# Immigrants or Jobs: Which comes First to a Metro?

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## Abstract

Does immigration generate jobs in an MSA, or do employment opportunities entice immigrant inflows to an MSA? Is immigration responsible for higher unemployment, or do foreign-born inflows cause increases in self-employment that lead to improvement in labor market conditions? The temporal causal relationship between immigrants, job growth and unemployment is a politically and economically salient subject, but has been statistically untested in the economic literature. Using annual data of 500 MSAs, we use panel Granger causality tests to assess the temporal ordering of immigration and labor market conditions in an MSA. Results demonstrate one-way Granger causality from immigration to rising job growth and lower unemployment. Granger causality tests further reveal that foreign-born inflows cause higher self-employment rates, which in turn contribute to job creation. Results reject the booming city hypothesis that immigration and labor market outcomes are spuriously correlated due to improving labor market conditions attracting immigration to an MSA.



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# 1. Introduction

The relationship between immigration and the labor market remains an open question. This study is the first to examine the temporal causal relationship between immigration and jobs, measured by employment growth, change in employment share, unemployment rate and self-employment rate in U.S. MSAs. We address a major difficulty endemic in the immigration literature, endogeneity: cities that are experiencing an economic boom may simultaneously attract immigrants. Borjas (2003), for instance, writes, "If immigrants endogenously cluster in cities with thriving economies, there would be a spurious positive correlation between immigration and wages. Second, natives may respond to the wage impact of immigration on a local labor market by moving their labor or capital to other cities." To evaluate these concerns, Granger Causality tests assess short-run temporal ordering, and evaluate several salient questions in the immigration literature: Which comes first to a metro: job growth or immigrants? What is a possible mechanism? Does immigration depress wages and lead to native-born workers leaving a metro?

The immigration literature has primarily adopted decennial Census data and focused on changes in real wages over three or four decades. Most works employ a relatively small panel dataset; for example, Card's prominent 2007 work examined the 17 largest metros and a second dataset looked at the 100 largest metros over three decades. In contrast, our paper adopts the new ACS (American Community Survey) data that comprise annual observations since 2005 of more than 500 MSAs. This dataset has several advantages over prior works.

Annual data allow a focus on temporal causality; whereas, causality tests with decennial data are problematic for a number of reasons. Decennial data contain only a limited number of time series observations due to differencing and lagging; additionally, the definition of MSA regions and the number of sampled MSAs has risen several fold over the past several decades. Further, most studies employ decennial data from 1960 or 1970 to 2000. This data however maybe dated as the composition of immigrants has evolved; e.g., in recent years, the Census reports a rising proportion of immigrants arriving from Asia. Wadhwa, Freemand and Rissing (2008) find Asian immigrants tend to be more educated, technology-focused, and entrepreneurial than immigrants arriving a decade or two ago from Latin America. Rampell (2013) also reports that over the past decade (see later discussion), immigrants have become more entrepreneurial, perhaps because of their changing ethnic composition. Hall et al. document that the percentage of high-skilled immigrants has increased from 24% in 1990 to 30% in 2010. Hence, in contrast, to prior immigration work, our data from 2005-2011 reflects this new immigration composition, their increased education and entrepreneurship, and then highlights the consequences of their higher self-employment rates.

The concept of causality, moreover, is less straightforward using data sampled a decade apart; that is, causality testing is a temporal concept and analyzes the response of Y to an innovation in X. When economists analyze what affects/predicts/causes job growth, they use quarterly or annual data, not data observed once a decade. For instance, if immigration increased in Chicago from 1980 to 1990, and we then observe job growth rose from 1990 to 2000, there could be many structural factors that affect the job market over the decade. This includes changes in industrial structure or education (the typical control in most immigration wage studies). It is more straightforward to examine the relationship between immigration increasing from 2006 to 2007 or 2007 to 2008 and then test job market movements in subsequent years controlling for lagged job growth. The relevance of demographic controls such as education is less relevant on a year-to-year basis since educational attainment slowly changes over-time, and hence is unlikely to be a major factor in explaining employment changes in the short to medium-run (the following year or two).[1]

The focus on causality, rather than a structural model using instrumental variables, has the additional advantage that it avoids both model specification problems and the instrumental variable dilemma (of picking exogenous instruments). The Granger Causality method is model free, avoids simultaneity issues, and lets the data speak by directly addressing a critical issue: Does immigration lead to improved economic outcomes, or is this relationship spurious, and due to improved economic opportunities in a metro attracting immigration inflows?

The focus on jobs, unemployment and immigration with annual data is more policy relevant. Although the academic literature has largely focused on wages, the popular press and policy makers emphasize job creation and unemployment, not wage growth, when comparing economic activity across metros. Discussion of the negative effects of immigration largely stem from their possible effects on replacing native-born jobs, and thereby contributing to unemployment in a city. Annual data allows an evaluation of immigration's impact on the labor market over several years, a relevant period for policy-makers and addresses a relevant policy concern: Has immigration lead to job growth or are immigrants merely taking native-born worker jobs?

Lastly, our new panel dataset contains a substantially larger cross section of MSAs than prior works. The variation in the labor market (measured by job growth, change in employment share

[1] As a result, the importance of education controls, while standard for decennial wage analysis, is less common for job prediction. Oywang, Rapach and Wall (2009) find no evidence that education affects differences in state employment changes over the business cycle. Rapach and Strauss (2008, 2010, 2012) use a combination of different variables to forecast job growth; education was not a relevant variable. Results in Table 3 also highlight that controlling for education has no effect on immigration estimates.

and unemployment rate) and immigration is considerable across the 500 metros, and imposing a common restriction across metros combined with the variation in explanatory variables imply our panel Granger Causality tests have considerable power to address unanswered questions in the academic literature.

Our approach moreover evaluates the booming city hypothesis postulated by Borjas (2003) who claims there is no causal relationship between immigrants and growing cities, but instead only a spurious correlation as immigrants move to cities that are thriving. This hypothesis maintains that both foreign-born inflows and wages (or in our case job creation) are simply responding to a common positive macroeconomic shock in the MSA. Granger causality tests are specifically designed to assess a temporal ordering, or which comes first Borjas, Freeman and Katz (1997) and Borjas (2003) argue further that it is critical to control for the "strong currents that tend to equalize economic conditions across cities and regions, " and mention the the importance of location decisions of the native population response to immigration, arguing native-born flows "to California has been greatly reduced by the influx of immigrants since 1970." To control for these equilibrating flows, trivariate Granger causality tests examine the causal relationship between immigration growth, job growth and native-born job growth. If domestic migration is an important equilibrating factor and a spurious relationship exists (between immigration and economic conditions), we should observe both a significant relationship between native-born and foreign-born labor flows, a significant relationship between domestic migration and economic conditions, and different results than the bivariate specification.

