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# A Dynamic General Equilibrium Model of International Migration

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## Abstract

The purpose of this paper is to introduce a dynamic version of the global trade and migration model (GMig2), which has been modified to include undocumented, unskilled workers in the United States. The development of a dynamic model is important because migration policy interacts with changes in population (e.g., the decline in population caused by declining birth rates in many developed countries) and human capital affecting the supply of skilled and unskilled workers, which, when combined with capital accumulation, are essential for ensuring continued high economic growth. We chose to examine US immigration policy because the US is a significant importer of migrant labor and in particular of undocumented workers. We show how this model can be used to examine the following policy scenarios: increased border control, one-time legalization (amnesty), and increased quota of foreign unskilled workers.

Key words: Applied General Equilibrium Model, International Migration, US Undocumented Workers

JEL classification: F22, D58

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## Introduction

The International Organization for Migration (IOM) has listed the United States as the largest host to international migrants – home to 20% of the world’s migrants. Worldwide, the estimate of international migrants is 200 million people (IOM 2008). The estimated number of undocumented or illegal immigrants in the United States ranges between 7 to 12 million, depending on which methodology is used (USOIS 2006; Passel 2005; Jordan et al. 2007).<sup>1</sup> Every year since 2000, an average of one million documented immigrants have entered the United States.<sup>2</sup> Over the same period, entry of new undocumented workers has averaged half a million per year (Passel 2005).

In this paper we introduce a dynamic version of the global trade and migration model (GMig2), which has been modified to include undocumented, unskilled workers in the United States. The development of a dynamic model is important because migration policy interacts with changes in population (e.g., the decline in population caused by declining birth rates in many developed countries) and human capital affecting the supply of skilled and unskilled workers, which, when combined with capital accumulation, are essential for ensuring continued high economic growth. The US immigration policy is considered because the US is a significant importer of migrant labor and in particular of undocumented workers. We show how this model can be used to examine the following policy scenarios: increased border control, one-time legalization (amnesty), and increased quota of foreign unskilled workers.

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<sup>1</sup>Undocumented migrants are those who have either entered the country without proper documentation or have entered the United States legally on a temporary basis but failed to depart at the time specified on their visa.

<sup>2</sup>Documented immigration includes both permanent and temporary; where permanent documented immigration is defined as those foreign-born who legally reside in the United States holding residency or green cards, while temporary documented immigrants hold visas in accordance with the purpose of their visit to the United States (i.e., worker, student, investor, etc.).

## **Background and Literature Review**

Current US immigration policy aims to control the flow of both documented and undocumented immigration. 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 United States 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.<sup>3</sup> Another supply-side policy instrument is border enforcement, which limits the flow of undocumented immigrants into the United States via Canada, Mexico, and the sea. Monitoring the hiring practices of employers is a demand-side policy which is also within the scope of migration policies and can be used to control both documented and undocumented migration; although this method is not used as often as the other two supply-side control measures, visas and border enforcement.

In the US, the annual number of new-arrivals with green cards for 1991–2005 averaged 416,000 per year and the number of temporary migrants who adjusted their status to permanent residency (green cards) during the same period averaged 400,000 per year. On average, 292,000 skilled temporary migrants entered the United States every year during the period of 1992–2008, while only 34,000 agricultural temporary workers entered during the same period.<sup>4</sup> In 2000, about 33 percent (2.3 million) of the total undocumented population were estimated to have overstayed their visa expiration date.

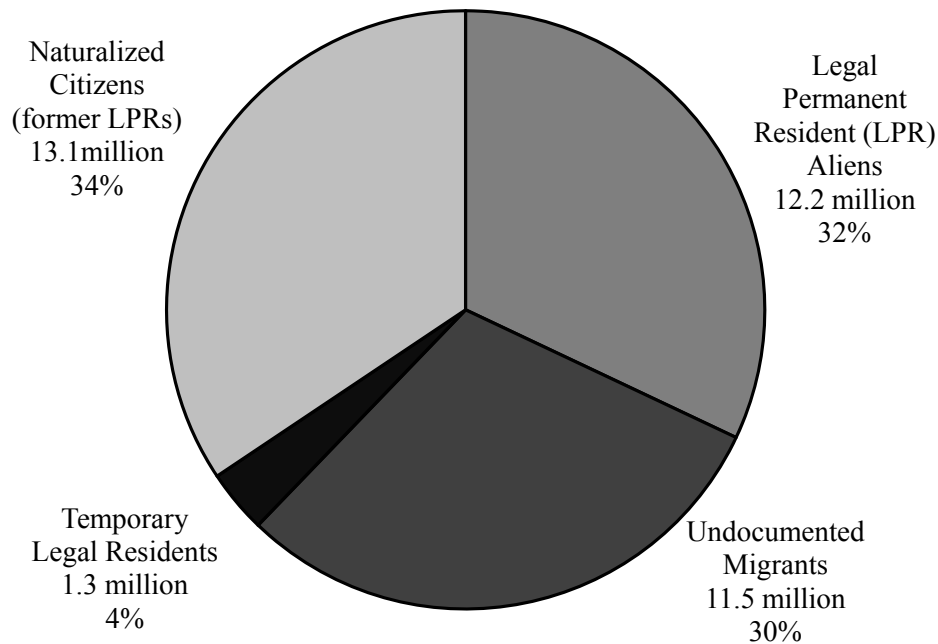
Figure 1 shows the distribution of US foreign born by legal status. The total number of foreign-born can be easily divided into four categories: naturalized citizens represent just above one-third of the foreign-born population at 13.1 million or 34% of the 38.1 million estimated total; legal permanent resident aliens, who are not yet citizens, represent about

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<sup>3</sup>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.

