Border Security as a Labor Screening Device: A New Model of Immigration Economics

Jesse D. Melvin*

October 25, 2017

Abstract

This paper presents a new model of immigration that describes the migration-decision process on an individual level, based on Spence's (1973) signaling model. The model allows for an explanation of phenomena such as chain migration and the positive selectivity of migrants, and specifically examines the positive relationship between a nation's immigration control policy and the productivity of the migrants entering that nation. The logic is straightforward: the personal cost of migrating into a nation rises as that nation's border security becomes stricter and more strongly enforced, which deters individuals who are less motivated and/or capable to migrate. Using data from the Current Population Survey (CPS), I present empirical evidence by using the implementation of the Homeland Security Act of 2002 as a natural experiment. The passage of the Act exogenously initiated a dramatic increase in the efficacy and strictness of immigration control policy in the United States, causing the personal cost of migrating to rise significantly. Regression results reveal that migrants who entered the nation after 2002 have a wage rate that is approximately 3.0 – 4.5% higher relative to their counterparts, and work 0.6 – 1.0 additional hours per week, ceteris paribus.

1. Introduction

With the recent regime change in the United States, there has been a strong political focus on immigration. President Trump and his conservative allies have stalwartly pushed for stricter vetting processes for legal migration, and building "the greatest ever" border wall to prevent illegal migration. The stated objectives of this movement are twofold: increased national security and economic protection for workers whose jobs have been threatened by migrants. However, the implementation of stricter immigration control policy will have a third important impact. By making it more difficult for migrants to enter the nation, this policy will deter migrants who are relatively less motivated and/or capable of making the journey.

* Department of Economics, University of Delaware. Email address: jmelvin@udel.edu

Therefore, the increase in border security will "screen" these individuals who tend to have a lower productivity, leading to a smaller pool of migrants with a higher overall productivity.

Within the field of economics, researchers have focused mainly on the question of how migration and immigration control policies affect the welfare and wages of the host population and laborers. This has been accomplished through the application of simple supply and demand models, with the assumption that migrant labor is a close substitute to native labor with the same type of skills, and complementary to laborers of differing skillsets. Therefore, when these researchers examine the economic effects of changes in international immigration control policies they do so solely through the lens of labor supply expansion/restriction. One issue with this type of analysis is that it automatically assumes that there is no differentiation amongst individuals within a particular skill category (as determined by education, work experience at home, work experience abroad, etc.). The migrants are all assumed to have identical productivity, motivation, and ability and therefore have identical reactions to immigration control policies.

By introducing laborer heterogeneity, the model I present in this paper examines the effect of international immigration control policies on the *composition* of the migrant labor force, rather than just the *size* of the migrant labor force. I begin by establishing the migration-decision utility function for individuals considering migration, which is based on the classic demographic "Push-Pull" model of immigration developed by Lee (1966). Then, I apply a modified form of Spence's labor signaling model (1973) to this migration-decision process, wherein migrants consider relocation as a form of costly "investment" that will afford them a higher wage rate, and firms pay laborers a wage rate equal to their expected marginal productivity. Analogous to Spence's model, an individual's motivation and/or capability is assumed to be negatively correlated with the personal cost of this investment, and positively correlated with their workplace productivity. Thus, when the costs of migration rise (e.g. through stricter border security), we expect to see an increase in the average productivity of the incoming migrant population.

In order to evaluate this model and relationship, I conduct an empirical analysis using the passage and implementation of the Homeland Security Act of 2002 as a natural experiment.

Put into effect for national security reasons in the aftermath of 9/11, the Act made migrating into the United States significantly more difficult. Using data from the U.S. Census Current Population Survey (CPS), I examine the impact of the Act on migrants' wage rates and number of hours they work per week. After controlling for outside factors, I find that migrants who entered the nation after 2002 earned a real wage rate that was 3.0 – 4.5% higher than those who entered before 2002, and worked approximately 0.6 – 1.0 hours more per week. These results are not driven by a supply and demand, since the regression analyses control for year of observation, and there was not a significant change in the aggregate migrant population in this time period.

The paper is organized as follows. In the next section, I briefly describe Spence's labor signaling model, followed by a discussion of the existing literature regarding immigration economics. In Section 3, I introduce the demographic Push-Pull explanation of immigration, model the migration-decision process after it, and interpret the results. In Section 4, I perform regression analyses to show that migrants who were screened by the HSA earn a higher wage rate and work longer hours. I present the conclusion in Section 5, in which I discuss the implications of these results as well as potential avenues of future research.

2. Literature Review

Literature Regarding Labor Screening

The concept of labor signaling and screening was introduced by Spence (1973). He first describes a world of information asymmetry in which firms cannot directly observe a potential employee's productivity. In the absence of any sort of screening/signaling strategy, we expect to see a pooled equilibrium in which firms hire all workers at the same wage rate, despite the fact that they have varying productivities. Assuming that firms are risk-neutral, this wage rate is equal to the unconditional expected marginal productivity of the worker pool.

Firms and potential employees can avoid this "blind" hiring by utilizing a labor signaling strategy. While Spence notes that there are many different types of signals, educational

attainment is the most widely recognized. Formal education is an easily observed trait (a firm can simply request an applicant's diploma or school transcript) and in order to obtain further education, an individual must pay the associated (signaling) costs. For the purposes of this analysis, I will be replacing these 'costs of education' with 'costs of migration.'

Since these signaling costs are negatively correlated with productivity, firms are able to discern between the high-productivity workers from the low-productivity workers and offer them different wage schedules (equal to their marginal productivity). Therefore, the high-productivity individuals will pursue an education to send a signal to employers, and achieve a higher wage as a result. If the required education level is set high enough, low-productivity individuals will observe a wage differential that is smaller than the cost of obtaining the education. Therefore, these workers will choose not to incur the costs of signaling and will accept the lower wage offer.

Literature Regarding Immigration Economics

Effect on Native Employment and Wages

One of the most widely debated aspects of immigration is its effect on the employment opportunities of the native population. There is a particularly strong political interest in the topic, as there is a commonly held belief that immigrant workers "steal" job opportunities from native workers. This phenomenon is tentatively supported by factor-demand and supply economic theory. Employers consider migrant labor and native labor, within a skill group, to be close substitutes. Therefore, when an influx of immigrants causes the wage rate of migrant labor to decrease, it could be expected that employers will substitute some of their native laborers for migrant laborers.

This has led to research in which economists measure the impact of migrant workers on the employment (or the unemployment rate) of the domestic labor force. This has typically been accomplished by estimating the relationship between native employment and the relative number of immigrants in a particular geographic area, which researchers assume to be a closed

labor market. Since immigrants tend to cluster in metropolitan areas, the trend is to examine this correlation in major cities.

