Immigration Reform and Fiscal Policy *

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November 9, 2018

Abstract

Adjustments to U.S. immigration policy have the potential to reshape the demographic and skill composition of the U.S., both today and in the future. Shifts in demographics and skill composition will lead to changes in wages and ultimately net tax receipts. I quantify such shifts and calculate the potential welfare changes and fiscal consequences of different immigration policies. To do this I use a calibrated OLG model with heterogeneity in skills, the intergenerational transmission of their skills as well as fertility rates and the labor market outcomes of children by parents' country of origin. I find that moving to a merit-based immigration system can be be welfare improving for U.S. workers both with and without a college education. This is a result which is driven in part by the positive fiscal externalities generated by skilled immigrants. In addition, I show that children of immigrants are quantitatively important when considering policy changes, as is the intergenerational transmission of skills. Finally, I show that if recent changes in the composition of immigrant arrivals continues it can alleviate the predicted pressures on public finances as a result of an aging U.S. population.

*I am grateful to Loukas Karabarbounis, Ellen McGrattan and Todd Schoellman for their guidance and support throughout this project. I also thank Marcos Dinerstein, Keyvan Eslami, Carlos Esquivel, Kyle Herken- hoff, Fausto Patiño and participants of the Quantitative Macro Workshop at the Uni- versity of Minnesota for their helpful comments. All mistakes are my own.

1 Introduction

The focus of immigration reform has been on the skill composition of the immigrants allowed to come live and work in the United States. Apart from working, immigrants pay taxes, receive benefits and form families. There is a large body of literature showing a correlation between the labor market outcomes of parents and children. This implies that the future benefits of an immigration policy which alters the skill composition of immigrants today can potentially be amplified through the children of these newly-formed families. This paper will quantify both the effect on wages and public finances as a result of changes to immigration policy. I contribute to this literature taking into account not only the composition of the immigrants that come, but also of future generations incorporating intergenerational transmission of skills.

Current U.S. immigration policy allows for approximately 700,000 working age immigrants to come to live and work in the U.S. annually. Close to 70% are admitted on the grounds that family members are already resident in the U.S. This immigration policy is indeed designed to have familial ties at the heart of it, unlike those in countries such as Canada or the U.K, which place greater weight on education, language ability and prior experience. This has led many policy makers to consider the potential benefits for the U.S. of moving to a similar system.

Any change to U.S. immigration policy has the potential to change both the demographics and the skill composition of the labor force. These changes have implications for labor markets through wages and for public finances through net tax revenues. Policy changes will not only have effects today, but in the future through the outcomes of immigrants' children.

In this paper I will establish like others such as Card et al. (2000) that the children of immigrants attain higher levels of education, and earn more. I also show that second generation immigrants pay more in taxes and receive less in benefits than their counterparts with U.S. born parents. In addition I will present evidence that these observations vary by the parental country of origin; I will also establish that the profile of recent immigrant arrivals differs from arrivals in the 1980s and 1990s, in terms of both educational attainment and country of origin and that this can affect public finances. In addition, this change is significant given that the prominent papers that explore the relationship between immigration and fiscal policy by Storesletten (2000) and Lee and Miller (2000) use data from the 1980 and 1990 immigrant waves to parameterize their models.

The facts relating to the changing profile of immigrants and the outcomes of their children leads to the following questions: Can changing to a Canadian or UK style policy based up on educational attainment and skills lead to welfare gains for the U.S.-born population? How do the outcomes of immigrant children affect these results? Finally, how will changing immigrant profiles interact with public finances when considering the aging of the U.S. population?

To address these question I build a general equilibrium overlapping generations model which incorporates heterogeneity in the agent's fertility by country of origin and education as well as heterogeneity in the education of their children. In addition I also consider the fact that skills are passed down through generations. This model and its general equilibrium properties allow me to assess fully how the design of immigration policy affects wages, which in turn affects tax revenues and benefit receipts. This framework gives me the flexibility to run a number of policy counterfactuals, allowing me to change immigration policy design according to educational attainment and by number of immigrants admitted.

Using this model I find that moving to a immigration policy in which potential immigrants with greater skills are given priority can be welfare improving for both workers with and without a college education. Further, I show that the design of fiscal policy has an affect on the size of the welfare gains. The U.S. population with U.S. born parents without a college education experience lifetime welfare gains of 1.0% while their skilled counterparts experience lifetime welfare gains of 0.2%. These welfare changes come from two forces: wage effects and fiscal externalities. As the labor force becomes more skilled through the addition of more skilled immigrant workers, the wages of similarly skilled workers decrease. With complimentarities in the production function between different labor types, wages of less skilled workers increase. Increased wages for less skilled workers combined with additional skilled workers paying taxes leads to an increase in overall tax receipts. This generates positive fiscal externalities for both types of workers. These positive fiscal externalities outweigh the loss in wages for skilled workers, resulting in net welfare gains.

In contrast to Storesletten (2000) I find that the children of immigrants help the solvency of public finances rather than hinder it. Further, I find that including the intergenerational transmission of skills from immigrant parents to immigrant children is quantitatively important to the results of any immigration policy analysis.

Finally I find that the changing profile of immigrants is important when considering the long term effects of immigration on public finances. Given the forecasts for the decrease in the worker retiree ratio, I find that in order to make the government budget balance, social security transfers would have to decrease by 19% given previous patterns of immigration. However, if we consider the change to the composition of immigration arrivals, transfers would only need to decrease 14%.

The paper is structured as follows section 2 will review the literature, section 3 will present motivating data, section 4 will present the model, section 5 discusses the parameterization of the model, section 6 evaluates different policy counterfactuals, section 7 concludes the paper.

2 Literature Review

This paper considers the effects of different immigration policy design on wages in the U.S. as well as the welfare and fiscal effects of any policy changes. This paper is most closely related to the literature on the effects of immigration on government finances and on immigration policy and the labor market outcomes of immigrants and their descendants.

A number of papers estimate the effect on wages of previous waves of migration to the U.S. Borjas (2003) finds that immigrants during the 1990s have decreased the wages of low-educated U.S. natives by a maximum of 9%. By considering immigrants and natives as imperfect substitutes, Ottaviano and Peri (2012), find that immigration between 1990 and 2006 actually had an effect on wages between -2.2% and +1.7%, depending on the nesting structure and parameterization of the model. Another related approach has been to consider the tasks that immigrants perform when working. Schoellman (2010) considers an occupation as a set of skills, for example cognitive, manual or interpersonal and he differentiates occupations by how extensively each occupation uses each skill. Using the aforementioned framework, he estimates the skills of immigrants from different countries by observing which occupations they choose. With this model, Schoellman (2010) finds that immigration to the U.S. decreases wages of U.S. native workers by at most 5% and that the effect varies largely by occupation. This paper furthers the contributions of those papers, not only by analyzing the effect of past immigration policy on wages, but also the effect on lifetime welfare and fiscal contributions of immigrants.

Calculating the fiscal contribution of immigrants has been done most notably by Lee and Miller (2000) and Storesletten (2000). The former takes public use microdata from the 1994 CPS (Current Population Survey) to build up a profile of taxes paid and benefits received, over the lifecycle for immigrants and natives. Lee and Miller (2000) then use these profiles while making assumptions related to productivity, discount rates, health spending and immigrants' fertility, to calculate the net present value of an immigrant, i.e. the present value of net tax revenues from an immigrant. While this approach provides an informative analysis of the fiscal contributions of immigrants, it misses any general equilibrium effects if immigration were increased a substantial amount. Further, their results mask a great deal of heterogeneity of outcomes by educational attainment, as established later in this paper and in Orrenius (2017).

Storesletten (2000) addresses the partial equilibrium nature of Lee and Miller (2000) by using an overlapping generations model in the style of Auerbach et al. (1987), allowing immigrants' fertility to differ by education and country of origin. Storesletten's paper is the closest to this one. The central aim of Storesletten (2000) is to find which immigration policies will balance the U.S. government budget. Storesletten (2000) has two main findings, first the policy with the lowest number of college educated immigrants that will bal-

ance the budget is 1.5 million, assuming they arrive between the ages of of 41 and 45 i.e. those unlikely to have children. This number would have implied an 11 fold increase in arrivals (compared with 1990). The second is that children of immigrants largely erase any benefits to the government budget balance that their parents provided. The negative impact of children comes from the fact that Storesletten (2000) assumes that there is no correlation between the skills of immigrants and their children. Storesletten does not consider heterogenity in U.S. born workers and when calibrating, Storesletten finds that they are a burden on public finances. Given that the children of immigrants are not separated from other U.S. born workers this drives the negative findings of his paper.

This paper builds upon the approach taken by Storesletten (2000) by incorporating heterogeneity in immigrants in both fertility, education and country of origin and also considering heterogeneity in the skills of children of immigrants. However, this paper will focus as well on the question of whether any immigration policy is welfare-improving to different groups of U.S. natives.

The fertility of immigrants is a key component of the interaction between immigration policy, demographics and therefore public finances. Council et al. (1997) find an average fertility rate of 2.7 children per female immigrant compared to 2.0 for a native. Using data from the 1970 and 1980s U.S. Censuses, Blau finds that immigrants have higher fertility rates than natives. However, after controlling for age and rates of marriage, immigrant and native fertility rates are similar. Storesletten (2000) uses the 1980 and 1990 Censuses to estimate the fertility rate of immigrants. Storesletten (2000) finds that for those with high school or less the fertility rate is close to 3.4 children per woman and for those with college is closer to 1.8 per woman; this compares to 2.25 for the U.S. native in the same time period. More recently Swicegood et al. (2006) use data from the 2004 American Communities Survey and find that fertility, varies widely by country of origin, with immigrants from Nigeria having 3.1 children compared to Japanese immigrants who have 1.5. This paper performs a similar analysis using the 2015 American Communities Survey 5 year sample and finds that it is not only the country of origin that matters for fertility, but also education. In relation to the fertility of second generation immigrants, Fernandez and Fogli (2009) find a positive correlation between the average fertility of the parent's country and the second generation immigrants' fertility. This implies that those with immigrant parents continue to have more children than their counterparts with U.S. born parents.

While immigrants having more children is a facet of the interaction between immigration and fiscal policy, we must also consider the varying outcomes of the second generation immigrants. One of the most comprehensive analyses of second generation immigrants is by Card et al. (2000) who uses synthetic cohort methods to look at the levels of education and earnings of immigrants and their children by country of origin between 1940 and 1999. Card et al. (2000) finds that immigrant children tend to be better educated and earn more than their parents, the exception being those from wealthier countries such as the U.K. and Germany.

He also finds that on average immigrant children tend to out-earn and be better educated than children with two U.S. parents. Borjas (2006) uses the same method as Card et al. (2000) using updated data from the 2002-2004 CPS and comes to a similar conclusion. He does however, note that the gap between first and second generation immigrants in terms of earnings and educational attainment has been falling over time.

