

# MEASURING IMMIGRATION'S EFFECTS ON LABOR DEMAND:

## A REEXAMINATION OF THE MARIEL BOATLIFT\*

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### Abstract

The 1980 "Mariel Boatlift" of roughly 120,000 Cubans to Miami is one of the most famous natural experiments of exogenous international immigration. Previous researchers have found that the Mariel influx, like comparable cases of exogenous international immigration, had no real adverse long term effects on local wages. One overlooked reason is that the Mariels helped to boost labor demand through their consumption activities. We examine immigration's effects on labor demand by testing a general equilibrium model of a retail economy in which imperfectly substitutable native and immigrant workers spend their wages on a local retail good. According to this model, an exogenous immigrant influx induces three responses: (a) a substitution of immigrant workers for natives; (b) native out-migration; and (c) higher demand for labor due to greater immigrant consumer demand. When the third effect is included, native wages can rise. An important implication is that failure to account for immigration's effects on demand may result in biased estimates of the ceteris paribus effects of exogenous immigration on native labor market outcomes. Wacziarg's "Channel Transmission" methodology is used to test the model. The data set includes approximately 6,600 observations for 1979-85 from the *Current Population Survey* on workers in 9 different retail labor markets and *Survey of Buying Power* data on retail spending by consumers in Miami and four comparison cities. Our results provide a more complete explanation for why the Boatlift's overall effect on native wages in Miami was benign: lower wages due to greater labor supply were exactly offset by higher wages due to greater labor demand.

## I. INTRODUCTION

Much of the literature examining the effects of exogenous (supply-push) immigration on the destination economy's labor market has relied on natural experiments involving extraordinary levels of international immigration. Perhaps the most famous of these natural experiments was the "Mariel Boatlift," the migration of some 120,000 Cuban refugees on a flotilla of privately chartered boats to Miami from May to September, 1980.<sup>1</sup> The arrival of these Cubans was the outcome of an unusual sequence of events that culminated in Fidel Castro's April 20, 1980 declaration that those wishing to migrate to the USA could freely do so from the Port of Mariel, Cuba. Approximately one-half of the Mariels settled permanently in the Miami metropolitan area, resulting in a 7% increase in Miami's labor force. Many who remained in Miami were absorbed by the retail goods and services, textile and apparel manufacturing and construction industries.

While the Mariel influx was very small compared to total immigration to the USA in 1980, Miamians were greatly concerned about the long term effects of the influx. These concerns are reflected in the following quotation from the August 25, 1980, issue of *Business Week* in an article titled "The New Wave of Cubans is Swamping Miami":

"The migration of 120,000 Cubans to the U.S. last Spring was just a passing spectacle for most of the country, but for Miami it is turning into a long-term nightmare. Thousands of the refugees have settled in, pushing unemployment among Florida's Gold Coast to double-digit levels and overwhelming the area's ability to provide shelter and education. These immigrants are also competing for jobs with blacks, Haitians, and union workers in the construction, restaurant, and hotel industries, and this could prolong a festering racial conflict that resulted in four days of riots earlier this year. 'There is no way this community can absorb so many people without serious socioeconomic problems,' says Paul L. Cejas, a member of the Dade County (metropolitan Miami) School Board.'<sup>2</sup>

<sup>1</sup> Some other famous natural experiments of exogenous immigration that have been analyzed include Hunt's (1992) study of the 1962 repatriation of French colonists from Algeria to France, Carrington and de Lima's (1996) study of the repatriation of overseas Portugese following the independence of Portugal's African colonies in 1973, Friedberg's (2001) study of Jewish migration to Israel after the fall of the Soviet Union and Suen's (2000) study of the large influx of Chinese refugees to Hong Kong.

<sup>2</sup> No. 2651, August 25, pp. 86-88.

What actually were the long term effects of the Boatlift on the Miami labor market? In a famous study, Card (1990) used individual micro-data for 1979-85 from the Merged Outgoing Rotation Group (MORG) samples of the Current Population Survey (CPS) to show that the Mariel influx had virtually no effect on the wages or unemployment rates of white, black, non-Cuban Hispanic, earlier Cuban immigrant and all low-skilled workers for the first 5 years following the influx.<sup>3</sup> Card was careful to control for macroeconomic and regional trends by including four comparison labor markets (Tampa, Atlanta, Houston and Los Angeles) in his study. Card's findings generally match those of comparable natural experiments involving exogenous international migration<sup>4</sup> and are also compatible with studies of the wage effects of immigrant clustering in specific localities.<sup>5</sup>

Why did the Mariel Boatlift, as well as other natural experiments of exogenous immigration, not adversely affect the labor market in the destination economy? First, for the case of the Mariel Boatlift, Card (1990) suggested that the influx of Cubans to Miami may have triggered offsetting out-migration from the local labor market, which would have mitigated the influx's depressing effect on wages and unemployment. He also suggested that Miami may have responded to the influx like a traditional Heckscher-Olin open economy in that the unskilled-intensive goods produced by the Mariels were simply exported to product markets outside of Miami.<sup>6</sup> However, Lewis (2004) showed there was no evidence to support this explanation, arguing instead that the

<sup>3</sup> Card did find, though, that the relative earnings of Cubans dropped by a modest amount. He attributed this primarily to a drop in the mean level of skills among Cuban workers following the influx, as most of the Mariels had skill levels on average below those of other Cubans in the Miami labor market.

<sup>4</sup> This evidence is best summarized in Friedberg and Hunt's (1995) widely cited survey, which concludes that supply-push immigration actually has very little effect on wages or unemployment rates in the destination country, even when immigration flows are very large.

<sup>5</sup> For example, in a widely cited study, Card (2001) used 1990 census data for nearly 200 U.S. cities and found that exogenous immigrant inflows during the 1980s had very modest adverse effects on wages of low-skilled natives.

<sup>6</sup> The argument is essentially that the decline in the relative wage of unskilled labor in Miami, brought about by the Boatlift, created profitable opportunities for exporting firms and induced increases in labor demand as industry capacity rose.

Boatlift induced the affected industries to employ more unskilled-intensive production technologies, that is, the incentives of Miami producers to adopt new skill-complementary technologies may have been substantially reduced.<sup>7</sup> The absorption of the Mariels was made even easier, Card argued, by the fact that a large proportion of those working in the affected industries spoke Spanish. Second, Card (2001) and other researchers<sup>8</sup> have suggested that, in general, estimates of immigration's effects on local labor markets can reflect simultaneous equations bias. For example, immigration could be endogenous (demand-pull) if immigrants tend to cluster in areas with thriving economies.<sup>9</sup> Third, as Borjas, Freeman and Katz (1996) and Borjas (2003) point out, immigration could induce flows of other factors of production across the economy. For example, natives may respond to the local wage impact of immigration by moving their factor services to other localities, generating re-equilibration across the national labor market and explaining why inter-city differences in native employment outcomes from immigration tend to be very small.<sup>10</sup>

We offer another explanation for why the Mariel influx did not appear to hurt native workers in Miami, one which could easily apply to other famous natural experiments: Immigrants boost consumer demand, leading to higher demand for native labor and helping to offset any reductions in native wages brought about by greater labor supply. The Mariels were

<sup>7</sup> There is a third related possibility. The Rybczynski theorem from international trade suggests that, in addition to existing firms changing their technology, the influx of immigrants may have stimulated the expansion of those firms that manufacture products requiring a greater proportion of unskilled labor. This argument has not been made previously for the case of the Mariel Boatlift.

<sup>8</sup> See, for example, Borjas, Freeman and Katz (1992,1996).

<sup>9</sup> Most researchers have recognized the possibility of endogenous immigration (as well as out-migration) by the use of instrumental variables [for excellent examples of such studies, cf. Altonji & Card (1991), Card (2001) and Pedace (1998)].

<sup>10</sup> Borjas (2003) got around this problem by redefining the labor market as national, sorting workers into particular skill groups based on educational attainment and work experience, and exploiting substantial differences in immigrant shares across these groups. He found, in stark contrast to previous studies, that immigration has significant adverse effects on natives; a 10 percent increase in immigrant labor supply reduces native wages by 3 to 4 percent.

also new consumers whose purchasing activities stimulated labor demand throughout the economy. One labor market in Miami very likely to have experienced higher demand was the retail market. Even if only a few of the Mariels were employed in retailing, retail labor demand very likely rose due to higher consumption by all the Mariels on groceries, restaurant meals, gasoline, motor vehicles, apparel and home furnishings, etc.<sup>11</sup> The effect of immigration on demand has not been considered for this and other natural experiments involving extraordinary supply-push immigration.

There is strong justification in international trade theory for a local demand effect of international labor migration. Standard theory shows that international migration increases total world output, and thus real income, when factors move from where their marginal products are small to where their marginal products are higher. While family reunification and political sentiments may have motivated many of the Cuban immigrants to go to Miami, they nevertheless moved from a low wage country to a high wage country and, therefore, increased total world output. This income effect by itself will generate some small world demand effect for all factors, including the immigrants' own labor services. But, because many goods and services, such as housing and local government services, are not inter-regionally or internationally tradable, the income/consumption effect of immigrants' increased marginal productivity will be concentrated in the local community where the immigrants work and reside. Because the Mariel immigrants spent a substantial portion of their higher incomes on retail goods and services, and, of course, local taxes to fund local government activities in the Miami metropolitan area, they effectively contributed to their own employment.

<sup>11</sup> The Boatlift may also have induced economies of scale effects. Miami experienced above-average unemployment in the very early 1980s, so the demand effect of immigration may have induced a Keynesian multiplier effect.