The results of these studies vary, but there is a general consensus: an increase in immigrant labor negatively impacts the employment of domestic labor, but the relationship is very weak. A metadata review conducted by Friedberg and Hunt (1995) found that there is no evidence that immigration causes an "economically significant" reduction in native employment. More recently, Kerr and Kerr (2011) collected a survey of North American and European studies conducted since 1991 that examined the correlation between the immigrants' share of population and native employment. Out of 16 total studies, nine of them found evidence of a negative correlation. Four of the studies found no statistically significant correlation and, surprisingly, three studies found evidence of a positive employment effect. Out of the studies that found a negative correlation, five of them calculated and reported an employment elasticity (the percentage change in employment in response to a 1% increase in immigrants' share of population). Of these five studies, the average employment elasticity is approximately -0.13, implying that immigration has a relatively small effect.

Economists have also examined the impact of immigration on the wages of the domestic labor force. The theory is simple: an increase in the number of immigrants within a closed labor market leads to an increase in the labor supply in that market, which causes wages to decrease. Therefore, we expect to see a negative correlation between migrant labor supply and natives' wage rate.

Many studies have examined this relationship, typically by using a spatial fixed-effects model regressing logged wage rate on the share of immigrant population and a set of controls. The overall results of these wage studies are very similar to that of employment: there is a general consensus of a negative, but small, correlation. A survey of the literature conducted by Borjas (1994) found that there is "only a weak negative correlation." A summary of several UK studies (Dustmann, Frattini, Preston 2008) reports that there is no evidence for negative average wage impacts. Kerr and Kerr (2011) collected and reported the wage elasticities that were calculated in 29 different studies. Out of these, only 11 studies reported a wage elasticity

that was statistically significantly negative, while 5 studies reported a significantly positive elasticity.

There are several empirical concerns regarding the validity of these spatial correlation results. One of these issues is in regard to the endogeneity of the choice of location for immigrants. When deciding on their destination, new migrants are naturally attracted to areas with higher wages, potentially leading to a spurious positive correlation between immigrant share of population and wages in a labor market.

Researchers have utilized several methods in an attempt to avoid the endogeneity issue. The most prevalent is the application of a natural experiment, in which there is an exogenous influx of immigrants into a particular labor market. Perhaps the most famous of these studies is that of Card (1990), which examined the effect of the 1980 Mariel boatlift. The politically-inspired exodus of Cubans caused Miami's population to rapidly rise by 7%, and this sudden rise in the low-skill labor supply had almost no impact on the market. Low-skill non-Cuban laborers experienced virtually no change in their wage rate or unemployment rate, and even native Cuban laborers were not "substantially effected." Hunt (1992) reviewed the 1962 repatriation of Algerians into France following Algerian Independence, and the Friedberg (2001) study examined the mass migration of Jews into Israel following the breakup of the Soviet Union. Both of these studies also concluded that immigration had a very weak adverse impact on natives' wages and employment. In addition to these natural experiment studies, researchers perform analyses that use past immigrant populations and migration trends as an instrumental variable (e.g. Altonji and Card 1991, Card 2001, Peri 2007). The results of these "chain migration" studies also support the finding of immigration having a weak negative impact on similar-skill native workers.

The other major empirical issue with these spatial correlation studies is the assumption that the labor markets being observed are actually "closed." Researchers have directly investigated how "open" spatial labor markets actually are by examining how native laborers reacted to a change in immigration population/share. Studies by Card and DiNardo (2000) and Card (2001) showed that metropolitan natives did not emigrate in response to increased immigration, and research by Peri (2007) revealed the same lack of response in a cross-state

analysis. However, an analysis of U.S. rural counties (Partridge, Rickman, Ali 2008) found a significant out-migration response by native laborers, a rare and important find, considering that the recent growth rate of the immigrant population ratio is significantly higher in rural counties than in metropolitan counties. Despite the recent research by Partridge et al, the general consensus is that native laborers (particularly urban) do not exhibit high mobility in response to changes in immigration.

In terms of capital mobility, economists originally looked to changes in cross-industry composition to explain the absorption of new migrant laborers. Card (2005) and Card and Lewis (2007) found "limited evidence" that increased immigration causes changes in industry composition; claiming that most of the response that occurs is within-industry. In a study utilizing detailed plant-level data, Lewis (2005) tracked the adoption of numerous manufacturing technologies and found that plants located in regions with a high share of low-skill population had significantly slower adoption of automating technologies. In other words, industries will change their in-house composition of capital and technology in response to changes in migrant labor supply, such that wages remain relatively constant.

Employment and Earnings of Immigrants

For political as well as economic reasons, there has been interest in how immigrants fare upon arrival in a new country. Virtually all of the research agrees: newly-arrived immigrants have lower employment ratios and lower earnings/wages than their labor market counterparts.[2] This could be explained by a lack of local labor market information, imperfectly transferable human capital, language barriers, and other cultural differences. However, the negative gap in employment and earnings appears to diminish over time as immigrants begin to

[2] Out of a survey of 29 American and European studies collected by Kerr and Kerr (2011), 19 of the studies found a significant negative wage gap. Only 5 found significant positive results. In terms of labor market status, Angrist and Kugler (2003) report that immigrants into the EU have lower participation and employment rates than natives. Research by Nekby (2002), Vilhelmsson (2000), and Ekberg (1999) on Nordic labor markets has revealed that non-Nordic immigrants have significantly lower participation and employment rates, while Nordic-based immigrants had employment outcomes comparable to natives. Recent American studies have found comparable results (e.g. Chiswick et al. 2007, Card 2001, Borjas 1995).

assimilate into their new environment. The foundational cross-sectional analysis by Chiswick (1978) found that, after 10 to 15 years of residence, U.S. male migrant earnings matched that of American-born men with similar education and age. After those 15 years, average migrant earnings surpassed that of their American counterparts.

Subsequent research seemed to bolster these findings, until Borjas (1985) pointed out that a cross-sectional analysis like the one performed by Chiswick cannot control for cohort effects. He argues that a decline in the "quality" of cohorts since the mid-20th century caused an overstatement of the effect of residence duration on earnings. In his longitudinal study, he finds a positive years-since-migration effect, but of a significantly smaller magnitude. Beyond cohort effects, other researchers argue that a significant fraction of migrants decide to permanently re-migrate, thus removing themselves from the samples of these assimilation studies. Studies have shown that these out-migrants tend to have significantly lower earnings than "permanent" immigrants, causing an overstatement of the effect of residence duration on earnings in analyses that do not account for this. (Edin, LaLonde, Åslund 2000, Bellamare 2003, Lubotsky 2007)

3. Model

I begin this section by describing the traditional Push-Pull demographic model of immigration. Using the principles of this model, I present the migration-decision utility function and migrants' marginal productivity function, with the "motivation/ability" attribute as the centerpiece. I then solve for the steady state equilibrium of the model under the assumption of endogenous wage-setting, in which there is a feedback loop between average migrant productivity and the wage rate offered to migrants. I find a positive labor screening effect: there is a direct relationship between average migrant productivity and the level of immigration control policy.