This paper explores the consequences of continuing the current U.S. immigration system, which is based largely around family preferences. Many of the aforementioned papers are based upon immigration patterns from the 1990s. However, the profile of immigration during the past 20 years has changed, as documented primarily by Borjas (2015) who finds that immigrants who come to the U.S. today are older and better educated than the immigrants of the 1980s and 1990s. Further, the source countries of immigrants have changed; while immigration in the 1980s and 1990s was largely from Central and South America, more recently a greater number of Chinese and Indian immigrants have arrived as documented by the Department of Homeland Security (2016). Given that Lagakos et al. (2018) establish that the returns to experience are highly heterogeneous for immigrants from different countries, this will be important to consider when changing immigration policy as it relates to taxes paid and benefits received.

3 Data

3.1 Country of Origin

Given that labor market outcomes and fertility rates are heterogeneous by country of origin, I will categorize country of origin into three categories: low-income, middle-income and high income. I reconcile this categorization with the World Bank definition by first combining the low income and lower middle income into one group and redefining the upper middle income as middle income. This implies that an immigrant from a "low income" country is one who comes from a country with a GNI (Gross National Income) of less than $4,035, "high income" as any country with a GNI above $12,476 and 'middle income' as any country with a GNI in between. In this paper, I define country of origin separately from source country. Source country refers to the exact country from which an immigrant or their parents came from. This distinction will be used when calculating fertility rates as well as comparing earnings and educational attainment between generations.

3.2 Fertility

Given that the amount of government transfers received and taxes paid differ over various points in the life cycle, any changes in demographics can alter public finances. Therefore, when exploring the interaction between immigration policy design and public finances, it is is necessary to consider the changes any immi-

gration policy may have on the average fertility of the immigrants affected and therefore demographics. It is well established that immigrants are a highly selected group. As such, we cannot just simply use the fertility rate of an immigrant's home country to approximate the fertility rate of an immigrantonce in the U.S..[1]. To analyze immigrant and native fertility, I calculate the TFR (Total Fertility Rate) for each immigrant's country of origin, that is, the number of children a woman can expect to have if she lives to the age of 45. To obtain the TFR, I first calculate source country-age-specific fertility rates, that is the number of children born to immigrant women from a specific source country. I then divide the births by the number of women in that age group, using five year age bins. To disaggregate by educational attainment, I separate observations into college or more and less than college. This gives a dataset of individual source country age-specific total fertility rates by educational attainment.

To check whether the fertility of immigrants from different regions to the U.S. is different from the U.S. average, I use the resulting dataset described above and the following regression:

$$TFR_{i,e} = \beta_0 + \sum \beta_{g,e} \times origin_{i,g} \times education_{i,e} + \epsilon_{i,e}$$

where $origin_{i,g}$ is a dummy for a country's income category and $education_{i,e}$ is a dummy for college or more and less than college. Table 1 displays the results of this regression. From Table 1 it is evident that immigrants with less than a college education have more children than their U.S. born counterparts. Further, immigrants from low income countries with a college education have more children than their U.S. born counterparts. This will be important when considering how immigration policy design will affect overall U.S. fertility, given that immigrants from low income countries now account for 40% of all college graduate arrivals to the U.S. Interestingly, immigrants with a college education from middle income countries have children at nearly half the rate of their less than college counterparts. A less surprising result of this analysis is that immigrants from high income countries have fewer children than other immigrants. Given that the bulk of these immigrants are from the E.U., where fertility is already low relative to other countries, it would be surprising to see a reversal of this after migration.

3.3 The Second Generation

Any change in immigration policy today has the potential to also change the composition of the future labor force through the children of immigrants. To assess how any such policy change will affect the labor force and, in turn, its impact on public finances, I consider how the children of immigrants adapt to a country that is different from their parents'. Clearly, if the children adapted poorly and were limited to low paid

[1]Using IPUMS international data, I find that immigrants to the U.S. tend to have lower fertility than those who remain in their home countries, even after controlling for education

Table 1: Differences in Fertility by Country of Origin and Education

	Less than College	College
Null Hypothesis	H_0: $\beta_0 + \beta_{g,e} = 1.80$	H_0: $\beta_0 + \beta_{g,e} = 1.91$
Low income	2.43**	2.37**
	(0.15)	(0.10)
Middle income	3.04**	1.72*
	(0.1)	(0.09)
High income	1.79	1.69
	(0.26)	(0.14)

Note : * Reject at 5% level, ** Reject at 1% level

work, this would put additional strain on public finances. To perform this analysis, I use data from the CPS Census supplemented by data from the GSS. Like Card et al. (2000) and Schoellman (2010), I show that the children of immigrants are a largely successful group and beneficial to public finances and that the magnitude is dependent on their parent's country of origin.

A second generation immigrant is defined as any child of two immigrant parents [2], whether born abroad or arriving in the U.S. before the age of 16. Currently there exists no large scale dataset that links the labor market outcomes of immigrants and their children. To overcome this problem I follow the literature, using a grouping estimation strategy as in Borjas (1993) to asses the educational and labor market outcomes of parents and children. The estimation strategy is as follows: to measure the educational attainment and labor market outcomes of immigrant parents and of U.S. born parents, I use data from the 5% 1990 U.S. Census. I restrict the sample to fathers with a child under the age of 16 years old. The bound of 16 years old ensures that the immigrant child completes some of their education in the U.S. I then regress educational attainment and log hourly wages on source country and region of residence dummies, age and age squared as shown in 1.

$$y_{i,g} = \beta_0 + \sum_g \beta_g source_i + \sum_r \beta_r region_{i,g} + \beta_1 age_{i,g} + \beta_2 age_{i,g}^2 + \nu_{i,g} \tag{1}$$

With these parameters I can calculate the average schooling and earnings by country of origin at the age of 40. Further, with this sample I create a distribution of weights by age group and region of residence.

[2] I also perform the analysis based on a second generation immigrant as having just one immigrant parent and find little difference.

To measure the educational attainment and earnings outcomes of the second generation of immigrants and those with U.S. born parents, I use the CPS March supplement from 2007-2017 which records where respondents were born and where their parents were born, unlike the larger sample ACS and Census. I restrict the CPS (Current Population Survey) sample to ensure that every respondent was younger than 16 years old in 1990. If there are fewer than 30 observations for any individual parent country I drop all the child observations associated with that source country.

For each respondent in the CPS I attach the mean schooling and hourly earnings based upon the place of birth of their father. For both male and female respondents I regress the educational attainment and hourly earnings on father's birthplace [3] controlling for region, age, age squared and the. When performing each regression I use the age-region of residence weighting distribution created using the 1990 Census. Figures 1, 2 and 3 display the mean predicted of each variable of interest when both the fathers and children are 40 years old, by country of origin.

In Figure 1 if an observation is above the solid line, it implies the child has achieved a greater level of schooling than its parents. If an observation is above the dashed line then it implies that that observation attains on average a higher level of schooling than their counterpart with at least one U.S. born parent. From Figure 1 it is evident that even if the immigrant parents arrive with low levels of schooling, their children tend to attain on average higher levels of schooling.

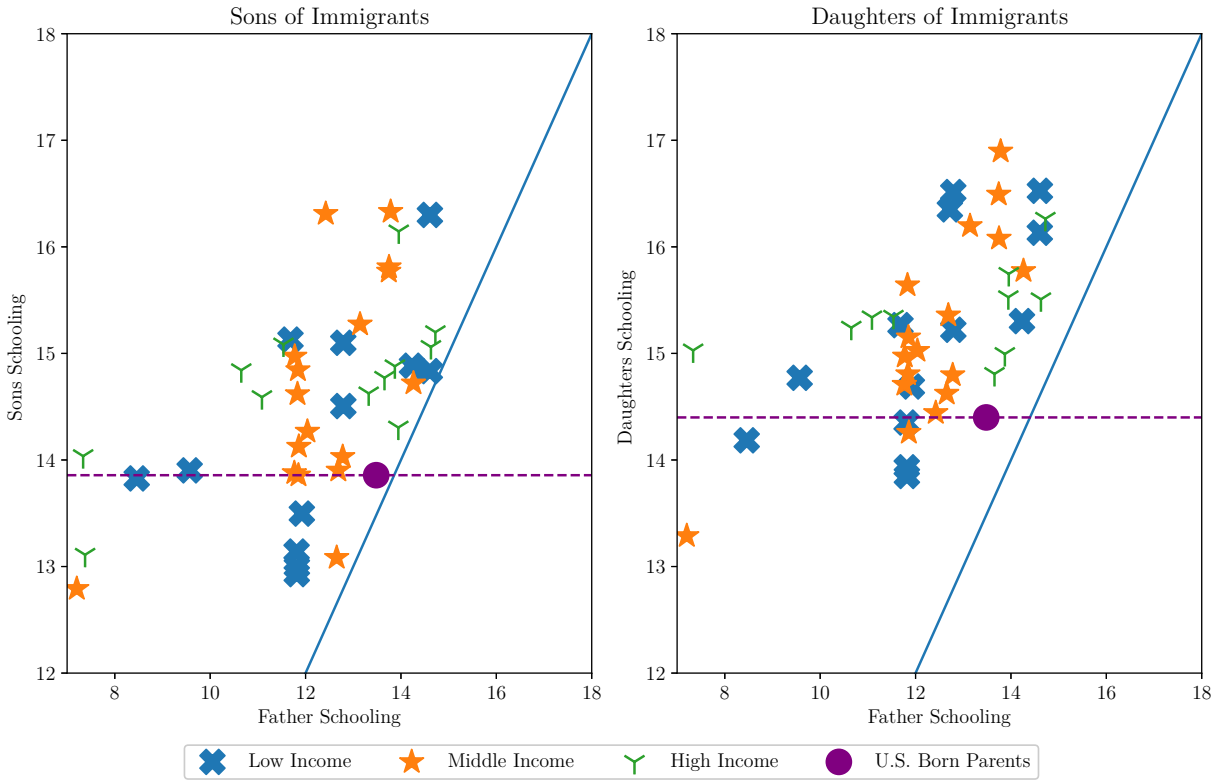
For example, children of Mexican immigrants attain on average 13 years of schooling. This is less than their counterparts with U.S. born parents (13.7 years), but much higher than their parents who obtain just 7 years. Further, it is also evident that the majority of second generation immigrant groups attain higher average levels of schooling than their counterparts with U.S. born parents.

Figure 2 shows the percentage of second generation immigrants and their parents that completed college. On average the second generation of immigrants are attaining a college education at a higher rate than their parents and their counterparts with U.S. born parents. The notable exception is second generation immigrants with parents from middle income countries. While a greater fraction of this group attain a college degree than their parents, it is a lower fraction than their counterparts with U.S. born parents. Further exploration of the data reveals that many immigrants from middle income countries are completing some college, but not all four years, with many completing an associates degree.

Figure 3 establishes that the higher levels of education for children of immigrants does translate into higher hourly earnings, with the majority of second generation groups earning more than their counterparts with U.S. born parents.

[3] I also perform each analysis using data on mother's and find little difference with respect to educational attainment. On average daughters earn close to 5% more than their mothers, the son's earn 20% more.

