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A Look at Occupation-Level Evidence**

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Does Immigration Affect Wages? A Look at Occupation-Level Evidence

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Abstract: Previous research has reached mixed conclusions about whether higher levels of immigration reduce the wages of natives. This paper reexamines this question using data from the Current Population Survey and the Immigration and Naturalization Service and focuses on differential effects by skill level. Using occupation as a proxy for skill, we find that an increase in the fraction of workers in an occupation group who are foreign born tends to lower the wages of natives in blue collar occupations—particularly after controlling for endogeneity—but does not have a negative effect among natives in skilled occupations. The results also indicate that immigrants adjusting their immigration status within the United States, but not newly arriving immigrants, negatively impact the wages of low-skilled natives. This suggests that immigrants become substitutes for natives only as they spend more time in the United States.

JEL classification: J61

Key words: immigrants, natives, wages

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Does Immigration Affect Wages? A Look at Occupation-Level Evidence

Immigration has accounted for almost one-half of the total labor force growth in the U.S. in recent years. This influx of immigrants has been disproportionately large in certain regions, such as the Northeast and the Southwest, where immigration accounted for over 90 percent of labor force growth during the period 1996 to 2000. Immigrants have also been disproportionately concentrated in certain occupations, particularly low skilled occupations such as agricultural work, in which the number of immigrants rose even as total employment fell (Mosisa, 2002). This influx of immigrants and their concentration in certain regions and occupations raises the question of how immigration affects the wages of natives, particularly low-skilled natives. This study uses data on immigration inflows and natives' wages within occupation groups to examine this issue.

Most previous studies of the effect of immigration on wages use a cross-area approach that compares the number of immigrants in an area with wages in that area. These studies, such as Altonji and Card (1991), Butcher and Card (1991), LaLonde and Topel (1991), and Schoeni (1997), typically conclude that immigration has little or no significant negative effect on natives' wages. As noted in many papers, the cross-area approach can yield misleading results if immigrants' locational choices are endogenous, with immigrants going to areas with higher wages. For example, immigrants within a certain educational group tend to settle in areas with relatively high returns to that group (Borjas, 2001). In addition, cross-sectional results are biased if immigration causes offsetting migration by natives and previous immigrants or changes in industry mix.

In response to these potential problems, several studies use factor proportions models to estimate the effect of immigration on wages. Factor proportions models do so by making assumptions about the elasticity of substitution between immigrants and natives (e.g., Borjas, Freeman and Katz, 1992, 1997; Jaeger, 1996; Johnson, 1998). Using reasonable elasticities, such models can yield sizable negative effects at the national level for unskilled workers. The effect of immigration on skilled workers, however, is modest at best in such studies. Moreover, results from factor proportions analysis tend to be sensitive to changes in the underlying assumptions of the model, such as the functional form and the number of factors (Leamer, 2000).

A few studies focus on the effect of immigration within occupations or skill groups. Using data from the 1990 Census, Card (2001) estimates the relationship between immigrant inflows and wages for six occupational groups in 175 large U.S. cities. Most of his results indicate significant negative effects, which generally increase in magnitude when instrumental variables techniques are used to control for endogeneity. Card does not discuss whether the effects differ between skilled and unskilled workers. Using a similar approach but at the national level with data from the 1991 Current Population Survey (CPS), Camarota (1997) finds a negative association between immigration and wages within low-skilled occupations. Both of these studies use a single year of cross-sectional data.

Two studies use multiple cross sections of national-level data to look at effects by occupation or education groups. Friedberg (2001) uses Israeli micro data to study the impact of Russian immigration by occupation on Israeli wages and employment. Using an instrumental variables strategy, she does not find evidence of an adverse wage effect on natives whether in a pooled sample or in regressions by high and low skill level. Using several years of data from the Census and the CPS, Borjas (2003) finds that higher immigrant inflows within education and

experience groups—which proxy for skill—are negatively associated with wages of male natives at the national level, particularly for workers who did not attend college.

This study estimates the effect of immigration inflows on wages within occupational groups using data from the Immigration and Naturalization Service (INS) and the Current Population Survey.¹ Our approach offers several contributions to the literature. First, no study has used INS data on new recipients of legal permanent resident status to examine the effects of immigration on wages even though the data present several advantages. As discussed below, the INS data offer a novel instrumental variable for immigration inflows, contain a complete count of new legal immigrants, and allow us to distinguish between newly arriving immigrants and those who adjust status while already in the U.S. In addition, we use several years of data whereas most previous cross-area and occupation-level studies relied on a cross-sectional approach. Using multiple years of data allows us to control for unobservable local area effects, which was not possible in cross-area studies that used only one year of data. Our approach thus blends the multiple-year, skill-level analysis of Friedberg (2001) and Borjas (2003) with the single-year, cross-area methodology of most previous studies, such as Card (2001).

The next section discusses the effects of immigration on wages from a theoretical perspective. We then discuss the data used to examine the relationship between immigration and natives' wages at the occupational group level; we focus on professional, service-related, and manual labor occupation groups during a seven-year period, 1994-2000, at the metropolitan area level. The results indicate that, after controlling for endogeneity, higher immigration inflows lower average wages among natives working in manual labor occupations—the least skilled group—but do not appear to have a negative effect among natives in professional and service

¹ The INS was renamed the Bureau of Citizenship and Immigration Services in March 2003. For simplicity, we refer to it as the INS here.

occupation groups, in which workers tend to be more skilled. Immigrants who are already present in the U.S. and who adjust from nonimmigrant status have a more negative effect on natives' wages than do newly arrived immigrants, indicating that assimilation leads to increased substitutability of immigrants for native workers.

