ECONOMIC IMPACT OF LATIN AMERICAN & OTHER IMMIGRANTS

IOWA, NEBRASKA & THE OMAHA-COUNCIL BLUFFS METROPOLITAN AREA

University of Nebraska Omaha

OLLAS

Office of Latino/Latin American Studies

The Economic Impact of Latin American & other Immigrants in Iowa, Nebraska & the Omaha-Council Bluffs Metropolitan Area

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Executive Summary

Although recent research from the Pew Hispanic Center suggests that the rate of recent immigration to the United States has slowed considerably, other studies clearly show that immigrants make substantial economic contributions to the communities in which they settle.

Using the US Census Bureau's American Community Survey (ACS) data for the sample period 2006-2010, this report focuses attention on the quantitative economic impact of first-generation, foreign-born individuals on the Omaha-Council Bluffs economy as well as the Nebraska and Iowa state economies in 2010.

While much of the report is focused on the total immigrant group, some particular attention is paid to those immigrants from Mexico, Central America, South America and the Caribbean (henceforth labeled Central/South American in origin), and their impact on the three economies of interest.

It should be emphasized that this study follows closely the 2008 study by Christopher S. Decker and colleagues, which primarily focused on the impact of immigrants on the Nebraska economy. While the main focus of this study is on the Omaha-Council Bluiffs economy (which particular attention to the Central and South American immigrant population), we do offer some updated information on Nebraska. That said, since different data sources and modeling platforms are employed here, correlations between results here and the 2008 report are made only where possible and one should exercise substantial caution in making further comparisons.

A few key findings are highlighted here:

- In 2010, immigrant spending resulted in $1.4 billion worth of total production (output) in the Omaha-Council Bluffs economy, with a possible range of $1.2 to $1.5 billion.[2] Spending by Central/South American immigrants generated between $477 and $615 million worth of total production in the Omaha-Council Bluffs economy in 2010.

- In 2010, immigrant spending in Iowa generated between $2.5 and $3.2 billion worth of total production. Central/South American spending accounted for between $749 and $963 million worth of production.

- In 2010, immigrant spending in Nebraska generated between $1.9 and $2.4 billion worth of output. Central/South American spending was responsible for between $834 million and $1.1 billion worth of production.

- The immigrant population in the three economies of interest makes a substantial contribution to the labor force in three key economic sectors; construction, food services, and animal slaughtering and processing. In the Omaha-Council Bluffs 2010 economy, the immigrant labor force accounted for 11 percent of total employment in construction, 10 percent of total employment in the food services sector, and 54 percent in meat processing.

- In this study, we conducted experiments addressing what would happen if the immigrant portion of the labor force was unavailable in these key sectors. We found that total production in the Omaha-Council Bluffs economy would fall by $6.5 billion if these immigrants were not present in these sectors, about 7.8 percent of total production. If just the Central/South American immigrant population was removed from these sectors, the resulting loss would be $5.6 billion, or 6.8 percent of total production. This loss represents about 34,000 jobs.

[1] http://www.brookings.edu/~/media/research/files/papers/2012/3/15%20immigrant%20workers%20singer/0315_immigrant_workers_singer.pdf : accessed on May 28th, 2010.

[2] "Total production" or "total output" is a measure of the dollar value of all goods and services bought (demanded) and sold (supplied) in an economy.

- Total production losses in Nebraska and Iowa would have been $18.2 billion (10.7 percent of total production) and $12.0 billion (4.2 percent of total production), respectively. These losses represent about 82,000 jobs in Nebraska and 62,000 jobs in Iowa.

- In Iowa, the foreign-born population accounted for 3.4 percent of state revenues from income, sales, and gasoline taxes. This population accounted for 3.1 percent of total state expenditures on public assistance, Medicaid, and education. This indicates that the foreign-born in Iowa paid into government accounts slightly more than they took out in public benefits in 2010.

- In Nebraska, the foreign-born population accounted for 4.3 percent of state revenues from income, sales, and gasoline taxes. This population accounted for 4.1 percent of total state expenditures on public assistance, Medicaid, and education. This suggests that the foreign-born in Nebraska paid into government accounts slightly more than they took out in the form of public benefits in 2010.

- For both states, the Central/South American-born population paid into state government accounts a percentage roughly equivalent to what they drew out in the form of public assistance, Medicaid, and education. The same can be said for the native-born group in both states.

Impact of Total Foreign-born Spending	Production Impact ($ millions)	Employment Impact (# jobs)
Omaha-Council Bluffs	$1,393	8,315
Iowa	$2,826	22,599
Nebraska	$2,151	17,478
Impact of Removing Total Foreign-born Labor	**Production Impact ($ millions)**	**Production Impact (# jobs)**
Omaha-Council Bluffs	-$6,476	-33,952
Iowa	-$12,015	-61,688
Nebraska	-$18,155	-82,032
Fiscal Contributions and Costs for Total Foreign-born Population	**Iowa**	**Nebraska**
Contributions (percent of total)	3.4%	4.3%
Costs (percent of total)	3.1%	4.1%

Source: Authors' calculations using IMPLAN 3.0. Figures reflect 2010 dollars.

A technical note about the foreign born included in this report is warranted. For purposes of this report, Mexico, Cuba, Jamaica, and the Dominican Republic, among others, are included under the "Central and South American" category. The total foreign born category includes both those from Central and South America as well as the rest of the world. Table A1, in Appendix A, identifies the country of origin for the delineations used in this study.

Measuring the Economic & Fiscal Impact of Immigration

An Introduction

While recent evidence by Passel, Cohn and Gonzalez-Barrera (2012) of the Pew Hispanic Center suggests that the rate of immigration has slowed considerably in the United States, particularly in-migration from Mexico, a recent Brookings Institute report shows that the percentage of first-generation foreign-born workers in the nation's total labor force continues to grow.[3] Given this dynamic, the question is: What is the economic impact of these immigrants on job creation and economic growth and development?

As of late, many studies have been produced that measure the economic impact of immigrant groups, or ethnic groups such as Latinos where there tend to be a larger proportion of immigrants. Miller, Martinez and Faun (2010) investigated the Latino population in Michigan and found that Latino workers add about $25 billion to Michigan's output. Fennelly and Huart (2009) measured the economic impact of immigrants in Minnesota, finding that Hispanic-owned businesses in that state have grown 350 percent and immigrant workers account for $1.2 billion in Minnesota's personal income. Decker et al. (2008) found that immigrant labor in construction, meat processing and hotel and food services contributed $13.5 billion to Nebraska's economy. In a study of the Arizona economy, Gans (2007) found that immigrants in that state accounted for $44 billion worth of total production (output) in 2004. Also, the Fiscal Policy Institute (2007) in New York found that immigrants accounted for $229 billion worth of total production in 2004. Finally, focusing mostly on North Carolina's Hispanic population, a large percent of whom are foreign-born, Kasarda and Johnson, Jr. (2006) indicated that this population

[3] http://www.brookings.edu/~/media/research/files/papers/2012/3/15%20immigrant%20workers%20singer/0315_immigrant_workers_singer.pdf : accessed on May 28th, 2010.

generated a substantial amount of employment and economic activity in that state.[4]

It is this broader view of immigration's impact on an overall economy that is the focus of this analysis. To that end, using the US Census Bureau's American Community Survey (ACS) data for the sample period 2006 to 2010, this report attempts to quantitatively assess the economic impact of the international immigrants in the Omaha, Nebraska-Council Bluffs, Iowa economy in 2010, a major metropolitan region located in eastern Nebraska and western Iowa, comprising a population of nearly one million people. That said, one of our principal interests in this report is to assess the Latino immigrant population's economic impact. Available data often does not allow us to disaggregate by specific country of origin, or even specific world region of origin. Our population samples are simply too small. That said, we do pay particular attention those immigrants originating from a large world region encompassing Mexico, Central America, South American and the Caribbean (henceforth labeled Central/South American in origin). This group's impact can be reliably assessed. Gouveia and OLLAS collegues (2012) produced a seperate report for this project which further discusses the recent demographic changes in the Omaha-Council Bluffs metro area.

Additionally, this report offers some additional updated insights as to the immigrant impact on Nebraska and Iowa in 2010, again with attention to the Central/South American immigrant group. Some fiscal analysis is conducted as well, offering some insights as to the tax contributions and the uses of government services by immigrant groups in these two states.

[4] To be sure, an economy-wide measure of impact is not the only issue of attention when it comes to immigration. A major consideration is the impact on labor markets directly and this continues to be a very active area of research (see, e.g. Hotchkiss, Quispe-Agnoli, and Rio-Avila (2012). While substantial, the literature has produced little consensus as to the wage impact of immigration. Borjas (2003), for instance, found evidence that increased immigration places significant downward pressure on wages in a variety of sectors. However, Card's (2005) analysis suggests that Borjas' conclusion is too pessimistic, finding little evidence of any substantive link between wages and immigration. Indeed, this lack of consensus in the literature highlights a significant complexity in labor market dynamics that makes it difficult at best to conclude that immigrants necessarily pressure wages downward in the long run. This is a debate that will not be settled any time soon. Additionally, a major issue is the degree to which increased immigration places increased pressure on local communities' abilities to supply public services such as schools and health services relative to these groups' abilities to contribute in the form of property, income, and sales taxes. Here evidence is scant. That said, Garvey, Espenshade, and Scully (2002) recently found that in New Jersey, the state's immigrant population tended to "pay in" more than they received from state and local services relative to their native-born counterparts. Kasarda and Johnson, Jr. (2006) found some evidence indicating a reverse situation for North Carolina.

Major Elements & Regional Scope of Impact Study

To conduct an economic impact study, most researchers employ an Input/Output (IO) model. An IO, or Leontief model, describes an economy as a series of interlinked industries or sectors. A stimulus to one sector, say an increased wage-earning labor force, then impacts all other sectors, to varying degrees, through a "multiplier effect." This is illustrated in Figure 1 below.

The multiplier effect measures the "indirect" and "induced" impact of a direct injection. As a matter of technical exposition, "indirect" effects are those re-spending effects that filter through other industries in an economy as a result of the direct injection. For instance, suppose a direct impact on hotel expenditures boosts demand for cleaning services at these hotels (a first indirect effect). This stimulates demand for cleaning capital and products (a second indirect effect). This second indirect effect stimulates demand in other sectors, and so on. The sum of all these effects on other industries is the "indirect" effect. The "induced" effect is the effect on final demand in an economy. Final demand can be characterized in the following way. All of these sectors employ people locally. Increased demand for production from these sectors induces additional labor inputs, paid for via wages and salaries. The resulting increase in employee incomes induces additional spending locally. This additional spending is the "induced" effect. The continual "re-spending" of the original direct injection accumulates through to the local economy.