<sup>4</sup>Based on data from the US Office of Immigration Statistics.

12.2 million or 32% of all immigrants living in the United States; undocumented migrants are a significant share of the US foreign born (33%); and temporary migrants, which represent a small share of the total foreign-born in 2006. The small share of temporary migrants indicate that current policies related to temporary migration are very restrictive.



**Figure 1. Distribution of US Foreign Born**

Source: Passel (2005).

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 program would be open to undocumented workers in the United States, as well as to prospective migrants currently residing abroad. However, the US Congress did not pass the presidential proposal. Instead, the Congress requested more rigorous enforcement of immigration law with the consequent deportation of undocumented immigrants. This led to high-profile raids that in turn led to

the arrest of thousands of workers at processing plants and factories. In contrast, the current administration of President Barak Obama has stopped the raids and has focused on fines and other civil penalties aimed at employers that hire undocumented workers (Simpson 2009). The US financial crisis and economic recession have taken priority over proposed immigration policy changes. Comprehensive federal immigration reform is yet to come, although border states like Arizona, have already commenced their own immigration reform.

Worldwide, the majority of immigrant workers provide inexpensive unskilled labor, which benefit employers, but not necessarily the incumbent domestic labor force. Moreover, undocumented workers cannot lawfully demand fair compensation, therefore they generally receive lower wages (Borjas and Tienda 1993). 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.

Dixon, Johnson, and Rimmer (2008) 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, and find that fewer undocumented migrants (29% reduction) reduces the size of the US economy in 2019 by 1.6 percent, a \$200 billion reduction in terms of GDP, regardless of whether the decline is the result of supply or demand-side policies. Based on a welfare criterion, Dixon, Johnson, and Rimmer (2008) 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.

This study is similar to Dixon, Johnson, and Rimmer (2008) in that it evaluates the effect of restricting the supply of undocumented workers on the US economy. However, we contrast our analysis of border control by considering the impact of legalizing undocumented workers. Another difference between the two studies is that we use a global economy-wide model of migration, GMig2. While the GMig2 model does not have the sectoral detail of the USAGE-M model used by Dixon, Johnson, and Rimmer (2008), it does take into account remittances, the implications for trade, and the effect of the policies on labor-exporting countries. The studies are also similar in that they both examine the long run implications of the changes in policies.

In addition, this dynamic labor migration model will be somewhat similar to the dynamic model developed by Shi and Tyers (2005). In their paper they add a demographic structure to the GDyn model to analyze the effect of freer skilled migration. One key contribution of this model is the tracking of births, deaths, and the movement between age groups. In the model we proposed, changes in the labor force due to births, deaths, and capital accumulation will be imposed exogenously. Unlike, Shi and Tyers (2005), however, we also propose to track bilateral remittance flows, their impact on the current and capital account balances and on the labor-exporting economies.

The model presented here will contribute to the understanding of the linkage between migration and economic growth in both home and host countries over the long run. Consequently, this model will provide economists and policy makers with another tool for examining the impact of migration and evaluating potential alternative migration policies. The next section discusses the model development.



## **Dynamic Migration Model**

In order to build a dynamic migration model with undocumented workers, we combine the Dynamic GTAP (GDyn) model, developed by Ianchovichina and McDougall (2001), with the extended version of the comparative static migration model (GMig2) model, developed by Walmsley, Winters, and Ahmed (2007), which includes undocumented workers in the United States (Aguiar 2009). Both the GDyn and GMig2 models are based on GTAP's standard general equilibrium model. The standard GTAP model is a comparative-static general equilibrium model of the world economy (Hertel 1997).

In the standard GTAP model, capital can move between industries within a region but not across regions (Hertel and Tsigas 1997). The GDyn model extends the standard model by incorporating international capital mobility and capital accumulation (Ianchovichina and McDougall 2001).<sup>5</sup> Furthermore, the GDyn model takes account of foreign income flows and wealth, by keeping track of the ownership and location of assets.

In the GDyn model, international capital mobility is modeled using a disequilibrium approach. GDyn assumes an adaptive expectations mechanism that permits errors in expectations. Errors in expectations are gradually eliminated and the rates of return to investment gradually converge across regions, resulting in a gradual movement of economies towards the steady state growth (Ianchovichina and McDougall 2001).

The GMig2 model extended the GTAP model to consider skilled and unskilled bilateral labor movement across countries. In the GMig2 model, bilateral labor flows are modeled explicitly using the bilateral migration data base GMig2. 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, outlined in Walmsley, Winters, and Ahmed (2007), is a combination of the bilateral migration data base

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<sup>5</sup>Both domestic and foreign residents own equity in a region.

by Parsons et al. (2007), the GTAP 6 Data Base documented in Dimaranan and McDougall (2005) and other data related to the global labor markets.<sup>6</sup>

Merging these two models results in a model that features the capability of tracking both the accumulation of capital and the movement of labor over time. The dynamic migration model includes equations which will allow us to track:

- the accumulation of capital over time,
- the ownership of capital and the income flows to those capital owners,
- the movement of migrants and other changes in the labor force over time,
- the flow of remittances back to the migrants,
- the real income of migrants and permanent residents, and
- separately identifies undocumented workers and their use by sector.