Using a natural experiment from the meatpacking industry in rural Nebraska, Bodvarsson and Van den Berg (2003, 2006) estimated the consumer demand effect of immigration and found it to be substantial.<sup>12</sup> That test case, however, differs from the Mariel Boatlift case in three important ways. First, in the Nebraska test case, the labor market was uniquely segmented because all immigrants worked in the export-driven manufacturing sector, but consumed in the retail sector. This allowed Bodvarsson and Van den Berg to statistically separate the labor supply effect of immigration on wages in the manufacturing sector from the labor demand effect of immigration on wages in the retail sector. In contrast, the Miami labor market was not segmented in this manner at the time of the Mariel Boatlift, and many immigrants worked in the markets in which they consumed. Consequently, the estimation of a consumer demand effect is likely to be more complicated for the Mariel Boatlift case. Second, the Bodvarsson and Van den Berg study is not of supply-push immigration, but rather of demand-pull immigration. The immigrants to the Nebraska meatpacking industry were pulled in because of a favorable capital shock in the form of new plants with help-wanted signs on them, while the Mariel Boatlift is a clear case of immigration driven by exogenous changes in Cuba. Third, the Bodvarsson and Van den Berg study treated immigrant and native workers as perfect substitutes. As Chiswick (1978), Lalonde and Topel (1991) and others have suggested, in many cases of international immigration, immigrants and natives are imperfect substitutes because of differences in human capital

<sup>12</sup> Bodvarsson and Van den Berg examined the wage effect of a sudden large inflow of immigrants to Dawson County, Nebraska. In that test case, over 2,500 Hispanic immigrants were hired to work in a newly-built meatpacking plant in the county seat of Lexington in late 1990. They tested a general equilibrium model of this economy on data from Dawson County and 8 comparable counties in the region to show that throughout the 1990s, the Hispanic immigrant influx substantially increased retail wages and housing prices in Dawson County.

endowments. For example, Card (1990) presented evidence strongly suggesting that the Mariels were clearly not perfect substitutes for other Cuban or non-Cuban low-skilled workers.<sup>13</sup>

In this study, we take on the more difficult task of estimating the consumer demand effect of supply-push immigration when natives and immigrants are imperfect substitutes and work and consume in the same market. We have chosen the Mariel Boatlift as our test case, not only because it is such a famous case of exogenous immigration, but also because an explanation of what happened in the Miami labor market in the aftermath of the Boatlift is not yet complete. The current study complements a recent one by Saiz (2003), who examined the response of the Miami rental housing market to the Mariel Boatlift. Saiz found that the Boatlift added an extra 9% to Miami's renter population in 1980 and that rents increased from 8% to 11% more in Miami than in 3 comparison cities between 1979 and 1981.

We use MORG data from the *Current Population Survey*, aggregate retail sales data from the *Survey of Buying Power*, and data from other sources for 1979-85 for Miami and Card's (1990) four comparison cities to test a general equilibrium model of native and immigrant wages. The model is of a retail economy because that is the sector where the Mariels were most likely to have both worked and consumed.<sup>14</sup> We use the theoretical model to show that when natives and

<sup>13</sup> Card used information from the March, 1985 *Mobility Supplement Survey* to suggest that the human capital endowments of the Mariels were different from those of other Cubans. The Mariels had less education, were younger and more likely to be male and had lower labor force attachment and occupational attainment.

<sup>14</sup> Our model is similar in some respects to one by Altonji and Card (1991), who analyzed the wage and employment effects of immigration by including a consumer demand effect. Altonji & Card's theoretical model yielded the prediction that when immigrants consume a larger proportion of what they produce, local wages are less sensitive to immigrant inflows. However, they did not consider the case where natives and immigrants are imperfect substitutes, nor did they carry the demand effects of immigration from their theoretical model over to their econometric model with which they tested for immigration's effect on wages. We should also mention a related study by Hercowitz and Yashiv (2001), who examined the effects of mass immigration from the former Soviet Union to Israel. They found that when immigration is allowed to raise the demand for goods and lower the relative price of imports, this delays any negative employment effect on natives by about a year. However, as with Altonji and Card (1991), Hercowitz and Yashiv did not theoretically or empirically isolate the effects of immigration on Israeli labor demand.

immigrants are imperfect substitutes and consume at least some of their incomes in the sector where they work, immigration is capable of raising native wages.

## **II. A GENERAL EQUILIBRIUM MODEL OF A RETAIL ECONOMY WITH IMMIGRATION**

### *IIA. The demand and supply functions for native and immigrant labor*

What follows is an analysis of a two-sector general equilibrium model of an economy that produces only a retail good. An important feature of the model is that workers in this economy spend their earnings on the retail good which they produce. Suppose that employers are perfectly competitive in the product and labor markets and use two inputs in production – native labor and immigrant labor. For the sake of simplicity, we abstract from physical capital as an input in the production function. The supply of physical capital can be viewed as fixed, so that the wages of natives and immigrants are not affected by changes in the capital stock.

Both types of labor are assumed to be substitute inputs in production, meaning that they perform, and hence compete for, the same type of job. When two inputs are substitutes, the marginal product of one input is negatively related to the employment of the other, hence the demand for one input will be positively related to the market price of the other. If the two inputs are perfect substitutes, employers will hire either only natives or only immigrants, depending on relative wages. However, we want to allow for integration of the labor force, so we will assume that, while natives and immigrants are substitutes, they are only imperfectly so. Imperfect substitutability arises from native/immigrant differences in human capital endowments. For example, the average level of employment experience of workers in the native group may differ from that of workers in the immigrant group. Furthermore, pre-migration employment experience of immigrants may differ from employment experience of natives. There are also

likely to be differences between natives and immigrants in terms of the quantity or quality of education, training and language skills.

To capture the feature of imperfect substitutability, we assume that the employer faces the quadratic production function below:<sup>15</sup>

$$(1) Q = \alpha_1 N - \alpha_2 N^2 + \alpha_3 I - \alpha_4 I^2 - \alpha_5 NI,$$

where Q is output, N is the number of native workers employed, I is the number of immigrant workers employed, and  $\alpha_1$  through  $\alpha_5$  are positive coefficients. Note that the interaction term,  $\alpha_5$ , measures the degree of substitutability between the inputs. The negative sign on  $\alpha_5$  means that an increase in the employment of labor in one category reduces the marginal product of labor employed in the other category. For example, the larger is  $\alpha_5$ , the larger will be the decrease in the marginal product of native (immigrant) labor as a consequence of a unit increase in employment of immigrant (native) labor.

Assume that the market price of the retail good is P, which for now is assumed to be exogenous (this assumption will be relaxed later), that each immigrant worker is paid a wage of  $W_I$  and each native worker is paid a wage of  $W_N$ . The employer's profits,  $\pi$ , are thus:

$$(2) \pi = P [\alpha_1 N - \alpha_2 N^2 + \alpha_3 I - \alpha_4 I^2 - \alpha_5 NI] - W_N N - W_I I.$$

First and second order conditions yield the following demand functions for immigrant and native labor,  $I^D$  and  $N^D$ , respectively:

<sup>15</sup> An example of this production function is found in Doll and Orazem (1984, pp. 128-29), who use the example of hay and grain as competitive inputs in the production of milk. Frisch (1965, pp. 59) also discusses the case of a quadratic production function in which the interaction term between two inputs is negative. Bodvarsson and Partridge (2001) use a similar equation in a study of black/white salary differentials in the National Basketball Association. In that study, black and white players are treated as imperfect substitutes for the same reason that we treat immigrants and natives as imperfect substitutes in the present model, namely, due to differences in human capital endowments.

$$(3) I^D = \frac{\frac{1}{\alpha_5}(\alpha_3 - \frac{W_I}{P}) + \frac{1}{2\alpha_2}(\frac{W_N}{P} - \alpha_1)}{\frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}},$$

$$(4) N^D = \frac{\frac{1}{\alpha_5}(\alpha_1 - \frac{W_N}{P}) + \frac{1}{2\alpha_4}(\frac{W_I}{P} - \alpha_3)}{\frac{2\alpha_2}{\alpha_5} - \frac{\alpha_5}{2\alpha_4}}.$$

Note that in both demand functions the employment of one input and the price of the other are positively related.

A common assumption in previous studies is perfect inelasticity of immigrant labor supply. This is appropriate when examining immigrant supply to the entire labor market in the receiving country.<sup>16</sup> However, since we are studying immigration to one particular industry, it is very likely that immigrant retail workers will have employment opportunities in other industries, hence the wage elasticity of immigrant labor supply to the retail sector should be relatively high. We assume accordingly that the supply of immigrants to the retail sector,  $\theta_I$ , depends upon the real wage ( $W_I/P$ ), a real reservation wage,  $V_I$ , and other factors influencing the decision to migrate:

$$(5) \theta_I = \left(\frac{i}{V_I}\right)\left(\frac{W_I}{P}\right).$$

Expression (5) has three important features. First, the real wage ( $\frac{W_I}{P}$ ) is the nominal retail wage adjusted by *retail* product price. This is because immigrant workers are assumed to spend their earnings on what they produce and their living costs are thus equivalent to the costs of those

<sup>16</sup> It is plausible that international migrants who migrate for non-economic reasons will have zero reservation wages, but those who come in response to real income differentials clearly will not. It is likely that the assumption of perfect inelasticity has been made more for expositional simplicity than for other reasons.

goods and services. Second, expression (5) allows for both supply-push and demand-pull immigration. In this model, supply-push immigration is reflected in a rightward rotation of the labor supply curve<sup>17</sup> Supply-push immigration could be due to a lower immigrant reservation wage ( $V_I$ ) or other exogenous factors, the latter reflected by an increase in the “i” parameter in expression (5). These other exogenous factors could include changes in social and political conditions in the source country, changes in the receiving country’s immigration policies with respect to family reunification and the admission of refugees, or increased “migrant network effects” generated by growth in the receiving country’s community of migrants that hail from the destination country. Demand-pull immigration, in contrast, is a movement up the immigrant labor supply curve, induced by strengthened economic conditions in the receiving country (an increase in  $(\frac{W_I}{P})$ ). Suppose, for example, that there is an increase in consumer demand for the retail good. There will then be higher derived demand for labor and a higher nominal retail wage. If the nominal wage rises proportionately more than product price, new migrants will be pulled into the retail sector.

