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Migration Dynamics, Poverty, and Inequality: A Research Based on Population Dynamics Data of Taiwan Indigenous Peoples[1]

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[2] This paper is at its early stage and has not gone through careful proofreading. Any comments and suggestion are welcome.

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Abstract

The issue explored in this research is that the theoretical expectations of migration and numerous empirical results have repeatedly demonstrated that migrants have higher lifetime income and socioeconomic status than non-migrants, and that migration is an effective measure to enhance individual socioeconomic status and promote various types of mobility that in turns help reduce poverty and inequality. If migration theory is correct, the very migratory TIPs are expected to have benefitted from the process of migration and the gap in income and inequality between TIPs and non-TIPs should have converged gradually. However, this is not the case. Poverty and inequality among TIPs relative to the ordinary people remain persistent and prevailing. Mainly based on micro population dynamic data sets from Taiwan Indigenous Peoples Open Research Data (TIPD), the research objective is threefold: first, by controlling for the effect of fertility and mortality, the research aims to study how income inequality and absolute income level, with other factors being controlled, affect migration departure decision and migration destination choice; second, the assess the extent to which migration helps promote individual social mobility to overcome poverty trap and reduce inequality; third, to provide relevant policy suggestions based on research results. Research findings: (1) migration of TIPs is characterized by a circle of migration between areas of high incomes and high inequality and areas of low income and low inequality; (2) people are much more migratory in wealthy areas with high inequality than those in areas with high poverty and low inequality; inequality in wealthy areas outweighs income in triggering migration, but migration in areas with high poverty and low inequality is triggered by low income gain; (3) repeat migration, particularly return type, is characterized by a net gain of migrants moving from low poverty but high inequality areas into areas with high poverty and low inequality areas; (4) Onward migration of TIPs counters existing findings. Such situation might be a result of weak connection of ethnic social network with non-TIPs. Policy implication: strengthening ethnic relationship connection might help overcome poverty trap and improve inequality.

Keywords: ethnic social network, inequality, migration dynamics, population dynamics, poverty

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1 Research Objective

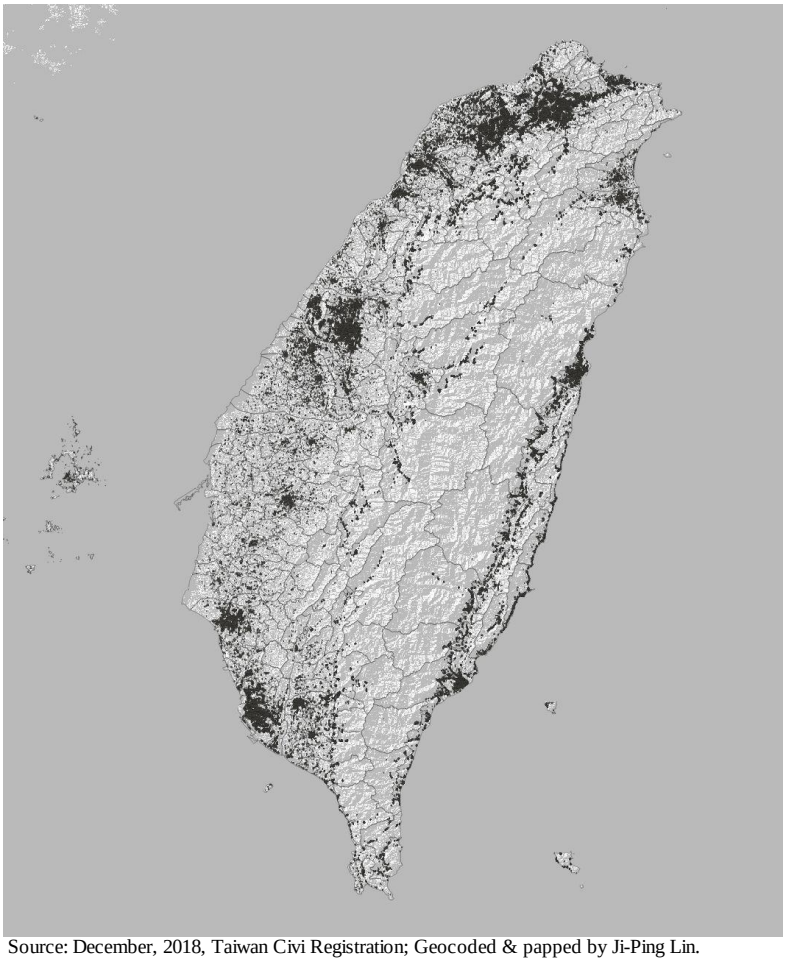
The issue to be explored in this research is that the theoretical expectations of migration and numerous empirical results have repeatedly demonstrated that migrants have higher lifetime income and socioeconomic status than non-migrants, and that migration is an effective measure to enhance individual socioeconomic status and promote various types of mobility that in turns help reduce poverty and inequality. If migration theory is correct, the very migratory TIPs are expected to have benefitted from the process of migration and the gap in income and inequality between TIPs and non-TIPs should have converged gradually. However, this is not the case. Poverty and inequality among TIPs relative to the ordinary people remain persistent and prevailing. Mainly based on micro population dynamic data sets from Taiwan Indigenous Peoples Open Research Data (TIPD), the research objective is threefold: first, by controlling for the effect of fertility and mortality, the research aims to study how income inequality and absolute income level, with other factors being controlled, affect migration departure decision and migration destination choice; second, the assess the extent to which migration helps promote individual social mobility to overcome poverty trap and reduce inequality; third, to provide relevant policy suggestions based on research results.

