Economic Analysis of U.S. Immigration Reforms

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Abstract

In January 2004, President George Bush proposed the creation of a temporary worker program to allow more migrant workers to enter the US legally. This new temporary worker program would be open to undocumented workers in the US, as well as to prospective migrants currently residing abroad. The program would temporarily allow immigrants to fill jobs that, according to employers, would otherwise go unfilled at the current wage. The US Congress vetoed the presidential proposal, however, and requested a stricter enforcement of immigration law and the consequent deportation of undocumented immigrants. This study analyzes the economic effects of these immigration reforms on the US economy using an applied global general equilibrium model of migration.

In this paper the global trade and migration model (GMig2) developed by Walmsley, Winters and Ahmed (2007) is modified to include a third labor category – undocumented unskilled – to reflect estimates of undocumented workers residing in the United States. The model is then used to analyze the impacts of two policy scenarios on the US economy: first, the deportation of undocumented workers currently residing in the US; and second, the legalization of undocumented agricultural workers. The first scenario is implemented through a decline in the number of undocumented workers residing in the US to zero, and a corresponding increase in the number of workers in Mexico. The second scenario is achieved by allowing undocumented workers to obtain legal status, thereby increasing their wages and productivity.

We find that the deportation of undocumented workers causes a considerable loss to the US economy in terms of real GDP. Legalization of Mexican undocumented immigrants, on the other hand, is found to increase US real GDP. Hence the paper demonstrates there are clear advantages to the US economy of implementing proposals that both allow migrant workers to remain in the United States and increase the workers ability to participate freely in the US labor force as legal residents.

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1. Introduction

The United States is the largest recipient of migrants worldwide. The US Census Bureau estimates that in 2003 the number of foreign born residing in the US was approximately 33.5 million people, or about 11.40 percent of total US population (Larsen, 2004). The estimated number of undocumented or illegal immigrants in the United States ranges between 7 to 12 million, depending on which methodology is used (US Office of Immigration Statistics, 2003; Passel, 2006; and Jordan and Bauerlein, 2007). Since the year 2000, an average of one million documented immigrants have entered the United States every year; over the same period, entry of new undocumented workers has averaged half a million per year (Passel, 2006).

Two questions are at the center of the US immigration debate: a) what impact does international migration have on the US economy and its citizens; and b) how should migration policy in the United States be tailored to provide most benefit to the US (Borjas, 1994; Martin et al., 2006). The American public is particularly concerned about the extent to which immigrants depress US wages and lead to unemployment of American workers. Borjas et al. (1997) argue that recent migration, which is mainly composed of low skilled workers, has had a negative impact on the wages of the least skilled US workers, at least in the short run.[1] Although the literature agrees that the effect on wages is significant, it has been determined that the impact is small (Greenwood et al., 1997; Hanson et al., 2002). Nonetheless, others argue of the existence of complementarities among workers of different skill levels and origin, which have a positive impact on the wages of US workers with at least a high-school diploma (Peri, 2007; Devadoss, 2007).

[1] Least skilled workers are high school dropouts and those in the bottom 20 percent of the wage distribution.

Current US immigration policy aims to control the flow of both documented and undocumented immigration. Documented immigration includes both permanent and temporary; where permanent documented immigration is defined as those foreign-born who legally reside in the US holding residency or green cards, while temporary documented immigrants hold visas in accordance with the purpose of their visit to the US (i.e., worker, student, investor, etc.). The annual number of new-arrival green cards for 1991–2005 averaged 416,000 per year and the number of adjustment of status to green cards during the same period averaged 400,000 per year. On average, 197,000 temporary migrants entered the US every year during the period of 1992–2004.[2]

Undocumented migrants are those who have either entered the country without proper documentation or have entered the US legally on a temporary basis but failed to depart at the time specified on their visa. In 2000, about 33 percent (2.3 million) of the total undocumented population were estimated to have overstayed their visa expiration date. In recent years, estimates of the flow of undocumented migrants suggest that this group averaged 500,000 per year during the period 1992–2004 (Passel, 2006).

US immigration policy is implemented through supply and demand-side tools which can control the inflow of both documented and undocumented immigrants. On the supply-side the US assigns quotas on the different types of visa and green cards based on specific criteria (e.g., type of visa, country of origin, and world limit) to control the number of permanent or temporary documented workers.[3] Another supply-side policy instrument is border enforcement, which limits the flow of undocumented entry of immigrants into the US via Canada, Mexico, and the sea. Monitoring the hiring practices of employers is a demand-side policy which is also within

[2] Based on data from the US Office of Immigration Statistics.
[3] For example, the temporary worker visa for the highly-skilled, H1B, started out with a ceiling at 65,000 per year in the mid-1990s and went up to 195,000 per year around 2000 in response to employers' labor needs.

the scope of migration policies and can be used to control both documented and undocumented migration; although this method is not enforced as often as the other two control measures (i.e., visas and border enforcement).

In January 2004, President George Bush proposed the creation of a temporary migrant worker program to fill the increasing number of jobs which, according to employers, would otherwise go unfilled at the current wage. This new temporary worker program would be open to undocumented workers in the US, as well as to prospective migrants currently residing abroad. However, the US Congress did not pass the presidential proposal. Moreover, the Congress requested stricter enforcement of immigration law with the consequent deportation of undocumented immigrants.

Given the high level of undocumented workers, the concerns of the American public, and the recent immigration policy reform proposals, this study is set to analyze the effects of the alternative policy proposals using a multi-region economy-wide model of migration. The benefit of the multi-region economy-wide model is that it allows us to examine the economic impacts on the US and on the source countries like Mexico. The purpose of this study is two-fold. First, we modify the global trade and migration model (GMig2) developed by Walmsley, Winters, and Ahmed (2007) to account for undocumented immigrants in the US. Second, we evaluate the impact on the US economy of two opposing US immigration policy proposals using the revised global trade and migration model.

The first proposal assumes that the US successfully deports all unauthorized Mexican workers, thereby lowering the number of workers available to meet the needs of the US economy and raising the Mexican labor force in Mexico. The second proposal consists of the creation of a larger temporary worker program which essentially legalizes all Mexican undocumented

workers. We target Mexican immigrants only because of their high number, economic impact, and their prominent position in the national debate on immigration reform. Moreover, the effects on the country of origin are more distinguishable by targeting a single source-country.

In the following section, an overview of the US immigration policy background and economic literature is presented. Section 3 summarizes the GMig2 model of migration and presents the modifications made to this model to incorporate undocumented/illegal migrant workers. Section 4 outlines the policy scenarios, and simulation details. Finally in Sections 5 and 6, we present our results and conclusions respectively.

2. Background and Literature Review

During the 1800's while the US was still developing, immigrants and temporary migrant workers were welcomed; in fact migration was an integral part of the success of the US economy. Initially, most migrants were European farmers attracted by the vast and rich lands of the US. In the mid-1800's, the discovery of gold in California attracted many Chinese immigrants and many more were recruited in China for the construction of the Central-Pacific Rail Road.

A primer for the immigration quota system was the Immigration Act of 1924, which limited the number of immigrants who could be admitted from any country to 2% of the number of people from that country who were already living in the United States.

From the 1930s through the 1980s, annual admissions rose steadily. During World Wars I and II, the US facilitated the entry of temporary workers to avoid labor shortages caused by Americans serving in the military. One such a program was the 'bracero' program, which was established between 1942 and 1964. During this period, 4.5 million Mexicans were brought over to legally work on US farms. A mutual dependence between US employers and Mexican

workers resulted, which continued illegally after government-approved recruitment stopped. As a result, this migration corridor is today the world's largest (Martin et al., 2006).[4]

In the Immigration and Nationality Act of 1965 quotas based on national origins were abolished. Instead, both annual quotas based on the region of origin[5] and a family reunification program subject to no numerical restriction were adopted. The latter consisted of US residents petitioning the US government to admit their family members as residents. These type of migrants represents the largest subset of total migrants.

The Immigration Reform and Control Act of 1986 is the basis for current US immigration policy on illegal immigration. This reform made it illegal to employ undocumented workers, mandated monitoring of employers, and expanded border enforcement. It also offered amnesty to illegal aliens who had resided in the United States since before 1982; agricultural workers were subject to a shorter residency requirement. This resulted in the US granting legal permanent residence to 2.7 million individuals, two million of whom were Mexican nationals.

Apart from the regulatory changes that have occurred in the US, migration flows appear to coincide with US economic behavior. For example, during the record economic expansion at the end of the 1990's immigration increased rapidly and slowed down after 2001 when the US suffered a downturn in the economy, in addition to a greater scrutiny of prospective migrants after the September 11th attacks. After 2003, as economic growth resumed, migration levels increased to a new peak by 2006 (Passel and Suro, 2005).

The immigration debate has been an integral part of US history. In 1751 Benjamin Franklin expressed his concern about Pennsylvania becoming Germanized following a large

[4] The Philippines is the second largest labor exporter with estimates of seven million living abroad.
[5] The Eastern Hemisphere countries had an annual quota of 170,000 visas with no more than 20,000 per country. By 1968, the Western Hemisphere countries faced an annual quota of 120,000 immigrants. These visas were available on a first-come, first-served basis.

inflow of German immigrants into the then British colony. Similar feelings toward a large inflow of Chinese workers gave place to the Chinese Exclusion Act of 1882. However, non-Asian immigration remained largely unregulated until the Immigration Act of 1924, which set a numerical limit per country that mainly targeted Southern and Eastern European countries. The next wave of migration flows were migrant workers from Mexico and other Latin American countries. This wave started with the "bracero" programs in 1942 and 1964 and has continued to increase through the various channels of migration (i.e., green card applications, various visas, and undocumented).