Theoretical Framework

Immigration inflows can negatively or positively impact natives' wages, depending on the degree of substitution or complementarity between immigrant and native workers and a number of other factors. Because there is already a large theoretical literature, we do not present a formal model of the effect of immigration on natives' wages but simply review the underlying reasons why immigration might affect natives' wages and in what direction.²

The degree of substitution between immigrants and natives is a key determinant of the effect of immigration on native wages. Holding capital constant and assuming a constant returns to scale production technology, an increase in labor supply due to immigration will lower wages if immigrants and natives are substitutes and labor supply is not perfectly elastic with respect to wages.³ The magnitude of the negative effect increases with the degree of substitution between immigrants and natives and with the size of the immigrant inflow. If immigrants are a complement for natives in production, in contrast, immigration will boost natives' wages.

The degree of substitution between immigrants and natives is likely to vary across skill levels. Substitution is likely to be easier in industries with less skilled workers because employees are more interchangeable and training costs are lower than in industries with skilled

² For formal models, we refer readers to, among others, Borjas (1999), Greenwood and Hunt (1995), and Johnson (1998).

³ These assumptions can be relaxed to accommodate changes in the relative prices of goods and in the use of capital versus labor inputs. See Chapter 4 in Smith and Edmonston (1997) for a more general model.

workers. In skilled jobs, the need for English language proficiency and institutional knowledge may make it difficult for employers to substitute immigrants for native workers. Some skilled professions, such as physicians, also involve licensing requirements, limiting the substitutability for natives of immigrants educated and trained abroad.⁴ Returns to education and experience acquired abroad are generally lower than for education and experience acquired in the host country, so skilled immigrants may experience larger earnings penalties than unskilled immigrants (Friedberg, 2000; Duleep and Regets, 1999). Moreover, skill transferability, the degree to which immigrants can use human capital acquired in their home country at U.S. jobs, tends to be higher for unskilled jobs than for skilled positions (Gallo and Bailey, 1996). As immigrants assimilate over time they acquire the knowledge and language skills to better compete with natives for higher-skilled jobs. As they become more substitutable for native workers, adverse wage effects may follow.

In order to capture these differential effects by skill level, we use occupation as a proxy for skill in our empirical model below. If the elasticity of substitution is greater among unskilled workers than among skilled workers, as we hypothesize, the effect of immigration on wages should be larger in unskilled occupations than in skilled occupations. The degree of complementarity (or substitution) between immigrants in a given occupation and natives in another occupation also influences natives' wages, a topic we do not explore in this study; studies suggest that most such cross-elasticities are small (Hamermesh, 1993).

Another factor that influences the effect of immigration on wages is changes in capital. Immigrants might add to the capital stock, both initially if they bring savings when they migrate and over time (Chiswick, Chiswick, and Karras, 1992). If immigration adds to the capital stock,

⁴ For example, among immigrants who applied to have foreign-earned qualifications (engineering, nursing, etc.) recognized in Australia, only 42 percent received approval (Chapman and Iredale, 1993).

natives' wages might rise if capital is a complement to labor, particularly skilled labor. Unskilled labor, in contrast, appears to be a substitute for capital (Hamermesh, 1993). Capital also may move across industries and areas in response to immigration inflows.⁵ Such movements in capital could therefore at least partially counterbalance the negative effect of an increase in labor supply on natives' wages. The empirical model we present below does not control for capital because we do not have measures of capital at the occupation and area level; since we only examine a seven-year period, ignoring changes in capital may not be unrealistic. Time-invariant cross-area differences in the existing capital stock will be picked up by the area fixed effects.

The elasticity of labor supply with respect to wages also influences the impact of immigration on wages. Natives and previous immigrants might respond to immigration-induced changes in wages by altering their labor supply, moving to a different area, or upgrading or downgrading their skills.⁶ Such changes would reduce any negative effect of immigrant inflows on wages. Studies have not reached a consensus as to whether offsetting migration occurs in response to immigrant inflows (e.g., Card, 2001; Frey, 1995; Kritiz and Gurak, 2001). Because we examine only a five-year period here, our estimates of the impact of immigration on wages are probably more negative than the long-run effect. In the long run, endogenous shifts in labor supply would likely lead to less negative estimates than any found here.

Finally, immigration inflows may lead to changes in output mix that cushion any wage impact on natives. Previous studies suggest that immigration may lead to changes in the output mix within areas, with industries intensive in low-skilled labor expanding in or moving to areas

⁵ Quispe-Agnoli and Zavadny (2002) do not find a significant association between immigration and capital mix at the state level.

⁶ See Chiswick (1989) for a model of how natives adjust their human capital to minimize adverse wage effects due to immigration.

with large numbers of immigrants (Altonji and Card, 1991; Hanson and Slaughter, 2002). Such changes in production should increase the demand for labor and thereby reduce any negative effects of immigration on wages. Similarly, immigration may lead to scale effects, with demand for output increasing in response to immigration; an increase in output demand would raise demand in factor markets, putting upward pressure on wages. Such effects would also at least partially offset any negative effect of immigration on wages.

As discussed below, we instrument for changes in the labor supply as a consequence of immigration to help control for the above factors. Instrumenting, as well as including area fixed effects, also controls for endogeneity bias due to immigrants settling in areas that pay high wages or have strong wage growth, which would upward bias the estimated coefficients away from finding an adverse effect.

Empirical Methodology

To estimate the effect of immigration on natives' wages, we regress the average earnings of natives in occupation group o on the fraction of workers in that occupation group who are foreign born and other variables, or

$$\ln w_{o,s,t} = \mathbf{a} + \mathbf{b}I_{o,s,t} + \mathbf{g}X_{o,s,t} + \mathbf{w}O_o + \mathbf{s}S_s + \mathbf{t}T_t + \mathbf{e}_{o,i,t} \quad (1)$$

where s indexes areas and t indexes years. The measure of wages is the log of real average hourly wages for natives in a given occupation group, area, and year.