A preview of the Granger Causality tests highlights several salient findings. First, increases in a MSA's lagged immigrant share (foreign-born/population) or immigration growth lead to significantly higher employment growth, rise in employment share (employed/labor force) and decline in the unemployment rate. In contrast, changes in lagged employment growth, employment share or unemployment do not lead to a rising foreign-born share or immigration growth in a MSA. This implies that one-way Granger causality exists from rising immigration to job creation and lower unemployment. Results are robust to controlling for changes in education including dropout and college graduation rates; however, the positive effect of lagged foreign inflows on employment growth appear to be concentrated for younger workers, ages 20-44.

Second, results show that domestic and foreign inflows are approximately orthogonal and controlling for domestic migration has no effect on the immigration-employment relationship. Further, domestic migration has a substantially smaller contemporaneous and lead relationship on job creation than immigration. Immigrants are more likely to move to MSAs that are struggling not MSAs with improving economic conditions. Hence, data significantly reject the booming city/spurious correlation premise between immigrants and job creation.

Third, we evaluate two possible paths that immigration may improve job creation - increases in self-employment or lower wages (proxied by income). Results reveal rising immigration Granger Causes increased self-employment in a city, which in turn contributes to higher job creation. Moreover, immigration Granger Causes higher (not lower) income growth. Hence, we identify self-employment as the mechanism through which immigration positively impacts job opportunities in a metro. These results supports a recent report by the Partnership for a New American Economy (2013) that finds immigrants are "creating American jobs through self-employment. The rate of immigrant self-employment is roughly three times the rate among the U.S.-born population. By helping businesses grow (through demand of local services) and starting their own firms, immigrants create the very opportunities that make communities attractive to others."

Since issues of job creation and population growth are critical to a metros success, many metros in the Midwest that are struggling with declining demographics and low employment growth have launched immigration initiatives to jump-start their economy. For example, Welcome Dayton, Global Cincinnati, Global Cleveland, Global Detroit, Welcome Tennessee, Global Pittsburgh, the Mosaic Project (St. Louis) and efforts in Lansing and Indianapolis are all aimed at rejuvenating job growth and economic vitality in their cities by attracting immigrants. The Nytimes (Preston, 2013) reports "many struggling cities are trying to restart growth by luring enterprising immigrants, both highly skilled workers and low-wage laborers." These metros are hoping that immigration "by building the talent, innovation, and culture change to a region' can "spark its economic renaissance." (Global Detroit, 2012). Global Detroit's 160 page document is well-written with motivating stories of how immigration can help through entrepreneurship; however, it does not provide empirical evidence that shows immigration leads to increased economic activity. In a city such as Detroit that is struggling with very high jobs losses (the BLS reports a decline of 113,000 from 2005-2011), it is natural to ask the question: can increasing the labor supply with more immigrants improve an economy by creating jobs? Monogan (2013) recently finds that "immigration policies in U.S. states are influenced by legislative professionalism, electoral ideology, state wealth and changes in the foreign born population." It is time that economics and data play an important role as well.

The rest of the paper proceeds as follows. Section 2 explains the data and econometric methodology, while Section 3 presents the empirical results. Section 4 concludes.

# 2. Data and Methodology

## 2.1. Data

We use Census data from factfinder2.census.gov, and consider a relatively large sample of 505 MSAs from the American Community Survey (ACS). One-year estimates from 2005 to 2011 are examined and the analysis begins with analyzing jobs:

*"S2301 Employment Status, Employed; Population 16 years and over and In labor force; Population 16 years and over"*

S2301 contains the employment rate or employment share ($ES$), which is the percentage of people working in the civilian labor force, the unemployment rate ($U$) and labor force. Employment growth, $EG$ is obtained by multiplying the employment rate by the labor force and then log differencing. The number of foreign-born my MSA is given by:

*"B05002 Place of Birth by Nativity & Citizenship Status, foreign born, native born in other state."*

B05002 provides place of birth. Immigrants are under the foreign-born heading and individuals born in other states are a separate heading and are used to track native-born migration.

Following Altonji and Card (1991), Borgas Grogger and Hansen (2010) and others we consider the foreign-born share, $FBS$; this is obtained by dividing the foreign-born by the total population in that metro, which is the first column of data in this file. For robustness, we also consider the effects of increases in the growth rate of the foreign born, $FBG$. We also examine the domestic migration share, $MGS$, obtained by dividing native-born Americans born in other states by population. For robustness we consider the growth of this variable as well, $MGG$. To obtain self-employment, we use the following data:

*" S2408 Class of Worker by Sex and Median Earnings in the past 12 Months for the civilian employed population 16 years and over."*

This dataset has two categories of self-employed: Self-employed in own incorporated business workers, $SEI$, and self-employed in own not incorporated business workers and unpaid family workers$SEN$,. We divide incorporated self-employed by total population to obtain its share $SEIS$; additionally, we add incorporated and unincorporated together to obtain total self-employment ($SE$=$SEI$,+$SEN$) and divide by population, $SES$.

Following the literature (Altonji and Card, 1991), we use education as a control variable. High school dropouts, and college graduation are obtained in the ACS at:

*"S1501 Educational Attainment."*

Median earnings and average earnings are given in:

*" S2408 Total; Estimate; Civilian employed population 16 years and over with earnings - Private for-profit wage and salary workers."*
*"S1902 Mean Income in the past 12 Months."*

In terms of terminology, foreign-born and immigrants are identical terms, and native-born refer to Americans born in the U.S. or outside the U.S. to American parents (this latter part is a relatively small component).

## 2.2. Regression Specification

As mentioned, a critical but neglected issue with the immigration literature is causality. We use panel Granger Causality tests that impose a common coefficient restriction across the panel. To accommodate for cross-sectional heteroscedasticity we use a White heteroscedasticity correction. The regression framework has an advantage in its simplicity and lack of model priors, and the bivariate tests is specified as:

$$EG_{i,t} = \alpha + \beta_1 \Delta FBS_{i,t-1} + \beta_2 \Delta FBS_{i,t-2} + \beta_3 EG_{i,t-1} + \beta_4 EG_{i,t-2} \tag{1}$$

$$\Delta FBS_{i,t} = \alpha + \gamma_1 \Delta FBS_{i,t-1} + \gamma_2 \Delta FBS_{i,t-2} + \gamma_3 EG_{i,t-1} + \gamma_4 EG_{i,t-2} \tag{2}$$

where employment growth is EG and the Foreign-born share of the population, FBS, is differenced due to its high persistence. We use two lags due to AIC criteria; a third lag is not significant. If $\chi^2$ statistics reject $\beta_1 = \beta_2 = 0$ but can not reject $\gamma_3 = \gamma_4 = 0$, one-way Granger Causality exists from immigration to employment growth. If $\beta_i > 0$, cities that are experiencing a rising immigrant share are generating increased job creation the following year or two. If $\chi^2$ statistics reject both $\beta_1 = \beta_2 = 0$ and $\gamma_3 = \gamma_4 = 0$, and both $\beta_i$ and $\gamma_i > 0$, then two-way Granger causality occurs; e.g., higher immigration leads to more jobs, and more jobs attract foreign-born inflows to a metro. No causal relationship exists if $\chi^2$ statistics cannot reject both $\beta_1 = \beta_2 = 0$ and $\gamma_1 = \gamma_2 = 0$.

