Do Immigrants Free Ride More Than Natives?*

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Abstract

Are the foreign born a burden on host societies, because they receive benefits from, but do not contribute to, the provision of public goods and services? In this paper, we investigate theoretically and empirically the impact of immigrant status on the voluntary provision of public goods. We do not find evidence that immigrant households free ride more than similar native born households, by using regression analysis and propensity score matching methods. In addition, second generation households do not significantly differ from third or higher generations in their voluntary contributions to public good provision and their receipt of benefits from government and non-government sources.

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1 Introduction

The growth of the foreign born-population in the U.S. has fueled significant academic and policy debate. This immigration debate is taking place in federal and state legislatures, and also in schools and neighborhoods. A growing concern is that recent immigrants will place a burden on U.S. communities.[1] Athough there is extensive research on U.S. immigrants' use of means-tested welfare programs and their fiscal impacts (Bollinger and Hagstrom, 2008; Borjas and Hilton, 1996; Hu, 1998; Fix and Passel, 2002; Neidell and Walffogel, 2009), much less is known about immigrants' private contributions to public good provision. Beyond the relevance of this question to current policy debates, the extent to which households differ in their willingness to contribute to the private provision of public goods is of fundamental interest to economists and other social scientists (Bergstrom, Blume and Varian, 1986; Roberts, 1984; Samuelson, 1954; Warr, 1982).[2]

Are the foreign-born a burden on host societies because they receive benefits from, but do not contribute to the private provision of public goods and services? Privately provided public goods play a central role in U.S. economic and social life. Nearly 90 percent of U.S. households give money or volunteer time to the United Way, the American Red Cross, the Salvation Army, faith-based institutions, as well as other charitable causes, with total monetary contributions from individuals and institutions amounting to nearly $300 billion (Giving USA, 2011). Since welfare reform in 1996, U.S. charitable organizations have gained visibility because some researchers have provided evidence that the services that charitable and non-profit organizations provide to the foreign-born may have grown in the past decade (Ku and Freilich, 2001; Hungerman, 2005). Indeed, the locus of the policy debate on the costs and benefits of immigration for the public sector has increasingly shifted to include services provided by charitable and non-profit institutions and state and local governments.[3] The U.S. depends heavily on private contributions from individuals or a mix of private and public contributions, perhaps more than in any other industrialized nation, for the financing of social services, higher education, health care, disaster relief, and other public goods.

In this paper, we investigate immigrant-native differences in voluntary contributions to public

[1] The concern that the foreign-born may place a burden on host societies is not a new one. During the colonial period, immigration laws restricted the entry of non-citizens likely to become dependent on public charity. In 1645, Massachusetts enacted the earliest public charge laws. Immigration laws were strengthened in the early twentieth century to allow the deportation of non-citizens who became a public burden.

[2] To date, much of the existing literature on contributions to public goods has emphasized the role of gender. For example, Andreoni, Brown, and Rischall (2003) find strong evidence that men and women have different preferences towards charitable contributions. However, much less is know about the role of immigrant status.

[3] "Bill on Illegal-Immigrant Aid Draws Fire," *New York Times*, December 30, 2005, Section A, Page 24, Column 1. "Illegal Immigrants: Are they Freebies or Freeloaders?" The San Diego Union Tribune, June 2 2006, "The Gospel vs. H.R. 4437," *New York Times* March 3, 2006, Section A, Page 22, Column 1.

goods as well as benefits received. This paper is based on a new philanthropy supplement to the Panel Study of Income Dynamics (PSID) and the Current Population Survey (CPS). The new PSID data set represents the largest one-time study of monetary and time contributions toward the private provision of public goods in the United States. The PSID also provides a comprehensive picture of the receipt of benefits from government and non-government sources. Taken together, these data sources provide a unique opportunity to examine whether foreign and native-born households differ in their voluntary contributions and benefits received from non-government and government sources.

We do not find evidence that the foreign-born free ride more than the native-born, particularly in regards to three aspects of our study. First, we find that immigrants are not significantly less likely to give monetary contributions to privately funded public goods, compared to similar native-born households. However, we do find that immigrants are less likely to give time contributions to privately funded public goods than similar native-born households, although the immigrant-native differences in time contributions tend to diminish over time as immigrant households acquire U.S. experience. Second, we find that immigrant households are less likely to report receiving assistance from non-government and government sources when compared to similar native born households. Finally, we examine the voluntary contributions of second-generation immigrants to gain information about the long-term impact of immigration. We do not find significant differences between the children of immigrants and third or higher generations of Americans in their contributions of money and time and/or the benefits received from government and non-government sources. The results are robust to various income and wealth controls and alternative empirical specifications.

We consider two empirical approaches to study immigrant-native differences in voluntary contributions and the receipt of benefits; a multivariate regression approach as well as propensity score matching (PSM) estimation. Both approaches show that there are no significant differences in monetary contributions and the receipt of benefits between immigrant and similar native-born households. The results are robust across various propensity score model specifications, bandwidth choices, and trimming levels, and they pass balancing tests and specification tests.

The remainder of the paper is organized as follows. Section 2 provides the conceptual framework. Section 3 describes the data and basic trends. Section 4 discusses the multivariate probit and Tobit models and the corresponding results. Section 5 introduces the propensity score matching methods the the corresponding results. Section 6 concludes, and Section 7 is the mathematical appendix.

2 Conceptual Framework

In this section, our goal is to shed light on how and why the foreign-born households differ from the native-born in their willingness to contribute to the private provision of public goods. Important studies of voluntary contributions suggest that households contribute money and time because they care about the provision of a public good - for example, education, health care, services for the poor - or due to the private benefits that households derive from their charitable donations in the form of "warm glow" considerations (Andreoni, 1989, 1990), social approval, status, and other benefits received (Becker, 1974).

We consider two main channels through which the immigrant status may affect voluntary contributions. The first channel is that resource constraints differ across immigrant and native-born households, inducing differences in voluntary contributions to public goods. In particular, we assume that immigrants have lower initial wealth holdings and lower wage rates, compared to the native-born. We examine the impact of lower initial wealth holdings and wage rates of immigrant households on their voluntary contributions compared to similar native-born households.[4]

A second channel is the extent to which private transfers to family members influence contributions to public goods. While private transfers to extended family have attracted considerable interest, they have yet to be formally incorporated in studies of contributions to public goods (Becker, 1974). Several researchers have noted the importance of private transfer networks and coresidence among immigrant households (Van Hook and Glick, 2007). If extended family resources are lower for immigrant households, this may induce greater participation in private transfer networks for immigrants, and perhaps lower public good contributions, leading immigrant households to free ride on the voluntary contributions of the native-born.

This conceptual framework suggests several hypotheses to be tested in the empirical analysis. First, immigrant households tend to make lower monetary and time contributions than native households, but make more private transfers. Second, the immigrant-native gaps in monetary and time contributions and private transfers diminish over time under certain conditions on household preferences.[5]

[4]Researchers have documented that immigrants have substantially lower wealth levels (See Amuedo-Dorantes and Pozo, 2002; Hao, 2004, Cobb-Clark and Hildebrand, 2006, Krivo and Kaufman, 2004).

[5]To conserve space, we present the detailed theoretical model and analysis in a mathematical appendix.

3 Data and Basic Trends

3.1 Data

Two data sets are used in this paper: (1) a new philanthropy supplement to the 2003 wave of the Panel Study of Income Dynamics (PSID), and (2) the volunteer supplement and the annual social and economic (ASEC) supplement to the 2003 wave of Current Population Survey (CPS). The PSID and CPS data are unique in several dimensions. Both data sources provide information for nationally representative samples of U.S. households. In addition, the PSID is the world's longest running household panel survey, and includes a refresher sample of recent U.S. immigrants, added in 1997 to ensure the PSID's continued accurate representation of the U.S. population. We should note that both data sources provide detailed information about households' voluntary contributions to public goods and receipt of benefits.[6] The PSID also contains information about households' voluntary private transfers to extended families, providing us with a comprehensive picture of households' contributions.

The PSID and CPS report not only whether the head of each household was born outside the United States, but also whether the head's parents were born outside the United States. This allows us to define those households whose heads were born outside the U.S. as immigrant households, and all other households as native-born households. We define second-generation households as native-born households in which at least one of the head's parents was born outside the U.S., while all other native-born households defined as third-or-higher-generation households. By examining second-generation household status, we are able to examine the long term impact of immigration.

