Immigration and Work Schedules: Theory and Evidence

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Abstract

Economists have long been interested in analyzing the effects of immigration on native wages and employment. Yet, there is little evidence on the effects of immigration on work conditions. We provide a theoretical framework to analyze the effects of immigration on work schedules. Immigrants have incur a lower disamenity cost from working at night, which leads them to disproportionately choose night-time employment. Because day-time and night-time tasks are imperfect substitutes, the relative wage of day-time tasks increases as their supply becomes relative more scarce. Consistent with our hypotheses, we show that immigration decreases the premium for working night shifts and increases the probability of workers working during the day.

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1 Introduction

A popular argument in favor of immigration is that immigrants accept jobs that natives would never accept. There is a growing literature analyzing immigrant-native differences in occupational risk across several developed economies and recent empirical evidence indicates that immigrants are more likely to hold jobs involving worse working conditions (Orrenius and Zavodny, 2012, 2009; Giuntella et al., fothcoming). However, quite surprisingly, there has been little theoretical and empirical investigation of the relationship between immigration and natives non-pecuniary job characteristics.

This paper attempts to fill this void, specifically focusing on work schedules. We build a model in which immigrants having a lower disamenity cost for accepting night-time work, which causes them to specialize in non-traditional schedules. Our model predicts that, because of these factors, an increase in the fraction of immigrants in an economy leads to an increase in the proportion of jobs worked at night. However, because night and day production are imperfect substitutes, the relative wages of day-time workers increase, which in turn induces an increase in day-time employment for natives.

We confirm our predictions empirically using the Decennial Censuses and American Community Survey. Using time- and spacial-variation of the concentration of immigrants, we find that a 10% increase the fraction of foreign workers leads to a .24 percentage point decrease in the probability of natives working at night, and a .78 percentage point decrease in the night-shift wage premium.

Economists have long been interested in understanding the effects of immigration on the labor market (Card, 1990; Hunt, 1992; Friedberg and Hunt, 1995; Borjas, 1995; Carrington and Lima, 1996; Dustmann et al., 2005; Borjas et al., 2012, 2008; Ottaviano and Peri, 2012; Glitz, 2012). Most studies found little evidence of negative effects of immigration on overall native wages and employment. The debate becomes more controversial when one focuses on individuals who are more likely to suffer immigrant competition on the labor market: low-skilled workers, ethnic minorities, and previous cohorts of immigrants. Yet, to this point we know very little about how immigration affects other important labor market characteristics such as the occupational risk, physical intensity, and the type of schedule associated with a given job. There is some

recent empirical evidence that immigration reduced occupational risk and physical intensity among high-skilled natives and pushed natives into more standard work-shifts (Giuntella et al., fothcoming; Giuntella and Mazzonna, 2015; Giuntella, 2012). However, there has been little theoretical investigation of the effects of immigration on working conditions. One exception is Peri and Sparber (2009). Using a general equilibrium model with multiple tasks, they show that an increase in immigration leads to an increase in the relative provision of jobs with manual tasks, and an increase in the relative wages of jobs that require a high-degree of communication tasks. Our model builds on their framework.

Work schedules can have long-lasting effects on workers physical health (Ravesteijn et al., 2018; Fletcher and Sindelar, 2009; Case and Deaton, 2005) and cognitive abilities (Mazzonna and Peracchi, 2014). Working in physically demanding jobs accelerates aging, increasing stress and the risk of injury. Similarly, working irregular shifts or nightly schedules increases the risk of negative health outcomes, and reduces time spent with family and friends affecting the consumption of relational goods, marital stability, and children's and family well-being (Costa, 1996; Presser, 2000; Davis et al., 2008; Strazdins et al., 2006; Enchautegui, 2013; Vyas et al., 2012). Medical evidence suggests that working non-standard hours increases the risk of obesity, ischemic heart disease, and breast cancer (Costa, 1996). More generally, work schedules has important effects on the likelihood of reporting feelings of chronic fatigue, anxiety, and depression.