The total impact is then the sum of the direct, indirect, and induced effects. From these figures, we obtain economic multipliers, which measure the impact of one dollar's worth of direct injections. For instance, if an additional $100 of direct expenditure is spent on, say, groceries, this would stimulate spending by the grocery sector to source grocery items from suppliers. This spending might be $40. In turn, there may be a need for additional labor in the grocery sector, generating additional income and thus additional spending, of say, $15. Taken together, the aggregate impact of the initial $100 injection was $155 to the economy.

Figure 1. The Multiplier Effect

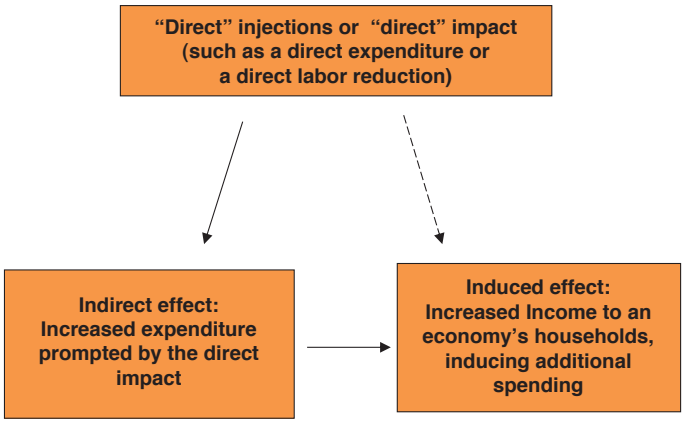
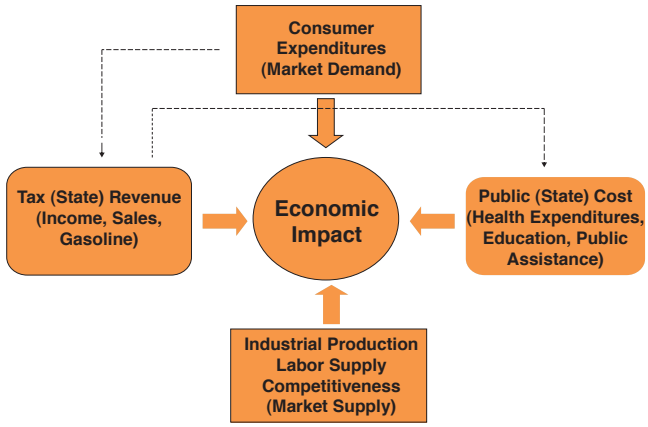


Figure 2: The Major Elements of an Economic Impact Study



As is generally done, these effects are normalized to one dollar, meaning that, in our example, one dollar of direct spending results in an addition 55 cents added to the economy; the overall impact is $1.55. This figure is commonly referred to as the final demand multiplier. The overall dollar impact on an economy is often called the "multiplier effect."

Following Kasarda and Johnson, Jr. (2006), the basic makeup of most impact studies of this nature generally have four elements. These elements, described below, are depicted in Figure 2.

The four elements are:

- Consumer expenditures impact: This effect focuses attention on the demand side of an economy. A given group, such as first-generation immigrants, will be income earners and will spend income on a variety of locally provided goods and services in certain sectors of the economy. These expenditures are our "direct" injection expenditures. These expenditures will, in turn, stimulate further "indirect" spending increases and increased labor earnings, generating the "induced effect." Taken together, these direct, indirect, and induced expenditures provide a measure of total expenditure impact on an economy.

- Production impact: The production impact measures the effect of an increase/decrease in labor on an economy. This, too, will have a multiplier effect associated with it. For instance, a reduction in the meat-processing industry of, say, 100 workers will result in lower output in the meat-processing sector. Moreover, as a result of reduced production and incomes, there will be lower demand for other goods and services in an economy, thus creating an adverse indirect effect on other sectors of the economy. Moreover, lower household incomes create an adverse induced effect. The total impact is, again, measured by a total multiplier effect.

- Fiscal contributions: Increases in employment, immigrant or otherwise, generates income tax revenue for the state. In addition, sales tax revenue is generated through spending and excise tax revenue is generated through the sale of gasoline. These fiscal contributions to state and local economies go to support education, health services, road construction and repair, etc. These effects must also be considered as part of the overall impact on an economy.

- Public sector costs: Increased population, immigrant or otherwise, will place increased pressure on public goods and services. Hence, part of the impact on the economy needs to

address this increased demand. As discussed in detail below, in this study we consider expenditures on food stamps, public assistance support supplied by the state of Nebraska, cost of supplying educational services, and state support for health care expenditures. To be sure, there may be other public sectors to consider. However, in Iowa and Nebraska, these categories tend to be the major sources of public expenditure.

Data Sources and Model Platform Utilized for Immigration Analysis

Throughout this report, data sources are referenced. However, the primary data source is the American Community Survey (ACS), sampled over the years 2006 to 2010, available from the US Census Bureau. These data samples, adjusted to reflect 2010 estimates, offer researchers the most recent and comprehensive secondary statistical data source for demographic and economic information at the state and county geographic levels. From these data we obtain information on population and income by demographic group as well as employment by industrial sector. The ACS sample is sufficiently large to offer statistically reliable and detailed information by native, foreign-born, and foreign-born from Central/South American countries for all three of our economies of interest, including the Omaha-Council Bluffs study area, something that was not possible in Decker et al.'s 2008 report. To these data we apply a number of other sources of information to obtain estimates of necessary economic variables. For additional details regarding these data, see Appendix A.

In terms of model platform, the key to a complete impact study is to employ an IO model measuring both direct injections and the resulting indirect and induced effects that result from the multiplier effect. Creating multipliers requires an IO model that can be costly and data-intensive to create. Fortunately, there are many sources of such models and multipliers. One of the most common models used is IMPLAN, developed by the Minnesota IMPLAN Group, Inc. (MIG, Inc.). [5]The IMPLAN model provides substantial industry detail (a desirable characteristic as multipliers will vary from industry to industry), provides substantial detail on direct injections and indirect effects, and is quite flexible in that it allows users to input a variety of market characteristics that may be unique to a particular area of the country. IMPLAN 3.0 is used throughout this analysis.[6]

Geographic Scope of Impact Study

As indicated above, the primarily study area in this report is the Omaha-Council Bluffs economy. This economy, or study area, necessitated by ACS sampling characteristics, is defined by The US Census Bureau's Public Use Microdata area (PUMA) region (see Figure 3). The region encompasses the counties listed in Table 1. On the Nebraska side of the border, six counties are included and on the Iowa side eight counties are included. It should be noted that these counties include all counties comprising the Omaha metropolitan statistical area as defined by the US Congressional Budget Office. [7]

[5] For details, visit http://www.implan.com.

[6] This program essentially includes, for a given user-defined geographic economy, a mathematical matrix of data that measures the industrial structure of the defined economy. This matrix (the so-called IO matrix) accounts for the fact that each sector in an economy depends on inputs supplied by other sectors in an economy. Hence, any external factor that directly impacts one sector will have the "ripple effects" that filter through the rest of the economy as described above. This, then, generates the multipliers discussed above. MIG updates the data used in the model periodically. The model year used here is 2010. The primary data sources IMPLAN uses comes from survey data and estimates generated by The US Bureau of Economic Analysis. In Appendix D, we provide a brief overview of IO models. However, for more detail, readers are referred to Raa (2005), Yan (1969), and Hewings (1985). Each provides an excellent overview.

[7] The Omaha MSA is comprised of Cass, Douglas, Sarpy, Saunders, and Washington Counties in Nebraska, and Harrison, Mills, and Pottawattamie Counties in Iowa.

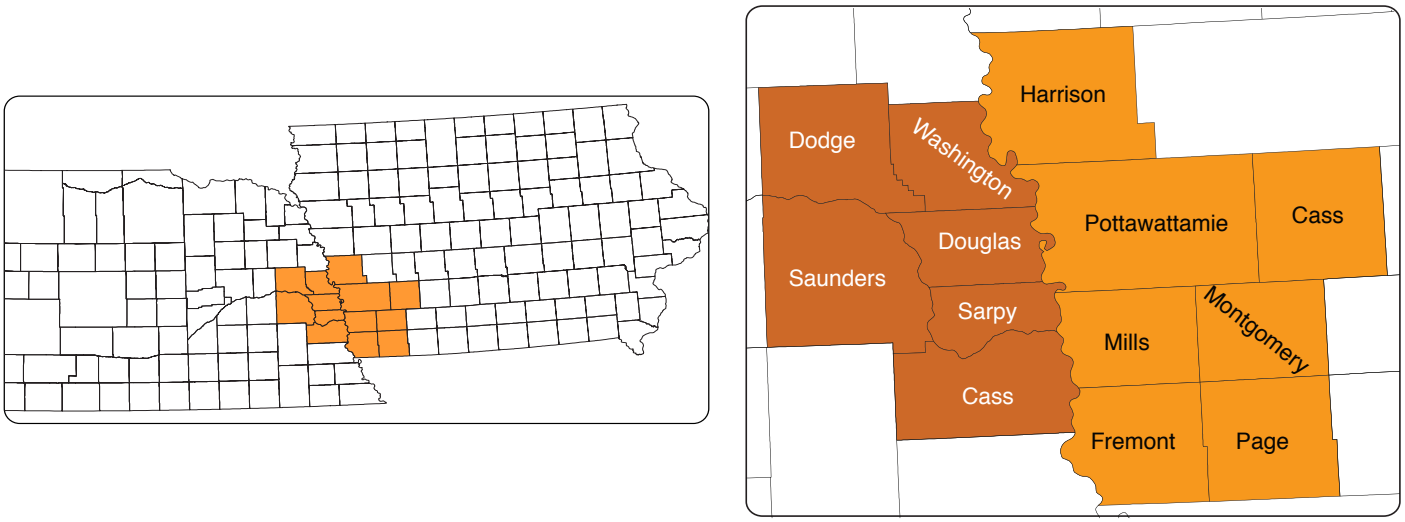
Table 1. Counties in the Omaha-Council Bluffs Study Region: 2010 Population Estimates

Counties	Total	Native-Born	Foreign-Born
Nebraska Counties			
Cass	25,246	24,945	301
Dodge	36,621	34,751	1,870
Douglas	505,545	463,844	41,701
Sarpy	152,180	144,634	7,546
Saunders	20,543	20,306	237
Washington	20,148	19,905	243
Iowa Counties			
Cass	13,969	13,800	169
Fremont	7,528	7,445	83
Harrison	15,073	14,936	137
Mills	15,157	14,901	256
Montgomery	10,901	10,684	217
Page	16,095	15,774	321
Pottawattamie	91,928	88,829	3,099
Shelby	12,328	12,267	61

Source: U.S. Census Bureau, Census 2006-2010 ACS, Omaha-Council Bluffs PUMA, Nebraska and Iowa.