Results also report the effect of foreign born growth (FBG) on job growth:

$$EG_{i,t} = \alpha + \beta_1 FBG_{i,t-1} + \beta_2 FBG_{i,t-2} + \beta_3 EG_{i,t-1} + \beta_4 EG_{i,t-2} \tag{3}$$

$$FBG_{i,t} = \alpha + \gamma_1 FBG_{i,t-1} + \gamma_2 FBG_{i,t-2} + \gamma_3 EG_{i,t-1} + \gamma_4 EG_{i,t-2} \tag{4}$$

We begin with employment growth as policy makers are often interested in creating more jobs in the MSA. However, it is also important to examine the changes in the employment rate or share, ΔES, (as this variable is population free) and the unemployment rate, ΔU, which directly addresses the question are immigrants taking jobs away and causing rising unemployment? In this case, EG in (1)-(4) is replaced by ΔES or ΔU as both variables are highly persistent. Additionally, although most Granger Causality test specifications are bivariate, Hsiao (1982) introduced a multivariate specification which includes lags of other potentially relevant variables. To evaluate the booming city hypothesis and potentially control for its implications (it posits the importance of native-born migration flows), we introduce changes in native-born individuals (ΔMG) from other states as a control variable:

$$\begin{aligned} EG_{i,t} = \alpha + \beta_1 \Delta FBS_{i,t-1} + \beta_2 \Delta FBS_{i,t-2} + \beta_3 EG_{i,t-1} + \beta_4 EG_{i,t-2} + \beta_5 \Delta MGS_{i,t-1} \\ + \beta_6 \Delta MGS_{i,t-2} + \beta_7 \Delta COL_{i,t-1} + \beta_8 \Delta DRP_{i,t-1} \end{aligned} \tag{5}$$

$$\begin{aligned} \Delta FBS_{i,t} = \alpha + \gamma_1 \Delta FBS_{i,t-1} + \gamma_2 \Delta FBS_{i,t-2} + \gamma_3 EG_{i,t-1} + \gamma_4 EG_{i,t-2} + \gamma_5 \Delta MGS_{i,t-1} \\ + \gamma_6 \Delta MGS_{i,t-2} + \gamma_7 \Delta COL_{i,t-1} + \gamma_8 \Delta DRP_{i,t-1} \end{aligned} \tag{6}$$

Equations (5) and (6) also allow for changes in education as this may impact economic conditions in an MSA; for conciseness, we report only the estimates using one lag for change in college graduate rate ($\Delta COL$) and dropout rate ($\Delta DRP$) as results for two lags are very similar. Further, to assess robustness of immigration's effect on the labor market, we also report the impact of FBG on EG, ΔES and ΔU.

# 3. Results

## 3.1. Summary Statistics and Graphical Evidence

Table 1 presents summary statistics. As expected, immigration's annual growth rate is positive, and twice the size of domestic migration across states; further, the average growth from 2005-2011 in immigrant inflows differs considerably across the the 505 MSAs, and the first and third quartiles of average immigration growth across 2005-2011 is -2.4% to 8.9%. Note aggregate job growth is approximately zero since from 2005 to 2011, and reflects the lack of job creation in total across the U.S.. This however hides the considerable dispersion of economic activity across the country; e.g., the 1st and 3rd quartiles of average employment growth from 2005-2011 across the 500 metros is -3.4% and 1.8% , and the 1st and 3rd quartiles for changes in unemployment from 2005-2011 is -.25% and 1.25%.

To illustrate this variation, Figure 1 presents a scatterplot of average immigration and job growth from 2005-2011 across the 500 MSAs. The scatterplot clearly displays the large variation across metros in both immigration and job growth; further, the regression line is visibly upsloping and reflects the positive and very significant correlation (27%, with a $t$ statistic of 6.06) between both variables.

If the booming city premise explains the positive immigration/job creation relationship, native-born and foreign-born workers are substitutes and subject to similar economic incentives. Thriving cities hence should also attract native-born migration; however, Figure 2 illustrates no significant relationship occurs between native-born migration and job growth; e.g., the correlation (probability) is -0.02 [.67]. Further, a high positive correlation should exist between native-born and foreign-born flows as job opportunities should attract inflows of both foreign and native-born workers.[2] Again, the correlation is approximately zero in Figure 3. The lack of common movement cast further doubt that a common macro-shock (leading to a spurious correlation) is behind the immigration-job creation relationship in Figure 1.

Figure 4 further demonstrates that the positive correlation between immigration growth and job growth is not spurious, as growth in immigration from 2005-2008 significantly leads strong growth in jobs 2009-2011. The Figure clearly exhibits a positive regression slope with a correlation ($t$ statistic) .12 (2.5). In contrast, Figure 5 shows the reverse relationship does not hold; that is, no significant relationship between job growth in 2005-2008 and immigration growth 2009-2011. Although these figures are not Granger Causality tests (because we are not controlling for lags in the dependent variable), they strongly infer that immigration comes first to metro, and then job growth follows, as well as job growth in an MSA does not attract foreign-born inflows to an MSA.[3]

Additionally, Figures 6-7 illustrate no relationship between native-born migration to a city from 2005-2008 and job growth 2008-2011, and vice-versa, and provides more evidence against the booming city hypothesis. Lastly, Figure 8 illustrates the relationship between immigration growth from 2005-2008 and migration 2009-2011. Frey (1995, 1995), Borjas, Freeman and Katz (1997), and Borjas (2003) posit immigration by lowering the real wage (which we test in Table V) leads to native-born flight. Figure 8 reveals no relationship between foreign-born inflows and subsequent native-born outflows, and hence does not support native-born flight.

Overall, the evidence illustrates several important premises. First, a strong relationship exists between immigration and job growth, and this same relationship does not occur between native-born migration and job growth. Second, this relationship appears to be causal not

[2] One can reasonably assume that native-born Americans should be more responsive to job opportunities since they do not have Visa restrictions (are not sponsored by a employer and therefore have to remain at the job), and should have better information due to language and culture; additionally, foreign-born workers are attracted to immigrant enclaves.

[3] Moreover, controlling for lagged job growth (2005-2008) is unlikely to affect inference since its correlation with job growth 2009-2011 is only -0.02.

spurious since immigration leads job growth and job growth does not lead immigration; again, domestic migration does not lead job growth. Lastly, there appears little relationship between domestic and foreign-born migration; hence, it is unlikely that immigration is merely responding to an already booming city (and a common macro shock) as native-born workers should also migrant to booming cities if they are substitutes with foreign-born workers.