Besides the assimilation issue, immigrant workers provide inexpensive unskilled labor, which benefit employers, but not necessarily the currently employed. Since undocumented workers cannot lawfully demand fair compensation, they are willing to work for lower pay. In addition, undocumented migrants have been accused of taking advantage of welfare benefits and public services intended for the domestic population and in this way becoming an extra burden for tax payers. Several studies have examined the demographic characteristics of undocumented migrants, the economic impact of undocumented migrants on native workers, and the effect of potential changes in immigration policy on the US economy. The following is a review of these studies with an emphasis on those that evaluate the impact of changes in immigration policy.

First, Hanson and Spilimbergo (1999) explain that while high wage differentials between the US and Mexico have traditionally been the cause of northern migration, the surge of undocumented migration from Mexico, during the 1980's, is mainly the result of other factors, such as the increase in the relative size of Mexico's working age population and the greater volatility of Mexican wages relative to the US.

Hanson, Robertson, and Spilimbergo (2002) evaluated the effectiveness of various migration policies including policies aimed at border control and monitoring the hiring practices of employers. Focusing on US states that border with Mexico, they used a vector auto regression econometric model to estimate how border enforcement influences and is influenced by wages. They conclude that current laws are imperfectly enforced and also suggested that the lack of effectiveness of current policies may reflect political demands from businesses to continue to allow illegal migration of workers in order to alleviate job market pressures.

Borjas (1994, 1999) claims that the relative skills[6] of recent immigrant waves have declined compared to pre-war waves of immigrants. Borjas (1994) argues that recent migration waves have participated in welfare programs more strongly than previous waves, and that this is likely to have had an adverse fiscal impact. He suggests that changes towards an immigration policy that favors highly skilled migrants could be a solution to this problem, since skilled workers have higher earnings and are less likely to require public assistance programs.

Dixon et al. (2008) also evaluate the long term effects of restrictions to the demand and supply of undocumented immigrants in the US economy. They use a dynamic applied general equilibrium model called USAGE-M. Based on a welfare criterion, the authors favor the use of demand side policies aimed at taxing and fining employers that hire undocumented migrants to control undocumented migration; as opposed to controlling migration with supply side policies such as border control. The reasons for this conclusion stems from the fact that the collection of taxes and fines by the US government transfer income to the legal residents in the form of tax breaks or higher public spending; while supply side policies such as border control do not generate any monetary gains that could be transferred to US legal residents.

[6] Borjas compares the means of number of years at school per country of origin of current migrants with that of previous migrants.

Dixon et al. (2008) estimate that a reduction of 30 percent of undocumented immigrants, via the taxing and fining of employers that hire undocumented workers, benefits legal residents because it reduces public expenditure in 2019 by $45 million dollars, which outweighs the loss of labor. In addition, the impact on wages is uncertain. First, there is increased demand for low-paid occupations to fill in the vacancies left by the deported undocumented immigrants, which raises the wages of unskilled; and second, deportation causes a reduction in the size of the economy, which affects the employment opportunities of all legal workers lowering wages. This general movement of workers to less skilled (and lower salaried) jobs is referred to as the occupation-mix effect.

This paper is similar to Dixon et al. (2008) in that it evaluates the effect of restricting the supply of undocumented workers in the US economy. However, in addition to the deportation scenario, we also consider the impact of legalizing undocumented Mexican workers. Finally we use a global economy-wide model of migration, GMig2, which takes into account remittances, the implications for trade, and the effects on the Mexican economy. Further details on the GMig2 model can be obtained from Walmsley, Winters and Ahmed (2007). Here we concentrate on providing a description of the revisions made to the model and data to incorporate undocumented workers.

3. The GMig2 Model and Modifications

The global migration model (GMig2) developed by Walmsley, Winters and Ahmed (2007) adjusts the GTAP model (Hertel, 1997) to take account of skilled and unskilled bilateral labor movement across countries. In the GMig2 model, it is the underlying bilateral migration data base that allows bilateral labor flows to be modeled explicitly. The use of bilateral migration data also allows us to analyze the effect of changes in US immigration policy targeting

particular migrant source-countries, such as Mexico. The GMig2 data base was developed by Walmsley, Ahmed and Parsons (2007) and is a combination of the bilateral migration data base by Parsons et al. (2005), the GTAP 6 Data Base documented in Dimaranan (2005) and other data related to the global labor markets.[7]

Three of the main assumptions of the GMig2 model are: a) like permanent workers, migrants are assumed to be of two kinds, skilled and unskilled, b) foreign and domestic labor are perfect substitutes, and c) wages of migrants are initially (in the data base) equal to the home wage plus a proportion (β) of the difference between host and home wage. Walmsley, Winters and Ahmed (2007) discuss these and other assumptions in greater detail.

In the GMig2 model, labor movement can occur either exogenously, through changes in quotas or quantities, or endogenously, in response to wages. An additional feature of the GMig2 model is that it tracks remittances and the real incomes of permanent residents, and new and returning migrants.

In this paper, the GMig2 model is modified to include a third labor category to reflect estimates of undocumented workers in the US. This required changes to both the GMig2 Data Base and Model which are discussed in turn below.

3.1 The Data Base

The data base modifications to incorporate information about undocumented workers in the US are based on estimates by Passel (2006). Passel (2006) estimates the total number of unauthorized migrants to be 11.5 million and we assume the number of undocumented workers

[7] The remittance data was obtained from Ratha (2004), participation rates were obtained from the ILO LABORSTA database website (ILO, 2006), skill splits were estimated from data obtained from LABORSTA and Docquier and Markouk (2004), and wage rates from Freeman and Oostendorp (2005).

in the US to be 6.3 million, based on the share of US labor force with respect to the US population.

Passel (2006) also provides estimates on the national origins and the employment distribution by industry of these undocumented migrants – we use both of these categories to allocate undocumented workers among the regions and sectors in the GMig2 database. Passel's estimates are based on data from Census 2000, the March 2005 Current Population Survey (CPS) and the monthly Current Population Surveys through January 2006.

Figure 1 displays the distribution of the unauthorized population in the US by country of origin. According to this figure, more than half of US unauthorized foreigners are from Mexico, and when combined with other Latin American countries, Hispanics account for 83% of total unauthorized foreigners. These shares give us the number of undocumented unskilled workers in the US by origin. Table 1 shows how these are mapped to the 28 sectors used in this study.

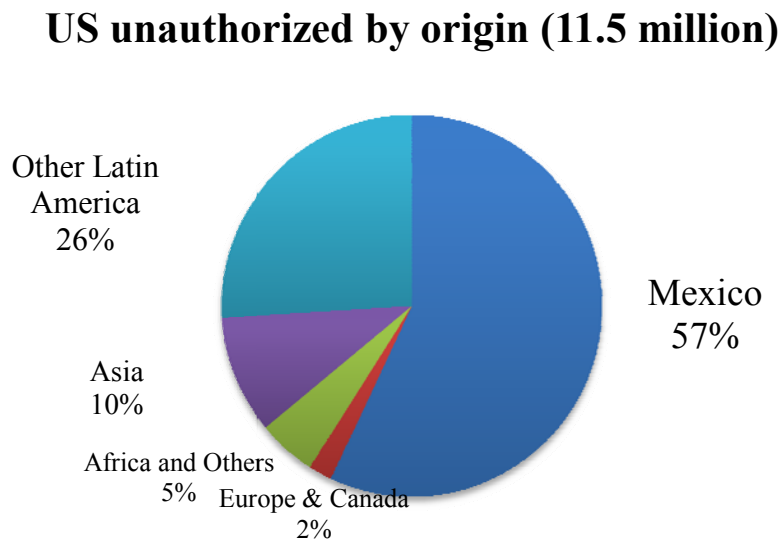

Figure 1. Unauthorized population in the US by country of origin.

Passel's (2006) estimates of the share of undocumented workers by selected occupations are displayed in Figure 2. In the US, farm, fish and forest occupations have the highest share of undocumented workers with 21 percent of their total employed labor. These allow us to estimate the number of unskilled undocumented workers by industry[8].

