IMMIGRATION MULTIPLIER: A NEW METHOD OF MEASURING THE IMMIGRATION PROCESS

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Introduction

The growth of ethnic populations in the United States has been the focus of much academic research in various aspects of population studies. Some of these studies have focused on the growth of the immigrant population in the context of immigration theories, and some on the immigrant reproduction in the destination countries. This research studies the overall growth of the immigrant population and ethnic groups within the United States by presenting a statistical method for measuring the immigration process. The presented method treats the immigrant reproduction processes as part of migration processes, and calculates the overall immigration multiplier.

The focus of this research is on the "explosiveness" of the migration waves in the last 30 years, as most research suggested that family migration is the leading cause. In 1981, the Select Commission on Immigration and Refugee Policy (SCIRP) argued that such "chain migration" effect is the result of current immigration law that permitted "runaway demand" or an explosive chain migration multiplier[2]. It is also clear that migration is a socioeconomic immigration process that is directly affected by state control (in terms of immigration laws). Therefore, the actual chain migration effect not only reflects the current immigration process, but also the impact of immigration policies (Zolberg 1999). Research shows that chain migration effect is not a unique phenomenon in the United States. If we review the immigration process in other countries, we will observe similar growth patterns that can be attributed to the migration chain. One such

example could be illustrated in the analysis of mass immigration in Israel (Friedlander 1975; Friedlander and Goldscheider 1978).

Many studies on chain migration[3] demonstrate that the immigration patterns can be explained in terms of principal immigrants and dependent immigrants. Efforts have been made to measure the scope and magnitude of chain migration. The Immigration Multiplier, as an indicator for measuring chain migration, has been suggested for measuring the chain effect of migration (Jasso and Rosenzweig 1986, 1989, 1990; Reimers 1985, 1992; Arnold *et al*. 1989; Gunatilleke 1998). In their studies, Reimers (1985, 1992), Arnold *et al*. (1989) and Gunatilleke (1998) estimated the Immigration Multipliers via case studies and/or surveys. Their estimates of Immigration Multipliers range from as low as 0.5 to as high as 18. The significant variations of the values are mainly attributed to two factors: different research regions and different definitions of the Immigration Multipliers. Reimers (1985, 1992) and Arnold *et al*. (1989) studied immigrants to U.S., and their Immigration Multipliers include family members (relatives) only. However, Gunatilleke (1998)'s studies focused on South Asia), and the Immigration Multipliers do include friends in addition to family members.

Research done by Jasso and Rosenzweig (1986, 1989) has been characterized as the only theoretical calculation of the Immigration Multipliers so far. They conclude that the Immigration Multiplier is in the range of 1.16 to 1.40. With this Immigration Multiplier, some scholars (Goering 1989; Massey *et al*. 1994) conclude that the concerns of the chain migration effect might have been overstated because the lower than expected values of Immigration Multipliers. This may have discouraged further research on the

Immigration Multiplier in the 1990s and after. However, the method Jasso and Rosenzweig used for calculating the Immigration Multiplier has been widely analyzed. Certain scholars did voice concerns over several key issues such as the method, sample size, research criteria, *etc*. (Passel and Woodrow 1987; Arnold *et al*. 1989; Teitelbaum 1989). Massey and associates (Massey *et al*. 1994) suspected that the low Immigration Multiplier (from Jasso and Rosenzweig's research) might be related to the limitations of their sample. They suggest that the potential for future immigration through such multiplier effects is still real because of the long backlog of granting immigrants legal entry visas from many countries, especially the applicants from Mexico. They continue to suggest that "results thus far come from a relatively small number of community case studies and a small number of quantitative analyses from a limited range of countries and datasets." Therefore, he challenged scholars that "more and better research on non-Mexican samples is clearly needed to confirm the generality of findings." Edmonston (1996) also concludes that "[t]here is currently inadequate information on the rates at which immigrants sponsor new immigrants and thus on the size of the Immigration Multiplier" (Edmonston 1996: 52). As Goering (1989) concluded, "…. [T]here are substantial methodological and analytic difficulties associated with reliably measuring the size and characteristics of immigrant multiplication. …… That is, there are no technically simple means to calculate the size and growth of the expansion of immigrant chain" (Goering 1989: 809).

With the magnitude of immigration growth since the 1970s, more questions are to be answered on the possible effects of chain migration. In this research, I will re-visit and reevaluate the Immigration Multiplier effect in the chain migration process. My

study of the Immigration Multiplier will be focused within the context of chain migration, with the purpose to de-mystify the complicated nature of the Immigration Multiplier, and to present a new method in calculating it. Since we know that immigrants tend to stay in the destination country permanently if children are born there (Krafft 1994; Carter and Sutch 1998), and that population composition of the destination country is changed cumulatively due to the production of future generations of the immigrants (Smith and Edmonston 1997), I have included the study of reproductive pattern of immigrants as part of the immigration processes because the examination of migration and fertility together provides valuable insights into each of the two demographic phenomena (Lindstrom and Saucedo 2002: 1342-1343). This would help us to measure the full scope of the multiplier effect of the migration process, and to understand better the current and future ethnic composition of the U.S. population. Hence, the concept of Immigration Multiplier[4] in this research has been expanded to study the second generation of immigrants as the final phase of the migration chain. The new method will offer us a new tool, not only to measure the migration aspect but also the reproductive aspect of the multiplier effect of the waves of immigration.

The Concept

This concept of the new immigration multiplier is based on the chain migration concept that defines *principal immigrants* and *migration chain* as its foundation. A principal immigrant is defined as any immigrant who is sponsored by non-family members such as employers (sponsoring economic immigrants such as professional workers or seasonal workers), governments (admitting refugees or asylum-seekers), or U.S.-born citizens (marrying foreign-born individuals). A *derived family immigrant* is an immigrant

sponsored by family members, who may or may not be the original principal immigrants. Hence, a principal immigrant is the initial chain of the migration chain, because he/she can sponsor his/her family members, who in turn can further sponsor their family members, thus creating a series migration chains. Migration, thus, can be described as a chain process that begins with principal immigrants, who expand the migration chains by sponsoring their family members. Since all immigrants are also capable of producing children in the destination country, the size of second-generation immigrants is directly linked to the size of the migration chain, with the immigrant fertility being a factor. The migration chain will become inactive only when the immigrant stops sponsoring his/her family members for good. Any child born to immigrants in the destination country (a second-generation immigrant) is also defined as the last node of the particular branch of the chain because the U.S.-born child will be considered U.S. citizen, and becomes a member of the native-born population of the destination country. Therefore, any new foreign-born immigrant this second-generation immigrant sponsor (such as spouses) will be considered as *a principal immigrant,* who can start a new migration chain again. In short, all first-generation immigrants are active "chains" within the chain migration process who are capable of both sponsoring their family members and producing children in the destination country.