In addition, the dynamic migration model assumes that like domestic workers, foreign workers are assumed to be of two kinds: skilled and unskilled. Foreign and domestic workers of the same skill type, are imperfect substitutes, but there is no distinction between foreign workers, that is, firms demand foreign workers without regard of their country of origin (Aguiar 2009).

The model does not accurately track migrant taxes and it does not account for their consumption of the goods and services provided by the government.

The model is usually run in two stages. First, the base case scenario, or business as usual. In our case this shows what the United States (and the world) would look like between 2001 and 2020 without changes to US immigration policy<sup>7</sup>. The second stage, the policy

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<sup>6</sup>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 (2005), and wage rates from Freeman and Oostendorp (2005).

<sup>7</sup>This baseline does not account for the financial crisis. The purpose of this paper is to introduce the dynamic model of migration, therefore the examination of US policies is a mere example of how this model could be used.

scenario. In this case, we model how the US economy would respond to increased border control, one-time legalization of undocumented workers, and an increase in the quota of unskilled foreign workers. The difference between the base case and the policy measures the the impact of the proposed US immigration policy changes in the long run. Typically these results will be presented in cumulative differences plotted against time.

## **Policy Scenarios**

In this section, combinations of the following policy scenarios are considered: increased border control, one-time legalization (Amnesty), and increasing the quota of undocumented workers. These policy scenarios are explained below.

### *Increased Border Control*

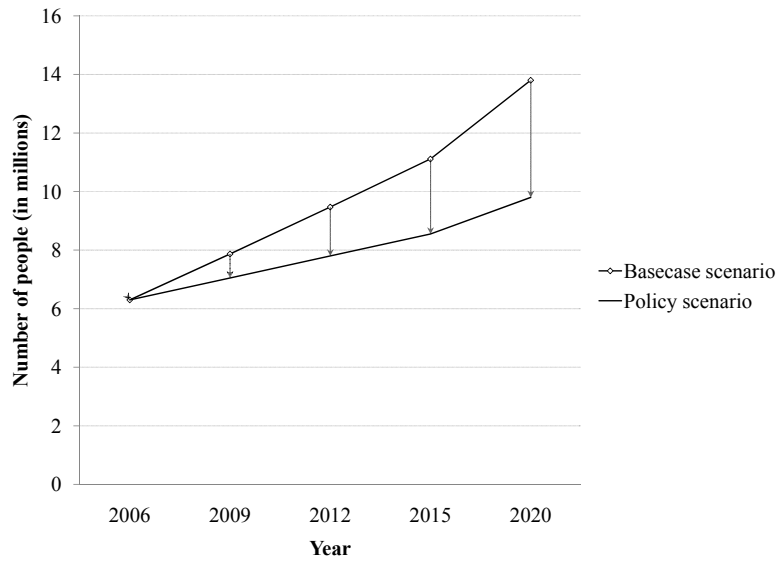
This policy scenario forever reduces by half the expected new entry of undocumented workers into the United States under the base case scenario based on the assumption that increased border control effectively reduces new entry by half. This policy scenario only allows 250 thousand people to enter the United States each year. The estimated undocumented labor force in 2006 is 6.3 million migrants (Passel 2005). Figure 2(a) shows how the increased border control affects the number of undocumented labor in the United States. By the year 2020 the stock of undocumented migrants will reach 9.8 million, as opposed to the 13.8 million in the baseline. This is a considerable decline in the growth of undocumented workers.<sup>8</sup>

### *Amnesty and Increased Border Control*

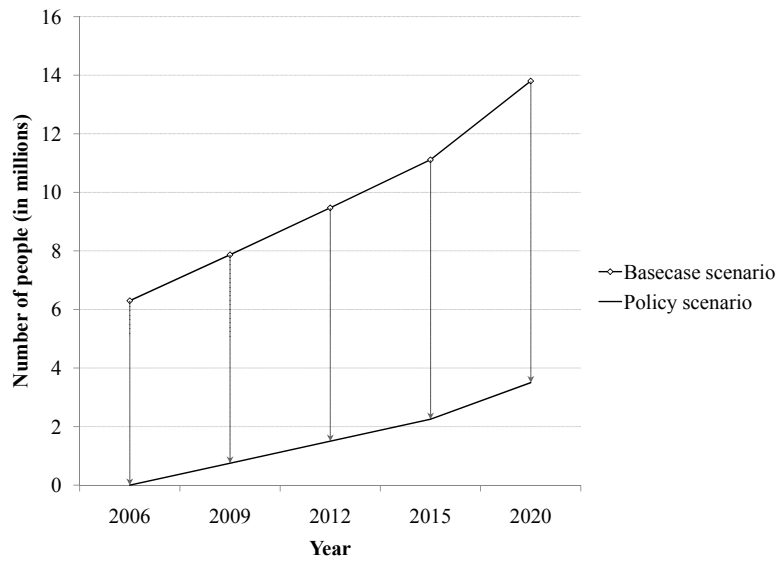
This scenario combines the increased border control with a one-time legalization of all undocumented workers in 2006, also referred to as amnesty. This scenario attempts to provide US firms with the unskilled labor they need by legalizing current undocumented migrants, but at the same time alleviate fears of increased uncontrolled illegal migration

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<sup>8</sup>Also reflected in Figure 2(a) by the flatter slope of the policy scenario line.