Again, as stated above, in addition to the Omaha-Council Bluffs study area, this report also investigates the economic impact of immigrant populations in Iowa as well as an updated impact assessment for the state of Nebraska.[8]

Figure 3. Geographic Scope (Omaha-Council Bluffs study region highlighted)



[8] Decker et al. (2008) assessed the impact of immigrant populations on the state of Nebraska as well as defined sub-regions within that state. While this report updates some of the 2008 figures, caution should be exercised when making any direct comparisons largely since the IO platforms differ. The 2008 study employed IMPLAN 2.0 and the current report employs IMPLAN 3.0. While similar, the two programs do have some key differences. See www.implan.com for comparative information.

Expenditure Impacts of First Generation Foreign-born Immigrants

As stated above, the primary data source used is the US Census Bureau's ACS data system. Table 2 provides a summary picture of the demographic and earnings figures for the Omaha-Council Bluffs study region as well as for Nebraska and Iowa.

Table 2. Summary of Population and Income Characteristics

	Total	Native-Born	Foreign-Born	Central /South American-Born
Omaha-Council Bluffs PUMA				
Population 16 and over	724,634	673,646	50,988	26,961
Mean Income ($)	$34,302	$34,958	$25,549	$19,966
Total Income ($ millions)*	$25,343	$24,026	$1,317	$546
Nebraska				
Population 16 and over	1,397,195	1,301,461	95,734	52,683
Mean Income ($)	$31,624	$32,276	$22,702	$18,982
Total Income ($ millions) *	$44,990	$42,792	$2,199	$1,013
Iowa				
Population 16 and over	2,378,523	2,265,289	113,234	47,960
Mean Income ($)	$31,719	$32,042	$25,208	$18,854
Total Income ($ millions)*	$76,738	$73,853	$2,885	$917

Source: U.S. Census Bureau, Census 2006-2010 ACS, Omaha-Council Bluffs PUMA, Nebraska and Iowa.
*2010 dollars.

These data reflect a few essential elements. In the Omaha-Council Bluffs study area, 7.0 percent of the population 16-and-over were foreign-born in 2010. In Nebraska and Iowa, these individuals accounted for 6.8 and 4.8 percent of the total population, respectively. With respect to those born in Central/South America, the population concentrations in the Omaha-Council Bluffs, Nebraska and Iowa economies were 3.7, 3.8, and 2.0 percent, respectively, in 2010.

Mean income levels for foreign-born populations in 2010 tended to be lower relative to native-born mean income levels in all three economies. In Omaha-Council Bluffs, the mean income for foreign-born and Central/South American-born individuals was $25,548.57 and $19,966.28, respectively, or about 73.1 and 57.1 percent of the native-born population's mean income levels. In Nebraska, mean incomes for the foreign-born and Central/South American-born populations were 70.3 and 58.8 percent of native-born mean incomes, respectively. Finally, in Iowa, these immigrant groups earned, on average, 78.7 and 58.8 percent of the native-born mean income.

Much of this differential is likely due to occupational and demographic differences. Immigrant populations tend to have a higher proportion of younger individuals than the native population and many immigrant jobs tend to be in sectors with comparatively lower wages. The implication of this lower per capita income is that the overall economic impact of immigrant spending in these three economies, while still significant, will tend to be lower than their population concentrations would initially suggest.[9]

Expenditure Impacts

To obtain a measure of 2010 consumer expenditures from the income data described above, we deducted federal and state income taxes as well as payroll taxes, yielding an estimate of after-tax personal income.[10] Using data from the United States' Congressional Budget Office February 2011 report "Migrants' Remittances and Related Economic Flows", for the immigrant populations, we deducted a percent of income remitted (i.e. sent or transferred) to immigrants' country of origin.[11]

Table 3 reports these expenditure estimates and the resulting impact on the dollar value of economic activity (i.e. the total value of output) this spending generates for each of our three economies. For the Omaha-Council Bluffs study area, the total estimated after-tax and remittances income for the total foreign-born population in 2010 was $834.16 million. For the foreign-born of Central/South American origin, the 2010 estimate was $329.06 million. For Iowa, foreign-born and Central/South American-born spending in 2010 was estimated at $1.835 billion and $558.67 million, respectively.

Finally, for Nebraska, the spending figures for our two groups were $1.392 billion and $621.34 million, respectively, in 2010. As indicated above (see footnote 7), given different sampling techniques and modeling platforms, direct comparisons with Decker et al. (2008) should be undertaken with a great deal of caution. That said, at least on the expenditure side of the impact, reasonable parallels can be made since the spending patterns by group are comparable. Indeed, the Decker et al. (2008) study found, spending by the foreign-born population in 2006 was estimated at $1.188 billion and for the Central/South American population spending was estimated at $516.10 million. The current figures are thus moderately higher in 2010, due in large measure to higher estimates for the population aged 16 and older (at 95,734 in 2010 for the total foreign-born group, up from 69,844 in 2006).[12]

[9] Also, the Central and South American immigrant populations tend to send a substantial portion of their take-home pay back to families still residing in their respective countries of origin. We will have more to say about this issue later on in this report.

[10] For details on this procedure, see Appendix B.

[11] For details on how these remittances figures were obtained and implemented, again see Appendix B.

[12] Mean per-capita incomes are actually down from 2006. In 2006, according to Decker et al (2008), mean incomes for the foreign-born population was $26,195. In 2010, the mean income level is $22,702.

Table 3. Economic Impact of Immigrant Spending: Total value of output ($ millions)

	Direct	Indirect	Induced	Total
Omaha-Council Bluffs PUMA				
Total Foreign-Born	$834	$269	$335	$1,393
Central/South American-Born	$329	$101	$131	$543
Nebraska				
Total Foreign-Born	$1,392	$405	$441	$2,151
Central/South American-Born	$621	$171	$197	$949
Iowa				
Total Foreign-Born	$1,835	$494	$552	$2,826
Central/South American-Born	$559	$142	$169	$853

Source: Authors' estimates using IMPLAN 3.0. Figures reflect 2010 dollars.

These expenditure figures were input into IMPLAN to generate the overall impact of such spending on the state.[13] As shown in Table 4, the direct expenditure by the Omaha-Council Bluffs foreign-born population resulted in $269.17 million in indirect and $334.73 million in induced expenditures, resulting in a total impact of $1.393 billion to the region's economy. The resulting output multiplier is 1.67, indicating that for every dollar spent by the state's immigrant population in 2010, 67 additional cents were created through indirect and induced effects. This $1.393 billion figure represented about 3.5 percent of total personal income in the Omaha-Council Bluffs study region.[14] Similarly, the total impact of the $329 million spent directly by Central/South American immigrants in the Omaha-Council Bluffs study area was $543.5 million.

Table 4. Employment Impact of Immigrant Spending: (# jobs)

	Direct	Indirect	Induced	Total
Omaha-Council Bluffs PUMA				
Total Foreign-Born	5,179	1,445	1,691	8,315
Central/South American-Born	2,043	570	667	3,280
Nebraska				
Total Foreign-Born	11,177	3,137	3,164	17,478
Central/South American-Born	4,988	1,400	1,412	7,799
Iowa				
Total Foreign-Born	14,825	3,745	4,030	22,599
Central/South American-Born	4,513	1,140	1,227	6,879

Source: Authors' estimates using IMPLAN 3.0. Figures reflect 2010 dollars.

Table 4 displays the impact of spending on jobs. Spending by immigrants in the Omaha-Council Bluffs economy was directly linked to 5,179 jobs in 2010, and through indirect and induced effects, ultimately accounted for a total of 8,315 jobs, or approximately 1.3 percent of total employment in the study region.[15] Spending by Central/South American-born consumers specifically in Omaha-Council Bluffs generated 3,280 jobs in 2010.

[13]With aid from MIG, a set of figures was developed that estimated, for a given income range, the share of one dollar worth of expenditure on each of a set of 395 industrial sectors. For instance, individuals earning between $25,000 and $50,000 per year spent 2.2 percent of their disposable income in the motor vehicle and parts sector. These expenditure shares were derived from Consumer Expenditure Survey publications provided by the US Bureau of Labor Statistics (see, http://www.bls.gov/cex/home.htm).

[14]According to data the US Bureau of Economic Analysis Regional Economic Accounts (http://www.bea.gov/iTable/iTable.cfm?ReqID=70&step=1&isuri=1&acrdn=5), personal income in the Omaha-Council Bluffs study area totaled $40.13 billion in 2010.

[15] According to data supplied by IMPLAN, total employment was 627,299 in 2010.

In Nebraska, spending by foreign-born individuals generated $2.151 billion worth of economic activity in 2010, a multiplier of about 1.54. This activity generated 17,478 jobs for the state. Spending by Central/South American-born individuals generated a total of $949.46 million in 2010, a multiplier of about 1.53, linked to a total of 7,799 jobs. Again, these figures are higher than in Decker et al. (2008). In that study, spending by foreign-born individuals resulted in $1.643 billion in economic activity and 12,448 jobs. Spending by Central/South American-born individuals generated $176.5 million in 2006, resulting in 5,405 jobs.

In Iowa, spending by foreign-born individuals generated $2.826 billion worth of economic activity in 2010, again, a multiplier of about 1.54. This overall impact was linked to 22,699 jobs for the state, about 0.3 percent of total employment. Spending by Central/South American-born individuals generated a total of $853.43 million in 2010, a multiplier of about 1.53, linked to a total of 6,879 jobs. It is worth noting that the overall spending impact of the foreign-born population in Iowa was larger than in Nebraska but the spending impact from the Central/South American-born population in Iowa was smaller than that of Nebraska. These differences can largely be attributable to the overall population characteristics of these groups. The total foreign-born population aged 16 and over in Iowa in 2010 was larger than in Nebraska but Nebraska had a larger number of immigrants from Central/South America than did Iowa.

Alternative Expenditure Estimates

While the expenditure figures provided above represent the most likely picture of immigrant expenditure impacts on our three economies, it is worth remembering that these figures are estimates subject to statistical error. Hence, it can be beneficial to provide a range of impacts assuming alternative direct expenditure figures. To this end, alternative direct expenditure figures were constructed using alternative estimates for Central/South American remittances. Our baseline estimates for remittance expenditures in 2010 for Omaha-Council Bluffs, Nebraska and Iowa were $82.0 million for Omaha-Council Bluffs (21 percent of after-tax earnings), $158.1 million for Nebraska (20 percent of after-tax earnings), and $141.8 million for Iowa (20 percent of after-tax earnings).[16] To construct a high (low) remittance range, we added (subtracted) 10 percent from the baseline after-tax remittance percentage in each of our three economies. Similar adjustments were made to the remittance estimates for the total foreign-born population (see Appendix C).[17]

[16] For context, Decker et al.'s (2008) baseline estimate for Nebraska remittances in 2006 was $154 million.

[17] Admittedly, this range is somewhat arbitrary. However, with little by way of error estimates from our primary data sources on remittances, we believe our results provide a reasonable range for expenditure impact.

