



**The Importance of Timing in the U.S. response to
Illegal Immigrants: A Recursive Dynamic Approach**

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THE IMPORTANCE OF TIMING IN THE U.S. RESPONSE TO UNDOCUMENTED IMMIGRANTS: A RECURSIVE DYNAMIC APPROACH

Abstract

In an attempt to control the flow of undocumented immigrants, successive US governments have considered everything from large scale deportation, amnesties, expanding visa programs, to fining firms who hire undocumented workers. Using a comparative static model, Aguiar and Walmsley (2013), find that amnesties have a positive impact on the US economy. However such policies are one-time changes in the labor force, whose benefits diminish over time, and which are unlikely to stem the flow of undocumented workers or fulfill the demands of U.S. firms for cheap foreign labor. In this paper we use a global dynamic model to investigate the long run implications of three alternative policy scenarios: 1) a one-time amnesty for undocumented workers living in the US; 2) a permanent increase in the number of foreign worker visas; and 3) enhanced border security. We find that an amnesty is much less effective than a permanent increase in visas at promoting growth in the U.S., while enhanced border control by the U.S. is beneficial for Mexico in terms real GDP.

Key words: Global Dynamic General Equilibrium Model, USA Migration Policy, Permanent, One-off temporary policy changes, undocumented migrants.

1. Introduction

In 2010, the number of international migrants worldwide was estimated to be 214 million people, having grown at an average of 2% per year since 1960 (United Nations, 2012). Migration from developing to developed countries was the fastest growing component, rising from 16 to 37 percent of international migration (Parsons et al, 2007) as developed economies have gradually liberalized their immigration policies.

The United States is the most important migrant destination in the world, home to 20% of the world's migrants and the top destination for migrants from some 60 sending countries (Parsons et al, 2007). About a quarter of those migrants are undocumented or undocumented unskilled workers that have crossed the border, usually from Mexico, illegally.

The estimated number ranges between 7 to 12 million, depending on which methodology is used (USOIS 2006; Passel 2006; Jordan et al. 2007).¹ While it is generally recognized that immigration can have a positive impact on the economy, the large proportion of undocumented immigrants in the US is cause for concern amongst the U.S. populace. In an attempt to control the flow of these undocumented immigrants, successive US governments have contemplated everything from deportation, amnesties, expanding the availability of visas to fining firms that illegally hire undocumented immigrant workers.

A number of studies (Walmsley et al., 2011 and World Bank, 2006) have shown that there are potentially large comparative static gains from increased international migration between developing to developed economies. Aguiar and Walmsley (2013) use a modified version of the comparative static migration model (GMig2) to examine the impact of various supply-side policies aimed at controlling undocumented workers. Like other studies, they find migration has a positive impact: the legalization of undocumented migrants generally has a positive impact on the US economy, while increased border control or deportation has a negative impact. They also find that undocumented immigrants are an important source of workers for the US agricultural sector, and argue that an amnesty is unlikely to curb neither the demand for cheap farm workers by the agricultural sector, nor the supply of undocumented farm workers, in the future.

The impacts of immigration and immigration policies have a dynamic component. Changes in the number of immigrants interact with demographic changes in the population and human capital, which affect the labor supply and growth in both the short and long-run. Moreover timing is an important consideration when examining the impact of immigration policies. For instance, an amnesty provides a very large one-off shock to the productivity and mobility of labor; while expanding the visa program causes the US labor force to increase gradually over time. It is also not unusual for multiple policies to be applied simultaneously in an effort to control migration in both the short and long run. For instance, an amnesty might be used to reduce the number of undocumented migrants currently in the country; while increased border control paired with a gradual increase in the annual visa quota might be used to reduce future problems.

While the comparative static model used by Aguiar and Walmsley (2013) was able to examine the impact of the changing composition of the labor under an amnesty, a dynamic model is needed to examine how large immediate one-off changes differ from gradual changes over time. As a result, capturing the benefits of changes in migration policies is best accomplished using a dynamic model which takes account of the often subtle differences between the implementation of migration policies and their potential impact on the labor force, capital accumulation and growth. Dixon, Johnson, and Rimmer (2011) evaluated the

¹ 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 stamped on their visa.

long term effects of restrictions to the demand and supply of undocumented immigrants in the US economy, using a dynamic applied general equilibrium model of the US economy. They find that a 29% reduction in the number of undocumented migrants 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. This analysis differs in two ways. First it focuses not just on reducing the number of undocumented workers but also on increasing the number of documented workers so as to alleviate future demand for workers by U.S. firms. Second, ours is a Global model, which allows us to track the effect of US immigration policies in the migrants' home country.

The model developed in this paper is based on the Dynamic global model (GDyn) developed by Ianchovichina and McDougall (2012) and the comparative static migration model (GMig2) developed by Walmsley et al (2007) and revised in Aguiar and Walmsley (202013). 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. The new features of the model, along with a discussion of the design decisions made, are discussed in section 3. Following this we use the model to investigate the dynamic implication of three alternative policy scenarios specifically aimed at undocumented workers: 1) a one-time legalization or amnesty for workers currently living in the US illegally; 2) a permanent increase in the number of annual visas available to foreign unskilled workers; and 3) a reduction in the flow of undocumented workers brought about by an enhanced security at the border.