Demographic Model of Immigration

Within the demographic literature, the dominant framework regarding immigration is the Push-Pull model that was popularized by Lee (1966). The model establishes a dichotomy of motivating influences: positive factors that *pull* migrants into a new location, and negative factors that *push* migrants out of their current location. Acting as the connection between the place of origin and the destination are the *intervening obstacles*, which must be overcome by the migrant if he or she wishes to relocate. And lastly, Lee recognizes that potential migrants have varying *personal factors* that influence – or even make possible – the choice of migration.

The various "push" factors include religious strife, an oppressive political environment, and military action (such as civil war). Out of the total volume of international migration, a minority is principally caused by push factors. These refugees are moving out of necessity rather than opportunity. Therefore, these imperiled individuals tend to move to the nearest or safest location, regardless of their individual characteristics or the economic opportunities in their new home. (Ul-Haq and Ul-Haq 1979) Thus, we expect immigrants who are primarily influenced by "push" factors to have lower productivity, since they do not exhibit the properties pertaining to a labor screening process. This "push" factor effect has interesting ramifications when it comes to interpreting the results of various studies. Studies such as Card's Mariel Boatlift examine situations in which immigrants have been "pushed." Therefore, those results may be biased since these individuals were not screened by immigration control policy.

There are several types of "pull" factors as well, including religious freedom and family reunification. However, the "pull" factor of paramount importance is the pursuit of an advanced standard of living. This typically means moving to a location where one can obtain a higher likelihood of employment, better upward mobility, and/or significantly higher wages. (e.g. Bade 2003, Borjas 1990) This has led to, in most cases, individuals leaving less-developed regions and gravitating toward those that are more economically advanced (Doerschler 2006). In addition to being the most prevalent form of migration, this type of migration is relevant to the analysis in this paper because the individuals are *deliberating* relocation, not being *forced* into relocation. Therefore, a potential migrant is taking the costs of migration into

consideration. This allows for the labor screening process I have described, since low motivation/ability individuals are less likely to suffer the higher costs of migration.

A person who has decided to migrate faces a myriad of "intervening obstacles." In the framework of the analysis in this paper, these "intervening obstacles" are the source of the costs of migration that potential migrants face when relocating. These obstacles include any physical barriers to movement, such as overall distance and the intervening terrain (e.g. mountains, oceans, rivers, etc.). There are often monetary costs, such as payments to smugglers (for illegal immigration) or bureaucratic processing fees (for legal immigration). There are also the psychological costs that arise from familial separation, cultural displacement, and the uncertainty associated with international immigration. To bring the thesis of this paper into focus, it is important to realize that the primary goal of immigration control policy is to create additional intervening obstacles. Border walls and immigration checkpoints are obvious examples of creating physical barriers to illegal immigration. These supplementary obstacles lead to even higher costs of migration.

Central to this analysis is the existence of varying "personal factors" that potential migrants possess. Examples include marriage status, parental status, land-owning status, age, physical build, intelligence, education, work experience, personal wealth, etc. While many of these characteristics will be accounted for in the empirical analysis, I will focus on one broad characteristic for the theoretical framework of this paper: motivation/ability. This attribute describes an individual's desire to improve their lot in life, and their capability to actually do so. As stated before, I assume that an individual with a high degree of motivation/ability will have relatively high workplace productivity and relatively low personal costs of migration.

Migration-Decision Utility Function

I begin by constructing a utility function for an individual who is considering migrating to another nation. I assume that the individual calculates an expected utility for every possible location choice and subsequently chooses the nation destination that affords the best outcome.

For purposes of illustration, I focus on the particular example of a Mexican laborer. Potential migrant i chooses country j that maximizes

$$U_i = max(U_{MEX,i}\ , U_{US,i}\ , U_{CAN,i}\ , \dots\ , U_{ji})$$

For the sake of simplicity, I assume that the expected utility of each nation-choice, U_{ji} is a function of two elements. The first is the migrant's expected real wage rate (W_{ij}) that he or she could earn in nation j's labor market. It is very important to note that this wage rate is *conditional* on the individual's personal characteristics (e.g. educational attainment, work experience, gender), and is adjusted for the cost-of-living in that nation. The second element of the potential migrant's nation-choice utility function is the expected cost of migration, C_{ji}. The expected cost of migration is different for each destination-nation, as well as for each individual i. Continuing with the example, the Mexican laborer observes the following:

$$U_{MEX,i} = f(W_{MEX,i})$$

$$U_{US,i} = f\left(W_{US,i}\right) - C_{US,i}(P_{US}\ , D_{US,i}\ , E_{US,i}\ , M_i)$$

$$U_{CAN,i} = f\left(W_{CAN,i}\right) - C_{CAN,i}(P_{CAN}\ , D_{CAN,i}\ , E_{CAN,i}\ , M_i)$$

…

$$U_{Ji} = f\left(W_{ji}\right) - C_{ji}(P_j\ , D_{ji}\ , E_{ji}\ , M_i)$$

The variable P_j represents the strictness of nation j's immigration control policy, which is pivotal to the analysis in this paper. The costs that are incurred through immigration control policy manifest both in legal and illegal immigration. When obtaining legal residency documentation, a myriad of bureaucratic obstacles require time, energy, and money to overcome. Illegal migration comes with an even greater variety of costs. In order to cross protected borders undetected, some migrants are forced to navigate dangerous terrain such as desert or ocean, and these migrants face a significant chance of serious injury or death. Regardless of the method used to relocate, we assume that the costs of migration rise as immigration control policy becomes stricter. In addition to all of these factors, as the effectiveness/strictness of immigration agencies increases, the risk of being deported or stopped and returned at the border increases. Not only does this expulsion render a migrant's

"investment" wasted, but they also must incur the physical and emotional costs that are inherent in the arrest and detainment process.

The variable D_{ji} represents the distance between nation j and the potential migrant's current location. As the distance between the two nation increases, the cost of migrating increases due to several factors. The most obvious is the monetary/temporal/physical cost of actually transporting the migrant's person to the new nation. Other factors include reduced information about the new nation, significant temperature or climate change, and the toll of long-distance familial separation.

The variable E_{ji} represents "ethnic differences." This variable captures all of the culture-shock effects of relocating to a new country. Perhaps the most significant of these is the struggle of dealing with international language barriers. Combined with a lack of knowledge of local institutions and customs, migrants can find it very difficult to adapt to a new labor market. In addition to this, belonging to a minority or foreign ethnic group potentially leaves a migrant vulnerable to the actions of xenophobic natives. In order to mitigate some of these ethnic costs, many migrants move to geographic areas in which their particular nationality/ethnicity has a strong presence, which economists have dubbed "chain migration."