The Method

The method presented here is based on the above discussed chain migration concept to measure the multiplier effects. The term *Immigration Multiplier (IM)* is used with new definitions along with mathematical formulas. The new Immigration Multiplier will be defined as the product of two components: the *Immigration Unification Multiplier*

(IUM), and the *Immigration Reproduction Multiplier (IRM)*. The value of IM can be explained as the combined total number of all first-generation immigrants (including the principal immigrants) and second-generation immigrants each principal immigrant will generate. First-generation immigrants are defined as all foreign-born immigrants that include both principal immigrants and all immigrants who were sponsored by these principal immigrants. The IUM, where the *denominator* is the total number of principal immigrants and the *numerator* is the total number of first-generation immigrants, can be explained as the total number of first-generation immigrants (including the principal immigrant him/herself) each principal immigrant will generate. The IRM, where the *denominator* is the total number of all first-generation immigrants, and the *numerator* is the combined total number of the first- and the second-generation immigrants, can be explained as the total number of all first- and the second-generation immigrants each first-generation immigrant will generate.

Using this new definition of the Immigration Multiplier, including the IUM and the IRM, we can now better understand the chain migration process (see Table 1, Figure 1, 2, and 3). In the actual calculation of the Immigration Multiplier, I would also derive the concepts of Net IUM and Net IRM from IUM and IRM to exclude the denominators from the numerators. The value of Net IUM can be explained as the total number of family dependent immigrants each principal immigrant will sponsor, and the value of Net IRM can be explained as the total number of native-born children each foreign-born immigrant will be responsible for.

Table 1 Immigration Multiplier Analysis

Immigration Multiplier Analysis							
Charactristics of Immigrants			Role in the Migration Chain	Begin of the Migration Process	Migration Chain Process	Final Stages of the Migration Chain	Migration Chain Anslysis
1st Generation	Principal Immigrants	Principal Immigrants	Initiate the Chain Migration Process	Principal Immigrants only.	Principal immigrants and all of the derived family immigrants. They are the 1st generation of immigrants.	This is the total population that is directly resulted from the principal immigrants. It is the combination of 1st- and 2nd-generation immigrants.	If principal immigrants were to migrate alone with no future sponsorship or future descendents, there would be no migration chains.
	Family Members	Spouses & Children	Chains				Migration chain would grow: the more immigrants in this population pool, the more obvious chain-effects would be observed.
		Parents					
		Siblings					
2nd Generation	Descendents of immigrants	Children born in the destination country	End of the Chains				As the final step of the migration chain: the more immigrants in the migration chain, the more immigrant children born in the destination country.

In creating the mathematical formulas for the calculation of the IM, IUM and IRM, we have to break down the immigrants into several categories based on their classes of admission per INS (Immigration and Naturalization Services). The principal immigrants are grouped as *Level 0 immigrants*; the accompanying family members of the initial principal immigrants are grouped as *Level 1 immigrants*; the later-sponsored family members of the principal immigrants are grouped as *Level 2 immigrants*; all exempt family members of U.S. citizens (including parents, spouses of naturalized U.S. citizens and minor children of U.S. citizens and/or their spouses) are grouped as *Level 3 immigrants*; all extended family members of U.S. citizens (including married/unmarried adult children and siblings of U.S. citizens) are grouped as *Level 4 immigrants*. The *Reproduction Level* of the chain is defined as all children born to immigrants in the U.S., or the second-generation immigrants. Therefore, we have the following formulas for these Immigration Multipliers:

$$IUM = \frac{E_0 + G_0 + R_0 + \sum_{i=1to4}(S_i + C_i + M_i + B_i + P_i)}{E_0 + G_0 + R_0} = \frac{I}{Z}$$

$$NetIUM = \frac{\sum_{i=1to4}(S_i + C_i + M_i + B_i + P_i)}{E_0 + G_0 + R_0} = \frac{I - Z}{Z}$$

Where: E is the employment related principal immigrants (*Level 0*);
G is the government-sponsored principal immigrants (*Level 0*);
R is the foreign-born spouses of U.S.-born citizens (*Level 0*);
S is foreign-born immigrant spouses (*Level 1 & 2*);
C is foreign-born immigrant minor children (*Level 1, 2 & 3*);
M is foreign-born adult immigrant children (*Level 4*);
B is foreign-born siblings of U.S. citizens (*Level 3*);
P is immigrant parents of U.S. citizens (*Level 3*);
Subscript indicates the levels in the migration chain[5]. Here, $E_0 + G_0 + R_0$ makes the total of principal immigrants Z, and I is the total number of first-generation immigrants.