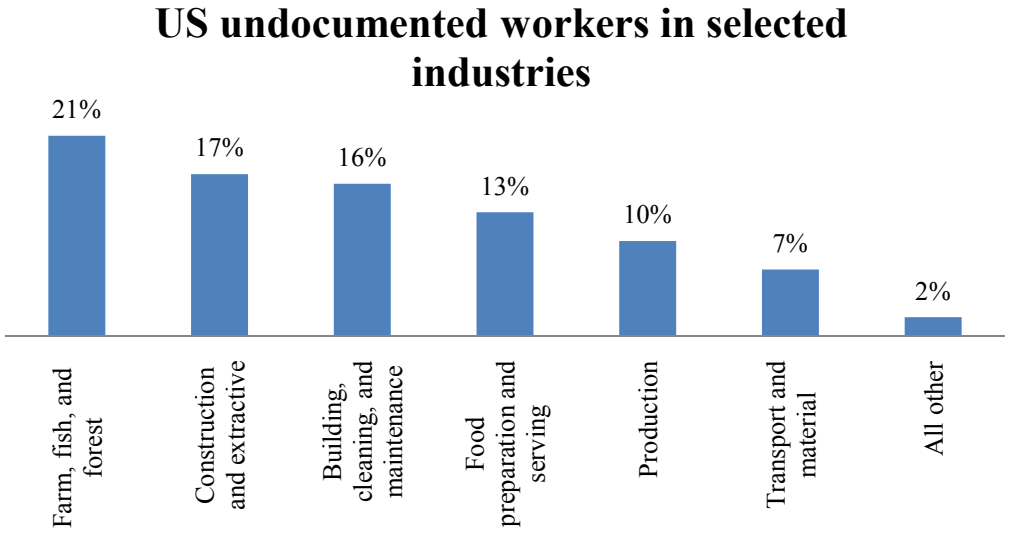

Figure 2. Undocumented workers in selected industries of the US

Unfortunately, there are no data available on either labor income or wage rates earned by migrant documented and undocumented workers. Walmsley, Ahmed and Parsons (2007) developed a data base of foreign wages based on the fact that the wages of migrant labor are generally lower than the wages prevailing in the host country (Borjas, 2000). They assume that the wage rates of workers of skill i, from region r, located in region c ($W_{i,r,c}$) are equal to the home wage ($HW_{i,r}$) in region r, plus a proportion (β) of the difference between the host and home wage ($HW_{i,c}$ - $HW_{i,r}$):

[8] The Passel data does not cover all industries in our database. The Passel estimates are more aggregated, hence we first map each of our sectors (see table 1) to one of Passel's sectors and use the corresponding share.

$$W_{i,r,c} = HW_{i,r} + \beta_{i,r,c}(HW_{i,c} - HW_{i,r})$$

where β is the proportion of the difference obtained by a person of labor type *i* migrating from region *r* to region *c* and assumed to be 0.75. Similarly, to obtain the initial wages of these undocumented unskilled workers ($W^{ILL}{}_{i,r,c}$), we assume that their wages are equal to the home wage of unskilled foreign documented workers ($W^{LEG}{}_{i,r,c}$) times a proportion ($\gamma = 0.7$).

$$W^{ILL}{}_{i,r,c} = \gamma \times W^{LEG}{}_{i,r,c}$$

These combined with the GMig2 database and estimates of the number of undocumented workers and sectoral allocation based on the Passel data, provide estimates of the value of undocumented workers in production. Finally these modifications are incorporated into version 6.2 of the GTAP data base.[9] The 96 regions of version 6.2 are then aggregated to 9 countries/regions, including: the US, Canada, Mexico, China, India, Other Latin America, Other OECD, Other Asia Pacific, and Rest of the World. The original 57 GTAP sectors were also aggregated into 28 sectors (see Table 1 below).

[9] The reference year for the GTAP Data Base is 2001.

Table 1. Sectors used in this study

		Sectors Name	Map to Passel sectors
Agriculture / Food	1	Irrigated Agriculture	Farming, fish and forest
	2	Traditional Agriculture	Farming, fish and forest
	3	Animals and Animal Products	Farming, fish and forest
	4	Other Agriculture	Farming, fish and forest
	5	Other Processed Foods	Sales and Admin Support / Production, installation and repair
	6	Sugar	Sales and Admin Support
	7	Beverage and Tobacco	Sales and Admin Support
Manufactures	8	Forestry and Fisheries	Farming, fish and forest
	9	"Raw" Energy	Production, installation and repair
	10	Mining	Production, installation and repair
	11	Textiles	Sales and Admin Support
	12	Garments	Sales and Admin Support
	13	Leather, Wood and Paper Products	Sales and Admin Support
	14	"Refined" Energy	Sales and Admin Support
	15	Chemicals, Plastics, Rubber	Sales and Admin Support
	16	Mineral Products	Sales and Admin Support
	17	Ferrous Metals	Sales and Admin Support
	18	Other Metals and Products	Sales and Admin Support
	19	Motor Vehicles and Parts	Sales and Admin Support
	20	Transportation Equipment	Sales and Admin Support
	21	Electronic Equipment	Sales and Admin Support
	22	Non-Electric Machinery and Equipment	Sales and Admin Support
	23	Other Manufactures	Sales and Admin Support
Services	24	Utilities	Production, installation and repair
	25	Construction	Construction and Extractive
	26	Trade and Transport	Transportation and Material Moving / Production, installation and repair
	27	High-tech services: finance, insurance, real estate	Sales and Admin Support / Production, installation and repair
	28	Government and Misc Services	Production, installation and repair / Service Occupations

3.2 The Model

In this section we will discuss the modifications made to the GMig2 model starting with the changes to the demand structure, followed by the modifications to supply. The model modifications expand the traditional structure of GTAP and GMig2 models to include firms' demand for unauthorized unskilled workers. Figure 3 shows the tree diagram of the additional structure of the modified model. First, we assume a degree of substitutability between domestic and foreign unskilled workers; and between authorized and unauthorized foreign unskilled workers. In the case of skilled workers, there are no undocumented skilled foreign workers, although domestic and foreign skilled workers are also treated as imperfect substitutes.

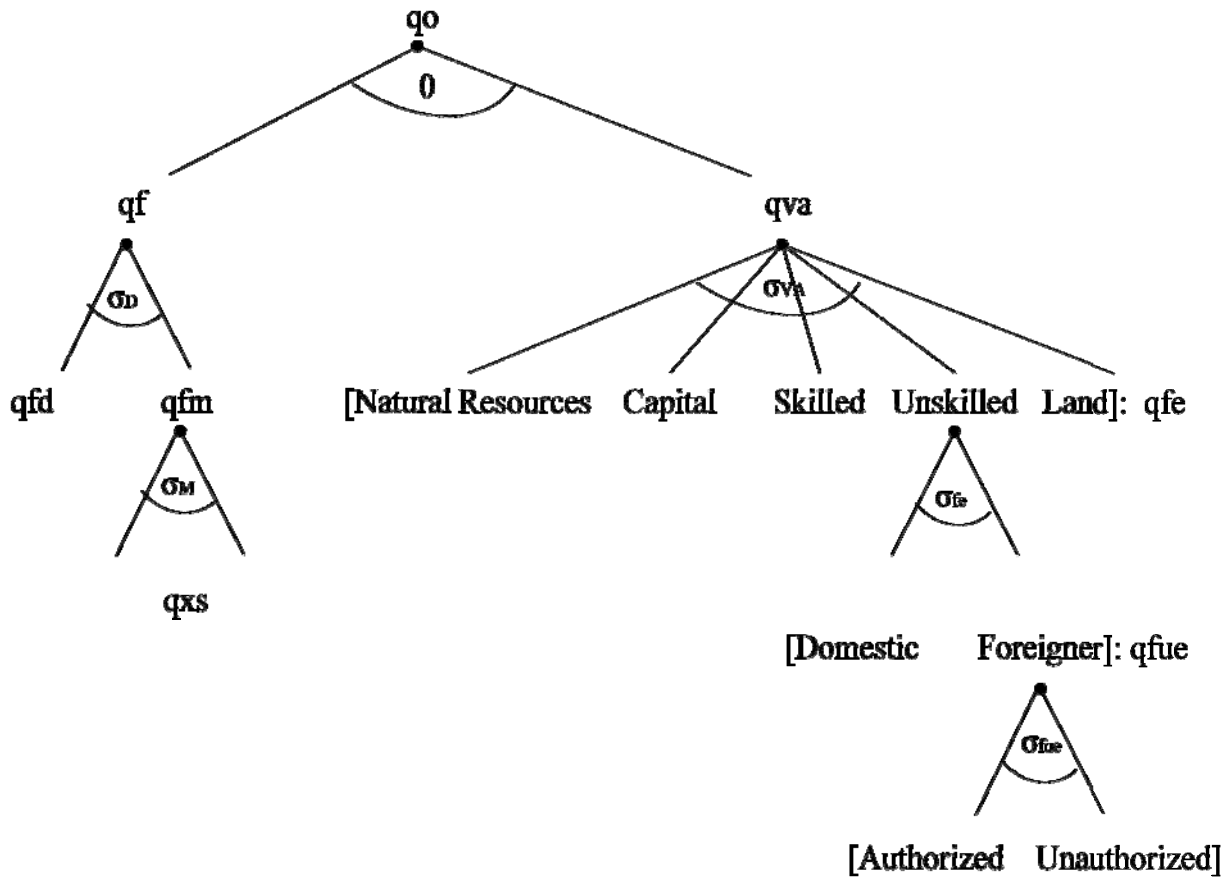

Figure 3. Model Structure modification of Figure 2.6 in Hertel and Tsigas (1997)

The elasticity of substitution between unskilled domestic and foreign workers is set equal to 6. The elasticity of substitution between authorized and unauthorized workers is also assumed to be 6.[10] Ottaviano and Peri (2006) estimated the elasticity of substitution between domestic and foreign legal workers to be 7.5. Dixon et al. (2008) used a lower elasticity of substitution between legal and illegal workers (i.e., 5) and demonstrated that the results were insensitive to a 50 percent increase in this elasticity of substitution. Our results are also insensitive to changes in these parameters.[11] Any changes in the labor force (by skill and legality/documentation), due for instance to changes in migration, will therefore be allocated across sectors so that the percentage change in wages equates across sectors.