One benefit to accepting worse work conditions is earning a compensating wage differential. However there is little empirical evidence on risk premiums. Overall, research indicates that immigrants earn risk premiums that are similar to natives, but some groups (e.g. Mexicans in the US) earn smaller or no risk premiums (Hersch and Viscusi, 2010). The wage premium for irregular shifts is also relatively small. In the United States, only a small fraction of workers report working non-standard hours because of a compensating wage differential (McMenamin, 2007). This evidence suggests that, for most workers, non-standard schedules are the result of limited labor market opportunities. Furthermore, the distribution of job-disamenties among workers is highly unequal. As reported by Enchautegui (2013), 60 percent of workers with non standard schedules have earnings below the median of the typical American worker, and 40 percent have earnings that are lower than those of 75 percent of all workers. Thus, there is growing attention towards increasing workers awareness of the risks associated with particular

work conditions and improving the job quality of immigrants has become an important policy issue (Enchautegui, 2008).

We investigate how immigration affects the allocation of work schedules and in particular the likelihood of working nightly shifts. We use US Census data (1990, 2000) and American Community Survey data (2005-2015) and study how changes in the spatial concentration of immigrants over time affect the likelihood of working nightly shifts and the allocation of risky jobs. As immigration may be endogenous to unobservable local trends in the labor market and because natives may respond to immigration by moving to other areas we use the traditional shift-share instrument proposed by Altonji and Card (1991) and Card (2001). We argue that by including commuting zone fixed effects, we can reasonably assume that past immigrant concentrations are uncorrelated with current unobserved local trends that may be correlated with the demand for nightly shifts and riskier jobs. We also provide evidence that our instrument is uncorrelated with lagged changes in our outcome of interest.

This paper is organized as follows. Section 2 reviews previous literature on immigration, job risk, and work schedules. Section 3 introduces our theoretical framework, In Section 4, we illustrate the data. Section 5 discusses the main results. We provide concluding remarks in Section 6.

2 Previous Work

2.1 Why immigrants hold riskier jobs

Media reports have popularized the idea that immigrant workers are in jobs that native workers would never accept. But beside anecdotal evidence, there are several reasons we might expect immigrants to hold riskier jobs. Coming from countries that are, on average, characterized by worse working conditions, immigrants may have different perception of job risks than natives. Differences in risk knowledge and perception may also be explained by differences in socio-economic status and language proficiency (Dávila et al., 2011).

Because of language barriers, the cost to provide safety training to immigrant workers may be higher (Hersch and Viscusi, 2010). Furthermore, immigrants, who took the risk of migration, may have lower risk aversion than natives (Berger and Gabriel, 1991). This may explain

the self-selection of immigrants in riskier jobs, but also a lower productive within jobs as immigrants take higher risks than expected or necessary. In addition, as most immigrants in the developed world arrive with lower human capital and less financial assets than natives, they have higher incentives than natives to accept worse working conditions for higher life-time earnings (Grossman, 1972). These incentives are reinforced by the fact that immigrants are usually young and relatively healthy (i.e. the "healthy immigrant effect." See Antecol and Bedard, 2006; Kennedy et al., 2015) and might therefore be willing to trade-off some of their health capital for better wages. Newly arrived immigrants may face language barriers, and, therefore, may have a comparative advantage in working in more manual-intensive jobs, than in occupations requiring communication and social interaction. Furthermore, as the exit rates from these jobs are higher (Martin and Scarpetta, 2012), there may be more opportunities and lower search costs for recent immigrants. One may therefore expect immigrants to self-select in occupations involving higher physical intensity and worse schedules.