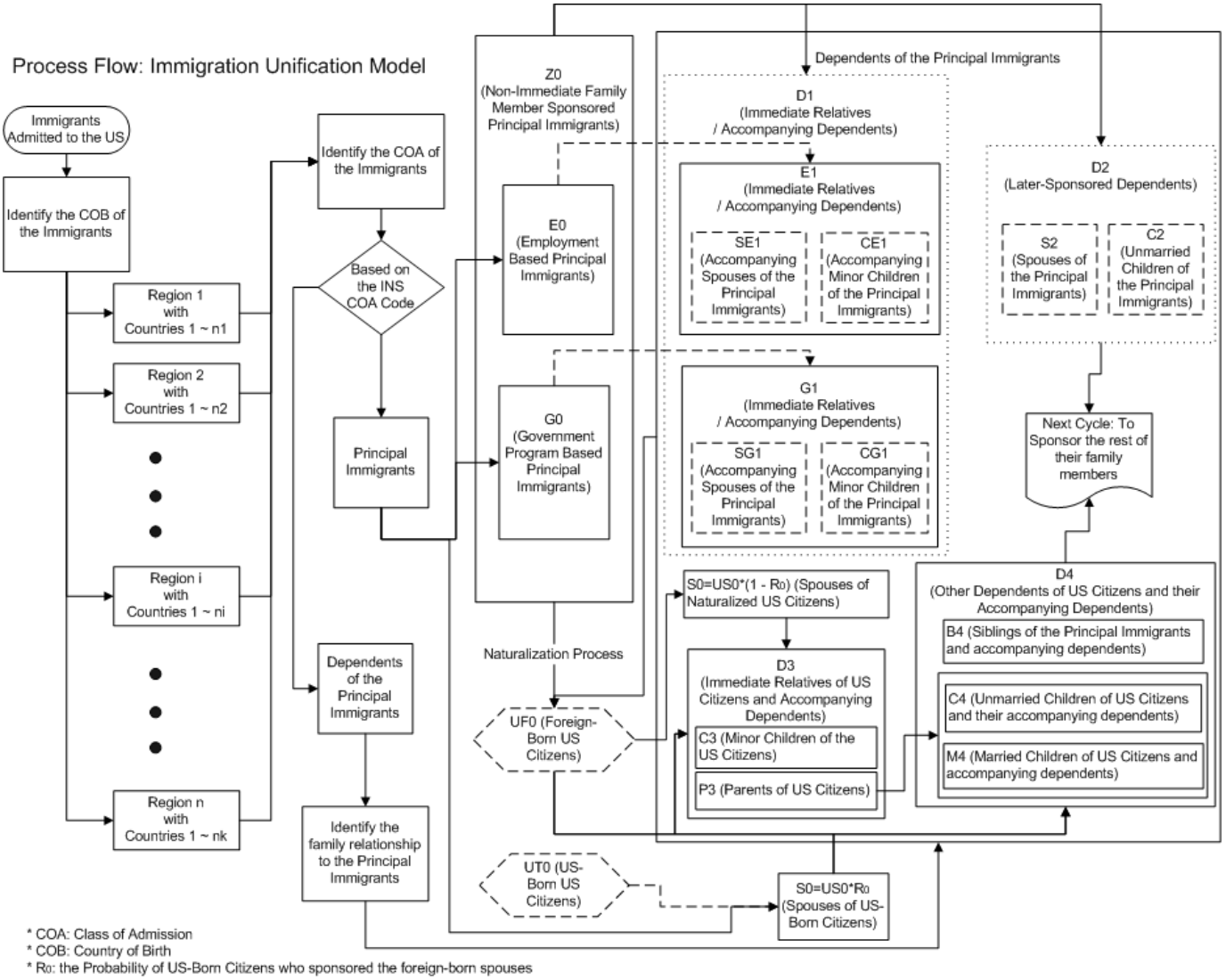

Figure 1 Immigration Model: Immigration Unification Process

In order to measure the Immigration Reproduction Process, we must first measure the total number of children born to immigrants, *i.e.*, the total number of immigrant second generation. The model is quite complicated because it relates to the citizenship of the children's parents (Figure 2).

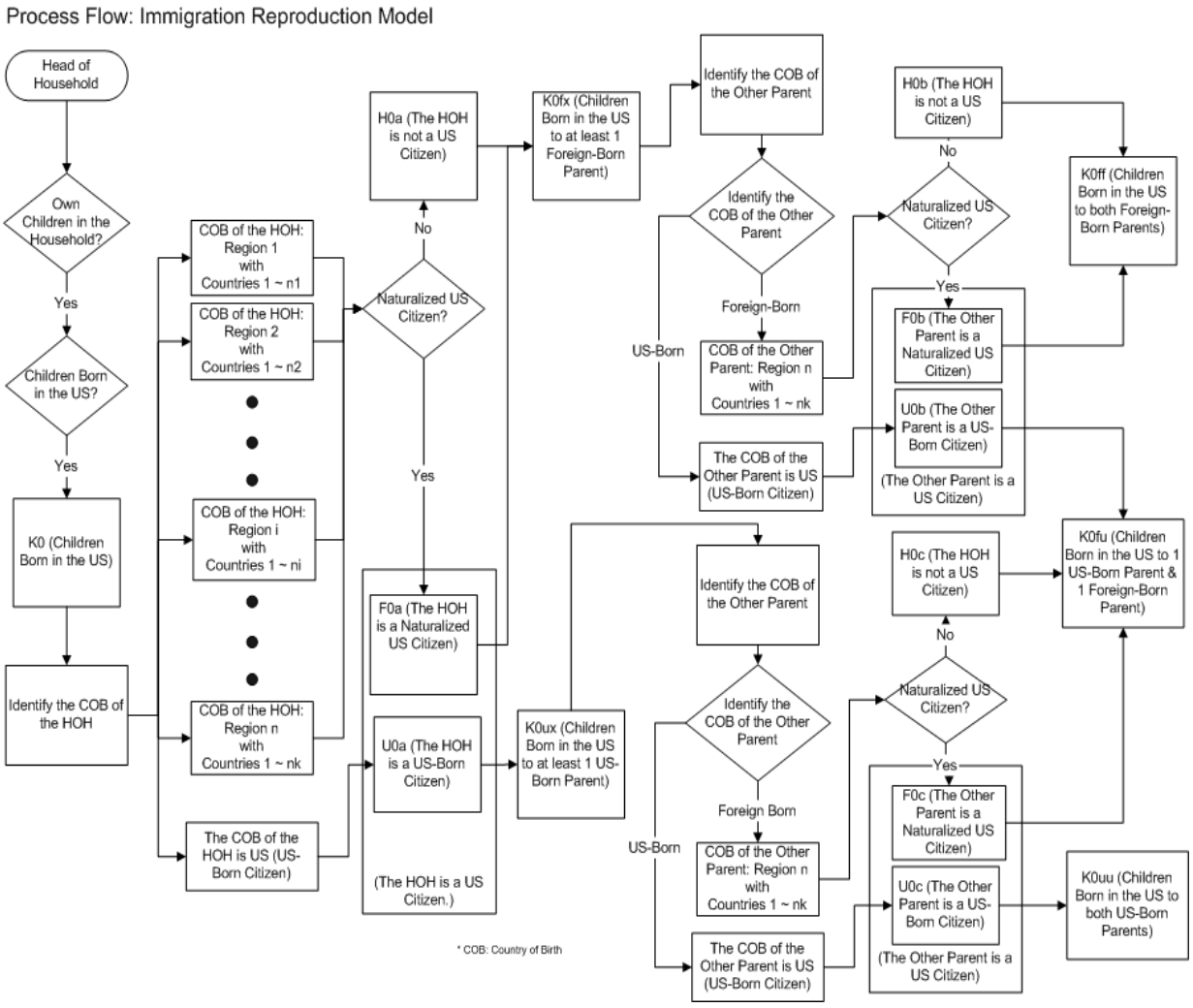

Figure 2 Immigration Model: Reproduction Process

Second-generation Immigrants are identified by determining the birth places of their parents. The total number of second-generation immigrants is equal to the total population of U.S.-born children who have at least one foreign-born parent. In order to measure the immigrants' contribution to the second generation of immigrants, the fertility

patterns for both genders have to be studied. It is important to note that the majority of demographic studies have been on female fertility behavior; few have studied male fertility patterns. Since the majority of principal immigrants are male (as data in this research shows), it is very important to measure the role that gender plays in the Immigration Reproduction Process.