Table 5. Alternative Economic Impact of Immigrant Spending: Total value of output ($ millions)

	High Remittance	Baseline	Low Remittance
Omaha-Council Bluffs PUMA			
Total Foreign-Born	$1,231	$1,393	$1,564
Central/South American-Born	$477	$543	$615
Nebraska			
Total Foreign-Born	$1,888	$2,151	$2,405
Central/South American-Born	$834	$949	$1,072
Iowa			
Total Foreign-Born	$2,500	$2,826	$3,166
Central/South American-Born	$749	$853	$963

Source: Authors' estimates using IMPLAN 3.0. Figures reflect 2010 dollars.

Table 5 reports the total output impacts (i.e. the direct, indirect, and induced impacts) from these high and low remittance scenarios on the three economies considered in this study. Based on these estimates, the total output impact of expenditures by the foreign-born population in Omaha-Council Bluffs ranged from $1.231 billion to $1.564 billion in 2010. Isolating just direct expenditures from those immigrants of Central/South American origin, the total output impact ranged from $476.6 million to $614.7 million.

For Nebraska, the total impact range from foreign-born spending was $1.888 billion to $2.405 billion in 2010. Likewise, the range from Central/South American-born individuals in 2010 was $834 million to $1.072 billion. In Iowa, the total foreign-born effect was estimated to range between $2.5 billion and $3.166 billion in 2010 while the range for the Central/South American population was between $749 million and $963 million.

Production Impact

The foreign-born population aged 16 and over in Omaha-Council Bluffs accounted for 7.0 percent of total population aged 16 and over in the study area in 2010. In Nebraska and Iowa this group accounted for 6.9 and 4.8 percent of the total population, respectively. Immigrants of Central/South American origin accounted for 3.7 percent, 3.8 percent, and 2.0 percent of total population aged 16 and over in Omaha-Council Bluffs, Nebraska and Iowa respectively. These groups' labor force contributions are considerably higher in certain key sectors.

In this section we estimate the likely impact on state and regional economies if this labor force were, in effect, unavailable. In doing this experiment, we identified three sectors that tend to rely heavily on immigrant labor (primarily Central/South American immigrant labor) and where many immigrants find work: construction, animal slaughtering and processing, and food services. Table 6 summarizes these employment figures.

Table 6. Employment Summary Data

	Native-Born		Foreign-Born		Central/South American-Born	
	Employed	Percent	Employed	Percent	Employed	Percent
Omaha-Council Bluffs						
Construction	36,285	89%	4,387	11%	4,127	10%
Mfg-Animal slaughtering and processing	4,994	46%	5,878	54%	5,040	46%
Restaurants and other food services	29,414	90%	3,305	10%	2,220	7%
Percent of total employment*	13%		32%		49%	
Nebraska						
Construction	69,917	90%	7,351	10%	6,703	9%
Mfg-Animal slaughtering and processing	10,102	38%	16,584	62%	12,251	46%
Restaurants and other food services	59,987	92%	5,292	8%	3,536	5%
Percent of total employment*	13%		37%		51%	
Iowa						
Construction	119,744	95%	6179	5%	4,568	4%
Mfg-Animal slaughtering and processing	16,996	59%	11,690	41%	9,102	32%
Restaurants and other food services	93,752	92%	8,440	8%	4,489	4%
Percent of total employment*	13%		28%		46%	

Source: U.S. Census Bureau, Census 2006-2010 ACS, Omaha-Council Bluffs PUMA, Nebraska and Iowa.
*Figures reflect the percent of total jobs these three sectors account for, stratified by demographic group.

For the Omaha-Council Bluffs study area, 4,387 immigrants were employed in construction in 2010, accounting for 11 percent of total construction employment (Central/South American immigrants account for nearly all of this, making up 10 percent of total construction employment).[18] In animal slaughtering and processing, immigrants accounted for 5,878 jobs, or 54 percent of total employment. Immigrants from Central/South America accounted for 5,040 of these jobs, or 46 percent of the total.

In Nebraska, immigrant labor in construction, animal slaughtering and processing, and food services accounted for 10 percent, 62 percent, and 8 percent, respectively, of each sector's total. Immigrants from Central/South America accounted for 9 percent, 46 percent, and 5 percent, respectively, for these three sectors.[19]

In Iowa, the percentages of immigrant labor are smaller. Immigrants accounted of 5 percent of construction jobs in Iowa and 8 percent of those jobs in food services. Central/South American immigrants accounted for 4 percent in each of these two sectors as well. Immigrant labor has a larger presence in animal slaughtering and processing, accounting for 41 percent of jobs in that sector in 2010. Those from Central/South America accounted for 32 percent of animal slaughtering and processing jobs in Iowa.[20]

[18] Within IMPLAN 3.0, the construction sector is comprised of five different sub-sectors, broadly comprising residential, nonresidential, and non-building (e.g. highway and utility network) construction as well and residential, nonresidential, and non-building repairs. However, the ACS data are only available for the aggregate category. To implement the impact within IMPLAN 3.0, we divided the ACS immigrant employment data based on the total employment shares of each of these five sub-sectors as reported within the model.

[19] Unlike the expenditure side of the overall impact where some comparisons with the Decker et al. (2008) study are possible, with respect to the production side of the impact it is definitely not advisable to compare the current set of data (or measured impacts) for Nebraska in this study with the 2008 study. Not only is the IMPLAN model different, the 2008 study used a different Census data set with a different sampling technique. Moreover, the earlier study used an occupational classification to count workers in the meat-processing industry. This classification only included production workers, i.e. those actually working in the processing plant. In this study, we are using the ACS which uses industry classifications to count employees. The ACS industry classification in animal processing includes not just those on the cutting floor, but also those in clerical, office, and administrative positions. We have greater confidence in these figures as the ACS data has superior sampling characteristics which allow for a reliable set of estimates for the sectors available.

[20] At first glance, the percentage of both Nebraska and Iowa Central and South American born immigrants working in animal slaughtering and processing may seem small given both popular perceptions as well as some historical data would suggest that many immigrants, particularly undocumented workers migrating to the Midwest, find work in meat-packing plants. These figures are suggesting two things. First, the ACS classification for animal slaughtering and processing include not only those working on the cutting floor (which in all likelihood, has a much higher percentage of Latino immigrant employment), but, as stated in the footnote above, also those workers in clerical, office, and general administrative jobs, where immigrant employees exist, but in lower concentrations. These additional immigrant employees are, in numerical terms, rather significant. For instance, in 2010, Nebraska had about 12,000 Central/South American-born workers in this sector. The 2008 report, which just counted those working on cutting floor, reported about 9,000 such workers in 2006. Therefore, the earlier report may very well have under-counted a number of immigrant workers' contributions to a valuable industry. A second reason for a smaller overall percentage might be that a greater number of immigrant children, who are native born citizens of working age are now finding work in meat processing. This could partially explain the lower percentage of Central and South American immigrants working in this sector. On this second reason, more research is needed. However, current available data does not allow for further examination at this point.

Production Impacts – Omaha-Council Bluffs

With these employment figures in place, we used IMPLAN to generate estimates of what would be lost from our three economies from a hypothetical removal of these laborers.[21] Table 7 summarizes the output impact on our three economies. For the Omaha-Council Bluffs economy, if a total of 13,570 immigrant jobs were removed from the economy (across the three sectors identified), the resulting direct impact on the dollar value of output in 2010 would have been a loss of $3.4 billion. Furthermore, there would have been a reduction in indirect and induced benefits since the initial labor reduction would cause less production from the three sectors, resulting in less demand for inputs from other sectors of the economy (the indirect effect) and lower spending by households due to fewer income earners (the induced effect).

Thus, the value of total output lost would have been $6.5 billion, a sizable multiplier effect of 1.9. Hence, for every dollar of production removed from one of these three sectors, an additional 90 cents would have been lost through indirect and induced effects.

Table 7. Economic Impact of Total Immigrant Employment Removal in Construction, Animal Slaughtering and Processing, and Food Services: Total value of output ($ millions)

	Direct	Indirect	Induced	Total
Omaha-Council Bluffs PUMA				
Total Foreign-Born	-$3,377	-$2,095	-$1,004	-$6,476
Central and South American-Born	-$2,915	-$1,802	-$871	-$5,588
Nebraska				
Total Foreign-Born	-$8,646	-$7,465	-$2,044	-$18,155
Central and South American-Born	-$6,528	-$5,556	-$1,561	-$13,646
Iowa				
Total Foreign-Born	-$6,411	-$4,233	-$1,371	-$12,015
Central and South American-Born	-$4,868	-$3,258	-$1,026	-$9,152

Source: Authors' estimates using IMPLAN 3.0. Figures reflect 2010 dollars.

Table 8 summarizes the employment impacts. This same reduction in jobs in 2010 would have resulted in an overall drop in employment of 33,952, a multiplier of 2.5. For every job removed from one of these sectors an additional 1.5 jobs would have been lost through indirect and induced effect. To place these figures in context, according to data supplied by IMPLAN, in 2010 the value of total output in Omaha-Council Bluffs was $82.6 billion. Hence, the total lost production from removing immigrant workers from the economy alone would have represented about 7.8 percent of total output.

[21] This experiment ignores the potential that some of the native population may have been employed absent this immigrant labor. The issue of labor substitution is a complex issue and is addressed later in this report. That said, since the estimates provided by this experiment do not consider substitution of native for immigrant labor, they can be reasonably considered a type of "upper bound" effect on the total impact on production and employment.

Table 8. Economic Impact of Total Immigrant Employment Removal in Construction, Animal Slaughtering and Processing, and Food Services: (# jobs)

	Direct	Indirect	Induced	Total
Omaha-Council Bluffs PUMA				
Total Foreign-Born	-13,570	-11,126	-9,257	-33,952
Central/South American-Born	-11,387	-9,599	-8,031	-29,018
Nebraska				
Total Foreign-Born	-29,227	-32,989	-19,816	-82,032
Central/South American-Born	-22,490	-24,763	-15,135	-62,389
Iowa				
Total Foreign-Born	-26,309	-21,988	-13,391	-61,688
Central/South American-Born	-18,159	-16,819	-10,023	-45,001

Source: Authors' estimates using IMPLAN 3.0.

Focusing specifically on Central/South American immigrants, the value of total output lost from removing 11,387 jobs would have been $5.6 billion, a multiplier effect of 1.9. This same reduction in jobs would have resulted in an overall drop in employment of 29,018 jobs, a multiplier of 2.5. For every job removed from one of these sectors an additional 1.5 jobs would have been lost through indirect and induced effects. The total lost production from removing Central/South American immigrant workers from the economy alone would have represented about 6.8 percent of total output.