We find that timing is important when examining the impact of migration policies. We demonstrate that although the amnesty proposal delivers a very large, one-off, shock to the labor market, the US would be better off with gradual increases labor force over time. Our model shows that the fluctuations of the labor endowment, in this case undocumented workers, has an effect on its own price (wage) and that of other factors of production such capital and other labor types. Through its effect on the price of capital this would affect investment levels, capital accumulation, and economic growth. These linkages highlight the importance of the model as it provides economists and policy makers an analytical tool to examine the long run implications of immigration policy change on the home and host countries.

2. US Immigration Policy

Current US immigration policy aims to control the flow of both documented and undocumented immigration through the use of both supply and demand side tools. 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.² 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 as frequently used 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 1991–2009 averaged 423,600 per year in addition, the number of temporary migrants who adjusted their status to permanent residency (green cards) during the same period averaged 552,800 per

² 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.

year. On average, 285,300 skilled temporary migrants entered the United States every year during the same period of 1991–2009, while only 41,900 agricultural temporary workers entered during the same period.³ According to a report by the Pew Hispanic Center, in 2000, about 33 percent (2.3 million) of the total undocumented population were estimated to have overstayed their visa expiration date.⁴ Figure 1 shows the distribution of the stock of US foreign born in 2005 by legal status. The small share of temporary migrants (4%) indicates that current policies related to temporary migration are very restrictive.

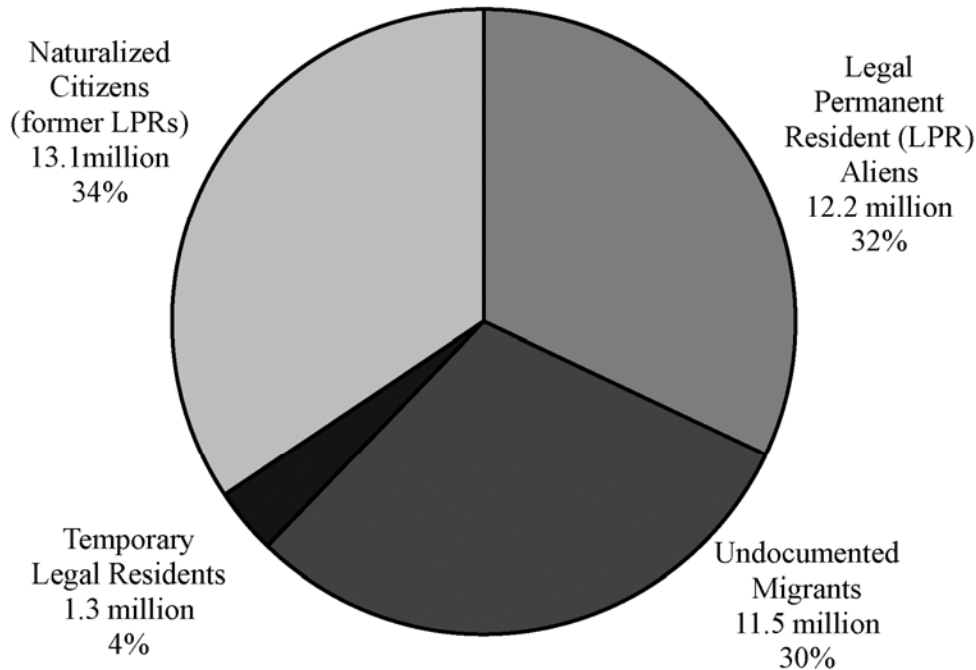


Figure 1. Distribution of US Foreign Born.
Source: Passel (2006).

The 2010 Dream Act was the latest attempt to modify the US immigration policy.⁵ This proposal would have provided young undocumented migrants residency if they continued their college education or joined the army. This proposal has been introduced unsuccessfully several times in the House and Senate. Even as part of the more ambitious Comprehensive Immigration Reform Act of 2007, this was also an attempt to satisfy the high demand for unskilled labor in the US.

In light of Congress' inability to reach a consensus on immigration policy reform, some states like Arizona and Alabama have already commenced their own immigration reform, which has been effective at reducing the number of undocumented migrants. Unfortunately, this has affected US farmers in these states because they now face labor shortages, even during the recent economic crisis, which has resulted in higher rates of unemployment (Dwoskin, 2011).

³ Based on data from the US Office of Immigration Statistics.

⁴ The report is entitled "Modes of Entry for the Unauthorized Migrant Population" and is available online at <http://pewhispanic.org/files/factsheets/19.pdf>

⁵ The DREAM Act (Development, Relief, and Education for Alien Minors) was first introduced in the Senate on August 1, 2001, by Dick Durbin and Orrin Hatch.

The following sections describe the economic model and data base that we construct and use in this study for the analysis of prospective immigration reforms.

3. A Global Dynamic Migration Model

In order to build a global dynamic migration model, we combine the Dynamic GTAP (GDyn) model and database⁶, developed by Ianchovichina and McDougall (2012), with the extended version of the comparative static migration model (GMig2) model and database⁷, developed by Walmsley, Winters, and Ahmed (2007) and extended in Aguiar and Walmsley (2013) to include undocumented workers. Both the GDyn and GMig2 models are based on GTAP's standard general equilibrium model (Hertel, 1997).

