The Uniformity of Immigration's Effect on Wages

Final Draft

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Abstract: Using the same approach and model found in Peri & Ottaviano (2006), this paper analyzes the effect of immigration on native wages from 1990-2004. Instead of examining the effects on a national scale, this analysis divides the country into four separate regions. This paper supports the conclusion that the effect of immigration on wages is small, less than one percent in some regions, but does not support the conclusion found in Peri & Ottaviano that immigration has increased native wages. Additionally, changing the order of aggregation in Peri & Ottaviano's model leads to different estimates for wages. This suggests a theoretical weakness in using nested constant elasticity of substitution functions to describe different skill groups of labor's contribution to output.

Section I-A: Introduction

This study analyzes the effects of immigration on wages by utilizing a general equilibrium model of capital and labor. The approach is the same as that found in Giovanni Peri's and Gianmarco Ottaviano's (herein abbreviated PO) paper, "Rethinking the Effects of Immigration on Wages" (2006). Their study finds that immigration—defined herein as individuals born abroad by non-American parents—has caused increases in wages for natives on average during 1990-2004 due largely to the imperfect substitutability of home and foreign workers. Their analysis only looks at wage changes on a national level. This study divides the U.S. into four separate regions and conducts the same analysis in an attempt to discover heterogeneity in how regional economies absorb immigrant labor. Since it is the finding of PO's work that home-born and foreign-born workers are imperfectly substitutable on a national scale, this study attempts to measure the same elasticity of substitution for each region. If immigrants are more

substitutable in one region, one would expect a greater negative impact on native wages due to more direct competition for wages. Conversely, if home-born and foreign-born workers are less substitutable, one would expect an increase in native wages due to the fact that they are complements in production. Once one estimates this elasticity of substitution, it is possible to use the model to find the net impact of immigration on native wages for each region. Section II details the theoretical model. Section III provides data and descriptive statistics. Section IV provides the parameter estimates and results in PO. Section V details the regional results. Section VI addresses a problem with the theoretical model and some empirical critiques raised by George Borjas, Jeffrey Grogger, and Gordon Hanson. Section VII concludes.

Section I-B: Summary of Political Economy of Immigration

Immigration is a politically contentious topic whose economic significance is not well known. The United States proportionally has the fourth largest population of foreign born individuals in the OECD, reaching 11.7% in 2003 (Hanson 5). The increase in immigration that Americans see today came largely as a result of policy reform enacted in the 1960s, which changed the main entry criterion from skills to family ties. In 1998, 72% of the individuals who entered were immediate family members of someone already living in the U.S. 12% of immigrants enter as skilled labor (Hanson 7). A natural consequence of a ceiling on immigration is an increase in the number of individuals attempting to enter the country illegally, an aspect of the immigration debate that proves especially difficult to address. A primary issue with illegal and legal immigration is the perception that immigration reduces native wages or eliminates native jobs. This is conceptualized simply as an increase in labor supply. Essentially, with more individuals

competing for the same amount of jobs, workers are willing to offer their services for less in order to get a job. Similarly, businesses offer lower wages because they see a surplus of workers. This framework is more applicable the closer home-born and foreign-born workers are substitutes for each other.

Immigration is location specific. According to a 1989 article by Ann Bartel, immigrants tend to concentrate in the top twenty-five metropolitan statistical areas (389). A more recent article by David Card agrees with this finding but adds that immigrants tend to concentrate in the gateway states. Since the distribution of immigrants is not uniform across the country, it is reasonable to postulate that the effect of immigration on wages is also not uniform across the country, holding all other mechanisms of change constant. However, it is possible that the other adjustment mechanisms already are occurring, such as the migration away from gateway regions by natives or capital adjustments by firms.

Section I-C: Literature Review

The literature on immigration is extensive, especially in wake of the political economy of the issue. The major studies conducted by labor economists began in the mid 1980s and early 1990s including Jean Grossman's article "The Substitutability of Natives and Immigrants in Production" (1982) and George Borjas' 1994 survey article, "The Economics of Immigration." David Card's 1990 article on the impact of the Mariel Boatlift on Miami's labor market conducts what one could call a natural experiment, as Fidel Castro's announcement that Cubans wishing to emigrate to the United States caused "a 7% increase in the labor force of Miami and a 20% increase in the number of Cuban workers in Miami" (Card 246). This increase was essentially an exogenous shock to

labor supply. Card finds that there was no significant negative impact of this labor supply shock on native wages or employment opportunities, even for unskilled labor. However, the author notes that the wages for Cuban workers declined relative to the other ethnic groups in Miami; additionally, he concludes that there was a 34% wage gap between the Mariel immigrants and the other Cubans already settled in the labor market (250). In conclusion, Card finds that overall, the Mariel boatlift caused no significant change in native wages or in the wages of Cubans after a few years, which he interprets as the time period which they were absorbed in labor market. He attributes this to the possibility that "the Mariels displaced other immigrants and natives who would have moved to Miami in the early 1980s had the boatlift not occurred" (255). Thus, there was some other adjustment mechanism at work here other than wages and employment opportunities, namely, the movement—or lack thereof—of populations across labor markets. The Card approach is labeled an area study. Additionally, it is important to note that Rachel Friedburg conducts a similar experiment on the impact of mass migration on the Israeli labor market and arrives at a similar conclusion, namely that she fails to reject the hypothesis that the migration of Russians to Israel caused no changes in earnings or employment of natives (1403).

There is one primary drawback to this approach. Area studies tend to treat specific cities as closed economies, essentially eliminating any movement of workers or capital across cities, states, or regions. These studies do so by not accounting for native outflows. Since one can surmise that migration does occur, this characterizing assumption of area studies is far too restrictive. Borjas, Freeman, and Katz address this problem in their article, "How Much Do Immigration and Trade Affect Labor Market

Outcomes" (1997). The authors use factor proportions analysis to determine how immigration affects capital movements and domestic net migration. A factor proportions analysis measures the amount of capital and labor in a given area and attempts to explain changes in those factors of production. They find that natives adjust their migration patterns due to immigration, citing California as a primary example. The authors assert that increased immigration to California caused decreased domestic migration from other states, presumably because competition for employment opportunities increased in California. David Card agrees with this finding in his 2001 article on native outflows for the state of California, but when he expands the analysis to the rest of the country, he does not find that this is the case. In fact, in his 2000 article, Card concludes that "systematic out-migration by native-born individuals is unlikely to provide an explanation" for immigration's effect on native wages (366). Thus, there must be other adjustment mechanisms at work. For this reason, it is largely agreed that factor proportions analyses are extremely difficult to conduct because of the high number of immeasurable factors. For instance, it is difficult to determine why domestic workers make migration decisions. In any case, the primary conclusion coming from this discourse is that because of the possible arbitrage effects that may or may not exist, it may be a better idea to use data on a national level to examine the full effect of immigration on wages and employment opportunities.