## 3.2. Granger Causality Tests: Immigration and Job Creation

Table 2 presents bivariate Granger Causality tests between immigration and jobs. The sample size includes a cross-section of 505 Metros, and a total, unbalanced panel of 1980 observations. Equations (2.1)-(2.6) test the null hypothesis that lagged changes in the foreign-born share ($\Delta FBS_{t-i}$) or foreign-born growth ($FBG_{t-i}$) do not lead to improvements in the job market, measured by positive employment growth ($EG_t$), rise in the employment share ($\Delta ES_t$) or decline in the unemployment rate ($\Delta U_t$). Equations (2.7)-(2.12) test the opposite causality hypothesis - increases in lagged changes in employment growth or employment share or fall in the unemployment rate do not lead to higher foreign-born inflows (measured by immigration share or growth).

Results in (2.1) and (2.2) demonstrate that both $\beta_1 > 0$ and $\beta_2 > 0$; $t$ statistics exceed six in both equations, and $\chi^2$ statistics exceeding forty for $\beta_1 = \beta_2 = 0$, with Probability of 0.0000; hence, we strongly reject the hypothesis that lagged changes in the immigration share or immigration growth do not lead to significantly greater job growth. At the time, $\gamma_3 \ngtr 0$ and $\gamma_4 \ngtr 0$ in (2.7) and (2.8); thus, results can not reject the hypothesis that lagged employment growth does not lead to rises in foreign-born inflows. Results support one-way Granger Causality from immigration to higher job growth. Curiously $\gamma_1 < 0$ in (2.7), indicating that improved employment growth leads to lower immigration and implies immigrants are not attracted to booming cities. This provides additional evidence against the booming city hypothesis.[4]

Results in equations (2.3) and (2.4) along with (2.5) and (2.6) also show that both $\beta_1 > 0$ and $\beta_2 > 0$ and $\gamma_3$,$\gamma_3 \ngtr 0$; $\chi^2$ statistics again exceeded 40 for $\beta_1 = \beta_2 = 0$, with Probability of 0.0000. Increases in immigration lead to a higher employment share (more people working as a percentage of the labor force) and lower unemployment. This supports Hall et al. (2013) who find that immigrants have higher rates of employment than native-born workers. Since $\gamma_3 \ngtr 0$ and $\gamma_4 \ngtr 0$ in (2.9) and (2.10), a rising employment share or lower unemployment does not lead to additional foreign-born inflows to a metro. As a result, there is one-way Granger

[4]Although $\gamma_3 = 0$ in (2.8), $\gamma_3 < 0$ (although small) in (2.9) and (2.10) and $\gamma_1 > 0$ in (2.11)-(2.12) for unemployment. These results also do not support against the booming city hypothesis, since cities with declining employment and rising unemployment are attracting immigrant inflows.

causality - higher foreign-born inflows cause more jobs and lower unemployment.

Table 3 presents multivariate Granger Causality tests that control for changes in lagged native-born migration flows and education. The booming city hypothesis implies that controlling for native-born migration should lower $\beta_1$ and $\beta_2$ and raise their standard errors (since there should be collinearity) − as both native and foreign-born should respond to economic opportunities if their labor are substitutes. Results however in (3.1) and (3.2) are relatively similar to (2.1) and (2.2) and both $\beta_1$ and $\beta_2$ are highly significant with $t$ statistics exceeding six. At the same time, $\gamma_3$,$\gamma_4 \ngtr 0$ in (3.7) and (3.8) and indicate no reverse causation; hence, increases in immigration Granger Cause higher job growth. Note, further, that although the migration estimates are often significant in (3.1)-(3.2), they are half the foreign-born estimates.

Table 3 also shows that immigration Granger causes a greater employment share and a decline in unemployment rates; as the lagged foreign-born estimates are significant in (3.3)-(3.6), but the lagged employment shares and unemployment rates are not significant in (3.9)-(3.12) in explaining immigration inflows. The education controls are insignificant, and controlling for migration and education has little impact on inference.[5]

## 3.3. Granger Causality Tests: Identifying the Mechanism

Table 4 evaluates a possible mechanism through which immigration can impact employment conditions - increasing self-employment. Equations (4.1)-(4.3) test whether immigration leads to more self-employment. Results in (4.1) show that increases in the foreign-born share significantly raise the incorporated self-employment rate, while (4.7) demonstrates that increases in the incorporated self-employment rate have no impact on the foreign-born share. Hence, immigration Granger causes increases in the incorporated self-employment rate. Results in (4.3) also reveal that immigration Granger Causes increase in changes in incorporated businesses. In contrast, equation (4.2) shows that a rise in immigration inflows has no effect on total self-employment (incorporated + unincorporated) ; and although not shown for conciseness, immigration also has no impact on changes in total self-employment (incorporated + unincorporated). What is the difference between incorporated and unincorporated?

The Census (2012) reports, "Overall, incorporated self-employed workers appeared to have more human capital compared with nonincorporated self-employed workers. More incorporated self-employed workers had a bachelors degree or more education or were U.S. citizens (+14.6

[5]Tests using changes in high school graduation and manufacturing share in a metro were also conducted. These variables were insignificant, and did not change inference. Additionally, we also tested equations (3.1)-(3.6) using the college graduate rate and dropout rate in levels; again, there was little change in $\beta_1$ and $\beta_2$ and their significance.

and +5.3 percentage points respectively) and fewer reported speaking English less than very well (5.2 percentage points) compared with nonincorporated self-employed workers." Further, incorporated businesses tend to possess sales several times more than unincorporated businesses. The BLS (Hippie, 2010) additionally reports that incorporated businesses tend to be more full-time than unincorporated businesses, and Asian incorporated rates are more than twice that of Latinos and above native-born Americans; unincorporated businesses also are more than three times more likely to have not graduated from high school and twice as likely not to have attended college.

The immigration link to self-employment backs work by Fairlie (2011, 2012) that finds business formation rates for immigrants are more than twice native-born workers, and immigrants are more likely to higher employees (so self-employment generates further employment growth) - an average of 8 employees. Moreover, he reports that recent Asian immigrants possess nearly double the sales ($460,000) of Hispanic owned businesses ($257,000). The additional payroll generates further demand for local goods and services, along with additional employment in the region. The impact of Asian immigrants are likely important in differentiating this paper from prior immigration work based on past decennial data. The Pew Research Center (2012) reports that Hispanic immigrants were 60% of new immigrants in 2000 and Asians less than 20%, however, by the end of the decade, Asian immigrants were nearly 40%, and Hispanics less than 33%. The doubling of Asian immigrants and their propensity to start small businesses that then generate substantial payrolls is likely responsible for generating job growth (discussed below), while previous immigration studies based on earlier data missed this pattern.