(a) Increased Border Control



(b) Amnesty and Increased Border Control

**Figure 2. US Undocumented Labor Force after Policy Scenarios (a) and (b)**

by raising border protection. Increased border control dissuades new migrants who might be encouraged by the amnesty and reduces illegal migration to 250 thousand people per year, half of what would have entered under the baseline. Figure 2(b) shows the effect of these policies on the number of undocumented migrant workers over time. Note that in 2006, the number of undocumented workers is zero because their status is now that of unskilled foreign documented workers. The increased border control reduces the entry of new undocumented workers by half and is reflected by the flatter slope of the policy scenario line in Figure 2(b).

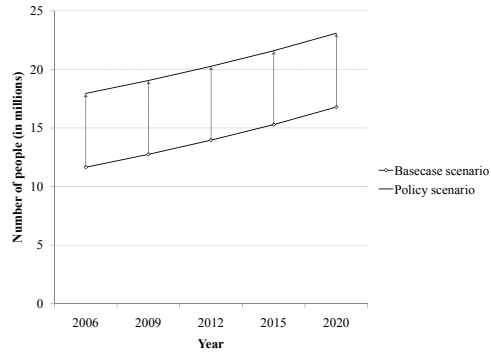
The effect of the one-time legalization of these 6 million undocumented workers on foreign documented workers is presented in Figure 3(a). This figure depicts an upward parallel shift in the level of unskilled foreign documented workers in the United States.<sup>9</sup>

#### *Increased Border Control and Unskilled Foreign Quota*

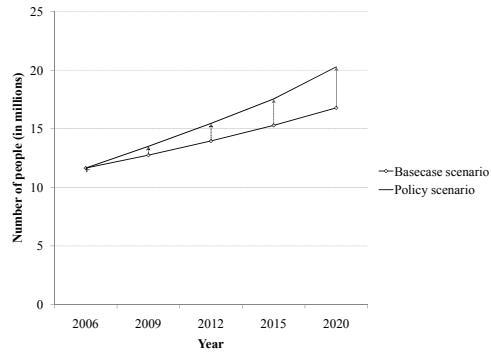
This scenario increases border control as in previous scenario, reducing the new entry to half of what is expected in the base case scenario. However, rather than a one-off increase in legal unskilled workers, this policy scenario examines the impact of raising quotas on temporary unskilled workers. Both scenarios provide US firms with much needed labor, however the amnesty supplies a large number of workers immediately, while the increase in quotas supplies this labor gradually over time. We assume that the program permits the new entry of 250 thousand unskilled documented migrant workers. The effect on the undocumented labor force will be the same as presented in Figure 2(a). The effect on the unskilled foreign documented labor force is shown in Figure 3(b). The supply of unskilled foreign documented workers increases by 250 thousand per year the increase in the quota. By 2020, the number of documented workers under this scenario is still much lower than under amnesty with increased border control scenario. In fact, under the amnesty with in-

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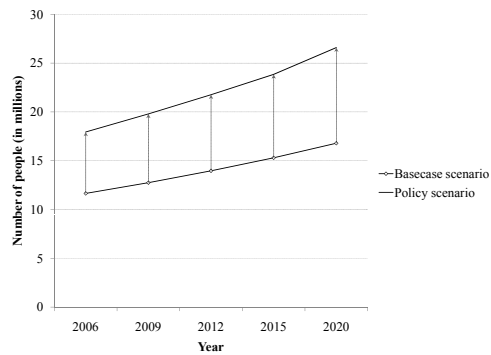
<sup>9</sup>We assume that newly legalized undocumented workers are unskilled and remain so after legalization.



(a) Amnesty and Increased Border Control



(b) Increased Border Control and Unskilled Foreign Quota



(c) Amnesty, Increased Border Control and Unskilled Foreign Quota

**Figure 3. US Documented Labor Force after Policy Scenarios (a), (b) and (c)**

creased border control scenario, the documented foreign labor force is larger than increased border control with increased foreign unskilled workers right from the start.

#### *Amnesty, Increased Border Control and Unskilled Foreign Quota*

Finally in this scenario we combine all three policies: a one-time legalization of all undocumented workers in 2006; increased border control, and an increase in the quota of unskilled workers permitted to enter the United States over time. The effect of this set of policies on the undocumented labor force in the United States is the same as depicted in Figure 2(b). The stock of undocumented workers in 2006 is legalized, reducing the number of undocumented workers to zero and having a lower growing rate due to increased border control. The effect of these policies on the unskilled foreign documented work force is presented in Figure 3(c). This figure shows a shift due to the legalization of 6.3 million undocumented workers in 2006 and a steady increase of unskilled foreign documented workers due to the proposed increase of the unskilled foreign quota.