In a more recent article written by Borjas—"The Labor Demand Curve *Is* Downward Sloping" (2003)—he adds a new component to the analysis previously left out of other studies. Because work experience is a crucial component of human capital as asserted in Gary Becker's work on the topic, Borjas incorporates an imperfect

substitutability among workers with the same education level but different amounts of work experience. He manifests this change within his model using a constant elasticity of substitution (CES) technology function. With this new component, he finds that immigration *does* indeed cause a larger negative effect on native wages; in this study, a 10% increase in immigration causes a 6.4% decrease in annual wages for all male native workers and a 3.7% reduction in the amount of time worked (1349). While Borjas utilizes the CES function to allow for imperfect substitutability between workers with different levels of education and work experience, he assumes that home-born and foreign-born workers are still perfectly substitutable. He also assumes that the capital stock is fixed for a 20-year period, which means that his model captures no capital adjustment due to changes in the labor force. PO expand the CES production function to relax this assumption and test for imperfect substitutability between immigrants and natives in order to provide a more accurate picture of the labor market.

Section I-D: Why is this addition a valid contribution?

The primary aim of this paper is to investigate whether the effects of immigration are homogenous across regions of the country and if indeed immigrants and natives are imperfect substitutes for each other. In an early survey article, Borjas notes that "natives benefit from immigration only if immigrants are different from natives" (13). If fundamentally these workers are similar, one would expect that native wages and employment opportunities would decrease due to a higher degree of competition. Thus, the crux of PO's work is to determine if this is true. Although their work is controversial in several ways, they initially conclude that this is the case on a national level. It is essential to this study to test whether the data support a similar conclusion for each of the

regions. A look at the data reveals that the Midwest region has a smaller proportion of foreign-born labor than the other three regions examined in this study. One can hypothesize that the effect of immigration on native wages is smaller than that in the other regions because of less direct competition for wages and employment opportunities. Another possible outcome in the Midwest is that the smaller number of immigrants creates fewer supervisory jobs for native workers—a potential result of imperfect substitutability—which would mean that one would see more negative wage effects due to immigration than those seen in the other regions. Additionally, workers tend to concentrate in different occupations in different regions. This may provide differences in wage effects due to immigration across those regions.

Section II-A: Discussion of General Equilibrium

The approach in PO uses a two-factor—capital and labor—general equilibrium model. The endowments of capital and labor are treated as given, using the standard assumption found in the Solow model where alpha, the share of capital, equals 0.3. Factor price equalization occurs, which means that the rental rate of capital and the wages of labor are only determined by commodity prices.

There are a few key assumptions in using a general equilibrium model. There is free movement of capital and labor, meaning that there are no transportation costs associated with moving from country A to country B or region X to region Y. In international trade models, this is the primary assumption that would allow for equalization of wages and rental rates over time. While it may not prove to be a realistic assumption, it is an argument for wage convergence in the long run. One can assert that

actual transportation costs are much lower in the U.S. due to geography, thus making this framework closer to reality.

There are many implications to such a model. In the long run, the capital-labor ratio remains constant. Thus, an increase in labor supply does not affect the rental rate of capital or the wages of labor. This implies that labor's share of total income does not change; however, the wages paid to given groups of native workers or foreign workers may change. Labor supply changes are only of consequence in the short run, when a change affects the capital-labor ratio. Afterwards, capital is allowed to adjust to the increase in labor, and the capital-labor ratio will return to its long run equilibrium. This framework provides a basis for a null hypothesis of zero wage changes due to immigration since capital can adjust to changes in labor supply and since labor can move across regions.

Section II-B Constant Elasticity of Substitution Framework

PO also use a constant elasticity of substitution (CES) framework to relax the assumption that immigrant labor and domestic labor are perfect substitutes for each other. By using an elasticity parameter between different subgroups of labor, the authors assume that workers are imperfect substitutes. The model incorporates these parameters to describe the elasticity of substitution between domestic and foreign workers, the elasticity of substitution between workers with different experience levels within the same education group, and the elasticity of substitution between workers with different education levels. A parameter value of infinity in this framework means that workers are perfectly substitutable; thus, a higher value for any of the parameters will indicate

increased substitutability, implying a greater negative impact of immigration on native wages.

One limitation of the CES framework is that the estimates will yield one elasticity parameter for each equation, implying that workers with minor differences in work experience or education are equally substitutable as workers with significant differences in work experience or education. While this is an obvious weakness of this framework, it expands upon the even simpler assumption of perfect substitution while forgoing the complexity of a variable elasticity of substitution framework. Under the CES framework, it is necessary to estimate the parameters for each level of aggregation, which will be explained later. While using a variable elasticity of substitution framework may be the next logical step in this particular area of research, it is beyond the scope of this paper due to the high number of parameters that one would need to estimate.

Section II-C: Details of PO Model

The model seen in PO begins as a Cobb-Douglas production function similar to that seen in the Solow Model, where A equals total factor productivity and is assumed to increase exogenously, L equals the input of labor into production of goods and services, and K equals the input of capital into production of goods and services; the share of output contributed by capital is determined by the parameter alpha, typically assumed to equal 0.3. To assume constant returns to scale, it is assumed that the share attributed to labor equals $1 - \alpha$, so that the two weights sum to one and the function collapses to Cobb-Douglas form (Jones 20).