What is the impact of increases of incorporated self-employment on the labor market? Equations (4.4)-(4.6) show that a rise in the incorporated self-employment share leads to job growth, greater employment share and a decline in the unemployment rate. Additionally, (4.10)-(4.12) demonstrates that bi-causality exists as increases in the labor market (rise in employment growth or employment share or decline in the unemployment rate) lead to more self-employment. Immigration thus leads to more self-employment and job growth, which then are mutually reinforcing.

Figure 9 illustrates the rising entrepreneurial endeavors of new immigrants. The dashed line shows that entrepreneurship rates for immigrants approximately doubled from 0.3 to 0.62 from 2001 to 2010; most of the rise occurred from 2005 to 2010 (our sample period) when immigration rates increased from 0.35 to 0.62. Prior decennial Census data and academic work likely missed this upward trend. Creation of small businesses thus lead to increased employment growth as these firms expand, or self-employed immigrants purchase local goods and services, which leads to increased local economic activity and job expansion at firms in the metro.

These results are consistent with Wadhwa et al. (2008) that shows that skilled immigration is the backbone of entrepreneurship and a "driving force in recent U.S. economic growth." Catherine Rampbell (2013) reports "One of the key economic arguments underpinning the immigration overhaul is that immigrants create jobs  not only because they spend money, but because they tend to be unusually entrepreneurial and innovative and so create job opportunities for the people around them." Rambell also posits that "immigrants are also more likely to start a business in any given month. In 2010, the business formation rate per month among immigrants was 0.62 percent, meaning that of every 100,000 non-business-owning immigrants, 620 started a business each month. The comparable rate for nonimmigrants was 0.28 percent (or 280 out of every of 100,000 non-business-owning adults). As for job creation, companies owned by immigrants are slightly more likely to hire employees than are non-immigrant-owned companies." As a result, immigrants do not steal jobs, but help create them as increases in self-employment lead to more jobs and lower unemployment.

A second reason that immigration may lead to job creation is that business location theory posits that a critical factor in affecting a firm's choice of a particular metro is the availability of skilled labor (Berger and Fisher, 2013; Bania, Calkins and Dalenberg, 1992; Karakaya and Canel, 1998; Fox and Murray, 1990). Immigrants provide different skill sets than native-born workers (Peri, 2007), and as a result, further, do not crowd-out work of native-born individuals (Peri, 2009). A series of six reports by Brookings Institution (2012, 2013) demonstrate that immigrants are improving the economic climate of a region (which then creates jobs for all workers) through a number of factors: patents by immigrants are reinventing the American economy, the importance of their propensity for small business creation, their critical role in STEM, their contribution to stabilizing housing prices and less desirable communities, and their ability to create and preserve manufacturing jobs. Hunt and Gauthier-Loiselle (2010) reveal that immigrants have abundant human capital and ideas, and patent at double the native rate, due to their disproportionately high share of science and engineering degrees.[6] Additionally, immigrants in the U.S. were twice as likely to have received Nobel prizes from 1990-2000 or be physicians (Hunt and Gauthier-Loiselle, 2010), or founders of public venture-backed companies in the 19902005 period (Anderson and Platzer, 2006), or to be entrepreneurs of new high-tech companies with sales exceeding 1 million dollars (Vivek Wadhwa et al., 2007).

[6]Using a 1940-2000 state panel, they find that a 1% increase in the share of immigrants with college degrees increases patents per capita by 9%18%. They also offer some tantalizing facts on the importance of these effects for the United States: 50% of all new Ph.Ds. in engineering; 45% of all new Ph.Ds. in life sciences, physical sciences and computer sciences, and 40% of all new masters degrees in computer sciences, physical sciences, and engineering are awarded nationally to foreign-born students.

Immigrants for instance are also heavily over-represented among members of the National Academy of Sciences and the National Academy of Engineering, among authors of highly cited science and engineering journal articles, and among founders of biotech companies (Stephan and Levin, 2001). Kerr and Kerr (2013) find “Immigrants play a significant role in many aspects of the US economy, but their impact in occupations related to science, technology, engineering, and mathematics (STEM) is especially pronounced. Immigrants account for about a quarter of all STEM workers with college degrees or higher in the 2000 census, and about half of those with doctorates. Much of the recent growth in US employment in STEM occupations is linked to immigrants.” Further, immigrants by increasing the population size leads to positive agglomeration, and leads to more firms migrating to the city (Glaeser and Gottlieb, 2009; van Oort, Burger, Knoben and Raspe, 2012). This story is consistent with our results: immigrants move to a metro, start small businesses and then job creation occurs.

Table 5 examines the impact of immigration on income and employment growth by different age cohorts. The $t$ statistics in (5.1) and (5.2) exceed three and hence immigration significantly increases both average and median income growth; at the same time, this causation is one-way, lagged income growth is not a significant determinant of foreign-born inflows as the $t$ statistics in (5.7) and (5.8) are not significant. Thus, immigration Granger Causes income growth.

Figure 8, which is discussed above, illustrates the lack of a causal relationship between immigration and native-born flight; what does Granger Causality tests tell us? Lagged foreign-born share estimates ($t$ statistics) in year one and two are .49 (2.2) and .51 (3.0), and hence significantly positively lead domestic migration. In contrast, lagged migration flows estimates ($t$ statistics) are .008 (1.26) and .004 (.54) and are not a factor in explaining or causing immigration. Hence, domestic migration does not contribute to or cause foreign-born migration.[7] Thus, immigration by creating positive economic conditions Granger Causes native-born migration into a metro, not flight.

Equations (5.3)-(5.6) test the effects of lagged immigration on employment growth for age cohorts, 20-24, 25-44, 45-54 and 55-64. The lagged foreign-born share leads employment growth for age cohorts 20-24 and 25-44 in (5.3) and (5.4); further, since $\gamma_3 = \gamma_4 - 0$ for (5.9) and (5.10)), immigration Granger causes employment growth for younger workers, ages 20-44. However, immigration does not lead to more employment growth for middle-aged workers, 45-64. This is an interesting finding, and potentially deserves further exploration.

[7]For conciseness, the full regression results are not reported in Table 5 but available upon request.

## 4. Conclusion

This paper is the first to explore the short-run causal relationships between immigration, employment growth and small business creation in U.S. metros. This issue has considerable public policy implications as many cities are currently promoting more immigration to improve their economy. Hence, it is critical to analyze the effects of immigration on job growth and unemployment and validate their initiatives. Our results show that the positive relationship between immigration and labor market conditions in a metro is not spurious. Increased immigration in a metro Granger Causes higher employment growth, a rising employment share and declining unemployment. The positive effect on employment growth however appears to be concentrated for younger workers, ages 20-44.