On the supply side the revised version of the GMig2 model includes equations which track unauthorized migrant workers, remittances and incomes. These revisions to the GMig2 model allow us to examine policies specifically aimed at unauthorized workers, such as legalizing the status of unauthorized workers or the deportation of these unauthorized foreign workers.

4. Policy Scenarios

As discussed in Section 2, a number of options have been considered by the US senate to reform migration, including legalization of some undocumented migrants who meet certain work and English-language requirements; a temporary worker program with a path to permanent status; restructuring the visa criteria for high skill workers; an expansion in the number of visas for permanent employer-sponsored immigrants; and strengthened border controls (MIS, 2007). If implemented, these changes are likely to reduce the number of undocumented migrant workers

[10] These parameters need not be equal; different parameters were used and the results were consistent.
[11] We changed the elasticities of substitution between domestic and foreign unskilled workers to 5 and between authorized and unauthorized to 10 and vice versa with no significant changes to our results.

and increase the pool of legal migrant labor across all sectors, having a substantial impact on the US economy as a whole.

In order to analyze the impact of US immigration policy on its economy, this study considers two policy scenarios. The first policy scenario combines the deportation of undocumented workers with increased border control, and therefore reflects the US Congress' requests for stricter control, after vetoing the presidential proposal in 2004. We assume that the US Immigration service successfully deports all undocumented Mexican workers and tightens border control preventing the re-entry or new-entry of undocumented workers. Although somewhat unrealistic it represents the worst case scenario and allows us to separate the impact of the scenarios on Mexico.[12]

In the second policy scenario, we analyze what the economy would look like if the presidential proposal, that is a new temporary migrant worker program, had been approved and implemented by the US Congress. We implement this legalization of undocumented workers by transferring them from the undocumented to the documented status, raising their productivities and wages. Since the legalization of current undocumented workers is likely to encourage new prospective migrants to enter the US with hopes of obtaining legal status in the future, we also consider the impact of two alternative border control policies. In the first, border enforcement prevents new entry of undocumented workers; and in the second, increased border controls fail to restrict the entry of new undocumented migrants into the US. Table 2 displays the changes in documented and undocumented Mexican migrants under the scenarios considered in this paper.

[12] Expanding the scenarios to include all countries would result in larger (absolute gains/losses) to the US economy, and the impact on the Mexican economy would also be prevalent in other Latin American economies that send undocumented workers,

Table 2. Policy Scenarios

Variable Description	Base Data (Number of people)	Mexican Deportation Scenario	Mexican Legalization	
			with border control	without border control
Undocumented unskilled Mexican Migrants in the US	3,590,568	-100%	-100%	-50%[13]
Documented unskilled Mexican Migrants in the US	3,527,450	N/A	102%[14]	102%

In Table 2, the 'Base Data' column indicates the estimated number of unskilled Mexican workers in the US with and without proper documentation in the initial data base. The next column describes the change in the supply of labor resulting from the deportation of undocumented unskilled Mexican workers. The last two columns illustrate the change in labor supply due to the legalization of all 3.59 million of undocumented Mexican migrants. Note that the workers continue to be considered unskilled after deportation/legalization.[15]

The first legalization scenario assumes that there are no new undocumented unskilled workers moving into the United States to replace the deported undocumented workers and hence the number of Mexican undocumented workers decreases by 50%. This scenario will be referred to as legalization with border control. In the second legalization scenario, half of the current undocumented workers from Mexico are replaced by new undocumented migrants from Mexico. This scenario is referred to as legalization without border control. The following section presents the results of these policy scenarios.

[13] 100% leave to become legal foreign workers plus 50% new undocumented migrant from Mexico.
[14] The numbers of documented workers increases by 102% as there are slightly less documented than undocumented workers in the base data.
[15] Although some undocumented migrants may be skilled, it is assumed that they remain in the unskilled category even once they obtain the proper documentation. To the extent that legalization allows migrants to move into the skilled category, the model will underestimate the benefits of legalization.

5. Results

In this section we present the economic impacts of the deportation and legalization scenarios in the US on the US and Mexican economies. We begin by describing the effects on the key macroeconomic variables, followed by the changes in sectoral demand for labor. The changes in macroeconomic variables for each of the policy scenarios are displayed in Table 3.

The deportation of all undocumented Mexican workers causes a loss in real GDP of 0.61 percent (see first column in Table 3). Legalization on the other hand, has a positive effect on real GDP regardless of border control. Although the extent to which the border remains porous, causes larger gains in real GDP, 0.53 percent as opposed to 0.17 percent in the border control scenario. Below we examine each of the scenarios in turn.

Table 3. Macroeconomic results for the US (% changes)

Variable Description	Mexican Deportation	Mexican Legalization	
		with border control	without border control
US Real GDP	-0.61	0.17	0.53
Real Wage of Skilled Labor	-0.38	0.12	0.35
Real Wage of Unskilled Domestic labor	0.49	-0.12	-0.41
Real Wage of Unskilled Foreign documented labor	0.50	-6.00	-6.29
Real Wage of Unskilled Foreign undocumented labor	18.45	17.73	5.07
Remittances from the US to Mexico	-36.40	9.44	31.61
Rate of return to Capital	-1.08	0.12	0.76
Investment	-1.05	0.11	0.74
Terms of Trade	0.04	-0.04	-0.06
Real Exports	0.19	0.11	-0.003776
Real Imports	-0.72	0.07	0.50
Change in Trade Balance ($US Millions)	11,575.18	-367.76	-7,261.29

5.1 Deportation Scenario

As a result of the deportation, undocumented unskilled workers become scarce and their real wages increase by 18.45 percent. The top left hand panel of Figure 4 helps illustrates this reduction in supply using a simplified diagram of the supply and demand of unskilled undocumented workers in the US.

In response to the deportation of unskilled, undocumented Mexican workers, firms must re-adjust their input structure by substituting undocumented workers for domestic and foreign legal unskilled workers. Real wages of unskilled domestic and foreign legal workers increase as a result (Figure 4), by almost the same amount 0.49 and 0.50 percent respectively.

This re-adjustment also involves firms adapting to changes in demand for other endowments such as capital and skilled labor. As mentioned above the loss of unskilled (undocumented) workers reduces production (Real GDP). The decline in production lowers demand for all endowments. In the case of unskilled this reduces the expected increase in demand partially, but is not sufficient to offset the increase in real wages discussed above. The real wages of skilled workers however, fall by 0.38 percent (Figure 4, bottom right panel) and the rate of return on capital also falls by 1.08 percent. The lower rate of return also leads to a quite considerable decrease in investment of 1.05 percent, which is likely to have significant long run implications.

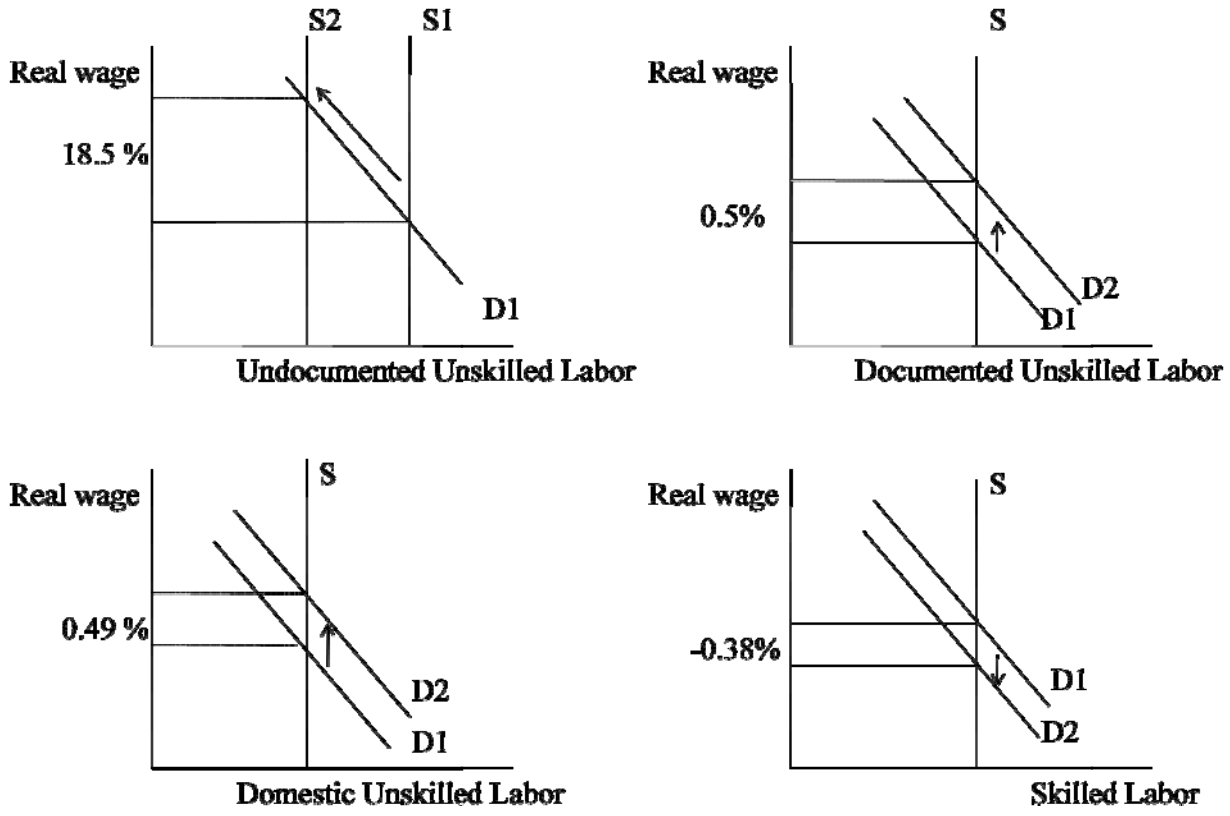

Figure 4. US Demand for Labor

The deportation of all undocumented Mexican workers reduces remittances flowing back to Mexico by 36.40 percent. Therefore, the US current account increases and in order to restore the macroeconomic balance, the trade balance increases. In Table 3, real exports increase by 0.19 percent, while real imports decrease by 0.72 percent.