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \quad (1)$$

The labor term is subdivided into three separate aggregators that incorporate the CES framework. PO choose to separate labor into skill groups using the same method found in Card and Lemieux (2001). The first level of aggregation is the separate education groups.

$$L_t = [\sum_{k=1}^{4} \theta_{kt} L_{kt}^{(\delta-1)/\delta}]^{\delta/(1-\delta)} \quad (2)$$

This equation captures the elasticity of substitution between workers with different educational attainment. θ_{kt} captures education-specific productivity. PO assume that there are four categories of education (k) that individuals can fall into: high school dropouts, high school graduates, college dropouts, and college graduates (abbreviated respectively as HSD, HSG, COD, COG). The next level of aggregation incorporates workers that fall into the same education category with varying levels of work experience (j).

$$L_{kt} = [\sum_{j=1}^{8} \theta_{jkt} L_{jkt}^{(\eta-1)/\eta}]^{\eta/(1-\eta)} \quad (3)$$

The work experience variable is constructed as described in Section IV. There are eight levels of work experience in 5 year increments. Thus, a worker that falls into category three has between 10-14 years of work experience. This separation applies for all four education categories, giving us thirty-two separate groups of labor. Lastly, the final aggregation asks whether or not a given worker with a certain education and work experience is born in the U.S. (H) or born abroad (F).

$$L_{kjt} = [\theta_{Hjkt} H_{jkt}^{(\sigma-1)/\sigma} + \theta_{Fjkt} F_{jkt}^{(\sigma-1)/\sigma}]^{\sigma/(1-\sigma)} \quad (4)$$

For each separate group, there is an efficiency parameter that affects the output of a given type of worker. This is important for a discussion of wages and is determined when calculating the parameters of the model.

In perfect competition, wages are equal to the marginal products of each type of labor. This is determined by partially differentiating the production function with respect to each type of labor. One will notice that capital is allowed to adjust in this model, a key facet of the general equilibrium framework.

To acquire a demand function for home-born workers with education k and experience j, one must partially differentiate the production function with respect to the supply of home-born workers with that set of characteristics. In a perfectly competitive economy, workers are paid their marginal product. Taking logs and partially differentiating the production function acquires the following equation for wages:

$$\text{Ln}(MP_{Hkjt}) = \text{Ln}(w_{Hkjt}) = \text{Ln}(\alpha A_t K_t / L_t^{1-\alpha}) + (1/\delta)\ln(L_t) + \ln(\theta_{kt}) - (1/\delta - 1/\eta)\ln(L_{kt}) + \ln(\theta_{kjt}) - (1/\eta - 1/\sigma)\ln(L_{kjt}) + \ln(\theta_{Hkjt}) - (1/\sigma)\ln(H_{kjt}) \quad (5)$$

Using the particular form of aggregation discussed previously, the supply of home-born workers with education k and experience j is a subset of all workers with education k and experience j. The supply of all workers with education k and experience j is a subset of the supply of all workers with education k; finally, the supply of all workers with education k is a subset of the supply of all workers. Thus, an increase in foreign-born workers with education k and experience j increases L_{kjt}, L_{kt}, L_t. When analyzing the effects of immigration on wages, the previous literature solely examined the impact of an increase in the supply of workers on L_{kjt}. Similarly, an increase in foreign-born workers with education k but experience $i \neq j$ increases L_{kt} and L_t. Lastly, an increase in foreign workers with education $m \neq k$ and experience $i \neq j$ will increase solely L_t. If one includes the effects on wages due to an increase in L_{kt} and L_t, there is ambiguity as to the overall effect on native wages. L_t affects wages positively for $\delta > 0$, while L_{kt} enters negatively

since the hypothesis is that $\eta > \delta$ (thus $1/\delta > 1/\eta$). This means that workers with different levels of work experience are more substitutable than workers with different levels of education.

$Ln(\alpha A_t K_t / L_t^{1-\alpha})$ captures the positive effect on native wages due to economic growth. As the exogenous term A_t increases, the production function expands, thus increasing native wages by its growth rate g (Jones 37). The term $\ln(\theta_{kt})$ captures the positive effect on wages due to productivity increases within a specific education group. The term $\ln(\theta_{kjt})$ captures the positive effect on native wages due to increasing productivity for a specific education-experience group. The term $\ln(\theta_{Hkjt})$ captures the positive effect due to productivity increases for home-born workers within that same education-experience group. The remaining terms in this equation represent the effects on native wages of four separate effects. Each effect operates through the variables H_{kjt}, L_{kjt}, L_{kt}, and L_t.

The term $(1/\sigma)\ln(H_{kjt})$ captures the negative impact of an increase of home workers with education k and experience j due to direct competition for wages. This direct competition is expressed by $1/\sigma$.

$(1/\eta - 1/\sigma)\ln(L_{kjt})$ captures the negative impact of an increase in L_{kjt} on native wages. The preceding term with the elasticities of substitution expresses two things. First, $1/\eta$ is negative because there is more competition for wages within the same experience group. $1/\sigma$ is positive here because an increase in home-born or foreign-born workers in the same education-experience cell contributes to an increase of Y_t. $1/\sigma$ captures the fact that home-born and foreign-born workers are imperfect substitutes for each other, which therefore has a positive effect on wages. In an extreme case, suppose

$1/\sigma$ equals zero. This would indicate that home and foreign workers were perfect substitutes. If this held true, then the effect of an increase in workers with education k and experience j would only be negative, because there would be even more direct competition for wages. Since it is thought that $1/\eta > 1/\sigma$, the overall effect will be negative. This essentially means that home-born workers are closer substitutes for foreign-born workers with the same education and experience than foreign workers with different levels of work experience.

The term $(1/\delta - 1/\eta)\ln(L_{kt})$ captures the negative effect of an increase in L_{kt} on native wages. An increase in foreign born workers with education k and experience $i \neq j$ increases L_{kt}. One could distribute the preceding negative sign to obtain $(1/\eta - 1/\delta)$. Since the hypothesis is that $1/\delta > 1/\eta$, there is an overall negative effect. $1/\delta$ is negative here because there is more direct competition for wages for workers within the same education group. $1/\eta$ is actually positive here since there is imperfect substitutability between workers with different experience levels. Similar to the case for $1/\sigma$ in the previous term, if there was perfect substitutability between workers with different levels of work experience, there would be solely the aforementioned negative effect on wages due to an increase in L_{kt}.

Finally, the term $(1/\delta)\ln(L_t)$ captures the positive effect of an increase in L_t on native wages. Because this term is only directly influenced by an increase in workers with education $m \neq k$ and experience $i \neq j$, all of the impacts of direct competition for wages have been incorporated in the previous terms. Thus, this term measures the imperfect substitutability of workers with different levels of education, which enhance the overall product of this group.