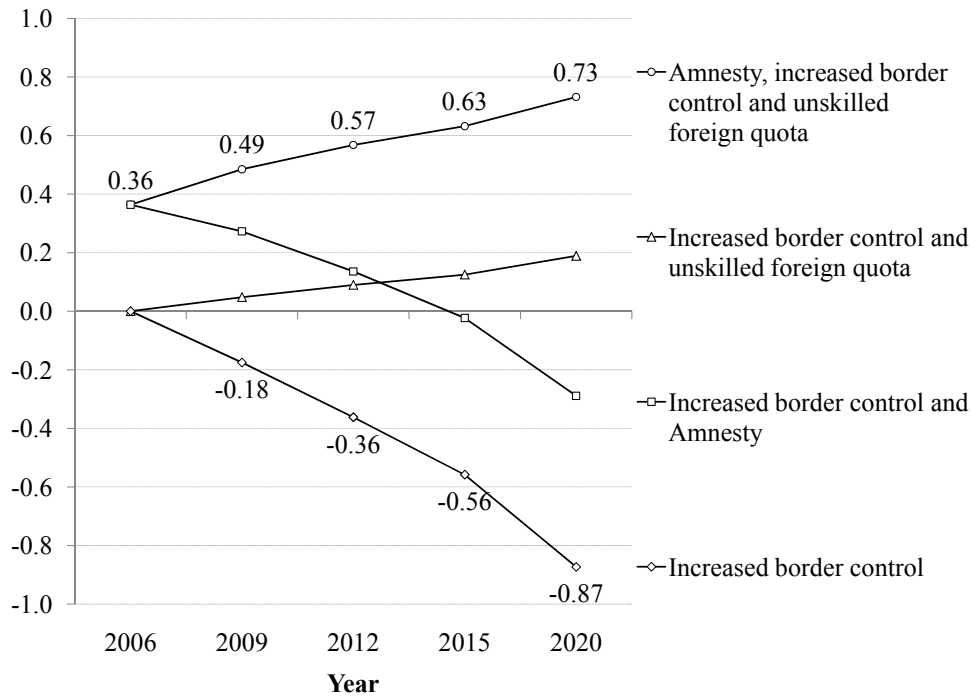
### **Results and Implications**

In this section, the cumulative percentage deviations, policy versus baseline, are presented for all scenarios: a) border control; b) border control and amnesty; c) border control and increased quota; and d) border control, amnesty, and increased quota programs. The results are presented as cumulative percentage deviations from the base case. We first discuss the effects of these policies on the United States and abroad emphasizing the effects on Mexico.

#### *Effects of Prospective US Immigration Policies on US GDP*

Increased border control reduces the inflow of the undocumented labor force to half (250 thousand undocumented migrant workers) of what is expected under the base case scenario (500 thousand undocumented migrant workers). Under this scenario, US GDP grows at a slower pace than in the baseline, see Figure 4. In 2006, the US GDP is \$11.25 trillion, by 2020, the baseline scenario estimates that the US GDP will be \$16.15 trillion. The border

control scenario, estimates a US GDP of \$16.01 trillion by 2020, a drop of \$140 billion with respect to the base case.



**Figure 4. US GDP Growth Response to Prospective US Immigration Policies**

Note: Cumulative percentage deviation from base case

If apart from border control, we consider the increase on unskilled foreign quota (e.g., the creation of a foreign unskilled worker program), we reduce the supply of undocumented workers but increase the supply of foreign documented workers, which help alleviate the absence of the expected number of undocumented workers in the economy. Moreover by increasing the supply of foreign unskilled documented workers, the US economy will have a small increase in its GDP when compared to the base case scenario.



Pairing border control with a one-time legalization program<sup>10</sup>, instead of increasing the number of documented foreign workers gradually through the increased of the foreign unskilled worker quota, results in a higher GDP in 2006, see shift in Figure 4. The proposed one-time legalization program has a higher initial effect than increasing the quota of foreign unskilled workers. At the beginning, both of these policies offset the negative effect caused by restricting the supply of undocumented workers due to the increased border control. But over time, the effect of the amnesty program disappears and the cumulative effect is negatively dominated by the increased border control.

The problem with the increased border control and foreign unskilled quota, is that the economy retains the 6 million undocumented workers, while with the border control plus amnesty, the negative impact of increasing the border control quickly outweighs the positive impact from the amnesty. The most proactive policy scenario for the United States is therefore to embark on a combination of all three policies, providing amnesty to most of the undocumented workers present in 2006, restricting the new entry of undocumented workers, and creating a worker program to admit unskilled foreign workers.

As in the previous policy scenario, the amnesty program causes a jump in US real GDP in 2006, see Figure 4. Even though, foreign undocumented workers have been restricted, the increased quota of foreign unskilled workers, provides foreign documented workers to US firms, increasing the labor supply of unskilled foreign documented workers and hence offsetting the negative impact of the border control in the long run. This increase of labor endowments help increase US production.

#### *Effects of Prospective US Immigration Policies on selected US Variables*

Table 1 presents the effect of these US immigration policies on selected US variables. The effect is measured as the cumulative percentage deviation from the base in 2020.

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<sup>10</sup>Also called amnesty for undocumented workers, consists in the legalization of almost all 6.3 million undocumented workers present in 2006.