5.2 Legalization Scenario

Unlike the deportation scenario, legalization of unskilled undocumented Mexican workers increases real GDP by 0.17 percent with border control and by 0.53 percent under the legalization without border control scenario. The increase in real GDP is the result of a) newly legalized workers being able to move across sectors to obtain jobs in new sectors where they can

be more productive (both scenarios); and b) the increase in unskilled undocumented migrant workers (no border control scenario or the difference between the two scenarios).

Legalization with border control causes a decline in the supply of undocumented unskilled foreign workers and a corresponding rise in documented foreign workers which causes real wages to rise (17.73%) and fall (6%) respectively (see Figure 5 below). The rise in wages of undocumented is slightly lower than that in the deportation case since firms can more easily substitute documented workers for the undocumented workers, due to the rise in documented foreign workers, albeit the increase in real GDP would raise demand slightly. The impact of the scenario on the real wages of unskilled domestic labor is slightly negative (0.12 percent, Figure 5).

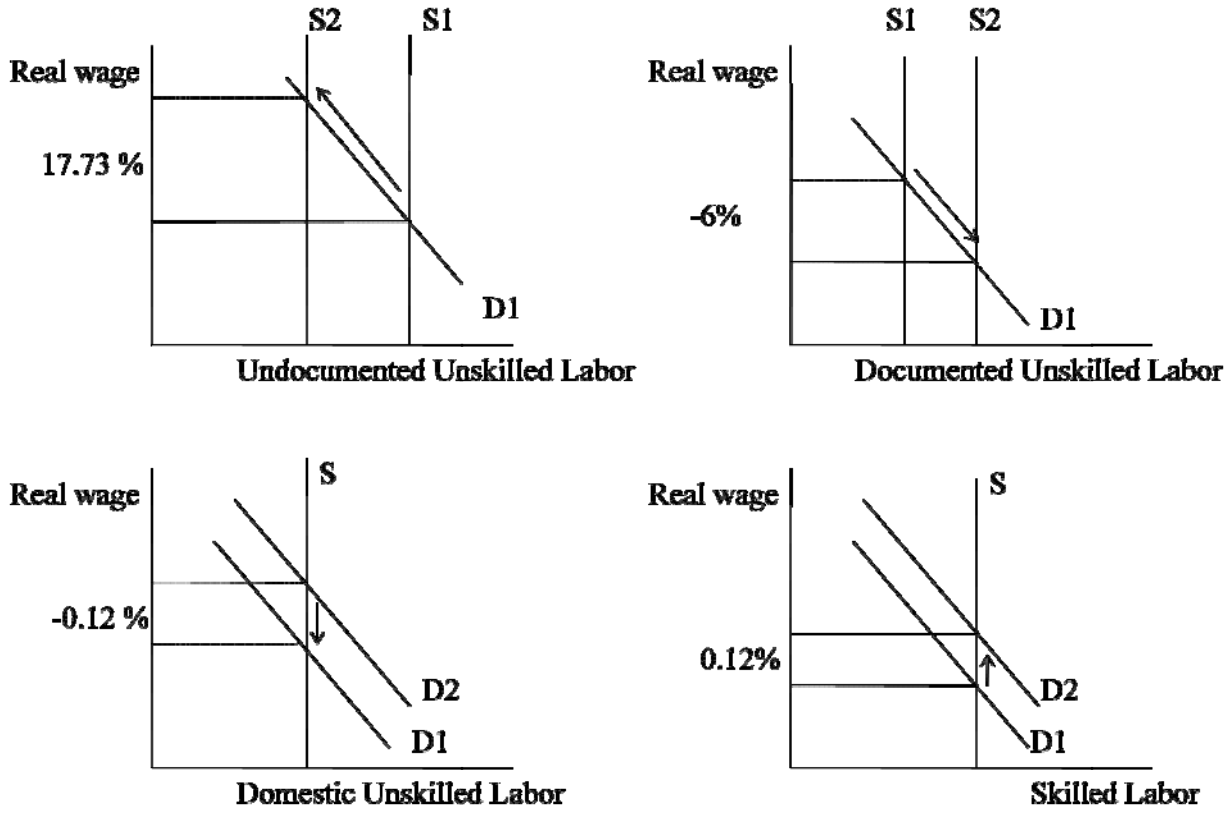

Figure 5. US Labor demand under legalization with border control

Legalization without border control has similar effects on the real wages of unskilled domestic and foreign legal workers, albeit the inflow of new undocumented workers to replace the newly legalized workers causes the real wages of unskilled workers to decline further, or not rise as much (see Figure 6 below).

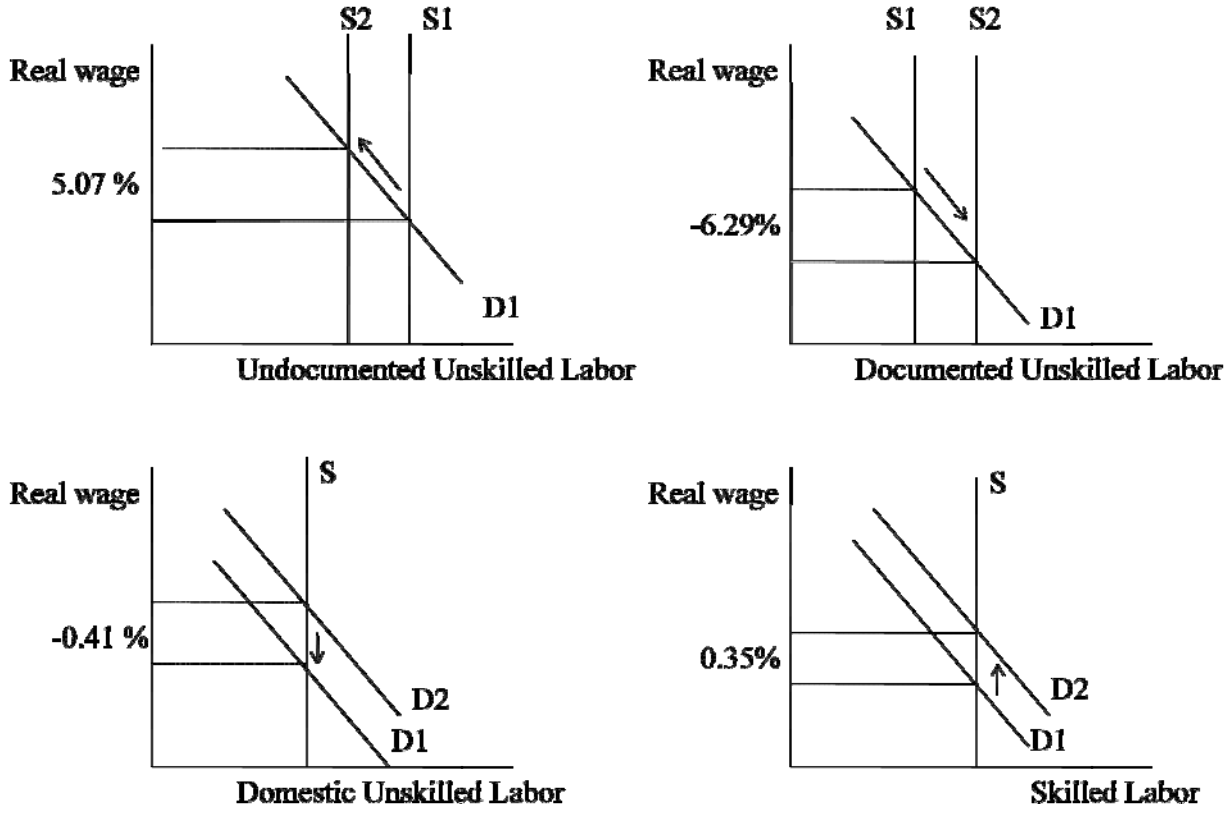

Figure 6. US Labor demand under legalization without border control

The real wage of undocumented workers under the two legalization scenarios is significantly different. The change in real wage under legalization with border control is an increase of 17.73 percent. This result is similar to the one obtained by deportation scenario (i.e., 18.45 percent) because it reflects the fact that undocumented workers are becoming scarcer. When legalization occurs without border control is considered, undocumented workers are not as

scarce as in the previous scenario and therefore the real wage of undocumented workers only increases by 5.07 percent.