In this research, the reproduction process within the migration chain is considered as the *Chain Migration Reproduction Level*. At the Reproduction Level, both principal and derived family members are responsible for producing the immigrant second generation. Therefore, we can define the IRM as follows:

$$IRM = \frac{I + C}{I} = \frac{I + \sum_{a=0}^{99} C_{f,a} + \sum_{a=0}^{99} C_{m,a}}{I}$$

$$NetIRM = \frac{C}{I} = \frac{\sum_{a=0}^{99} C_{f,a} + \sum_{a=0}^{99} C_{m,a}}{I}$$

where:

C: is the estimated total number of immigrant second generation, based on the fertility pattern of the first-generation immigrants, where $\sum_{a=0}^{99} C_{f,a}$ is the total number of children born in the U.S. to female immigrants of age a, while $\sum_{a=0}^{99} C_{m,a}$ is the total to male immigrants[6];

I: is the total number of first-generation immigrants.

The overall Immigration Multiplier (IM), therefore, will be the product of IUM and IRM:

$$IM = IUM * IRM = \frac{I}{Z} * \frac{I + C}{I} = \frac{I + C}{Z}$$

$$= \frac{Z + \sum_{i=1 to 4} (S_i + C_i + M_i + B_i + P_i) + \left(\sum_{a=0}^{99} C_{f,a} + \sum_{a=0}^{99} C_{m,a} \right)}{Z}$$

Defining Immigration Multipliers

Immigration Multipliers	Formulas
IUM =	$\frac{\text{Total Number of First - Generation Immigrants}}{\text{Total Number of Principal Immigrants}}$
IRM =	$\frac{\text{Combined Total of First - and Second - Generation Immigrants}}{\text{Total Number of First - Generation Immigrants}}$
IM = IUM * IRM =	$\frac{\text{Combined Total of First - and Second - Generation Immigrants}}{\text{Total Number of Principal Immigrants}}$
Net IUM = IUM -1 =	$\frac{\text{Total Number of Derived Immigrants (Family Dependents)}}{\text{Total Number of Principal Immigrants}}$
Net IRM = IRM -1 =	$\frac{\text{Total Number of Second - Generation Immigrants}}{\text{Total Number of First - Generation Immigrants}}$
Net IM = IM – 1 =	$\frac{\text{Combined Total of Drived and Second - Generation Immigrants}}{\text{Total Number of Principal Immigrants}}$

where:

IUM ≥ 1 and Net IUM >=0

When: IUM=1 (or Net IUM =0)

If and only if the total number of derived immigrants is 0, *i.e.* no new immigrants admitted to the United States through family unification sponsorship.

When: IUM>1 (or Net IUM >0)

This is the real-life case. Here, the total number of derived immigrants is always greater than 0. The larger the value of IUM (or Net IUM), the more new immigrants admitted into the United States through family unification sponsorship.

Note:

It is impossible for IUM to be smaller than 1 (or for Net IUM to be smaller than 0). According to the definition of Immigration Unification Multiplier, the total number of principal immigrants is a subset of total number of first-generation immigrants. Therefore, it is impossible for the total number of first-generation immigrants to be smaller than the total number of principal immigrants.

IRM>=1 and Net IRM >=0

When: IRM=1 (or Net IRM = 0)

If and only if the total number of immigrant descendents is 0, *i.e.* no children born to immigrants parent(s) in the United States.

When: IRM>1 (or Net IRM >1)

This is the real-life case. Here, the total number of immigrant descendents is always greater than 0. The larger the value of IRM (or Net IRM), the more children born to immigrants parent(s) in the United States.

Note:

It is impossible for IRM to be smaller than 1 (or for Net IRM to be smaller than 0). According to the definition of Immigration Reproduction Multiplier, the total number of first-generation immigrants is a subset of the combined total of the first-generation immigrants and the second generation. Therefore, it is impossible for the combined total of the first-generation immigrants and the second generation to be smaller than the total number of first-generation immigrants.

Figure 3 Immigration Multipliers Defined

$$\text{Net IM} = \frac{\sum_{i=1 to 4}(S_i + C_i + M_i + B_i + P_i) + \left(\sum_{a=0}^{99} C_{f,a} + \sum_{a=0}^{99} C_{m,a}\right)}{Z}$$

The non-mathematical forms of IM, IUM and IRM are summarized in Figure 3.

Data

In this research, I combined data sets from both PUMS and INS. The INS data on *Immigrants Admitted to the United States* (U.S. Dept. of Justice, INS. 1972 - 2000) are the main data sets I used for the research on the family unification process part of the chain migration process, and the 5% of IPUMS for Census Year 1980, 1990 and 2000 (Ruggles *et al*. 2004) are used to study the reproduction part of the chain migration process. With the birth place and naturalized citizenship information from the Census, and the home country of immigrants from INS, the two data sets are combined at te aggregate level, using the region and country codes[7].

The Results

As Figure 4 illustrates, we see that the significant compounded multiplier effects of the Immigration Multiplier. Since the overall value of IUM is 3.1 and the calculated value of IRM is 0.7, then the overall IM value for U.S. from 1972 through 1997 for measuring the *Immigration Multiplier Effect* is 5.3 (i.e. 3.1 * 0.7)[8]. This is the value of the multiplier effect that has played its role in contributing to the growth of immigrant population in the U.S. during the last 30 years. Table 2 summarizes all of the IUMs and the IRMs from 1972 through 1997, with the combined calculations on IMs for each of the unification chains (Level 1 through 4) and for the reproduction chain, and provides an overview of the migration patterns in the United States. For example, the values of Net IUM have been increasing, from 1.33 in 1972 to 2.27 in 1980, to 2.44 in 1990, and to 2.58 in 1997. This value refers to the total number of family members who were admitted to the U.S. via the sponsorship by principal immigrants (including both direct and indirect sponsorship). These Net IUM values show that the chain migration process

has a significant *unification multiplier effect*. On average, *each principal immigrant would bring 2.1 family members to the United States as part of the unification process.*