2.2 Previous evidence on immigrant-native differences in risky jobs

Despite all these arguments and anecdotal evidence, Berger and Gabriel (1991) and Hamermesh (1998) found little evidence that immigrants work in riskier jobs than natives. However, more recent studies provide evidence that immigrants are in fact more likely to work in riskier jobs (Loh and Richardson, 2004; Giuntella, 2012; Orrenius and Zavodny, 2012, 2009). The differences in the results with respect to earlier research are explained by differences in the way of measuring risk, but also by the different samples analyzed. In particular, Orrenius and Zavodny (2009) argue that the increase in immigrants' job risk in the US may be explained by a decline in the average human capital among immigrants, and by the fact that immigrants were crowded into riskier jobs because of the increase in the immigrant population over time. However, it is important to stress that most of previous studies have focused on occupational risk analyzing the different likelihood of natives and immigrants to work in jobs with high injury and fatality rates. One exception is a recent paper by Giuntella et al. (fothcoming) who analyze the effects of immigration on physical intensity and average injury risk of native workers in the UK. However, they do not investigate work schedules, nor they present a model to explain the mechanisms

behind their empirical findings. To the best of our knowledge this is the first study analyzing the effects of immigration on work schedules in the US and one of the very few studies on the effects of immigration on non-pecuniary working conditions.

3 A Model of Equilbrium Work Schedules with Immigration

3.1 Primitives

We consider an open economy similar to Peri and Sparber (2009). Firms combine two inputs, day-time tasks (D) and night-time tasks (N), through a CES production function to produce a final good Y:

$$Y = [\beta D^{\frac{\theta-1}{\theta}} + (1-\beta)N^{\frac{\theta-1}{\theta}}]^{\frac{\theta}{1-\theta}} \tag{1}$$

where $\theta \in (0, \infty)$ measures the elasticity of substitution between the two inputs and β captures their relative productivities.[1] We treat Y as the numeraire good so that all wages are in terms of the price of Y.

Workers are either foreign (f) or native (n), with fraction f of the population foreign. They supply one unit of labor inelastically to the market, and are hired by perfectly competitive firms to either a day or night task, which pay w_D and w_N, respectively. Workers employed at night bear a disamenity cost that is in part determined by their nativity. Native worker i incurs cost c_i, while a similar foreign worker incurs cost λc_i, with $\lambda < 1$. The parameter c is distributed over $(0, \infty)$ throughout the population by the continuous, twice-differentiable probability distribution $G(c)$. In other words, the distribution of native disamenity costs stochastically dominates that for foreign workers, or foreign workers are on average more willing to perform night tasks.[2]

Workers have concave utility with respect to wages. Specifically a worker who earns income x receives utility $U = \ln(x)$. This functional form allows for a tractable characterization of the equilibrium, but is otherwise inconsequential.

[1] Note, that while we focus on work schedules, we could equivalently view the inputs as risky and safe tasks, or tasteful and distasteful work.

[2] In an earlier version of this paper, we also allowed foreign workers to have a comparative advantage in the production of night tasks. This extension generated all of the same predictions as presented below and none additional that were testable with our data.

3.2 Labor Demand

Perfectly competitive firms maximize profits by choosing the amount of workers to employ in D and N given wages w_D and w_N,

$$\pi = [\beta D^{\frac{\theta-1}{\theta}} + (1-\beta)N^{\frac{\theta-1}{\theta}}]^{\frac{\theta}{\theta}-1} - w_D D - w_N N. \tag{2}$$

From the two first order conditions, then, we obtain a relative demand function

$$\frac{D^D}{N^D} = \left(\frac{\beta\omega_N}{1-\beta}\right)^{\theta}, \tag{3}$$

where $\omega_N \equiv \frac{w_N}{w_D}$ is the relative nightly wage.

3.3 Labor Supply

Taking wages as given, workers choose to work either days or nights to maximize their utility. Therefore native worker i will work at night so long as

$$\begin{aligned} c_i &\leq \ln(w_N) - \ln(w_D) \\ e^{c_i} &\leq \omega_N \end{aligned} \tag{4}$$