Production Impacts – Nebraska and Iowa

For Nebraska, if the 29,227 jobs performed by immigrant workers in the three identified sectors were removed from the economy, the resulting direct impact on the dollar value of output in 2010 would have been an $8.6 billion loss. Additional indirect and induced losses would have cost the economy a total of $18.2 billion (see Table 7). Using total production estimates from IMPLAN for 2010, approximately $169.5 billion, this loss would have amounted to 10.7% of total economic activity in the state. A total of job losses due to direct, indirect, and induced effects would have been on the order of 82,000 (see Table 8), about 6.7 percent of total employment in the state.

With respect to the Central/South American immigrant impact, were the 22,490 individuals working in the three identified sectors removed, the total (direct, indirect, and induced) loss would have been $13.6 billion worth of economic activity and a little over 62,000 jobs.

The overall impact of immigrant labor on Iowa's economy would be smaller than the impact in Nebraska. This is due in large measure to the fact that the number of immigrants employed in the construction, animal slaughtering and processing and food services, both in absolute terms and as a percent of total employment, is smaller in Iowa.[22] Nonetheless, immigrants do make an identifiable contribution to the state's economy. For Iowa, removing the 26,309 immigrant workers in the three identified sectors would have resulted in a direct loss in 2010 of $6.4 billion. Additional indirect and induced losses would have cost the economy a total of $12.0 billion (again see Table 7). Using total production estimates from IMPLAN for 2010, approximately $281.9 billion, this loss would have represented 4.2% of total economic

[22] Some might express concern that our study biases the Iowa impact downwards due to the selection of the three above delineated sectors, which admittedly do account for a smaller number of overall jobs in Iowa (26,309) than in Nebraska (29,227). However, for the overall Iowa economy, the proportion of immigrant to total employment is smaller in Iowa than in Nebraska. According to ACS data, immigrant labor accounted for 4.9 percent of total employment in Iowa in 2010, compared with about 7 percent in Nebraska. Again, we would anticipate a smaller impact relative to Nebraska had all sectors been impacted.

activity in Iowa. Total job losses due to direct, indirect, and induced effects would be slightly less than 62,000 (see Table 8), about 3.2 percent of total employment in the state.

With respect to the Central/South American immigrant impact, were the 18,159 workers in the three identified sectors removed in 2010, the total (direct, indirect, and induced) loss would be $9.2 billion worth of economic activity and 45,000 jobs.

Alternative Employment Impact Scenarios

To be sure, the above experiments ignore the potential for labor substitution. That is, in the absence of this immigrant labor, some of the native population may have been employed. Assuming "no labor substitution" is an important limitation of the above analysis. Labor substitution and market dynamics are a very complex issue and estimating such substitution effects precisely would require a substantial amount of analysis far beyond the scope and intent of this study. That said, in this section alternative impacts are presented based on assumptions regarding the degree to which jobs held by the economy's immigrant population in the construction, food services, and animal slaughtering and processing sectors might be absorbed by the native-born labor force as well as other key assumptions.[23]

Three different absorption rates were considered. The first was where 25 percent of immigrant jobs are filled by the native-born labor force, the second where 50 percent of immigrant jobs are filled by domestic workers, and the third where 75 percent of immigrant jobs are filled by the native-born.[24] These figures, shown in Tables 9 and 10, give a range of possible impacts from the removal of immigrant labor from the Omaha-Council Bluffs, Nebraska, and Iowa Economies, respectively, in 2010.

One can see that there are still substantial adverse impacts on all three economies from the hypothetical removal of the total immigrant labor force. Assuming a 25 percent absorption rate, Omaha-Council Bluffs would have lost $4.9 billion worth of production and 25,463 jobs. Iowa would have lost over $9.0 billion in total economic output and over 46,200 jobs. Nebraska would have suffered the most, losing $13.6 billion in production and over 61,500 jobs in 2010.

[23] Indeed, there are two key assumptions being made in this section. First, it is assumed that there is sufficient native-born surplus labor available to absorb these vacated jobs. Second, closely related to the first, it is assumed that the native-born labor force would take those jobs at prevailing wages. By their very construction, IO models treat prices, including wages, as fixed, essentially assuming that there are sufficient resources in an economy to meet any changes in final demand for goods and services.

[24] Adverse economic impacts will obviously get smaller with larger absorption rates. If 100 percent of all immigrant jobs were replaced by domestic labor, then there would be no adverse impact on the economy. With such a tight labor force, such an outcome would be highly unlikely in Nebraska.

Table 9. Alternative Economic Impact of Immigrant Labor Removal: Total value of output ($ millions)

	Percent of Immigrant Jobs Absorbed by Native Workers		
	25%	50%	75%
Omaha-Council Bluffs PUMA			
Total Foreign-Born	-$4,857	-$3,238	-$1,619
Central/South American-Born	-$4,191	-$2,794	-$1,397
Nebraska			
Total Foreign-Born	-$13,616	-$9,078	-$4,539
Central/South American-Born	-$10,235	-$6,823	-$3,412
Iowa			
Total Foreign-Born	-$9,011	-$6,007	-$3,004
Central/South American-Born	-$6,864	-$4,576	-$2,288

Source: Authors' estimates using IMPLAN 3.0. Figures reflect 2010 dollars.

Under the more favorable condition where 75 percent of the missing immigrant labor force is replaced with domestic labor, Omaha-Council Bluffs would have experienced a $1.6 billion loss in production and 8,488 jobs. Iowa would have seen its economy shrink by about $3 billion and 15,422 jobs. Again, Nebraska's economy would have been hurt the most, losing $4.5 billion in production and 20,500 jobs.

Table 10. Alternative Economic Impact of Immigrant Labor Removal (# jobs)

	Percent of Immigrant Jobs Absorbed by Native Workers		
	25%	50%	75%
Omaha-Council Bluffs PUMA			
Total Foreign-Born	-25,463	-16,975	-8,488
Central/South American-Born	-21,762	-14,508	-7,254
Nebraska			
Total Foreign-Born	-61,524	-41,016	-20,508
Central/South American-Born	-46,792	-31,195	-15,597
Iowa			
Total Foreign-Born	-46,267	-30,845	-15,422
Central/South American-Born	-33,752	-22,501	-11,251

Source: Authors' estimates using IMPLAN 3.0.

Fiscal Contributions & Social Cost Pressures from the Immigrant Population in the State of Nebraska

The analysis above suggests that immigrant populations do contribute substantially to the economy in meaningful ways. First, through their spending activity, jobs are created for both immigrants and native-born groups. Second, the sectors these immigrant groups are largely employed in are critical to the economic well-being of the economies studied here.

However, to assess more completely the impact of the immigrant population on an economy, analysis of the fiscal contributions and social pressures this group has on a given economy is in order. Many concerns have been expressed regarding immigrant populations' pressure on publicly supplied services, such as educational and health services, and contributions made in the form of tax revenue. In this section, we attempt, to the extent possible, to assess these relative costs and contributions for both Nebraska and Iowa.[25] The focus here will be on state government costs and contributions. Figure 4 below depicts the various categories identified here.

Costs and Contributions

Contributions to state governments come from several sources. We consider three: income taxes, sales taxes, and energy (gas) excise taxes paid to the state. Table 11 shows, based upon 2010 estimates, the percent of total contributions for these three revenue sources coming from each demographic group for Nebraska and Iowa.[26] Costs comprise public assistance, Medicaid expenditures by each state and education expenditures for each state.[27] Details on how estimates were constructed are supplied in Appendix C.

[25] Much like the production impact, direct comparisons between the fiscal costs/contributions made in this section are not comparable to Decker et al. (2008). There are simply too many differences between the data sources available for each respective study. Moreover, with this study, a greater effort was made to focus particular attention on state-only costs and contributions so as to facilitate comparisons with Iowa, a comparison not done in Decker et al. (2008).

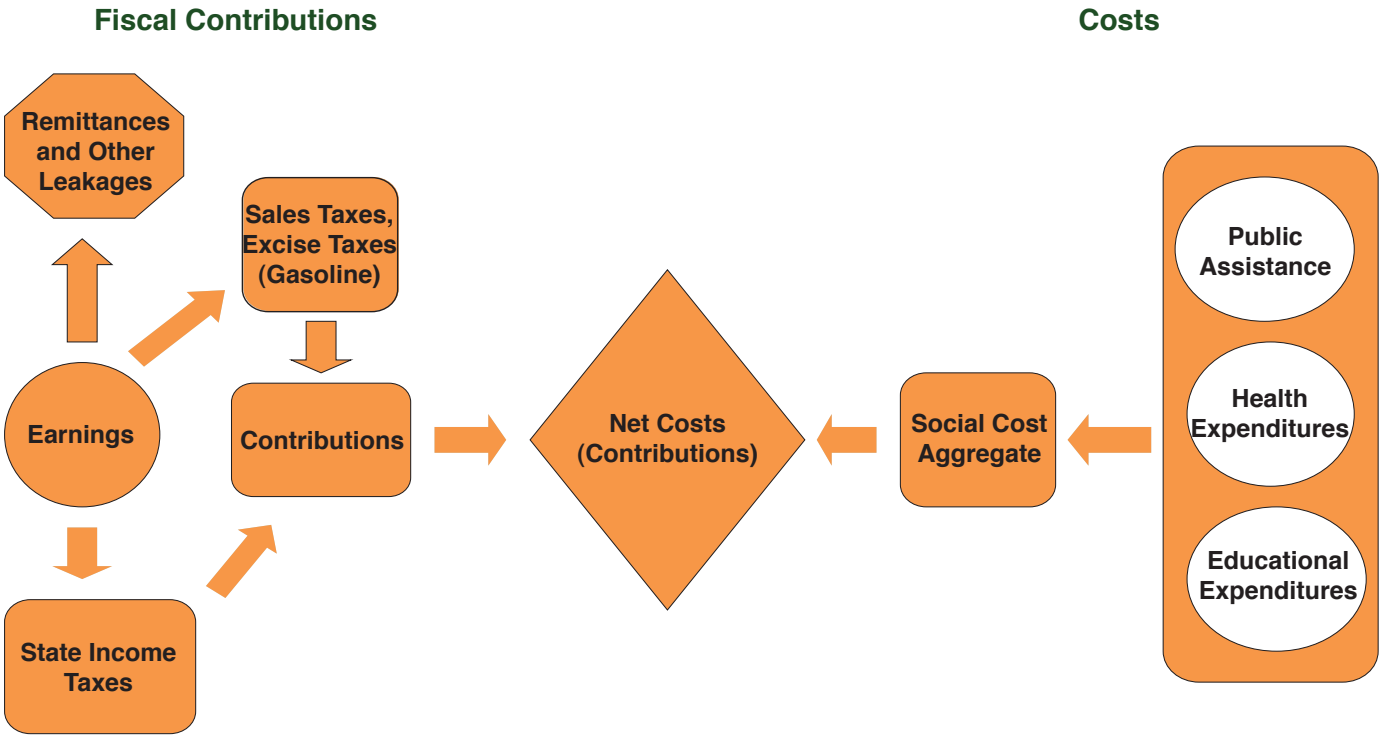
[26] Note that summing the foreign-born and native-born percentages yields 100 percent. Central and South American immigrants are a sub-group within the foreign-born group and therefore their contributions and costs are subsumed within the foreign-born figures.