The variable I in Equation 1 is the number of immigrants with a given occupation group relative to total employment in that occupation group. If an area experiences an influx of

immigrants within a given set of occupations, this fraction rises, reflecting the increase in the relative labor supply of immigrants. The underlying hypothesis is that occupations and areas experiencing larger inflows of immigrants relative to the total number of workers in that occupation and area should experience larger declines in wages, and the magnitude of the decline depends on how substitutable immigrants are for other workers. As noted below, a large number of cells have the immigrant share variable equal to zero. We therefore do not log the immigrant share variable and interpret its estimated coefficient as an elasticity; instead, the estimated coefficient of the immigrant share variable indicates the average percentage change in wages for a 1 percentage point increase in immigrants as a percentage of all workers.

The vector X controls for the average demographic characteristics of workers in that occupation. We control for the fraction of native-born workers who are female, black, married, and union members. We also control for the distribution of workers across five-year age groups and three of four education groups (less than high school, high school, some college, and college graduates).

All regressions include a full set of occupation and year fixed effects in order to control for unobservable determinants of earnings within an occupation or year. We also include area fixed effects in some specifications. Pooling seven years of data allows us to control for unobserved determinants of wages that are constant within areas over time; previous studies could not control for such factors because they used cross-sectional data. We White-correct the standard errors in order to control for heteroscedasticity and weight observations by the total number of native-born workers in the occupation, area, and year.

We estimate Equation 1 by pooling observations for each of the three occupation groups examined here. The immigrant share variable, I , is interacted with an indicator variable for each

occupation group in order to allow the effect of immigration to differ across skill categories.

Because we have only seven years of data and therefore limited degrees of freedom, we constrain the effects of the variables measuring worker characteristics and the area and year fixed effects to be the same across occupation groups.

Endogeneity bias is a concern because immigration into an area may not be independent of local wages or wage growth. We use two methods to address this problem. First, we include area fixed effects in some specifications, which controls for time-invariant factors that affect immigrants' locational choices, such as relatively high wages or wage growth. Second, we utilize an instrumental variables approach. The instrument must be correlated with the influx of immigrants into a given MSA and occupation but uncorrelated with unobserved factors driving wages and wage growth. We therefore use immigrants who are admitted to the U.S. in a given year as the spouse of a U.S. citizen (and report a given occupation and area) as an instrument for the immigrant share in that occupation group, area, and year. We restrict these immigrant spouses of U.S. citizens to newly-arriving immigrants and immigrants adjusting from non-work related statuses.

Immigrant spouses of U.S. citizens are an effective instrument for many reasons. First, because immigrant spouses presumably immigrate for family reunification reasons and settle where their citizen spouse lives, their location choice is largely exogenous to local wages in their reported occupation group.⁷ Although spouses may make joint location decisions over time that depend in part on returns to the immigrant's occupation, it is probably much less likely in the

⁷ Data from the CPS for 1994-1998 indicate that most U.S. citizen spouses of recent immigrants work (88 percent of male spouses and 68 percent of female spouses) and that about two-thirds of these citizen spouses earn more than their immigrant spouses. In addition, 69 percent of citizen spouses have at least as much education as their recent immigrant spouses. This supports our assumption that location decisions are not driven by the earnings potential of the immigrant spouse. (The CPS sample is of citizens married to foreign-born persons who report arriving in the U.S. within the last 5-6 years.) Among recent immigrants with citizen spouses in the INS data, about 69 percent of

year in which the immigrant spouse first receives legal status than for other immigrants. Jaeger (2000) reports that, among major admission categories, the locational choices of spouses of U.S. citizens are the least responsive to local area economic conditions; indeed, he finds a significant positive association between the spouses' locational choices and the change in the unemployment rate. Spouses of U.S. citizens are also the most geographically dispersed and educationally diverse group among the categories Jaeger investigates.

We construct our instrumental variable to exclude immigrant spouses whose locational choice or occupation might depend on relative returns. For this reason, the instrument does not include immigrant spouses who convert from work-related visas (e.g., H1-Bs), refugee status, or entry without inspection status. The instrument includes only immigrants who are married to a U.S. citizen and who are either new arrivals in the U.S. or adjusting from a status in which they were not eligible to work legally in the U.S. (such as F1 student visas and temporary visitor for pleasure—tourist—visas).⁸ Because an immigrant is typically not eligible to become a naturalized citizen for five years after receiving a green card, the immigrants who compose our instrument are unlikely to be married to naturalized citizens who immigrated to the U.S. because of the potential future returns to the occupation of the spouse who is now receiving a green card.⁹ About 42 percent of the immigrants who compose our instrument are adjusting status, and over 70 percent of those had an unexpired tourist visa (which does not allow the holder to work legally and, at the time, had a maximum allowable duration of one year).

immigrants reporting manual labor occupations are male, 48 percent of immigrants reporting professional occupations, and 42 percent of immigrants in service-related occupations.

⁸ Although immigrants adjusting from entry without inspection status also could not work legally, they are more likely to have been working in the U.S. than many other categories of adjusters who were not authorized to work. We therefore do not include them in our instrument.

⁹ Data from the CPS indicate that, among U.S. citizens married to recent immigrants, the citizen is native born in about 60 percent of couples.