The supply of native labor is also assumed to depend upon the real retail wage and a real reservation wage  $V_N$ :

$$(6) \theta_N = \left(\frac{n}{V_N}\right)\left(\frac{W_N}{P}\right)$$

<sup>17</sup> It is customary to think of supply-push immigration as involving a shift in the labor supply curve rather than a rotation. The only difference between the two situations is that in the former, the labor supply curve does not come out of the origin, whereas in the latter it does. We chose not to include an intercept purely for expositional simplicity.

There are assumed to be  $H$  employers of natives and immigrants. When the native retail labor market is in equilibrium,  $HN^D = \theta_N$  and when the market for immigrant workers is in equilibrium,  $HI^D = \theta_I$ .

### IIB. Wages in partial equilibrium

The next step in our analysis is to derive expressions describing the partial equilibrium nominal wages for native and immigrant retail labor. Our approach will be to solve for  $W_N$  and  $W_I$  from the above supply and demand expressions. These will be partial equilibrium wages because, for now, retail price is assumed to be exogenous to immigration. We begin by deriving the partial equilibrium native nominal wage. First, multiply equation (3) by  $H$ , set that equal to the supply of immigrants (5) and solve for the immigrant wage:

$$(7) \quad W_I = \frac{\frac{HP}{\varepsilon} \left( \frac{\alpha_3}{\alpha_5} + \frac{W_N}{2\alpha_2 P} - \frac{\alpha_1}{2\alpha_2} \right)}{\left( \frac{H}{\varepsilon\alpha_5} + \frac{i}{V_I} \right)},$$

$$\text{where } \varepsilon = \frac{2\alpha_4}{\alpha_5} - \frac{\alpha_5}{2\alpha_2}.$$

Now multiply equation (4) by  $H$ , set that equal to the supply of natives (6) and solve for the immigrant wage:

$$(8) \quad W_I = 2\alpha_4 \left( \frac{\phi n W_N}{V_N H} - \frac{P}{\alpha_5} \left( \alpha_1 - \frac{W_N}{P} \right) \right) + \alpha_3 P,$$

$$\text{where } \phi = \frac{2\alpha_2}{\alpha_5} - \frac{\alpha_5}{2\alpha_4}.$$

Now equate (7) and (8) and solve for  $W_N$ . This yields the partial equilibrium native worker wage:

$$(9) W_N = \frac{P\left[\left(\frac{H}{\varepsilon\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)}\right)\left(\frac{\alpha_3}{\alpha_5} - \frac{\alpha_1}{2\alpha_2}\right) + \frac{2\alpha_1\alpha_4}{\alpha_5} - \alpha_3\right]}{2\alpha_4\left(\frac{1}{\alpha_5} + \left(\frac{n}{V_N}\right)\left(\frac{\phi}{H}\right)\right) - \left(\frac{H}{2\varepsilon\alpha_2\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)}\right)}$$

If  $\alpha_5$  is positive and not too high<sup>18</sup>, then  $\frac{\alpha_3}{\alpha_5} > \frac{\alpha_1}{2\alpha_2}$ ,  $\frac{2\alpha_1\alpha_4}{\alpha_5} > \alpha_3$  and the numerator in expression

(9) will be positive. The denominator will be positive if  $2\alpha_4\left(\frac{1}{\alpha_5} + \left(\frac{n}{V_N}\right)\left(\frac{\phi}{H}\right)\right) > \left(\frac{H}{2\varepsilon\alpha_2\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)}\right)$ . In

the analysis that follows, it is assumed that these very reasonable restrictions are in effect.

Differentiating equation (9) with respect to the immigrant reservation wage ( $V_I$ ), we find that a lower reservation wage, by inducing supply-push immigration, will result in a lower equilibrium native wage:

$$(10) \frac{\partial W_N}{\partial V_I} = P \left[ \frac{\left[\left(\frac{H}{\varepsilon^2\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)^2}\right)\left(\frac{\alpha_3}{\alpha_5} - \frac{\alpha_1}{2\alpha_2}\right)\left(\frac{i\varepsilon}{V_I^2}\right)\right]}{2\alpha_4\left(\frac{1}{\alpha_5} + \left(\frac{n}{V_N}\right)\left(\frac{\phi}{H}\right)\right) - \left(\frac{H}{2\varepsilon\alpha_2\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)}\right)} + \frac{\left[\left(\frac{H}{\varepsilon\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)}\right)\left(\frac{\alpha_3}{\alpha_5} - \frac{\alpha_1}{2\alpha_2}\right) + \frac{2\alpha_1\alpha_4}{\alpha_5} - \alpha_3\right] \frac{\frac{iH}{V_I^2}}{2\alpha_2\varepsilon\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)^2}}{\left[2\alpha_4\left(\frac{1}{\alpha_5} + \left(\frac{n}{V_N}\right)\left(\frac{\phi}{H}\right)\right) - \left(\frac{H}{2\varepsilon\alpha_2\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)}\right)\right]^2} \right] > 0,$$

Now differentiating equation (9) with respect to the  $i$  parameter in the immigrant labor supply function, we find that supply-push immigration induced by some factor other than a lower immigrant reservation wage will lower the native wage:

<sup>18</sup> If this parameter were very high,  $Q < 0$ .

$$(11) \frac{\partial W_N}{\partial i} = (-)P \left[ \frac{\left[ \left( \frac{H}{\varepsilon^2 \left( \frac{H}{\varepsilon \alpha_5} + \frac{i}{V_I} \right)^2} \right) \left( \frac{\alpha_3}{\alpha_5} - \frac{\alpha_1}{2\alpha_2} \right) \left( \frac{\varepsilon}{V_I} \right) \right]}{2\alpha_4 \left( \frac{1}{\alpha_5} + \left( \frac{n}{V_N} \right) \left( \frac{\phi}{H} \right) \right) - \left( \frac{H}{2\varepsilon\alpha_2 \left( \frac{H}{\varepsilon\alpha_5} + \frac{i}{V_I} \right)} \right)} + \frac{\left[ \left( \frac{H}{\varepsilon \left( \frac{H}{\varepsilon \alpha_5} + \frac{i}{V_I} \right)} \right) \left( \frac{\alpha_3}{\alpha_5} - \frac{\alpha_1}{2\alpha_2} \right) + \frac{2\alpha_1\alpha_4}{\alpha_5} - \alpha_3 \right] \frac{\frac{H}{V_I}}{2\alpha_2\varepsilon \left( \frac{H}{\varepsilon\alpha_5} + \frac{i}{V_I} \right)^2}}{\left[ 2\alpha_4 \left( \frac{1}{\alpha_5} + \left( \frac{n}{V_N} \right) \left( \frac{\phi}{H} \right) \right) - \left( \frac{H}{2\varepsilon\alpha_2 \left( \frac{H}{\varepsilon\alpha_5} + \frac{i}{V_I} \right)} \right) \right]^2} \right] < 0.$$

For example, an increase in the number of refugee arrivals (manifested by an increase in  $i$ ) will lead to a lower native wage, all other things equal. Expressions (10) and (11) illustrate the traditional effect of immigration on the native wage, which we will call the “input substitution effect”. According to this effect, greater immigrant labor supply reduces the immigrant wage and induces employers to substitute immigrants for natives. This leads to a leftward shift of the demand curve for native labor and a lower native wage.

We now derive the partial equilibrium immigrant nominal wage. Solve first for the native wage from the condition for equilibrium in the immigrant labor market:

$$(12) W_N = \frac{\left( \frac{i}{V_I} \right) \left( \frac{W_I}{P} \right) + \frac{H}{\varepsilon} \left( \frac{\alpha_1}{2\alpha_2} - \frac{1}{\alpha_5} \left( \alpha_3 - \frac{W_I}{P} \right) \right)}{\frac{H}{2\varepsilon\alpha_2 P}}$$

Then solve for the native wage from the condition for equilibrium in the native labor market:

$$(13) W_N = \frac{P \left[ \frac{H}{\phi} \left( \frac{\alpha_1}{\alpha_5} + \frac{1}{2\alpha_4} \left( \frac{W_I}{P} - \alpha_3 \right) \right) \right]}{\left( \frac{H}{\alpha_5 \phi} + \frac{n}{V_N} \right)}$$

Equating expressions (12) and (13) and solving for the immigrant wage, the immigrant wage in partial equilibrium is

$$(14) W_I = \frac{P \left[ \frac{H}{\phi \left( \frac{H}{\alpha_5 \phi} + \frac{n}{V_N} \right)} \left( \frac{\alpha_1}{\alpha_5} - \frac{\alpha_3}{2\alpha_4} \right) - \frac{H}{\varepsilon \left( \frac{H}{2\varepsilon\alpha_2} \right)} \left( \frac{\alpha_1}{2\alpha_2} - \frac{\alpha_3}{\alpha_5} \right) \right]}{\frac{i}{V_I \left( \frac{H}{2\varepsilon\alpha_2} \right)} + H \left( \frac{1}{\varepsilon\alpha_5 \left( \frac{H}{2\varepsilon\alpha_2} \right)} - \frac{1}{2\phi\alpha_4 \left( \frac{H}{\alpha_5\phi} + \frac{n}{V_N} \right)} \right)}$$