The last variable, M_i, represents the motivation/ability of the individual making this decision. This catch-all variable encompasses an individual's personal drive and enthusiasm for a better life, as well as their ability to complete demanding tasks. Therefore, I assume that this motivation/ability attribute is positively correlated with the migrants' marginal productivity, θ_{ij}. I model marginal productivity as a function of M_i and K_j, which represents baseline productivity in nation j:

$$\theta_{ji} = f(M_i) + K_j$$

$$where \ {}^{\partial\theta_i}/_{\partial M_i} > 0 \ \ and \ \ K_j > 0.$$

I assume that the motivation/ability variable follows a continuous and uniform distribution bounded between M_L and M_H:

$$M_i \sim [M_L, M_H]$$

where $M_H \leq 1$, since a motivation/ability attribute exceeding 1 would lead to the highly improbable situation in which individuals decide to migrate to nation j despite not receiving any benefits for doing so (recall that the motivation/ability modifier is $1 - M_i$).

I also assume that M_i is negatively correlated with the expected costs of migration. This is in accordance with Spence's labor screening model; I am simply substituting the "cost of migration" for the "cost of education." In order to illustrate this inverse relationship, consider a migrant who is more physically and mentally capable than others (high θ). This individual is less likely to incur serious injury during a border crossing or suffer setbacks in the process of legal immigration. Therefore, that migrant's expected costs of migration will be lower than other potential migrants.

The utility and marginal productivity functions could take many forms. For the sake of simplicity, I will assume that the functions are linear for the rest of this analysis. The utility and marginal productivity functions are written as:

$$(1) \quad U_{ji} = W_{ji} - (\alpha P_j + \beta D_{jh} + \gamma E_{ji})(1 - M_i)$$

$$(2) \quad \theta_{ji} = \delta M_i + K_j$$

Steady-State Equilibrium Model

Endogenous Wage Setting

In order to determine the equilibrium of this model, I establish that the wage rate that is offered to migrants is determined endogenously.[3] In other words, firms use current information to determine migrant's expected (or average) marginal productivity, and set the wage rate for the next market period accordingly. I will assume that firms are risk-neutral in this model, such that:

$$(3) \quad W_{ji} = E(\theta_{ji})$$

[3] The phenomenon can be modelled with exogenously determined wages and the model performs similarly.

Due to the endogeneity of the wage rate offering, I model the phenomenon as a multi-stage game with a feedback loop between the decisions of potential migrants and the wage being offered to those who migrate. Firms offer a particular wage rate, which causes some migrants to enter nation j. After hiring the migrants for one period, the firms learn their average marginal productivity, and offer a new wage rate to the incoming migrants based on this information. This new wage rate causes a different group of individuals to migrate, and the process continues until a steady-state equilibrium is reached in the long run.

Solving for Steady State Equilibrium

In order to solve the model, I must first identify which of the potential migrants will relocate to country j. We know that an individual will migrate if doing so confers a higher utility then the next best alternative nation: $U_{ji} > U_{ALT}$.[4] After substituting equation (1) in for U_{ji}, an individual migrates if:

$$W_{ji} - \left(\alpha P_j + \beta D_{jh} + \gamma E_{ji}\right)(1 - M_i) > U_{ALT}$$

Solving for M yields the level of the motivation/ability attribute necessary in order for an individual to migrate to country j:

$$M_i > \frac{U_{ALT} - W_{ji} + \alpha P_j + \beta D_{jh} + \gamma E_{ji}}{\alpha P_j + \beta D_{jh} + \gamma E_{ji}}$$

Using this information, I identify the minimum level of the motivation/ability attribute of incoming migrants as:

$$(3) \quad M_{min} = 1 - \frac{W_{ji} - U_{ALT}}{\alpha P_j + \beta D_{jh} + \gamma E_{ji}}$$

I now proceed to calculating average migrant marginal productivity. According to equation (2), average migrant productivity is equal to:

[4] I simplify the model by assuming that there are only two nations. Thus, U_{ALT} represents the utility derived by remaining in one's home country. This model can be expanded to multiple nations, but that is a matter for another article.

$$E(\theta_{ji}) = \delta E(M_i) + K_j$$

Since M_i follows a uniform distribution, average migrant marginal productivity is equal to:

$$E(\theta_{ji}) = 0.5\delta(M_{min} + M_{max}) + K_j$$

We can automatically infer that $M_{max} = M_H$, since all individuals with $M_i > M_{min}$ migrate. Therefore, average migrant productivity is defined as:[5]

$$(4) \quad E(\theta_{ji}) = 0.5\delta(M_{min} + M_H) + K_j$$

Firms set their wage rate equal to expected marginal productivity, thus:

$$W_{ji} = 0.5\delta(M_{min} + M_H) + K_j$$

I substitute equation (3) in for M_{min} and rearrange in order to determine the steady-state minimum level of the attribute necessary to migrate:

$$(5) \quad \bar{M}_{min} = \frac{U_{ALT} - 0.5\delta M_H - K_j + \alpha P_j + \beta D_{jh} + \gamma E_{ji}}{0.5\delta + \alpha P_j + \beta D_{jh} + \gamma E_{ji}}$$

I calculate expected migrant marginal productivity by substituting the above equation for $\bar{M}_{min}$ into the firm's wage-setting equation:

$$(6) \quad \bar{E}(\theta_{ji}) = \bar{W}_{ji} = 0.5\delta\left(\frac{U_{ALT} - 0.5\delta M_H - K_j + \alpha P_j + \beta D_{jh} + \gamma E_{ji}}{0.5\delta + \alpha P_j + \beta D_{jh} + \gamma E_{ji}} + M_H\right) + K_j$$

Interpreting the Impact of Immigration Control Policy

Now that I have solved for the steady state equilibrium, I move onto examining the relationship between immigration control policy and migrant productivity. In other words, does increased border security and stricter legal migration practices act as an effective labor screening device? Taking the partial derivative of (6) with respect to P_j yields:

[5] It is important to note that this is the equilibrium result for an "interior solution" in which $M_H > \bar{M}_{min} > M_L$. There are also two possible "corner solutions" in which there is total or zero migration:
$\bar{E}(\theta_{ji}) = 0.5\delta(M_L + M_H) \qquad if\ \bar{M}_{min} < M_L$
$\bar{E}(\theta_{ji})\ is\ undefined \qquad if\ \bar{M}_{min} > M_H$
In both of these cases, a differential change in P_j will have no impact on the market.

$$(7) \quad \frac{\partial \bar{E}(\theta_{ji})}{\partial P_j} = 0.5\delta\alpha \frac{0.5\delta + 0.5M_H + K_j - U_{ALT}}{\left(0.5\delta + \alpha P_j + \beta D_{jh} + \gamma E_{ji}\right)^2}$$

The parameters δ and α are both positively valued, as is the squared term in the denominator. Based on the assumptions of this model, the numerator of (7) is positive (refer to Appendix 1.A for proof). Therefore, we observe that immigration control policy acts as an effective labor screening device for nation j: $\frac{\partial \bar{E}(\theta_{ji})}{\partial P_j} > 0$.