The above equation for wages for native workers in a particular education-experience incorporates every possible effect measured by this model; however, this paper hopes to measure exclusively the impact of immigration on wages, it is necessary to tailor the equation to do so. PO assume that the relative efficiency terms θ_{kt}, θ_{kjt}, and θ_{Hkjt} as well as A_t are technological factors and are independent of the supply of foreign-born. Additionally, the supply of home-born workers with education k and experience j is clearly independent of the supply of foreign-born workers in the same cell. Thus, the five terms that are independent of the supply of foreign born are not incorporated into the final native wage equation. This leaves the effects due to L_{kjt}, L_{kt}, and L_t as follows:

$$(\Delta W_{Hkjt}/W_{Hkjt})\text{Total} = 1/\delta\ [\Sigma_i\Sigma_m\ S_{Fmit}\ (\Delta F_{mit}/F_{mit})] + (1/\eta - 1/\delta)(1/S_{kt})[\Sigma_i\ (S_{Fkit})\ (\Delta F_{kit}/ F_{kit})]\ + (1/\sigma - 1/\eta)(1/S_{kjt})(S_{Fkjt})(\Delta F_{kjt}/F_{kjt}) + (1\text{-}\alpha)(\Delta\kappa_t/\kappa_t)_{\text{immigration}} \quad (6)$$

$1/\delta\ [\ \Sigma_i\ \Sigma_m\ S_{Fmit}\ (\Delta F_{mit}/F_{mit})]$ comes from $(1/\delta)\ln(L_t)$. This term only captures the imperfect substitutability between workers with different levels education and experience. Specifically, wages for native workers with education k and experience j are positively affected by the percentage change in foreign workers with education $m \neq k$ and experience $i \neq j$ and by the share of wages earned by foreigners within that same classification. Additionally, should δ increase (which means that workers with different education backgrounds are more substitutable), there would be a smaller positive effect on native wages.

The next term, $(1/\eta - 1/\delta)(1/S_{kt})[\Sigma_i\ (S_{Fkit})\ (\Delta F_{kit}\ /\ F_{kit})]$, comes from $(1/\delta - 1/\eta)\ln(L_{kt})$. $1/\eta$ positively affects wages because of the imperfect substitutability of workers across experience groups. Having workers with different levels of work experience adds to the productivity of workers in the original level j. $1/\delta$ is negative here

because this term incorporates workers with the same level of education attainment. $1/S_{kt}$ is present here because this term only addresses wages earned by this particular education group. The remaining variables in this term have a similar explanation as the previous one. The share of wages earned by foreign workers with education k and experience $i \neq j$ is multiplied by the percentage change in foreign workers within the same group to complete how an increase in L_{kt} affects native wages. One can conclude that an increase in foreign born workers with education k and experience $i \neq j$ leads to decrease in native wages since $1/\delta > 1/\eta$.

Finally, $(1/\sigma - 1/\eta)(1/S_{kjt})(S_{Fkjt})(\Delta F_{kjt}/F_{kit})$ represents the effects expressed through L_{kjt}. An increase in foreign-born workers in group k, j adds to the productivity of native workers insofar as they are imperfect substitutes for each other, which is captured by the parameter $1/\sigma$. This has a positive effect on wages. $1/\eta$ factors negatively here because of the increase in workers within the same experience-education cell. Because $1/\eta > 1/\sigma$, native wages are overall negatively affected by an increase in foreign born workers in the cell k, j. $1/S_{kjt}$ is present because only the wages earned by the cell k, j are concerned.

Section III-A: Data Description

The data come from the Integrated Public Use Microdata Series (IPUMS) (Ruggles, et al). This paper uses the 1960 1% sample, the 1970 Form 2 1% State Sample, the 5% samples from 1980, 1990, and 2000, and the 2004 American Community survey (ACS). These are the largest public-use samples available for each year. The 1% samples are 1-in-100 national random samples of the population, the 5% samples are 1-in-20 national random samples of the population, and the 2004 ACS is approximately a 1-in-239 national random sample. The data from the 1980, 1990, and 2000 decennial

censuses and from the 2004 ACS are weighted samples, thus requiring use of personal weights for accurate statistics. Essentially, for each entry, there is a weight that indicates how representative that entry is of the entire population.

The IPUMS provides the following variables: the region in which a given individual lives, a given individual's birthplace, an indicator variable for educational attainment, an individual's age, and an individual's nominal yearly income. This draft examines four major regions of the country, which are defined as the South, the Midwest, the West, and the Northeast. While it would be possible to examine larger subregions of these four major regions, it is more likely that the results would hurt by insufficient data. Birthplace is given by state if one is born in the U.S., and people born in all other locations are distinguished by country. Since this paper does not concern with the country of origin, the variable has been converted to a simple binary dummy variable to indicate whether someone is born here or abroad. There are two variables for education because the collection of educational data changed in 1980. In 1960, 1970, and 1980 the variable for education is given by number of years of school attended. For years 1990, 2000, and 2004 the variable simply indicates a person's level of education. Nominal yearly wage income has been multiplied by a CPI adjustment factor provided by the IPUMS in order to adjust for inflation.

The variable not provided by the IPUMS is work experience, which I constructed from available data. Assuming that a person enters the work force at age 17 if he is a high-school dropout, age 19 if he is a high school graduate, age 21 if he is a college dropout, and age 23 if he is a college graduate, I subtract the number of years in school from age to acquire years of work experience. This construction may systematically bias

years of work experience upward for older individuals, since it is more likely that someone may have taken more time off due to unemployment or injury the older he is.

Section III-B: Descriptive Statistics

There are tables of the distribution of native and foreign workers divided into education cells located in Appendix A. For education cells, the table is subdivided by region. On a national scale, it appears that close to 40% of foreign workers are considered high school dropouts, as opposed to just 23% of domestic workers. Similarly, there is a higher percentage of foreign college graduates—19.8%—working in the United States than the percentage of native college graduates, which consists of 18.5% of all native workers. The Midwest has the smallest ratio of foreign workers to all workers at 4.5%, while the Northeast has the highest ratio: 19.2% of all workers are foreign.

Section III-C: Predictions and supporting evidence

One of the goals of this paper is to see if the elasticities of substitution estimated in the PO's article are the same if the data are restricted to given regions. PO begin by establishing a relationship between the relative wages and relative supplies of each education-experience group of labor, as given below:

$$\text{Ln}(W_{Hkjt}/W_{Fjkt}) = -1/\sigma \ln(H_{kjt}/F_{kjt}) + \ln(\theta_{Hjkt}/\theta_{Fjkt}) \qquad (9)$$

In words, the natural logarithm of the relative wage earned by home and foreign workers in the same education-experience cell depends negatively on the relative supply of home and foreign workers in that same cell and positively on the relative efficiencies of the two classes of workers. The parameter of interest, $1/\sigma$, measures to what degree home and foreign workers are substitutes for each other. In an extreme case, if home and foreign

workers were perfect substitutes, relative wages would only depend on relative efficiencies.