[27] Since this does reflect a complete set of contributions, dollar value totals and comparisons can be misleading. However, a comparison based upon percentage contributions from each demographic group can offer some insight. As addressed below, this is also true for public costs. Since a complete set of public expenditure estimates would be quite involved and well beyond the scope of this study, dollar value of cost estimates are not very useful in this context. Yet, of the cost categories we can offer estimates for, the percent of public expenditures going to meet the needs of our various demographic groups can offer some information regarding the pressure these groups place of state-supported public programs.

Nebraska

In terms of state income, sales, and gasoline tax revenues generated, Nebraska immigrants accounted for about 4.3 percent of the total in 2010. They accounted for slightly less income tax revenue (4.2 percent), largely because per capita incomes tend to be lower than the native-born population. However, in 2010 they accounted for slightly more sales and gasoline tax revenue in percentage terms (4.6 percent) since they tend to spend a slightly higher percentage of their disposable income on taxable items (see Appendix C for details).

Figure 4. Fiscal Contributions and Social Costs



It is the case that the foreign-born population's share of revenue contributions was less than proportional to their population share (this group accounted for 6.8 percent of the state's population in 2010), it is worth noting that this group accounted for 4.1 percent of public expenditures on public assistance, (state contributions to) Medicaid and education. Indeed, the ratio of 4.3 to 4.1 (1.055) implies that, in percentage terms, the foreign-born population paid in slightly more than it drew from state funded programs in 2010. This result is consistent with other studies, such as Decker et al. (2008) and Garvey, Espenshade, and Scully (2002) who found similar results.

In terms of the Central/South American immigrant group specifically, we found that in Nebraska the percent of contributions paid to the state (2.0 percent) effectively offset the benefits received from the state in the form of public assistance, Medicaid and education (again about 2.0 percent) in 2010.

With respect to the native-born group, it by far accounted for the greatest percentage of contributions

[28] While a comparison of contributions to cost percentages in Table 11 (95.7 percent and 95.9 percent, respectively) suggests that this group pays in less than it draws out, the contributions and costs percentages are so close as to be within any reasonable margin of error in our estimates. Therefore, it is statistically advisable to consider parity in costs and contributions.

(roughly 96 percent). As this group accounted for over 93.2 percent of Nebraska's population, the percent paid in to state coffers was proportionately higher in 2010. In terms of benefits received from the state for public assistance, Medicaid, and education, this group accounted for about 96 percent, again suggesting parity in costs and contributions.[28]

Table 11. Fiscal Contributions and Costs for 2010

	Nebraska			Iowa		
	Foreign-Born	Central/South American-Born	Native-Born	Foreign-Born	Central/South American-Born	Native-Born
Contributions						
Income taxes	4.2%	1.8%	95.8%	3.5%	1.0%	96.5%
Sales taxes	4.6%	2.4%	95.4%	3.2%	1.3%	96.8%
Gasoline taxes	4.6%	2.3%	95.4%	3.2%	1.2%	96.8%
Total	**4.3%**	**2.0%**	**95.7%**	**3.4%**	**1.1%**	**96.6%**
Costs						
Public Assistance	4.7%	1.8%	95.3%	3.7%	0.8%	96.3%
Medicaid	4.6%	1.7%	95.4%	3.2%	0.9%	96.8%
Education	3.6%	2.1%	96.4%	3.0%	1.2%	97.0%
Total	**4.1%**	**2.0%**	**95.9%**	**3.1%**	**1.1%**	**96.9%**

Source: Authors' estimates. See Appendix C.

Iowa

A similar pattern emerges for Iowa. In terms of tax revenues generated, Iowa immigrants accounted for about 3.4 percent of the total in 2010. This is smaller than in Nebraska, but the foreign-born group in Iowa represented only 4.2 percent of the total population that year, less than the 6.8 percent figure for Nebraska.

Like Nebraska, the foreign-born groups' contributions were less than proportional to their population share. However, this group accounted for only 3.1 percent of state expenditures on public assistance, Medicaid, and education in 2010. Again, like Nebraska, the ratio of 3.4 to 3.1 (1.10) implies that, in percentage terms, the foreign-born population in Iowa paid in slightly more than it drew from state-funded programs.

In terms of the Central/South American immigrant group specifically, we found that in Iowa the percent of contributions paid to the state (1.1 percent) effectively offset the benefits received from the state in the form of public assistance, Medicaid and education (again about 1.1 percent). These percentages are smaller than in Nebraska due in large measure to the fact that the proportion of the population from Central/South American (1.7 percent) was smaller in 2010 than in Nebraska (3.2 percent).

With respect to the native-born group, it again accounted for the greatest percentage of contributions (roughly 97 percent). As this group accounted for over 95.8 percent of Iowa's population, the percent paid in state revenue was higher. In terms of benefits received from the state, this group accounted for about 97 percent in 2010, again suggesting parity in costs and contributions.[29]

[29]Again, like Nebraska, the data suggest that contributions are less than costs in percentage terms (96.6 percent for contributions and 96.9 percent for costs. However, again since estimates are so close to parity, it is advisable to consider a balance between contributions and costs for this group in Iowa as well.

Conclusion & Future Research

This study has attempted to quantitatively measure the impact of immigrant populations on the Omaha-Council Bluffs, Nebraska, and Iowa economies, with some attention paid to Latin American immigrant groups. There are several key results that arise from this analysis.

First, on the demand or spending side, immigrant spending generated between $1.2 to $1.5 million worth of economic activity in the Omaha-Council Bluffs economy in 2010. Spending by Central/South American Immigrants generated between $477 and $615 million worth of total production in 2010.

Also, in 2010, immigrant spending in Nebraska generated between $1.9 and $2.4 billion worth of output. Central/South American spending was responsible for between $834 million and $1.1 billion worth of production. Moreover, immigrant spending in Iowa generated between $2.5 and $3.2 billion worth of output. Central/South American spending was responsible for between $749 and $963 million worth of production.

On the supply, or production side, the immigrant population in the three economies of interest made considerable contributions to the labor force in three key economic sectors; construction, food services, and animal slaughtering and processing. In the Omaha-Council Bluffs economy, the immigrant labor force accounted for 11 percent of total employment in construction in 2010, 10 percent of total employment in the food services sector, and 54 percent in meat processing.

In this study, we conducted experiments addressing what would have happened if the immigrant portion of the labor force was unavailable in these key sectors in 2010. We found that total production in the Omaha-Council Bluffs economy would fall by $6.5 billion if these immigrants were not present in these sectors, about 7.8 percent of total production. If just the Central/South American immigrant population were removed from these sectors, the resulting loss would be $5.6 billion, or 6.8 percent of total production. This loss represents about 34,000 jobs.

Using the same experimental conditions, total production losses in Nebraska and Iowa would have been $18.2 (10.7 percent of total production) and $12.0 billion (4.2 percent of total production), respectively. These losses represent about 82,000 jobs in Nebraska and 62,000 jobs in Iowa.

Finally, with respect to tax revenue contributions from, and public expenditures on, immigrant populations in Nebraska and Iowa, we found that in 2010, the foreign-born population tended to pay in to government accounts slightly more than they drew out in the form of public assistance, Medicaid, and education. This result is generally consistent with many existing studies. The Central/South American-born group tended to make contributions that were (in percentage terms) on par with the benefits they drew from state-supported institutions. Similarly, in percentage terms, the native-born groups in both states tended to pay in to government accounts at a level roughly equivalent to what they drew out in public benefits.

While this study has utilized the most recent and reliable data available and one of the most detailed and commonly employed modeling platforms (i.e. IMPLAN) to measure the economic impact of immigrant populations, the study does have some limitations which suggest a number of fruitful avenues for future research. Several such extensions are discussed below.

First, the issue of documented versus undocumented immigrant populations is important, at least from a public sector perspective. From an economic impact assessment, assuming (reasonably) that immigrants have similar incomes and exhibit similar spending habits irrespective of legal status, then the expenditure multipliers will be the same. Moreover, if this undocumented group is employed in similar jobs to those documented immigrants, then again, the multipliers will be the same. Unfortunately, detailed data is sparse.[30] However, if one did have data on employment and population characteristics for the undocumented immigrant group, then one could reasonably estimate their impact as a percentage of the impact values measured in this report.[31] In short, from the economic impact perspective, there may be little to gain from focusing on the undocumented immigrant group unless more reliable detailed income and expenditure data can be found to refine any direct effect measurements.

Second, the fiscal impact may be a useful avenue for future research. While Pearson and Sheehan (2007) and others have articulated, undocumented immigrants do pay property, sales, and income taxes, and tend to access the medical care system at rates much lower than native-born citizens, there are still too many unknowns, particularly at the regional level, about the nature and extent of the undocumented immigrant population to make any definitive conclusions. Hence, more research here may be in order.

Third, many Latino immigrants have been present in this region sufficiently long to have had children born in this country and are now of working age. This second generation may be finding employment in a variety of sectors and an analysis of this generation's impact has yet to be fully conducted. Current data from sources such as the ACS do not provide sufficient information to track this population. However, perhaps via direct survey, it might be possible to assess their economic contribution. This is an essential next step in research in this area.

Fourth, IO models, by their very construction, assume fixed prices, including factor prices such as wage rates. This, in effect, implies that there are no meaningful resource constraints in an economy. Hence, if there is an increase in final demand for some good or service, it is assumed that there are sufficient resources (including labor) available to meet that additional demand. In an environment where there are limited resources, then one would expect a corresponding change in price. For example, if there were an increase in demand for meat, fish, and poultry, then there would be a corresponding increase in labor demand in this sector. If there was a significant amount of surplus labor available, then one would anticipate no change

[30] Passel (2005) does offer some population estimates but little is available on type of jobs held or average incomes.

[31] This is possible due to the inherent linearity of IO models. For example, we have estimated the total spending impact from Nebraska's foreign-born population to be $2.15 billion. If data revealed that the total undocumented population was 20 percent of the total foreign-born population in 2010, then the resulting total spending impact of this group would be estimated at $430 million (i.e. 0.2*$4.15 billion).

in wages and thus no upward pressure on meat, fish, and poultry prices. However, if there was only a limited amount of surplus labor available, then one would expect an increase in wages and thus some inflationary pressure on meat, fish, and poultry goods and, in turn, inflationary pressure further down the supply chain as well.

As indicated earlier in this report, the existing literature linking wage increases/decreases to immigration flows is largely inconclusive and therefore there may be little bias in the results generated by the IO model in this study. However, as also indicated earlier in this report, labor market dynamics are quite complex. It may, then, still be fruitful to investigate specific labor markets within this state to see if wages are sensitive to immigrant population levels. These, and other, considerations are left for future research.