The two legalization scenarios have positive effects on the real wage of skilled labor and the rate of return to capital since real GDP increases causing a general increase in demand for value added. Legalization with border control increases the real wage of skilled labor by a mere 0.12 percent versus a 0.35 percent without border control. The rate of return to capital is 0.12 and 0.76 percent for with and without border control, respectively. These rates of return have a positive effect on investment, which would increase by 0.11 and 0.74 percent in the case of with and without border control, respectively.

Although not modeled in this study, the increase in investment is likely to raise capital stocks in the long run, which would further raise real GDP.

5.3 Sectoral Impact

In this section we examine the sectoral impact of the scenarios and their impact on demand for endowments in greater detail. For this analysis we refer to the Rybczynski Theorem which is based on the Hecksher-Ohlin (H-O) model. Under the full employment assumption of the H-O model, the Rybczynski theorem demonstrates how changes in an endowment affect the outputs of the goods. An increase in one of the endowment factors increases the production of the industry which uses it intensively and decreases the production of the industry that uses it less intensively. Conversely, according to the Rybczynski Theorem, if the level of endowment decreases, the industry that uses it intensively would decrease production and the industry which uses it less intensively would increase its production.

Figure 7 shows the initial shares of the value of wage payments made by each sector by type of labor. Apart from the Forestry and Fisheries and the Construction sectors, the sectors in the agricultural industry use undocumented workers most intensively.

Table 4 reports the changes in US output by sector due to the implementation of the deportation scenario. From Table 4, other sectors heavily affected by the deportation of undocumented Mexican workers, are the textiles, garment, and construction sectors. These sectors are labor intensive as depicted by their share in total endowment in Figure 8. After the deportation, these sectors reduce their demands for all labor, both unskilled and skilled, see Table 5. Table 5 lists the demand for two skilled labor categories, domestic and foreign, and three unskilled labor categories, domestic, foreign documented and foreign undocumented.

The deportation scenario contracts the supply and hence demand for undocumented workers across all sectors falls.[16] The overall US demand for unskilled domestic and documented workers increases; with fixed supply, real wages rise. Table 5 identifies the changes in each sectors' demand for labor. Those sectors which most intensively use undocumented workers shift towards domestic and documented foreign workers. Those sectors using few undocumented workers may increase or decrease demand for labor, but the changes are small. Table 5 indicates that there are a few sectors (e.g., textiles, garments, forestry and fisheries, mining, government and misc services, utilities and high-tech services) which have decreased their demand for all labor categories. The labor that these sectors no longer use is captured by other sectors that have lost the ability to hire undocumented workers (i.e., agricultural sectors).

[16] Undocumented Mexican workers account for roughly half of all undocumented workers in the US.