Moreover there is no reverse causality - increased job growth does not entice more immigrant inflows to a city. Immigration further leads to higher self-employment rates, which in turn lead to increased job creation. The increase in labor supply additionally does not depress the real wage nor lead to flight of native-born workers.

Table 1: **Summary Statistics**

| VAR | FBG | ΔFBS | MGG | ΔMGS | EG | ΔES | ΔU | INCG |
|---|---|---|---|---|---|---|---|---|
| Mean | 0.036 | 0.001 | 0.01 | 0.001 | 0.003 | -0.774 | 0.531 | -0.019 |
| Median | 0.031 | 0.001 | 0.051 | 0.001 | 0.005 | -0.6 | -0.067 | -0.018 |
| Maximum | 2.111 | 0.066 | 5.587 | 36.785 | 0.230 | 10.200 | 3.537 | 1.316 |
| Minimum | -2.252 | -0.069 | -4.895 | -36.639 | -0.236 | -11.5 | -0.569 | -1.233 |
| Std. Dev. | 0.274 | 0.013 | 1.723 | 4.092 | 0.05 | 2.485 | 1.428 | 0.218 |
| Skewness | -0.126 | 0.049 | 0.069 | 0.129 | -0.232 | -0.195 | 1.402 | -0.191 |
| Kurtosis | 10.895 | 5.92 | 3.025 | 25.42 | 4.484 | 3.979 | 3.42 | 7.221 |

FBG and ΔFBS are foreign-born growth and change in the foreign-born share (foreign-born/population), respectively. MGG and ΔMGS are domestic migration (individuals moving from other states) growth and change in migration share (native-born from other states/population), respectively. EG and ΔES are employment growth and change in employment share (employment/labor force). ΔU is the change in the unemployment rate, and INCG is the growth rate in the real median wage income.

Table 2: **Bivariate Granger Causality Tests between Immigration and Employment**

| | (2.1) | (2.2) | (2.3) | (2.4) | (2.5) | (2.6) |
|---|---|---|---|---|---|---|
| VAR | ΔFBS⇏EG | FBG⇏EG | ΔFBS⇏ΔES | FBG⇏ΔES | ΔFBS⇏ΔU | FBG⇏ΔU |
| CON | -0.006** | -0.007** | -1.601** | -1.654** | 1.372** | 1.416** |
| | 0.001 | 0.001 | 0.004 | 0.040 | 0.040 | 0.033 |
| $\Delta FBS_{t-1}$ | 0.538** | 0.018** | 19.624** | 0.714** | -19.53** | -0.678** |
| | 0.072 | 0.003 | 5.212 | 0.153 | 3.55 | 0.161 |
| $\Delta FBS_{t-2}$ | 0.295** | 0.015** | 18.621** | 1.012** | 0.001 | -0.881** |
| | 0.089 | 0.003 | 4.228 | 0.182 | 0.001 | 0.144 |
| $EV_{t-1}$ | -0.271** | -0.153** | -0.461** | -0.478** | -0.281** | -0.277** |
| | 0.015 | 0.016 | 0.021 | 0.016 | 0.018 | 0.017 |
| $EV_{t-2}$ | 0.011 | -0.023 | -0.322** | -0.362** | -0.300** | -0.310** |
| | 0.015 | 0.013 | 0.017 | 0.106 | 0.107 | 0.018 |
| $R^2$ | 0.112 | 0.107 | 0.282 | 0.301 | 0.188 | 0.187 |
| | **(2.7)** | **(2.8)** | **(2.9)** | **(2.10)** | **(2.11)** | **(2.12)** |
| VAR | EG⇏ΔFBS | EG⇏FBG | ΔES⇏ΔFBS | ΔES⇏FBG | ΔU⇏ΔFBS | ΔU⇏FBG |
| CON | 0.001** | 0.048** | 0.001 | -0.024 | 0.001 | 0.044** |
| | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| $\Delta FBS_{t-1}$ | -0.576** | -0.558** | -0.572** | -0.414** | -0.480** | -0.554** |
| | 0.017 | 0.020 | 0.017 | 0.022 | 0.015 | 0.002 |
| $\Delta FBS_{t-2}$ | -0.277** | -0.240** | -0.272** | -0.006** | -0.002* | -0.235** |
| | 0.019 | 0.017 | 0.021 | 0.001 | 0.001 | 0.017 |
| $EV_{t-1}$ | -0.009** | -0.059 | -0.0002* | -0.001* | 0.003** | 0.004** |
| | 0.002 | 0.046 | 0.0001 | 0.0001 | 0.001 | 0.001 |
| $EV_{t-1}$ | -0.004* | 0.035 | -0.0004 | 0.0001 | 0.001 | -0.001 |
| | 0.002 | 0.039 | 0.0003 | 0.0001 | 0.001 | 0.001 |
| $R^2$ | 0.309 | 0.328 | 0.323 | 0.322 | 0.305 | 0.336 |

The top half of Table 2 tests the impact of lagged immigration on employment growth (EG) and change in employment share($\Delta ES$), and change in unemployment rate ($\Delta U$)). (2.1), (2.3) and (2.5) test whether $\Delta FBS$ lead to EG, $\Delta ES$ and $\Delta U$. (2.2), (2.4) and (2.6) test whether immigration growth ($FBG$) lead to EG, $\Delta ES$ and $\Delta U$. $EV_{t-i}$ is the lagged economic/labor variable, and represents job growth, change in job share and change in unemployment share for (2.1)-(2.2), (2.3)-(2.4) and (2.5)-(2.6). Equations (2.2), (2.4) and (2.6) (along with (2.8), (2.10) and (2.12) control for changes in $FBG_i$ (not $FBG_i$). The bottom half tests the opposite causation − the effect of lagged labor conditions on the foreign-born share and foreign-born growth rate. All Tables reports coefficients and White Heteroscedasticity-consistent standard errors. ** (*) indicates significance at the 1% (5%) level.