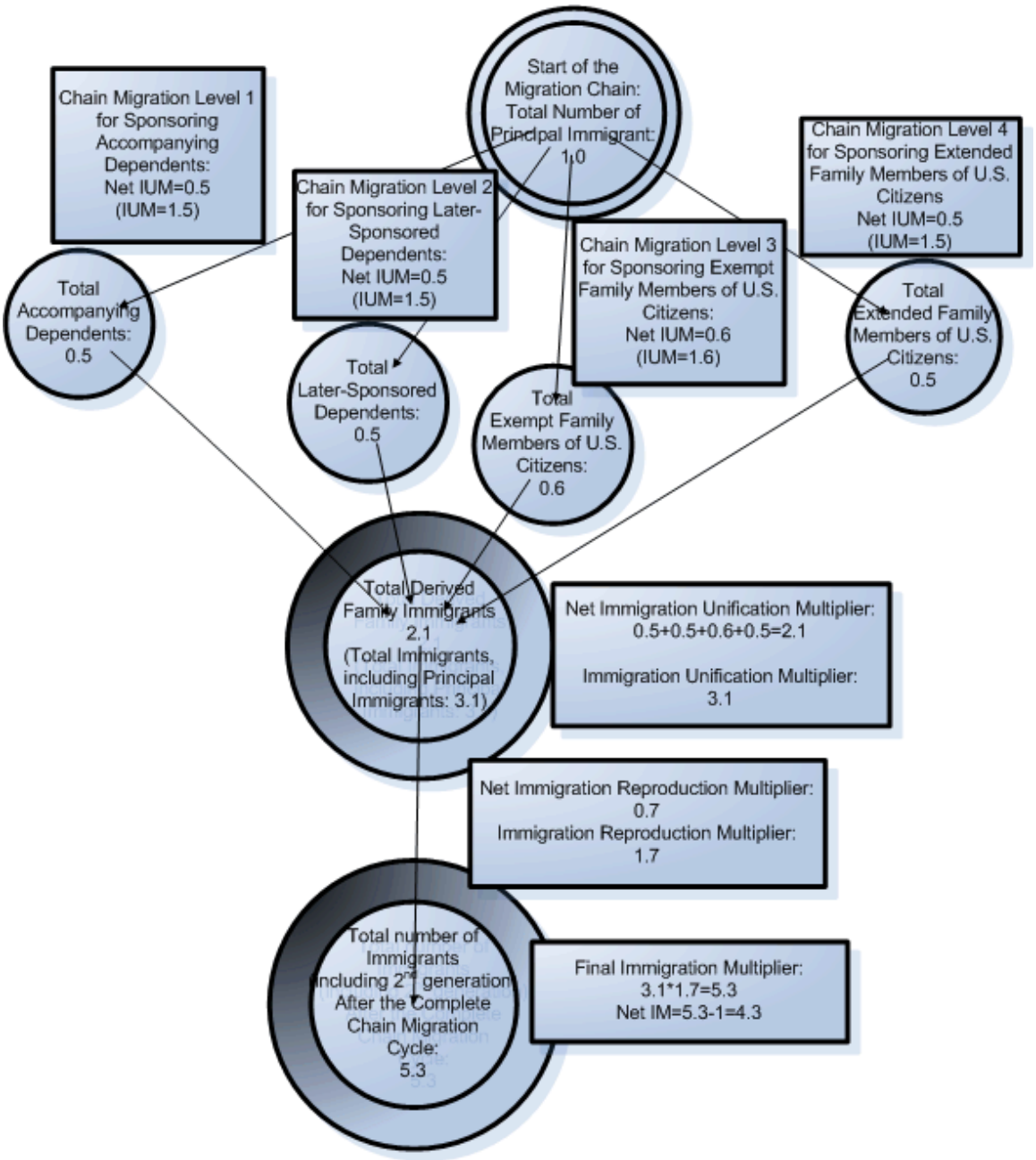

Figure 4 Immigration Multiplier for the Complete Immigration Model

The Net IRM values however, have a declining trend. This may reflect the time-lag factor that the birth waves have not caught up with the immigration waves yet,

especially after the significant increase of immigrant population in the U.S. since the late 1980s and early 1990s[9]. Nevertheless, the Net IRM values are still significant. They suggest that the reproduction multiplier shows the *theoretical minimum impact*. With the Net IRM being 0.7 on average, we conclude that *each immigrant will produce 0.7 immigrant second generation (U.S.-born children)*.

Table 2 Complete Immigration Multiplier Calculation: by Year (1972-1997)

Year of Admission	NetIUM					IUM	NetIRM	IRM	NetIM	IM
	Level 1 NetIUM	Level 2 NetIUM	Level 3 NetIUM	Level 4 NetIUM	Overal NetIUM					
1972	0.49	0.22	0.31	0.31	1.33	2.33	0.87	1.87	3.36	4.36
1973	0.51	0.27	0.36	0.33	1.46	2.46	0.88	1.88	3.63	4.63
1974	0.49	0.28	0.37	0.33	1.47	2.47	0.87	1.87	3.61	4.61
1975	0.44	0.27	0.33	0.34	1.37	2.37	0.85	1.85	3.39	4.39
1976	0.41	0.27	0.35	0.37	1.39	2.39	0.82	1.82	3.35	4.35
1977	0.36	0.31	0.32	0.43	1.43	2.43	0.79	1.79	3.34	4.34
1978	0.47	0.38	0.35	0.55	1.75	2.75	0.84	1.84	4.06	5.06
1979	0.43	0.82	0.68	0.83	2.75	3.75	0.77	1.77	5.64	6.64
1980	0.44	0.67	0.48	0.68	2.27	3.27	0.63	1.63	4.32	5.32
1981	0.50	0.63	0.45	0.59	2.17	3.17	0.68	1.68	4.30	5.30
1982	0.54	0.58	0.48	0.48	2.08	3.08	0.80	1.80	4.54	5.54
1983	0.51	0.73	0.59	0.62	2.44	3.44	0.78	1.78	5.13	6.13
1984	0.48	0.74	0.65	0.65	2.52	3.52	0.78	1.78	5.27	6.27
1985	0.44	0.67	0.68	0.59	2.39	3.39	0.76	1.76	4.96	5.96
1986	0.46	0.65	0.73	0.60	2.43	3.43	0.74	1.74	4.97	5.97
1987	0.36	0.53	0.58	0.47	1.94	2.94	0.70	1.70	4.00	5.00
1988	0.37	0.50	0.63	0.49	2.00	3.00	0.68	1.68	4.04	5.04
1989	0.52	0.66	0.77	0.61	2.56	3.56	0.69	1.69	5.02	6.02
1990	0.57	0.55	0.78	0.54	2.44	3.44	0.67	1.67	4.75	5.75
1991	0.64	0.51	0.78	0.50	2.43	3.43	0.65	1.65	4.64	5.64
1992	0.95	0.56	0.66	0.41	2.59	3.59	0.66	1.66	4.94	5.94
1993	0.75	0.46	0.59	0.35	2.15	3.15	0.62	1.62	4.11	5.11
1994	0.69	0.50	0.69	0.42	2.31	3.31	0.61	1.61	4.31	5.31
1995	0.61	0.73	0.69	0.46	2.49	3.49	0.59	1.59	4.57	5.57
1996	0.57	0.69	0.82	0.43	2.51	3.51	0.57	1.57	4.52	5.52
1997	0.55	0.52	1.04	0.47	2.58	3.58	0.55	1.55	4.54	5.54
Total	**0.5**	**0.5**	**0.6**	**0.5**	**2.1**	**3.1**	**0.7**	**1.7**	**4.3**	**5.3**

Multiplying the overall IUM (2.1+1=3.1) by overall IRM (0.7+1=1.7), we have the final IM value of 5.3. By definition, the Net IM value is 4.3, which is the overall measurement of the complete migration chain. This suggests that *each principal immigrant will generate a multiplier effect of 4.3 (i.e. contributing a total 4.3 first- and*

second generation immigrants) on average. Out of the 4.3 total, 2.1 would be the total of all family members directly/indirect/y sponsored by the principal immigrant, and 2.2 would be second-generation immigrants born to these immigrants (principal immigrant and all of the family members he/she directly/indirectly sponsored) [10].