**Table 1. Cumulative differences result in selected US variables in 2020**

	Increased border control	Increased border control and amnesty	Increased border control and unskilled foreign quota	Amnesty, increased border control and unskilled foreign quota
Investment	-1.77	-1.09	0.23	0.85
Capital Accumulation	-0.70	-0.23	0.10	0.53
Real Wages for:				
Domestic Skilled	-0.60	-0.26	0.10	0.49
Domestic Unskilled	0.50	0.25	0.00	-0.21
Foreign Documented Skilled	-0.70	-0.21	0.10	0.53
Foreign Documented Unskilled	1.40	-2.26	-2.50	-5.51
Foreign Undocumented Unskilled	5.40	-53.05	3.50	-54.21
Volume of:				
Exports	-0.45	0.21	0.13	0.76
Imports	-0.69	-0.47	0.10	0.29
Change in Trade Balance (\$US million)	7038.69	13613.25	323.19	7019.75
Terms of Trade	0.158	0.014	-0.027	-0.164

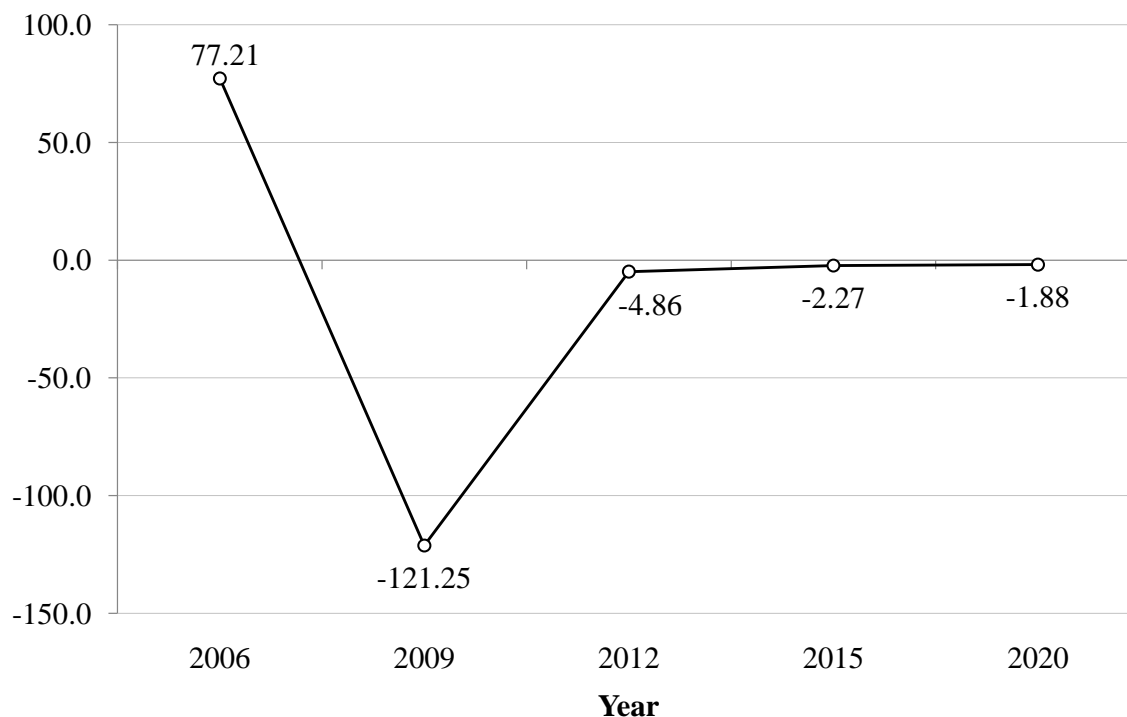
In the increased border control scenario, first column of Table 1, the decline in production lowers demand for all other endowments such as skilled labor (domestic and foreign) and capital. Therefore, investment falls with respect to the base case. Following the response of investment to increased border control, capital stock will be lower than in the base case (no border control).

US firms need to adjust their input structure by substituting undocumented workers for domestic and foreign legal unskilled workers. This adjustment also involves firms adapting to changes in demand for other endowments such as capital and skilled labor. Because they become more scarce, the remaining undocumented workers receive higher wages(5.4%). The wages of other unskilled workers (domestic and documented) also increase, 0.5 and 1.4 per cent each.

In contrast to the previous scenario, when the United States adds to the increase in border control an increase in the quota of foreign unskilled workers (i.e., through the improved temporary worker scheme), US firms will have to adjust to having more unskilled foreign documented and less undocumented than in the baseline. The decrease in supply of unskilled foreign undocumented workers increases their real wage, while the increase in unskilled foreign documented workers causes a decrease in the real wage of this type of workers, see Table 1. The demand for capital will also increase raising capital's rental rate causing the rate of return to be higher attracting more investments, which subsequently provokes an increase in capital stock of the United States.

The effect of the one-time legalization on wages of undocumented workers is large at first. Only a few thousand undocumented workers would remain in the United States and those remaining witness a large increase of their wages initially, but overtime this wage increase is vanished due to the entry of new undocumented workers each year. Figure 5 depicts this large fluctuation and Table 1 shows the cumulative effect on undocumented workers' wages by 2020.