Figure 1: Years of Schooling of First and Second Generation Immigrants



(a) Child data from the CPS 2007-2017. Parent data from 1990 U.S. Census 5% sample.

(b) Any point above the solid blue line indicates the child has a more years of schooling than the parent.

(c) Any point above the dashed purple line indicates the a child with immigrants parents has more years of schooling than their counterparts with two U.S. born parents.

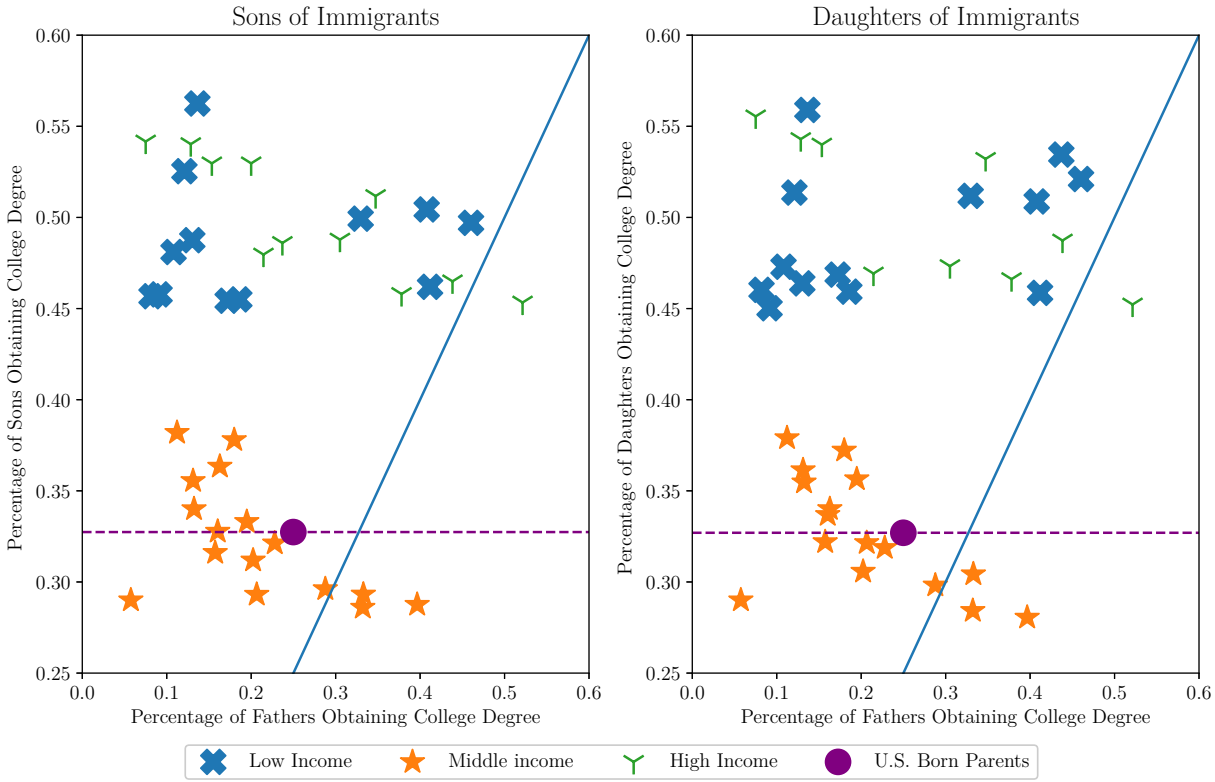
The above analysis presents the mean educational attainment and earnings of immigrant children unconditional on parental education. To supplement the above analysis and provide evidence that conditioning on parents educational achievement is important, I use the GSS (General Social Survey), a bi-annual, nationally representative survey with a focus on social attitudes in the U.S. Important to this analysis, it covers the respondents' educational attainment and country of birth as well as their parent's educational attainment and country of birth.

To calculate the probability of a child going to college conditional on their parent's education, I first merge the responses of each survey between 2000-2016, dropping any respondent under the age of 30 [4]. Merging over years gives a reasonable sample size for the children with immigrant parents [5]. I then split the sample into those whose parents either had, or had not, completed college. To obtain the probabilities of interest, I use a linear probability model with a dummy for whether the child completed college as the dependent

[4]This is done to avoid having respondents who are likely to return to education.

[5]It also assumes that the transmission of education from parents to children did not change in these years.

Figure 2: College Attainment of First and Second Generation Immigrants



(a) Child data from the CPS 2007-2017. Parent data from 1990 U.S. Census 5% sample.

(b) Any point above the solid blue line indicates a greater fraction of the children finished college than the parent.

(c) Any point above the dashed purple line indicates a greater fraction of the children with immigrant parents finished college than their counterparts with two U.S. born parents.

variable. The regressors are dummies for parent's nativity status, age, sex and region in which the child lived at age 16 and family income at age 16.[6] Table 2 displays the mean predicted values of the model with the standard errors.[7] In Table 2 we see that the inter-generational transmission of education for both immigrants and natives is similar. However, it does appear that conditional on their parents having a college education, immigrant children have a higher probability of completing college than those with comparable U.S. parents.

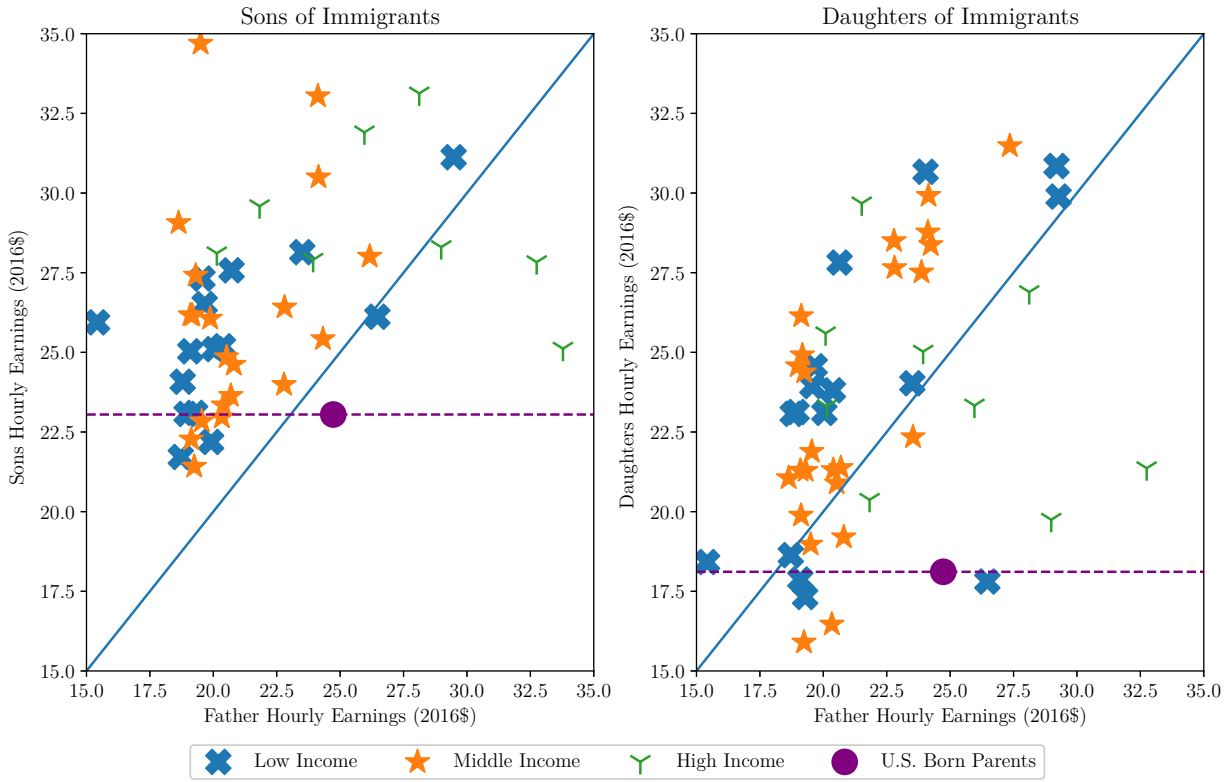
While the GSS does not report the specific country of birth for parents, I can break down the data by using ethnicity of the child as a crude proxy for parent's country of origin (conditional on the child having immigrant parents).[8] This gives the following options for parent's origin: U.S. born, asian-indian, asian-non-indian, hispanic, white and other. I then perform the same exercise that generated Table 2 for each ethnicity.

[6]The family income variable is the child's assessment of their family income aged 16 with 5 options between far below average and far above average

[7]The predicted value is the probability of a child attaining a college degree, therefore the probability of not attaining a college degree is 1 minus this probability

[8]ethnicity to country of origin is not a 1:1 mapping. However, analysis of the top countries of immigrant origin to the U.S. show that in each country has a ethnicity that accounts for at least 80% of the population.

Figure 3: Hourly Earnings



(a) Child data from the CPS 2007-2017. Parent data from 1990 U.S. Census 5% sample

(b) Any point above the solid blue line indicates the child earns more per hour than their parent group

(c) Any point above the dashed purple line indicates the a child with immigrants parents earns more per hour than their counterparts with two U.S. born parents

To map the matrices to the low, middle, high income countries that are defined in 3.1 I do the following. I obtain a population distribution over ethnicity for each country group using the 2007-2017 CPS restricting the sample to second generation immigrants over the age of 30.[9] I then compute an average matrix for each country group using the matrices weighted using the population distribution calculated from the CPS.

From Table 3 it is evident that there are differences in inter-generational transmission of education by an immigrant's country of origin. While the immigrant's transmission of education on average looks nearly identical to natives, when broken down by country of origin we do see starker differences. For those with parents from low income countries, the transmission of college education happens more frequently than for those of middle and even high income countries. This result is driven by the fact that close to 80% of the low income group identify as Asian-Indian or Asian-non-Indian - two groups for which the persistency of completing college between generations is high. It is a result that fits with the 'model minority' narrative of

[9]The one exception is that I classify anyone with two asian-indian parents as asian-indian, since the CPS ethnicity does not distinguish between asian-non indian and asian-indian.

Table 2: Intergenerational Education Transmission Matrices by Parent's Nativity

U.S. Born Parents

Parents \ Children	LC	C
LC	0.77	0.23
	(0.004)	(0.004)
C	0.37	0.63
	(0.009)	(0.009)

Observations: 12,462

Immigrant Parents

Parents \ Children	LC	C
LC	0.76	0.24
	(0.009)	(0.009)
C	0.32	0.68
	(0.02)	(0.02)

Observations: 1,596

(a) Data is from the General Social Survey 2000-2016

(b) LC indicates less than college, C indicates college or more

Table 3: Intergenerational Education Transmission Matrices by Parent's Country of Origin

Low Income

Parents \ Children	LC	C
LC	0.53	0.47
	(0.07)	(0.07)
C	0.15	0.85
	(0.04)	(0.04)

Medium Income

Parents \ Children	LC	C
LC	0.75	0.25
	(0.07)	(0.07)
C	0.44	0.56
	(0.1)	(0.1)

High Income

Parents \ Children	LC	C
LC	0.70	0.30
	(0.01)	(0.01)
C	0.35	0.65
	(0.04)	(0.04)

(a) Data is from the General Social Survey 2000-2016 and CPS 2007-2017.