Table 3: **Mulitvariate Granger Causality Tests between Immigration and Jobs**

| | **(3.1)** | **(3.2)** | **(3.3)** | **(3.4)** | **(3.5)** | **(3.6)** |
|---|---|---|---|---|---|---|
| VAR | ΔFBS⇏EG | FBG⇏EG | ΔFBS⇏ΔES | FBG⇏ΔES | ΔFBS⇏ΔU | FBG⇏ΔU |
| CON | -0.007** | -0.007** | -0.026** | -0.026** | 1.368** | 1.363** |
| | 0.001 | 0.001 | 0.001 | 0.001 | 0.032 | 0.035 |
| $\Delta FBS_{t-1}$ | 0.635** | 0.020** | 19.71** | 0.436** | -29.352** | -.750** |
| | 0.091 | 0.091 | 5.01 | 0.080 | 3.938 | 0.152 |
| $\Delta FBS_{t-2}$ | 0.397** | 0.016** | 22.63** | 0.450** | -18.435** | -.916** |
| | 0.100 | 0.100 | 4.33 | 0.084 | 4.970 | 0.145 |
| $\Delta MGS_{t-1}$ | 0.225** | 0.010 | 8.16** | 0.154** | -7.290** | -2.080 |
| | 0.055 | 0.055 | 2.03 | 0.041 | 2.568 | 0.582 |
| $\Delta MGS_{t-2}$ | 0.202** | 0.008 | 0.187** | 0.180** | -7.152** | -4.357** |
| | 0.045 | 0.045 | 0.004 | 0.040 | 2.594 | 0.673 |
| $EG_{t-1}$ | -0.280** | -0.059** | -0.440** | -0.443** | -0.271** | -0.271** |
| | 0.016 | 0.016 | 0.017 | 0.017 | 0.018 | 0.018 |
| $EG_{t-2}$ | 0.024 | -0.024 | -0.332** | -0.331** | -0.297** | -0.294** |
| | 0.015 | 0.015 | 0.017 | 0.017 | 0.018 | 0.018 |
| $\Delta COL_{t-1}$ | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | -0.033 |
| | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.027 |
| $\Delta DRP_{t-1}$ | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | -0.045 |
| | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.030 |
| $R^2$ | 0.122 | 0.123 | 0.265 | 0.261 | 0.174 | 0.179 |
| | **(3.7)** | **(3.8)** | **(3.9)** | **(3.10)** | **(3.11)** | **(3.12)** |
| VAR | EG⇏ΔFBS | EG⇏FBG | ΔES⇏ΔFBS | ΔES⇏FBG | ΔU⇏ΔES | ΔU⇏FBG |
| CON | 0.002** | 0.002** | 0.001** | 0.001** | 0.001** | 0.001** |
| | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| $\Delta FBS_{t-1}$ | -0.576** | -0.574** | -0.575** | -0.575** | -0.578** | -0.575** |
| | 0.018 | 0.018 | 0.017 | 0.018 | 0.018 | 0.018 |
| $\Delta FBS_{t-2}$ | -0.274** | -0.280** | -0.271** | -0.277** | -0.269** | -0.275** |
| | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 |
| $\Delta MGS_{t-1}$ | 0.010 | 0.010 | 0.010 | 0.008 | 0.014* | 0.013* |
| | 0.006 | 0.006 | 0.006 | 0.006 | 0.007 | 0.006 |
| $\Delta MGS_{t-2}$ | 0.004 | 0.003 | 0.006 | 0.005 | 0.006 | 0.005 |
| | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| $EG_{t-1}$ | -0.009** | -0.008** | 0.001 | 0.001 | 0.001 | 0.001 |
| | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| $EG_{t-1}$ | -0.003 | -0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| $\Delta COL_{t-1}$ | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| $\Delta DRP_{t-1}$ | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | 0.001 | 0.001 | 0.001 | 0.0010 | 0.001 | 0.001 |
| $R^2$ | 0.307 | 0.308 | 0.323 | 0.322 | 0.315 | 0.320 |

The top half of Table 3 tests the impact of lagged immigration on employment growth (EG), change in employment share($\Delta ES$), and change in unemployment rate ($\Delta U$). (3.1), (3.3) and (3.5) test if $\Delta FBS$ causes EG, $\Delta ES$ and $\Delta U$. (3.2), (3.4) and (3.6) test lagged $FBG$ on EG, $\Delta ES$ and $\Delta U$. $EC_{t-i}$ is the lagged economic variable, and represents EG, $\Delta ES$ and $\Delta U$ for (3.1)-(3.2), (3.3)-(3.4) and (3.5)-(3.6). $MGS$ is the migration share, COL college rate and DRP the drop-out rate. Equations (3.2), (3.4) and (3.6) (along with (3.8), (3.10) and (3.12) control for changes in $FBG_i$ and $MGG$. The bottom half tests the opposite causation − the effect of lagged labor conditions on $\Delta FBS$ and FBG.

Table 4: **Multivariate Granger Causality Immigration and Jobs**

| | **(4.1)** | **(4.2)** | **(4.3)** | **(4.4)** | **(4.5)** | **(4.6)** |
|---|---|---|---|---|---|---|
| VAR | $\Delta$FBS $\nRightarrow$ SEIS | $\Delta$FBS $\nRightarrow$SES | $\Delta$FBS $\nRightarrow\Delta$SES | SES$\nRightarrow$EG | $\Delta$SES$\nRightarrow\Delta$ES | $\Delta$SES$\nRightarrow\Delta$U |
| CCON | 0.002** | -0.001** | .001 | -0.006 | -1.547** | 1.333** |
| | 0.000 | 0.000 | 0.060 | 0.001 | 0.039 | 0.035 |
| SEIS$_{t-1}$ | 0.424** | -0.611** | 0.234** | 0.012** | 0.114** | -0.050** |
| | 0.016 | 0.016 | 0.022 | 0.003 | 0.017 | 0.017 |
| SEIS$_{t-1}$ | 0.386** | -0.332** | 0.200** | -0.007** | 0.041* | 0.034 |
| | 0.015 | 0.016 | 0.012 | 0.004 | 0.017 | 0.020 |
| $\Delta FBS_{t-1}$ | 0.018* | 0.015** | -2.641 | | | |
| | 0.007 | 0.006 | 5.496 | | | |
| $\Delta FBS_{t-2}$ | 0.024** | 0.022** | 20.090** | | | |
| | 0.007 | 0.006 | 7.055 | | | |
| $\Delta MGS_{t-1}$ | -0.002 | 0.003 | 13.249** | | | |
| | 0.004 | 0.004 | 3.500 | | | |
| $\Delta MGS_{t-2}$ | -0.003 | 0.003 | 8.688* | | | |
| | 0.003 | 0.003 | 3.002 | | | |
| $\Delta EV_{t-1}$ | | | | -0.277** | -0.463** | -0.270** |
| | | | | 0.016 | 0.018 | 0.018 |
| $\Delta EV_{t-2}$ | | | | 0.013 | -0.377** | -0.320** |
| | | | | 0.016 | 0.017 | 0.018 |
| $R^2$ | 0.75 | 0.327 | 0.234 | 0.098 | 0.282 | 0.168 |