Then, denoting $h(c) = e^{g(c)}$, we can define the labor supply of night work coming from native workers as

$$N_n = (1-f)H(\omega_N), \tag{5}$$

and similarly for day work,

$$D_n = (1-f)\left[1 - H(\omega_N)\right]. \tag{6}$$

Foreign workers face a similar problem, only each worker experiences λ less disutility for nightwork conditional on their position in the cost distribution. Therefore, foreign worker i

selects night employment whenever

$$e^{c_i} \leq \omega_N^{\frac{1}{\lambda}}, \tag{7}$$

the supply of night work from foreign workers is

$$N_f = fH(\omega_N^{\frac{1}{\lambda}}), \tag{8}$$

and the supply of day work is

$$D_f = f\left[1 - H(\omega_N^{\frac{1}{\lambda}})\right]. \tag{9}$$

Combining the expressions for the labor supply of foreign and native workers, we can arrive at the total relative labor supply in the economy,

$$\begin{aligned} \frac{D^S}{N^S} &= \frac{D_n + D_f}{N_n + N_f} \\ \frac{D^S}{N^S} &= \frac{(1-f)[1 - H(\omega_N)] + f\left[1 - H\left(\omega_N^{\frac{1}{\lambda}}\right)\right]}{(1-f)H(\omega_N) + fH\left(\omega_N^{\frac{1}{\lambda}}\right)} \end{aligned} \tag{10}$$

3.4 Equilibrium

The labor market will be at equilibrium when the relative supply of labor is equal to the relative demand for labor. By equating (3) to (10) we find,

$$\omega_N = \left[\frac{(1-f)[1 - H(\omega_N)] + f\left[1 - H\left(\omega_N^{\frac{1}{\lambda}}\right)\right]}{(1-f)H(\omega_N) + fH\left(\omega_N^{\frac{1}{\lambda}}\right)}\right]^{\frac{1}{\theta}} \frac{1-\beta}{\beta} \tag{11}$$

Equation (11) implicitly defines the equilibrium relative wages in the economy. Given these relative wages, the equilibrium relative employment is determined through equation (3). Note that we can close the model for general equilibrium by assuming that workers spend all of their income on Y.

3.5 Comparative Statics

The main interest of our model is analyzing the effect of an in increase in immigration. We first show that immigrants always have stronger preferences for night-time jobs.

Lemma 1. *The proportion of foreign workers in night-jobs is strictly higher than the proportion of native workers in night-jobs.*[3]

The proof is straightforward. Because foreign workers have a lower cost distribution for working at night than natives, at any given relative wage a higher proportion of them will choose to work at night. Proposition 1 then immediately follows.

Proposition 1. *An increase in the proportion of the population that is foreign leads to a decrease in the relative day-time employment and a decrease in the relative wages of night-time jobs.*

Since foreign workers always work more night-tasks than native workers, increasing the relative proportion of foreign workers leads to a decrease in the relative provision of night-tasks. In equilibrium then, since day-time and night-time tasks are imperfect substitutes, the relative wage of day-time tasks increases as their supply becomes relatively more scarce.

However, it is important to emphasize that while day-time employment decreases in the *aggregate* this is not true for the average worker.

Proposition 2. *An increase in the proportion of the population that is foreign leads to an increase in the proportion of foreign and native workers employed in day-time jobs.*

This is a direct result of the wage effects show in Proposition 1. Because relative wages in night jobs decrease, the previously marginally worker (both foreign and native) no longer finds it worth incurring the disamenity cost to work at night. We would therefore expect to see movement into day-time tasks conditional on worker characteristics, including nativity. The effects on aggregate employment in Proposition 1 are driven entirely by a change in the composition of the workforce towards more night-time friendly employment.

[3]For proof of this and all other results, see Appendix A.

4 Data

Our primary sources of data are the US Census 1990 and 2000 IPUMS, and the 2005-2015 waves of American Community Survey (ACS) (Ruggles et al., 2017). These data include a variety of economic and demographic variables, including country of birth, as well as the time of departure from home and work. For our instrument we draw on the 1970 Census IPUMS. As a robustness check, we will also use data from the 2003-2014 waves of American Time Use Survey (ATUS) which has precise information on the hours worked from personal time diaries, but substantially smaller samples and coarser geographic information. We will focus on employed prime-age workers (25-54), but our results are substantively unchanged when including the full working age population (15-64).

We define a local labor market as a commuting zone (CZ), following the definitions created by Tolbert and Sizer (1996). We assign individuals to a CZ based on their county group (1970) or PUMAs (1990, 2000, and ACS) using the crosswalks constructed in Autor and Dorn (2013) and Autor et al. (fothcoming). We classify immigrants based on their country of birth and calculate the share of immigrants by national origin living in each commuting zone (CZ).