(b) LC indicates less than college, C indicates college or more.

Wong et al. (1998).

3.4 Fiscal differences

In sections 3.2 and 3.3, I establish that immigrants have on average more children than the current U.S. native population and on average those children outperform natives in terms of earnings. To assess the effects on public finances due to any change in immigration policy, we must also consider how much immigrants receive in benefits. The 1996 Welfare Reform Bill established the principle that immigrants are usually unable to claim any form of government transfers within the first 5 years after arrival in the U.S. There are

exceptions, for example, immigrants themselves are eligible for the ETIC (Earned Income Tax Credit) as well as the CTC (Child Tax Credit). The children of immigrants are also eligible for Medicaid and Children's Health Insurance Program. To assess the use of government transfers by immigrants, I use CPS data from 2011, 2013, 2015. I use the CPS given that it has a wide array of data on government transfer programs and identifies second generation immigrants.

I consider the following transfers: EITC, CTC, workers compensation, supplemental social security, TANF, unemployment, veterans' benefits and foodstamps as well as Medicaid, Medicare and social security. Since 2008 the CPS only contains information on whether a respondent has received Medicare or Medicaid and not the value of the care received, I impute the value of Medicare received using the Annual Centers for Medicare Medicaid Service public use file, which breaks down the average per-capita Medicare expenditures by state. To impute the value of Medicaid, I use the Medicaid actuarial report from 2011, 2013 and 2015, values which are broken down into average per-capita spending on children, adults, disabled and the elderly. I only assign the value of disability-related Medicaid to a respondent if the respondent reports receiving supplemental social security. Further, I divide total government consumption, after subtracting defense and education spending, by the total population and treat that as a cash transfer to respondents. I treat the education spending as a transfer to those between the ages of 4 and 18 who were born in the U.S.

The taxes I consider are federal, state, FICA, property and sales taxes. I set sales tax paid equal to the state tax as in Evans (2017), which finds very little difference between the amounts paid. Each value of taxes and benefits is scaled, so that when aggregating each variable, I match data from 2015 national accounts.

With this dataset I create a lifecycle profile of taxes and benefits received at each age and by country of origin and parent's country of origin. With this lifecycle profile I calculate the ratio of present value of taxes paid to present value of benefits received as illustrated below.

$$\text{Tax to benefit Ratio} = \frac{\sum_j \left(\frac{1}{1+r}\right)^j Taxes_j}{\sum_j \frac{1}{1+r}\Big)^j Benefits_j}$$

I calculate this ratio for children of immigrants assuming they are born tomorrow. When calculating the ratio for immigrants themselves, I assume they arrive tomorrow at the average age of immigrants of their country of origin group. Table 4 presents these results. Further, I assume a discount rate of 3%. If the value in the Table is 1, it would imply that the net present value of taxes is equal to net present values of benefits and therefore increasing the portion of that group would have no effect on aggregate public finances.

From Table 4 it is clear that there are differences in the contributions to public finances, within the cohorts of both first and second generation immigrants and compared to those with two U.S. born parents.

The second generation of immigrants with high school education have a similar tax-benefit ratio compared to those with U.S. born parents at 0.4. The bigger differences become evident with the second generation that completes college. For each of the three categories of second generation immigrants, they have a higher tax benefit ratio than their counterparts with U.S. born parents.

Given that the U.S. does not bear the cost of education for the first generation immigrants, it is not surprising that the tax-benefit ratios are higher for those with a college education. However, the opposite conclusion can be reached for the high school educated first generation. Table 4 gives a snapshot of the contribution of different groups to public finances.

Table 4: Lifetime Tax to Benefit Ratio by Country of Birth and Parent's Country of Birth

	Less than College	College
Two U.S. born parents	0.40	1.22
Second generation		
Low income	0.40	1.67
Middle income	0.33	1.33
High income	0.47	1.44
First generation		
Low income	0.45	2.19
Middle income	0.40	1.83
High income	0.55	2.57

(a) Data is from CPS 2011-2015

(b) Present value of both taxes and benefits is calculated assuming a 3% discount rate

4 Model

I use an overlapping generations model to analyze the fiscal and welfare effects of changing the design of U.S. immigration policy to allow for both more immigrants and different compositions of immigrant populations.

4.1 Agents

Each agent is born with type $h \in \{U, S\}$ either unskilled or skilled and this type remains constant over their lifetime. Each agent has an origin g which is a tuple of the agent's country of birth as well as the agent's parents' country of birth and can take the following values $\{L, M, H, A\}$ either low, middle, high income or the U.S. For all immigrants their parent country will be the same as their country of origin. For children of immigrants their country of origin will be A with parents country of origin differing. I denote age as j and a

corresponding probability of survival between j and $j+1$ is element j of the $J \times 1$ vector of γ^g. Agents have a $J \times 1$ vector of fertility rates $\eta^{h,g}$ and productivity $\epsilon^{h,g}$. If $j < J$, before this age they die with probability $1 - \gamma^g$ as described above. In addition, they choose retirement at age $\chi < J$.

4.2 Population Evolution

The path of population over time will depend upon the fertility rates η, inter generational transmission of skills π from parents to children, survival rates γ and immigration policy ς. At time t for each skill $h \in \{U, S\}$ the following will have their own separate laws of motion.

- $I_{j,t}^{h,g}$: Immigrant population with origin g
- $E_{j,t}^{h,g}$: Population with immigrant parents with origin g
- $N_{j,t}^{h}$: Population with U.S. born parents

Therefore for any age j for an immigrant from country g of skill h

$$I_{j,t}^{h,g} = \underbrace{I_{j,t-1}^{h,g} \times \gamma_j^g}_{\text{Surviving population}} + \underbrace{\varsigma_{j,t}^{h,g}}_{\text{New immigrant arrivals}}$$

The population of age 0 of skill h who have immigrant parents from country g is

$$E_{0,t}^{h,g} = \underbrace{\left(I_t^{U,g} \cdot \eta^{U,g}\right) \times \pi^{U,g}(h|parent = U)}_{\text{Children of skill h born to unskilled parents}} + \underbrace{\left(I_t^{U,g} \cdot \eta^{U,g}\right) \times \pi^{S,g}(h|parent = S)}_{\text{Children of skill h born to skilled parents}}$$

For any $j > 0$

$$E_{j,t}^{h,g} = E_{j-1,t-1}^{h,g} \times \gamma_j^g + \varsigma_{j,t}^{h,g}$$

Finally the population of the U.S. born population with U.S. born parents population of age 0 is

$$\begin{aligned} N_{0,t}^{h} = &\left(\left(\sum_g E_t^{U,g} + N_t^U\right) \cdot \eta^{U,A}\right) \times \pi^{U,A}(h|parent = U) \\ &+\left(\left(\sum_g E_t^{S,g} + N_t^S\right) \cdot \eta^{S,A}\right) \times \pi^{S,A}(h|parent = S) \end{aligned}$$

and therefore for $j > 0$

$$N^h_{j,t} = N^h_{j-1,t-1} \times \gamma^g_j$$

This aggregates together to give the following measure of skill h at age j at time t

$$\psi^h_{j,t} = \begin{bmatrix} I^{h,L}_{j,t} \\ I^{h,M}_{j,t} \\ I^{h,H}_{j,t} \\ E^{h,L}_{j,t} \\ E^{h,M}_{j,t} \\ E^{h,H}_{j,t} \\ N^h_{j,t} \end{bmatrix}$$

In section 4.7 I will use similar notation for hours worked $l^{h,j}_t$, consumption $c^{h,j}_t$ and assets $a^{h,j}_t$

4.3 States

The state vector of the economy can be defined as follows

- t: time period
- $a^{h,j}$ and $\psi^{h,j}$: assets and measure of each agent of age j with type h
- B government debt owned by households
- K aggregate stock of capital

For ease of notation I define $\Lambda_t = (K_t, B_t)$

4.4 Agent's problem

In each period each agent of solves the following recursive problem. Entering the period with savings a, each agent chooses consumption c as well as labor l savings for tomorrow a' and retirement χ.

$$V^{h,g}_j(a, \chi, \Lambda) = \max_{c,l,a',\chi'} u(c, l) + \beta(1 - \gamma^g)V^{h,g}_{j+1}(a, \chi', \Lambda')$$

They choose consumption, labor and savings according to the budget constraint in equation 3. Labor income is dictated by hours worked, productivity and the hourly wage w. Agents incur taxes τ_l on any labor income they earn and receive transfers according to the transfer function $T^h(\chi)$ which is dependent on the agent's type, age and retirement status.

If an agent chooses retirement I they can no longer work and simply receive income from transfers and their savings. In addition, agents pay a tax on consumption τ_c and agents receive a return $R(1-\tau_k)$ on their savings and bequests from those in their generation who die that period.

$$c(1+\tau_c) + (1-\gamma_j^g)a \leq wl\epsilon^{h,g}(1-\tau_l) + T_j^{h,g}(\chi) + (1+R(1-\tau_k))a \tag{2}$$

$$\tag{3}$$

$$\Lambda' = F(\Lambda) \tag{4}$$

4.5 Firms

Firms maximize profits and choose capital K, unskilled labor L^U and skilled labor L^S and solve the following[10]

$$\max_{K,L^U,L^S} Y - w^U L^U - w^S L^S - rK \tag{6}$$

$$Y_t = AK^\theta \left(\lambda L^{U\rho} + (1-\lambda) L^{S\rho}\right)^{\frac{1-\theta}{\rho}} \tag{7}$$

4.6 Government

The government budget constraint is as follows:

$$G + (1+R)B + \sum_{h,j} \psi^{h,j} \cdot T^{h,j} = \tau_k A + \tau_l w^U L^U + \tau_l w^S L^S + B' + \tau_c C \tag{8}$$

where B is aggregate government debt, G is government consumption, C is aggregate household consumption and A is aggregate household saving.

[10] λ incorporates a level and a skill specific labor-augmenting technology Ω^h. Ω_U and Ω_S are calibrated to ensure the existence of a steady state equilibrium. The condition that any calibration must satisfy as shown in in Maliar and Maliar (2011) is as follows:

$$\mu = \frac{\Omega^U}{\omega^U} = \frac{\Omega^S}{\omega^S} \tag{5}$$

where μ is the growth rate of the economy due to population growth.