2 Why the Research, Importance, and Intersection with the IUSSP Population, Poverty, and Inequality

Population dynamics, poverty, and inequality are mutual causation in the sense that population dynamics have impacts on poverty and inequality, and in turn poverty and inequality will affect the course of population dynamics. Research in population dynamics, poverty, and inequality, to my knowledge, mostly focuses on the effect of fertility on population growth, and thus how population growth impacts the formation of poverty and inequality that in turn go back to affect population growth. The main reason that triggers me to conduct the research on migration dynamics, poverty, and inequality is due to the fact that less attention in research has been placed on the interaction of migration dynamics with poverty and inequality. The other and the most important reason that pushes me to explore this research theme is that, in the past 15 years, many contradictions with theoretical expectations are observed from my field work during my study in the population of Taiwan Indigenous Peoples (TIPs). TIPs are a branch of the most widely-spread population in the world, the Australasians or Malayo-Polynesian Population.

The current population of TIPs amounts to around 560 thousand persons, which makes up about 2.4% of the whole population of Taiwan. The development toward diversity in various aspects in the past three decades also accelerates migration of TIPs, mostly rural-to-urban migration. Based on the author's previous studies with peers on the population and internal migration of TIPs, TIPs are characterized by four features in terms of population distribution (Figure 1) and migration: (1) geographically segregated population distribution, (2) being very migratory, with migration being mainly of the rural-to-urban type, (3) the periphery of metropolitan areas serving as the main

destination choice for rural-to-urban TIP migrants; (4) weak ability of TIP migrants to make onward migration and return migration the main type of migration once repeat migration occurs (Lin 2012, Lin 2013a, Lin 2013b, Lin 2016).



Source: December, 2018, Taiwan Civi Registration; Geocoded & papped by Ji-Ping Lin.

Figure 1. Distribution of Taiwan Indigenous Peoples (1 dot = 1 person)

Similar to the situations of other ethnic minorities and disadvantaged population in other countries, TIPs are characterized in comparison to ordinary people in Taiwan by: (1) in terms of demographic characteristics, TIPs have higher fertility rate, higher infant and youth mortality rate, much shorter life expectancy, and much higher migration likelihood; (2) in terms of socioeconomic characteristics, they are associated with less education opportunity, lower labor force participation, more likely to be unemployed, less individual income/wage gains, having below average household income level, and less access to medical and health care resources, being associated with less social mobility, etc..