We discuss advantages of each data source. In the PSID, we are able to exploit unusually detailed information on income and wealth by using the longitudinal data on annual family income available in the PSID to construct a measure of permanent income. We define a household's permanent income as its average annual income in the last 3 waves of PSID data. The measure of permanent income accurately captures a household's economic position, and permanent income has been shown to have a larger effect on transfer behavior than transitory income (Auten, Sieg, and Clotfelter, 2002). The CPS includes large sample sizes of immigrant and native-born households, allowing us to compare results across the PSID and the CPS, which serves as an important robustness check.

[6]The PSID philanthropy module is the only data set on giving comparable to the IRS taxpayer data in coverage. However, we should note that the IRS taxpayer database provides a more accurate picture of charitable giving at and above the 90th percentile of charitable giving. The IRS tax data is less suitable for this study because information of immigrant status and experience is not recorded, and immigrants may be less likely to itemize their deductions.

Because of our interest in the private contributions to public good provision, we focus mainly on three classes of voluntary contributions: monetary contributions, time contributions, and private transfers. Monetary contributions include donations of money, assets, or property with a combined value of more than 25 dollars to religious or charitable organizations in the survey period.[7] Time contributions are volunteer activities (i.e., time spent doing unpaid work) through charitable organizations in the survey period. Private transfers are monetary transfers to anyone who was not living within the household at the time of the survey, including child support, alimony, money given to parents, and other transfers to non-household members.[8] All voluntary contribution decisions are measured at the household level. With the rich information available in the PSID, we are able to construct a dichotomous variable for each class of voluntary contributions to measure the incidence of contributions, as well as a continuous variable to capture the level of contributions.

To obtain a comprehensive picture of households' free riding behaviors, we also study benefits received by each household from non-government and government sources. Even though the locus of the policy debate on the costs and benefits of immigration has shifted to the private provision of benefits and services,[9] the federal means-tested public benefits still play an important role in household welfare. To capture the whole picture of households' receipt behaviors, we include the federal means-tested benefit programs in our analysis.

We define non-government benefits to include help or support received from non-government sources, including churches, places of worship, or a community group. In the PSID, households were asked whether they received assistance in the past two years from non-government sources in the form of housing, child care, transportation, clothing, health care, and job training. The CPS does not provide information on non-government benefits received by households. However, both data sources provide information on whether each household received assistance from means-tested government programs, including ADC/AFDC/TANF, General Assistance programs, Supplemental Security Income (SSI), Medicaid, Food Stamps, and free or reduced prices on school breakfast and lunch, as well as the dollar amount of the received government assistance.[10]

[7] Our key dependent variable on monetary contributions was constructed using the following question, which was posed to PSID survey respondents: During the year 2002, did you or anyone in your family donate money, assets, or property with a combined value of more than $25 to religious or charitable organizations?

[8] In 2005, U.S. immigrants sent $40 billion to their origin families in Latin America and the Caribbean, according to the Inter-American Development Bank (IADB). According to the World Bank, global remittances amounted to $232 billion in 2005.

[9] Indeed, in the past one decade, the ability of immigrants to access federal entitlement programs was greatly restricted by welfare reform: in August 1996, the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), combined with the 1996 Immigration Reform Act, greatly reduced federal welfare eligibility for U.S. immigrants.

[10] The receipt of benefits from government sources tends to be underreported in several household surveys. Meyer

3.2 The Basic Trends: The Immigrant-Native Differences without Controlling for Household Characteristics

Mean Differences in Voluntary Contributions and Benefits Received

Table 1 provides descriptive statistics. From Table 1, Panels I and II, over 65 (31) percent of U.S. households report voluntary contributions of money (time); however, only 14 percent report private transfers to non-household members. About 3 percent of households report that they receive assistance from non-government sources. In contrast, a larger fraction, 21.9 percent of households report the receipt of government benefits.

We note some interesting mean differences by immigrant status. We find that immigrant households are less likely to contribute money and time to charitable organizations compared to native-born households, and among those that contribute, their average monetary and time contributions tends to be lower. About 22.1 percent of immigrant households report sending private transfers to non-household members compared to 13.5 percent of native-born households. Conditional on participating in private transfer networks, immigrant households also have higher mean levels of private transfers compared to their native-born counterparts.

we also find that 38.1 percent of immigrant households report receiving assistance from government sources, in comparison to 20.8 percent of native-born households. On the contrary, a smaller fraction of immigrant households report receiving benefits from non-government sources than native-born households do (1.8 vs 2.9 percent). The average dollar amount of government benefits received is $503.69 for immigrant households, and $389.81 for native households.

The descriptive statistics also provide the differences between second generation households and third or higher generation households. Second-generation households are more likely to contribute money (time) than third-and-higher-generation households, and among those that contribute, their average monetary (time) contributions are higher. Interestingly, second-generation households are less likely to report receiving assistance from both government and non-government sources, and receive lower levels of assistance.

Columns 1 and 2 in Table 2 report the immigrant-native differences in the PSID and the CPS, respectively. The immigrant-native differences in time contributions are very similar across the PSID and the CPS; the proportion of immigrant households who make time contributions is 16.8 percentage point lower than that of native-born households in the PSID, nearly identical to the

et al (2009) estimate that as many as half of the dollars received through Food Stamps, Temporary Assistance for Needy Families (TANF) and Workers' Compensation have not been reported in the Current Population Survey (CPS).

corresponding difference of about 18.4 percentage point in the CPS. The average time contributions of immigrant households is about 38.6 hours lower than those of native-born households in the PSID, compared to the gap of 40.3 hours in the CPS. The results in the PSID also show that immigrant households tend to have 13 percentage point lower incidence of monetary contributions than native-born households, and $620.7 lower in level of monetary contributions. Moreover, the proportion of immigrant households that make private transfers is 8.6 percentage point higher than that of native-born households.

An important issue that has been raised in recent debates on immigration policy and welfare reform is whether immigrant households rely on benefits from non-government sources for health care, education, and other social services because they face restrictions in accessing government benefits, particularly at the federal level. Panel B of Table 2 suggests that on average, foreign-born households are less likely than their native-born counterparts to receive assistance from non-government sources, though the difference is insignificant at 10% level. Interestingly, the incidence of receipt of government benefits by immigrant households tends to be higher in both the PSID (by 17.3 percentage point) and in the CPS (by 7.1 percentage point), and the average dollar amount of government benefits received by immigrant households tends to be higher in both the PSID (by $113.9) and the CPS (by $65.2).

We also investigate the long-term impact of immigration by studying the differences between second generation households and third-or-higher generation households in voluntary contributions and benefits received, and report the results in Columns 3 and 4 of Table 2. In Column 3, the results from the PSID show some interesting patterns. Compared with third-or-higher generation households, second generation households have 18.8 (8.0) percentage point higher contribution rates of money (time) to charitable organizations and their levels of monetary (time) contributions are $593.77 (40.43 hours) higher on average. Second generation households are also less likely to receive benefits from non-government and government sources, and conditional on receiving benefits, report receiving lower levels of benefits from government sources.

Mean Differences in Household Characteristics

Table 3 provides a comprehensive picture of the demographic and socioeconomic characteristics of immigrant and native-born households in the PSID and CPS. The results show significant differences between immigrant and native-born households in their sociodemographic characteristics. In particular, the heads of immigrant households tend to be younger, more likely to be married,

non-white, and tend to have fewer years of completed schooling. Moreover, the observed household characteristics explain about 69.3 percent (32.2 percent) of the variation in the immigrant status in the PSID (CPS), and are jointly significant at 1 percent significance level in a probit regression of the immigrant status on these covariances. These differences in observable characteristics suggest the importance of controlling for household characteristics.

From the conceptual framework, household wealth and extended family resources can induce differences in the contribution behaviors of immigrant households compared to their native-born counterparts. Given the rich data sources available in the PSID, we are able to closely examine the role of wealth and income differences in explaining the gap in voluntary contributions between immigrant and native-born households. To this end, we construct a measure of permanent income in order to accurately capture a household's economic position, as this factor has been shown to have a larger effect on transfer behavior than transitory income (Auten, Sieg, and Clotfelter, 2002).[11] Mean permanent household income is lower among immigrant households compared to native-born households. Specifically, mean permanent income is $45634 for the foreign-born compared to $71970 for native-born households. Average wealth holdings for immigrant households are also considerably lower compared to native-born households ($92761 vs. $300000). The PSID data set does not contain a direct measure of extended family resources. However, to capture extended family economic circumstances, we use a proxy variable—the household head father's education. We find striking differences in the educational attainment of extended family members between foreign-born and native-born households. While the proportion of immigrant households whose heads' fathers have less than a high school education is 96.6 percent, the proportion of native households is 35.7 percent.