As with the native wage, supply-push immigration depresses the immigrant wage:

$$(15) \frac{\partial W_I}{\partial V_I} = \frac{P \left[ \frac{H}{\phi \left( \frac{H}{\alpha_5 \phi} + \frac{n}{V_N} \right)} \left( \frac{\alpha_1}{\alpha_5} - \frac{\alpha_3}{2\alpha_4} \right) - \frac{H}{\varepsilon \left( \frac{H}{2\varepsilon\alpha_2} \right)} \left( \frac{\alpha_1}{2\alpha_2} - \frac{\alpha_3}{\alpha_5} \right) \right] \left( \frac{i}{V_I^2 \left( \frac{H}{2\varepsilon\alpha_2} \right)} \right)}{\left[ \frac{i}{V_I \left( \frac{H}{2\varepsilon\alpha_2} \right)} + H \left( \frac{1}{\varepsilon\alpha_5 \left( \frac{H}{2\varepsilon\alpha_2} \right)} - \frac{1}{2\phi\alpha_4 \left( \frac{H}{\alpha_5\phi} + \frac{n}{V_N} \right)} \right) \right]^2} > 0,$$

$$(16) \frac{\partial W_I}{\partial i} = (-) \frac{P \left[ \frac{H}{\phi \left( \frac{H}{\alpha_5 \phi} + \frac{n}{V_N} \right)} \left( \frac{\alpha_1}{\alpha_5} - \frac{\alpha_3}{2\alpha_4} \right) - \frac{H}{\varepsilon \left( \frac{H}{2\varepsilon\alpha_2} \right)} \left( \frac{\alpha_1}{2\alpha_2} - \frac{\alpha_3}{\alpha_5} \right) \right] \left( \frac{1}{V_I \left( \frac{H}{2\varepsilon\alpha_2} \right)} \right)}{\left[ \frac{i}{V_I \left( \frac{H}{2\varepsilon\alpha_2} \right)} + H \left( \frac{1}{\varepsilon\alpha_5 \left( \frac{H}{2\varepsilon\alpha_2} \right)} - \frac{1}{2\phi\alpha_4 \left( \frac{H}{\alpha_5\phi} + \frac{n}{V_N} \right)} \right) \right]^2} < 0.$$

According to equations (15) and (16), increased immigration creates more competition for jobs between immigrants and the market wage for immigrant labor drops.

Equations (9) and (14) together imply that in partial equilibrium, the nominal market wage for each class of labor will depend on consumer demand (P), industry size (H), reservation wages ( $V_N$  and  $V_I$ ), other factors driving supply-push immigration (i), factors influencing native labor supply other than the native reservation wage and cost of living (n), the degree of substitutability ( $\alpha_5$ ) and the other parameters in the production function ( $\alpha_1$  through  $\alpha_4$ ).

### IIC. *Measuring the effects of immigration on consumer demand*

If retail consumer demand is not influenced by inflows and outflows of immigrant workers, then the derived demands for native and immigrant retail labor will not be endogenous to immigration. In that case, expressions (10), (11), (15) and (16) will accurately measure the *ceteris paribus* effects of exogenous immigration on wages. As previous research (Bodvarsson and Van den Berg (2003, 2006)) has demonstrated, however, the derived demand for labor is likely to be endogenous to immigration. If immigrant workers consume the goods they produce, then changes in the supply of immigrant labor will ultimately induce changes in retail price and the derived demand for labor. When labor demand is endogenous to immigration, then immigration exerts a “consumer demand effect” on wages. Accordingly, the next step in our analysis is to allow for retail product price to be endogenous to immigrant labor supply and to derive expressions for general equilibrium wages. These expressions will allow us to separate the traditional input substitution effect from the consumer demand effect.

Suppose retail product demand  $Q_{DR}$  depends linearly upon aggregate consumer income  $Y$  (we assume the good is normal) and retail product price  $P$ :

$$(17) Q_{DR} = \psi_1 Y - \psi_2 P ,$$

Retail product supply  $Q_{SR}$  depends linearly upon price and the two wages:

$$(18) Q_{SR} = \delta_1 P - \delta_2 W_N - \delta_3 W_I.$$

Retail consumers include native and immigrant retail workers and their incomes include wages and distributed retail profits. Native workers spend all their incomes locally, but

immigrants remit a fraction of their incomes elsewhere. Assume that immigrants spend a fraction  $k$  ( $k < 1$ ) locally.<sup>19</sup> Total retail income spent locally is thus:

$$(19) Y = W_N\theta_N + kW_I\theta_I + \lambda,$$

where  $\lambda$  is distributed retail profits. When (19) is substituted into (17), we see that retail product demand depends on each worker group's wage and size:

$$(20) Q_{DR} = \psi_1(W_N\theta_N + kW_I\theta_I + \lambda) - \psi_2P.$$

Expression (20) illustrates the linkage between the retail product and labor markets; retail product demand depends on the retail wage.

Now set (18) equal to (20) and solve for  $P$ . Equilibrium retail price ( $P^*$ ) is:

$$(21) P^* = \frac{W_N^*(\psi_1\theta_N^* + \delta_2) + W_I^*(k\theta_I^* + \delta_3) + \psi_1\lambda}{\psi_2 + \delta_1},$$

where  $\theta_N^* = \frac{nW_N^*}{V_N P}$  and  $\theta_I^* = \frac{iW_I^*}{V_I P}$ ,  $W_N^*$  and  $W_I^*$  are the partial equilibrium wages derived

above,  $\theta_N^*$  is native employment when the native wage is  $W_N^*$  and  $\theta_I^*$  is immigrant employment when the immigrant wage is  $W_I^*$ . Expression (21) illustrates the linkage between retail prices and labor supply. It is not a closed form expression, though, since the right-hand side variables are equilibrium expressions and are themselves endogenous to product price. However, for illustrative purposes the expression allows one to distinguish between the different effects of exogenous immigration on retail prices. Recall that exogenous immigration can occur if the immigrant reservation wage ( $V_I$ ) falls or for other reasons ( $i$  rises). Differentiating expression (21) with respect to each of these parameters, the marginal effects of exogenous immigration on retail price are:

<sup>19</sup> Although there are legal restrictions on sending money to Cuba, it is widely recognized that Cuban immigrants do send money back to relatives there.

$$(22) \frac{\partial P^*}{\partial V_I} = \frac{\frac{\partial W_N^*}{\partial V_I}(\psi_1 \theta_N^* + \delta_2) + \frac{\partial \theta_N^*}{\partial V_I}(\psi_1 W_N^*) + \frac{\partial W_I^*}{\partial V_I}(k\theta_I^* + \delta_3) + \frac{\partial \theta_I^*}{\partial V_I}(kW_I^*)}{\psi_2 + \delta_1},$$

$$(23) \frac{\partial P^*}{\partial i} = \frac{\frac{\partial W_N^*}{\partial i}(\psi_1 \theta_N^* + \delta_2) + \frac{\partial \theta_N^*}{\partial i}(\psi_1 W_N^*) + \frac{\partial W_I^*}{\partial i}(k\theta_I^* + \delta_3) + \frac{\partial \theta_I^*}{\partial i}(kW_I^*)}{\psi_2 + \delta_1}.$$

Expression (22) measures the marginal effect of immigration on product price when immigration is induced by a fall in the immigrant reservation wage. Expression (23) measures the marginal effect of immigration on product price when immigration is induced by other exogenous factors. According to the first two terms in the numerators of expressions (22) and (23), retail price falls because immigration depresses native consumer demand for the retail product. That group's demand falls because: (a) each native retail consumer's income falls ( $\frac{\partial W_N^*}{\partial V_I} > 0$ ); and (b) there will be some out-migration of native retail consumers ( $\frac{\partial \theta_N^*}{\partial V_I} > 0$ ). The next two terms measure the change in price attributable to changes in retail immigrant demand. According to the third term, retail price falls because each immigrant retail consumer has less money to spend ( $\frac{\partial W_I^*}{\partial V_I} > 0$ ). According to the fourth term, however, price *rises* because there are now more immigrant retail consumers ( $\frac{\partial \theta_I^*}{\partial V_I} < 0$ ). Therefore, immigration will result in a net increase (decrease) in price if the gain in demand due to more immigrant consumers outweighs (falls below) the loss in demand due to lower native and immigrant wages and out-migration of natives.

A general equilibrium expression for price may be obtained by replacing the four endogenous right-hand side variables in expression (21) with closed form expressions. First, replace  $W_N^*$  with the right-hand side of expression (9), then replace  $W_I^*$  with the right-hand side

of expression (14). Then, since  $\theta_N^* = \frac{nW_N^*}{V_N P}$ , replace  $W_N^*$  in that expression with the right-hand

side of expression (9). Finally, since  $\theta_I^* = \frac{iW_I^*}{V_I P}$ , replace  $W_I^*$  in that expression with the right-

hand side of expression (14). After doing these substitutions and some simplifying, we obtain:

$$(24) P^* = \frac{\left(\frac{\psi_1 n A^2}{V_N}\right) P^* + (\delta_2 A) P^* + \left(\frac{kiB^2}{V_I}\right) P^* + (\delta_3 B) P^* + \psi_1 \lambda}{\psi_2 + \delta_1},$$

$$\text{where } A = \frac{\left[\left(\frac{H}{\varepsilon\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)}\right)\left(\frac{\alpha_3}{\alpha_5} - \frac{\alpha_1}{2\alpha_2}\right) + \frac{2\alpha_1\alpha_4}{\alpha_5} - \alpha_3\right]}{2\alpha_4\left(\frac{1}{\alpha_5} + \left(\frac{n}{V_N}\right)\left(\frac{\phi}{H}\right)\right) - \left(\frac{H}{2\varepsilon\alpha_2\left(\frac{H}{\alpha_5} + \frac{i}{V_I}\right)}\right)} \text{ and}$$

$$B = \frac{\left[\frac{H}{\phi\left(\frac{H}{\alpha_5\phi} + \frac{n}{V_N}\right)}\left(\frac{\alpha_1}{\alpha_5} - \frac{\alpha_3}{2\alpha_4}\right) - \frac{H}{\varepsilon\left(\frac{H}{2\varepsilon\alpha_2}\right)}\left(\frac{\alpha_1}{2\alpha_2} - \frac{\alpha_3}{\alpha_5}\right)\right]}{\frac{i}{V_I\left(\frac{H}{2\varepsilon\alpha_2}\right)} + H\left(\frac{1}{\varepsilon\alpha_5\left(\frac{H}{2\varepsilon\alpha_2}\right)} - \frac{1}{2\phi\alpha_4\left(\frac{H}{\alpha_5\phi} + \frac{n}{V_N}\right)}\right)}$$