4.7 Equilibrium

To close the model, given the population evolution I define a steady state equilibrium as:

- Prices $\{w^U, w^S, r\}$
- Policy functions for consumption, labor and savings $f_c^h(a_t)$, $f_l^{h,g}(a)$, $f_{a'}^{h,g}(a)$ and $f_\chi^{h,g}(a)$
- Value functions $V_j^{h,g}(a, \epsilon, \Lambda)$

That solve the agent's problem, the firm's problem and markets clear, such that

$$L^U = \sum_j \psi_j^U \cdot l^{U,j} \cdot \epsilon^U$$

$$L^S = \sum_j \psi_j^S \cdot l^{S,j} \cdot \epsilon^S$$

$$K = \sum_{h,j} \psi_j^h \cdot a_j^h - B$$

$$C + X + G = Y$$

$$r = MP_K$$

$$R = r - \delta$$

$$w_u = MPL_u$$

$$w_s = MPL_s$$

5 Parameterization

5.1 Demographics

Agents are born age 0, start work at age 18 and die with certainty at age 90; each period is 1 year. Before the age of 90 at age j they can die with probability γ^g as described in 4. To calculate their survival probabilities I use the Vital Statistics NCHS Multiple Cause of Death Data for 1999-2001 and the 2000 U.S. Census. The NCHS data has data on the number of deaths in the U.S. by year as well as by immigration status. The 2000 Census gives the population of both immigrants and natives, with the number of births and deaths in any given year. There are more recent versions of this survey available, however, after 2004 the NCHS removed the immigrant variable from the public use file. With this data I can calculate the survival probabilities according to the life tables. I perform this exercise for those over the age of 18. For those under the age of 18

I assume the survival probability for each period is 1. Using this data, I find that immigrants have an average life expectancy of 79. This compares to 78 for U.S. natives. This is in line with a study by Singh and Miller (2004) who uses confidential data from the US National Vital Statistics System and finds immigrants have an average life expectancy of 80 compared to 76.6 for natives. The survival rates, the fertility rates estimated in section 3.2, as well as population shares from the CPS 2011-2015 and assuming that future immigrant arrivals are of the same composition as those already here imply values for ψ both in the steady state and for any change in policy. These parameters imply a worker-retiree ratio of 3.9. To calibrate π the conditional intergenerational education transmission matrix I use the data from the GSS and results of the exercise that generate Table 3.

5.2 NIPA Accounts

Table 6 displays the annual averages from NIPA (National Income and Product Accounts), taking into account adjustments to NIPA's measure of GNP (Gross National Product). The adjusted GNP is the NIPA measure of GNP, arrived at by adding in the services from consumer durables and government fixed capital, then subtracting sales taxes and excise taxes. Consumption is the private consumption of non-durable goods and of services in addition to government expenditure excluding spending on defense. Investment is defined as gross private domestic investment, consumer durables and the non-defense portion of government investment.Defined this way, consumption comprises 76% of adjusted GNP while investment accounts for 19% of adjusted GNP.

In this model I treat government expenditures on non-defense items as lump sum transfers to agents. This assumes that government spending on public services such as education, law and order and transportation services is perfectly substitutable with cash.

5.3 Fixed Asset Tables

To calculate the model equivalent of A_t I sum private fixed assets, stock of consumer durables and privately held inventories from the BEA fixed asset tables. In addition I add the value of land from the U.S. flow of funds data. Fixed assets and consumer durables are approximately 3.07 times adjusted GNP, inventories are are 0.12 and land 0.61 giving a capital output ratio of 3.8.

Table 5: Fiscal Policy Parameters: All are Percentage of adjusted GNP

Moment	Value	Source
Government debt	97.0%	Flow of funds
Defense spending	4.6%	NIPA : Federal defense expenditures
Non-defense spending (excluding education)	11.4%	NIPA : Government consumption expenditures
Education spending	4.6%	National Transfer Accounts
Social Security and Medicare transfers	8.1%	NIPA
Other transfers	6.3%	NIPA : Total transfers - Social Security - medicare
τ_l	39.5%	CPS 2011, 2013, 2015
τ_k	30.1%	Flow of Funds - Taxes on Domestic Corporate Profits

5.4 Parameters based on Macro Data

The utility function is specified as follows

$$u(c,l) = \log c + \alpha \log(1-l) \tag{9}$$

The preference parameters α and β are set to match the total hours of work relative to the working age population and the capital output ratio respectively. The average annual hours worked in the U.S. according to the CPS are 1350; thus with a potential 100 hour work week this implies that the fraction of time spent working is 0.247. I set the depreciation rate to match investment to adjusted GNP ratio of 0.21. The income share parameter, θ, is set to match the labor share of adjusted GNP to be equal to 0.54, that is the total value of compensation and 70% of proprietor's income. This latter parameter, while lower than traditional estimates, is in line with recent findings by Karabarbounis and Neiman (2013).

Using NIPA data I set policy parameters so that the model matches the following data: defense spending is 4.6% of adjusted GNP, combined Social Security and Medicare spending is 8.1%, non-defense spending excluding education expenditures is 11.4% and education expenditures amount to 4.6%. To calculate the ratio of other transfer programs to adjusted GNP programs, I use total government spending on social benefits,

Table 6: Internally Calibrated Parameters

Parameter	Parameter Value	Moment	Model	Data	Source
β	0.964	K/Y	3.8	3.8	BEA 2010-2016
α	1.76	Average hours	0.247	0.247	CPS 2011, 2013, 2015
δ	0.053	X/Y	0.21	0.21	BEA 2010-2016
$1-\theta$	0.54	Labor share of income	0.54	0.54	BEA 2010-2016
λ	0.39	w^S/w^U	2.00	2.00	CPS 2011, 2013, 2015
ρ	0.29	-	-	-	Katz and Murphy (1992)
$\epsilon^{i,g,p}$	-	$w^i\epsilon^{i,g,p}/w^i\epsilon^{i,A,A}$	-	-	CPS 2011, 2013, 2015

subtracting Social Security and medicare, which gives a value of 6.1%. With flow of funds data summing total federal and state debt, I find that government debt as fraction of adjusted GNP is 97%. All of these numbers are averages between 2010 and 2016.

I set λ, the share of labor income accruing to unskilled workers such that in the model the skill premium i.e. the ratio of hourly wages is 2.0. This matches the ratio from the CPS 2011-2015.For both skilled and unskilled U.S. native workers I set the efficiency units $\epsilon = 1.0$. As with λ I set the efficiency units of each of the other types, to match the differences in hourly wages according to the CPS 2011-2015. I set the parameter dictating the elasticity of substitution between skilled and unskilled inputs, $\rho = 0.28$ as estimated in Katz and Murphy (1992). Further I keep the efficiency units constant over the life cycle.

5.5 Taxes and Transfer Distribution

The transfer function $T^{h,j}(\chi)$ can be broken down into 3 parts: (i) common transfers from government consumption expenditures other than defense spending (ii) means-tested transfers based upon income such as Medicaid, the Earned Income Tax Credit and supplemental Social Security benefits and (iii) transfers in retirement which are Social Security and Medicaid.

The transfers from government consumption excluding education are divided pro-rata between all agents and ages. The education budget is divided up pro-rata between those aged between 4 and 18. The means tested transfers that I consider are workers' compensation, Supplemental Social Security Income, Temporary Assistance for Needy Families, unemployment benefits, veterans' benefits, Child Tax Credit, Earned Income Tax Credit and Medicaid. To match the distribution of these benefits from the CPS 2011 - 2015 I distribute benefits in the following way. I distribute 78% of means tested transfers to unskilled workers who are of working age and 12% to skilled workers of working age. The other 10% of these transfers go to the retired population; 6% to those who were unskilled workers and 4% who were skilled workers. The transfers within

each group are given out equally across ages.

Agents have three choices of retirement age; 62, 66 and 70. If they retire at age 66 they will receive full retirement benefits. If they retire at 62 they will receive for life 75% of the benefits they would have received had they retired at age 66. All agents must retire by the age of 70 and if they chose the latest date they will receive for life 137% of the retirement benefits they'd have received at the age of 66. Once an agent has chosen to retire, they cannot go back to work. These numbers are chosen to match the current U.S. Social Security payment policy. I omit an additional state variable from the model that would track the contributions to Social Security by individuals and then link it to their retirement benefits. While higher incomes imply higher Social Security payments in retirement, they also imply higher taxes, which is why Steuerle and Quakenbush (2012) find that there is only an 18% lifetime difference between a worker who has earned 60% above the average wage and one who earns the average wage.

The transfer function is the same regardless of nativity. Using the 2015 ACS 5 year sample I test, using a linear probability model for participation in a variety of government transfer programs. I restrict the sample to any immigrant who has been here for more than 5 years, given that is when they are eligible for most programs. I find that while immigrants do have higher rates of participation in these programs, after controlling for income, region and age the differences are negligible. The full details of this exercise are in the appendix.

Finally I paramaterize the tax on labor income using the CPS 2011-2015. To do this, I divide each family up into bins based on their AGI (Adjusted Gross Income). I then calculate the average marginal rate for each bracket using data on federal and state marginal rates. These rates are calculated by the CPS as well as payments to FICA. Taking an average using the total AGI of each bracket as in Barro and Redlich (2013), I find an average marginal rate of 39.5%. Breaking this down by educational attainment, I find an average marginal rate of 35.2% for those with less than college and 40.3% for more than college. The reason for such little dispersion is as follows. Those with low income who will predominantly be those with less than college will pay low marginal federal rates. However, all face a rate of 14.7% for FICA payments. For those who are high income, who will largely be the college educated they face federal marginal rates but much lower marginal rates on their FICA.

I use the average tax rate on domestic corporate profits from the flow of funds data to parameterize τ_k. Averaging over 2010-2016 I find the average rate to be 30.1%. The tax on consumption τ_c is set to 12.8% to ensure that the government budget balances, given its debt levels, expenditures and tax revenue collected.

6 Evaluation of Alternative Immigration Policies

In this section I evaluate a number of different immigration policies and compare them to the status quo, i.e. the current U.S. immigration policy which is based primarily upon family ties and which allows for 700,000 adult immigrants to enter the U.S. annually. I analyze the changes in welfare of continuing the current U.S. immigration policy, but increasing the number of immigrants admitted. I also analyze the welfare changes upon moving to a system closer to those of the U.K. and Canada, in which immigrants with higher levels of education and experience are given preference for entry. Finally, I consider how recent changes in the composition of immigrants to the U.S. can affect public finances when we also consider the demographic changes that are predicted to occur over the next 60 years.

The baseline policy assumes that the immigrant arrivals match the distribution of immigrant population in the 2015 ACS and that 700,000 adults arrive each year. Under each policy scenario I keep the ratio of government debt and defense spending to adjusted GNP the same, at 97% and 4.5% respectively. In addition, I keep the value of per-capita transfers for non-defense government expenditures, education spending, means-tested transfers and retirement the same as the steady state. Under each policy change I analyze the welfare changes for cohorts born before and after the change. Further, all welfare changes are analyzed from the perspective of U.S. born workers. [11]The migration decision is a feature that has been abstracted from in this framework.[12]

6.1 Continue Current U.S. Policy at Increased Levels

The first policy counterfactual I run is to continue with the current family-ties-based immigration policy, but increasing the number of adult immigrants allowed in, from 700,000 per year up to 1.4 million per year.