Columns 3 and 4 in Table 3 report the average household characteristics for the second generation and third-or-higher generation households in the PSID, and Columns 7 and 8 report corresponding results in the CPS. We find significant household characteristics differences between second generation households and third-or-higher generation households. Interestingly, second-generation households have higher mean levels of education, income, and wealth compared to third-or-higher generations in both the PSID and CPS. In addition, the extended family's educational attainment vary by second generation status, with 67.8% of second generation household heads reported that their fathers had an incomplete high school education, compared with 32.1 percent of third-or-

[11] Our measure of permanent income is based on the average family income from 1999, 2001, and 2003 waves of the PSID. Total family income can contain negative values. The number of households with negative numbers for those variables is relatively small, and we replace these negative values with missing values.

higher generation households.

4 Multivariate Probit and Tobit Models and the Corresponding Restuls

This section presents one of the two main empirical approaches used in this paper - multivariate probit and Tobit models - and the corresponding results.

4.1 Specifications

We examine three classes of voluntary contribution decisions in the PSID: monetary contributions, time contributions, and private transfers. A household's participation in each activity is measured by two variables; the first is an indicator variable of whether the household participated in that activity in the last year, while the second is a continuous variable that captures the extent of its participation. Consistent with the literature, we observe a large proportion of households who do not contribute money and time to charitable organizations and/or who do not participate in private transfer networks. In addition, a household's decisions to contribute money and time to a charitable organization tend to be affected by the same unobserved household characteristics. Given these features, a multivariate probit model appears well-suited to study the incidence of contributions, and we use a multivariate Tobit model to study the contribution levels. This approach allows us to account for the correlation in the contribution decisions that can not be explained by the observed household characteristics. In the CPS, we only observe time contributions and thus we apply the standard probit and Tobit regressions to examine the impact of immigrant status on households' time contributions.

The Multivariate Probit Model

The multivariate probit model is specified as follows:

$$Y_i^* = \beta_0 + \beta_1 I_i + \beta_2 X_i + e_i. \tag{1}$$

Index $i = 1, 2, ..., N$ identifies each household. $Y_i^* = (Y_{1,i}^*, Y_{2,i}^*, .., Y_{K,i}^*)'$ is a vector of latent variables, with $Y_{k,i}^*$ for Activity k. I_i is a dummy variable indicating whether i is foreign-born. X_i is a vector of $M-1$ covariates including other household characteristics, and $\beta = (\beta_0, \beta_1, \beta_2)$ is a

$K \times (M+1)$ matrix with each row being a vector of $M+1$ coefficients. We assume that e_i is a $K \times 1$ vector of error terms which follows a multivariate normal distribution,

$$e_i \sim_{iid} N(0, \Omega) \qquad \Omega = \begin{bmatrix} \sigma_1 & \rho_{1,2} & \cdots & \rho_{1,K} \\ \rho_{2,1} & \sigma_2 & \cdots & \rho_{2,K} \\ \cdots & \cdots & \cdots & \cdots \\ \rho_{K,1} & \rho_{K,2} & \cdots & \sigma_K \end{bmatrix}$$

We do not observe the vector of latent variables Y_i^*, but only the choices made by the household $Y_i = (Y_{1,i}, Y_{2,i}, .., Y_{K,i})'$. The relationship between the latent and observed variables can be represented by

$$Y_{k,i} = \begin{cases} 1 & \text{if } Y_{k,i}^* > 0 \\ 0 & \text{otherwise} \end{cases} \qquad k = 1, 2, .., K \tag{2}$$

The joint probability (likelihood function) of $Y_{k,i} = y_{k,i}$ ($y_{k,i} = 0$ or 1) is given by

$$\hat{l}(\beta, \Omega, X_i) = \int_{-\infty}^{S(y_{1,i})X_i'\beta_1} \cdots \int_{-\infty}^{S(y_{K,i})X_i'\beta_K} \phi(e_{1,i}, \ldots, e_{K,i}; \Omega) de_{1,i} \cdots de_{K,i},$$

where

$$S(y_{k,i}) = \begin{cases} 1 & \text{if} \quad y_{k,i} = 1 \\ -1 & \text{if} \quad y_{k,i} = 0 \end{cases}$$

and $\phi(e_{1,i}, \ldots, e_{k,i}; \Omega)$ is the density function of e.

The maximum likelihood estimators$(\hat{\beta}, \hat{\Omega})$ are defined as

$$(\hat{\beta}, \hat{\Omega}) = arg \max_{\beta,\, \Omega} log\hat{L}(\beta, \Omega) = arg \max_{\beta\, \Omega} \sum_{i=1}^{N} log\hat{l}(\beta, \Omega, X_i).$$

The Multivariate Tobit Model

The multivariate Tobit model shares the same fundamental structure, (1), with the multivariate probit model, but with (2) becoming

$$Y_{k,i} = \begin{cases} Y_{k,i}^* & \text{if } Y_{k,i}^* > 0 \\ 0 & \text{otherwise} \end{cases} \qquad k = 1, 2, \ldots, K \tag{3}$$

The likelihood function for household i when $Y_{1,i} = 0, Y_{2,i} > 0, \ldots, Y_{K,i} > 0$ is given as follows:

$$\tilde{l}(\beta, \Omega, X_i) = \int_{-\infty}^{-X_i'\beta_1} \phi\big(e_{1,i}, \ldots, e_{K,i}; \Omega\big) de_{1,i} = \int_{-\infty}^{-X_i'\beta_1} \phi\big(e_{1,i}, (Y_{2,i} - X_i'\beta_2), \ldots, (Y_{K,i} - X_i'\beta_K); \Omega\big) de_{1,i}$$

The formula of $\tilde{l}(\beta, \Omega, X_i)$ for other sets of values of $Y_{1,i}, \ldots, Y_{K,i}$ can be written similarly. The maximum likelihood estimators $(\tilde{\beta}, \tilde{\Omega})$ are defined as

$$(\tilde{\beta}, \tilde{\Omega}) = arg \max_{\beta,\, \Omega} log\tilde{L}(\beta, \Omega) = arg \max_{\beta\, \Omega} \sum_{i=1}^{N} log\, \tilde{l}(\beta, \Omega,\, X_i).$$

4.2 Regression Results

The Impact of Immigrant Status on Voluntary Contributions and Benefits Received

Table 4 (Columns 1 and 2) reports the estimated coefficients of immigrant status $(\hat{\beta}_1)$, standard errors, marginal effects, and significance levels in the multivariate probit and Tobit models based on Equation (1). All specifications control for head's age, age squared, gender, marital status, educational attainment, race, family size, annual family income (measured in logs), and employment status. The specifications based on the PSID include additional controls for the head's religious affiliation, household permanent income (measured in 10 equally sized categories), wealth, head father's education level, and the price of giving (measured in logs).[12] For dichotomous variables, the results represent the change in the probability and the percentage change in the levels of contributions associated with a change in the indicator variable from zero to one.

We find that the estimated impact of immigrant status on the incidence of monetary contributions is close to zero and statistically insignificant. However, the dollar amount of monetary contributions is about 62.4 percent lower for immigrant households than for similar native-born households. The time contributions results in the PSID and the CPS are strikingly similar. Specifically, the immigrant status is associated with -13.7 percentage points lower incidence of time contributions in the PSID and -15.4 percentage points in the CPS, and the impact of the immigrant status on the level of time contributions is -77.1 percent in the PSID and -60.6 percent in the CPS.

When we turn to investigate benefits received from non-government and government sources, we do not find any significant immigrant-native differences in the PSID. However, from the CPS,

[12] the price of giving equals 1 minus the marginal income tax rate, because of the tax deductibility of charitable donations.

immigrant households are 4.8 percentage points *less* likely to receive government benefits, and receive 9.7 percent lower levels of government benefits than similar native-born households. These differences are significant at 1 percent level of significance. These results are quite striking and consistent with several studies that have shown that since the 1996 Personal Responsibility and Work Opportunity Act (PRWORA), immigrants are less likely to receive government benefits (Borjas, 2002; Fix, 2010; Kaushal and Kaestner, 2005).

The Long-Term Effects of Immigration

Recent policy debates on U.S. immigration policy have increasingly focused on the children of immigrants and their economic progress. To study the long-term impacts of immigration, we estimate the multivariate probit and Tobit regressions as specified in Equation (1), but restricting the sample only to native-born households and replacing the immigrant status indicator with a second-generation status indicator, which is equal to 1 for second generation households, and 0 for third-or-higher generation households. We exclude all immigrant households in this stage of the analysis.