The standard GTAP model is a comparative-static general equilibrium model of the world economy (Hertel 1997). Most of the features of the GTAP model are retained in the dynamic migration model including:

1. Ability to examine results at the detailed regional and sectoral level.
2. The regional household allocates income across private consumption, government and savings.
3. Private household preferences are modeled using the non-homothetic CDE functional form.
4. Sectoral production defined by perfect competition and constant returns to scale.
5. Inter-sectoral factor mobility – capital, skilled and unskilled labor move freely between industries within a region.
6. International trade and transport margins explicitly taken into account. Bilateral trade is modeled under the Armington assumption.

The GMig2 and GDyn extensions to the GTAP model each incorporate foreign 'ownership' of the labor and capital respectively. As a result an important feature of the GMig2Dyn model is that the regional household now collects all income from endowments owned and retained by the regional household, rather than income earned on all endowments located in the region. This means that returns to foreign owned capital and remittances transferred back to families by immigrants are allocated appropriately back to the foreign regional household. These remittances and returns to capital are linked to changes in wages and the ownership of labor and capital.

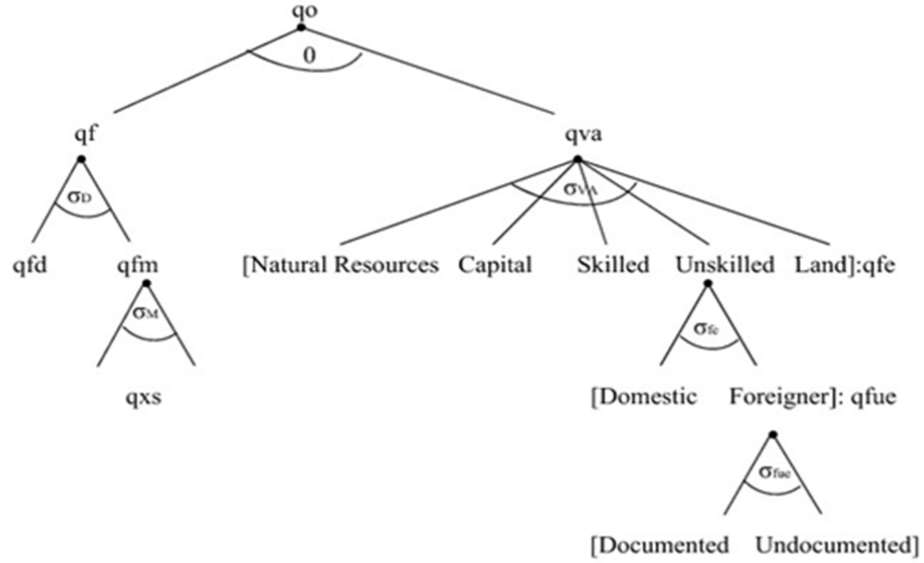
Another implication of this is the ability to track changes in the foreign 'ownership' of the labor and capital. As a result of GMig2, skilled and unskilled labor can move, either endogenously – as a result of changes in real wages between your home country and the potential host economy – or exogenously, between regions. A country's total labor supply by skill is therefore made up of domestic residents and foreign migrants by region/country. Bilateral migration from Parsons et al. (2007) is available, allowing foreign labor to be tracked bilaterally.

Firms demand value added, including skilled and unskilled labor; and then between domestic and foreign and finally, in the case of unskilled labor, between authorized and unauthorized workers (Figure 2). Foreign and domestic workers of the same skill type are imperfect substitutes, but there is no distinction between foreign workers by region, that is, firms demand foreign workers without regard of their country of origin (Aguiar 2009).

⁶ Chapter 4 in Ianchovichina and Walmsley (2012) presents an overview of the Dynamic GTAP Data Base.

⁷ The GMig2 data base, outlined in Walmsley, Winters, and Ahmed (2007), is a combination of the bilateral migration data base by Parsons et al. (2011), the GTAP 7 Data Base documented in Narayanan and Walmsley (2008) and other data related to the global labor markets, including remittance data obtained from Ratha (2004), participation rates from the ILO LABORSTA database website (ILO 2006), skill splits from LABORSTA and Docquier and Markouk (2005), and wage rates from Freeman and Oostendorp (2005).

Figure 2: Structure of Firm Demand for Value Added and Intermediates



The inclusion of the GDyn model (Ianchovichina and McDougall 2012) into the dynamic migration model, GMig2Dyn, makes the model recursive dynamic and ensures that capital accumulates over time. Investment in a region is modeled using a disequilibrium approach, assuming an adaptive expectations mechanism that permits errors in expectations. Over time, these 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 steady state growth (Ianchovichina and McDougall 2012). Investment then adds to capital stocks located in the region each period.

The ownership of accumulated capital is determined using an entropy theoretic approach. Unlike migration, data on the bilateral ownership of capital is unavailable and hence we introduce a global trust to track foreign ownership by a region and located in a region. The entropy theoretic approach determines the ownership allocation of capital and regional wealth across domestic and foreigners while keeping the ownership shares constant given changes in capital and wealth.

