynomial, while Columns (3) to (5) use a spline of distance to border with 5, 10 or 20 knots. Panel B shows results for alternative measures of distance. Column (1) refers to our baseline estimates which use airline distance from the municipality's centroid to the nearest border crossing. Column (2) instead uses driving distance, while Column (3) uses driving times. Standard errors clustered at the district level in parentheses.
Data Source: German Social Security Records, border region, 1990 and 1993.

Table O.III: Alternative Computations of Standard Errors

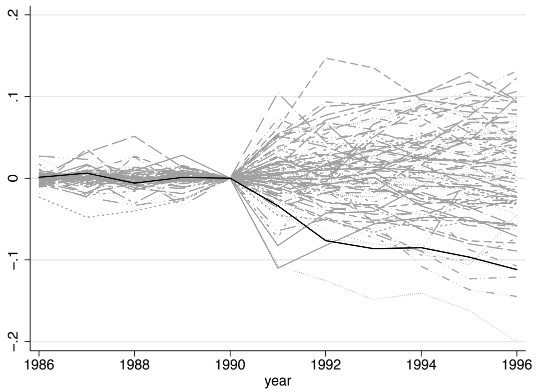
Panel A: Wage Effects			SHAC		Clustering	
	1	2	3	4	5	6
	district	bw=50km	bw=100km	bw=200km	district, ignore first stage	municipality
all	0.002	0.002	0.002	0.002	0.002	0.002
	(0.066)	(0.0502)	(0.0530)	(0.0643)	(0.062)	(0.051)
unskilled	-0.057	-0.057	-0.057	-0.057	-0.057	-0.057
	(0.106)	(0.0820)	(0.0800)	(0.0851)	(0.099)	(0.086)
skilled	-0.052	-0.052	-0.052	-0.052	-0.052	-0.052
	(0.057)	(0.0506)	(0.0500)	(0.0565)	(0.056)	(0.049)
Panel B: Employment Effects			SHAC		Clustering	
	1	2	3	4	5	6
	district	bw=50km	bw=100km	bw=200km	district, ignore first stage	municipality
all	-0.930	-0.930	-0.930	-0.930	-0.930	-0.930
	(0.243)	(0.236)	(0.243)	(0.230)	(0.210)	(0.263)
unskilled	-1.203	-1.203	-1.203	-1.203	-1.203	-1.203
	(0.328)	(0.275)	(0.271)	(0.263)	(0.261)	(0.293)
skilled	-0.522	-0.522	-0.522	-0.522	-0.522	-0.522
	(0.214)	(0.226)	(0.230)	(0.213)	(0.206)	(0.243)
# municipalities	1,550	1,550	1,550	1,550	1,550	1,550

Note: The table compares standard errors using alternative estimation procedures. The sample includes both the border region and matched inland control districts and the specification refers to the long difference regression (as in column (v) in Table V). Columns (1) to (3) report standard error estimates based upon the spatial HAC technique of Conley (1999), using a uniform kernel and bandwidths of 50, 100 or 200 kilometers, respectively. Columns (4) to (6) report standard errors from a wild bootstrap procedure. While column (4) ignores uncertainty in the first stage, Columns (5) and (6) do not. Columns (4) and (6) cluster on the district, Column (5) on the municipality level.
Data Source: German Social Security Records, border region and matched control districts, 1990 and 1993.

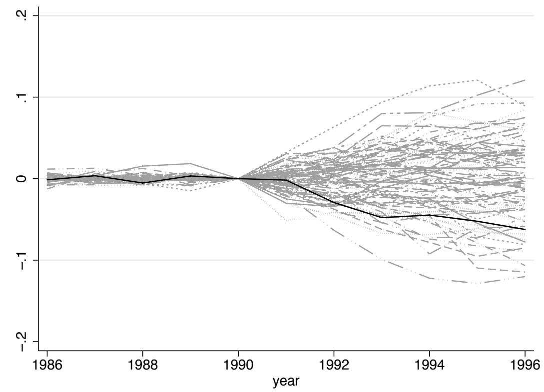
Figure O.I: Synthetic Control Method for Unskilled and Skilled Native Workers, with Permutation Tests