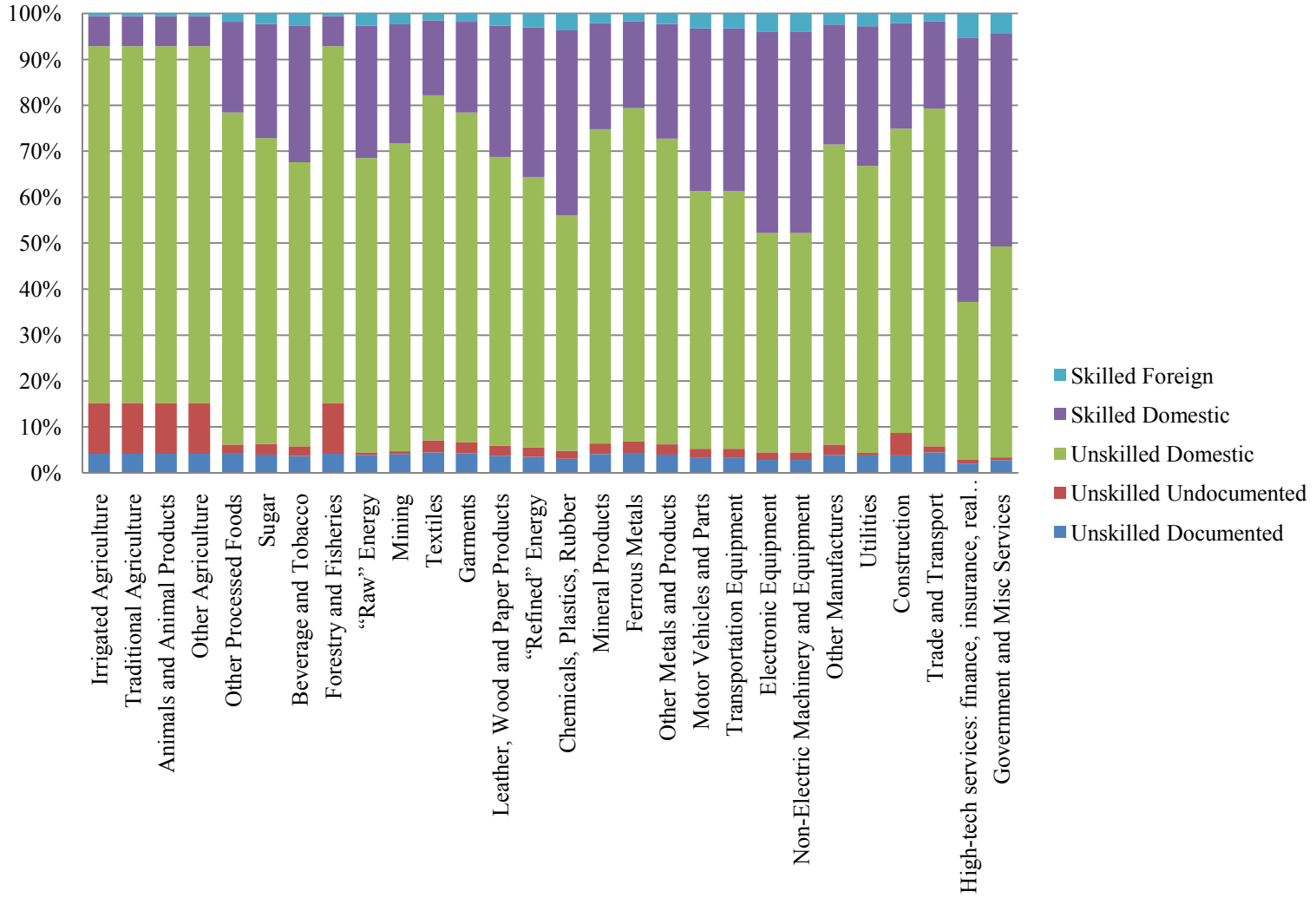

Figure 7. Share of Value of Wages Paid by Sector by type of Labor

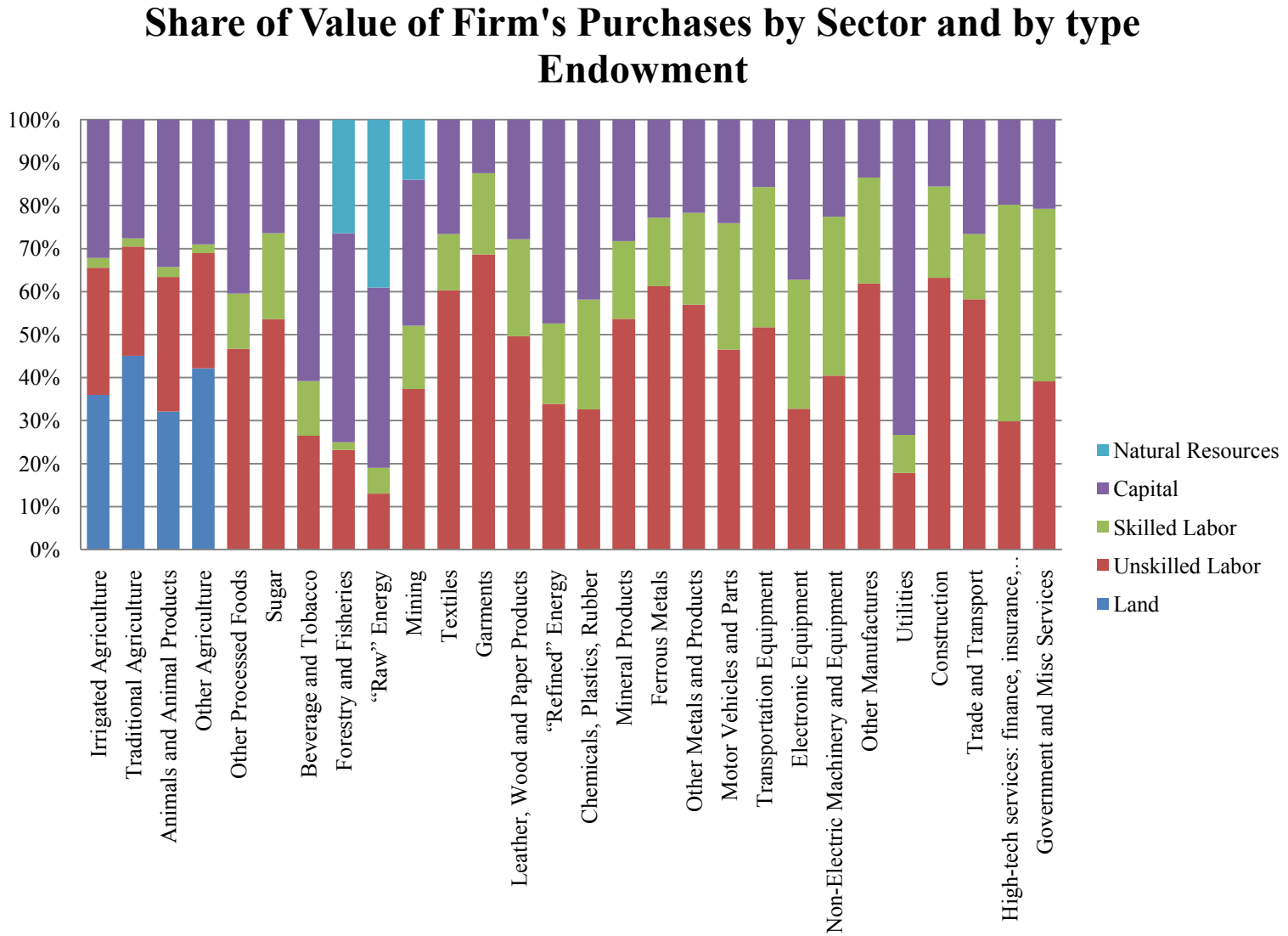

Figure 8. Share of Value of Firm's Purchases by Sector and by Endowment

Table 4. Output change by sector due to deportation

	Sector Name	% Change	Absolute Change ($US millions)
Agriculture / Food	Irrigated Agriculture	-1.36	-378.12
	Traditional Agriculture	-0.61	-257.89
	Animals and Animal Products	-1.03	-943.63
	Other Agriculture	-0.50	-187.57
	Other Processed Foods	-1.09	-5,014.07
	Sugar	-1.01	-102.99
	Beverage and Tobacco	-1.05	-1,083.93
Manufactures	Forestry and Fisheries	-0.68	-126.28
	"Raw" Energy	-0.11	-90.85
	Mining	-0.65	-161.52
	Textiles	-1.37	-1,452.43
	Garments	-1.44	-1,023.80
	Leather, Wood and Paper Products	-0.87	-4,711.38
	"Refined" Energy	-0.58	-857.47
	Chemicals, Plastics, Rubber	-0.60	-3,703.42
	Mineral Products	-0.77	-840.40
	Ferrous Metals	-0.74	-834.65
	Other Metals and Products	-0.80	-2,705.96
	Motor Vehicles and Parts	-0.84	-3,419.55
	Transportation Equipment	-0.62	-1,116.20
	Electronic Equipment	-0.29	-1,346.90
	Non-Electric Machinery and Equipment	-0.66	-4,859.80
	Other Manufactures	-0.98	-694.47
Services	Utilities	-0.60	-2,343.41
	Construction	-0.90	-10,885.40
	Trade and Transport	-0.69	-18,614.72
	High-tech services: finance, insurance, real estate	-0.55	-18,519.23
	Government and Misc Services	-0.52	-21,186.40

Table 5. Demand for labor in the US under the deportation scenario (percent change)

	Sector Name	Unskilled Labor			Skilled Labor
		undocumented	documented	domestic	documented \ domestic
Agriculture / Food	Irrigated Agriculture	-53.64	5.53	5.56	-1.41
	Traditional Agriculture	-53.26	6.38	6.40	-0.62
	Animals and Animal Products	-53.47	5.90	5.92	-1.07
	Other Agriculture	-53.21	6.50	6.52	-0.51
	Other Processed Foods	-56.24	-0.40	-0.38	-0.49
	Sugar	-55.97	0.21	0.23	-0.26
	Beverage and Tobacco	-56.16	-0.22	-0.20	-0.69
Manufactures	Forestry and Fisheries	-53.28	6.34	6.36	-0.76
	"Raw" Energy	-56.01	0.14	0.16	-0.14
	Mining	-56.24	-0.39	-0.37	-0.66
	Textiles	-56.12	-0.13	-0.11	-0.42
	Garments	-56.10	-0.07	-0.05	-0.36
	Leather, Wood and Paper Products	-55.97	0.21	0.23	-0.08
	"Refined" Energy	-55.96	0.25	0.27	-0.04
	Chemicals, Plastics, Rubber	-55.98	0.20	0.22	-0.09
	Mineral Products	-55.90	0.37	0.39	0.08
	Ferrous Metals	-55.83	0.53	0.55	0.24
	Other Metals and Products	-55.89	0.39	0.41	0.10
	Motor Vehicles and Parts	-55.98	0.19	0.21	-0.10
	Transportation Equipment	-55.85	0.49	0.51	0.20
	Electronic Equipment	-55.84	0.52	0.54	0.23
	Non-Electric Machinery and Equipment	-55.95	0.27	0.29	-0.03
	Other Manufactures	-55.94	0.29	0.32	0.00
Services	Utilities	-56.58	-1.17	-1.15	-0.41
	Construction	-55.08	2.24	2.26	0.59
	Trade and Transport	-56.27	-0.46	-0.44	0.37
	High-tech services: finance, insurance, real estate	-56.15	-0.19	-0.17	-0.12
	Government and Misc Services	-56.35	-0.64	-0.62	-0.02

In contrast, the legalization scenario with border control restricts the supply of undocumented workers while increasing the supply of documented unskilled workers. This has a positive effect in output for all sectors except Irrigated and Other Agricultural sectors. These irrigated, traditional and other agricultural sectors are among those which use large shares of undocumented workers as inputs (Figure 7). Table 6 shows the change in output by sector due to the legalization of all undocumented Mexican workers in the US with border control.

In response to the policy scenario and the subsequent effects on output, the demand for the different types of labor readjusts. Table 7, shows how much demand for labor by each sector changes in response to the legalization scenario with border control. In general, the demand for undocumented workers decreases due to the supply contraction. The legalization of undocumented workers increases the supply of unskilled foreign documented workers and firms demand more of them, substituting away from the undocumented workers which are no longer available. Overall, the demand for unskilled domestic workers decreases (Figure 5) as firms substitute towards the newly documented unskilled foreign workers. The exceptions are the sectors that use undocumented workers intensively (i.e., agricultural sectors, forestry and fisheries, and construction); these sectors have increased their demand for both unskilled domestic and foreign workers.

Shifting from undocumented workers to newly legalized workers increases the cost of production for firms and these negatively affects sectors. In the case of irrigated, traditional and other agricultural sectors, the rise in costs due to the loss of undocumented workers raises prices and causes substitution towards imports by consumers (i.e., 20%, 37%, and 67% respectively).

Table 6. Output change by sector due to legalization with border control

	Sector Name	% Change	Absolute Change ($US millions)
Agriculture / Food	Irrigated Agriculture	-0.05	-13.94
	Traditional Agriculture	-0.02	-8.86
	Animals and Animal Products	0.10	89.68
	Other Agriculture	-0.26	-95.30
	Other Processed Foods	0.12	567.48
	Sugar	0.13	12.81
	Beverage and Tobacco	0.11	117.82
Manufactures	Forestry and Fisheries	0.05	8.52
	"Raw" Energy	0.06	49.20
	Mining	0.14	35.74
	Textiles	0.21	221.76
	Garments	0.22	155.46
	Leather, Wood and Paper Products	0.17	925.91
	"Refined" Energy	0.14	206.52
	Chemicals, Plastics, Rubber	0.14	879.35
	Mineral Products	0.17	180.49
	Ferrous Metals	0.19	217.07
	Other Metals and Products	0.19	641.37
	Motor Vehicles and Parts	0.17	681.08
	Transportation Equipment	0.17	303.98
	Electronic Equipment	0.21	998.92
	Non-Electric Machinery and Equipment	0.16	1,142.67
	Other Manufactures	0.23	162.44
Services	Utilities	0.16	633.75
	Construction	0.13	1,542.18
	Trade and Transport	0.20	5,499.94
	High-tech services: finance, insurance, real estate	0.17	5,566.81
	Government and Misc Services	0.21	8,626.26

Table 7. Demand for labor in the US under scenario legalization with border control