Finally, the GTAP Data Base includes taxes on capital, and skilled and unskilled labor, which needs to be divided by owner. Domestic and foreign documented workers are assumed to pay taxes at the same rate, while undocumented workers do not pay tax. Taxes are also assumed to be paid on both domestic and foreign ownership of capital, again at the same rate. In determining changes in real incomes all tax revenues are assumed to add to the incomes of domestic residents, not immigrants and nothing is done to separate government expenditure into services provided to domestic and foreign residents.⁸

As a recursive dynamic model, the model is usually run in two stages: the baseline, or business as usual, scenario; and the policy scenario. The baseline is used to incorporate information known about the global economy and answers the question: What will the global economy look like without the policy? This baseline can be used to incorporate expected demographic changes that are expected to occur, regardless of the migration policy/ies being examined. The difference between the base case and the policy measures the impact of the

⁸ Some back of the envelop calculations can be made to estimate these impacts (see Aguiar and Walmsley, 2013).

proposed immigration policy changes over time and in the long run. Typically these results will be presented in cumulative differences plotted against time.

In the next section we use this global recursive dynamic model to examine the impact of policies aimed at reducing the numbers of undocumented migrants in the US.

4. The Impact of US Immigration Policies

As mentioned above the recursive dynamic model is usually run in two stages: the baseline, or business as usual, scenario; and the policy scenario.

The Baseline scenario which incorporates changes in the world economy between 2001 and 2020 without any changes to US immigration policy. In this case the number of legal migrants increases by approximately a million people per year, these represent new arrivals and those who adjust their status. According to Passel and Cohn 2008, the inflow of undocumented workers from 2000 to 2004 averaged 800,000 a year but fell to 500,000 a year from 2005 to 2008, and in this paper we assume that the inflow of 500,000 continues overtime. Figure 3 shows the estimated undocumented labor force in the baseline, starting at 6.3 million migrants in 2006 and increasing by 500 thousand each year (Passel, 2008).⁹ We use the macro baseline scenario of the Dynamic GTAP model developed by Walmsley (2006). Walmsley (2006) obtained projections for key macroeconomic variables, such as real GDP, population, and skilled and unskilled labor, which are consistent with the projections from the Global Economic Prospects Data (2006). The baseline consists of annual growth rates between 2001 and 2020.

The population estimates should account for all residents in a country regardless of citizenship or legal status, however, we include migration flows as explained above because it helps us achieve our policy simulation and because it has negligible effect on US population growth forecasts.

Based on the proposals outlined by George Bush in 2004, this paper examines the impact of the following four policy experiments:

Policy 1: Increase border control. Under this policy scenario increased border control is assumed to be effective at reducing the inflow of new undocumented workers by half, to 250 thousand people each year (Figure 3).¹⁰ 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.¹¹

Policy 2: Permanent increase in quota. This scenario assumes that the government raises the annual quotas of legal temporary unskilled workers permitted to enter the US permanently. We assume that the program permits the new entry of 250 thousand unskilled additional documented migrant workers that would otherwise migrate illegally. The increase, in terms of foreign documented workers, is depicted in Figure 4.

Policy 3: Amnesty. This scenario assumes a one-time legalization of all undocumented workers in 2006. This one-off legalization of all undocumented workers provides US firms with the (legal) unskilled labor they require.¹² It is assumed that the amnesty has no repercussions for the future inflow of undocumented workers across the US border; hence undocumented workers continue to enter the US as they did in the baseline, 500 thousand per year. Figure 5 shows the effect of these policies on the number of undocumented migrant

⁹ Passel (2008) estimate of undocumented migrants in the United States is 11.5 million, we assume that the U.S. undocumented work force has the same proportion as the labor force in total U.S. population that is about 55%.

¹⁰ These are more conservative numbers than those reported by The Pew Hispanic Center in: "Modes of Entry for the Unauthorized Migrant Population" (<http://pewhispanic.org/files/factsheets/19.pdf>).

¹¹ Also reflected in Figure 3 by the flatter slope of the policy scenario line.

¹² We assume that newly legalized undocumented workers are unskilled and remain so after legalization.

workers over time. The initial drop in 2006 of undocumented workers to zero is followed by an increase in undocumented workers at the same rate as in the baseline. Figure 6 shows the change in documented workers due to the amnesty.

Both the amnesty and increased quota scenarios provide US firms with much needed unskilled labor; however the amnesty supplies a large number of workers immediately, while the increase in quotas supplies labor only gradually over time. Despite the large increase in the quota, by 250 thousand new workers, the number of documented workers never rises to the same level as under the Amnesty scenario.

Policy 4: All policies considered. In the final 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 US each year. The effect of this set of policies on the undocumented labor force in the United States is the combination of Figures 3 and 5. The stock of undocumented workers is legalized, reducing the number of undocumented workers to zero and having a lower growing rate due to increased border control. The effect on foreign documented workers is reflected by the combination of Figures 4 and 6. There is a parallel shift in the number of foreign legal workers due to the one-time legalization of undocumented workers and increasing growth in the number of foreign legal workers, relative to the baseline, due to the foreign worker quota increase.