In addition, the spouses of U.S. citizens are not subject to a quota or admitted on the basis of skills, so their occupation plays no direct role in whether they become immigrants. Jasso and Rosenzweig (1995) report that these “marital immigrants” are less skilled than are immigrants admitted for employment-based reasons at the time they receive LPR status. They also find that marital immigrants experience considerable occupational upgrading over time in the U.S., suggesting that they become more substitutable for natives as duration of U.S. residence increases. Moreover, during the 1990s, the simple act of filing paperwork with the INS made a person fairly immobile geographically. The INS struggled with huge backlogs and lost thousands of files (Holmes, 2000). In this environment, few applicants risked transferring their casework from one district to another, as would be required in the case of most interstate moves. Immigrants adjusting their status therefore may not have moved across areas in response to wage differentials based on their skill level.

This empirical approach offers several advantages. Previous studies that controlled for endogeneity typically did so by using the foreign-born population share in an area at the beginning of a period as the instrument for the change in the share or by using lagged values as instruments. Because new immigrants tend to settle where previous immigrants reside, first-stage regressions using these approaches have good predictive power. However, the instruments are correlated with the error term in the second-stage earnings regressions if previous immigrants reside in certain areas for earnings-related reasons that also influence the locational choices of new immigrants. Our instrument—spouses of citizens—is more likely to be an exogenous determinant of locational choice for the reasons noted above.

Data

We use data on employment and earnings from the outgoing rotations groups of the Current Population Survey (CPS) and immigration data from the INS. Both data sets are for the period 1994 to 2000; the CPS data are for calendar years while the INS data are for fiscal years.¹⁰ We focus on three occupation groups: professional (executives/managers and professionals, such as teachers and doctors); service-related (clerical workers, which includes all administrative support workers; sales; and service workers); and manual laborers (precision production, craft, and repair, which consists of more skilled blue-collar jobs; operator, fabricators, and laborers, which is composed of less skilled blue collar jobs; and farm workers).¹¹ We use these relatively broad occupational groups because the groupings capture the set of occupations for which immigrants who report working in a particular occupation are likely to be substitutable for natives. For example, immigrants who report working as an agricultural laborer can also probably work in an unskilled manufacturing job but not in a clerical or professional job, and immigrants who were skilled blue-collar workers in their home country may work in unskilled blue-collar jobs in the U.S., at least initially.¹²

The primary data set we use is the CPS, a monthly survey that focuses on labor market outcomes. Since 1994, the survey has included questions about nativity, including country of birth and year of arrival in the U.S. (in intervals). From all employed native-born individuals

¹⁰ The difference implicitly allows for a one-quarter lag in effects.

¹¹ We include farm workers because they often reside and work in cities during the off season. About 2.7 percent of the immigrant sample and 1.5 percent of the native-born sample are farm workers. Average hourly earnings among sales workers are similar to those among clerical workers and significantly higher than average earnings in the low-skill occupational group, so we classify sales workers as medium skilled.

¹² Using the March 1995-1998 CPSs, we examined transition rates across occupation last year and occupation this year for workers who reported being recent immigrants and not present in the U.S. last year. Using the INS's 25 occupation groups, over 95 percent of these immigrants reported being within the same group last year and this year; using our three groups, over 97 percent were in the same group. Patterns among those immigrants who switched occupations underlie the classification of occupations across our three groups; for example, among persons who

aged 16 and older, we constructed measures of average hourly wages and total employment within the three occupation groups. In addition, we constructed from the CPS data the ratio of all immigrants to total employment; this is the typical measure used in cross-area studies to estimate the impact of immigration. The controls for the distribution of workers across 5-year age groups, four educational groups, sex, race, marital status, and union membership that are included in the regressions are also constructed from the CPS data.

We also constructed two alternate measures of immigrants to total employment by combining the CPS data with INS data. The INS data we use are the universe of new legal permanent residents, also known as “green card” recipients. Our sample includes all new legal permanent residents aged 16-64 who report an occupation. The INS data list 25 occupations, which are more detailed for skilled workers (e.g., architects) than for unskilled workers (e.g., operators, fabricators, and laborers).¹³ We drop individuals who report their occupation as homemaker, student, unemployed, or retired and collapse the remaining occupations into our three occupational groups.¹⁴ The INS data do not report individuals’ earnings or educational attainment.

The INS data offer several advantages compared with other data sources that include information on nativity. The INS data are a complete count of all new legal permanent residents, and they include the preference category under which immigrants were admitted, such as spouse of legal permanent resident, spouse of U.S. citizen, priority worker with extraordinary ability, or

reported a sales occupation for year t and a non-sales occupation for year $t+1$, about one-third were in clerical jobs and almost one-half in service jobs in year $t+1$.

¹³ We also tried running the regressions using the most detailed level of occupation available in the INS data, but most of the results were inconclusive because of the small cell sizes in many occupations and areas.

¹⁴ About 19 percent of immigrants aged 16-64 do not report an occupation, another 11 percent report being unemployed or retired, 13 percent report being a student and about 17 percent report being a homemaker. For comparison, in the 1994-1998 CPS ORGs about 55 percent of recent (last 5-6 years) immigrants are employed at the survey date.

refugee. As discussed above, we exploit the fact that some of these groups are exempt from immigration quotas to construct our instrumental variable. The INS data also distinguish between immigrants who are newly arriving in the U.S. and those already present and converting from another visa status, such as H1-B. The INS data report the most recent year of admission for those individuals converting from nonimmigrant status. The main disadvantages of the INS data are that they do not include other non-immigrants or illegal aliens and they contain a limited set of personal characteristics. Greenwood, McDowell, and Trabka (1991) further describe the advantages and shortcomings of the INS data.