In order to make this equation estimable, PO identify three sources of variation in the relative efficiency term that are independent of the variation of relative supply. Thus, the authors allow $\theta_{Hjkt}/\theta_{Fjkt}$ to have three systematic components. One controls for education by year fixed effects (D_{kt}), another controls for experience by year fixed effects (D_{jt}), and the last controls for education by experience fixed effects (D_{kj}). Essentially, these are dummy variables used to capture any systematic increase in wages due to technological factors or an increase in productivity. There are 24 education by year effects (4 education groups by 6 years of data), 48 experience by year effects, and 32 education by experience effects. This leads to the following regression specification:

$$\text{Ln}(W_{Hkjt}/W_{Fjkt}) = D_{kt} + D_{kj} + D_{jt} - 1/\sigma \ln(H_{kjt}/F_{kjt}) + u_{kjt} \quad (10)$$

Thus, relative wages now depend upon the relative supply of workers and 104 fixed effects that represent the relative efficiency term.

The null hypothesis is that this parameter is the same for a small region as it is the national level despite the smaller sample size. It is reasonable to assume that regional economies adjust at the same pace as the national economy. The alternative hypothesis is that the national estimate for the parameter is different from the regional estimate, which would be due to some other adjustment mechanism in a regional economy.

Section IV-A: Parameter Estimates from PO

Estimating the aforementioned equation for sigma—the elasticity of substitution between home workers and foreign workers—the authors reach a value of that suggests native workers and foreign workers are not perfectly substitutable for each other. The

authors use the entire panel of data from 1960-2004 to determine these estimates. For this estimate, they do not allow the parameter to vary across education groups; while the authors reject their null hypothesis that all sigma's across education groups are the same, I will make the assumption that they are the same for the purposes of this draft. Future drafts will soften this assumption and test to see if the parameters are the same for a regional analysis.

There is much literature behind an estimation of eta, the elasticity of substitution between workers with different levels of work experience within the same education group. Card and Lemieux's estimate finds that the value of eta is between 3.3 and 5. Borjas' estimate gives a value of 3.5 in his analysis. Peri and Ottaviano duplicate the estimation using their data and arrive at a value of 3.333 (24). The authors estimation of eta requires two-stage least squares. Given the consensus in the literature for this parameter estimate, this paper assumes that Peri and Ottaviano's estimate is correct.

Peri and Ottaviano estimate delta, the elasticity of substitution between workers with different education levels to be equal to 2 (25). The estimation method the authors use is similar to that seen for the previous two parameters. This result, combined with the estimation of eta, confirms that workers with different educational attainment are less substitutable than workers with different levels of work experience, as one would reasonably expect.

These estimates—without considering their effects on wages—confirm that foreign workers and domestic workers are not perfectly substitutable, as implied by the above estimate of sigma. While this seems a trivial result, it legitimizes the underlying reason for adopting a constant elasticity of substitution framework.

Section IV-B: Translation from Parameters to Results: Calculation of Wage Effects

The parameter estimates are important because they weigh in on the magnitude of immigration's effect on wages. Peri and Ottaviano derive the following equation to determine those effects:

$$(\Delta W_{Hkjt}/W_{Hkjt})\text{Total} = 1/\delta\ [\ \Sigma\ \Sigma\ S_{Fmit}\ (\Delta F_{mit}/F_{mit})] + (1/\eta - 1/\delta)(1/S_{kt})[\Sigma\ (S_{Fkit})\ (\Delta F_{kit}/\ F_{kit})]$$

$$+ (1/\sigma - 1/\eta)(1/S_{kjt})(S_{Fkjt})(\Delta F_{kjt}/F_{kit}) + (1\text{-}\alpha)(\Delta\kappa_t/\kappa_t)_{\text{ immigration}} \qquad (11)$$

Using the above equation and the estimated parameters to solve for the percentage change in wages earned by domestic workers, the authors find that average wages have increased by 1.8% during the time period of 1990-2004, as described in Table 1 below (PO 46).

Table 1: PO's Results for Immigration's Impact on Native Wages, 1990-2004

	HSD	HSG	COD	COG	Overall
Wage Changes	**-1.1%**	**+2.4%**	**+3.4%**	**+0.7%**	**+1.8%**

It should be noted that wages for high-school dropouts born in the U.S. are estimated to have decreasedhave decreased by 1.1% over this period, but this is the only group for which wages have fallen (PO 46). Additionally, this particular result is for long-run effects on wages due to immigration; that is, the percentage change in the capital-labor ratio equals zero. This assumption essentially says that capital instantly adjusts to changes in the labor force due to immigration or other factors and has no effect on the wage changes. PO also look at a case for yearly capital adjustment, which essentially signifies a delay between a shock to the capital-labor ratio and the subsequent adjustment of capital. Under this specification, the authors find that average wages for all U.S.-born

workers only increases by 0.7% instead of 1.8%. Interestingly, when this is imposed, the wages for native college graduates decrease by 0.4%. (PO 47)

Section V-A: Estimates of Sigma

Using the same regression specification mentioned before, one can estimate the parameter sigma below:

$$\text{Ln}(W_{Hkjt}/W_{Fjkt}) = D_{kt} + D_{kj} + D_{jt} - 1/\sigma \ln(H_{kjt}/F_{kjt}) + u_{kjt} \quad (12)$$

This generates the results for each of the regions found in Appendix B. The results for $1/\sigma$ are similar to those found in PO. All are significant at 5% level, and only the Midwest region shows a coefficient that is insignificant at the 1% level. All four specifications are jointly significant below the 1% significance level.

The estimate for the Midwest region is only about half as large as the other three. One could surmise that this is due to lower levels of immigration in this region (the population of immigrants in this region is approximately half of that found in other regions). If there are fewer immigrants, perhaps their labor is more valuable due to specific occupation choice, which makes their marginal productivity here higher than that found in other regions. One can justify this explanation by the reverse of diminishing marginal returns. This reflects a higher degree of substitutability as native workers are forced out of those occupations due to more direct competition.

Fortunately, this specification does not suffer from insufficient data, which was a problem when the analysis only focused on a small sub region of the country. Inspection of the data suggested that there were no outliers in the ratio of domestic wages to foreign wages in a particular education-experience cell or the ratio of home workers to foreign workers in a particular education-experience cell.

It is important to note that estimates of this parameter are only important insofar as it helps determine immigration's effect on wages. If $1/\sigma$ is positive, there is a positive effect on native wages due to the construction of the preceding wage equation.