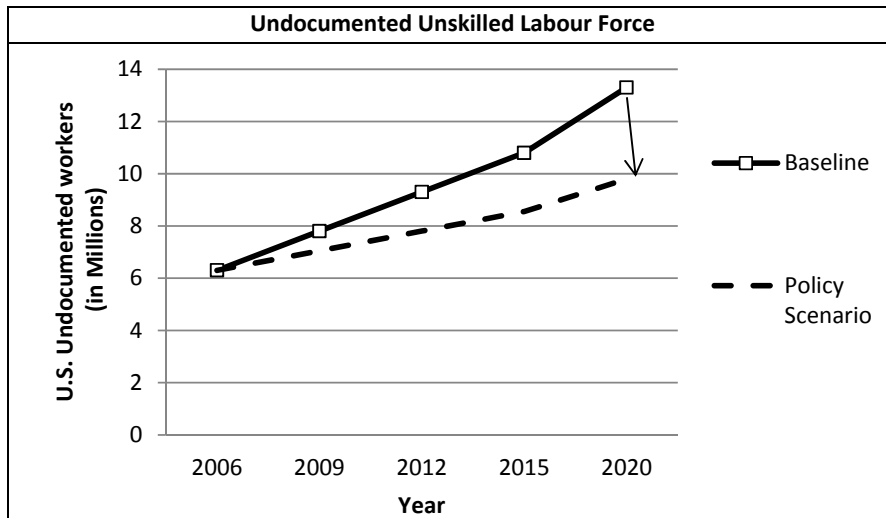


Figure 3. Increased Border Control effect on US Undocumented Workers

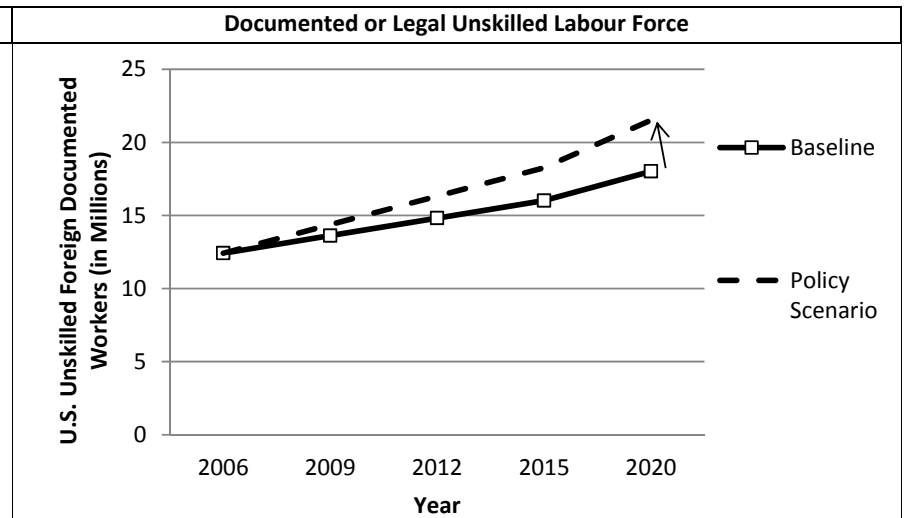


Figure 4. Increased Quota on Unskilled Foreign Documented Workers

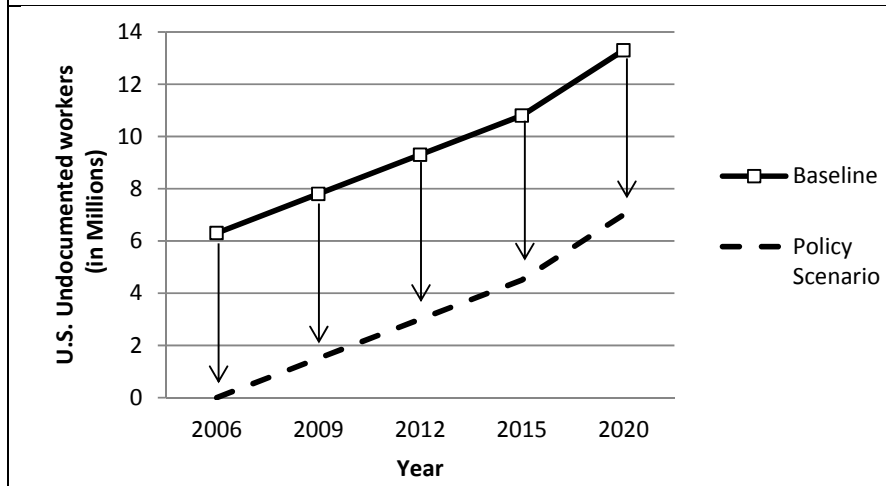


Figure 5. Amnesty Effect on U.S. Undocumented Workers

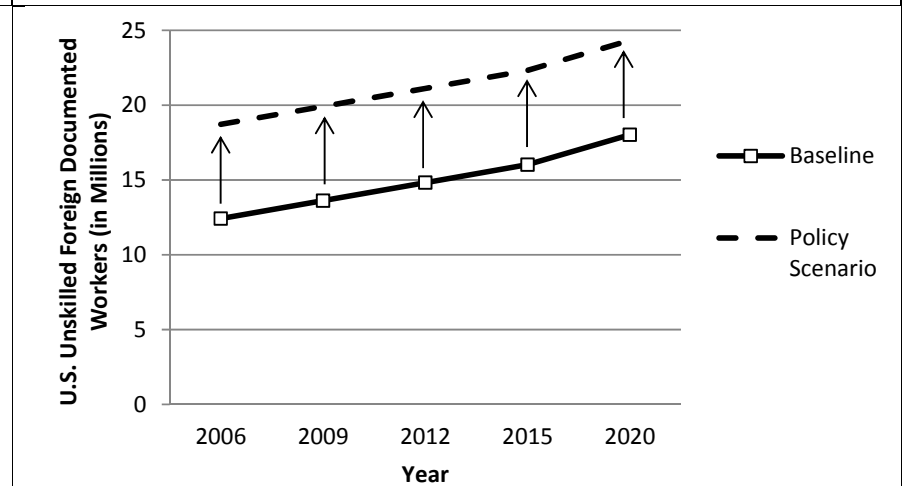


Figure 6. Amnesty Effect on U.S. Foreign Documented Workers

5. Results and Implications

In this section, we examine the impact of the four policy scenarios on the US, beginning with Real GDP. Increased border control causes real GDP in the US to grow at a slower pace than in the baseline (Figure 7). By 2020, US real GDP is 0.6% or \$140 billion less than it would have been had the border remained porous.