Columns 3 and 4 in Table 4 reports the estimated second-generation results using the PSID and CPS data respectively. The results from the PSID show that second generation households are 7.2 percentage points more likely to contribute money to charitable organizations compared to similar third-or-higher generation households. In general, however, we do not find other significant differences between second generation households and third-or-higher generations in the PSID. The results from the CPS further show that compared with third-or-higher generation households, second generation households are 3.8 percentage points less likely to receive government benefits, and levels of government benefits are 3.4 percent lower for second generation households compared to third-or-higher generations. These results suggest that children of immigrants do not tend to free ride in their voluntary contributions and benefit received, compared to third-or-higher generation households.

Censored Least Absolute Deviations (CLAD) Estimation

We also estimate the impact of immigrant (second generation) status on the level of monetary contributions using Powell's (1984) Censored Least Absolute Deviations (CLAD) regression model.[13] Unlike the Tobit regression and other maximum likelihood specifications, the CLAD es-

[13] A similar regression on the levels of time contributions and private transfers do not achieve convergence.

timate is robust to heteroskedasticity. Again, our results from the CLAD regression are consistent with the multivariate Tobit regression results presented earlier. In particular, after controlling for household characteristics, immigrant households contribute lower levels of monetary contributions to charitable organizations than similar native-born households, but second generation households are not significantly different from third-or-higher generation households in their monetary contributions.[14]

The Duration Effect of Immigration

One key question in this paper is how the voluntary contributions of immigrants evolve as immigrants accumulate U.S. experience and acquire language skills, information, social norms, and processes of their host communities.[15] A main implication of the theoretical model is that the immigrant-native gaps in voluntary contributions and private transfers will tend to diminish if the observed differences are mainly driven by the initial gaps in household and extended family resources.[16] However, if observed group differences are due to differences in preferences, we would expect persistent differences in voluntary contributions over time.

We now turn to examine the impact of duration of stay on voluntary contributions, i.e., how the immigrant-native differences evolve over time as immigrant households gain U.S. experience, by replacing Equation (1) with the following structure,

$$Y_i = \beta_0 + \beta_{1,1}\, I_{less10,i} + \beta_{1,2}\, I_{between1020,i} + \beta_{1,3}\, I_{more20,i} + \beta_2 * X_i + \epsilon, \tag{4}$$

where $I_{less10,i}$, $I_{between1020,i}$, and $I_{more20,i}$ are dummy variables indicating whether the immigrant household i has been in the U.S. for less than 10 years, between 10 and 20 years, or more than 20 years, respectively. These variables equal to 0 for native-born households. Again, the omitted group is the native-born households. The estimated coefficients, $(\hat{\beta}_{1,1}, \hat{\beta}_{1,2}, \hat{\beta}_{1,3})$, standard errors, marginal effects and significance levels are reported in Table 5.

From Columns 1 and 3 of Table 5, we find that the estimated duration effects of immigration on monetary contributions and the receipt of benefits are negligible and insignificant at the 10 per-

[14] To conserve space, the CLAD regression results are not reported in the paper, but are available upon request.

[15] We should note that there are some limitations because we rely on cross-sectional data on charitable giving. Ideally, longitudinal data would allow us to observe a given household over time, enabling us to separately identify the role of cohort or "time of arrival" effects and duration effects in the assimilation process.

[16] A large number of studies investigate the extent to which immigrants' earnings, skill levels, and occupational attainment converge to the native born (Borjas and Friedburg, 2006; Borjas, 1994; Borjas, 1985; Chiswick, 1978). Chiswick (1978) estimates that the wages of the foreign born converge to the native-born wages after 15 years. Borjas (1985) argues that the use of cross-sectional data may overstate the rate of wage assimilation.

cent level. However, there is evidence in the PSID that immigrants' U.S. experience affects private transfers and time contributions. The incidence and level of private transfers tend to decrease as immigrant households accumulate U.S. experience. Compared to similar native households, earlier waves of immigrants are more likely to contribute time than more recent arrivals. The CPS results, reported in Columns 2 and 4, are comparable to the corresponding PSID results on time contributions. In particular, the immigrant-native gap in time contributions tends to decline with U.S. experience. Interestingly, we find stronger evidence of duration of stay on government benefits in the CPS than in the PSID. Recent arrivals are significantly less likely to receive benefits from government sources compared to the native-born and receive lower levels of benefits (Panel B). Taken together, we find that the immigrant-native differences in voluntary contributions, private transfers, and benefits received tend to diminish with U.S. experience.

Unobserved Heterogeneity

One key concern is that immigrant households may differ systematically from their native-born counterparts along observed and unobserved dimensions, and this has implications for voluntary contributions and benefit received. In particular, unmeasured income and wealth, English language proficiency, social networks, and other factors may reduce the number of requests that immigrant households receive from charitable organizations to contribute money or volunteer their time, and these factors may also influence their ability to access benefits from government and non-government sources. To address this concern, we examine only low income households and define this subsample to include only households whose permanent income is at or below the 40^{th} percentile level. We observe in our data that low-income households appear more homogenous in their economic circumstances than the full sample.[17] We then estimate our multivariate probit and Tobit regressions focusing only on households whose permanent income falls in the lowest 40^{th} percentile bracket and examine immigrant-native differences in contributions and benefits within this subsample.

Table 6 presents results for the low-income subsample. The results from the PSID show that for low-income households, immigrant status does not have a significant impact on monetary contributions, private transfers, or receipt of benefits from non-government and government sources. However, the impact of immigrant status on the level of time contributions remains negative and

[17]We should note however that although the low income subsample is more homogenous in their observed income and wealth measures, the immigrant-native differences in some other household characteristics are more significant in the low income subsample. In particular, immigrant heads tend to be younger, more likely to be married and male compared to native born heads in the low income subsample.

significant in both the PSID and the CPS, it is interesting to note that this impact is smaller in magnitude than the corresponding impact estimated in the full sample. Specifically, time contributions are 52.7 percent lower for immigrant households in the low-income subsample versus 77.1 percent lower in the full sample of the PSID. The results from the CPS on time contributions are comparable. Time contributions are 37.3 percent lower for immigrant households in the low-income subsample versus 60.6 percent in the full sample of the CPS. When we examine the benefits received results in the CPS, we find that low-income immigrants are 5.8 percentage point less likely to receive benefits from government sources, and receive 40.7 percent lower levels of government benefits compared to low-income native-born households.

Table 6 (Columns 3 and 4) also presents the results for second generation households compared to third-or-higher generations for low income households. From the PSID and CPS, we find that second generation households are more likely to contribute money, but less likely to receive government benefits, and receive lower levels of government benefits. In general, we do not find significant differences in private transfers and time contributions within the low income households.

Another source of heterogeneity is how households allocate their money and time across subsectors. To provide additional insights, we classify monetary and time contributions into two broad categories, religious and secular, in order to better understand immigrant-native differences in voluntary contributions. However, we do not find significant differences between households' religious and secular contributions.[18]

5 Propensity Score Estimation

We recognize that the results presented above have some limitations for studying immigrant-native group differences. Given the goal of understanding group differences, we need to ensure that immigrants and native-born households overlap in their background characteristics sufficiently to carry out meaningful comparisons. Given this concern, we use propensity score matching (PSM) methods (Rosenbaum and Rubin, 1983) to estimate differences in voluntary contributions and benefits received between immigrant and native households, who share the same household characteristics. The propensity score is defined as the "probability" of being an immigrant given observed household characteristics. In this subsection, we introduce the PSM estimator, followed by a summary of two technical approaches: the Kernel matching algorithm and the trimming method.

[18]To conserve space, we do not report the results here. The results are available upon request from the authors.

5.1 Specifications

The PSM Estimator

In our estimation, we consider the immigrant households as the treated group and the native-born households as the comparison group. The most common evaluation parameter is the average treatment effect on the treated (ATT), defined as follows,

$$ATT = E[Y_1|I = 1] - E[Y_0|I = 1], \tag{5}$$

where I is the indicator variable of immigrant status, and Y_i the potential outcome. $I = 1$ for the immigrant household for whom Y_1 is observed and $I = 0$ for the native-born household for whom Y_0 is observed.

Let X denote a vector of observable household characteristics that influence both immigrant status assignment and potential outcomes, and $P(X)$ the probability of being an immigrant household given X. The *PSM estimator* of ATT is defined as follows

$$ATT_{psm} = E_{P(X)|I=1}\Big[E[Y_1|I = 1, P(X)] - E[Y_0|I = 0, P(X)]\Big]. \tag{6}$$

Rosenbaum and Rubin (1983) prove that the PSM estimator is unbiased, i.e., $ATT_{psm} = ATT$, if $Y_0 \perp I|X$, which is known as the *unconfoundedness assumption*, and if $P(I = 1|X) < 1$, which is known as the *overlap assumption*.