Our main dependent variable is the likelihood of working a nightly shift. We construct an indicator for nightly shifts which takes values equal to one for all workers who left home to work between 6pm and 6am. Table 1 estimates the basic OLS relationship between immigrant status and work schedules. Immigrants are 2.2 percentage points (or 13% relative to the mean native) more likely than natives to work a nightly shift (Panel A). Lack of English proficiency explains part of these differences (Table Panels B and C).

In Table 2, we turn to the ATUS, where we define night work as working at least 50% of overall working time between 7pm and 6am. Although natives are less likely to be classified as in a night shift by this definition, we see a similar percentage point gap, even after accounting for sociodemographic differences, and state and year fixed effects (columns 1-3). Occupational differences account for less than 25% of the gap in nightly work (column 4); that is, immigrants are working at night in the same occupations natives work during the day. With our full set of controls, immigrants are 1.5 percentage points more likely to work in night shifts than natives, or 20% more relative to the mean native.

5 Empirical Specification

To identify the effect of immigration on natives' likelihood of working nightly shifts, we exploit variation across time in the share of immigrants living in a given CZ. Formally, for individual i living in CZ c in time t we estimate the following equation:

$$N_{ict} = \alpha + \beta S_{ct} + X'_{ict}\gamma + Z'_{ct}\lambda + \delta_c + \omega_{Rt} + \epsilon_{ict}, \tag{12}$$

where N_{ict} is an indicator for whether the individual worked at night; S_{ct} is the immigrant share of the CZ working-age population; X_{ict} is a vector of individual-level characteristics (such as age, education, marital status and number of children); Z'_{ct} is a vector of time-varying CZ-level controls (such as log population and the share of the population with a high school degree); δ_c is a vector of commuting zone fixed effects; ω_{Rt} is a vector of region-by-year fixed effects, and ϵ_{ict} captures the residual variation in the likelihood of working nightly shifts.

We slightly modify this approach to test our prediction on wages:

$$W_{ihct} = \alpha_h + \beta_h S_{ct} + X'_{ict}\gamma + Z'_{ct}\lambda + \delta_c + \omega_{Rt} + \epsilon_{ihct}, \tag{13}$$

where W is the worker's wage, and $h \in \{D, N\}$ indicates whether the individual worked a day-shift or a night-shift. $\beta_D > \beta_N$ (i.e. a negative coefficient on the interaction between night-shift and immigrant share) indicates an increase in relative day-time wages in response to immigration as predicted by our model.

While the spatial correlation approach has been widely used in the immigration literature, it is subject to two main criticisms (e.g., Borjas et al., 1996; Borjas, 2003). First, immigration may induce out-migration of natives, which would bias wage and employment effects upwards. We note that while the literature on the effects of *immigration* on native migration is mixed (e.g., Card, 2001; Borjas, 2006), a large body of research has found little to no migratory response due to *economic* shocks to the local labor market, particularly for low-skill workers who would face the most direct competition from immigrants (e.g., Bound and Holzer, 2000; Glaeser and Gyourko, 2005; Autor et al., 2013; Batistich and Bond, 2018). Nonetheless, our model predicts a shifting of native employment into, and an increase in the relative wages of, daily tasks. We would

therefore expect that any migration response by night-working natives would bias us towards finding effects on employment, but away from finding effects on wages.

The second concern is that immigration is a non-random process and immigrants will cluster in areas with better economic opportunities. Previous work has shown that during expansionary periods (particularly in the short-run) employers prefer to increase production by extending work hours, and therefore the relative composition of night tasks, rather than hiring (Nunziata, 2003). To the extent that immigration is caused by local economic growth, we would therefore expect that OLS results would be biased away from finding the effects on natives predicted by our model.