4. Empirical Analysis

In order to test whether or not immigration control policy acts as an effective labor screening device, I examine the relationship between migrants' wages and weekly hours worked and the amount of funding and effort that goes into establishing obstacles for incoming migrants. I do so by analyzing the impact of the implementation of the Homeland Security Act of 2002 on migrants who moved to the United States after the legislation had passed. This event serves as a natural experiment, since the inception of the legislation was completely unrelated to migrants' economic conditions. Therefore, this analysis does not suffer bias due to endogeneity. By examining the United States labor market as a whole, this study also avoids the "closedness" issue that plagues other spatial correlation analyses in the field.

It is important to note that there is the potential for omitted variable bias, as other conditions may have changed after 2002, such as the recession that followed the Sept. 11 attacks. However, I attempt to control for these changes by employing various demographic, geographic, and temporal variables.

Homeland Security Act of 2002

The terrorist attacks on the September 11, 2001 had many far-reaching implications on the American people, including a significant shift in public attitude toward national security. Suddenly, all potential avenues of terroristic activity were under close scrutiny. By the start of

2002, politicians and their constituents began making claims that the United States border with Mexico was too porous. People feared that terrorists could easily cross the largely unprotected border. The avenue of legal migration was also viewed as a potential source of danger, and government agencies responded by increasing airport security and engaging in racial profiling.

When the Homeland Security Act was passed in November of 2002, it included many immigration control measures that strengthened security measures – especially along the border with Mexico – and mandated harsher punishment for those caught illegally crossing into the country. The implementation of these stricter immigration control policies caused the human costs of illegal migration to increase significantly. (Amuedo-Dorantes and Pozo 2014) Examples of these costs include a "significant increase" in migrants' perceived risks of death and familial separation. These migrants also faced a higher risk of deportation after successfully crossing the border, as the Homeland Security Act contained state-level legislation that allowed local and state law enforcement to act as de facto immigration agents. In fact, the number of immigrants that were returned and removed from the United States more than doubled from 2002 to 2008 (U.S. Department of Homeland Security).

Data

The data for this analysis come from the CEPR Uniform Extract of the March Current Population Survey (CPS). The CPS is a monthly survey conducted by the U.S. Census Bureau that collects extensive demographic information for non-institutionalized adults at the household level. This information includes variables of interest such as age, race, ethnicity, gender, citizenship status, and language, as well as the year of arrival and nation of origin for immigrants. The interviews for the CPS are conducted on a 4/8/4 rotation schedule in which a household is surveyed for 4 months, ignored for 8, and surveyed another 4 months before leaving the rotation. The sample size is approximately 60,000 households selected at random. In March, the survey includes questions from the Annual Social and Economic Supplement, which asks respondents about information on their annual earnings among other socio-

Table 1 Characteristics of Workers in the United States, by Origin of Birth (1998-2015)

	Native Citizens	Migrants
Average Hourly Wage	$24.62	$22.02
Average Hours per Week	39.7	39.7
% Unemployed	4.9%	4.9%
Average Age	39.7	39.5
Average Years of Education	14.0	12.5
% Residing in Rural Area	17.2%	4.3%
% Male	50.9%	58.9%
% White	77.1%	18.0%
% Hispanic	7.8%	49.6%
% Black	12.4%	8.5%
% Asian	1.7%	23.7%
% Other	1.1%	0.2%
Sample Size	1,163,655	212,679

Any individuals below the age of 18 or above the age of 65, belonging to the armed services, self-employed, or with an hourly real wage exceeding $10,000 were removed from the sample. All values estimated using CEPR Uniform Extract March CPS sampling weights.

economic conditions. The data for this analysis stretches from 2015 back to 1998, which was the first year that the March supplement was instituted.

Summary statistics of several key market and demographic characteristics are displayed separately for migrants and non-migrants in Table 1 above. Native laborers have an average hourly wage rate that exceeds migrants' by $2.60, a small but significant difference that could partially be explained by the fact that native laborers have an additional year and a half of educational attainment, on average. There is virtually no difference between the two populations in hours worked per week and the rate of unemployment. Citizens and migrants are also approximately the same age, on average. In terms of race and ethnicity, there is a wide degree of separation: only a small minority of migrants are non-Hispanic Caucasian. Nearly half

Table 2 Migrant Workers in the United States, by Year of Arrival (1998-2015)

	Entered before 2002	Entered after 2002
Average Hourly Wage	$22.41	$19.74
Average Hours per Week	39.8	38.8
% Unemployed	4.8%	5.5%
Average Age	40.4	34.4
Average Years of Education	12.5	12.5
Years Since Arrival	19.9	6.1
% Residing in Rural Area	4.2%	5.0%
% Male	58.1%	63.5%
% White	18.5%	15.6%
% Hispanic	49.7%	49.2%
% Black	8.2%	9.8%
% Asian	23.4%	25.2%
% Other	0.2%	0.2%
Sample Size	181,668	31,011

Any individuals below the age of 18 or above the age of 65, belonging to the armed services, self-employed, or with an hourly real wage exceeding $10,000 were removed from the sample. All values estimated using CEPR Uniform Extract March CPS sampling weights.

of all migrants identify as Hispanic, and almost a quarter are Asian. There is also a significant gender differential; males make up 8% more of the migrant labor population relative to the native laborer population.

Table 2 displays market and demographic characteristics for migrant laborers, sorted by whether they arrived in the United States before or after January 1, 2002. Migrants who arrived after 2002 have a lower real wage rate by $2.67, work an hour less per week, and have a higher unemployment rate. These market condition differentials can be explained by the fact that pre-2002 migrants are roughly 6 years older and have been residing in the country nearly 14 years longer, on average. The two groups have very similar educational attainment and racial/ethnic

characteristics, although the new migrants tend to be slightly more male and non-white, with increases in the shares of black and Asian individuals.

Methods

Using difference-in-difference techniques, I compare the wages of migrants who arrived in the U.S. before the passage of the Homeland Security Act with those who arrived afterward, relative to non-migrants. According to the model I present in this paper, immigrants arriving after 2002 should have a higher wage rate than their pre-2002 counterparts, after controlling for all other variables. In addition to this, I also investigate the impact of the increase in immigration control policy on the average number of hours worked per week.