The Kernel Matching Algorithm

The PSM estimator in its standard difference-in-means form was stated in the above formula, there are, however, various matching algorithms that have been used in the literature that vary in how the matched native-born households are selected, and in the weights assigned to each selected native-born household.[19] In this section, we focus on the kernel matching algorithm with Gaussian kernel type, as this algorithm has better finite-sample properties compared to other algorithms.[20]

Trimming Methods

The PSM estimator is only defined in the region of common support. Heckman et. al. (1997)

[19] For the technical detail of each matching algorithm, see Imbens (2004), Smith and Todd (2005), and Caliendo and Kopeinig (2008).

[20] See Zhao (2004) and Frolich (2004).

note that matching an incomparable comparison group to the treated group is a major source of evaluation bias as conventionally measured. Only the subset of the native-born households that is comparable to immigrant households should be used in the analysis (Dehejia and Wahba, 1999). Hence, an important step is to check the overlap and the region of common support between the immigrant and native-born households. The common support condition is particularly important for the implementation of kernel matching, compared to nearest neighbor matching (Caliendo and Kopeinig, 2008).[21] As in Smith and Todd (2005), we implement the trimming method to determine the region of common support, and set the trimming level at 2 percent. That is, we exclude those P values for which the estimated density is among the lowest 2 percent.

5.2 PSM Estimation Results

The PSM Estimation of the Impact of Immigration

Columns 1 and 2 in Table 7 report the PSM estimators of the immigrant-native differences in voluntary contributions and receipt of benefits. Column 1 reports the results from the PSID, and Column 2 results from the CPS. The estimated immigrant-native differences in time contributions again are very similar across the PSID and CPS, so are the estimated differences in government benefits received. Compared to similar native-born households, immigrant households tend to have lower incidence of time contributions (by 8.8 percentage points in the PSID and by 11.6 percentage point in the CPS,) and lower level of time contributions (by 30.6 hours in the PSID and by 28.9 hours in the CPS). In addition, the estimated immigrant-native gap in the level of received government benefits is -$311.61 in the PSID and -$200.26 in the CPS. These estimated immigrant-native differences, however, are insignificant at 10 percent level in the PSID, but are significant at 1 percent level in the CPS. Nevertheless, there is no evidence that immigrant households free ride more than native-born households.

The overall picture that emerges from the PSID results is that matching reduces the differences between immigrant households and their native-born counterparts, so the differences in voluntary contributions and benefits received are not statistically significant after matching. It is interesting to note that if we only consider those native-born households who are similar to immigrant households, the average differences in contributions and receipt of benefits tend to disappear in the PSID.

However, we do find persistent immigrant-native gaps in time contributions and benefits received from government sources after matching in the CPS. We should note that the significant

[21] For technical details, refer to the survey paper Caliendo and Kopeinig (2008) and Smith and Todd (2005).

immigrant-native differences observed in the CPS results even after matching may be due to the fact that the CPS does not provide information about household permanent income, wealth, religious affiliation, and extended family's wealth, all of which are important factors affecting the household's voluntary contributions. We should note that when we exclude these varaibles in the PSID, the PSM estimated immigrant-native differences in time contributions become significant as well. (See Appendix Table 3.)

The Long Term Impact of Immigration

We now turn to examine whether our results on the long term impacts of immigration are robust to the propensity score matching methods as well. To answer this question, we match second generation households with third-or-higher generation households, again using kernel matching methods with Gaussian kernel type and with common supports determined by the trimming method. In this section of analysis, the second generation households are the treated group while the third-or-higher generation households are the comparison group. Immigrant households are excluded from the analysis.

Columns 3 and 4 in Table 7 report the PSM estimators of the second-higher generation differences in the PSID and the CPS. In general, we do not find significant differences between second generation households and third-or-higher generation households in their voluntary contributions and benefits received, with two notable exceptions. First, the PSID results show that second generation households are 5.4 (5.9) percentage point more likely to contribute money (time) to charitable organizations compared to similar third-or-higher households. Second, the CPS results suggest that second generation households are 6.7 percentage point less likely to receive government benefits, and the level of government benefits received by second generation households is about $71.7 lower than that received by similar third-or-higher generation households. These results suggest that second generation households are more likely to make monetary and time contributions, but less likely to receive benefits and receive less benefits from government resources. Consistent with the regression estimates, we do not find evidence of long term impact of immigration on voluntary contributions or benefits received.

Unobserved Heterogeneity

Table 8 presents the PSM estimators of the immigrant-native differences in voluntary contributions and receipt of benefits for the low-income subsample including only those households whose

permanent income falls in the lowest 40^{th} percentile bracket. The results from the PSID show that for low-income households, immigrant status does not have a significant impact on monetary and time contributions, private transfers, or receipt of benefits from non-government and government sources. The results from the CPS on time contributions remain significant. More specifically, compared to similar native-born households, immigrant households tend to have lower incidence (by 6.5 percentage points) and lower levels (by 13.34 hours) of time contributions. Immigrant households also receive $396.61 lower benefits from government resources. Again, there is no evidence from the low-income subsample that immigrant households free ride more than similar native-born households.

-Table 8 (Columns 3 and 4) also presents the results for second generation households compared to third-or-higher generations in the low income subsample. The PSID results are insignificant at 10% level, suggesting that for low-income households, there are no significant second-higher-generation differences in voluntary contributions and receipt of benefits. The CPS results instead suggest that compared to third-or-higher generations, second generation households tend to be 5.4 percentage points less likely to receive benefits from government resources, and receive $180.17 lower in level.

Another source of heterogeneity is how households allocate their money and time across subsectors. To provide additional insights, we classify monetary and time contributions into two broad categories, religious and secular, in order to better understand immigrant-native differences in voluntary contributions. However, we do not find significant differences between households' religious and secular contributions.[22]

5.3 Quality of Matching and Other Estimations

5.3.1 Quality of Matching

One important step in the implementation of propensity score estimation is to assess matching quality. In particular, since we do not condition on all covariates but on the propensity score, we investigate whether the matching procedure is able to balance the distribution of the relevant variables in both the immigrant and native-born groups. An important first step is to check the overlap and the region of common support between immigrant and native-born households. If the common support condition is violated, remedial measures may be needed such as including

[22]To conserve space, we do not report the results here. The results are available upon request from the authors.

interaction terms in the estimation of the propensity score. A helpful theorem in this context is suggested by Rosenbaum and Rubin (1983) and states that

$$X \perp I \mid P(I = 1|X). \tag{7}$$

This means that after conditioning on the propensity score - $P(I = 1|X)$ - additional conditioning on X should not provide new information about immigrant status.

Table 9 provides three measures of the quality of matching between the immigrant and native households and between the second generation and third-or-higher generation households in the PSID and CPS. First, Table 9 shows that after matching, the immigrant-native (second-higher generation) differences in household characteristics become statistically and economically insignificant. For example, before matching the immigrant-native differences in the probabilities of the head being white, Hispanic, and Catholic are -0.53, 0.55, and 0.44 respectively and significant at 1 percent significance level, while after matching these numbers are -0.04, 0.03, and 0.01 respectively and become insignificant even at 10 percent level. This implies that Condition (7) is likely to be satisfied.

Second, the pseudo r-squared listed on the last third row in Table 9 tell us to what extent the immigrant (second generation) status is correlated with all the covariates after matching. In the PSID, the covariates can explain only 6.3 percent (1.5 percent) of the variation in the immigrant (second generation) status after matching. The number is even smaller in the CPS, which is 0.8 percent (1.2 percent). This result also implies that Condition (7) is likely to hold.

Third, the p-values reported in the last second row show that after matching, the immigrant (second generation) status is unlikely to have a linear relationship with the covariates. This is additional evidence in favor of Condition (7).

In summary, various measures of matching quality tell us that our PSM estimation with kernel algorithm and trimming method is reliable.

5.3.2 Nearest Neighbor Matching Estimation

To check robustness of the kernel matching results, we also use the *nearest neighbor* algorithm to match immigrant and native households,[23]and report the corresponding estimators in Appendix Table 4. The reported nearest neighbor matching estimators are similar to the estimators from the

[23]For the technical detail of the nearest neighbor matching algorithm, see Imbens (2004), Smith and Todd (2005), and Caliendo and Kopeinig (2008).

kernel matching algorithm, implying that our results are robust across various matching algorithms; in the PSID, there are no significant immigrant-native (second-higher generation) differences in voluntary contributions or receipt of benefits. In the CPS, immigrant households tend to have lower incidence of time contributions (by 10 percentage points) and lower level of time contributions (by 22.1 hours). However, immigrant households are also 3.5 percentage point less likely to receive government benefits, and receive $211.9 less in government benefits. Therefore, there is no evidence that immigrant households free ride more than natives.