The general equilibrium price is obtained by solving (24) for price:

$$(25) P^* = \frac{\frac{\psi_1 \lambda}{\psi_2 + \delta_1}}{\left[1 - \left(\frac{\left(\frac{\psi_1 n A^2}{V_N}\right) + \delta_2 A + \left(\frac{kiB^2}{V_I}\right) + (\delta_3 B)}{\psi_2 + \delta_1}\right)\right]}$$

Now that we have a closed form solution for price in expression (25), we will use that expression to measure the marginal effect of immigration on retail price. Differentiating expression (25) with respect to the immigrant reservation wage and the  $i$  parameter, we obtain:

$$(26) \frac{\partial P^*}{\partial V_I} = \frac{\left(\frac{\psi_1 \lambda}{(\psi_2 + \delta_1)^2}\right) \left[ \frac{\partial A}{\partial V_I} \frac{2\psi_1 nA}{V_N} + \frac{\partial A}{\partial V_I} \delta_2 + \frac{\partial B}{\partial V_I} \left(\frac{2kBi}{V_I} + \delta_3\right) - \frac{\partial B}{\partial V_I} \frac{kB^2 i}{V_I^2} \right]}{\left[ 1 - \left( \frac{\frac{\psi_1 nA^2}{V_N} + (\delta_2 A) + \left(\frac{kBiB^2}{V_I}\right) + (\delta_3 B)}{\psi_2 + \delta_1} \right) \right]^2},$$

$$(27) \frac{\partial P^*}{\partial i} = \frac{\left(\frac{\psi_1 \lambda}{(\psi_2 + \delta_1)^2}\right) \left[ \frac{\partial A}{\partial V_I} \frac{2\psi_1 nA}{V_N} + \frac{\partial A}{\partial V_I} \delta_2 + \frac{\partial B}{\partial V_I} \left(\frac{2kBi}{V_I} + \delta_3\right) - \frac{kB^2}{V_I} \right]}{\left[ 1 - \left( \frac{\frac{\psi_1 nA^2}{V_N} + (\delta_2 A) + \left(\frac{kBiB^2}{V_I}\right) + (\delta_3 B)}{\psi_2 + \delta_1} \right) \right]^2}.$$

Expression (26) is the reduced form equivalent to expression (22). Note the four terms comprising the bracketed expression in expression (26)'s numerator; these four terms are equivalent to the four terms comprising expression (22)'s numerator. According to the expression in brackets in equation (26)'s numerator, a reduction in the immigrant reservation wage induces four effects on retail price, the first three effects contributing to a reduction in price (the out-migration of native retail consumers, the drop in each native retail consumer's income and the drop in each immigrant retail consumer's income, respectively) and the last effect contributing to an increase in price (an increase in the number of immigrant retail consumers). As we saw with expression (22), the net effect of exogenous immigration on retail price can be positive, negative or neutral. Expression (27) is the reduced form equivalent to expression (23). The four terms comprising the bracketed expression in the numerator are equivalent to the four terms comprising expression (23)'s numerator. If exogenous immigration occurs for reasons other than a reduction in  $V_I$ , the net effect on retail price will be positive (negative) if the gain in consumer demand from more immigrant consumers is greater (lesser) than the loss in demand due to lower wages and fewer native consumers.

### IID. Wages in general equilibrium

The final step in our analysis is to derive expressions for native and immigrant wages where those wages account for the endogeneity of retail product price. The general equilibrium native wage may be obtained by substituting expression (25) into expression (9):

$$(28) \quad W_N = \frac{\left[ \frac{\frac{\psi_1 \lambda}{\psi_2 + \delta_1}}{\left( \frac{\psi_1 n A^2}{V_N} \right) + (\delta_2 A) + \left( \frac{kiB^2}{V_I} \right) + (\delta_3 B)} \right] \left[ \left( \frac{H}{\varepsilon \alpha_5} + \frac{i}{V_I} \right) \left( \frac{\alpha_3}{\alpha_5} - \frac{\alpha_1}{2\alpha_2} \right) + \frac{2\alpha_1 \alpha_4}{\alpha_5} - \alpha_3 \right]}{2\alpha_4 \left( \frac{1}{\alpha_5} + \left( \frac{n}{V_N} \right) \left( \frac{\phi}{H} \right) \right) - \left( \frac{H}{2\varepsilon \alpha_2} \left( \frac{H}{\varepsilon \alpha_5} + \frac{i}{V_I} \right) \right)},$$

and the general equilibrium immigrant wage may be obtained by substituting expression (25) into expression (14):

$$(29) \quad W_I = \frac{\left[ \frac{\frac{\psi_1 \lambda}{\psi_2 + \delta_1}}{\left( \frac{\psi_1 n A^2}{V_N} \right) + (\delta_2 A) + \left( \frac{kiB^2}{V_I} \right) + (\delta_3 B)} \right] \left[ \frac{H}{\phi \left( \frac{H}{\alpha_5 \phi} + \frac{n}{V_N} \right)} \left( \frac{\alpha_1}{\alpha_5} - \frac{\alpha_3}{2\alpha_4} \right) - \frac{H}{\varepsilon \left( \frac{H}{2\varepsilon \alpha_2} \right)} \left( \frac{\alpha_1}{2\alpha_2} - \frac{\alpha_3}{\alpha_5} \right) \right]}{\frac{i}{V_I \left( \frac{H}{2\varepsilon \alpha_2} \right)} + H \left( \frac{1}{\varepsilon \alpha_5 \left( \frac{H}{2\varepsilon \alpha_2} \right)} - \frac{1}{2\phi \alpha_4 \left( \frac{H}{\alpha_5 \phi} + \frac{n}{V_N} \right)} \right)}.$$

Note that expression (28) is equivalent to (P\*)(A) and expression (29) is equivalent to (P\*)(B), where P\* is retail product price in general equilibrium (expression (25)).

Focusing now on the native wage, expression (28) has one extremely convenient feature: it is very easy to separate the input substitution effect from the consumer demand effect of supply-push immigration on the wage. Differentiating expression (28) with respect to the immigrant reservation wage, we find that:

$$(30) \frac{\partial W_N}{\partial V_I} = \frac{\partial P^*}{\partial V_I} A + P^* \frac{\partial A}{\partial V_I} .$$

Doing the same for the  $i$  parameter in the immigrant labor supply function, we find that:

$$(31) \frac{\partial W_N}{\partial i} = \frac{\partial P^*}{\partial i} A + P^* \frac{\partial A}{\partial i} .$$

For each of equations (30) and (31), in general equilibrium the ceteris paribus effect of a change in immigrant labor supply on the native wage is simply the sum of the consumer demand effect (the first term on the right hand side of each equation) and the input substitution effect (the second term on the right hand side of each equation). The consumer demand effect is the change in the native wage that occurs when an inflow of immigrants induce a change in the MRP of native labor. As noted above, this effect can be positive, negative or neutral. The input substitution effect is the change in the native wage that occurs when an inflow of immigrants induce a substitution of immigrant hires for native hires. This effect is always negative when natives and immigrants are substitutes. Therefore, in general equilibrium the native wage will rise from immigration if the consumer demand effect is sufficiently positive and the input substitution effect is relatively small. On the other hand, the native wage will always fall if the consumer demand effect is negative.

What factors in the labor and product markets are likely to result in higher native wages when there are new migrants? Assuming that the migrant inflow is driven by weakened economic conditions in the source country, one factor is a positive and relatively large consumer demand effect (the  $-\frac{\partial B}{\partial V_I} \frac{kB^2i}{V_I^2}$  term in expression (26) is relatively large). This will tend to occur if: (a) the supply of immigrant labor is relatively elastic with respect to either the immigrant reservation wage or other exogenous factors; (b) the wage elasticity of demand for immigrant

labor is relatively high (immigrant retail spending power does not drop by much if there is an increase in immigrant labor supply); or (c) the wage elasticity of supply for native labor is relatively high (native out-migration and the drop in the native wage would not be high). Another factor is a relatively small input substitution effect. The input substitution effect will be relatively small if the wage elasticity of demand for immigrant labor and the wage elasticity of supply for native labor are relatively high.

Exogenous immigration will, in general equilibrium, induce two effects on the immigrant wage:

$$(32) \frac{\partial W_1}{\partial V_1} = \frac{\partial P^*}{\partial V_1} B + P^* \frac{\partial B}{\partial V_1}$$

$$(33) \frac{\partial W_1}{\partial i} = \frac{\partial P^*}{\partial i} B + P^* \frac{\partial B}{\partial i}$$

First, there will be the consumer demand effect, which is measured by the first terms on the right-hand side of expressions (32) and (33). The demand curve for immigrant labor shifts because, working through the product demand channel, immigration alters the MRP of immigrant labor. This effect can be positive, negative or neutral. Immigration also reduces the immigrant wage because of greater competition among immigrants. This is measured by the second term on the right-hand side of each of the two expressions above. The wage can rise from immigration provided that the consumer demand effect is positive and sufficiently large.

### III.E. *Could previous estimates of immigration's wage effect be biased?*

The model above implies that when product price is endogenous to immigration, expressions (10) and (11) will be biased measures of the *ceteris paribus* effects of immigration on the native wage. Suppose product price is endogenous and a researcher uses expressions (10) or (11) to

obtain an estimate of the complete effect of immigration on the native wage. What will be the magnitude of the estimation bias? The amount of bias ( $\Omega$ ) will equal precisely the difference between the partial and general equilibrium marginal effects of immigration on the wage. If supply-push immigration is triggered by a drop in the immigrant reservation wage, then the amount of bias will equal expression (10) less expression (30):

$$(34) \Omega = P^* \frac{\partial A}{\partial V_I} - \left( \frac{\partial P^*}{\partial V_I} A + P^* \frac{\partial A}{\partial V_I} \right) = \frac{\partial P^*}{\partial V_I} A.$$

The estimation bias depends on the size and sign of the consumer demand effect. If immigration pushes up retail prices ( $\frac{\partial P^*}{\partial V_I} > 0$ ), then expression (10) will be a negatively biased measure, meaning that it overstates the size of immigration's negative marginal effect on the native wage.<sup>20</sup> In contrast, if immigration leads to lower retail prices, then expression (10) will be positively biased. The magnitude of bias is determined in part by the size of  $\frac{\partial P^*}{\partial V_I}$ . Consequently, failure to control for the consumer demand effect can seriously bias estimates of the *ceteris paribus* effect of exogenous immigration on native labor market outcomes.