In order to conduct these analyses, I perform least-square regressions of the form:

$$(8)\quad y_i = \alpha + \beta(Migrant|Post\_2002\_entry_i) + \delta Migrant_i + \varphi Post\_2002\_entry_i + \gamma X_i + \varepsilon_i$$

where y_i is the market outcome variable of interest (log wage rate or hours worked), β is the coefficient of interest, and X_i is a set of controls including demographic characteristics (i.e. age, race, ethnicity, gender, rural/urban status), educational attainment, year of observation, and migrant interaction effects. Simply being a migrant, or entering the labor force after 2002, may influence a laborer's market outcome, thus I include the third and fourth terms in order to control for this variation.

Results

I begin this section with a naïve comparison of the hourly wage earned by the four subsets of American laborers, separated by migrant status and the year of entry into the labor force. These values are displayed in Table 3 on the next page, along with the differences between the temporally separated groups, and the final difference-in-difference. Workers who entered the labor force after 2002 make significantly less than those who entered beforehand, for both migrants and non-migrants. However, the difference between the migrant subsamples

Table 3 Comparison of Average Hourly Wages, 1998-2015

	Entered Labor Force		
	Before 2002	**After 2002**	**Difference**
Native Citizen	$25.80	$17.40	$8.40
Migrant	$22.41	$19.74	$2.67
		Difference-in-Difference:	$5.73

Any individuals below the age of 18 or above the age of 65, belonging to the armed services, self-employed, or with an hourly real wage exceeding $10,000 were removed from the sample. All values estimated using CEPR Uniform Extract March CPS sampling weights.

is much smaller than for native citizens. In fact, migrants entering the workforce before/during 2002 had a considerably lower wage rate than their native counterparts, whereas migrants entering after 2002 had a relatively higher wage rate than non-migrants, resulting in a large difference-in-difference calculation of $5.73.

This evidence suggests that the screening effect exists, but there are many underlying factors that could be driving these results. When native citizens enter the workforce, they are typically doing so between the ages of 16 and 26. In contrast, when migrants enter the labor force, they are doing so at whatever age they migrate to the new country, resulting in a higher average age and thus a higher experience level and wage rate. Other confounding factors include educational attainment, racial/ethnic makeup, geographic differentiation, and the impact of the subset of migrants who entered the country as a child. In order to control for these influences, I estimate equation (8), allowing for a more accurate calculation of the impact of the Homeland Security Act on migrants' market condition outcomes.

The results of these regression analyses are presented in Table 4 on the next page. For the sake of completeness, I conducted OLS regressions on two variables of interest – migrants' wage rate and the usual number of hours worked in a week – with six different specifications. The table shows only the key coefficient (i.e. the effect on migrants entering the United States after the passage of the HSA of 2002) and its respective p-value for each specification. I begin with a "naïve" specification with only the DID terms, and move onto specifications that include

Table 4 Regression Results: Impact of Post-2002 Entry on Migrants

		(1)	(2)	(3)	(4)	(5)	(6)
Log Real Hourly Wage	*Coefficient estimate*	0.244	0.060	0.030	0.034	0.045	0.031
	P-value	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Hours Worked	*Coefficient estimate*	4.020	1.112	0.650	1.043	0.966	0.664
	P-value	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Demographic characteristics		No	Yes	Yes	Yes	Yes	Yes
Years of education - linear		No	Yes	No	Yes	No	No
Diploma attainment		No	No	Yes	No	Yes	Yes
Year of observation - linear and squared		No	Yes	No	No	No	No
Year of observation - fixed effects		No	No	Yes	Yes	Yes	Yes
Migrant interaction effects		No	No	No	Yes	Yes	Yes
Year of arrival - linear and squared		No	Yes	No	No	Yes	No
"Young migrants" excluded		No	No	No	No	No	Yes

Any individuals below the age of 18 or above the age of 65, belonging to the armed services, self-employed, or with an hourly real wage exceeding $10,000 were removed from the sample. All parameters are estimated using CEPR Uniform Extract March CPS sampling weights, and errors are clustered by current state of residence. Demographic characteristics include experience, experience squared, and years since arrival, with dummy indicators for race/ethnicity, gender, and urban/rural status. For migrant interaction effects, new explanatory variables are introduced in which each independent variable is multiplied by a dummy indicator for whether the individual is a migrant. "Young migrants" are defined as individuals who relocated to the United States before having the chance to enter the labor force.

demographic control variables, education controls (linear or indicators), temporal controls (trend or fixed effects), and migrant interaction effects.

In the second and fifth specifications, I include trend variables (linear and squared) for migrants' year of arrival. It is possible that there has been a continuous and significant relationship between migrants' year of arrival and productivity. Without the aforementioned trend variables, a binary before/after 2002 analysis would register a significant difference, even if there was not a discrete jump in productivity after 2002. In the sixth specification, migrants who were too young to work when they entered the United States before 2002 were removed from the sample, since these individuals could potentially bias the difference-in-difference

results (they are migrants who entered the labor force post-2002, but were not "screened" by the Homeland Security Act).

For all six specifications, I obtain positive and statistically significant estimations of the parameter β for the hourly real wage rate and hours worked per week. With the naïve and the linear/squared time control specifications, the percentage wage differential is quite high: 24.4% and 6.0%, respectively. However, according to specifications (3) through (6) in which I employ annual fixed effects, migrants arriving after 2002 had a wage rate (or marginal productivity) that is approximately 3.0-4.5% higher relative to their counterparts, ceteris paribus. For the same set of specifications, migrants who arrived after the passing of the Act work approximately 0.65-1.04 more hours per week than those who arrived beforehand, after controlling for outside factors. This is compelling evidence that the increase in immigration control policy through the Homeland Security Act of 2002 had a "screening" effect on incoming migrants, resulting in a significantly more productive class of migrants.

The Supply and Demand Counterargument

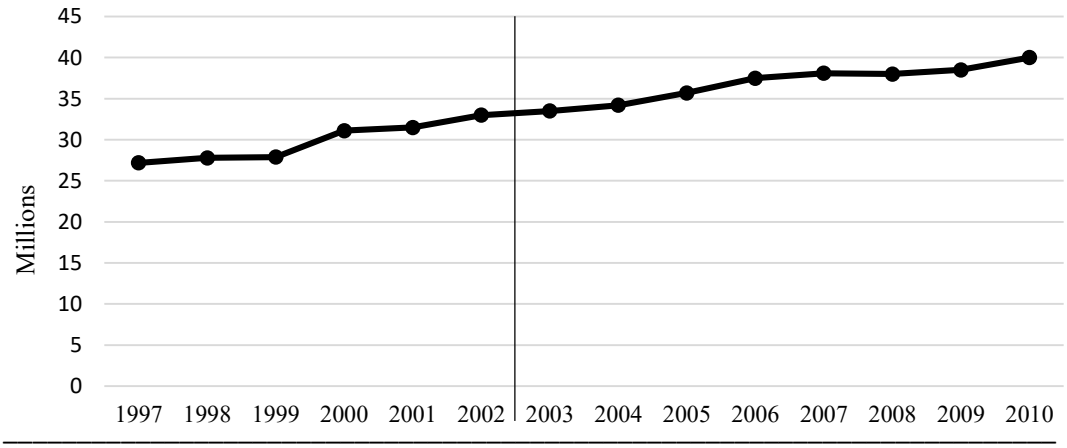
Traditionally, immigration economics has depended on a simple supply/demand model to explain the causes and impacts of migration. Thus, economists may naturally be inclined to point out that the observed wage differential may be due to a relatively lower supply of migrants, rather than a change in the characteristics of migrants. The logic: an increase in immigration control policy reduces the number of incoming migrants, thus causing a decrease in supply of their labor, leading to a rise in their wage rate.