5.3.3 Estimations using the Additional Wave of the PSID and CPS

To check robustness of the results from the 2003 wave of the PSID and the CPS, we apply the same empirical methodologies to the 2005 wave of the PSID and the CPS. We report the regression results in Appendix Table 5 and the propensity score matching results in Appendix Table 6.

We get similar results from the 2005 wave of the PSID and the CPS. The regression results, reported in Appendix Table 5, show that the immigrant status does not have a significant impact on the incidence of monetary contributions. Immigrant households are less likely to contribute time and contribute lower level of time towards charitable organizations. And there is evidence in the CPS that immigrant households receive 25.8 percent lower level of government benefits compared to similar native households. As to the long term impact of immigration, we do not find significant differences between second generation and third-or-higher generation households in their voluntary contribution behaviors. Compared to third-or-higher generation households, Second generation households, however, are less likely to receive government benefits by 1.9 percentage points in the PSID and 3.3 percentage points in the CPS, and receive 28.5 percent lower level of government benefits in the CPS. The propensity score matching results, reported in Appendix Table 6, show that there is no significant immigrant-native difference in their monetary contributions. However, compared to native households, immigrant households are less likely to make time contributions, and contribute lower level of time to charitable organizations. Although there is evidence from both the PSID and the CPS that immigrant households are more likely to receive government benefits, results from the CPS show that immigrant households receive $355 lower level of government benefits. In addition, there is no evidence of a long term impact of immigration. Instead, second generation households are more likely to make monetary contributions but less likely to receive government benefits, compared to third-or-higher generation households. Second generation households also receive lower levels of government benefits.

In sum, both the regression and propensity score matching results from the 2005 wave of the PSID and the CPS provide no evidence that immigrant households free ride more than similar native households. Neither is there evidence of a long term impact of immigration.

6 Conclusions

This paper provides new evidence on the immigrant-native differences in their voluntary contributions to public goods and receipt of benefits from government and non-government sources. Since welfare reform, policy debates on immigration have increasingly shifted attention away from the federal government towards non-profit institutions and state and local governments. In the U.S., perhaps more than in any other industrialized nations, the financing of social services, health care, higher education, disaster relief, and other public goods depends heavily on private contributions or on a mixture of public and private contributions. U.S. nonprofit charitable organizations are not legally required to verify immigration status when they provide assistance or when they receive voluntary contributions.

We do not find evidence that immigrants free ride more than the native-born.

First, immigrant status has no statistically significant impact on the likelihood of monetary contributions toward public good provision.

Second, we also find that the immigrant-native differences in time contributions tend to diminish over time as immigrant households acquire U.S. experience.

Third, compared to similar native-born households, immigrant households are less likely to report receiving assistance from non-government and government sources, and receive lower level of benefits from government sources.

Finally, we examine the voluntary contributions and received benefits of second-generation immigrants to gain information about the long-term impact of immigration, and we do not find significant differences between the children of immigrants and third-or-higher generations of Americans in their voluntary contributions of money and time and receipt of benefits from government and non-government sources. The results are robust to various income and wealth controls and alternative empirical specifications.

Beyond their role in the private provision of public goods, voluntary contributions of money and time have emerged in the recent literature as key indicators of "social capital"–defined as trust, norms, and networks that spill over to the market and state and that can improve the efficiency of

society by facilitating cooperative outcomes. With this in mind, the results on immigrant-native differences in voluntary contributions to public goods may have implications for understanding the impact of immigration on broader societal outcomes.

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7 Mathematical Appendix

In the mathematical appendix, we analyze the public good contributions of a representative immigrant household and a representative native-born household in a theoretic differential game framework. We first set up the game and each household's maximization problem. Then we analyze the immigrant-native differences in their Open-loop Nash equilibrium strategies, and how these immigrant-native differences develop over time.

7.1 The Model

We construct a differential game between two representative households indexed by $j = i, n$, with i being the immigrant household, and n being the native household. Household j's instantaneous utility at time t is:

$$U(x_t^j, l_t^j; g_t^j, v_t^j; G_t, V_t) + \beta U_F(A_{F}{}_t^j), \tag{8}$$

The first part of the utility function, $U(\cdot)$, is Household j's private utility, which depends on private consumption, x_t^j, leisure, l_t^j, the warm-glow effect of own monetary and time contributions, g_t^j and v_t^j, and the aggregate monetary and time contributions in the community, G_t and V_t, each of which is the aggregation of individual contributions:

$$G_t = g_t^i + g_t^n, \quad \text{and} \quad V_t = v_t^i + v_t^n. \tag{9}$$

The second part, $U_F(\cdot)$, captures the household's preference over the well-being of the extended family, which depends only on the extended family's wealth $A_{F}{}_t^j$. $0 < \beta < 1$ is the relative weight put on $U_F(\cdot)$.

We assume that the native household has more initial wealth and higher wage rate than the immigrant does. Household j's wealth at time t, A_t^j, must satisfy the following initial condition and law of motion:

$$A_0^i < A_0^n \quad \text{and} \quad \dot{A_t^j} = (1-\tau)(w_j n_t^j + r A_t^j - g_t^j) - x_t^j - e_t^j, \quad \text{with} \quad j = i, n \quad \text{and} \quad w_i < w_n, \tag{10}$$

where w_j is a constant wage rate for Household j, n_t^j working hours, r a constant interest rate, τ the marginal income tax rate,[24] and e_t^j private transfers to the extended family. We assume that the extended family's wealth is higher for the native household than the immigrant, and that e_t^j is

[24] So $1 - \tau$ is the price of monetary contributions due to the tax deductibility of charitable donations.

the only factor that increases extended family's wealth $A_{F}{}_t^j$:

$$A_{F}{}_0^i > A_{F}{}_0^n \quad \text{and} \quad \dot{A_{F}{}_t^j} = e_t^j, \quad j = i, n. \tag{11}$$

Each household also has the same time endowment, L, which is allocated across work, leisure, and voluntary time contributions, i.e.

$$L = n_t^j + l_t^j + v_t^j. \tag{12}$$

Household j solves the following optimal control problem:

$$\max_{\substack{x_t^j, l_t^j, n_t^j \\ g_t^j, v_t^j, e_t^j}} \int_0^\infty e^{-\rho t} \left[U(x_t^j, l_t^j; g_t^j, v_t^j; G_t, V_t) + \beta U_F(A_{F}{}_t^j) \right] dt, \tag{13}$$

subject to Constraints (8)-(12), where ρ is the time discount rate, and satisfies $\rho < r(1-\tau)$.

The Hamiltonian of this optimal control problem is

$$\begin{aligned} H_t^j =& U(x_t^j, l_t^j; g_t^j, v_t^j; g_t^n + g_t^i, v_t^n + v_t^i) + \beta U_F(A_{F}{}_t^j) \\ &+ \lambda_t^j \left[(1-\tau) \left(wL - wl_t^j - wv_t^j + rA_t^j - g_t^j \right) - x_t^j - e_t^j \right] + \delta_t^j e_t^j \end{aligned} \tag{14}$$

The maximum principle conditions, necessary for a Open-loop Nash equilibrium, are:[25]

$$\frac{\partial H_t^j}{\partial g_t^j} = U_{g_t^j} + U_{G_t} - (1-\tau)\lambda_t^j = 0 \tag{15}$$

$$\frac{\partial H_t^j}{\partial e_t^j} = \delta_t^j - \lambda_t^j \leq 0, \quad e_t^j \geq 0, \quad \text{and} \quad \frac{\partial H_t^j}{\partial e_t^j} e_t^j = 0 \tag{16}$$

$$\dot{\lambda_t^j} = -\frac{\partial H_t^j}{\partial A_t^j} + \rho\lambda_t^j = \left[\rho - r(1-\tau)\right] \lambda_t^j \tag{17}$$

$$\dot{\delta_t^j} = -\frac{\partial H_t^j}{\partial A_{F}{}_t^j} + \rho\delta_t^j = \rho\delta_t^j - \beta U_F'(A_{F}{}_t^j) \tag{18}$$

7.2 The Open-loop Nash Equilibrium

We first analyze the optimal monetary contributions in the open-loop Nash equilibrium (g_t^i and g_t^n), then time contributions (v_t^i and v_t^n), and finally private transfers (e_t^i and e_t^n).