Section V-B: Immigration's Effect on Native Wages

Using the parameter found in the preceding section and taking eta and delta as given from previous literature, it is now possible to determine the percentage change in native wages due to immigration from 1990-2004. The results acquired from equation (11) are found below in Table 2. The tables in Appendix C give frequencies and wage changes for individual education-experience cells for each region.

Contrary to results found in PO, wages have fallen by 0.184%, 1.216%, 0.061%, and 0.225% for the Northeast, the Midwest, the South, and West regions, respectively. Alarmingly, these results suggest that wages for college graduates have fallen significantly due to immigration. Wages changes for high school dropouts, high school graduates, and college dropouts do not show a consistent pattern, though overall they tend to show negative effects due to immigration. It is surprising that for all experience cells for high school dropouts in the northeast, there were positive wage effects. It is widely held that high school dropouts are the ones that experience the greatest negative impact to wages because of higher amounts of low-education foreign immigrants.

Because immigrants are predominantly high school dropouts or college graduates, it is not terribly surprising that these education groups would experience the greatest change in wages due to immigration. The magnitude of the changes for some groups of college graduates is surprising, however.

Table 2: Summary of Wage Results and Parameter Estimates Using PO's Specification

Statistic	Northeast	Midwest	South	West
Overall Wage Change	-0.1840%	-1.2160%	-0.0610%	-0.2280%
Estimate of 1/σ	-0.1467	-0.07005	-0.132	-0.1558
Standard Error	0.0245	0.02838	0.0265	0.02439

Native workers in the Midwest experienced the greatest impact to wages. The West also has the highest proportion of foreign workers to all workers, suggesting that competition for wages is positively related to the percentage of foreign workers.

Section VI-A: Order of Aggregation—Theory

Given the form a CES production function, one can raise the question if the order of aggregation matters to determining the wage equations detailed in the previous section. The magnitude of the three effects on native wages operating through L_{kjt}, L_{kt}, and L_t are determined by the preceding parameters. If one changes the order of aggregation, the demand function for labor changes. There is no mathematical or economic reason for aggregating labor in a certain way, since each separate aggregation will yield the exact same education-experience cells for native and immigrant labor. The only difference lies in the effects operating through the parameters, which is explored below. Suppose instead of using education as the first level of aggregation, one begins with experience, follows with education, and concludes by splitting workers into home-born and foreign-born. This is only a minor change, but partially differentiation of this new production function yields the following equation for wages:

$$\text{Ln}(MP_{Hjkt}) = \text{Ln}(w_{Hjkt}) = \text{Ln}(\alpha A_t \kappa_t^{1-\alpha}) + (1/\eta)\ln(L_t) + \ln(\theta_{jt}) + (1/\delta - 1/\eta)\ln(L_{jt}) + \ln(\theta_{jkt}) + (1/\sigma - 1/\delta)\ln(L_{jkt}) + \ln(\theta_{Hjkt}) - (1/\sigma)\ln(H_{jkt}) \quad (7)$$

There are several striking differences about this new equation. First, since $\eta > \delta$, the positive effect of increasing labor supply of foreign-born workers with education $m \neq k$ and experience $i \neq j$ (corresponding to an increase of L_t) is smaller than in the original equation. Second, $(1/\delta - 1/\eta)$ is now not preceded by a negative sign. This means that that the overall effect of an increase of L_{jt} is positive. Lastly, the sum of the parameters preceding L_{jkt} gives a lower number than that seen in the previous equation. Thus, the calculus provides an ambiguous result.

Using the same method as before, one can acquire an equation for the total effect of immigration on native wages:

$$(\Delta W_{Hkjt}/W_{Hkjt})\text{Total} = 1/\eta\ [\ \Sigma_m\Sigma_i\ S_{Fmit}\ (\Delta F_{mit}/F_{mit})] + (1/\delta - 1/\eta)(1/S_{jt})[\Sigma_m(S_{Fjit})$$
$$(\Delta F_{jmt}/F_{jmt})]\ + (1/\sigma - 1/\delta)(1/S_{kjt})(S_{Fkjt})(\Delta F_{kjt}/F_{kjt}) + (1\text{-}\alpha)(\Delta\kappa_t/\kappa_t)_{\text{immigration}} \qquad (8)$$

The difference here is the term $(1/S_{jt})[\Sigma_m(S_{Fjit})\ (\Delta F_{jmt}/F_{jmt})]$, which takes into account the change in foreign workers with work experience j and education $m \neq k$, while the opposite is true in the former equation. There is no evidence theoretically that this change will provide systematic overstatements or understatements of the effects of immigration on native wages, but it is likely that these two equations provide different results. The results found in the next section support this claim.

Section VI-B: Order of Aggregation: Results

Appendix D provides a table of wage results for each region using the wage equation reflecting a different order of aggregation. The changes for specific education-experience cells are dramatic, but one equation does not systematically overstate or understate the effect of immigration on native wages for the specific education-experience cells. The overall change in native wages for the four regions are -.00344%,

-1.810%, 0.339%, and 1.176% for the Northeast, Midwest, South, and West, respectively. This equation provides a higher average calculation for the Northeast, the South, and the West, but a lower for the Midwest. There are no economic implications in these results; however, they are important to demonstrate a flaw in the model.

Section VI-C: Borjas, Grogger, and Hanson's Critique

Within the last month, George Borjas, Jeffrey Grogger, and Gordon Hanson (herein abbreviated BGH) have posted a working paper that attempts to overturn the results found in PO. In their critique of PO's model, BGH raise several concerns regarding the construction of key variables. The most important point they discuss is that PO misclassify high school students as high school dropouts. The authors claim that this overstates the supply of high school dropouts with 0-4 years of work experience, since juniors and seniors still enrolled in school that have part-time jobs are included in the data. They argue that since a student's time is divided between school and a part-time job, it is reasonable to expect that these workers earn less, which is supported by the data. When removed, the number of high school dropouts with 0-4 years of experience decreases from 4.273 million to 1.266 million, and increases the average weekly wages from $209 to $313. On the other hand, it is somewhat arbitrary to exclude people that are indeed involved in the labor force, even if they are dividing time between school and work. These individuals are still competing for wages and employment opportunities. When BGH estimate equation (12) excluding high school students, they fail to reject the hypothesis that home-born workers and foreign-born workers are perfectly substitutable, conceptualized by a parameter estimate of infinity.