From the perspectives of various schools of migration theory, migration has the effects of narrowing down regional income gap, promoting individual lifetime income gains and socioeconomic status, and thus has the effect of promoting social mobility and reducing inequality. On the other hand, the process of migration will become less crucial and migration volume will decline, when the gap in wealth distribution and inequality

begins to shrink. For example, the classical wage differential theory argues that through the process of population redistribution, migration will change manpower supply and demand, and has the effect of reducing regional income gap and inequality. From the perspective of neo-classical school, migration that is viewed as an investment in human capital suggests migrants than non-migrants are expected to have much higher net lifetime income gains (Sjaastad 1962). Moreover, migration has the effect of promoting individual wellbeing and social mobility, suggesting migration has the effect of help overcoming poverty and thus reducing inequality.

The school of "new" economics of labor migration also recognizes the mutual interactions of migration with poverty and inequality from the perspective of relative income comparison within the so-called reference group (Stark 1991). Regarding migration as triggered by relative deprivation, "new" economics of labor migration argues that although migration that is triggered by feelings of relative deprivation tends to worsen income distribution and thus widen inequality as remittances are sent back by migrants at the initial stage of migration. But continuous inflow of remittances sent back by migrants will reduce poverty and inequality at the origin of migration. The improvement in wealth gain and distribution from migration remittances helps reduce inequality and thus the feelings of relative deprivation. In the end, the need to make migration will shrink.

The most noteworthy features of the aforementioned demographic characteristics associated with TIPs is that TIPs are much more migratory than the ordinary people. In light of migration theory recognizing the mutual interaction between migration, poverty, and inequality, if migration theory is correct, the very migratory TIPs are expected to have benefitted from the process of migration and the gap in income and inequality between TIPs and non-TIPs should have converged gradually. However, this is not the case. Poverty and inequality among TIPs relative to the ordinary people remain persistent and prevailing. The phenomenon of "high migration likelihood" and "low socioeconomic status" among TIPs is perplexing. In other words, the positive effect of migration in raising income gains and promoting social mobility (e.g., Schlottmann and Herzog 1984) that in turns have the effect of helping overcome poverty trap and reduce inequality apparently does not hold to be true for TIPs.

A rich body of empirical studies have confirmed the interactions of migration with poverty and inequality. It thus is unlikely to be the flaws of existing migration theoretical framework. However, such circumstance has really puzzled me for a long time. However, after a long period of comprehensive analysis of various research materials and years of field investigations and interviews, I gradually realize that such contradiction may be an outcome due to the complexity and particularity of the ethnic relationship: the degree of connection between the internal ethnic groups and the lack of strength of the social network connection with the non-indigenous people (Lin 2018). The differences in the degree of social network connectivity among different ethnic groups and the low connectivity of non-indigenous social networks further contribute to the reduced selectivity and diversity of TIPs migration. If the aforementioned hypothesis is correct, it becomes easy to account for why migration fails to reduce poverty and inequality, and how persistent poverty and inequality serves as key factors that continue to trigger migration.

3 The Data and Research Methods
3.1 Population dynamics data

Population dynamics data sets in the research come from Taiwan Indigenous Peoples Open Research Data (TIPD, see Lin 2017a). I have been serving as the PI of TIPD since 2013, with population dynamics data as one of the most innovative outputs in the TIPD project. For details about TIPD, see https://osf.io/e4rvz/; about population dynamics data, see the directory of data repository "6_PopulationDynamcicsData" at https://osf.io/e4rvz/files/?view_only=8764e9e3d9f543eeb4bf507e21dfc6fa.

The source data of TIPD are individual records of Taiwan Household Registration System (THRS). According to 2013-2017 and 2018-2021 bilateral joint research programs signed by Council of Taiwan Indigenous Peoples and Academia Sinica, source data sets are collected from THRS on a monthly base since 2013. Variables in THRS include: personal identification number, family name, given name, household ID, full household address (including geographic information on zip code, region name, county name, township name, "chun-li" (village) name, "lin" (sub-unit of village) name, street name, street section number, address number), household head name, relationship with household head, parents' names, spouse name (if married), gender, date of birth, education, marital status, birth place, and ethnicity.