However, there are two issues with this particular counterargument. First, the regression analysis I have employed divides the sample of migrants by their year of arrival into the United States, not by the year of observation. If the subsamples had been determined by the latter, it is possible that a decrease in the aggregate supply of laborers would have a supply/demand impact on "post-2002 observation" migrants. However, the analysis regresses on each migrant's wages according to arrival date, while using annual fixed effects to try and control for temporal market impacts. Thus, any potential supply/demand aggregate impacts

should be picked up by controls in the model and not the difference-in-difference variable of interest.

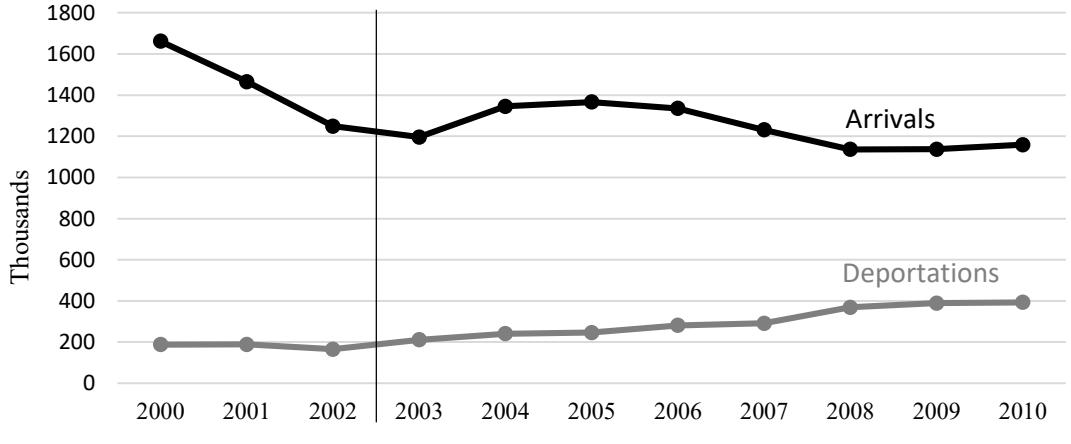
The second issue with this counterargument is that the passage of the Homeland Security Act did not have a significant impact on the aggregate number of migrants in the United States. Annual migrant population counts from 1995 to 2010 are presented in Figure 1 below, with a vertical indicator for the implementation of the Act in 2002. We can see that

Figure 1 **Number of Immigrants Living in the U.S.**



Sources: U.S. Census - Current Population Survey (CPS) for 1997-1999 and American Community Survey (ACS) for 2000-2010

Figure 2 **Number of U.S. Migrant Arrivals and Deportations**



Sources: Arrivals: U.S. Census - 2000 Decennial Census and American Community Survey (ACS)
Deportations: U.S. Department of Homeland Security (DHS)

there is no perceptible change in the trend of population growth following the passage of the Act, despite the fact that migrating became significantly more difficult. Why wasn't there a substantial change in the numbers of migrants? This is best explained by examining the amount of incoming migrants and number of deportations, presented annually in Figure 2 on the previous page. Following the passage of the Act of 2002, we observe that the number of migrants entering the nation remains relatively stable for the next eight years, with a slight rise and then decline after the program had been in effect for a few years. Over that same time period, there is a steady rise in the number of migrants being returned and removed from the nation. Thus, it would appear that the number of *potential* incoming migrants remained steady or slightly grew after 2002,[6] but these migrants were passing through a tougher "screen," resulting in a consistent aggregate stock of migrants, but with different personal characteristics.

5. Conclusion

In this article, I present a new model of immigration that examines potential migrants' decision to relocate to a new nation, based on the personal costs of migrating to that nation and the motivation/ability of the individual making the decision. I assume that there is an inverse relationship between the two: a more motivated and capable individual will have lower perceived costs of migration. I also assume a direct relationship between a worker's motivation/ability and their productivity. Therefore, in the model present in this paper, migrants who have been 'screened' by relocating to a nation with higher costs of entry are going to be relatively more productive.

The main implication of the model is that a nation with stricter immigration control policy will have a relatively smaller and more productive pool of incoming migrants. In order to provide empirical evidence of this relationship, I use the passage of the Homeland Security Act of 2002 as a natural experiment, in which the United States significantly tightened its border

[6] This could be attributed to the relative attractiveness of American social welfare programs, a positive information feedback network from previous successful migrants, an increase in the number of work visas issued by the U.S. Department of State, and other factors.

security and legal migration processing after the September 11th attacks. Utilizing data from the March CPS from 1998 to 2015, I find that migrants who entered the United States after 2002 had a 3.0-4.5% higher wage rate and worked 0.65-1.04 more hours per week, all other factors held constant.

The model may have important implications for economic research on immigration. For instance, many studies in the literature use the predicted movements of 'chain migrants' (i.e. individuals who migrate to a geographic area in which their nationality/ethnicity has a strong presence) as an instrumental variable in determining the market impacts of immigration. These chain migrants incur relatively lower costs of migration due to the reduced "ethnic costs" of living with people who share their language and customs. Because of these lower costs, the model indicates that these individuals have a relatively lower average productivity than other immigrants. Therefore, a city with higher levels of chain migration would observe a decrease in wages due to this drop in productivity. However, a study using chain migration as an instrumental variable would draw the biased conclusion that the city's wage rates had fallen solely due to the increase in the supply of immigrant workers.

Researchers have also studied the impact of events in which migrants were 'accepted' by a host nation without having to overcome the usual geo-political obstacles of migration (e.g. Mariel Boatlift or the exodus of Post-Soviet Jews to Israel). Much like chain migrants, these individuals also incur a relatively lower personal cost of migration than their counterparts since they did not have to pass through a border security 'screen.' Thus, these migrants have a lower average productivity and subsequently earn a lower wage rate in the labor market. Therefore, studies that are examining the market impact of an influx of these 'un-screened' migrants may have a downward bias, since they will completely attribute the decrease in wages to the rise in the migrant population rather than the change in migrants' characteristics.