While the inclusion of high school students is the authors' most striking argument against the validity of the results found in PO, there are several other minor points worthy of note. BGH object to using annual wages as the empirical representation of the marginal product of labor. While weekly wages would provide a closer proxy, the ideal choice would be the hourly wage. Weekly wage data is available, but hourly wage data is not available. Lastly, the 1960, 1970, and 1980 censuses use a different variable for education than the 1990, 2000 censuses and the 2004 ACS. PO do not use the variable provided by the IPUMS that reconciles the two different variables.

Section VI-D: Testing the Model without Students

Replicating BGH's approach to remove workers enrolled in school, the national estimate for sigma loses significance. Recall that this means that one cannot reject the hypothesis that home-born workers and foreign-born workers are perfectly substitutable within the framework of this model. The estimates for sigma on both the national scale and the regional scale are provided below in Table 3.

Table 3: Estimates of Sigma without Students

Statistic	Northeast	Midwest	South	West	National
Estimate of 1/σ	-0.03551	0.047364	-0.04692	-0.03104	-0.02983
Standard Error	0.0314	0.0307	0.03768	0.02589	-0.228
T-Statistic	-1.13	1.54	-1.25	-1.2	-1.31
P-Value	0.26	0.125	0.215	0.232	0.193
F-Statistic	12.66	14.46	12.88	6.17	17.5
R-Squared	0.7104	0.6853	0.714	0.5443	0.7723

All of the specifications yield estimates for sigma that are not statistically significant from zero. Within the model, there is not a positive effect on native wages due to home-born and foreign-born workers complementing each other. Using an estimate for sigma

of zero in equation (11) causes a systematic decrease in wages across all education-experience groups.

While this critique provides an interesting set of results, it is important to note that it does not discredit the original PO results. BGH provide a different approach and come up with a set of results, and PO do the same. It is difficult to assert which approach is better, but it is interesting to note the different conclusions. However, one can certainly assert that this critique does not discredit the model that PO develop; the issue lies with the results. One can easily argue that using a model that tests for imperfect substitutability across different groups of workers provides a more accurate picture of the labor market and the effects of immigration.

Section VII: Conclusion

Breaking up the data into four separate regions changes the results found in PO's study, which examines the effects of immigration on native wages on a national scale. Using their equation, immigration caused a wage decrease between approximately 0.06% and 1.2%. Thus, this study agrees with the conclusion found in the early literature that the effect of immigration on native wages is close to zero. The aspect of this model that distinguishes itself from previous literature is the incorporation of a constant elasticity of substitution framework, and its purpose is to provide a more realistic picture of how home-born and foreign-born workers interact. Unfortunately, there is a theoretical problem with the model and an empirical problem with the results. There are three nested CES functions to describe the labor term in the production, and these levels of aggregation are not communitive due to the fact that the terms are raised to powers. There are six different ways that one could aggregate labor, and it is reasonable to

suppose that each different method of aggregation would provide different results for the effect of immigration on native wages. While there is no economic explanation for this problem, it does provide a tradeoff between a more complex model and the reliability of the results. Borjas, Grogger, and Hanson also object to the methodology of constructing certain variables, and correcting this issue wipes out the results that Peri and Ottaviano find in their work. The result is that wages for native workers fall by a small amount due to immigration. Though the model itself has flaws, it does support the commonly held expectation that immigration has a negative impact on native wages since an influx of immigrants is simply an increase in labor supply.

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Appendix A: Descriptive Statistics of Immigration

Percentage of Native and Foreign Population Belonging to Education Groups – Regional

	HSD	HSG	COD	COG	Total
Northeast - Natives	0.0375	0.0620	0.0417	0.0385	0.1797
Northeast – Foreign	0.0110	0.0070	0.0052	0.0060	0.0292
Midwest - Natives	0.0507	0.0831	0.0589	0.0376	0.2303
Midwest - Foreign	0.0043	0.0027	0.0023	0.0027	0.0120
South - Natives	0.0875	0.0964	0.0762	0.0532	0.3132
South - Foreign	0.0102	0.0055	0.0057	0.0055	0.0269
West - Natives	0.0304	0.0467	0.0556	0.0359	0.1687
West - Foreign	0.0172	0.0073	0.0083	0.0071	0.0400
All	0.2488	0.3108	0.2538	0.1866	1.0000

Percentage of Population Belonging to Education-Experience Cells – National

	HSD	HSG	COD	COG	Total
0-4 Years	0.057	0.053	0.065	0.032	0.207
5-9 Years	0.020	0.038	0.035	0.030	0.123
10-14 Years	0.020	0.038	0.033	0.028	0.120
15-19 Years	0.021	0.037	0.031	0.026	0.115
20-24 Years	0.021	0.035	0.027	0.022	0.105
25-29 Years	0.021	0.031	0.022	0.019	0.094
30-34 Years	0.022	0.028	0.018	0.014	0.082
35+ Years	0.066	0.051	0.023	0.014	0.154
All	0.249	0.311	0.254	0.186	1.000

Appendix B: Regression Results from all Regions for Sigma

Statistic	Northeast	Midwest	South	West
Estimate of 1/σ	-0.1467	-0.07005	-0.132	-0.1558
Standard Error	0.0245	0.02838	0.0265	0.02439
T-Statistic	-5.99	-2.47	-4.99	-6.4
P-Value	0.000	0.015	0.000	0.000
F-Statistic	7.46	14.46	13.55	5.66
R-Squared	0.505	0.6853	0.6498	0.4365

Students Excluded

Statistic	Northeast	Midwest	South	West	National
Estimate of 1/σ	-0.03551	0.047364	-0.04692	-0.03104	-0.02983
Standard Error	0.0314	0.0307	0.03768	0.02589	-0.228
T-Statistic	-1.13	1.54	-1.25	-1.2	-1.31
P-Value	0.26	0.125	0.215	0.232	0.193
F-Statistic	12.66	14.46	12.88	6.17	17.5
R-Squared	0.7104	0.6853	0.714	0.5443	0.7723

Appendix C: Changes in Wages for Native Workers in Education-Experience Cells, PO's Aggregation

Northeast:

Percent Wage Change

	HSD	HSG	COD	COG
0-4 Years	3.838	0.163	0.979	-2.374
5-9 Years	3.582	0.220	1.006	-2.720
10-14 Years	3.535	0.078	0.872	-2.888
15-19 Years	2.844	-0.903	0.122	-3.035
20-24 Years	3.693	-1.064	-0.177	-3.807
25-29 Years	3.538	-0.958	-0.378	-4.382
30-34 Years	3.197	-0.781	-0.350	-5.032
35+ Years	3.390	-0.450	-0.121	-4.264