To address these concerns, we instrument for the local immigrant population share using a "shift-share" instrumental variable (IV) approach originally proposed by Altonji and Card (1991) and Card (2001), and used more recently at the CZ-level by Smith (2012) and Orrenius and Zavodny (2015). This strategy exploits the fact that immigrants tend to locate in CZs that have higher densities of residents from their country of origin, and thus we identify off of a "pull factor" related to social preferences rather than economic forces.[4]

Specifically, let us define F_{kt} as the total population of immigrants from country k residing in the US in year t and $s_{kc,1970}$ as the share of that population residing in CZ c as of year 1970. We calculate the population of immigrants from that country of origin in each CZ, $\hat{F}_{kct}$, were immigration patterns to follow that of 1970:

$$\hat{F}_{cmt} = s_{kc,1970} F_{kt}. \tag{14}$$

We then impute the total share of immigrants in each CZ as:

$$\hat{S}_{ct} = \sum_k \hat{F}_{kct} / P_{c,1970}, \tag{15}$$

where $P_{c,1970}$ is the total commuting zone population in 1970. We then estimate equation (12) by two-stage least squares (2SLS), using $\hat{S}_{ct}$ as an instrument for S_{ct}, and similarly for (13). In words,

[4]Note, however, that social networks can have important benefits for immigrant labor markets (Åslund et al., 2014; Dustmann et al., 2015). What matters for our identification, however, is that these economic benefits are orthogonal to positive aggregate shocks to the local labor market.

our instrument is the CZ-level immigrant population share that would have been predicted based on the historical geographic distribution of immigrants in the United States. Cross-time variation in $\hat{S}_{ct}$ is driven only by changes in the national population of immigrants; the denominator is held fixed at its 1970 value.

A typical criticism of this instrument is that the local economic shocks that drove the initial distribution of immigrants can persist. These concerns should be mitigated by our use of CZ fixed effects which capture any time invariant economic conditions, and region-year fixed effects which capture time-varying shocks at a larger geographic level. We thus isolate variation due only to the differential impact on CZs in close geographic proximity of changes in the national composition of immigrants. Futher, our 1970 base year predates the large recent structural changes in labor demand (e.g., skill-biased technical change and increases in trade from low-income countries), as well as most of the shift away from Europe as the primary source of immigration (e.g., Borjas, 1994; Katz and Autor, 1999; Autor et al., 2008, 2013).[5]

6 Results

Effects on Native Schedules

Table 3 documents OLS estimates of the effects of immigration on the propensity of natives to work in night shifts. Our baseline specification includes individual controls for education (4 groups), marital status, experience, a quartic in age, and dummies for race; time-varying CZ-level controls for the share of high school dropouts, high school degree holders, college degree holders, and whites, and the log of population; and commuting zone and year fixed effects. We find a 10 percentage point increase in the share of immigrants in the local labor market (roughly one-half of a standard deviation) is associated with a .24 percentage point increase in the probability of natives working at night, or 1.4% relative to the average native. Columns 2 and 3 look at heterogeneous effects by gender. We find slightly stronger effects on male workers, though the point estimates are economically similar.

Table 4 applies the instrumental variable strategy outlined in Section 5. Our 2SLS estimate

[5]In particular, the U.S. system of immigration quotas based on the ethnic composition of early 20th century immigrant populations was not fully repealed until 1968.

for the full population (column 1) is more than 2.5 times larger (in absolute value) than in OLS, consistent with our prior that the correlation between economic growth and immigration should bias OLS estimates downwards. We also find more pronounced gender differences, at least when measured in percentage points (columns 2 and 3). A 10 percentage point increase in immigrant share decreases the probability of males working a night shift by .73 percentage points (35% of native mean), and .44 percentage points for women (39% of native mean).

In Table 5 we turn to our predictions on wages and estimate (13) using 2SLS. First, we find evidence of a substantial compensating differential of around 7.8% for working at night. Second, we find a negative effect of immigration on wages. Our model however is concerned about the effect of immigration on the night-time premium, which is represented by the interaction between immigrant share and the day-time indicator. Consistent with our model, we find that a 10 percentage point increase in immigrant share causes a .78 percentage point lowering of the night-time premium.