On the other hand, there are events in which migrants have been 'pushed' out of their home nation by tragedy, such as the Pied-Noir exodus following the Algerian War or the current crisis in Syria. Also known in the demographic literature as 'forced migrants,' many of these individuals simply travel to the nearest safe location, with little consideration of market conditions or other factors. According to the Migration Policy Institute, up to 95% of all forced

migrants remain in their nation of origin or move to a country in the immediate neighborhood. Since these forced migrants are not deliberately engaging in the 'screening' process described in this article, they may also have a lower average productivity relative to migrants who are seeking economic opportunity.

References

Altonji, Joseph and David Card. 1991. "The Effects of Immigration on the Labor Market Outcomes of Less-Skilled Natives." *Immigration, Trade and the Labor Market*, University of Chicago Press: 201-234.

Amuedo-Dorantes, Catalina and Susan Pozo. 2014. "On the Intended and Unintended Consequences of Enhanced U.S. Border and Interior Immigration Enforcement: Evidence from Mexican Deportees." *Demography,* 51 (6): 2255-2279.

Anwar-ul-Haq and Anwar-ul-Haq. 1979. "Perspectives on Migration Research: A Review of Theory, Evidence, Methodology and Research Priorities." *Pakistan Economic and Social Review* 17(2): 66-81.

Bade, Klaus J. 2003. *Migration in European History*. Translated by Allison Brown. Malden, MA: Blackwell Publishing Ltd.

Bellemare, C. 2003. "Economic Assimilation and Out Migration of Immigrants in West Germany Earnings" Discussion Paper 65*, Tilburg University, Centre for Economic Research*.

Borjas, George J. 1994. "The Economics of Immigration." *Journal of Economic Literature,* 32: 1667-1717.

———. 1990. *Friends Or Strangers: The Impact of Immigrants on the American Economy*. New York: Basic Books.

———. 1985. "Assimilation, changes in cohort quality, and the earnings of immigrants." *Journal of labor Economics,* 3(4): 463-489.

Card, David. 2005. "Is the New Immigration really so Bad?" *The Economic Journal* 115 (507): F300-F323.

———. 2001. "Immigrant Inflows, Native Outflows, and the Local Market Impacts of Higher Immigration." *Journal of Labor Economics* 19 (1): 22-64.

———. 1990. "The Impact of the Mariel Boatlift on the Miami Labor Market." *Industrial and Labor Relations Review*, 43 (2): 245-247.

Card, David and Ethan G. Lewis. 2007. "The Diffusion of Mexican Immigrants during the 1990s: Explanations and Impacts." In *Mexican Immigration to the United States*, edited by G. J. Borjas, 193-227.

Card, David and John DiNardo. 2000. "Do Immigrant Inflows Lead to Native Out-Flows?, American Economic Review Papers and Proceedings, 90, 2, 360-367." *American Economic Review Papers and Proceedings* 90 (2): 360-367.

Chiswick, Barry R. 1978. “The Effect of Americanization on the Earnings of Foreign-born Men.” *Journal of Political Economy*, 86(5): 897-921.

Doerschler, Peter. 2006. "Push-Pull Factors and Immigrant Political Integration in Germany." *Social Science Quarterly,* 87 (5): 1100-1116.

Dustmann, Christian; Tommaso Frattini; Ian Preston. 2013. “The Effect of Immigration along the Distribution of Wages.” *The Review of Economic Studies,* 80 (1): 145-173.

Edin, Per-Anders; Robert LaLonde; Olof Åslund. 2000. "Emigration of Immigrants and Measures of Immigrant Assimilation: Evidence from Sweden." *Swedish Economic Policy Review* 7: 163-204.

Friedberg, Rachel M. 2001. "The Impact of Mass Migration on the Israeli Labor Market." *Quarterly Journal of Economics* 111: 1373-1408.

Friedberg, Rachel M. and Jennifer Hunt. 1995. "The Impact of Immigrants on Host Country Wages, Employment and Growth." *The Journal of Economic Perspectives,* 9 (2): 23-44.

Hunt, John. 1992. "The Impact of the 1962 Repatriates from Algeria on the French Labor Market, Industrial and Labor Relations Review, 45, 556-572." *Industrial and Labor Relations Review* 45: 556-572.

Kerr, Sari Pekkala and William R. Kerr. 2011. "Economic Impacts of Immigration: A Survey." *Finnish Economic Papers, Finnish Economic Association,* 24 (1): 1-32.

Lee, Everett S. 1966. "A Theory of Migration." *Demography,* 3 (1): 47-57.

Lewis, Ethan. 2005. "The Impact of Immigration on New Technology Adoption in U.S. Manufacturing." *Federal Reserve Bank of Philadelphia*.

Lubotsky, D. 2007. "Chutes Or Ladders? A Longitudinal Study of Immigrant Earnings." *Journal of Political Economy* 115 (5): 820-867.

Partridge, Mark D., Dan S. Rickman, and Kamar Ali. 2008. "Recent Immigration and Economic Outcomes in Rural America." *American Journal of Agricultural Economics* 90 (5): 1326-1333.

Peri, Giovanni. 2007. "Immigrants' Complementarities and Native Wages: Evidence from California." *NBER Working Paper 12956*.

Spence, A. M. 1973. "Job Market Signaling." *Quarterly Journal of Economics,* 87 (3): 355-374.

Appendix 1.A

In order to find the inverse correlation that we would expect, the term in the numerator must be positive: $0.5\delta + 0.5\delta M_H + K_j - U_{ALT} > 0$

Or alternatively:

(9) $0.5\delta + 0.5\delta M_H + K_j > U_{ALT}$

I show this to be true by starting with the fact that, in order for *any* migrants to enter nation j ($M_{min} < M_H$), the following must be true:

$U_{ij} > U_{ALT}$

$W_{ij} - (\alpha P_j + \beta D_{jh} + \gamma E_{ji})(1 - M_H) > U_{ALT}$

We know that firms offer $W_{ij} = 0.5\delta (M_{min} + M_H) + K_j$. Therefore the following formula must be larger than U_{ALT}: $0.5\delta(M_{min} + M_H) + K_j - (\alpha P_j + \beta D_{jh} + \gamma E_{ji})(1 - M_H)$

I substitute the above formula for U_{ALT} in inequality (9). Since the formula substituted in is larger than U_{ALT}, the conclusion is valid if the inequality holds.

$0.5\delta + 0.5\delta M_H + K_j > U_{ALT}$

$0.5\delta + 0.5\delta M_H + K_j > 0.5\delta (M_{min} + M_H) + K_j - (\alpha P_j + \beta D_{jh} + \gamma E_{ji})(1 - M_H)$

$0.5\delta - 0.5\delta M_{min} + K_j > -(\alpha P_j + \beta D_{jh} + \gamma E_{ji})(1 - M_H)$

The inequality holds, since M_{min} and M_H both have an upper bound of 1, and the rest of the parameters and variables have a positive value. Therefore, the conclusion that there is a positive relationship between immigration control policy and the average productivity of migrants is valid.