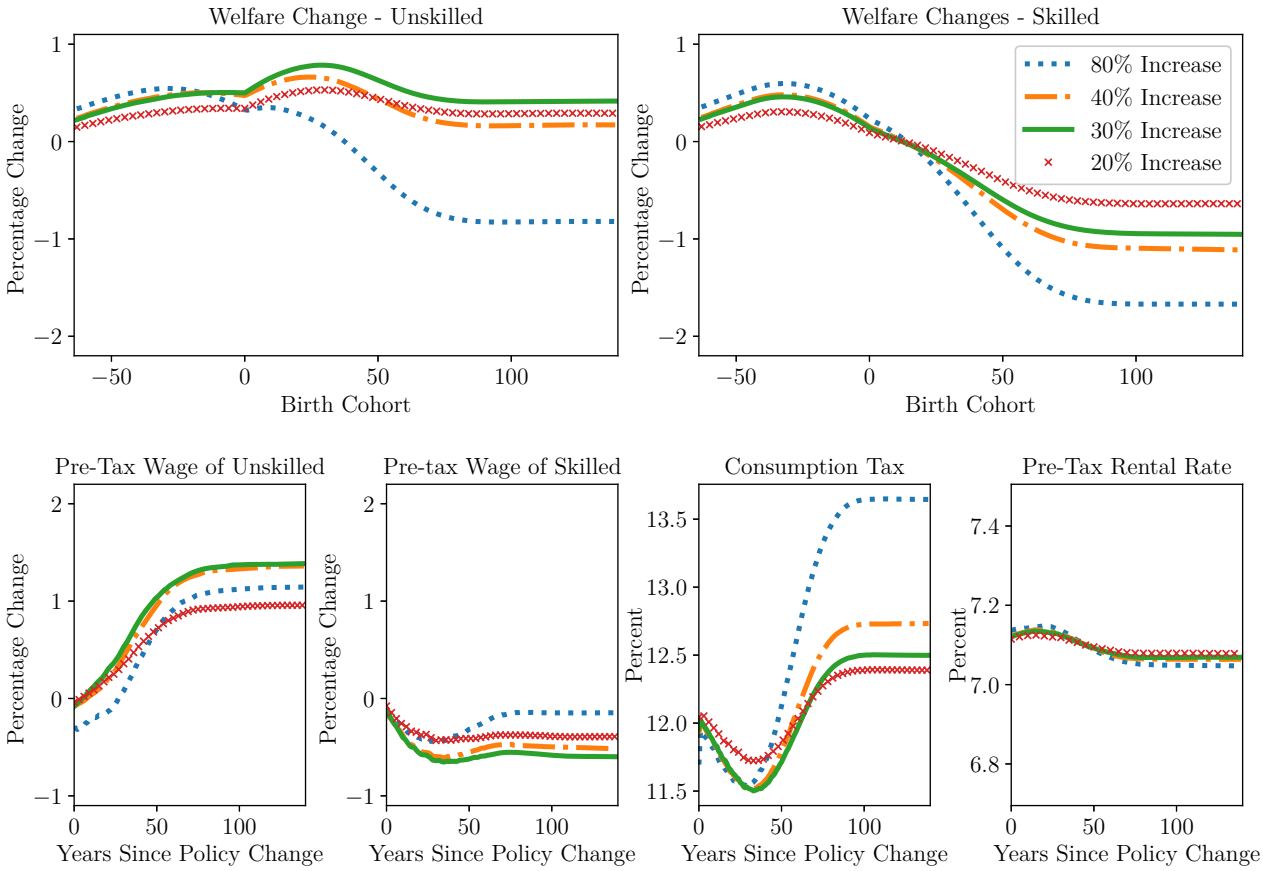
When performing the policy counterfactual of expanded immigration, I increase overall immigration between 10 and 100%. However, I cap the increase in skilled workers that come, to 180,000. The upper-bound is chosen to match the number of applicants who are rejected from the H1B skilled visa lottery in the U.S. These applicants are not rejected due to lack of skills, but rather because of the arbitrary cap on the number of H1B visas that are distributed. An alternative parameterization of this could be the number of immigrants who meet the criteria for a merit based visa to Canada, but don't receive it because of cap limits. However, I calculate this number to be close to 30,000. [13]. Figure 4 shows the result of this counterfactual:

[11]I omit the analysis of immigrant welfare changes; to fully quantify these welfare changes, the initial decision to migrate must be taken into account.

[12]Adding a migration decision would change little in this model. Given the set up of the model, to match immigrant inflows would require calibrating some form of preference shock. This would add an additional state variable to the model and result in the same arrival origin distribution as established exogenously in the data

[13]Given the potentially large wages gains for many immigrants - especially those from low and middle income countries - by moving to the U.S., putting a limit on the number of skilled immigrants may seem strange. However, we must also consider that while people may be allowed to move and receive higher wages as a result, they may chose not to. For example, after the

Figure 4: Results of Expanding Status Quo Immigration Policy



(a) All welfare changes are from the perspective of a U.S. born worker with U.S. born parents

Under this policy counterfactual I find that increases in immigration of up to about 40% are welfare improving for the unskilled workers. Under each policy counterfactual the wages of the unskilled workers go up. Even as the new immigrant population becomes less skilled relative to the existing working age population, the effective labor supply of skilled inputs still increases. Given the complimentarity in the production function, this increases the wages of unskilled workers while decreasing the wages of skilled workers.

As wages change, the taxes needed to make the government budget constraint bind also change. Immediately after the policy the working age population increases, increasing tax receipts and therefore lowering the level of τ_c needed. As the new immigrants retire this effect is diminished and τ_c increases again. For high levels of immigration, as the population of immigrants becomes more unskilled, government transfers also

expansion of the E.U. to include Poland in 2004, although many skilled immigrants did move to the U.K. and other countries, far more remained in Poland. Further, upon entry to the E.U., close to 50% of migrants had a college degree, but by 2008 this had dropped to 25%

therefore increase. This leads to higher levels than the original steady state level of τ_c. The negative effects on wages for skilled workers combined with the increases in τ_c leads to welfare losses for skilled workers of most cohorts. Unskilled workers experience increased wages, but the increases in consumption taxes offset these gains at high levels of immigration.

6.1.1 Alternative Fiscal Instruments

In this section I also evaluate the same policy counterfactuals as in section 6.1, keeping τ_c fixed at the initial level of 12.1% and using τ_k, τ_l to make the government budget constraint bind. The results of these exercises are in Table 7. While the choice of policy instrument will affect the magnitudes of the welfare changes resulting from policy changes, it does not change the result that for modest expansions of the current U.S. immigration policy, unskilled workers would experience small lifetime welfare gains while the skilled workers would see their welfare decrease.

Table 7: Comparison of Policy Counterfactuals 100 Years After Policy Change Takes Place

		40% Increase in Immigration			80% Increase in Immigration		
		τ_c	τ_l	τ_k	τ_c	τ_l	τ_k
Baseline (%)		12.10	39.50	31.0	12.10	39.50	31.0
After Policy Change (%)		12.50	39.80	31.50	13.50	41.50	34.50
Welfare Change (% Change)	Unskilled	0.15	0.25	0.22	-0.93	-1.70	-1.65
	Skilled	-1.00	-0.80	-0.91	-1.80	-3.50	-2.50
Pre-tax Wage Changes (% Change)	Unskilled	1.15	1.10	1.02	1.38	1.46	1.11
	Skilled	-0.15	-0.70	-0.52	-0.40	-0.85	-0.21
Pre-tax Rental Rate of Capital Changes (% Point Change)		0.00	0.00	-0.05	0.00	0.00	0.11

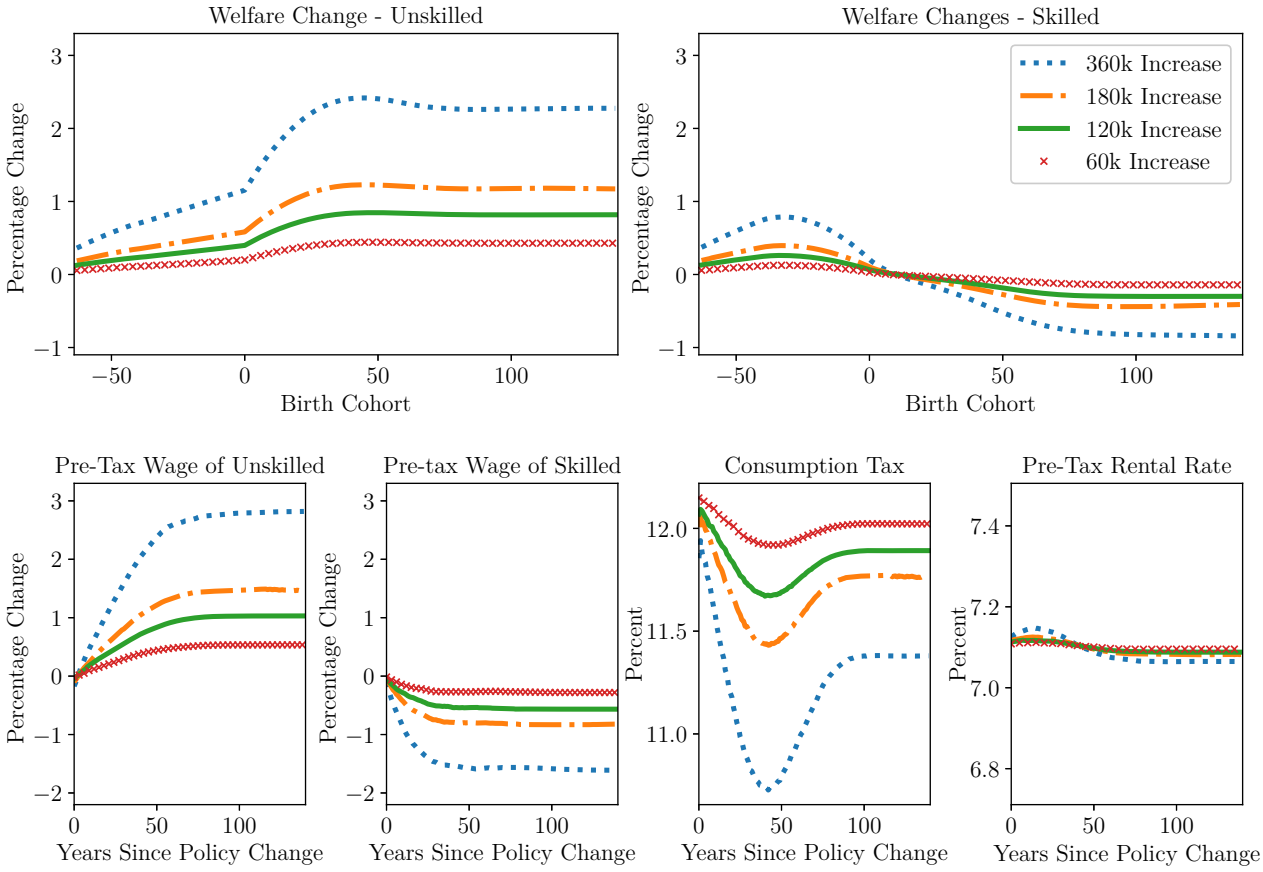
6.2 Increase Skilled Immigration

The second counterfactual I run is to move the U.S. to a immigration policy similar to those in the U.K. and Canada. Much of the political debate has indeed focused on crafting a high skill immigration policy for the U.S. If the goal of policy makers is to ensure that those at the bottom of the income distribution are not hurt by any immigration policy a skilled immigration policy seems the natural option.