Panel A: Employment

A.1 Unskilled

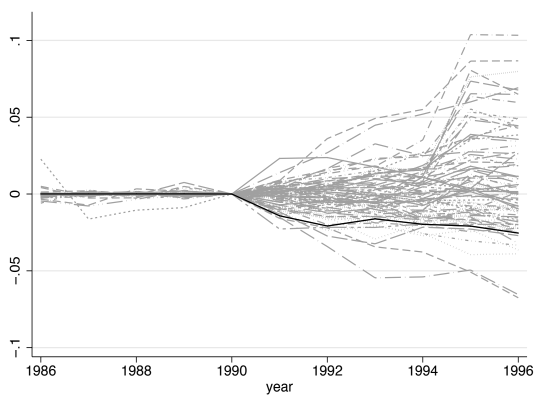


A.2 Skilled

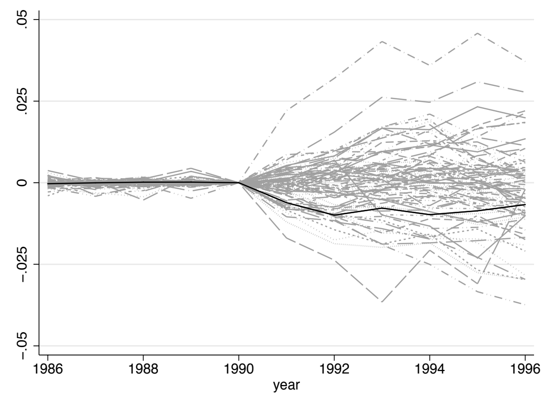


Panel B: Wages

B.1 Unskilled



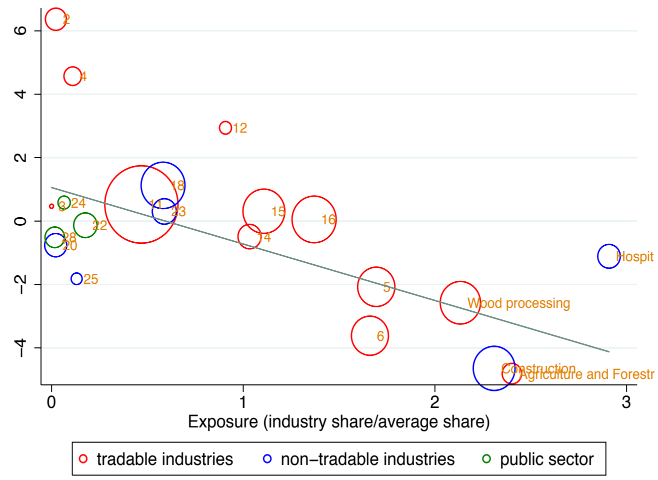
B.2 Skilled



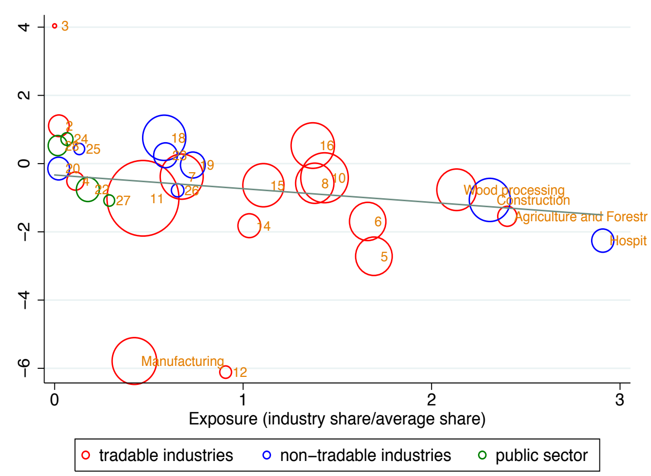
Note: The figures display, following Abadie, Diamond, and Hainmueller (2010), the employment and wage gaps between the highly affected inner border region and its synthetic control (bold line) as well as the respective gaps from 85 placebo districts, separately for unskilled and skilled workers. To make sure that the wage effects are not underestimated because of worker selection, wage growth is computed for all workers who remain employed in the district between two consecutive years, as in our baseline specification.
Data Source: German Social Security Records, inner border region and inland districts, 1986 to 1996.

Figure O.II: Employment Effects by Industry

Panel A: Unskilled



Panel B: Skilled



Industry codes:
[1] Agriculture and forestry
[2] Energy
[3] Mining
[4] Chemical industry
[5] Plastics
[6] Pit and quarry
[7] Ceramic and glass
[8] Metal production and processing
[9] Manufacturing
[10] Vehicle manufacturing
[11] IT, electronics, optics
[12] Musical instruments, jewelry, toys
[13] Wood and wood processing
[14] Printing and paper processing
[15] Leather and textile
[16] Food and tobacco
[17] Construction
[18] Trading
[19] Transportation and communications
[20] Credit and insurance
[21] Hospitality
[22] Healthcare and welfare
[23] Business-related services
[24] Educational services
[25] Recreational services
[26] Household services
[27] Social services
[28] Public administration

Note: The Figure plots the coefficients from a regression of employment growth of unskilled (Panel A) or skilled (Panel B) native workers in the industry on the predicted (by the square in distance to border) local overall inflow of Czech workers against the ratio between the industry-specific and average share of Czech workers. Employment growth regressions are pooled over the years 1987 to 1993 to estimate municipality-specific linear time trends using the pre-shock period. The size of each circle is proportional to industry-specific employment in 1990. See side legend for industry codes.
Data Source: German Social Security Records, border region and matched control districts, 1987 to 1993.