### Increased Border Control and Amnesty Effect on Real Wage of Undocumented Workers (percentages)



**Figure 5. Undocumented Workers’ Wages after Increased Border Control and Amnesty**

Note: Year on year percentage deviation from base case.

Similarly, the one-time legalization boosts the US economy in 2006. With additional labor at lower costs, US firms demand more of the other endowments. Investment increases rapidly in 2006 and 2009 periods and start slowing down. Capital stock increases and is higher than in the base case, mainly because of the rapid increase of first large investment flows. Over time however, the massive legalization does not offset the effects of the increased border control.

The effect of the prospective US immigration policies on US trade balance is also displayed in Table 1. The increased border control has a negative effect on US exports. The shortage of undocumented workers forces US firms to hire more expensive labor and that increases its production costs, which in turn increases its export prices. The US reduces

its remittances out and investment due to the lack of foreign documented workers. With exports falling, imports drop further and this results in a positive trade balance.

When amnesty is also considered, the supply of documented workers dramatically increases and subsequently this reduces production costs for US firms. In this scenario, US export prices decrease, which increases US exports. Remittances and investment are again lower than in the base case. US imports again drop to maintain the macroeconomic balance.

Combining border control with an increase in the unskilled foreign documented quota instead of the amnesty program results in a reduction of the trade balance at first because essentially in this scenario the US is losing cheaper labor for more expensive one. On the one hand it has the same labor endowment but has to pay more for it. Over time, this original reduction fades away and what is reported in Table 1 is an almost even increase on US exports and imports, but this is the cumulative effect. Remittances out and investment increase with this scenario. When all three policies are considered (increase in border control, amnesty, and increased quota of foreign unskilled workers), US exports increase due to lower export prices and raises imports due to the higher increases on US investment and the remittances out.

#### *Effects of Prospective US Immigration Policies Abroad*

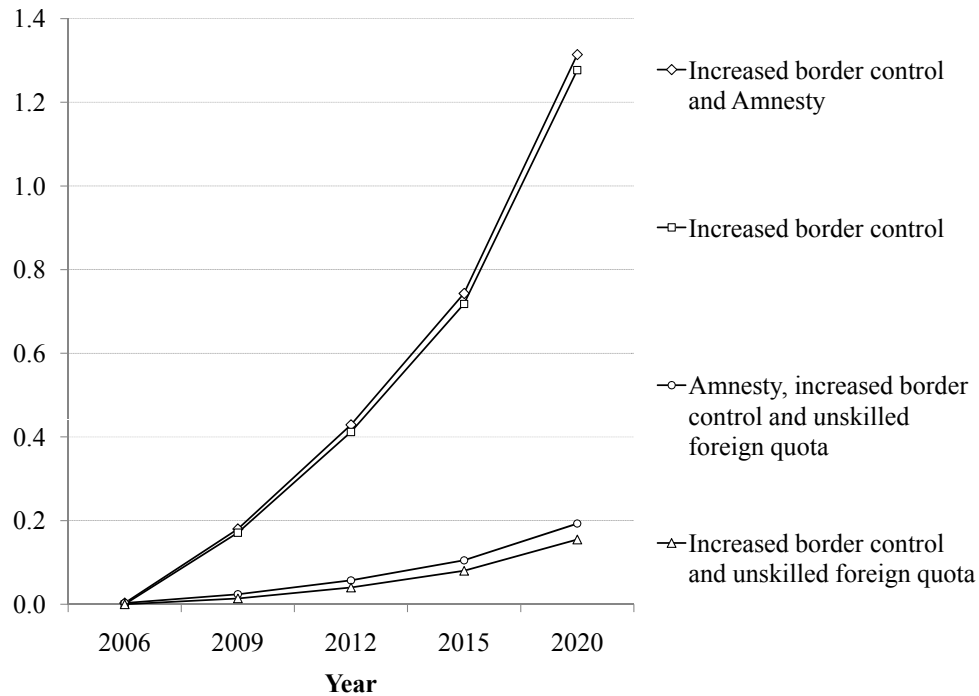
Being the preferred destination for migrants worldwide, changes to US immigration policy will have considerable effects on labor-exporting countries. Table 2 presents the effect of these policies on other countries' GDP. The relevant effect in other countries depends from two sources, a) changes in the supply of labor and b) changes in flow of remittances. We focus on Mexico, since this is a country with an important migration presence in the United States.

Overall, the effect of the prospective US immigration policies on the Mexican GDP is positive when compared to the baseline, see Figure 6. In the baseline, the majority of the incoming undocumented workers are from Mexico. By increasing US border control, fewer

**Table 2. GDP Cumulative Difference in 2020**

	Increased border control	Increased border control and amnesty	Increased border control and unskilled foreign quota	Amnesty, increased border control and unskilled foreign quota
United States	-0.87	-0.29	0.19	0.73
Canada	0.05	0.06	0.00	0.01
Mexico	1.28	1.31	0.16	0.19
China	0.04	0.01	-0.01	-0.04
India	0.06	0.01	-0.01	-0.06
Other Latin America	0.31	0.29	0.03	0.01
Other OECD	0.07	0.04	-0.01	-0.04
Other Asia Pacific	0.06	0.03	-0.01	-0.03
Rest of the World	0.08	0.02	-0.01	-0.07

Mexicans cross the border and under the full employment assumption, Mexican wages are lower than in the base case. With lower production costs for Mexican firms, Mexico's GDP increases.