Columns 2 and 3 of Table 5 separate our sample into natives and immigrants, respectively. We find strong evidence for a positive effect of immigration on relative daily-wages, with a similar magnitude to that of the whole population. However, we find no evidence for an increase in relative daily wages for immigrants, and little evidence they receive a premium for working at night at all. One potential explanation for this finding is that our model assumed that all workers were equally productive in day and night tasks. If this is not the case, by lowering the night-shift wages, immigration will also lower the day-time productivity of the marginal worker who accepts day-time employment, and thus lower the average productivity of day-time workers.[6] Depending on the shape of the immigrant productivity distribution (for example, if there were a large number of immigrants who were barely competent at day-time work and few who excelled), it is possible that this effect could swamp the increase in the relative price of day-time production.

[6]The elasticity of substitution between immigrants and natives is controversial. See Ottaviano and Peri (2012) and Borjas et al. (2012) for two contrasting views.

7 Conclusion

This paper develops a simple theoretical framework to analyze the effects of immigration on the allocation of work schedules. Because immigrants have lower disamenity costs for working at night, immigrants specialize in non-standard shifts. Thus, immigration increases the supply of nightly shifts, pushing natives towards daily schedules. The empirical findings support the main implication of the model. We find that immigration reduces natives' likelihood of working nightly shifts, as well as their wage premium for working at night. The reallocation of tasks and schedules may therefore have non-trivial implication on the health of native workers.

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Table 1: Work Schedules by Immigrant Status and English Proficiency

	(OLS) Night
	Panel A
Foreign-born	0.0222***
	(0.000283)
Observations	23,732,385
	Panel B
No English	0.0144***
	(0.00111)
Observations	23,732,385
	Panel C
Bad or no English	0.00522***
	(0.000587)
Observations	23,732,385
Commuting zone fixed effects	YES
Year fixed effects	YES

Notes - Standard errors in parentheses, clustered at CZ level. *** Significant at the 0.1% level. ** Significant at the 1% level. * Significant at the 5% level. † Significant at the 10% level.

Table 2: Immigrant-Native Differences (ATUS, 2003-2014)

	(OLS) Night work	(OLS) Night work	(OLS) Night work	(OLS) Night work
Foreign-born	0.0199***	0.0184***	0.0197***	0.0152***
	(0.004)	(0.004)	(0.004)	(0.004)
Sociodemographic		YES	YES	YES
State FE			YES	YES
Year FE			YES	YES
Occupation FE				YES
Observations	59,455	59,455	59,455	57,114
R-squared	0.001	0.037	0.039	0.066
Mean of Dep. Var	0.07	0.07	0.07	0.07
St.Dev.	0.25	0.25	0.25	0.25

Standard errors in parentheses, clustered at state level.

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes - **Night work** - working at least 50% of one's working hours between 7pm and 6am

Table 3: Effects of Immigration on Native Likelihood of Working Night Shifts (OLS)

	(OLS) All	(OLS) Men	(OLS) Women
Share of Immigrants	-0.0242**	-0.0254*	-0.0226***
	(0.00874)	(0.0119)	(0.00576)
Observations	21,186,612	11,262,501	9,924,111
Adjusted R-squared	0.0489	0.0423	0.0216
Mean of dep. variable	0.166	0.212	0.113
Standard deviation of dep. variable	0.372	0.409	0.317
Commuting zone fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES

Notes - Standard errors in parentheses, clustered at CZ level. Data are drawn from the 1990 and 2000 US Census and the 2005-2015 American Community Survey. All estimates include controls for education, experience, race, gender, a quadratic in age, year and commuting zone fixed effects. *** Significant at the 0.1% level. ** Significant at the 1% level. * Significant at the 5% level. † Significant at the 10% level.

Table 4: Effects of Immigration on Native Likelihood of Working Night Shifts (2SLS)

	(2SLS) All	(2SLS) Men	(2SLS) Women
Share of Immigrants	-0.0614**	-0.0738**	-0.0440**
	(0.0242)	(0.0307)	(0.0177)
Observations	21,186,612	11,262,501	9,924,111
Mean of dep. variable	0.166	0.212	0.113
Standard deviation of dep. variable	0.372	0.409	0.317
First-Stage F	63.67	64.09	62.97
Commuting zone fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES

Notes - Standard errors in parentheses, clustered at CZ level. Data are drawn from the 1990 and 2000 US Census and the 2005-2015 American Community Survey. All estimates include controls for education, experience, race, gender, a quadratic in age, year and commuting zone fixed effects. *** Significant at the 0.1% level. ** Significant at the 1% level. * Significant at the 5% level. † Significant at the 10% level.