We separate the INS data on new immigrants into newly arriving immigrants and immigrants adjusting status and compute each as a share of total workers (based on the CPS data). We distinguish between newly-arriving immigrants and those adjusting status because the foreign born who are already present in the U.S. but only now receiving legal permanent resident status are likely to be more substitutable for natives than newly arriving immigrants. In addition, immigrants adjusting their status are already working in the U.S. in the occupation reported in the data, whereas immigrants newly arriving in the U.S. report their occupation in their home country unless they are admitted under employment-based preferences. This partially motivates our use of broad occupational categories.¹⁵ About 44 percent of new LPRs in our data are adjusting status, most commonly from temporary visitor for pleasure or H-1 visas, refugee status, or "entry without inspection" status (each accounting for about 15 percent within those adjusting status). The average time between receipt of LPR status and the most recent year of admission for those adjusting status is about four years, and over 50 percent of adjusters reported converting within three years.

We conduct the analysis at the metropolitan statistical area (MSA) level because MSAs more closely approximate labor markets than do states.¹⁶ The INS data are by zip code of intended residence (by MSA for 1999 and 2000), which we merged with the metropolitan area codes in the CPS. The final sample consists of an unbalanced panel of 1735 observations per occupation for 283 MSAs during the period 1994-2000.

Table 1 reports the fraction of workers in each occupation group who are immigrants and natives' average wages. Column 1 shows the fraction of workers who are foreign born based on CPS data. Columns 2 and 3 show, based on the combined INS and CPS data, the number of immigrants adjusting status and newly arriving immigrants relative to all workers. The first column thus measures the relative stock of immigrants while the second two are measures of the relative flow.¹⁷ The foreign born make up a larger fraction of workers in manual labor occupations, accounting for over 9 percent of such workers but for about 6-7 percent of professional and service-related workers.¹⁸ Although the U.S. granted over 650,000 persons LPR status each year during our sample period, the number of new immigrants relative to total workers in each occupation group is small, as columns 2 and 3 indicate. There are 527 observations with no newly arriving immigrants or no persons adjusting status.

¹⁵ Most immigrants work in the same occupational group in the U.S. as in their home country. In the 1995-98 March CPS, which asks occupation last year as well as current occupation, over 90 percent of workers who reported not being in the U.S. last year were in the same occupation last year as during the current year.

¹⁶ We note that the immigrants who settle in urban areas tend to differ from those who live in other areas. In particular, immigrants tend to initially settle in urban areas where other immigrants live and then move over time to areas with lower concentrations of immigrants

¹⁷ We note that the INS data are not a perfect count of all foreign-born workers entering an occupation for several reasons. Not all immigrants work in the U.S. in the occupation indicated to the INS at the time they received legal permanent resident status (some immigrants also may live in an area other than that reported to the INS). In addition, the data do not include illegal aliens and non-immigrants, and immigrants already present in the U.S. move between occupations. Nonetheless, the numbers should be well correlated with the inflow of immigrants into occupations and areas.

¹⁸ The total fraction of workers who are foreign born is about 12 percent in the data. These means are lower because the observations are weighted by the number of natives working in that occupation, area, and year and the distribution of natives differs from that of immigrants.

Column 4 of Table 1 shows the number of spouses of U.S. citizens who are new arrivals or non-work adjusters and new green cards holders as a fraction of total employment in each occupation. About 19 percent of legal immigrants during fiscal years 1994-2000 were admitted as the spouse of a U.S. citizen, so our instrument is small relative to total employment. The last column in the table reports average hourly wages of natives as calculated from the CPS data.

Results

Table 2 shows OLS estimates of the relationship between natives' wages and immigrant shares by occupation group. As indicated in the table, we show specifications with and without MSA fixed effects; the regressions without area fixed effects are similar to the cross-sectional methods used in most previous studies. Including the area fixed effects controls for time-invariant MSA-level determinants of earnings, such as differences in the cost of living, and helps control for endogeneity. Based on the results in Table 2, the endogeneity bias in the cross-sectional approach is considerable. All of the coefficients for the immigrant share variable decline substantially when area fixed effects are included. Consider newly arriving immigrants as an example: adding fixed effects (going from column 5 to 6) reduces the coefficients from 0.2614 to .116, 0.276 to 0.093, and from 0.047 to -0.008 for professionals, service-related workers, and manual laborers, respectively.

As Table 2 shows, when controlling for area fixed effects, immigrant inflows have different effects on natives' wages depending on the occupation group and the type of immigrant. Higher immigrant shares are generally associated with positive wage effects on more skilled natives. For example, average wages in executive and professional occupations are significantly positively associated with all measures of the immigrant share—the total stock,

those adjusting status, and newly arriving immigrants. A 1 percentage point increase in the total immigrant share is associated with an increase in native-born executives' average wages of 0.25 percent, controlling for area fixed effects (column 2). A 1 percentage point increase in the adjusting and new immigrant shares, meanwhile, are associated with positive wage impacts of 7 and 11.6 percent, respectively, among natives in professional occupations. It bears noting that a a percentage point increase in the flow measures of immigrants (adjusting and new, columns 3-6) represents a much larger increase in the immigrant share than a percentage point increase in the stock measure (all immigrants, columns 1-2). Evaluating the wage effects at the means given in Table 1 gives a more comparable measure: the effect of all, adjusting, and new immigrants, respectively, on professional natives' wages is 1.6, 0.84, and 1.51 percent when area fixed effects are included. The estimated effects are also positive, albeit not always significant, for clerical, sales, and service workers.