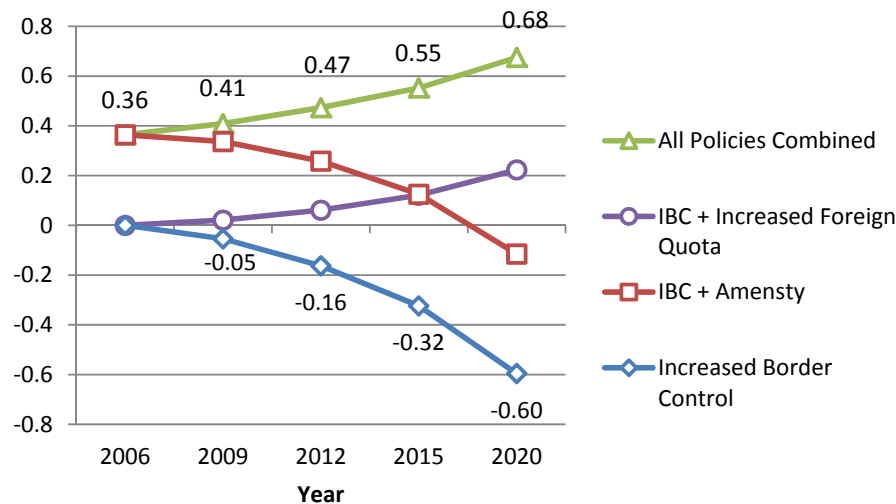


Figure 7. Cumulative percentage deviation from base case of US GDP in response to prospective US Immigration Policies

Pairing border control with a permanent increase in the annual quota on unskilled foreign workers raises the number of workers available to US firms gradually and hence raises US real GDP gradually over the entire period. Pairing border control with a one-off amnesty, on the other hand, causes real GDP in the US to fall by 2020. The amnesty does not alter the number of workers available to US firms it simply increases the productivity of undocumented workers and allows them to move between sectors more easily than they could as undocumented workers, resulting in further efficiency gains. The amnesty therefore causes an immediate increase in US real GDP (Figure 7), however over time the positive effect of the amnesty program gradually diminishes and by 2020 this positive effect is dominated by the effects of increased border control.

The most proactive policy scenario for the US is to embark on a combination of all three policies, providing an amnesty to most of the undocumented workers present in 2006, restricting the new entry of undocumented workers, and creating a worker program to admit more unskilled foreign workers to meet future needs. This results in a 0.67% GDP increase by 2020.

Table 1 presents the effect of these US immigration policies on selected variables for the US. 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. Investment falls with respect to the base case, which would also lead to lower capital stocks over time and economic growth.

Table 1. Cumulative percentage differences in selected US variables in 2020

	Increased Border Control	IBC + Amnesty	IBC + Increased Foreign Quota	All Policies Combined
Investment	-1.34	0.51	1.65	0.82
Capital Accumulation	-0.46	0.37	0.55	0.46
Real Wages for:				
Domestic Skilled	-0.45	0.32	0.58	0.45
Domestic Unskilled	0.11	-0.15	-0.31	-0.35
Foreign Documented Skilled	-0.45	0.38	0.58	0.51
Foreign Documented Unskilled	1.58	-3.93	-2.91	-5.26
Foreign Undocumented Unskilled	3.92	-0.14	-1.43	2.35
Terms of Trade	0.09	-0.12	-0.11	-0.14
Real Exports	-0.20	0.54	0.29	0.63
Real Imports	-0.58	0.18	0.70	0.30
Change in Trade Balance (\$U.S. million)	8,161	5,643	-9,327	4,477

Source: Authors' computation.

In response to the increase in border protection, US firms adjust their input structure by substituting undocumented workers for domestic and foreign legal unskilled workers. Since the number of undocumented workers grows at slower rate, the remaining undocumented workers receive higher wages (an increase of approximately \$100/year by 2020). Similarly, the wages of other unskilled workers (domestic and foreign documented) also increase by \$36/year and \$10/year respectively.¹³

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 vanishes due to the entry of new undocumented workers each year. Table 1 shows that the cumulative effect by 2020 is smaller than in the base case due to the increase in border security, in spite of original large scale legalization.

The one-time legalization boosts the US economy in 2006 because with additional labor at lower costs, US firms demand more of the other endowments. The additional demand increases the rental rate of capital which attract more investment flows in 2006 and 2009 periods but after that the flows start slowing down. This results in capital stock increasing and being higher than in the base case and border control only, 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.