The data model of constructing population dynamics is straightforward. It is mainly based on (1) comparison and (2) record linkage of two population data sets in time point 1 and time point 2. In terms of comparing two population data sets, the population who can be found in the data of time point 1 but not available in the data of time point 2 are termed as "decreased population" in this research; likewise, the population who are not available in the data of time point 1 but become available in time point 2 are termed as "increased population". Population who survive in the period of both time points 1 and 2 are termed as "intact population". Record linkage is applied to incorporate information in both time points 1 and 2 for "intact population".

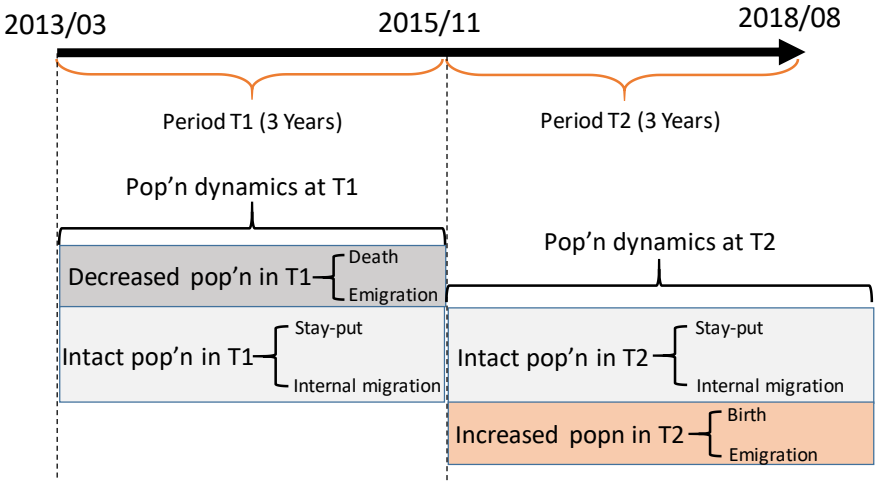


Figure 2. Research Framework of Population Dynamics

To distinguish factors contributing to population dynamics, “intact population” are dichotomized into two groups of population: the “stay-put” population and the population who make internal migration in the period of time points 1 and 2; “increased population” are divided into two categories: new-born population and immigration population; “decreased population” are also divided into two categories: deceased population and emigration population. In brief, the data model of constructing population dynamics is illustrated in Figure 2.

3.2 Computational methods of constructing population dynamic data

Constructing individual data of population dynamics involves two types of record linkage: deterministic and probabilistic. Both types of record linkage demand powerful computing infrastructure. To accelerate the construction of population dynamics data, the research takes advantage of in-memory high performance computing (HPC) techniques, comprising three central skills of manipulating digital infrastructure: (1) overclocking CPUs, (2) overclocking internal memory speed, and (3) accelerating I/O bus bandwidth that links CPUs and internal memory. The initial digital infrastructure in the research is a high-end workstation (Lin 2017b). Computing facilities have been upgraded in late 2018, including with (1) two Xeon E5-2683V4 CPUs, (2) 768GB DDR4 2600 DRAM, (3) 8TB RAID00 high-speed SATA3 SSD storage array, (4) 8TB PCI-E 3.0 NVMe SSD with VROC (Virtual RAID on CPU) RAI0 high-speed storage array, and (5) 80TB HDD storage.

Based on household address information, this study also locates all household geographic coordinates. It was initially implemented through address matching based on Taiwan Address Matching System (TAMS). I later develop a program which is coded in Delphi (object Pascal) language to parse geocode information directly from Google Map. The geographic coordinate system used to represent household locations of Taiwan indigenous peoples is WGS84. The total number of indigenous households amounts to around 210,000. The research achieves to locate 99.5% of indigenous households. Based on fully located indigenous household geocodes, the study goes further to locate each individual geo-information dynamics.