Table O.IV: Impact of Czech Inflows on Number of Firms and Native Job Creation

	# of establishments		native job creation by establishment entry		# of establishments in tradable sector		# of establishments in non-tradable sector	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
all	0.356	0.305	-0.257	-0.252	-0.029	0.097	0.413	0.440
	(0.113)	(0.171)	(0.090)	(0.149)	(0.197)	(0.262)	(0.158)	(0.201)
unskilled	-	-	-0.357	-0.364	-	-	-	-
			(0.098)	(0.172)				
skilled	-	-	-0.204	-0.238	-	-	-	-
			(0.093)	(0.156)				
trend controls	no	yes	no	yes	no	yes	no	yes
# municipalities	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550

Note: Columns (1) and (2) show 2SLS estimates for the impact of the inflow of Czech workers into the municipality (measured as the increase in the number of Czech workers between 1990 and 1992 as a share of employment in 1990 and instrumented by a quadratic in airline distance to border) on the percentage change in the number of establishments in the municipality between 1990 and 1993. Column (1) refers to the period 1990-1993, while Column (2) pools over the period 1987-1993 to estimate municipality-specific linear trends using the pre-shock period. Columns (3) and (4) show the corresponding estimates for native job creation, measured as the number of all (unskilled, skilled) native workers in new establishments in 1993 divided by native (unskilled, skilled) employment in 1990. Columns (5) to (8) display 2SLS estimates for the impact of the inflow of Czech workers into the municipality on the percentage change in the number of establishments in the municipality between 1990 and 1993 separately for the tradable and non-tradable sector. Bootstrapped standard errors clustered on the district level are reported in parentheses.
Data Source: German Social Security Records, border region and matched control districts, 1987 to 1993.

Table O.V: Impact of Czech Inflows on Male and Female Employment and Wage Growth

	unadjusted		trend-adjusted	
	(1)	(2)	(1)	(2)
	men	women	men	women
Panel A: Wage Effects				
all	-0.114	-0.198	-0.151	-0.320
	(0.043)	(0.054)	(0.060)	(0.064)
unskilled	-0.233	-0.233	-0.187	-0.396
	(0.067)	(0.091)	(0.066)	(0.111)
skilled	-0.085	-0.072	-0.147	-0.265
	(0.043)	(0.056)	(0.062)	(0.064)
Panel B: Employment Effects				
all	-0.974	-0.851	-0.955	-0.902
	(0.240)	(0.246)	(0.378)	(0.330)
unskilled	-1.871	-1.038	-1.540	-1.367
	(0.308)	(0.362)	(0.563)	(0.477)
skilled	-0.680	-0.086	-0.916	-0.835
	(0.244)	(0.233)	(0.369)	(0.316)
# municipalities	1,550	1,550	1,550	1,550

Note: The table presents 2SLS estimates for the impact of the inflow of Czech workers into the municipality (measured as the change in the number of Czech workers between 1990 and 1992 divided by employment in 1990 and instrumented by a quadratic in airline distance to border) on local native wage and employment growth between 1990 and 1993, separately for men and women. We report both unadjusted estimates (columns (1) and (2)) and trend-adjusted estimates which use the 1987-1989 pre-shock period to estimate municipality-specific linear time trends. Bootstrapped standard errors clustered on district level in parentheses.
Data Source: German Social Security Records, border region and matched control districts, 1987 to 1993.

Table O.VI: Impact of the Skill-Specific Inflow of Czech Commuters on Skill-Specific Native Wage Growth, 1990-1993

Panel A: 2SLS	(1)	(2)	(3)	(4)
Wages	-0.228	-0.163	-0.249	-0.106
	(0.047)	(0.092)	(0.043)	(0.060)
Employment	-2.134	-0.612	-2.985	-0.127
	(0.263)	(0.317)	(0.338)	(0.397)
Skill fixed effects	no	yes	no	yes
Municipality fixed effects	no	no	yes	yes

Panel B: OLS	(1)	(2)	(3)	(4)
Wages	-0.086	-0.032	-0.097	-0.004
	(0.024)	(0.033)	(0.037)	(0.038)
Employment	-0.700	0.043	-1.240	-0.063
	(0.095)	(0.128)	(0.251)	(0.105)
Skill fixed effects	no	yes	no	yes
Municipality fixed effects	no	no	yes	yes

N: 582 (291 municipalities X 2 skill groups)

Note: The table reports 2SLS (Panel A) and OLS (Panel B) estimates of the skill-specific inflow of Czech workers into the municipality (measured as the change in the number of Czech workers of a particular skill-group divided by skill-specific employment in 1990) on native employment and log wage growth in the municipality. In Panel A, the skill-specific inflow of Czech workers is instrumented with a quadratic in airline distance to the border. In Column (1), neither skill nor municipality fixed effects are included. In Columns (2) and (3), either skill or municipality fixed effects are included. In Column (4), both skill and municipality fixed effects are controlled for. Bootstrapped standard errors clustered on the district level are reported in parentheses.
Data Source: German Social Security Records, border region, 1990 to 1993.