In contrast, when the US increases the quota of foreign unskilled workers and border control, US firms are able to hire the new unskilled foreign documented. The decrease in supply of unskilled foreign undocumented workers increases their real wage, albeit the

¹³ If the wage differentials appear small, keep in mind that the total US labor force is approximately 155 million people, then the undocumented labor force only represents 4%. By 2020, in the policy scenarios that are considered, this share ranges between 1.5% and 6.5%.

increase is less than in the border control case (\$60/year as opposed to \$100/year) only since demand for goods (real GDP) is now higher. The real wage of unskilled foreign documented workers decreases by an average \$80/year with respect to the base case. Demand for capital now rises with the increase in real GDP.

When combined, the increased border control, amnesty, and increased foreign unskilled quota causes the wages of domestic unskilled workers and foreign documented workers to fall, with foreigners experiencing the greatest losses of all. On the winning side we estimate that all skilled workers gain. The big winners are those who have been legalized because in spite of the wages for foreign documented workers being lower than before, they are still higher than the undocumented wages.

Increased border control results in an increase in the trade balance. This is due to the fall in investment: as a result imports and exports fall. When amnesty is also considered, the supply of documented workers increases substantially (in 2006) and remittances-out rise causing the trade balance to become larger. Real exchange rate effects will then allow exports to rise. Combining border control with an increase in the unskilled foreign documented quota results in a reduction of the trade balance due to a rise in investment. Finally, when all three policies are implemented, higher investment causes the trade balance to decline, imports rise with incomes and hence US exports must increase.

5.1 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.

Table 2. GDP Cumulative Difference in 2020

	Increased Border Control (IBC)	IBC + Amnesty	IBC + Unskilled Foreign Quota	All Policies Combined
United States	-0.60	-0.12	0.22	0.67
Canada	0.04	0.04	0.00	0.00
Mexico	0.83	0.86	0.00	0.03
China	0.03	0.00	-0.01	-0.04
India	0.04	0.00	-0.01	-0.05
Other Latin America	0.20	0.19	-0.01	-0.02
Other OECD	0.05	0.02	-0.01	-0.04
Other Asia Pacific	0.04	0.02	-0.01	-0.03
Rest of the World	0.05	0.00	-0.02	-0.06

Source: Authors' computation.

Note: Results are cumulative percentage change.

Overall, the effect of the prospective US immigration policies on the Mexican GDP is positive when compared to the baseline, see Figure 8. In the baseline, the majority of the incoming undocumented workers are from Mexico. By increasing US border control, fewer 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. If we assume unemployment in Mexico, wages would be fixed and our model predictions on GDP would be the least.

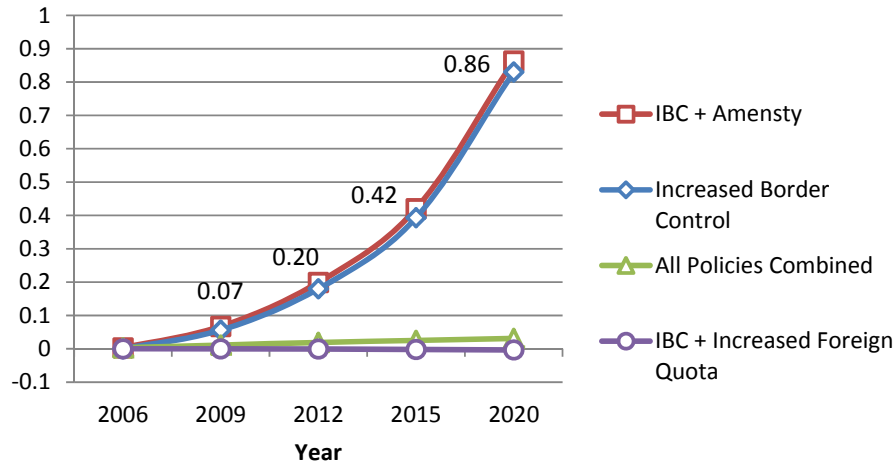


Figure 8. Mexican GDP Growth Response to Prospective US Immigration Policies

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 8, 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 US. 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.

Table 3. Remittances Cumulative Differences in 2020

	Increased Border Control (IBC)	IBC + Amnesty	IBC + Unskilled Foreign Quota	All Policies Combined
Canada	-0.37	-0.98	-0.24	-0.74
Mexico	-7.38	0.11	3.46	10.37
China	-1.27	-1.17	0.18	0.33
India	-1.87	-0.53	0.8	2.03
Other Latin America	-3.71	-1.17	1.43	3.80
Other OECD	-0.59	-1.16	-0.21	-0.66
Other Asia Pacific	-1.52	-1.07	0.37	0.82
Rest of the World	-3.37	-0.96	1.50	3.68

Source: Authors' computation.

Note: Results are cumulative percentage change.

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 because the newly legalized receive higher wages once they can legally work in the US; overtime, however, the labor force growth decreases their wages and with it remittances growth slows over time. In addition, the remittances that other countries with a large number of foreign documented workers receive from the US decrease because the legalization makes these workers 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. First, the number of foreign workers increases and by legally entering the United States, migrant workers earn higher wages, which result in an increase in 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.

6. 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.

Timing is important when examining the impact of migration policies. In a static framework, we would argue that the one-time legalization would be the best alternative. Because we are using a dynamic model, we demonstrate that although the amnesty proposal delivers a very large one-off shock to the productivity and mobility of labor, the US would be better off expanding the visa program which gradually increases labor force over time.