### III. A TEST OF THE MODEL

#### IIIA. *The Wacziarg Model of Channel Effects*

If a researcher were interested in estimating how immigration affects the native wage, all other things equal, he/she could estimate a form of the following regression equation:

$$(35) W_N = a_0 + a_1(\theta_I) + a_2(Z) + u,$$

<sup>20</sup> For example, suppose according to expression (10) that the addition of one immigrant to the economy causes the native wage to fall by 1%, but according to expression (30) the fall is only 0.5%. Then, the amount of bias is -0.5%, meaning that expression (10) overstates the negative effect of immigration by 0.5%.

where  $Z$  is a vector of other explanatory variables that also influence the labor market outcome (that must be included to avoid omitted variable bias) and  $u$  is a disturbance term. The problem is that if there are multiple mechanisms through which immigration affects the native wage, equation (35) precludes the researcher from being able to empirically distinguish between the contribution of each mechanism; the coefficient  $a_1$  is only an estimate of the overall effect of immigration on the wage. Consequently, equation (35) is not useful in empirically distinguishing between the input substitution and consumer demand effects discussed above.

The goals of the empirical analysis below are to: (1) obtain an accurate estimate of the consumer demand effect on native wages resulting from the Mariel influx; and (2) determine the proportionate contribution of the consumer demand effect to the estimated overall effect of immigration on the native wage. To achieve these goals, we apply an econometric methodology due originally to Wacziarg (1998, 2001) and Tavares and Wacziarg (2001) that is very compatible with our theoretical model.<sup>21</sup> This methodology allows for the estimation of a simultaneous equations regression model in which an independent variable affects the dependent variable through different *channels*, to use Wacziarg's exact terminology. The model includes: (1) separate *channel equations*, each describing the hypothesized process by which the fundamental causal variable influences the dependent variable; and (2) an *aggregate equation* that explains the dependent variable and includes, among other determinants, each of the channel variables as explanatory variables. The overall effect of the fundamental causal variable on the dependent variable is the sum of the effects from each of the channels.

<sup>21</sup> This methodology is based on three-stage least squares (3SLS), pioneered by Zellner and Theil (1962) and described more broadly in Theil (1971). The 3SLS method is asymptotically efficient and superior to other full-information methods when the covariance matrix is not known and the sample is large.

In our adaptation of Wacziarg's methodology, the dependent variable is the native wage and the two channel equations describe each of the input substitution and consumer demand effects. The stock of immigrants appears as an explanatory variable in each of the channel equations, but not in the aggregate equation which explains the native wage. Wacziarg's methodology is particularly appropriate for estimating our theoretical model because the methodology allows us to estimate the complete effect of immigration on the native wage as the sum of the effects stemming from each of the channel equations, which is precisely what the theory predicts. Furthermore, this methodology has the added advantage of allowing us to ascertain the relative contributions of the consumer demand and input substitution effects.

In order to empirically distinguish between the input substitution and consumer demand effects, we test the following two hypotheses: (1) immigration influences the demand for native labor through its effects on the immigrant wage ( $W_I$ ); and (2) immigration influences the demand for native labor through its effects on retail sales per capita ( $P$ ). Suppose our study of the variables  $W_I$  and  $P$  also suggests that immigration is not the only explanatory variable, that the vector of variables  $R$  also explains some of the variation in  $W_I$ , and that the vector of explanatory variables  $S$  helps to explain  $P$ . Accordingly, we estimate the simultaneous-equations regression model consisting of the following three equations:

$$(36) W_N = a_0 + a_1(W_I) + a_2(P) + a_3(Z) + u \text{ ,}$$

$$(37) W_I = b_0 + b_1(\theta_I) + b_2(R) + u \text{ ,}$$

$$(38) P = c_0 + c_1(\theta_I) + c_2(S) + u.$$

If our estimation procedure is consistent and the estimates are statistically significant, we will gain estimates of the relative strengths of the two channels through which immigration is hypothesized to influence wages. The effect of immigration on wages through the  $W_I$  channel is

$(b_1 \cdot a_1)$  and the effect of immigration through the P channel is  $(c_1 \cdot a_2)$ . It follows that the total effect of immigration on the wage is  $(a_2 \cdot c_1) + (a_1 \cdot b_1)$ , of which the consumer demand effect accounts for the proportion  $(a_2 \cdot c_1) / ((a_2 \cdot c_1) + (a_1 \cdot b_1))$ . A more general description of the Wacziarg methodology is illustrated in the Appendix.

The regression model to be estimated consists of the following three equations:

$$(39) W_N = a_0 + a_1(W_1) + a_2(P) + a_3(\text{Min}) + a_4(T) + u ,$$

$$(40) W_1 = b_0 + b_1(\theta_1) + b_2(\text{Birth}) + b_3(\text{Death}) + b_4(\text{Human}) + b_5(\text{Emm}) + u ,$$

$$(41) P = c_0 + c_1(\theta_1) + c_2(\text{Interest}) + c_3(\text{UN}) + c_4(\lambda) + c_5(W_N) + c_6(\text{GRGDP}) + c_7(T) + u ,$$

where (Min) is city specific minimum wage, (T) measures technology and a time trend, (Birth) is the city specific birth rate, (Death) is the city specific death rate, (Human) is a proxy for human capital and is the highest grade obtained, (Emm) is emigration to each specific city by other native labor, (Interest) is the federal funds rate and is a measure of factor substitution, (UN) is the U.S. unemployment rate,  $(\lambda)$  is non-labor income, and (GRGDP) is the growth of real U.S. gross domestic product.

### IIIB. *The Data Set*

We use data from a wide variety of sources to test the model. The principal data source consists of observations on 6,569 persons who were part of the MORG samples of the *Current Population Survey* (CPS) for 1979-85 in Miami (approximately 11% of the observations) and the same 4 comparison cities used in Card's (1990) study – Atlanta (approximately 12.5% of the observations), Tampa (11%), Houston (17%) and Los Angeles (48.5%). Since our theoretical model is of the retail labor market, the CPS observations used in our study are specifically of persons employed in 9 different retail CPS-classified categories. These categories are the following:

Grocery stores  
Eating and drinking places  
Department, variety and general merchandise stores  
Apparel and accessories stores  
Furniture and household furnishings stores  
Motor vehicle dealers  
Gasoline service stations  
Lumber and building material retailing and hardware stores  
Drug stores

Following Card's (1990) approach, we break the CPS sample down by four categories for Miami (Whites, Blacks, Cubans and Hispanics) and three categories for the other cities (Whites, Blacks and Hispanics). Because of the extremely small number of Cubans residing in the four comparison cities, the CPS includes a separate category for Cubans only for Miami. Of the 722 observations in our sample for Miami, 209 (29%) self-reported being Cuban. While this proportion is very likely larger than the true proportion of Cubans that resided in Miami during that time, it is probably a reasonable estimate of the Cuban share of the Miami retail sector, particularly since many jobs in that sector tend to be unskilled and a large portion of the Mariel immigrant pool was relatively unskilled.

To control for differences in skill levels between retail workers, we use educational attainment (measured by highest grade attended), age at the time of the survey and potential labor market experience (constructed from the sample as:  $\text{age} - \text{highest grade attended} - 5$ ) as human capital controls. For our sample, the mean age of respondents is 30 years, mean grade attended is approximately 12 and mean potential labor market experience is 13 years. The respondents earned on average \$4.70 per hour and approximately \$160 per week before taxes and worked an average of approximately 33 hours per week. Because of the nature of the retailing industry, the sample consisted of both part time and full time workers.

The CPS does not, unfortunately, include any information on each respondent's retail spending. The Bureau of Labor Statistics' *Consumer Expenditure Survey* does have micro-data on household retail spending, but it is not broken down by city and is not available for the period under study. Therefore, we turned to another data source -- the *Survey of Buying Power* (published by *Sales and Marketing Management Magazine*) -- which provides aggregate annual sales data for each of the 9 retail categories above for each of our cities and years.<sup>22</sup> These data are used to proxy the "retail price" (P) variable in our theoretical model.