To test the implications of this policy change on welfare and prices, I allow for an overall increase in immigration of between 60,000 and 360,000 skilled workers between ages 30 and 50 only.

In Figure 5 we can see that increasing skilled immigration is welfare increasing for unskilled workers and is strictly increasing in the number of additional skilled immigrants allowed in. This is driven primarily by the increases in wages due to the complimentarity with skilled workers. In each policy experiment a secondary force is at work: as the wages of unskilled workers increase, so do their overall tax receipts; in addition, while the wages of skilled workers decrease, their overall tax receipts increase due to the increase in the number of skilled workers, these two results allow for a drop in the consumption tax. This decrease in consumption tax lowers the relative price of consumption leading to increased welfare gains. Skilled workers' experience welfare losses for any expansions over 60,000 skilled immigrant workers. While skilled workers receive the positive fiscal externality described, the decrease in wages dominates.

Figure 5: Results of an Increase in Skilled Immigration



6.2.1 Alternative Fiscal Instruments

Under the counterfactual of increasing skilled immigration - unlike expanding the status quo - the fiscal instrument used to make the government budget balance is important, not only for the magnitude, but also as an indicator of welfare changes for the skilled workers. Figure 6 shows the effects when, instead of using the consumption tax to make the government budget constraint bind after a change in immigration policy, changes in the labor tax, tax on savings and increases to government consumption that are not returned to the population.[14]. The latter counterfactual provides insight into when any benefits from an improved fiscal environment as a result of change in immigration policy are not given back to the population and gives an idea of the importance of the positive fiscal externalities from increasing skilled immigration. From Figure 6 it is evident that even large increases in skilled immigration to the U.S. can results in welfare gains for skilled workers. The mechanism behind this is as follows : with a greater effective supply of skilled labor, the wage rate of unskilled workers increases. As the wage rate of unskilled workers increases, so do their tax receipts. This increase in tax receipts allows for the τ_l required to make the government budget balance decrease. This decrease is enough to offset the wage decrease for skilled U.S. natives as a result of increased skilled immigration.

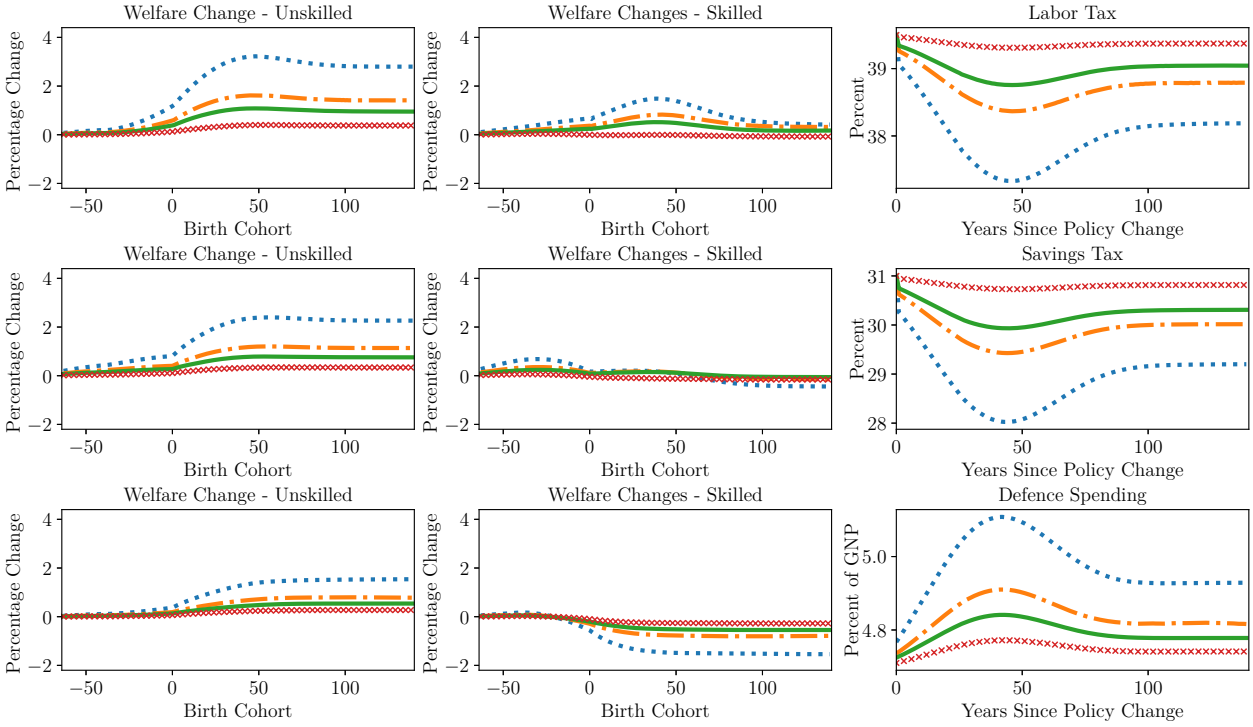
In the scenario whereby the tax on savings is changed to make the government budget balance, skilled workers also experience welfare gains as a result of increases in skilled immigration of up to 180,000 per year. Again, the wages of unskilled workers increases and so do their tax receipts, allowing for the decreasing of τ_k. However, as the unskilled workers earn more, they save more, thus reducing the rental rate of capital and decreasing tax receipts to the government. While these two forces work in opposite directions the decrease in τ_k is just enough to offset the wage losses for skilled workers.

The bottom row of Figure 6 displays the results of the government using any additional tax revenues resulting from skilled immigration to fund additional spending on goods that the population does not benefit from.[15] This counterfactual is the most closely comparable to what the current immigration literature studies as, in it, the only changes the agents face when making decisions are changes in wages and returns to saving. Therefore, the changes in welfare are driven primarily by changes in wages and given that unskilled wages go up and skilled wages go down, unskilled workers still experience welfare gains. However, these gains are lower compared to the other counterfactuals displayed in Figure 6 given that they do not receive the positive fiscal externality. This is the same reason why skilled workers' welfare losses are amplified.

[14] This could be thought of as an increase in defense spending

[15] In the data this would be treated as an increase in defense spending

Figure 6: Results of an Increase in Skilled Immigration Using Different Fiscal Instruments to Make Government Budget Constraint Bind



6.2.2 Removing Correlation Between Skills of the Parents and Children

To highlight the role correlation between the skill of parents and children, I run the policy experiment of allowing for an additional 180,000 skilled immigrants setting the education transmission matrix π using the unconditional probability of a child with U.S. born parents going to college. The new matrix is displayed in Table 8. I run this counterfactual comparing the welfare effects and changes in public finances using both the consumption tax and labor tax to ensure the government budget constraint binds. The results of this exercise are displayed in Figure 7. From Figure 7 it is evident that the role of correlation between parental and child skill is quantitatively important. Ignoring correlation between generations would likely underestimate the welfare gains accruing to unskilled workers as a result of immigration policy change. As Figure 7 shows the welfare gains increase around 0.4 percentage points. For the skilled U.S. workers, when using a consumption tax to make the government budget constraint bind, the additional welfare gains when modelling correlation are close to 0. If instead the labor tax is adjusted, welfare gains are close to 0.2 percentage points. Further, Figure 7 shows that modelling for the correlation between parents and children does lead to an improvement in public finances, as judged by the additional decrease of 0.1 percentage points in the consumption tax and 0.85 percentage points in the labor tax.

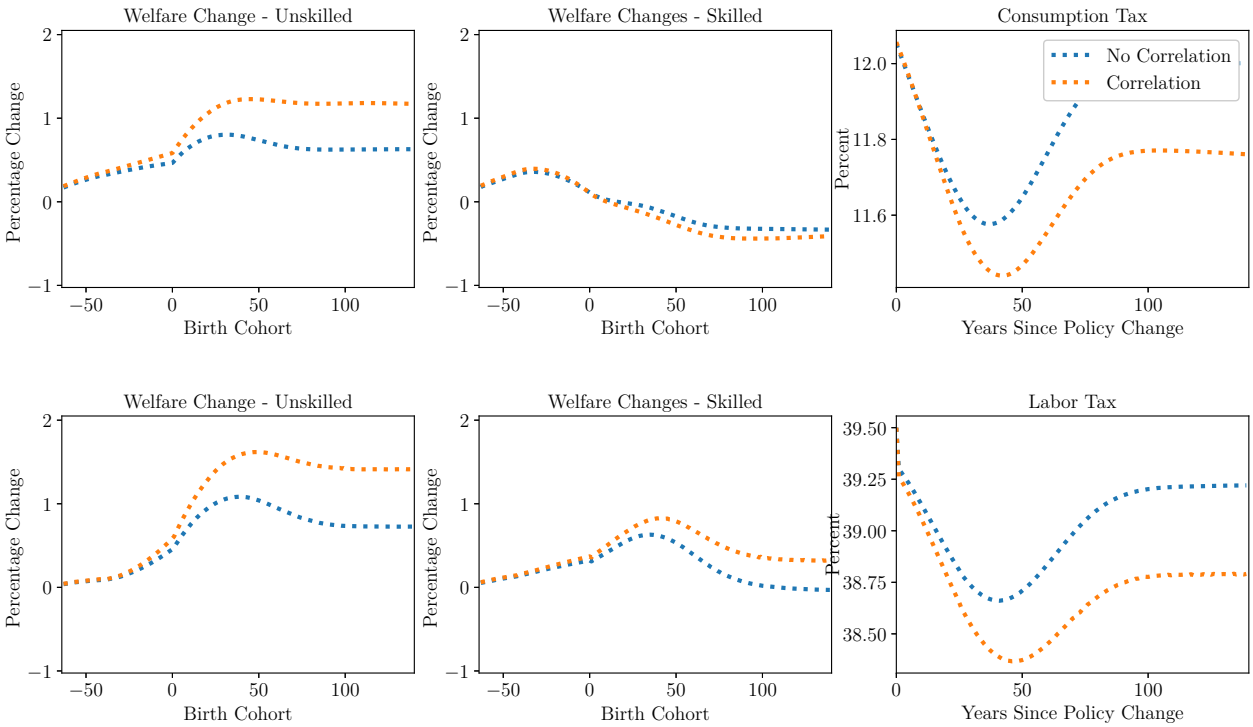
Table 8: Intergenerational Education Transmission Matrices Unconditional on Parents' Skills