Moreover, our model shows that the availability of the labor endowment, excess or shortage, in this case undocumented workers, has an effect on its own price (wage) and that of other factors of production such capital and other labor types considered in the model (skilled or unskilled, domestic or foreign by country of origin, given by our bilateral migration data). Consequently, through its effect on the price of capital this would affect investment levels, capital accumulation, and economic growth. These linkages highlight the importance of the model as it provides economists and policy makers an analytical tool to examine the long run implications of immigration policy change on the home and host countries.

References

- Aguiar, A.H. 2009. "Analysis of U.S. Immigration Policy Reform." PhD dissertation, Purdue University, West Lafayette, Indiana.
- Aguiar, A.H. and T. Walmsley. 2013. "Deport or legalize? An Economic Analysis of US Immigration Reform" GTAP Working Paper No. 74, Purdue University, West Lafayette, Indiana.
https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=4257
- Borjas, G.J., and M. Tienda. 1993. "The Employment and Wages of Legalized Immigrants." *International Migration Review* 27:712–747.
- Dixon, P. B., Johnson, M. and Rimmer, M. T. 2011. Economy-Wide Effects Of Reducing Illegal Immigrants In U.S. Employment. *Contemporary Economic Policy*, 29: 14–30.
- Docquier, F., and A. Markouk. 2005. "International migration by educational attainment (1990-2000) - Release 1.1, F." In C. Özden and M. Schiff, eds. *International Migration, Remittances and Development*. Palgrave Macmillan: New York, chap. 5, pp. 151–199.
- Dwoskin, Elizabeth (2011, November 09). Why Americans Won't Do Dirty Jobs. *Bloomberg BusinessWeek*. Retrieved November 25, 2011, from <http://www.businessweek.com/magazine/why-americans-wont-do-dirty-jobs-11092011.html>
- Freeman, R.B., and R.H. Oostendorp. 2005. "Occupational Wages Around the World Database." Working paper, National Bureau of Economic Research, September.
- Hertel, T. 1997. *Global Trade Analysis: Modeling and Applications*. Cambridge: Cambridge University Press.
- Hertel, T., and M. Tsigas. 1997. "Structure of GTAP" In T. W. Hertel (ed.), *Global Trade Analysis: Modeling and Applications*. Cambridge University Press, chap. 2, pp. 13–73.
- Ianchovichina, E., and R. McDougall. 2012. "Theoretical Structure of Dynamic GTAP." In E. Ianchovichina and T. Walmsley (eds.), *Dynamic Modeling and Applications for Global Economic Analysis*. Cambridge University Press, chap. 2, pp. 13–70.
- Ianchovichina, E., and T. Walmsley. 2012. *Dynamic Modeling and Applications for Global Economic Analysis*. Cambridge University Press.
- ILO. 2006. "International Labour Organization website, LABORSTA." <http://www.ilo.org/public/english/bureau/stat/portal/online.htm>, Retrieved on July 23, 2006.
- IOM. 2008. "International Organization for Migration. World Migration Report 2008: Managing Labour Mobility in the Evolving Global Economy."
- Jordan, M., V. Bauerlein, A. Carrns, M. Jordan, V. Bauerlein, and A. Carrns. 2007. "Bank of America Casts Wider Net For Hispanics."
- Narayanan, Badri and Terrie L. Walmsley, Editors. 2008. *Global Trade, Assistance, and Production: The GTAP 7 Data Base*, Center for Global Trade Analysis, Purdue University.
- Parsons, C., R. Skeldon, A. Winters, and T.L. Walmsley. 2007. "Quantifying International Migration: A Database of Bilateral Migrant Stocks." In C. Özden and M. Schiff, eds. *International Migration, Economic Development, and Policy*. Palgrave and World Bank, chap. 1, pp. 17–58.
- Passel, J.S. 2006. "The Size and Characteristics of the Unauthorized Migrant Population in the U.S. Estimates Based on the March 2005 Current Population Survey."
- Passel, J.S. and D'Vera Cohn. 2008. "Trends in Unauthorized Immigration: Undocumented inflow now trails legal inflow."
- Pew Hispanic Center. 2006. "Modes of Entry for the Unauthorized Migrant Population". Retrieved February 2, 2009 from <http://pewhispanic.org/files/factsheets/19.pdf>

- Ratha, D. 2004. Understanding the Importance of Remittances. World Bank, Washington, DC.
- Shi, Q., and R. Tyers. 2005. "Global Demographic Change and Economic Performance: Applications of an Augmented GTAP-Dynamic." Working paper, Center for Global Trade Analysis.
- Simpson, C. 2009. "Obama Hones Immigration Policy."
- USOIS. 2006. "US Office of Immigration Statistics website. Yearbook: various years." <http://uscis.gov/graphics/shared/statistics/index.htm>, Retrieved on March 1 2006.
- Walmsley, T. L. 2006. "A Baseline Scenario for the Dynamic GTAP model." Purdue University. www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2204
- Walmsley, T.L., A. Winters, and S.A. Ahmed. 2007. "Measuring the Impact of the Movement of Labor Using a Model of Bilateral Migration Flows." GTAP Technical Paper No. 28, Center for Global Trade Analysis, Purdue University, IN, USA.
- World Bank. 2006. Global Economic Prospects: Economic Implications of Remittances and Migration. Washington, DC.
- United Nations, Department of Economic and Social Affairs, Population Division. [2012]. United Nations Global Migration Database v0.3.6. New York: United Nations. <http://esa.un.org/unmigration>