The regional variations of IMs for every aspect of the migration chain are listed in Table 3[11]. The data show the rankings of all regions in terms of sending first- and second-generation immigrants to the U.S. and the break-downs of the Immigration Multipliers that explains the reasons.

Table 3 Complete Immigration Multiplier Calculation: by Region (1972-1997)

	NetIUM										Immigrants Total			
Year of Admission	Level 1 Net IUM	Level 2 Net IUM	Level 3 Net IUM	Level 4 Net IUM	Overall Net IUM	IUM	Net IRM	IRM	Net IM	IM	Principal Immigrants	Unification Immigrants	Second-Generation Immigrants	Grand Total
Latin America	0.42	0.78	0.64	0.40	2.25	3.25	0.78	1.78	4.79	5.79	1,845,059	4,145,224	4,692,492	10,682,775
Asia	0.72	0.56	0.77	0.74	2.79	3.79	0.57	1.57	4.95	5.95	1,449,523	4,047,146	3,133,058	8,629,727
Europe	0.53	0.17	0.36	0.35	1.40	2.40	0.54	1.54	2.71	3.71	1,001,807	1,403,633	1,310,551	3,715,991
Middle East	0.50	0.37	0.61	0.55	2.03	3.03	0.74	1.74	4.29	5.29	256,054	519,790	577,545	1,353,389
Africa	0.38	0.18	0.29	0.21	1.06	2.06	0.76	1.76	2.63	3.63	235,722	250,740	368,125	854,587
North America	0.48	0.16	0.27	0.24	1.14	2.14	0.61	1.61	2.46	3.46	162,973	186,186	214,283	563,442
Oceania/Other	0.27	0.24	0.27	0.47	1.25	2.25	0.44	1.44	2.24	3.24	44,002	54,822	43,796	142,620
Total	**0.5**	**0.5**	**0.6**	**0.5**	**2.1**	**3.1**	**0.7**	**1.7**	**4.3**	**5.3**	**4,995,140**	**10,607,541**	**10,339,849**	**25,942,530**

The rankings of final IM values suggest that Asia is the top region with the highest IM value (5.95), and Latin America is a close second (5.79). This means that each Asian principal immigrant will contribute almost 5 additional immigrants (2.79 from family unifications, 2.16 from producing second-generation immigrants). Since the IRM for Asia (1.57) is among the lowest, this chain migration pattern suggests that *the growth of Asian immigrants in the U.S. is mainly driven by the high unification multiplier*. Compared to Asian immigrants, however, Latin America has the highest IRM (1.78), and second highest IUM (3.25). Therefore, *the growth of Latin American immigrants was driven by both the high unification multiplier and the high reproduction multiplier*.

Having the largest principal immigrant population (1.8 million and 1.4 million) compounding with high multipliers, both Latin America and Asia have become the top two immigrant sending regions in the world. On the contrary, Europe, having a very low IM value (3.71, ranked distant number 4), which means weak multiplier effect throughout the chain migration process, is mainly contributed by the total of principal immigrants (1.0 million, ranks close number 3).

Both Middle East and Africa have similar size of principal immigrant populations (0.26 million and 0.23 million). However, their chain migration patterns are not quite the same. Both regions are among top regions that have the highest IRM values (1.74 for Middle East, and 1.76 for Africa). Yet, the Net IUM for Middle Eastern immigrants is very high (almost the same as that for the Latin America), and its value doubles that for African immigrants (2.03 vs. 1.06). Therefore, the chain migration pattern for Middle Eastern immigrants is very similar to that for Latin Americans: *the combined high unification multiplier and reproduction multiplier yields very high IM (5.29), and it combined multiplier has contributed the significant growth of Middle East immigrants.* Meanwhile, the high IRM and low IUM have made up a relatively low IM for African immigrants (3.63). Therefore, the final total of first- and second-generation African immigrants is only 0.85 million, significantly smaller than the size for Middle Eastern immigrants (1.45 million), although both started with similar size of principal immigrants.

The other two regions (North America and Oceania) are relatively balanced in terms of IUM values vs. IRM values.

Conclusions

This research has demonstrated that the chain immigration process does exist, and we can measure the multiplier effects by calculating immigration multipliers. With the introduction of the Immigration Multiplier (IM), Immigration Unification Multiplier (IUM) and Immigration Reproduction Multiplier (IRM)), we can clearly differentiate different immigration patterns across different regions. It is also very important to notice that few demographic researches on immigration processes have ever combined the immigration unification process with the immigration reproduction process into one complete immigration model. This research is a first attempt to do so.

The new Immigration Multiplier method I introduced here has many aspects that other traditional measures do not have. The most important aspects are: *measurable* (for measuring the chain migration process), *complete* (for measuring both the immigration unification process as well as the immigrant reproduction process), *comparable* (for comparing immigration patterns region-by-region, country-by-country, year-by-year), *practical* (for performing the relatively simple calculations). With this concept and method of the Immigration Multiplier developed in this research, we can now use it to measure the migration chains and its multiplier effects for any immigrant population, and provide the explanations why they are different. Therefore, this method has provided a tool to accomplish the goal of better understanding the chain migration process, and it could be used for further academic research and policy evaluations.

References

Arnold, F., B.V. Carino, J.T. Fawcett and I.H. Park. 1989. Estimating the Immigration Multiplier: An Analysis of Recent Korean and Filipino Immigration to the United States. *International Migration Review* 23(4):813-838.

Azam, F-I. 1998. International Migration Dynamics in High and Low Migration Districts of Pakistan. In R. Appleyard (ed.) *Emigration Dynamics in Developing Countries*, *Volume II, South Asia*. Ashgate Publishers, UK.

Banerjee, B. 1983a. The Role of the Informal Sector in the Migration Process: A Test of Probabilistic Migration Models and Labour Market Segmentation for India. *Oxford Economic Papers (New Series*) 35(3).