| | **(4.7)** | **(4.8)** | **(4.9)** | **(4.10)** | **(4.11)** | **(4.12)** |
|---|---|---|---|---|---|---|
| VAR | SEIS $\nRightarrow\Delta$FBS | SES$\nRightarrow\Delta$FBS | $\Delta$SES$\nRightarrow\Delta$FBS | $\Delta$EG$\nRightarrow$SES | $\Delta$ES $\nRightarrow\Delta$SES | $\Delta$U$\nRightarrow\Delta$SES |
| CON | 0.002** | 0.001** | 1.507** | | | |
| | 0.000 | 0.000 | 0.099 | | | |
| SEIS$_{t-1}$ | -0.017 | -0.047 | 0.001 | | | |
| | 0.030 | 0.031 | 0.001 | | | |
| SEIS$_{t-2}$ | 0.011 | -0.077 | .001 | | | |
| | 0.030 | 0.032 | 0.001 | | | |
| $\Delta FBS_{t-1}$ | -0.575** | -0.573** | -0.578** | -0.100** | -0.088** | -0.068** |
| | 0.017 | 0.017 | 0.018 | 0.010 | 0.015 | 0.012 |
| $\Delta FBS_{t-2}$ | -0.279** | -0.279** | -0.280** | -0.532** | -0.527** | -0.530** |
| | 0.020 | 0.020 | 0.019 | 0.019 | 0.018 | 0.019 |
| $\Delta MGS_{t-1}$ | 0.014 | 0.013 | 0.011 | -0.280** | -0.271** | -0.267** |
| | 0.007 | 0.007 | 0.007 | 0.018 | 0.018 | 0.018 |
| $\Delta MGS_{t-2}$ | 0.006 | 0.007 | 0.003 | 0.001 | 0.001 | 0.001 |
| | 0.007 | 0.007 | 0.007 | 0.001 | 0.001 | 0.001 |
| $\Delta EV_{t-1}$ | | | | 1.337** | 0.025** | -0.030** |
| | | | | 0.222 | 0.005 | 0.005 |
| $\Delta EV_{t-1}$ | | | | 0.649** | 0.006 | -0.028** |
| | | | | 0.209 | 0.005 | 0.004 |
| $R^2$ | 0.301 | 0.296 | 0.302 | 0.261 | 0.267 | 0.275 |

Equations (4.1)-(4.3) tests the impact of lagged immigration on incorporated self-employment (SEI) and total self-employment (SE). (4.4)-(4.6) test the effects of the lagged incorporated self-employment share on employment growth, change in employment share and change in unemployment. $EV_{t-i}$ is the lagged economic/labor variable and represents employment growth, employment share and unemployment in (4.4)-(4.6). The bottom half tests the opposite causation − the impact of lagged self-employment share on immigration (4.7)-(4.9) and then the impact lagged economic conditions on the self-employment share. ** (*) indicates significance at the 1% (5%) level.

Table 5: **Multivariate Granger Causality Immigration, Wages and Employment Growth by Age**

| | **(5.1)** | **(5.2)** | **(5.3)** | **(5.4)** | **(5.5)** | **(5.6)** |
|---|---|---|---|---|---|---|
| VAR | ΔFBS⇏AINC | ΔFBS⇏MINC | ΔFBS⇏EG1 | ΔFBS⇏EG2 | ΔFBS⇏EG3 | ΔFBS⇏EG4 |
| CON | 0.009** | 0.006** | -0.017** | -0.026** | -0.005** | 0.064** |
| | 0.001 | 0.001 | 0.008 | 0.010 | 0.005 | 0.004 |
| $EG_{t-1}$ | -0.258** | -0.276** | -0.547** | -0.362** | -0.465** | -0.449** |
| | 0.017 | 0.017 | 0.013 | 0.068 | 0.050 | 0.030 |
| $EG_{t-2}$ | -0.150** | -0.132** | -0.174** | -0.126* | -0.081 | -0.165** |
| | 0.016 | 0.017 | 0.038 | 0.057 | 0.060 | 0.031 |
| $\Delta FBS_{t-1}$ | 0.202* | 0.235* | 1.266** | 0.660 | -0.206 | 0.262 |
| | 0.110 | 0.123 | 0.347 | 0.242 | 0.077 | 0.190 |
| $\Delta FBS_{t-2}$ | 0.418** | 0.685** | 1.295** | 0.561** | 0.247 | 0.181 |
| | 0.108 | 0.139 | 0.117 | 0.198 | 0.150 | 0.239 |
| $\Delta MGS_{t-1}$ | 0.187** | 0.148** | 0.600** | 0.198** | 0.023 | 0.082* |
| | 0.063 | 0.069 | 0.160 | 0.065 | 0.050 | 0.036 |
| $\Delta MGS_{t-2}$ | 0.353 | 0.302 | 0.714 | 0.198 | 0.120 | 0.158 |
| | 0.056 | 0.070 | 0.091 | 0.099 | 0.042 | 0.084 |
| $R^2$ | 0.124 | 0.117 | 0.339 | 0.338 | 0.225 | 0.215 |
| | **(5.7)** | **(5.8)** | **(5.9)** | **(5.10)** | **(5.11)** | **(5.12)** |
| VAR | AINC⇏ΔFBS | MINC⇏ΔFBS | EG1⇏ΔFBS | EG2⇏ΔFBS | EG3⇏ΔFBS | EG4⇏ΔFBS |
| CON | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 |
| $EC_{t-1}$ | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| | 0.001 | 0.002 | 0.001 | 0.003 | 0.002 | 0.001 |
| $EC_{t-2}$ | -0.004 | -0.006* | -0.001 | -0.004 | -0.003 | 0.001 |
| | 0.001 | 0.002 | 0.001 | 0.003 | 0.003 | 0.001 |
| $\Delta FBS_{t-1}$ | -0.574** | -0.575** | -0.579** | -0.581** | -0.580** | -0.582** |
| | 0.017 | 0.017 | 0.019 | 0.017 | 0.018 | 0.018 |
| $\Delta FBS_{t-2}$ | -0.283** | -0.284** | -0.287** | -0.287** | -0.290** | -0.288** |
| | 0.019 | 0.019 | 0.030 | 0.029 | 0.029 | 0.027 |
| $\Delta MGS_{t-1}$ | 0.012 | 0.012 | 0.007** | 0.007** | 0.010 | 0.007** |
| | 0.006 | 0.007 | 0.002 | 0.002 | 0.003 | 0.002 |
| $\Delta MGS_{t-2}$ | 0.005 | 0.006 | 0.002 | 0.001 | 0.002 | 0.001 |
| | 0.006 | 0.007 | 0.006 | 0.006 | 0.007 | 0.007 |
| $R^2$ | 0.308 | 0.309 | 0.307 | 0.306 | 0.304 | 0.304 |

Equations (5.1)-(5.3) tests the impact of the lagged immigration on average income growth (AINC) and median income growth (MINC). EG1, EG2, EG3 and EG4 is employment growth for age cohorts 20-24, 25-44, 45-54 and 55-54, respectively. $EC_{t-i}$ is the lagged economic variable and represents wage growth in (5.7)-(5.8) and employment growth by age cohort in (5.9)-(5.12). The bottom half tests the opposite causation − the effect of lagge wage growth on immigration (5.7)-(5.8) and the impact of lagged employment growth by age cohort of immigration (5.9)-(5.12) ** (*) indicates significance at the 1% (5%) level.

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