[25] To conserve space, we only list the conditions that will be used in following analysis.

7.2.1 Monetary Contributions

From (17) we get

$$\lambda_t^j = \lambda_0^j e^{[\rho - r(1-\tau)]t}. \tag{19}$$

By substituting (19) into (15) we get

$$U_{g_t^j} + U_{G_t} = (1-\tau)\lambda_0^j e^{[\rho - r(1-\tau)]t}. \tag{20}$$

By subtracting (20) with $j = n$ from (20) with $j = i$, we get

$$U_{g_t^i} - U_{g_t^n} = (1-\tau)e^{[\rho - r(1-\tau)]t}(\lambda_0^i - \lambda_0^n). \tag{21}$$

Note that λ is the marginal utility of wealth, and the immigrant is assumed to have less initial wealth than the native, so $\lambda_0^i > \lambda_0^n$, and $U_{g_t^i} - U_{g_t^n} > 0$, and thus $g_t^i < g_t^n$, $\forall t$.

To analyze the time path of monetary contributions, we need to solve for the motion functions. By taking the total derivative[26] on both sides of (20) and rearranging it, we get the law of motion of g_t^i as a function of $\dot{g_t^n}$

$$\dot{g_t^i} = \frac{(1-\tau)\lambda_0^i e^{[\rho - r(1-\tau)]t}\left[\rho - r(1-\tau)\right] - U_{G_tG_t}\dot{g_t^n}}{U_{g_t^i g_t^i} + U_{G_tG_t}}, \tag{22}$$

and symmetrically, the law of motion of g_t^n as a function of $\dot{g_t^i}$

$$\dot{g_t^n} = \frac{(1-\tau)\lambda_0^n e^{[\rho - r(1-\tau)]t}\left[\rho - r(1-\tau)\right] - U_{G_tG_t}\dot{g_t^i}}{U_{g_t^n g_t^n} + U_{G_tG_t}}. \tag{23}$$

Solving (22) and (23) gives us the reduced forms of law of motion of monetary contributions for both the immigrant and the native-born households:

$$\dot{g_t^i} = \frac{(1-\tau)e^{[\rho - r(1-\tau)]t}\left[\rho - r(1-\tau)\right]\left[(\lambda_0^i - \lambda_0^n)U_{G_tG_t} + \lambda_0^i U_{g_t^n g_t^n}\right]}{U_{G_tG_t}(U_{g_t^i g_t^i} + U_{g_t^n g_t^n}) + U_{g_t^i g_t^i}\cdot U_{g_t^n g_t^n}}, \tag{24}$$

$$\dot{g_t^n} = \frac{(1-\tau)e^{[\rho - r(1-\tau)]t}\left[\rho - r(1-\tau)\right]\left[(\lambda_0^n - \lambda_0^i)U_{G_tG_t} + \lambda_0^n U_{g_t^i g_t^i}\right]}{U_{G_tG_t}(U_{g_t^i g_t^i} + U_{g_t^n g_t^n}) + U_{g_t^i g_t^i}\cdot U_{g_t^n g_t^n}}. \tag{25}$$

Note that (24) and (25) have the same denominator, which is positive. Further because $\rho - r(1-\tau) < 0$, and $\lambda_0^i > \lambda_0^n$, it follows that $(\lambda_0^i - \lambda_0^n)U_{G_tG_t} + \lambda_0^i U_{g_t^n g_t^n} < 0$, and thus $\dot{g_t^i} > 0$.

[26] We refer to the full derivative with respect to time as the total derivative.

On the other hand, the sign of $(\lambda_0^n - \lambda_0^i)U_{G_tG_t} + \lambda_0^n U_{g_t^i g_t^i}$ is ambiguous. If $U_{gg} \approx 0$ compared to U_{GG}, then $(\lambda_0^n - \lambda_0^i)U_{G_tG_t} + \lambda_0^n U_{g_t^i g_t^i} \approx (\lambda_0^n - \lambda_0^i)U_{G_tG_t} > 0$, and thus $\dot{g_t^n} < 0$; while if $U_{GG} \approx 0$ compared to U_{gg}, then $(\lambda_0^n - \lambda_0^i)U_{G_tG_t} + \lambda_0^n U_{g_t^i g_t^i} \approx \lambda_0^n U_{g_t^i g_t^i} < 0$, and thus $\dot{g_t^n} > 0$.

We summarize the above results of households' monetary contributions in the following proposition.

Proposition 7.1. *The immigrant household contributes less money than the native household does over time. The immigrant household always increases her monetary contributions over time. On the other hand, the native household decreases (increases) her monetary contributions, if the marginal utility in warm-glow effect (the marginal utility in total monetary contributions) is approximately constant.*

We then study the question whether the immigrant-native difference in monetary contributions diminishes over time. This question is equivalent to whether $\dot{g_t^i} > \dot{g_t^n}$. The following proposition answers this important question.

Proposition 7.2. *The immigrant-native difference in monetary contributions diminishes over time if any of the following conditions are satisfied:*

(i) $U_{gg} \approx 0$*, so that* $\dot{g_t^n} < 0$.

(ii) $U_{ggg} \leq 0$.

(iii) $U_{ggg}(\cdot) > 0$, $\partial E_g(U_{gg})/\partial g \geq 0$,[27] *and* $U_{g_0^i g_0^i} \geq \lambda_0^i/\lambda_0^n \cdot U_{g_0^n g_0^n}$.

Condition (i) follows directly from Proposition 7.1. We prove Conditions (i) and (iii) in two steps. We state the first step as a lemma.

Lemma 1. *For any* t, $\dot{g_t^i} > \dot{g_t^n}$ *if*

$$U_{g_t^i g_t^i} \geq \frac{\lambda_0^i}{\lambda_0^n} \cdot U_{g_t^n g_t^n}. \tag{26}$$

Proof. Subtracting (25) from (24) gives

$$\dot{g_t^i} - \dot{g_t^n} = \frac{(1-\tau)e^{[\rho - r(1-\tau)]t}\left[\rho - r(1-\tau)\right]\left[2(\lambda_0^i - \lambda_0^n)U_{G_tG_t} + \lambda_0^i \cdot U_{g_t^n g_t^n} - \lambda_0^n \cdot U_{g_t^i g_t^i}\right]}{U_{G_tG_t}(U_{g_t^i g_t^i} + U_{g_t^n g_t^n}) + U_{g_t^i g_t^i} \cdot U_{g_t^n g_t^n}}. \tag{27}$$

Condition (26) implies $\lambda_0^i \cdot U_{g_t^n g_t^n} - \lambda_0^n \cdot U_{g_t^i g_t^i} \leq 0$. Further because $\lambda_0^i > \lambda_0^n$ and $U_{G_tG_t} < 0$, the part in the square brackets on the RHS of (27) is negative. Then because $\rho - r(1-\tau) < 0$, (27) is positive as desired. □

[27] $E_x(y)$ is the elasticity of y with respect to x. In particular, $E_g(U_{gg}) = \partial log(U_{gg})/\partial log(g)$.

PROOF OF PROPOSITION 7.2:

We prove that either (ii) or (iii) in Proposition 7.2 is sufficient for (26) at any t.

Sufficiency of Condition (ii) is straightforward from Lemma 1. $\lambda_0^i/\lambda_0^n > 1 \geq U_{g_t^i g_t^i}/U_{g_t^n g_t^n}$, $\forall t$, so (26) is satisfied at any t.

To prove sufficiency of Condition (iii), it suffices to prove that under the conditions $U_{ggg} > 0$ and $\partial E_g(U_{gg})/\partial g \geq 0$, if $U_{g_t^i g_t^i}/U_{g_t^n g_t^n} \leq \lambda_0^i/\lambda_0^n$, then for $\forall \epsilon = t + dt \to t$, $U_{g_\epsilon^i g_\epsilon^i}/U_{g_\epsilon^n g_\epsilon^n} \leq \lambda_0^i/\lambda_0^n$. This result implies that if (26) is satisfied at time 0, it will be satisfied at any $t > 0$.

Suppose $U_{g_t^i g_t^i} \geq \lambda_0^i/\lambda_0^n \cdot U_{g_t^n g_t^n}$, then by Lemma 1, $\dot{g_t^i} > \dot{g_t^n}$. From Proposition 7.1, we know $\dot{g_t^i} > 0$, however, the sign of $\dot{g_t^n}$ is ambiguous, and we have to distinguish between two cases.