The effect on natives in manual labor occupations tends to be negative, in contrast. For manual laborers, the respective wage impacts of all, adjusting, and newly arriving immigrants are -0.74 , -0.29 , and -0.12 when evaluated at the means and controlling for area fixed effects (although the coefficient is not statistically significantly different from zero for the impact of newly arriving immigrants). The interpretation of these effects would be that average wages for low-skilled natives are about 0.74 percent lower as a result of the presence of all foreign-born workers in that occupation group, 0.3 percent lower because of immigrants adjusting to legal permanent resident status, and 0.1 percent lower because of new inflows of legal immigrants each year. Including area-specific linear time trends yields results similar to those shown in Table 2 throughout.

The fact that wage impacts vary by immigrant type is as interesting as the variation by skill level. Newly arriving immigrants (as compared with those adjusting status or as compared with the stock of all immigrants) have the largest positive (or smallest negative) wage impacts on natives in all three occupation groups. This is also the only group that does not cause a significant negative wage effect among natives working as manual laborers. This result could be due to the lack of substitutability of new immigrants for natives. Friedberg (2001) similarly argues that evidence of a positive wage impact of newly arrived Russian immigrants on the wages of Israeli natives suggests that new immigrants are not very substitutable for native workers. In our results, the positive wage effects are smaller in magnitude (and the negative wage effects larger) for immigrant groups with more U.S. experience, which gives them time to acquire social capital and English skills as well as possibly to work. Our findings are consistent with immigrant assimilation increasing the substitutability of immigrants for native workers and hence the wage impacts on natives becoming more adverse over time.

The OLS regression results in Table 2 are biased if immigrants settle in the areas that offer relatively high wages or wage growth for their occupations and the area fixed effects do not fully control for this endogeneity. Although this is a bigger problem for the INS data on new and adjusting immigrants, it is also a concern for the CPS data if the foreign born move within the U.S. in response to higher wages or wage growth. We therefore instrumented for the immigrant share with the number of immigrants in the INS data who are spouses of U.S. citizens (relative to total employment), as discussed above.

The first-stage results are reported in the Appendix. In all specifications, the instruments are each significantly different from zero as well as jointly significantly different from zero. The positive relationships between most of the instruments and the measures of the immigrant share

are simply mechanical. However, the relationship between the share of all foreign born workers and the share of new LPRs married to U.S. citizens is negative when area fixed effects are included (column 2). This negative relationship is likely due to marriage market factors: if an area has relatively few immigrants, single people—including citizens—may be more likely to marry someone who does not already have a green card. In other words, some people seeking an immigrant spouse cannot find one, so they are willing to, in essence, import one. The relationship is smallest (in absolute value terms) for manual laborers, who represent the largest pool of potential spouses already present in the U.S., either as green card holders or undocumented immigrants (neither of which is included in our instrument).

Table 3 shows the two-stage least squares results. The pattern of the results is similar to those discussed above. As expected, instrumenting for immigrant shares generally produces more negative effects, and the statistical significance of the positive wage effects when controlling for time-invariant area effects disappears for most groups. For manual laborers, the immigrant stock and the number of immigrants adjusting status now have slightly more negative significant wage effects than before. A 1 percentage point increase in the share of all immigrants reduces average wages of low-skilled natives by .26 percent, and a 1 percentage point increase in the share of immigrants adjusting status reduces native low-skilled wages by 4.2 percent (columns 2 and 4, respectively). Normalizing these effects by evaluating them at the means given in Table 1, overall low-skilled native wages are 2.4 percent lower as a result of the immigrant stock and 0.5 percent lower as a result of immigrants adjusting status each year.

Conclusion

In this paper, we take another look at how immigration affects the wages of U.S. natives. Findings in this literature are dominated by evidence of a modest but significant negative wage impact on unskilled natives, but there is little evidence on how other, more skilled workers are impacted by immigration. We address this question in several ways. First, we use INS data on new legal immigrants together with CPS data for 1994-2000. In order to allow wage effects to vary by worker skill level, we devise three occupational categories, ranging from manual laborers at the bottom of the skill range to professionals and executives at the top of the skill range.

Using an innovative instrumental variable—new immigrants who are spouses of U.S. citizens—and area fixed effects, we find two sets of interesting results. When instrumenting for immigrant shares, negative wage impacts are small in size and concentrated among low-skill, blue-collar occupations. We find wage effects that vary from about -0.05 to -0.25 percent for a 10 percent increase in the corresponding immigrant share. We find no evidence of adverse wage impacts on medium- and high-skilled native workers. In fact, increases in the newly arriving immigrant share of workers within professional and service-related jobs actually have slightly positive wage effects, suggesting there may be complementarities between native workers and newly arrived immigrants in the top skill categories.

The magnitudes of the wage effects—not just the signs—also appear closely related to both the skill group and the level of U.S. experience of the immigrant group. Wage effects generally become more negative as skill levels decrease. Wage effects also become more negative as immigrants' time in the U.S. increases. Although increases in the share of newly arrived immigrants have no statistically significant negative impact on the wages of low-skilled

natives, increases in the share of those who are already in the U.S. when they adjust status have a small but significant negative effect on low-skilled native wages. The biggest negative effect however, comes from the stock of all immigrants, which is also the immigrant group characterized by the most U.S. experience. Taken together, these findings suggest that the process of assimilation makes immigrants more substitutable for natives and hence increases wage competition.