Table 1 shows year-to-year growth rates in retail sales, using the *Survey of Buying Power* data, for Miami and the comparison cities for the sample period. These data also are illustrated in Figure 1, which shows retail sales in Miami and the three other cities in the Southern region, as well as Figure 2, which compares Miami and Los Angeles. The table and figures exemplify the importance of controlling for both regional and national economic trends when doing an examination of the Mariel Boatlift's effects on the Miami economy. According to the table and figures, Miami experienced large growth rates in retail sales between 1979 and 1980 and between 1980 and 1981, but much slower growth thereafter (although sales spiked dramatically between 1983 and 1984). Miami's growth rates need to be compared to those of the other cities

<sup>22</sup> Made available since 1948, *Survey of Buying Power* (SBP) data are sold on a subscription basis to business owners, consultants, libraries, research organizations and various public agencies. Survey information is organized within a geographic hierarchy by region, state, metropolitan area, county and by television market. We used annual SBP data for 9 basic retail store groups for each of our specific metropolitan areas. These 9 groups generally match the groups used in the *Current Population Survey*. However, some of the groups are named differently for each survey. Specifically, what the CPS calls "grocery stores" is called "food stores" in the SBP, what the CPS calls "Department stores, variety stores and general merchandise stores" is simply called "General merchandise stores" in the SBP (although the SBP definition of stores in this category includes the three subcategories used by CPS), what CPS calls "Furniture and household furnishings stores" is called "Furniture, home furnishings and appliance stores" (the CPS category does include appliances) in the SBP, what CPS calls "Motor vehicle dealers" in the CPS is called "Automotive dealers" in SBP, and what CPS calls "Lumber and building material retailing and hardware stores" is called "Building materials and hardware dealers" in SBP. These particular data were lifted from the sections of the SBP data books titled "Retail Sales by Store Group for Metropolitan Markets and all Counties." They are interpolative estimates for each year based on the *Census of Retail Trade*. The estimates for 1979-82 are based on the 1977 Census and the estimates for 1983-85 are based on the 1982 Census.

in order to gain proper perspective, however. Note that Miami's growth rates between 1979 and 1981 were lower than Houston's and larger than Los Angeles's. Houston's growth in retail sales was unusual for that city and very likely reflects the boom to its economy generated by the strength of the oil production and service industries around that time. Los Angeles's low growth rate may reflect softer economic conditions in that region of the country. The most appropriate comparison is thus between Miami and its two Southern sibling cities, Tampa and Atlanta. Observe that Miami's growth rates exceeded those of Atlanta and Tampa between 1979 and 1981, but were lower than Atlanta and Tampa thereafter. Therefore, taking into account Houston's oil boom and weaker growth in the West, the Mariel Boatlift may indeed have generated a boost to retail spending in the Miami area.

INSERT TABLE 1 ABOUT HERE

Dividends, interest and rents per capita for each city, obtained from the BEA website<sup>23</sup>, are used to proxy the non-labor income variable ( $\lambda$ ) in our theoretical model. The FRED database is the source for U.S. GDP, U.S. CPI, and federal funds rate data.<sup>24</sup> Monetary data are deflated using the CPI for the Southern region.<sup>25</sup> City unemployment rates control for general labor market conditions and were obtained from the BLS. Birth and death rates were obtained from the *Statistical Abstract of the United States*.

<sup>23</sup> The data for dividends, interest and rent provided on the BEA website are aggregate data, but the same website also provides city population, so we computed the per capita numbers by combining the two measures.

<sup>24</sup> See <http://research.stlouisfed.org/fred2/>.

<sup>25</sup> CPI data for Tampa are not available going back that far, so we chose to use the regional CPI for all 5 cities.

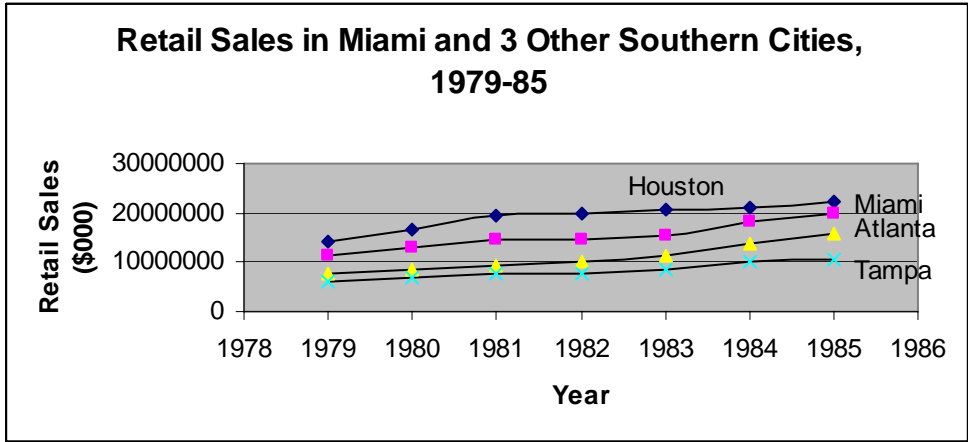


Figure 1

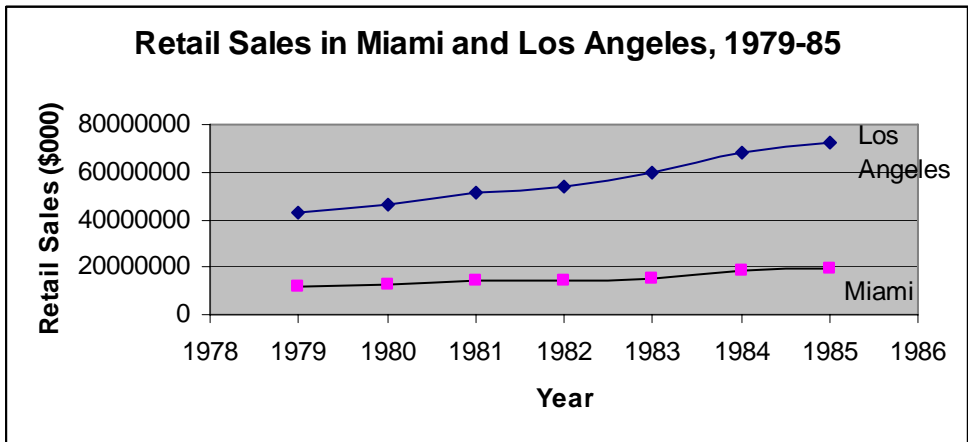


Figure 2

### III.C. Estimates from the Wacziarg Model

As required by the Wacziarg methodology, we apply 3SLS to estimate equations (39) through (41). The model tested meets the identification criteria of instrumenting, as there are eleven exogenous variables and three endogenous variables. Since the *Survey of Buying Power* data on retail sales in each retail category are aggregate data, we chose to regress the weighted mean value of the dependent variable on the weighted mean values of the independent variables, where the weights are the fractions of Cuban, black, Hispanic or white workers. Consequently,

the data set used in our regression analyses was compressed to 306 observations, where each observation is a city x year x retail category mean value.

The estimation results for equation (39) are presented in Table 2. In this case the dependent variable ( $W_N$ ) is the weighted average native retail wage for whites, blacks and Hispanics. The coefficient estimates for the variables included in the wage model closely match those of the existing literature, see for example, Hunt (1992) and Friedberg (2001). Of the channel variables, the immigrant wage ( $W_I$ ) has a significant negative effect on retail wages, and retail sales per capita are significantly associated with higher native retail wages. However, the native retail wage appears not to be influenced by the minimum wage, technology or national real GDP. Table 2 details the full set of econometric results.

INSERT TABLE 2 ABOUT HERE.

Table 3 reports the results of the first channel equation, which measures the input substitution effect. The dependent variable in equation (40) is the weighted average immigrant wage ( $W_I$ ). All else equal, it is positive and significantly related to the number of Cuban immigrants and the amount of human capital obtained per worker. This result would seem to indicate the existence of a positive network effect among Cubans. That is, the greater the number of Cuban immigrants, the greater the Cuban immigrant wage as newly arriving Cuban immigrants were able to obtain work in Miami. The immigrant wage is not affected by the other variables in the model, specifically, birth and death rates and emigration.

INSERT TABLE 3 ABOUT HERE.

Table 4 reports the results of the second channel equation, which measures the consumer demand effect. The dependent variable in equation (41) is retail sales per capita. Given that the estimated coefficient ( $c_1$ ) is positive and significant, the empirical results suggest that Cuban

immigrants have a direct consumer demand effect on retail sales. Greater native wages are also significantly related to retail sales. Interest rates, national unemployment rates, real U.S. GDP growth, non-labor income, and the time trend do not significantly affect retail sales.

INSERT TABLE 4 ABOUT HERE.

A summary of the channel effects of Cuban immigration on the wages of all natives, white natives only, black natives only and Hispanic natives only are given in Table 5.<sup>26</sup> The table reports the effects of each channel on a specific native wage category and, within a category, the effect of Cuban immigration on each channel. The last column reports the product of the two coefficients. Note that the *t*-statistics for the channel effects relies on a Taylor series expansion process.<sup>27</sup> Results for all native workers (dependent variable = weighted average native retail wage) confirm the theory in section II, as both the immigrant wage channel (input substitution effect) and the retail sales channel (consumer demand effect) have a statistically significant impact on the native wage. However, when both channels are added, the net effect of Cuban immigration on native wages is positive, but insignificant. Although the total marginal effect of an additional Cuban immigrant on the native weighted average wage over the six-year period is estimated to be 19.45 cents per hour, this is only significant at 10.3%. This suggests, therefore, that the consumer demand effect fully offsets the negative input substitution effect on wages and accounts for Card's (1990) finding that the Mariel influx had a benign effect on Miami wages.

INSERT TABLE 5 ABOUT HERE.

<sup>26</sup> We generated estimates for the three specific ethnic groups so as to stay consistent with Card's (1990) study.

<sup>27</sup> Wacziarg (1998) states that "The *t*-statistics for the channel effects are obtained by computing linear approximations of the products of the parameters around the estimated parameter values, and applying the usual formula for the variance of linear functions of random variables to this linear approximation. Computing these standard errors is possible thanks to the joint estimation of all the equations in the system, which allows the derivation of the covariance matrix for all of the estimated parameters." (pp. 23)

As Table 5 also shows, the results from splitting the sample into the three unique ethnic groups are reassuringly similar to the results for all natives. There is a significantly positive consumer demand effect present for whites, blacks and Hispanics, suggesting that the new Cuban immigrants patronized shops and businesses of all ethnic backgrounds. However, the evidence suggests a significantly negative immigrant wage channel for whites, blacks and Hispanics as Cubans served as substitute inputs to the three ethnic groups. As with the weighted average results and in line with previous authors' findings, white and black wages were on balance not affected by the Mariel influx. However, we found that native Hispanic wages were on balance affected by the influx. According to Table 5, the total marginal effect of an additional Cuban immigrant on the Hispanic wage over the six-year period is estimated to be 39.08 cents per hour, significant at 7%.