Bean, F.D., C.G. Swicegood and R. Berg. 2000. Mexican-Origin Fertility: New Patterns and Interpretations. *Social Science Quarterly* 81(1): 404-420

Böcker, A. 1994. Chain Migration over Legally Closed Borders: Settled Immigrants as Bridgeheads and Gatekeepers. *Netherlands' Journal of Social Sciences* 30 (2).

Bongaarts, J. and R.A. Bulatao. 1999. Completing the Demographic Transition. *Population and Development Review* 25(3): 515-529

Boyd, M. 1989, Family and Personal Networks in International Migration: Recent Developments and New Agenda. *International Migration Review* 23(3): 638-670.

Carter, S.B. and R. Sutch. 1998. Historical Background to Current Immigration Issues. In J.P. Smith and B. Edmonston (eds). *The Immigration Debate: Studies on the Economic, Demographic, and Fiscal Effects of Immigration.* Washing, DC: National Academy Press

Day, R.W. 1989. Current Policy Concerns on Immigration. *International Migration Review* 23(4):900-903.

Edmonston, B. (ed.). 1996. *Statistics on U.S. Immigration: An Assessment of Data Needs for Future Research*. Report of the Committee on National Statistics and Committee on Population, National Research Council. Washington DC: National Academic Press

Friedlander, D. 1975. Mass Immigration and Population Dynamics in Israel. *Demography* 12(4): 581-599.

Friedlander, D. and C. Goldscheider. 1978. Immigration, Social Change and Cohort Fertility in Israel. *Population Studies* 32(2): 299-317.

Fuller, T.D., P. Kamnuansilpa and P. Lightfoot. 1990. Urban Ties of Rural Thais. *International Migration Review* 24(3):534-562.

Goering, J.M. 1989. The Explosiveness of Chain Migration - Research and Policy Issues: Introduction and Overview. *International Migration Review* 23(4): 797-812.

Gunatilleke, G. 1998. The Role of Networks and Community Structures in International Migration from Sri Lanka. In R. Appleyard (ed.) *Emigration Dynamics in Developing Countries*, *Volume II, South Asia*,. Ashgate Publishers, UK.

Gunatilleke, G. 1991. Sri Lanka. In G. Gunatilleke (ed.) *Migration to the Arab World: Experience of Returning Migrants*. Tokyo, Japan: United Nations University Press.

Helmenstein C. and Yegorov Y., 2000. The Dynamics of Migration in the Presence of Chains. *Journal of Economic Dynamics & Control* 24 (2): 307-323

Hirschman, C., P. Kasinitz, J. DeWind (eds.). 1999. *The Handbook of International Migration: the American Experience*. New York: Russell Sage Foundation.

Hugo, G.J. 1981. Village-Community Ties, Village Norms, and Ethnic and Social Networks. In G.F. De Jong and R.W. Gardner (eds.) *Migration Decision Making: Multidisciplinary Approaches to Microlevel Studies in Developed and Developing Countries*. New York: Pergamon Press.

Hugo, G.J. 1995. International Labor Migration and the Family: Some Observations from Indonesia. *Asian and Pacific Migration Journal* 4(2-3): 273-301

Jasso, G. and M.R. Rosenzweig. 1986. Family Reunification and the Immigration Multiplier: U.S. Immigration Law, Origin-Country Conditions, and the Reproduction of Immigrants. *Demography* 23(3): 291-311.

Jasso, G. and M.R. Rosenzweig. 1989. Sponsors, Sponsorship Rates and the Immigration Multiplier. *International Migration Review* 23(4): 856-888.

Jasso, G. and M.R. Rosenzweig. 1990. The New Chosen People: Immigrants in the United States. *The Population of the United States in the 1980: A Census Monograph Series*. New York: Russell Sage Foundation

Kahn, J.R. 1994. Immigrant and Native Fertility during the 1980s: Adaptation and Expectations for the Future. *International Migration Review* 28:501-19

Kobrin, F.E. and A. Speare, Jr., 1983. Out-Migration and Ethnic Communities. *International Migration Review* 17(3): 425-444.

Krafft, S. 1994. Hide-and-seek with illegal aliens. *American Demographics* (16) 7:10

Lindquist, B. A. 1993 Migration Networks: A Case Study in Philippines. *Asian and Pacific Migration Journal* 2(1).

Lindstrom, D.P. and S.G. Saucedo. 2002. The Short- and Long-Term Effects of U.S. Migration Experience on Mexican Woman's Fertility. *Social Forces* 80(4): 1341-1368

Mahmood, R. A. 1991. Bangladesh Return Migrants from the Middle East: Process, Achievement, and Adjustment. In G. Gunatilleke (ed.). *Migration to the Arab World: Experience of Returning Migrants*. Tokyo, Japan: United Nations University Press.

Massey, D.S., J. Arango, G. Hugo, A. Kouaouci, A. Pellegrino and J.E. Taylor. 1994. An Evaluation of International Migration Theory: The North American Case. *Population and Development Review* 20(4): 699-751.

McDonald, J.S. and L.D. McDonald. 1964. Chain Migration, Ethnic Neighborhood Formation, and Social Networks, *Milbank Memorial Fund Quarterly* 42(1)

McDonald, J.S. and L.D. McDonald. 1974. Chain Migration, Ethnic Neighborhood Formation, and Social Networks, In C. Tilly (ed.) *An Urban World.* Boston: Little, Brown.

Menon, R. 1988. How Malaysian Migrants Pre-Arrange Employment. *Sociology and Social Research* 73(4): 257-259.

Passel, J.S. and K.A. Woodrow. 1987. Change in the Undocumented Alien Population in the United States, 1979-1983. *International Migration Review* 21(4): 1304-1334.

Price, C.A. 1963a. *Southern Europeans in Australia*. Melbourne: Oxford University Press.

Price, C.A. 1963b. *The Method and Statistics of 'Southern Europeans in Australia'*. Canberra: Research School of Social Science – The Australian National University

Reimers, D.M. 1985. *Still the Golden Door*: *The Third World Comes to America.* New York: Columbia University Press

Reimers, D.M. 1992. *Still the Golden Door*: *The Third World Comes to America.(2nd ed.)* New York: Columbia University Press

Ruggles, S., M. Sobek, T. Alexander, C.A. Fitch, R. Goeken, P.K. Hall, M. King, and C. Ronnander. 2004. *Integrated Public Use Microdata Series: Version 3.0* [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor].

SCIRP. 1981 *U.S. Immigration Policy and the National Interest*. The Final Report and Recommendation of the Select Commission on Immigration and Refugee Policy to the Congress and the President of the United States. Washington, DC: General Printing Office.