Table 5: Effects of Immigration on Relative Yearly Wages (2SLS)

	(IV) Ln (Yearly Wage) All	(IV) Ln (Yearly Wage) Natives	(IV) Ln (Yearly Wage) Immigrants
Share of Immigrants	-0.126*	-0.0492	-0.0656
	(0.0690)	(0.0631)	(0.105)
Share of Immigrants * Day	0.0776**	0.0726***	-0.0240
	(0.0241)	(0.0213)	(0.0427)
Night	0.0780***	0.0793***	0.0231
	(0.00637)	(0.00550)	(0.0179)
Observations	22,236,565	20,121,964	1,801,724
Mean of dep. variable	10.34	10.37	10.25
Standard deviation of dep. variable	0.922	0.917	0.909
First-Stage F	26.09	31.29	5.259
Commuting zone fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES

Notes - Standard errors in parentheses, clustered at CZ level. Data are drawn from the 1990 and 2000 US Census and the 2005-2015 American Community Survey. All estimates include controls for education, experience, race, gender, a quadratic in age, year and commuting zone fixed effects. *** Significant at the 0.1% level. ** Significant at the 1% level. * Significant at the 5% level. † Significant at the 10% level.

A Proofs of Main Results

Proof of Lemma 1

Proof. The proportion of foreign workers in night jobs is simply $H\left([\omega_N]^{\frac{1}{\lambda}}\right)$, while that same proportion for native workers is $H(\omega_N)$. As H is a strictly increasing function, and $\lambda < 1$, inspection of the arguments proves the lemma. □

Proof of Propostion 1

Proof. Implicitly differentiating (11),

$$\frac{\partial \omega_N}{\partial f} = \frac{1}{\theta}\omega_N^{1-\theta}\left(\frac{1-\beta}{\beta}\right)^{\frac{1}{1-\theta}} \Delta_S \left(1 - \frac{\partial \frac{D^S}{N^S}}{\partial \omega_N}\right)^{-1}, \tag{16}$$

where

$$\Delta_S = \frac{H(\omega_N) - H(\omega_N^{\frac{1}{\lambda}})}{\left[(1-f)H(\omega_N) + fH(\omega_N^{\frac{1}{N}})\right]^2}, \tag{17}$$

the change in the relative supply function due to a change in f holding w_N fixed. Wages, production shares, and the elasticity of substitution are always positive. The relative supply of day-time services due to a decrease in the relative wage of day-time services is always negative, so $\left(1 - \frac{d\frac{D^S}{N^S}}{d\omega_N}\right)^{-1}$ is also positive.[7] Finally, from Lemma 1 we knnow that $H(\omega_N) < H(\omega_N^{\frac{1}{\lambda}})$, and therefore $\Delta_S < 0$. Thus $\frac{d\omega_N}{df} < 0$.

Using the labor supply equation [equation (10)],

$$\frac{D}{N} = \left(\frac{1-\beta}{\beta}\right)^{-\theta} \omega_N^{\theta}. \tag{18}$$

Since $\frac{d\omega_N}{df} < 0$, it follows that $\frac{d\frac{D}{N}}{df} < 0$. □

[7] It is easy to show this derivative is strictly negative in our model. The exact analytical expression is long but is available upon request.

Proof of Proposition 2

Proof. From equations (5) and (6), the relative supply of native workers is

$$\frac{D_n^S}{N_n^S} = \frac{H(\omega_N)}{1 - H(\omega_N)}. \tag{19}$$

Differentiation and noting from Proposition 1 that $\frac{\partial \omega_N}{\partial f} < 0$ proves the result for natives. A similar argument holds for foreign workers.

□