		Children	
		LC	C
Parents	LC	0.70	0.30
	C	0.70	0.30

(a) LC indicates less than college, C indicates college or more

(b) Data taken from 2015 ACS 5 year sample

Figure 7: Welfare and Fiscal Effects when Turning off Correlation Between Parents and Children Skill's



6.3 Immigration and Demographic Change

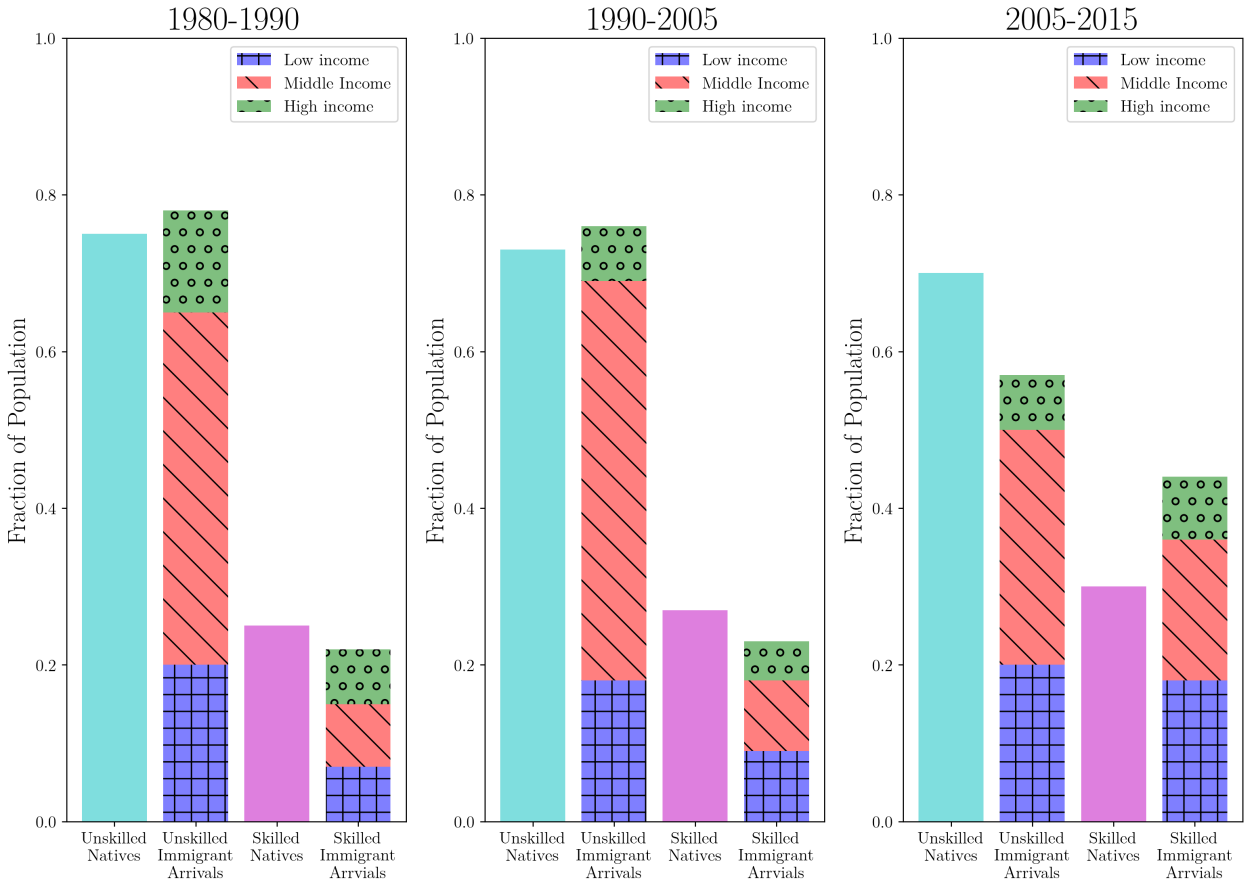
The final part of this paper shows the interaction of projected demographic change, changes in immigrant arrivals and the correlation between the skills of parents and children when considering fiscal policy.

It is well established that the U.S. has a population that is living longer and having fewer children. This is projected to play a substantial role in the future funding of current retirement programs, namely social security, given that the system depends on the worker to retiree ratio. In this section, I simulate fiscal outcomes incorporating the forecast that the worker retiree ratio will fall from around 3.9 to 2.6 over the next

60 years. [16]. Further, I evaluate the effects when assuming that immigrant arrivals resemble the composition of more recent arrivals to the U.S. as a pose to those who arrived during the 1990s. In addition, to highlight the role of correlation between parents and children, I set the education transmission matrix as in 6.2.2

Using the 1990 Census 5% sample, 2007 ACS 3 year sample and the 2015 ACS 5 year sample Figure 8 shows how the profile of immigrant educational attainment and country of origin has changed over the past 35 years. More recent immigrants have a higher skilled to unskilled ratio than U.S. natives. Further, the country of origin composition has changed. While the number of immigrants from middle income countries has remained stable at close to 50% of all immigration, immigrants from low income countries now make up close to 40% of all immigrant arrivals, up from close to 30% in 1980 and 1990.

Figure 8: Composition of Native Population and Population of Immigrant Arrivals 1980 - 2005



(a) Arrivals data taken from 1990 Census 5% sample, 2007 ACS 3 year sample and the 2015 ACS 5 year sample

(b) Low, middle and high income refers to immigrant country of origin

As a with each previous exercise, I attempt to use different fiscal instruments when comparing the world

[16]To do this I assume that fertility rates drop 12.5% over the next 70 years

with a worker retiree ratio of 2.6 to that of 3.9. In this exercise I also test the effects of decreasing retirement transfers. However, like McGrattan and Prescott (2017) I find that changing the labor tax or tax on capital is unable to make the government budget constraint balance. Table 9 shows the results of this exercise.

Table 9: The Effects of Changing Immigrant Composition 100 Years On

	Immigrant arrivals based on 2005-2015	Immigrant arrivals based on 1990-2000	Immigrant arrivals based on 2005-2015 with no intergenerational correlation
Consumption Tax Change	3.1%	4.3%	3.8%
Using retirement transfer to balance government budget	-14.0%	-19.0%	-16.0%
Output per capita	-3.9%	-5.6%	- 4.5%

(a) Change in consumption tax is in percentage points with a baseline of 12.1%

From Table 9 it is evident that if current trends in immigrant arrivals continue, it will help to alleviate some of the pressure on public finances that the U.S. will face over the next 70 years. In addition, it shows again that considering correlation between the skills of immigrant parents and their children is quantitatively important for any immigration-related policy analysis.

7 Conclusion

Immigration reform and its consequences have been a central part of policymakers' agendas for the past three decades. The question of which combinations of skills are crucial and how many immigrants to let in, has been at the heart of this debate. This paper goes some way to answering the question : what are the welfare effects of expanding immigration to the U.S.?

I establish that the profiles of immigrant children as adults, when measured by educational attainment, earnings and net tax payments, are different from those with U.S. born parents. This is especially true of those second-generation immigrants who complete a college degree and demonstrates that that the children of immigrants are a highly successful group.

With these observations in mind and using a general equilibrium, life-cycle model allowing for correlation between the skills of immigrants and their children's, I find that moving the U.S. to an immigration policy whereby priority is given to those with a college degree can be welfare-improving for those with and without a college degree. Moving to such a policy with a realistic expectation of how many skilled immigrants would come to the U.S. can result in welfare gains of up to 0.8% for U.S. natives without a college education and 0.2% for those with a college degree. This result is driven, by not only the positive fiscal externalities that

skilled immigrants generate, but also by the correlation between their skills and their children's achievements, which leads to a more skilled labor force.

Finally I show that if the composition of more recent immigrant arrivals continues, it can go some way to alleviating pressures on social security funding. Projecting future U.S. demographic changes with an aging population and on the basis that the composition of the most recent immigrant arrivals continuing to be the norm results in social security payments only need only be reduced 14.0%. This is compared to 19.0% if the composition of immigrant arrivals of the 1990s and early 2000s were the norm. In addition, if policy-makers do not consider the correlation between skills of immigrant parents and their children, they would underestimate the benefits of the change in the composition of immigrant cohorts.

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8 Appendix

8.1 Transfers by Nativity

The data used for this exercise is the same as in section **??** from the CPS 2011-2015. Each observation is a household and I consider a household to participate in a government transfer program, y if any member of the household reports participation.

The country of origin is assigned to each household based upon the head of household's country of origin and can be either, low, middle, high or U.S.. I assign the education of each household based upon the highest level of education received by the head of the household.

To establish the use of government benefit programs by immigrants compared to natives I use the following linear probability model where i denotes a household. The variable y is a binary variable of 0 or 1 if a household participates in a government transfer program. X_i contains information on log hourly wages, age, age squared, country of origin dummies, and region of residence.

$$y = \beta_0 + \gamma \times X_i + \epsilon_i$$

The results shown in 10 compare the probability of participating in a government transfer program relative to U.S. native households with high school education. While household's headed by immigrants from low and middle income countries participate in government programs at a higher rate than U.S. native households with a high school education the differences are small. The exceptions here are child medicaid and EITC for which the differences are larger.

Table 10: Probability of Participating in Government Transfer Programs

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	Adult Medicaid	CHIP	EITC	TANF	SNAP	SSI
Constant	0.793**	0.943**	1.779**	0.143**	1.052**	0.150**
	(0.010)	(0.010)	(0.013)	(0.004)	(0.010	(0.005)
Low income - HS	0.023**	0.086**	0.132**	-0.005**	-0.008**	-0.007**
	(0.005)	(0.005)	(0.006)	(0.002)	(0.004)	(0.003)
Middle income - HS	0.007**	0.126**	0.158**	-0.004**	0.012**	-0.021**
	(0.004)	(0.004)	(0.004)	(0.001)	(0.003)	(0.002)
High income - HS	-0.067**	-0.010**	0.008**	-0.004**	-0.034**	-0.025**
	(0.007)	(0.006)	(0.009)	(0.002)	(0.005)	(0.004)
Native - coll	-0.056**	-0.056**	-0.066**	-0.005**	-0.041**	-0.013**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Low income - coll	-0.040**	-0.036**	-0.026**	-0.009**	-0.039**	-0.013 **
	(0.004)	(0.004)	(0.004)	(0.001)	(0.003)	(0.002)
Medium income - coll	-0.050**	-0.016**	-0.012**	-0.008**	-0.030**	-0.021 **
	(0.005)	(0.004)	(0.005)	(0.001)	(0.003)	(0.002)
High income - coll	-0.086**	-0.036**	-0.035**	-0.008**	-0.036**	-0.028**
	(0.005)	(0.005)	(0.006)	(0.001)	(0.003)	(0.002)
log wage	-0.061	-0.061**	-0.152**	-0.012**	-0.085**	-0.017**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
Age	-0.003	-0.006**	0.003**	0.000**	-0.001**	0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age ^{2}	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note : * Reject at 5% level, ** Reject at 1% level