	Sector Name	Unskilled Labor			Skilled Labor
		undocumented	documented	domestic	documented \ domestic
Agriculture / Food	Irrigated Agriculture	-53.71	42.75	5.34	0.02
	Traditional Agriculture	-53.69	42.79	5.37	0.05
	Animals and Animal Products	-53.63	42.97	5.50	0.18
	Other Agriculture	-53.81	42.43	5.11	-0.20
	Other Processed Foods	-56.13	35.26	-0.19	-0.06
	Sugar	-55.96	35.81	0.22	-0.02
	Beverage and Tobacco	-55.93	35.89	0.28	0.04
Manufactures	Forestry and Fisheries	-53.64	42.93	5.48	0.12
	"Raw" Energy	-56.59	33.85	-1.23	0.07
	Mining	-56.57	33.91	-1.18	0.12
	Textiles	-55.92	35.91	0.30	0.02
	Garments	-55.93	35.89	0.28	0.01
	Leather, Wood and Paper Products	-55.92	35.91	0.29	0.02
	"Refined" Energy	-55.92	35.93	0.31	0.03
	Chemicals, Plastics, Rubber	-55.91	35.94	0.32	0.04
	Mineral Products	-55.93	35.88	0.27	0.00
	Ferrous Metals	-55.93	35.89	0.28	0.00
	Other Metals and Products	-55.92	35.90	0.29	0.01
	Motor Vehicles and Parts	-55.92	35.91	0.30	0.02
	Transportation Equipment	-55.93	35.90	0.29	0.01
	Electronic Equipment	-55.88	36.04	0.39	0.11
	Non-Electric Machinery and Equipment	-55.92	35.93	0.31	0.03
	Other Manufactures	-55.91	35.93	0.31	0.04
Services	Utilities	-56.37	34.54	-0.71	0.04
	Construction	-55.13	38.36	2.10	0.28
	Trade and Transport	-56.23	34.95	-0.42	-0.21
	High-tech services: finance, insurance, real estate	-56.07	35.46	-0.04	0.04
	Government and Misc Services	-56.34	34.62	-0.65	-0.03

The legalization scenario without border control increases the supply of unskilled documented workers as in the previous scenario. In this scenario, new undocumented workers are allowed to enter the US; therefore the supply of undocumented workers does not fall as much as in the previous scenario. The output response in every sector is positive as the labor endowment in the US economy has increased. The Garment and Textiles sectors increase their production the most because these are the sectors that use unskilled labor more intensively (Figure 8). Table 8 presents the change in production in each sector due to the implementation of the legalization without border control scenario.

Sectoral demands for the different types of labor do not differ from legalization with border control. The demand for undocumented workers decreases but not as much as it did before because in this scenario the reduced supply of undocumented workers is offset by new migrants. This means that those sectors using undocumented workers do not have to substitute towards the more expensive documented workers to the same extent. Hence irrigated, traditional and other agricultural increase production and the wages of unskilled, documented workers do not rise to the same extent.

Table 8. Output change by sector due to legalization without border control

	Sector Name	% Change	Absolute Change ($US million)
Agriculture / Food	Irrigated Agriculture	0.76	210.71
	Traditional Agriculture	0.34	144.98
	Animals and Animal Products	0.71	644.38
	Other Agriculture	0.04	13.96
	Other Processed Foods	0.76	3,507.46
	Sugar	0.72	73.10
	Beverage and Tobacco	0.73	752.58
Manufactures	Forestry and Fisheries	0.44	82.55
	“Raw” Energy	0.12	102.13
	Mining	0.53	131.41
	Textiles	1.01	1,064.28
	Garments	1.07	758.39
	Leather, Wood and Paper Products	0.68	3,725.09
	“Refined” Energy	0.48	715.87
	Chemicals, Plastics, Rubber	0.50	3,073.15
	Mineral Products	0.63	679.34
	Ferrous Metals	0.63	711.58
	Other Metals and Products	0.67	2,246.66
	Motor Vehicles and Parts	0.66	2,706.76
	Transportation Equipment	0.54	969.14
	Electronic Equipment	0.38	1,791.95
	Non-Electric Machinery and Equipment	0.55	4,036.94
	Other Manufactures	0.81	575.32
Services	Utilities	0.52	2,031.43
	Construction	0.67	8,031.37
	Trade and Transport	0.62	16,642.58
	High-tech services: finance, insurance, real estate	0.50	16,682.64
	Government and Misc Services	0.52	21,434.72

5.4 Implications of US Immigration Policy Abroad

In this study, changes in the US immigration policy targeted Mexican immigrants. In addition to the effects to the US, the policy will also have important effects on Mexico. The ways in which changes in US immigration policy affect Mexico are a) increased return migration and b) changes in the flow of remittances to Mexico, which will in turn affect Mexico's GDP and trade balance.

The deportation scenario has both positive and negative effects on the Mexican economy. On the positive side, it increases Mexico's supply for unskilled domestic labor, which decreases their unskilled domestic real wage by 9 percent. At a lower real wage, more unskilled workers will be employed and production will increase. Unskilled foreign workers in the agricultural sector of Mexico are displaced by returning Mexican migrant workers. Output increases in almost all sectors and GDP grows by 0.94 percent. With less Mexicans working in the US, the flow of remittances from the US into Mexico falls by 36 percent. The loss of remittances-in causes a decrease in income and an increase in the current account of Mexico. The macroeconomic closure equilibrates as Mexico increases its trade balance by increasing output and exports, through reduced prices and terms of trade.

Under the legalization scenarios, Mexico does not increase its supply for unskilled labor (in fact under legalization without border control, labor supply falls) but receives higher levels of remittances as Mexico's labor in the US earn higher salaries. Under the legalization with border control, remittances increase by 10 percent. Meanwhile, the legalization without border control causes remittances to increase by 32 percent. Higher levels of remittances into Mexico decrease Mexico's current account and the macroeconomic closure is equilibrated by decreasing the trade balance by lowering exports and increasing imports.

Looking past Mexico, since our assumption only affects Mexican workers, undocumented foreign workers from other countries benefit from the deportation of Mexican workers as this would increase real wages. Higher real wages increase remittances outflow by foreign workers to their countries of origin. Figure 9 shows the percentage change of remittances from the US to the aggregated regions considered in this study. Other Latin America stands out in this figure because it has the second largest undocumented population in the US, which means that more people will be sending money to their home countries. Of course this scenario is unlikely. The other countries are likely to experience the same impact as Mexico as the policies affect their migrant workers as well.

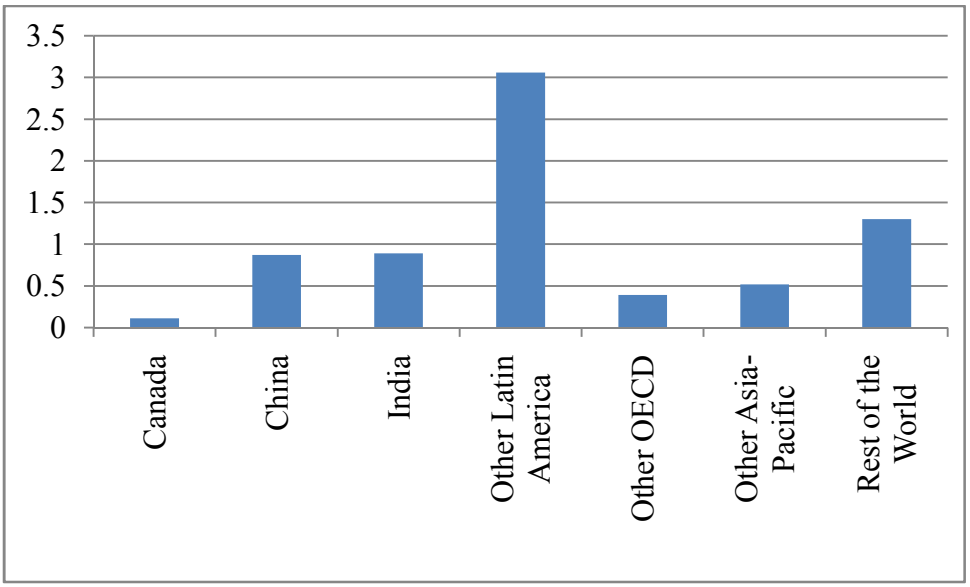

Figure 9. Changes in remittances after deportation

6. Summary and Conclusions

This study analyzed changes to the US immigration policy in the form of supply side changes of unskilled workers. The results showed that a successful deportation of all Mexican workers increases the demand of unskilled domestic and foreign documented workers; this is how employers would fill the gap of having less undocumented workers. The shift towards unskilled domestic and foreign documented workers raises the real wage of these workers which is beneficial for employees but not for the employers. With this increase in production costs, all sectors in the economy would reduce output, which in turn decreases GDP, which is consistent with the GDP reduction due to reduction in the employment of undocumented workers found by Dixon and Rimmer (2008).

In contrast, the legalization scenarios have a positive effect on US GDP. The legalization of unskilled workers increases competition and puts downward pressure on real wages which in turn benefits employers. The effects on the real wage of unskilled workers depends on whether domestic and foreign workers. The real wage of unskilled domestic workers is reduced by a small amount, as explained before by Greenwood et al. (1997) and Hanson et al. (2002). The real wages of the unskilled foreign documented workers decrease by a higher percentage, which is consistent with the findings of Borjas (1987). With lower production costs, sectoral output increases, which in turn increases GDP.

The analysis also highlights the relevance of US immigration policy on other countries through the effect of remittances out of the US. Deportation of Mexican workers decreases the flow of remittances into Mexico, while legalization increases the level of remittances from the US to Mexico. A World Bank report (2004) found that in Latin American countries, 70 percent of foreign direct investments were the result of remittances.

7. Future Research

Unlike Dixon and Rimmer (2008), this study analyzes only the impact of supply side shocks on the US economy. It would be interesting to also assess the impact of demand side policy shocks, such as taxing employers who hire undocumented workers, as undertaken by Dixon and Rimmer (2008).

In addition, the dynamic effect of immigration policy is not captured with the current model. In the future we hope to develop a dynamic model of international migration that would capture the behavior of investment and capital accumulation associated with foreign undocumented workers in the long run.

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