Programming languages used in the research to conduct computing work are RAD Studio Delphi 10.2 (object Pascal) and SAS V9.4. Various processes of data processing are integrated through the combination of pipeline and redirection commands. Each population dynamics data between time point 1 and time point 2 include three files: decreased population, increased population, and intact population between time point 1 and time point 2. Decreased population file refers to the population that exists in time point 1 but disappears in time point 2; increased population file to the population that does not exist in time point 1 but appears in time point 2; intact population the population that survives from time point 1 to time point 2. Each file for increased population, decreased population, and intact population has a variable “PopnDynaStus” to distinguish factors of population dynamics.

Each constructed file has a variable “PopnDynaStus” that is used to distinguish factors contributing to population dynamics. For intact population file, “PopnDynaStus = 11” refers to “stay-put” population (population who don’t make internal migration between time points 1 and 2), “PopnDynaStus = 12” refers to population who make

internal migration between time points 1 and 2. For decreased population file, "PopnDynaStus = 21" are those passing away in time point 2, and "PopnDynaStus = 22" are those making emigration in time point 2. For increased population, "PopnDynaStus = 31" refers to new borns in time point 1, and "PopnDynaStus = 32" to those who are immigrants in time point 2.

3.3 Research framework and methods

To distinguish the interactions of migration with poverty and inequality, the research includes three time points: 2013/03 (March 2013, denoted by T1), 2015/11 (November 2015, denoted by T2), and 2018/08 (August 2018, denoted by T3). The time span between T1 and T2 refers to Period P1, and that between T2 and T3 to Period P2. As a result, the population in research consists two sets of population dynamic data in two periods, Period P1 (2013/03 to 2015/11) and Period P2 (2015/11 to 2018/08). As illustrated by Figure 3, the sequence of migration dynamics and types of migration are defined as follows:

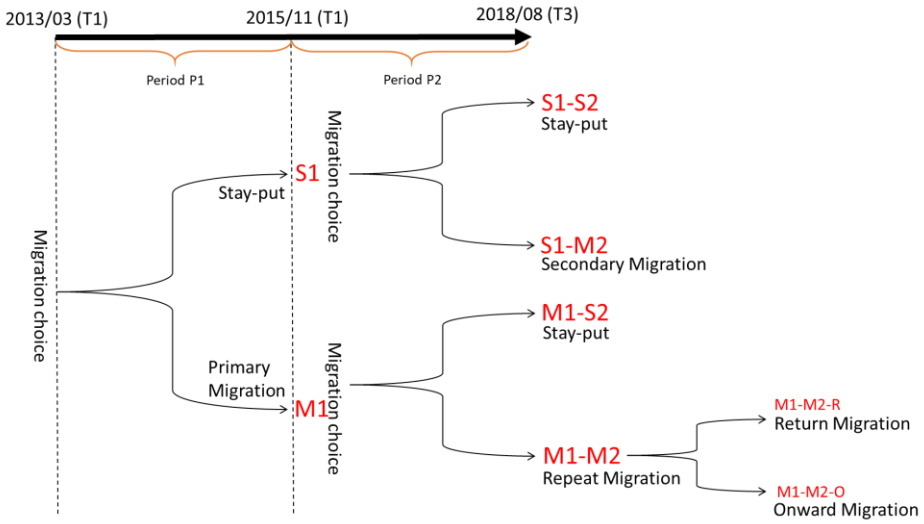
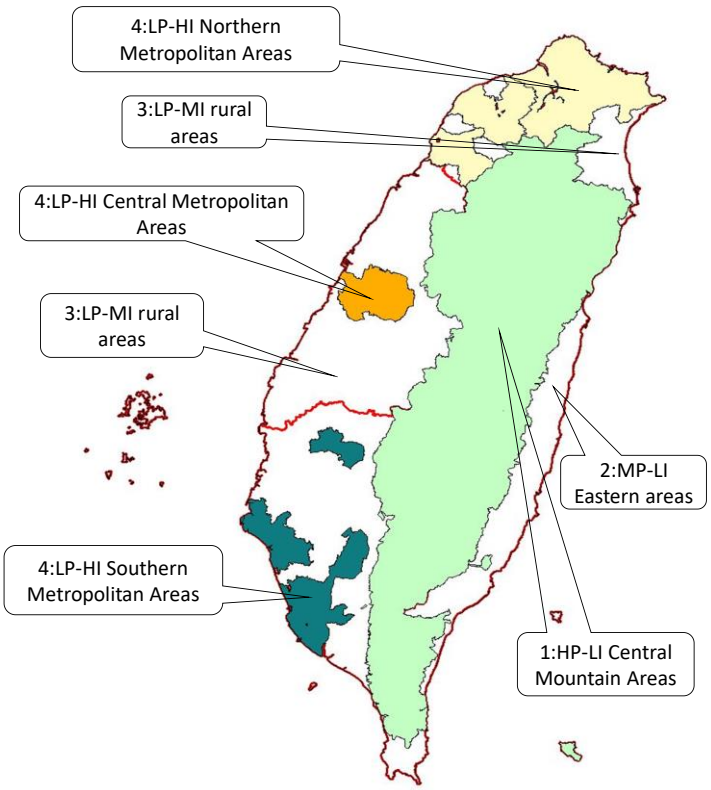