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Appendix A:
American Community Survey Public Use Microdata Sample

Many of the values used in this report use data from the Public Use Microdata Sample (PUMS) from the U.S. Census Bureau's 2006-2010 American Community Survey (ACS). Nationally, the ACS samples nearly 3 million addresses each year, resulting in nearly 2 million final interviews. In addition to the housing units, the ACS includes approximately 1 in 40 persons living in group quarters.

The annual ACS sample is smaller than that of the Census 2000 long-form sample, which included about 18 million housing units. As a result, the ACS needs to combine population or housing data from multiple years to produce reliable numbers for small counties, neighborhoods, and other local areas. To provide information for these areas, each year the ACS provides 5-year estimates. The primary advantage of using multiyear estimates is the increased statistical reliability. In the 2006-2010 ACS, the Census Bureau received completed interviews for the following number of persons in the study areas:

- Omaha/Council Bluffs Area 80,978
- Nebraska 197,760
- Iowa 329,347

Five-year estimates from the ACS are all "period" estimates that represent data collected over a period of time (as opposed to "point-in-time" estimates, such as the decennial census, that approximate the characteristics of an area on a specific date). A 5-year estimate includes data collected over a 60-month period. Therefore, ACS estimates based on data collected from 2006–2010 are not called "2006" or "2010" estimates. Nor are the 2006–2010 period estimates labeled "2008" estimates, even though that is the midpoint of the 5-year period. Multiyear estimates are labeled to indicate clearly the full period of time (e.g., "The number of foreign-born living in the Omaha/Council Bluffs area in 2006–2010 was X").

Standard ACS products answer the majority of questions data users are interested in, but some questions cannot be answered by these products. For example, the standard products do not provide a table showing detailed employment characteristics of foreign-born residents by country of origin. This can be produced using the PUMS files. With microdata, it is the user who determines the structure of the tabulation and the characteristic(s) to be tabulated.

There are more than 60 questions on the ACS, and they are comparable to those on the Census 2000 long form. PUMS files show the full range of responses made on individual questionnaires. The files contain records for a sample of all housing units and group quarters, with information on the characteristics of each housing unit and the people in the housing unit or group quarter. Each record shows most of the information associated with a specific housing unit or individual except for personal identifying information and some things that could be used to identify an individual.

The 2006-2010 PUMS file consists of approximately 5 percent of the housing units and 5 percent of the persons residing in group quarters. In the 2006-2010 period, the PUMS for the study areas included the following number of persons:

- Omaha/Council Bluffs Area 37,040
- Nebraska 90,094
- Iowa 154,296

Individual responses are given a weight so that the weighted values will estimate the characteristics of the total population.

As is the case for every sample survey, the PUMS is subject to two types of error: sampling error and nonsampling error. Sampling error results from using a sample of persons to estimate the characteristics of a population. Probability sampling allows us to conduct statistical analyses of sample data. All other things being equal, the larger the number of people included in the sample, the smaller the sampling error. Therefore, in this report, our analyses were limited if the unweighted number of persons included in the sample was too small.

Nonsampling errors are unknown and may affect the data in two ways. Some nonsampling errors are introduced randomly because of data entry or editing errors. These errors increase the variability of the data. Systematic errors, which are in one direction, introduce bias into the results of a sample survey and may result from the failure to obtain measurements from sampled housing units (nonresponse). The Census Bureau tries to minimize the effect of these systematic errors on survey estimates through sampling techniques, questionnaire design, and data collection, and processing procedures.

The PUMS file includes detailed country of origin information to aggregate foreign-born Nebraska residents who come from Central/South American countries, including, among others, Mexico, Cuba, Jamaica, and the Dominican Republic. Out total foreign-born group includes both those from Central/South America as well as the rest of the world. Table A1 below identifies the country of origin for the delineations used in this study.

Table A1. Place of Birth – Country Breakdown

Central & South American Origin		Rest of World				
		Europe & Canada		Asia & Middle East		Africa, Australia and Pacific Islands
Antigua & Barbuda	Guatemala	Albania	Iceland	Afghanistan	Lebanon	Algeria
Argentina	Guyana	Armenia	Ireland	Bangladesh	Malaysia	Cameroon
Bahamas	Haiti	Austria	Italy	Cambodia	Myanmar	Cape Verde
Barbados	Honduras	Azerbaijan	Latvia	China	Nepal	Egypt
Belize	Jamaica	Azores Islands	Lithuania	Hong Kong	Pakistan	Eritrea
Bermuda	Mexico	Belarus	Macedonia	India	Philippines	Ethiopia
Bolivia	Nicaragua	Belgium	Moldova	Indonesia	Saudi Arabia	Fiji
Brazil	Panama	Bosnia & Herzegovina	Netherlands	Iran	Singapore	Ghana
Chile	Paraguay	Bulgaria	Northern Ireland	Iraq	Sri Lanka	Guinea
Colombia	Peru	Canada	Norway	Israel	Syria	Kenya
Costa Rica	St. Kitts-Nevis	Croatia	Poland	Japan	Taiwan	Liberia
Cuba	St. Lucia	Czech Republic	Portugal	Jordan	Thailand	Micronesia
Dominica	St. Vincent & the Grenadines	Czechoslovakia	Romania	Kazakhstan	Turkey	Morocco
Dominican Republic	Trinidad & Tobago	Denmark	Russia	Korea	Uzbekistan	New Zealand
Ecuador	Uruguay	England	Scotland	Kuwait	Vietnam	Nigeria
El Salvador	Venezuela	Estonia	Slovakia	Laos	Yemen	Samoa
Grenada		Finland	Spain			Senegal
		France	Sweden			Sierra Leone
		Georgia	Switzerland			Somalia
		Germany	Ukraine			South Africa
		Greece	Yugoslavia			Sudan
						Tanzania
						Tonga
						Uganda
						Zimbabwe

Appendix B: Calculation of After-tax & Remittances Income

After-tax Income

To calculate after-tax income, we generated an effective Federal and State income tax rate by using mean income measures for our demographic groups and applied various marginal tax rates as supplied by a variety of sources on marginal tax rates. We obtained data on Federal marginal tax rates from the following web site: http://www.moneychimp.com/features/tax_brackets.htm, verified through US Internal Revenue Service sources, and for the states of Nebraska and Iowa we used information found at http://www.scribd.com/doc/83965147/State-Individualincome-Rates-2000-2012-20120216. These rates were verified through each state's department of Revenue. The Rates are provided below:

Table B1. Tax Rates for 2010

Federal Rates		Nebraska Rates		Iowa Rates	
Income Range	Rate	Income Range	Rate	Income Range	Rate
$0-$8,375	10%	$0-$2,400	2.56%	$0-$1,407	0.36%
$8,375-$34,000	15%	$2,400-$17,500	3.57%	$1,407-$2,814	0.72%
$34,000-$82,400	25%	$17,500-$27,000	5.12%	$2,814-$5,628	2.43%
$82,400-$171,850	28%	$27,000-over	6.84%	$5,628-$12,663	4.50%
$171,850-$373,650	33%			$12,663-$21,105	6.12%
$373,650-over	35%			$21,105-$28,140	6.48%
				$28,140-$42,210	6.80%
				$42,210-$63,315	7.92%
				$63,315 - over	8.98%

We then applied these tax rates to various levels of income up to the level of mean personal income. The resulting tax rates average about 13.0 percent for federal tax deductions and between 3.6 and 5.0 percent for state tax deductions depending on state and demographic group. An additional income deduction is the payroll tax. In 2010, the federal social insurance tax deducted from wages was 6.2 percent and the Medicare withholding was 1.45 percent. Together, the payroll tax in 2010 was 7.65.

Applying these three deductions gives us a measure of after-tax income. For example, consider the total immigrant group in the Nebraska economy, who as a whole earned $2.198 billion in wages and salaries in 2010. The after-tax income is estimated to be:

$2.198 billion *(1-Taxfed-Taxstate-Taxpayroll) = 2.198 billion*(1-0.1262-0.0408-0.0765)

= $1.674 billion

Remittances

Once these after-tax figures are calculated, we need to deduct that income immigrant populations tend to send to their region of origin, i.e. remittances, as these represent a leakage from the local economy and should not then be used as direct inputs into IMPLAN. Recent data on remittances at the state level are quite limited. However, the US Congressional Budget Office (CBO), February 2011 report "Migrants Remittances and Related Economic Flows," accessible at the following web site: http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/120xx/doc12053/02-24-remittances_chartbook.pdf, offers some statistics on remittance flows from the US to various regions of the world, including Latin America. Using these data, along with ACS data on per capita incomes, we constructed estimates for 2010 remittance levels for our three economies of interest.

For 2009, the CBO reports total private net remittances from the US to have been $82.2 billion. For simplicity, we assume the same value for 2010. According to the ACS, total foreign-born employment in the US in 2010 was 23,128, 902. This implies a per capita remittance level of $3,554. Assuming that this remittance level is roughly consistent across all foreign-born groups, given that, as estimated by the ACS, we had 44,471 Central/South American immigrant workers in Nebraska in 2010, then this implies total remittances from Nebraska to be $158 million (that is $3,354*44, 471). This figure is up slightly from the $154 million 2006 figure estimated directly for the state as estimated in the World Bank's "Migration and Remittances Factbook, 2008." (See Decker et al. 2008). This suggests that remittances account for 20 percent of after-tax income from Central/South American immigrants, again in line with Decker et al. (2008). Given that our current estimate seems to be in line with other sources, we applied this same procedure to other immigrant groups as well as the Omaha-Council Bluffs economy and for the state of Iowa. Our estimate for Iowa remittances by Central/South American immigrants was about $141.8 million in 2010 (about 20 percent of after-tax income), and for Omaha-Council Bluffs $82.0 million (about 21 percent of after-tax income).

Therefore, to arrive at an estimate for consumer income spent locally by immigrant group for each of our three economies of interest, we deduct remittances from after-tax income. For example, for Nebraska, our estimate for the percent of total after-tax income remitted was 16.8 percent. Therefore, our after-tax, after-remittance spendable income is

$1.674 billion *(1-% remitted) = 1.674 billion*(1-0.17)

= $1.392 billion.

We applied a similar procedure to the other immigrant groups and economies. These after-tax, after-remittance figures are then the direct spending figures presented in Table 3 of this report.

Appendix C: Calculations of Public Contribtions & Costs Estimates

As indicated in the text, the fiscal impact analysis focuses on state-level tax contributions from, and state-level public expenditures on, native-born, foreign-born, and Central/South American-born persons in Nebraska and Iowa in 2010. Offering a complete ledger of all costs and contributions is beyond the scope of this analysis. However, we were able to construct estimates for certain sources of tax contributions as well as certain prominent public expenditure categories. Tax contributions estimate state income tax, sales tax, and gasoline tax generated from each demographic group for 2010. Public expenditure estimates capture state spending on public assistance, Medicaid, and education for each demographic group. Since this does not reflect a complete set of cost and contributions, dollar value comparisons can be misleading. That said, a comparison based upon percentage costs and contributions from each demographic group can offer some insight.