#### **IV. CONCLUDING REMARKS**

In this paper, we extend the standard labor supply model of immigration to test for the demand-augmenting effect of immigration. Because immigration tends to raise overall world output and not all of the increased output consists of tradable goods, we hypothesize that immigrants generate a noticeable demand effect in their new home economies. We have suspected that this demand effect helps to explain the generally benign labor market effects of immigration found in so many studies. We thus set ourselves the challenge of testing for the presence of a labor demand effect in Miami after the 1980 Mariel boatlift, an exogenous immigration surge previously studied by Card (1990) in what is now a classic study of the economic effects of immigration. Card has attributed his finding of no negative wage effect to other causes, such as the outflow of native workers when the Cuban immigrants arrived.

The theoretical model developed in this paper demonstrates that the net effect of immigration on natives wages in a local economy is ambiguous because the arrival of immigrants both depresses wages through its effect on labor supply, but raises them through its effect on labor demand. To estimate separately the supply effect, demand effect, and the net total effects of immigration on native wages, we used an econometric methodology due originally to Wacziarg (1998, 2001). Our estimates confirm that, for all native workers, the demand effect of immigration was indeed substantial in Miami's retail labor market for at least the first half-decade following the Mariel Boatlift. In fact, we found that the consumer demand effect exactly offsets the traditional labor substitution effect of immigration. In addition, when we estimate the Boatlift's effects separately for white, black, and Hispanic native workers, we qualify the above conclusion somewhat. While we find that the effect of immigration on native white and black wages is positive but insignificant, as in the case of the overall results, the effect of immigration on native Hispanic wages is positive and significant. Further robustness checks are needed through the use of alternative data and models, as well as additional explanatory variables. For example, a larger sample may provide us with more accurate and statistically significant results.

We conclude, therefore, that Card's (1990) finding that the Mariel influx exerted no real effect on Miami-area wages is due to the new Cuban immigrants inducing a strong increase in the local demand for labor. This result is compatible with Bodvarsson and Van den Berg's (2003, 2006) earlier results for demand-pull immigration to small Great Plains communities. The strong evidence of a consumer demand effect found here and by Bodvarsson and Van den Berg suggests that the wage effects found in previous studies of famous natural experiments involving exogenous international migration may require re-estimation. For example, since earlier researchers overlooked the possibility of a consumer demand effect, depending on how they set

up their estimation models, their estimates of the ceteris paribus wage effects of immigration may be negatively biased.

Most important, our results confirm that the absence of completely costless international trade means the movement of consumers from one country to another moves the local demand for factors of production as well. Our application of the Wacziarg methodology shows that immigrants have both labor supply and labor demand effects, thus confirming that there is a “Say’s Law of immigration”: Immigrants spend a substantial portion of their incomes in their new home communities and thus demand at least some of the labor that they supply.

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## VI. APPENDIX

### *A Simple Illustration of the Wacziarg Model*

To understand Wacziarg's simultaneous equations method, suppose that the variable  $w$  is explained by the following function that contains three explanatory variables,  $x$ ,  $y$ , and  $z$ :

$$(i) \quad w = f(x, y, z)$$

Suppose also that the variables  $x$  and  $y$  are, in turn, explained by the following two functions:

$$(ii) \quad x = g(q, r)$$

$$(iii) \quad y = h(q, s)$$

We see then that the variable  $w$  can be explained by a three-equation model, in which the variables  $w$ ,  $x$ , and  $y$  are endogenous and  $z$ ,  $q$ ,  $r$ , and  $s$  are exogenous.

The model to determine the variable  $w$  could have been written in a more simplified form, namely the so-called *reduced form* in which an endogenous variable is shown as exclusively a function of exogenous variables:

$$(iv) \quad w = a(z, q, r, s).$$

If the equations are linear, then the magnitude of  $q$ 's influence on  $w$  is equal to the partial derivative of equation (4) with respect to  $q$ , or  $w_q'$ .

While this reduced form model is useful as a simple representation of how  $w$  is determined, it is not very helpful if we are interested in *how* the exogenous variables influence the variable  $w$ . The model (iv) loses the information contained in equations (ii) and (iii) about how the exogenous variables  $q$ ,  $r$ , and  $s$  work through the endogenous variables  $x$  and  $y$  to determine the variable  $w$ . If, for example, we already know that the variable  $w$  depends on  $q$ , but we do not know how strong is the influence of  $q$  through the variable  $x$  versus the influence of  $q$  through the variable  $y$ , then we definitely would like to see the three-equation model. We can use the three-equation model to find the magnitudes of the two channels through which  $q$  influences  $w$ . For example, in the case of linear equations, the total influence of  $q$  on  $w$  through the channel  $x$  is  $(g_q' \cdot f_x')$ . And, the total influence of  $q$  on  $w$  through the channel  $y$  is  $(h_q' \cdot f_y')$ . Together, the total effect of  $q$  on the variable  $w$  through the two channels  $x$  and  $y$  must sum to:

$$(v) \quad (g_q' \cdot f_x') + (h_q' \cdot f_y') = w_q'$$

**Table # 1**  
**Percentage changes in retail sales from Preceding Year for Sample Cities, 1979-85**

Year	Houston	Miami	Atlanta	Tampa	Los Angeles	Mean of Cities
1980	17.57	14.05	14.22	13.22	7.84	13.38
1981	16.97	12.13	9.69	12.08	9.07	11.99
1982	2.42	0.63	9.11	4.78	5.14	4.42
1983	3.13	6.18	8.49	9.90	11.49	7.84
1984	2.76	18.08	25.21	16.92	13.68	15.33
1985	4.4	7.26	14.06	5.30	6.73	7.55

**Table #2**  
**Estimated City Retail Wage Equation (Aggregate Equation)**  
**Dependent Variable: Weighted Average Native Retail Wage ( $W_N$ )**

Constant	702.08 (1.16)
City Minimum Wage (Min)	-3.789 (-0.03)
Immigrant Wage ( $W_I$ )	-0.382 (-5.25)**
Retail Sales Per Capita (P)	0.273 (5.98)**
U.S. Real GDP (RGDP)	-0.128 (-1.47)
Technology (T)	13.678 (1.16)
R-Squared	0.617

Notes: Figures in parentheses are heteroskedasticity-consistent  $t$ -statistics.

\*\* indicates significant at the 95% level, and \* at the 90% level. There are 306 data points.

**Table #3**  
**Immigrant Wage Channel Equation**  
**Dependent Variable: Immigrant Wage ( $W_I$ )**

Constant	-47.544 (-0.44)
Immigration ( $\theta_I$ )	43.193 (3.38)**
Birth Rate (Birth)	1.465 (0.41)
Death Rate (Death)	2.836 (0.47)
Human Capital (Human)	18.818 (4.05)**
Emmigration (Emm)	-0.00002 (-0.09)
R-Squared	0.828

Notes: Figures in parentheses are heteroskedasticity-consistent  $t$ -statistics.  
 \*\* indicates significant at the 95% level, and \* at the 90% level. There are 306 data points.

**Table #4**  
**Retail Sales Channel Equation**  
**Dependent Variable: Retail Sales Per Capita (P)**

Constant	-10120.00 (-1.41)
Immigration ( $\theta_I$ )	131.70 (6.27)**
Interest Rates (Interest)	-1.197 (-0.16)
National Unemployment Rate (UN)	-19.764 (-0.95)
Non-Labor Income ( $\lambda$ )	-0.001 (-0.04)
Native Retail Wage ( $W_N$ )	3.421 (8.87)**
Real GDP Growth (GRGDP)	1159.90 (1.33)
Technology (T)	-32.491 (-1.39)
R-Squared	0.107

Notes: Figures in parentheses are heteroskedasticity-consistent  $t$ -statistics.  
 \*\* indicates significant at the 95% level, and \* at the 90% level. There are 306 data points.

**Table #5**  
**Summary of Channel Effects on Native Wages**

Dependent Variable	Channel	Effect of Channel on Native Wage	Effect of Immigration on Channel	Effect of Immigration on Native Wages
Weighted Average Native Retail Wage	Immigrant Wage Channel ( $W_1$ )	-0.382 (-5.25)**	43.193 (3.38)**	-16.499 (-16.52)**
	Retail Sales Per Capita Channel (P)	0.273 (5.98)**	131.70 (6.27)**	35.951 (11.82)**
	<b>Total Effect</b> <i>t</i> -statistic Wald Statistic Wald <i>p</i> -value Sample Size			<b>19.455</b> (1.64) 2.656 (0.103) 306
White Native Retail Wage	Immigrant Wage Channel ( $W_1$ )	-1.092 (-4.28)**	43.100 (3.48)**	-47.065 (-2.31)**
	Retail Sales Per Capita Channel (P)	1.060 (7.71)**	100.480 (5.15)**	106.508 (2.67)**
	<b>Total Effect</b> <i>t</i> -statistic Wald Statistic Wald <i>p</i> -value Sample Size			<b>59.443</b> (0.14) 0.020 (0.88) 306
Black Native Retail Wage	Immigrant Wage Channel ( $W_1$ )	-0.404 (-3.01)**	40.173 (3.02)**	-16.229 (-16.26)**
	Retail Sales Per Capita Channel (P)	0.457 (5.13)**	80.973 (3.35)**	37.004 (18.36)**
	<b>Total Effect</b> <i>t</i> -statistic Wald Statistic Wald <i>p</i> -value Sample Size			<b>20.775</b> (0.51) 0.266 (0.61) 306
Hispanic Native Retail Wage	Immigrant Wage Channel ( $W_1$ )	-0.417 (-5.31)**	42.366 (3.30)**	-17.666 (-17.70)**
	Retail Sales Per Capita Channel (P)	0.284 (5.75)**	137.60 (6.37)**	39.078 (12.03)**
	<b>Total Effect</b> <i>t</i> -statistic Wald Statistic Wald <i>p</i> -value Sample Size			<b>39.078</b> (1.77) 3.160 (0.07) 306