Shah, N.M. and I. Menon. 1999. Chain Migration Through the Social Network: Experience of Labour Migrants in Kuwait. *International Migration* 37(2):361-382.

Simcox, D.E. (ed.) 1988. *U.S. Immigration in the 1980s*. Boulder, Colorado: Westview Press

Simon, R.J. and J.P. Lynch. 1999. A Comparative Assessment of Public Opinion toward Immigrants and Immigration Policies. *International Migration Review* 33(2): 455-467

Singhanetra-Renard, A. 1992. The Mobilization of Labor Migrants in Thailand: Present Links and Facilitating Networks. In M.M. Kritz, L.L. Lim and H. Zlotnik (eds.) *International Migration Systems: A Global Approach*. New York: Oxford University Press.

Smith, J.P. and B. Edmonston, (eds.), 1997. *The New Americans: Economic, Demographic and Fiscal Impacts of Immigration.* Washington, DC: National Academy Press.

Teitelbaum, M.S. 1989. Skeptical Noises about the Immigration Multiplier. *International Migration Review* 23(4): 893-899.

U.S. Dept. of Justice, INS. 1972 - 2000. *Immigrants Admitted to the United States, 1972 - 2000*: Annual Demographic File [Computer file]. Washington, DC: U.S. Dept. of Justice, Immigration and Naturalization Service [producer], 1972-2000. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor].

Zolberg, A.R. 1999. Matters of State**.** In C. Hirschman, P. Kasinitz and J. DeWind (eds.) *The Handbook of International Migration: the American Experience*. New York: Russell Sage Foundation.

Yu, Bin. 2005. Immigration Multiplier: A New Method of Measuring the Immigration Process. Providence, RI: Brown University.

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[2] SCIRP (1981) suggested that "[I]t is possible that no less than 84 persons will become eligible for visas in a relatively short period of time" as the result of admitting one immigrant. (SCIRP 1981:334-335)

[3] Please see research by Price 1963a; McDonald and McDonald 1964, 1974; Banerjee 1983a, 1983b; Menon 1988; Boyd 1989; Fuller, Kamnuansilpa and Lightfoot 1990; Mahmood 1991; Singhanetra-Renard 1992; Lindquist 1993; Böcker 1994; Kahn 1994; Hugo 1981, 1995; Azam 1998; Gunatilleke 1991, 1998; Shah and Menon 1999; Helmenstein and Yegorov 2000.

[4] Some demographers and sociologists define the term "Immigration Multiplier" quite differently, and use it for a totally different purpose. For example, Bongaarts and Bulatao (1999) defines the 'Immigration

Multiplier" as the ratio of Ps/Pn, where Ps is the total of standard population, which is the sum of native population and immigrants; Pn is the total of natural population, which is the total of native population without including immigrants. According to Jasso and Rosenzweig (1986), the Immigration Multiplier is defined as "the number of future immigrants who come to the United States as a result of the admission of one current immigrant" (Jasso and Rosenzweig 1986:291), who "is not him or herself sponsored for a family reunification visa by a previous immigrant." (Jasso and Rosenzweig 1989:858).

[5] Please note that the total numbers of immigrants for certain immigrant levels are zero (0). For example, $B_1 \sim B_3$ are all zero because only B_4 in valid.

[6] The actual calculation here is more complex, because of the fertility pattern differs by gender and time. $C \approx \sum_{a=0}^{99} C_{k,a} \approx I_{k,a} * \sum_{a=0}^{99} \frac{B_{k,a}}{F_{k,a}}$ where $I_{k,a}$ is the total number of newly admitted immigrants of gender *k* and age *a* from INS data, $F_{k,a}$ is the total number of immigrants of gender *k* and age *a* from U.S. Census data, and $B_{k,a}$ is the total number of children born in the U.S. to immigrants of gender *k* and age *a* from U.S. Census data. In order to study the fertility of both genders, I will take a different approach to calculating the Total Fertility Rates (TFRs) for first-generation immigrants. Unlike the traditional method of calculating TFRs, which considers children only in connection to their mothers, I will split the "credit" of each U.S.-born child, and assign half of the credit to the mother, and the other half to the father. Therefore, if both parents of the U.S-born child are foreign-born immigrants, both the mother and father get half the credit for each of their children. If only one parent of the U.S.-born child is a foreign-born immigrant and the other parent is U.S-born, the foreign-born parent (either mother or father) will get credit for half of the child in the calculation, and the other half will be assigned to the U.S-born parent, and will *not* be included in the calculation. In the case of a single-parent family, if the single parent is foreign-born, he or she will get half the credit for each of his or her children, while the other half credit will be *discarded* because of the unknown status of the other parent. It is important to note this research will only study the first- and second generation immigrants. All future generations of immigrants are not in the scope for this research. For more detailed description of the calculation method, please see Yu (2005).

[7] Please note that adoptions, anyone who lost U.S. citizenships and emigrants are excluded from this research. Since undocumented immigrants are not officially recorded in both data sets, no official categories are given for this group. However, since undocumented immigrants could still produce children in the U.S., the IRM should reflect the multiplier effect of undocumented immigrants. It is also important to note that the INS data only reports the admitted immigrants. The backlogs for some of the immigration categories are not part of the calculation in this paper. However, such backlogs could be viewed as the additional pressure to the IM, which could be amplified or diminished if the immigration policies are to be changed. Yu (2005) has extensive discussions on this topic.

[8] The overall IUM and overall IRM by year differ slightly from the overall IUM and IRM by region at the second digit after the decimal point due to rounding in calculations. Therefore, the values of the overall IUMs, IRMs and IMs presented here are rounded to keep only one significant digit after the decimal point so that no rounding differences would show up.

[9] It is important to understand that the birth cohort is the immigrant children born to immigrants who came to the U.S. in earlier years. Hence, the IRM values reflect the time lag factor. Therefore, the increased size of immigrant population would reduce the IRM values.

[10] 3.1 * 0.7 = 2.2, where 3.1 is the IUM, or the total number of all first-generation immigrants (including the principal immigrant) contributed by the principal immigrant, and 0.7 is the Net IRM. Hence, 2.2 is the total of second-generation immigrants who are contributed by these first-generation immigrants.

[11] I do want to mention the fact that the overall Net IRM is 0.66, which is different from the overall Net IRM value of 0.70 in the previous table of IRM by year. The major difference is mainly caused by usages of different TFR value sets. In the analysis of IRM values by year, the TFR values used were from the annual TFR values that are derived from the iPUMS data. In the analysis of IRM values by region, the TFR values used were from the regional analysis of the same iPUMs data, except that the data from every year have been collapsed together by region. Therefore, this new set of TFR values varies slightly in the actual calculation compared to the other calculation using year-specific TFRs.