Frequencies of Native Workers

	HSD	HSG	COD	COG
0-4 Years	1212141	1439597	1831570	1281192
5-9 Years	363917	1189116	1043648	1086489
10-14 Years	371901	1241276	1045718	1078645
15-19 Years	313555	1019568	900531	1045695
20-24 Years	271744	951895	714630	699880
25-29 Years	326311	863536	491113	468688
30-34 Years	361329	760713	368214	380567
35+ Years	1360683	1691052	569575	469651

Average Wage Change for All Workers: -0.184%

Midwest:

Percent Wage Change

	HSD	HSG	COD	COG
0-4 Years	-0.265	-0.312	0.453	-3.326
5-9 Years	-3.017	-0.638	0.621	-5.589
10-14 Years	-1.892	-1.026	-0.397	-5.517
15-19 Years	-2.980	-1.275	-0.024	-3.696
20-24 Years	-1.439	-0.351	0.009	-4.262
25-29 Years	-0.867	-0.198	-1.563	-5.701
30-34 Years	-1.250	-0.556	-0.364	-10.831
35+ Years	0.953	0.170	-0.259	-6.923

Frequencies of Native Workers

	HSD	HSG	COD	COG
0-4 Years	1699811	1747089	2568101	1205760
5-9 Years	493782	1572094	1510478	1029455
10-14 Years	560227	1739316	1558218	1061619
15-19 Years	463283	1466231	1373750	1074054
20-24 Years	406296	1271200	1009794	682889
25-29 Years	444186	1156162	697105	458789
30-34 Years	516130	1036514	503534	353819
35+ Years	1849255	2074839	749660	432100

Average Wage Change for All Native Workers: -1.216%

South:

Percent Wage Change

	HSD	HSG	COD	COG
0-4 Years	0.454	0.886	1.509	-1.661
5-9 Years	-0.877	0.719	1.353	-2.166
10-14 Years	-0.883	0.542	1.129	-2.214
15-19 Years	-1.691	0.112	0.465	-2.562
20-24 Years	-1.298	0.230	0.360	-3.605
25-29 Years	-0.354	0.362	0.328	-4.203
30-34 Years	-0.068	0.751	0.593	-3.855
35+ Years	0.732	1.032	0.859	-3.331

Frequencies of Native Workers

	HSD	HSG	COD	COG
0-4 Years	2639294	2523550	3310878	1547019
5-9 Years	1049941	2127515	1967069	1437491
10-14 Years	1109047	2163417	1946667	1475323
15-19 Years	1009781	1830687	1739756	1473747
20-24 Years	915866	1601114	1368236	975917
25-29 Years	1000008	1385316	948650	664822
30-34 Years	1014703	1179012	720253	531010
35+ Years	3230962	2218507	1062958	668609

Average Wage Change for All Native Workers: -0.061%

West:

Percent Wage Change

	HSD	HSG	COD	COG
0-4 Years	2.237	0.701	2.588	-1.710
5-9 Years	1.135	0.172	2.302	-2.580
10-14 Years	-0.201	-0.414	1.618	-2.809
15-19 Years	-1.731	-1.329	1.256	-2.604
20-24 Years	-3.570	-1.665	0.667	-3.557
25-29 Years	-3.310	-1.203	0.376	-4.297
30-34 Years	-2.909	-0.601	0.524	-5.390
35+ Years	0.000	-0.095	1.053	-4.396

Frequencies of Native Workers

	HSD	HSG	COD	COG
0-4 Years	1236309	1230987	2129323	897731
5-9 Years	435325	996507	1395735	935780
10-14 Years	428846	1003100	1481194	1008901
15-19 Years	329593	811116	1344504	1057365
20-24 Years	250317	654460	1061610	722692
25-29 Years	255550	592567	721440	490000
30-34 Years	283431	533457	546537	373225
35+ Years	970183	1122283	793827	455239

Average Wage Change for All Native Workers: -0.228%

Appendix D: Wage Results with Different Order of Aggregation

Northeast:

Percent Wage Change

	HSD	HSG	COD	COG
0-4 Years	2.526	0.267	1.093	-0.954
5-9 Years	2.832	0.764	1.737	-2.486
10-14 Years	3.535	0.907	1.982	-3.011
15-19 Years	2.103	-1.622	0.579	-3.046
20-24 Years	4.940	-1.988	0.486	-4.687
25-29 Years	4.142	-1.713	0.214	-5.889
30-34 Years	2.195	-1.673	0.427	-8.030
35+ Years	4.766	0.172	1.087	-3.282

Average Wage Change for All Workers: -0.0334%

Midwest:

Percent Wage Change

	HSD	HSG	COD	COG
0-4 Years	-1.094	-1.561	-0.057	-4.314
5-9 Years	-6.143	-2.116	0.904	-8.973
10-14 Years	-3.259	-2.272	-0.636	-8.736
15-19 Years	-5.654	-2.579	0.726	-4.953
20-24 Years	-2.273	-0.527	1.555	-5.755
25-29 Years	-1.227	-0.217	-1.454	-8.455
30-34 Years	-2.708	-1.453	1.100	-19.231
35 Years +	3.695	1.352	1.358	-8.880

Average Wage Change for All Native Workers: -1.810%

South:

Percent Wage Change

	HSD	HSG	COD	COG
0-4 Years	2.673	1.596	2.895	1.343
5-9 Years	-2.050	1.485	2.092	-1.301
10-14 Years	-1.800	0.386	1.380	-1.557
15-19 Years	-4.853	-1.237	-0.904	-3.445
20-24 Years	-2.408	-0.216	-0.719	-5.345
25-29 Years	-1.141	-0.398	-0.741	-6.809
30-34 Years	1.611	2.029	0.570	-4.754
35+ Years	2.724	3.673	2.799	-1.487

Average Wage Change for All Native Workers: 0.339%

West:

Percent Wage Change

	HSD	HSG	COD	COG
0-4 Years	11.552	4.005	5.019	2.506
5-9 Years	5.397	3.456	6.745	0.106
10-14 Years	1.680	0.449	2.924	-1.379
15-19 Years	-5.856	-4.235	0.369	-2.473
20-24 Years	-9.348	-3.534	-0.958	-4.462
25-29 Years	-9.703	-2.517	-1.292	-6.307
30-34 Years	-6.476	0.990	-0.215	-8.239
35+ Years	1.012	4.411	4.243	-1.685

Average Wage Change for All Native Workers: 1.176%