**Figure 6. Mexican GDP Growth Response to Prospective US Immigration Policies**

Note: Cumulative percentage deviation from base case

Increasing the US quota of unskilled documented foreign workers will have a negative effect on Mexico's GDP because this scenario reduces the Mexican labor force, increasing Mexican wages, which in turn increases production costs for Mexican firms. In Figure 6, since we consider this scenario combined with increased border control, we determine that the negative effect is offset by the positive effect that the increased US border control has on Mexican economy. This is the result of our policy specification. On the one hand, we restrict the new entry of undocumented Mexican workers to 250 thousand and on the other hand we allow the same number of documented Mexican workers to enter the United

States. The US amnesty program has no effect on Mexico's GDP because it only affects Mexican workers within US borders.

Having fewer migrants in the United States means lower amounts of remittances destined to home countries, see Table 3. Since most of undocumented workers are from Mexico, the border control scenario reduces the number of undocumented Mexican workers in the United States with respect to what was expected in the baseline. However, having better paid Mexican workers in the United States, increases the level of remittances back to Mexico.

Even if the United States combines border control with a one-time legalization program, the cumulative effect on remittances by 2020 is negative when compared to the base case. In this policy scenario, countries who had more undocumented workers (e.g., Mexico) see their remittances from the United States increase sharply during the first two periods and decrease their remittances growth over time and the cumulative effect is lower than in the base case. This is the case because the newly legalized receive higher wages once they become documented. However, the remittances that countries with a large number of foreign documented workers receive from the United States decrease because the legalization makes their mostly documented workers in the United States to receive lower wages than in the base case. This is the case for Canada and the other OECD countries.

Only when the US immigration reform considers increasing the foreign unskilled quota in addition to border control, then remittances will increase over time. By legally entering the United States, migrant workers earn higher wages and increase their remittances home.

The effect of these prospective US immigration policies abroad highlight the potential benefit for foreign countries to participate in the immigration debate and advocate, in the Mexican case, for higher border control, to keep workers at home, and temporary worker programs in order to increase the worker wages, which in turn increases remittances.



**Table 3. Remittances Cumulative Differences in 2020**

	Increased border control	Increased border control and amnesty	Increased border control and unskilled foreign quota	Amnesty, increased border control and unskilled foreign quota
Canada	-0.52	-1.18	-0.36	-0.88
Mexico	-9.99	-1.42	2.98	10.85
China	-1.78	-1.90	0.03	-0.03
India	-2.62	-2.69	0.69	0.51
Other Latin America	-5.15	-2.13	1.16	3.96
Other OECD	-0.83	-1.33	-0.35	-0.70
Other Asia Pacific	-2.13	-1.71	0.22	0.64
Rest of the World	-4.68	-2.40	1.29	3.30

## **Conclusions**

This paper develops a dynamic multi-region economic model of migration. We use this model to examine the long run effects of changes to US immigration policies on the US economy. A combination of three policy scenarios were considered, increased border control, increased quota on foreign unskilled workers, and an amnesty program.

The results indicate that, despite its popularity, increasing border control is detrimental to the US economy, which is consistent with previous literature. The lack of an effective border control and the decline in growth caused by border control reflects the needs of US businesses to have access to unskilled migrant workers in order to alleviate job market pressures. Hence any serious attempt at increasing border control will need to address this issue. In this paper we address the concerns of businesses were also considered by examining two possible alternative strategies: first, the provision of an amnesty to undocumented workers resident in the United States in 2006; and second, the increase in quotas of foreign unskilled migrants.

We find that only increase in quotas of foreign unskilled migrants alleviate the negative effects of increasing border control. When the United States combine a strict border control with an amnesty program, the one-time legalization program of current undocumented workers boosts the US economy in 2006 but this positive effect gradually faded away. Over time the negative effect of the strict border control dominates the cumulative effect by 2020. However, when a strict border control is matched with a quota increase of foreign unskilled workers, the flow of unskilled workers into the US is restored, alleviating the labor needs of US firms.

Adding both the increased in quota for unskilled migrants and amnesty to the increased border control provided most benefits with an increase in steady growth of the United States in terms of GDP, investment and capital stocks. Therefore, if the United States is considering increasing its border control, it should also increase its foreign unskilled quo-

tas, perhaps by establishing temporary worker programs to allow more unskilled workers to enter the United States. Increasing the quota of foreign unskilled workers is preferred to the amnesty program because the latter just provides a short-term boost to the US economy. If the United States cannot increase its quota of unskilled migrants, it would be better not to increase border control and maintain the *status quo*.

Changes to US immigration policy affect other countries through the effect of remittances out of the United States. Since remittances are often an important source of income for labor-exporting economies, these countries have an incentive to advocate for the creation of more and larger worker programs. Particularly, the results indicate that Mexico has an incentive to work with the United States to increase border control and set up a good legal worker program.

Finally, the model developed here provides an important analytical tool for economists and policy makers, allowing them to the examination of the long run effects of immigration policy on the home and host countries.

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