References

- Altonji, Joseph C., and David Card (1991). "The Effects of Immigration on the Labor Market Outcomes of Less-skilled Natives." In *Immigration, Trade, and the Labor Market*, ed. John M. Abowd and Richard B. Freeman. Chicago: University of Chicago Press, pp. 201-234.
- Borjas, George J. (1999). "The Economic Analysis of Immigration." In *Handbook of Labor Economics*, Vol 3, ed. Orley Ashenfelter and David Card. Amsterdam: Elsevier, pp. 1697-1760.
- Borjas, George J. (2001). "Does Immigration Grease the Wheels of the Labor Market?" *Brookings Papers on Economic Activity*: 69-133.
- Borjas, George J. (2003). "The Labor Demand Curve Is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market." NBER Working Paper No. 9755, June.
- Borjas, George J., Richard B. Freeman, and Lawrence F. Katz (1992). "On the Labor Market Impacts of Immigration and Trade." In *Immigration and the Work Force: Economic Consequences for the United States and Source Areas*, ed. George J. Borjas and Richard B. Freeman. Chicago: University of Chicago Press, pp. 213-244.
- Borjas, George J., Richard B. Freeman, and Lawrence F. Katz (1997). "How Much Do Immigration and Trade Affect Labor Market Outcomes." *Brookings Papers on Economic Activity*: 1-90.
- Butcher, Kristin F., and David Card (1991). "Immigration and Wages: Evidence from the 1980's." *American Economic Review* 81 (May): 292-296.
- Camarota, Steven A. (1997). "The Effect of Immigrants on the Earnings of Low-Skilled Native Workers: Evidence from the June 1991 Current Population Survey." *Social Science Quarterly* 78 (June): 417-431.
- Card, David (2001). "Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration." *Journal of Labor Economics* 19 (January): 22-64.
- Chapman, Bruce J., and Robyn R. Iredale (1993). "Immigrant Qualifications: Recognition and Relative Wage Outcomes." *International Migration Review* 27 (Summer): 359-387.
- Chiswick, Carmel U. (1989). "The Impact of Immigration on the Human Capital of Natives." *Journal of Labor Economics*. 7 (October): 464-486.
- Chiswick, Carmel U., Barry R. Chiswick, and Georgios Karras (1992). "The Impact of Immigrants on the Macroeconomy." *Carnegie-Rochester Conference Series on Public Policy* 37 (December): 279-316.
- Duleep, Harriet and Mark C. Regets (1999). "Immigrants and Human Capital Investment." *AER Papers and Proceedings* 89 (May): 186-191.

Frey, William H. (1995). "Immigration and Internal Migration 'Flight' from US Metropolitan Areas: Toward a New Demographic Balkanisation." *Urban Studies* 32 (May): 733-757.

Friedberg, Rachel M. (2000). "You Can't Take It with You? Immigrant Assimilation and the Portability of Human Capital." *Journal of Labor Economics* 18 (April): 221-251.

Friedberg, Rachel M. (2001). "The Impact of Mass Migration on the Israeli Labor Market." *Quarterly Journal of Economics* 116 (November): 1373-1408.

Gallo, Carmenza, and Thomas R. Bailey (1996). "Social Networks and Skills-Based Immigration Policy." In *Immigrants and Immigration Policy: Individual Skills, Family Ties, and Group Identities*, ed. Harriett O. Duleep and Phanindra V. Wunnava. Greenwich, CT: JAI Press, pp. 203-217.

Greenwood, Michael J., and Gary L. Hunt (1995). "Economic Effects of Immigrants on Native and Foreign-Born Workers: Complementarity, Substitutability, and Other Channels of Influence." *Southern Economic Journal* 61(April): 1076-1097.

Greenwood, Michael J., John M. McDowell, and Eloise Trabka (1991). "Conducting Descriptive and Analytical Research with the Immigration and Naturalization Service Public Use Tapes." *Journal of Economic and Social Measurement* 17: 131-153.

Hamermesh, Daniel S. (1993). *Labor Demand*. Princeton: Princeton University Press.

Hanson, Gordon H., and Matthew J. Slaughter (2002). "Labor-market adjustment in open economies: Evidence from US States." *Journal of International Economics* 57 (June): 3-29.

Holmes, Charles W. (2000). "Immigrants Caught in INS Backlog: Promised Land on Hold While the Agency from Hell Works to Reduce a Flood of Immigrant Applications." *Contra Costa Times*, July 2, A6.

Jaeger, David A. (1996). "Skill Differences and the Effect of Immigrants on the Wages of Natives." U.S. Bureau of Labor Statistics Working Paper No. 273, March.

Jaeger, David A. (2000). "Local Labor Markets, Admission Categories, and Immigrant Location Choice." Hunter College and Graduate School CUNY Working Paper, June.

Jasso, Guillermina, and Mark R. Rosenzweig (1995). "Do Immigrants Screened for Skills do Better than Family Reunification Immigrants?" *International Migration Review* 29 (Spring): 85-111.

Johnson, George A. (1998). "The Impact of Immigration on Income Distribution among Minorities." In *Help or Hindrance? The Economic Implications of Immigration for African Americans*, ed. Daniel S. Hamermesh and Frank D. Bean. New York, NY: Russell Sage Foundation, pp. 17-50.

Kritz, Mary M., and Douglas T. Gurak (2001). "The Impact of Immigration on the Internal Migration of Natives and Immigrants." *Demography* 38 (February): 133-145.

LaLonde, Robert J., and Robert H. Topel (1991). "Labor Market Adjustments to Increased Immigration." In *Immigration, Trade, and the Labor Market*, ed. John M. Abowd and Richard B. Freeman. Chicago: University of Chicago Press, pp. 167-199.

Leamer, Edward E. (2000). "What's the Use of Factor Contents?" *Journal of International Economics* 50 (February): 17-49

Mosisa, Abraham T. (2002). "The Role of Foreign Born Workers in the US Economy." *Monthly Labor Review* (May): 3-14.

Quispe-Agnoli, Myriam, and Madeline Zavodny (2002). "The Effect of Immigration on Output Mix, Capital, and Productivity." Federal Reserve Bank of Atlanta *Economic Review* 87 (Second Quarter): 17-27.