Case 1: $\dot{g_t^i} > 0 \geq \dot{g_t^n}$. Because $U_{ggg} > 0$, it follows that $\dot{U}_{g_t^i g_t^i} = U_{g_t^i g_t^i g_t^i}\dot{g_t^i} > 0$ and $\dot{U}_{g_t^n g_t^n} = U_{g_t^n g_t^n g_t^n}\dot{g_t^n} \leq 0$. Then we have for $\epsilon = t + dt \to t$ that

$$U_{g_\epsilon^i g_\epsilon^i} = U_{g_t^i g_t^i} + \dot{U}_{g_t^i g_t^i} dt > U_{g_t^i g_t^i} \geq \frac{\lambda_0^i}{\lambda_0^n} \cdot U_{g_t^n g_t^n} > \frac{\lambda_0^i}{\lambda_0^n} \cdot (U_{g_t^n g_t^n} + \dot{U}_{g_t^n g_t^n} dt) = \frac{\lambda_0^i}{\lambda_0^n} U_{g_\epsilon^n g_\epsilon^n}. \tag{28}$$

Case 2: $\dot{g_t^i} > \dot{g_t^n} > 0$. Because $0 < g_t^i < g_t^n$, thus $\dot{g_t^i}/g_t^i > \dot{g_t^n}/g_t^n > 0$. On the other hand, because $\partial E_g(U_{gg})/\partial g \geq 0$, $g_t^i < g_t^n$, and $U_{ggg} > 0$, it follows that $E_{g_t^i}(U_{g_t^i g_t^i}) \leq E_{g_t^n}(U_{g_t^n g_t^n}) < 0$. Taken together, we get

$$\frac{\dot{U}_{g_t^i g_t^i}}{U_{g_t^i g_t^i}} = E_{g_t^i}(U_{g_t^i g_t^i}) \cdot \frac{\dot{g_t^i}}{g_t^i} < E_{g_t^n}(U_{g_t^n g_t^n}) \cdot \frac{\dot{g_t^n}}{g_t^n} = \frac{\dot{U}_{g_t^n g_t^n}}{U_{g_t^n g_t^n}} < 0, \tag{29}$$

where the last inequality follows from $E_{g_t^n}(U_{g_t^n g_t^n}) < 0$ and $\dot{g_t^n}/g_t^n > 0$. Then we get as desired that

$$\begin{aligned} U_{g_\epsilon^i g_\epsilon^i} &= U_{g_t^i g_t^i} + \dot{U}_{g_t^i g_t^i} dt = U_{g_t^i g_t^i}\Big(1 + \frac{\dot{U}_{g_t^i g_t^i}}{U_{g_t^i g_t^i}} dt\Big) > U_{g_t^i g_t^i}\Big(1 + \frac{\dot{U}_{g_t^n g_t^n}}{U_{g_t^n g_t^n}} dt\Big) \\ &\geq \frac{\lambda_0^i}{\lambda_0^n} U_{g_t^n g_t^n}\Big(1 + \frac{\dot{U}_{g_t^n g_t^n}}{U_{g_t^n g_t^n}} dt\Big) = \frac{\lambda_0^i}{\lambda_0^n}\Big(U_{g_t^n g_t^n} + \dot{U}_{g_t^n g_t^n} dt\Big) = \frac{\lambda_0^i}{\lambda_0^n} U_{g_\epsilon^n g_\epsilon^n}. \end{aligned} \tag{30}$$

$$\tag{31}$$

We should note that Condition (ii) in Proposition 7.2 is equivalent to $P(g) = -U_{ggg}/U_{gg} \leq 0$, where $P(g)$ is the coefficient of absolute prudence. In addition, one can check that any HARA utility function[28] with $b = 0$ or $a \geq -1$, especially any CRRA utility, satisfies the conditions that $U_{ggg} > 0$ and that $\partial E_g(U_{gg})/\partial g \geq 0$ in Condition (iii).

[28] HARA utility is defined to satisfy $-U_{gg}/U_g = 1/(a \cdot g + b)$.

7.2.2 Time Contributions

The analysis for time contributions is the same as the above analysis for monetary contributions by replacing g_t^i with v_t^i, g_t^n with v_t^n, $G_t$with V_t and $1-\tau$ with $w_j(1-\tau)$. We conclude that the immigrant household provides less time contributions than the native-born. However, the immigrant-native gap in time contributions diminishes over time if the household's marginal utility in warm-glow effect is relatively constant, or if $U_{vvv} \leq 0$, or if $U(g,\cdot)$ exhibits $HARA$ with $b = 0$ or $a \geq -1$.

7.2.3 Private Transfers

We focus on the case where $e_t^j > 0, \forall t, \forall j$. Then (16) implies that $\delta_t^j = \lambda_t^j$ and $\dot{\delta_t^j} = \dot{\lambda_t^j}$. By substituting (17) and (18) into the last equation we get $A_F{}_t^j = U_F'^{-1}\left(\frac{r(1-\tau)}{\beta}\lambda_t^j\right)$, where $U_F'^{-1}(\cdot)$ is the inverse function of $U_F'(\cdot)$. Then taking the total derivative on both sides of the last equation gives the policy function for private transfer e_t^j,

$$e_t^j = \dot{A_{Ft}^j} = \frac{r(1-\tau)\left[\rho - r(1-\tau)\right]\lambda_t^j}{\beta U_F''(A_F{}_t^j)}. \tag{32}$$

In addition, from (17), (18), and the fact that $\dot{\delta}_t^j = \dot{\lambda}_t^j$ and $\delta_t^j = \lambda_t^j$, we get

$$\lambda_t^j = \frac{\beta U_F'(A_F{}_t^j)}{r(1-\tau)}. \tag{33}$$

By substituting (33) into (32) we get

$$e_t^j = \frac{\left[\rho - r(1-\tau)\right]U_F'(A_F{}_t^j)}{U_F''(A_F{}_t^j)} = \left[r(1-\tau) - \rho\right]T(A_F{}_t^j), \tag{34}$$

where $T(A_F{}_t^j) = -U_F'(A_F{}_t^j)/U_F''(A_F{}_t^j)$ is interpreted as the absolute risk tolerance.

Proposition 7.3. *If $T'(A) \leq 0$ on $A \in R_+$, then $e_t^i \geq e_t^n, \forall t \geq 0$.*

Proof. Suppose $T'(A) \leq 0$. Then by (34) it suffices to prove that $A_{Ft}^i \leq A_{Ft}^n, \forall t \geq 0$. Recall that $A_{Ft}^i - A_{Ft}^n$ is a continuous function in t, and $A_{F0}^i - A_{F0}^n < 0$. Then suppose for contradiction that $\exists \tau > 0$, such that $A_{F\tau}^i - A_{F\tau}^n > 0$. By intermediate value theorem, there is an $s < \tau$ such that $A_{Fs}^i - A_{Fs}^n = 0$. However, when $A_{Fs}^i - A_{Fs}^n = 0$, by (34) we know $e_s^i = e_s^n$, thus $\dot{A_F{}_t^i} = \dot{A_F{}_t^n}$, and $A_{Ft}^i = A_{Ft}^n, \forall t \geq s$. This is a contradiction. So $A_{Ft}^i \leq A_{Ft}^n, \forall t \geq 0$, as desired. □

Proposition 7.4. *If $T'(A) \leq 0$ and $T'' \geq 0$ on $A \in R_+$, then $\dot{e_t^i} \leq \dot{e_t^n}, \forall t \geq 0$.*

Proof. By taking the total derivative on both sides of (34) and after some computation, we get

$$\dot{e_t^i} - \dot{e_t^n} = [r(1-\tau) - \rho] \left[T'(A_{F}{}_t^i) e_t^i - T'(A_{F}{}_t^n) e_t^n \right]. \tag{35}$$

If $T'(A) \leq 0$ on $A \in R_+$, it follows from Proposition 7.3 that $e_t^i \geq e_t^n, \forall t \geq 0$. Then suppose $T''(A) \geq 0$ on $A \in R_+$. Because $A_{F}{}_t^i \leq A_{F}{}_t^n, \forall t \geq 0$, it follows that $T'(A_{F}{}_t^i) \leq T'(A_{F}{}_t^n), \forall t \geq 0$. Then from (35), it follows that $\dot{e_t^i} \leq \dot{e_t^n}, \forall t \geq 0$. □

Altogether, Propositions 7.3-7.4 say that if the household's risk tolerance on extended family's wealth, $T(\cdot)$, is a decreasing and convex function, then the immigrant household always provides more private transfers than the native-born, but the difference will diminish over time.