In this appendix, we describe the data sources and procedures necessary to estimate the costs and contributions that comprise our fiscal analysis.

Contributions

Income taxes. These estimates represent income taxes paid out of income to state government only. Details regarding the state tax rates employed and data sources used are discussed in Appendix B.

Sales taxes. The sales tax figures were based on expenditures in certain key consumer spending categories as defined by the US Bureau of Labor Statistics' Consumer Expenditure Survey, 2010. (CES). These categories were: food away from home, alcoholic beverages, utility fuels and public services, household operations, housekeeping supplies, household furnishings and equipment, apparel and services, vehicle purchases (net outlay), other vehicle expenses, entertainment, personal care products and services, tobacco products and smoking supplies, and miscellaneous items.

The CES offers expenditure estimates at the national level broken down by household income category. From the ACS, we obtained estimates for median household income for the Native-born, foreign-born, and Central/South American-born populations in Nebraska and Iowa. For the Native-born group, the median household income was approximately $50,000, for the foreign-born group, approximately $40,000, and for the Central/South American group, approximately $30,000 to $35,000, in 2010. Utilizing similar income classes from the CES, we calculated the percent of after-tax income spent on the taxable items listed above. For the native-born group, this percentage was approximately 33.6 percent, for the foreign-born group, about 37.0 percent, and for the Central/South American-born group 43 percent.

We then applied these percentages to the before-tax income for each population group in each state to estimate total spending on taxable items. To the Nebraska figures, we applied a 5.5 percent sales tax rate to estimate sales taxes generated in 2010. To the Iowa figures, we applied that state's 6.0 percent sales tax to estimate tax revenue generated in 2010.

Gasoline taxes. The gasoline consumption tax figures were calculated as follows. Based on data from the CES of total after-tax income, 5.8 percent for the Central/South American group, 5.1 percent for the foreign-born group, and 4.6 percent for the native-born group was spent on gasoline 2010. We applied these percentages to Nebraska and Iowa income estimates for each population group. Using estimates from Forbes on the average price per gallon estimate in 2010 for Nebraska and Iowa (see http://www.forbes.com/2010/04/14/gas-summer-prices-lifestyle-vehicles-oil-prices-car_chart.html), we estimated total gallons purchased by dividing these prices by gasoline expenditures. Finally, according to the National Tax Foundation (see http://taxfoundation.org/article/state-sales-gasoline-cigarette-and-alcohol-tax-rates-state-2000-2010), the gas tax in Nebraska was 27.7 cents per gallon in 2010. In Iowa, the tax was 22 cents per gallon in 2010. The total tax revenue generated was estimated by multiplying the tax by the gallons estimate.

Costs

Public Assistance. Public assistance and supplemental income come directly from the ACS.

Education. Educational expenditure estimates were constructed based on public school attendee data for native and immigrant groups aged 5 to 17 from the ACS for both Nebraska and Iowa. In Nebraska, the native-born, foreign-born, and Central/South American-born public school attendees aged 5 to 17 were 262,109, 9,926, and 5,820, respectively. In Iowa, the corresponding figures were 444,879, 11,958, and 5,623, respectively. We obtained 2010 estimates for state per pupil expenditures for both Nebraska and Iowa from The National Education Association Rankings & Estimates: Rankings of the States 2010 and Estimates for 2011 (see the following website: http://www.nea.org/assets/docs/HE/NEA_Rankings_and_Estimates010711.pdf). These data

indicate that in 2010 per pupil expenditure was $9,760 in Nebraska and $9,455 in Iowa. Applying these per pupil estimates to the population figures listed above provides the estimates for education expenses made by each state in 2010.

Medicaid. ACS provides estimates of those receiving Medicaid benefits in both Nebraska and Iowa, broken down by immigrant status. For example, ACS estimates that of the 228,879 individuals receiving Medicaid in Nebraska in 2010, 3,924, or 6.5 percent, were immigrants from Central/South America. We obtained an estimate of total state level Medicaid spending for fiscal year 2010 from the Kaiser Family Foundation (http://www.statehealthfacts.org/comparemaptable.jsp?ind=636&cat=4). For Nebraska, for example, in 2010, state contributions to Medicaid totaled $544.3 million. Applying this figure to 6.5 percent suggests that immigrants from Central/South America accounted for $9.3 million of the total.

Appendix D: Basic Input-Output (IO) Modeling & Derivation of IO Multipliers

Input-Output (IO) models are used extensively by economists and policy analysts to quantitatively measure the impact on an economy (either national or regional) from a variety of economic phenomena such as tax policy, pollution regulation, oil price spikes, military base closings, and industrial entry.

The main strength to the IO approach is that, with a primary focus on production, it recognizes that production processes are complex and that production of any given good or service requires production from other goods or services in the economy as inputs. Hence, it quantitatively measures the interdependency that exists between all industries in an economy. Something that impacts one market, say higher labor costs in the construction sector, will have subsequent impacts on many other sectors in the economy. Other regional models, such as Economic Base Theory, do not account for this interdependency. The magnitude of these "ripple effects" are ultimately what determine the magnitude of the various multipliers discussed in the text. The purpose of this appendix is to briefly describe the essential elements of an IO model from the perspective of highlighting where these multipliers come from. It is not designed to be a complete discussion of IO models in general.[32]

In general the following assumptions regarding IO models are made:

1. Each industry (i) produces only one homogeneous commodity or service (i).
2. Each industry uses a fixed input ratio (or factor combination) for the production of its output.
3. Production in every industry is subject to constant returns to scale, so that a k-fold increase in every input will result in a k-fold increase in output.

From these assumptions it will be the case that the production of one unit of the jth commodity requires a fixed proportion aij ( ) of the ith input.
The key to the IO model is the IO matrix which incorporates these fixed proportions. Consider, for instance, the following (simplified) IO matrix (denoted as A):

[32] For such a discussion, the reader is referred to Mouhammed (2000), Hewings (1985), and Hoover and Giarratani (1984).

		Output					
		1	2	3	…	n	
Input	1	a_{11}	a_{12}	a_{13}	…	a_{1n}	d_1
	2	a_{21}	a_{22}	a_{23}	…	a_{2n}	d_2
	3	a_{31}	a_{32}	a_{33}	…	a_{3n}	d_3
	…	…	…	…	…	…	..
	n	a_{n1}	a_{n2}	a_{n3}	…	a_{nn}	d_n
		v_1	v_2	v_3	…	v_n	

The columns of this matrix represent the input requirements from industries 1, 2, 3,..n needed for the production of commodity 1. Hence, to produce x1 units of commodity 1 requires as inputs the proportions of other commodities in the matrix: a21x2, a31x3, etc., as well as some primary input v1 (a labor and/or capital input for example). Algebraically, then, by reading down the first column of A we can describe a fixed proportions production function for commodity 1:

$$x_1 = a_{11}x_1 + a_{21}x_2 + a_{31}x_3 + \ldots + a_{n1}x_n + v_1 \tag{D1}$$

The rows of this matrix can be used to determine the total output necessary from a given industry to produce all the other commodities in the economy, as well as meet final (or end user) demand (households for instance) for that given industry. For example, if industry 1 is to produce an output level sufficient to meet the input requirements of the n commodities as well as final demand, commodity 1's output level, x1, must be (reading across the first row of A):

$$x_1 = a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + \ldots + a_{1n}x_n + d_1 \tag{D2}$$

where d1 is the final demand for commodity 1. To calculate the IO multipliers, we first solve (A2) for d1:

$$x_1(1 - a_{11}) - a_{12}x_2 - a_{13}x_3 - \ldots - a_{1n}x_n = d_1 \tag{D3}$$

We then do this same operation for the remaining industries comprising our economy. In so doing, we can represent the resulting system of equations compactly using matrix algebra notation:

$$\mathbf{(I\text{-}A)x = d} \tag{D4}$$

where x is a (nx1) output vector, d is and (nx1) final demand vector, and I is an (nxn) identity matrix. The matrix I-A is often referred to as the technology matrix and is critical to deriving IO multipliers. Notice that if we solve for our vector of industry output levels we obtain:

$$\mathbf{x = (I\text{-}A)\text{-}1d} \tag{D5}$$

where, letting B = (I-A)-1, comprises a matrix of individual industry multiplier effects and therefore can be summed to obtain the total output multiplier effect from an increase in a given final demand sector. To see this, expand (D5) and, for the sake of simplicity, assume only two sectors, 1 and 2. In so doing, we obtain:

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} d_1 \\ d_2 \end{bmatrix} \tag{D6}$$

Using matrix multiplication, this system becomes:

$$\begin{aligned} x_1 &= b_{11}d_1 + b_{12}d_2 \\ x_2 &= b_{21}d_1 + b_{22}d_2 \end{aligned} \tag{D7}$$

Notice now that the direct impact of a one dollar increase in final demand in sector 1 yields a b11 dollar increase in output from x1. Notice further, however, that that same dollar increase in sector 1's final demand has in indirect impact equal to d21 dollars on sector 2's output. The total output multiplier (i.e. the total direct and indirect effects) from a one dollar increase in sector 1's final demand is b11+b21. In general then, to determine the total output multiplier from an increase in final demand from a given sector i, we simply add up the elements in our B matrix corresponding to the ith column in B.

As stated above, the OI modeling framework has been and is currently used extensively in applied economic analysis because it has a number of desirable attributes that other model structures do not possess. However, there are some limitations as well. For completeness, these strengths and limitations are listed below.

Strengths of the IO modeling framework:
1. More industry detail than is typically provided in most regional econometric models.
2. The simultaneous nature of IO models allow for direct and indirect effects to be measured. Such feedback or ripple effects are generally not possible in most regional econometric models.
3. Ease and flexibility in simulation analysis.

Limitations of the IO Modeling framework:
1. The coefficients in production are fixed in the IO matrix. This does not allow for input substitution in response to relative input price changes.
2. IO matrixes are usually developed accurately for a particular year. Over time, it is reasonable to assume the matrix coefficients to change, perhaps due to technological innovations in production or processing. However, this sort of flexibility is generally lacking in IO models.
3. The IO framework by construction imposes constant returns to scale for all industries in the economy.
4. IO models assume the same production technology (i.e. a single, linear production function) is used in a particular industry. This has two potentially troubling implications. First, it assumes that all firms within a particular market employ the same production technology which may or may not be true in practice. Perhaps more troubling, however, is that often the definition of a "sector" may involve several relatively distinct industries. For instance, there exists an IO production function for the "Utility Sector." However, this sector is comprised of both electricity generation and electricity distribution, water supply systems, and natural gas production and distribution. It is unlikely that all of these industries would have the same production technology. Clearly then, more detail in an IO matrix is better than less. Unfortunately, cost and data limitations often limit the detail on most readily available models.

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