Schoeni, Robert F. (1997). "The Effects of Immigration on the Employment and Wages of Native Workers: Evidence from the 1970s and 1980s." Mimeo, RAND.

Smith, James P., and Barry Edmonston (1997). *The New Americans: Economic, Demographic, and Fiscal Effects of Immigration*. Washington, DC:National Academy Press.

Table 1
Descriptive Statistics

Occupation group	Immigrants as % all workers			Immigrant spouses as % all workers	Average wage
	All	Adjusting	New		
Professionals	6.44 (6.20)	.12 (.12)	.13 (.14)	.03 (.04)	19.04 (2.44)
Service workers	7.03 (8.10)	.07 (.11)	.10 (.11)	.03 (.04)	10.78 (1.41)
Manual laborers	9.25 (11.29)	.11 (.25)	.15 (.26)	.03 (.08)	12.13 (1.50)

Note: Shown are sample means (standard deviations). Service workers includes sales, service, and clerical occupations; manual laborers includes precision craft and repair occupations, laborers, and farm workers. In column 1, immigrants as a percentage of all workers is the number of foreign-born workers in the CPS relative to all workers in the CPS. Columns 2 and 3 are, respectively, the number of immigrants adjusting status and newly-arriving immigrants in the INS data relative to all workers in the CPS. Column 4 is the number of immigrants who are spouses of U.S. citizens and are new arrivals or adjusting from non-work visas in the INS data relative to all workers in the CPS. The average wage is the real average hourly wage of natives, computed as usual weekly earnings divided by usual weekly hours for salaried workers, deflated using the PCE. The data are for an unbalanced panel of 283 metropolitan areas during 1994-2000 for a total of 1735 observations per occupation.

Table 2
OLS Estimates of the Relationship between Natives' Wages and Immigration

Occupation group	All immigrants		Adjusting status		Newly arriving	
	(1)	(2)	(3)	(4)	(5)	(6)
Professionals	.0070** (.0006)	.0025** (.0004)	.248** (.023)	.070** (.016)	.261** (.030)	.116** (.020)
Service workers	.0040** (.0004)	.0008* (.0003)	.189** (.032)	.024 (.020)	.276** (.037)	.093** (.026)
Manual laborers	.0019** (.0003)	-.0008** (.0002)	.021 (.015)	-.026** (.007)	.047** (.014)	-.008 (.011)
Occupation fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area fixed effects	No	Yes	No	Yes	No	Yes

Note: Shown are estimated coefficients from OLS regressions of average natives' wages on the share of workers who are immigrants in an occupation, area, and year. In columns 1 and 2, the immigrant share is constructed using all foreign born workers in the CPS; in columns 3-6, the immigrant share is constructed using all immigrants adjusting status or newly-arriving immigrants in the INS data. The regressions also include controls for average worker characteristics (see text for details) and fixed effects as indicated. Robust standard errors are in parentheses. Each column is from a separate regression with 5205 observations.

† p < .10; * p < .05; ** p < .01

Table 3
2SLS Estimates of the Relationship between Natives' Wages and Immigration

Occupation	All immigrants		Adjusting status		Newly arriving	
	(1)	(2)	(3)	(4)	(5)	(6)
Professionals	.0078** (.0011)	.0007 (.0012)	.220** (.035)	.060 [†] (.031)	.204** (.030)	.128** (.038)
Service workers	.0058** (.0011)	-.0006 (.0012)	.221** (.049)	.050 (.037)	.227** (.050)	.092* (.046)
Manual laborers	.0031** (.0011)	-.0026* (.0012)	.052 [†] (.031)	-.042 [†] (.023)	.033 (.021)	-.012 (.021)
Occupation fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area fixed effects	No	Yes	No	Yes	No	Yes

Note: Shown are estimated coefficients from 2SLS regressions of average natives' wages on the share of workers who are immigrants in an occupation, area, and year. The instrument is the number of immigrants who are spouses of U.S. citizens and are new arrivals or adjusting from non-work visas in the INS data relative to all workers in the CPS in an occupation, area, and year. The regressions also include controls for average worker characteristics (see text for details) and fixed effects as indicated. Robust standard errors are in parentheses. Each column is from a separate regression with 5205 observations.

[†] $p < .10$; * $p < .05$; ** $p < .01$

Appendix Table 1
First Stage for 2SLS Estimates of the Relationship between Natives' Wages and Immigration

Occupation	All immigrants		Adjusting status		Newly arriving	
	(1)	(2)	(3)	(4)	(5)	(6)
Professionals	70.008** (7.556)	-59.422** (7.763)	2.529** (.164)	2.063** (.233)	2.911** (.181)	1.433** (.175)
Service workers	80.711** (8.883)	-38.659** (7.689)	2.130** (.191)	1.777** (.244)	2.124** (.115)	.670** (.159)
Manual laborers	41.878** (5.992)	-10.312** (3.520)	2.011** (.582)	1.789** (.563)	2.666** (.315)	1.433** (.175)
F-test for joint significance	54.17 (0.00)	21.56 (0.00)	107.39 (0.00)	37.44 (0.00)	154.13 (0.00)	26.61 (0.00)
Occupation fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area fixed effects	No	Yes	No	Yes	No	Yes

Note: Shown are estimated coefficients from first stage regressions of the fraction of workers who are immigrants on the fraction of workers who are admitted as spouses of U.S. citizens and are new arrivals or adjusting from non-work visas in an occupation, area, and year. The regressions also include controls for average worker characteristics (see text for details) and fixed effects as indicated. Robust standard errors are in parentheses (p-value for the F-test). Each column is from a separate regression with 5205 observations.

† p < .10; * p < .05; ** p < .01