Figure 3. Research Framework of Migration Dynamics

1. In period P1, the population in research can be divided into two broad groups: those who decide to stay put in P1 (sub-population S1) and those who decide to migrate during P1 (sub-population M1). Internal migration of intact population in P1 is defined as primary migration, and migrants M1 refer to primary migrants.
2. In period P2, sub-population S1 can be dichotomized into those who remain staying put in the period P2 (sub-population S1-S2) and those who choose to migrate in period P2 (sub-population S1-M2); Likewise, population M1can be divided into two groups for those who decide not to migrate in period P2 (sub-population M1-S2) and those who continue to make migration in period P2 (sub-population M1-M2). Migration of sub-population S1-M2 is defined as secondary migration and sub-population S1-M2 as secondary migrants.
3. Because those who migrate in both periods P1 and P2 are associated with two types of migration. The first one is the migration back to a place near the

household in T1, while the second one the migration to places different from that in T1 and T2. By definition, the first type of migration for sub-population M1-M2 refers to return migration, and sub-population M1-M2-R denotes return migrants, while the second type of migration for sub-population M1-M2 refers to onward migration, and sub-population M1-M2-O denotes onward migrants.

The research has successfully incorporated individual latitude and longitude information measured in WGS84 projection system into population dynamic data. As a result, migration distance between an individual pair of origin and destination can be precisely calculated, and the constructed population dynamics data enables us to visualize individual migration between two geographic points. Based on individual WGS84 location information, the research's operational definition of return migration is defined as an individual in sub-population M1-M2 whose migration destination in T3 is less than 10KM in distance from her/his household location in T1. To calculate the distance between two geographic points, the research adopts the method proposed by Vincenty (1975). The underlying reason to dichotomize population M1-M2 into return migrants and onward migrants lies in the fact that return migrants and onward migrants behave and respond to ecological variables (e.g. income level and inequality variable) in a very different way (e.g. see Da Vanzo 1983). It is highly necessary to further distinguish M1-M2 population between return and onward types.



1:HP-LI (high poverty-lowest inequality)
2:MP-LI (moderate poverty-lower inequality)
3:LP-MI (lower poverty-moderate inequality)
4:LP-HI (lowest poverty-highest inequality)

Figure 4. Category of Poverty-Ineqaulity Classification

To study primary, secondary, repeat migration and return/onward migration, the migration model that has been widely applied consists of the following interrelated nested models: (1) departure model, (2) repeat migration model, (3) onward/return model, and (4) destination choice model given an individual decides to migrate (Ben-Akiva and Lerman 1985; Kanaroglou, Liaw, and Papageorgiou 1986). Factors that affect migration decision, with migration distance being controlled, include two broad categories: (1) demographic and household characteristics, and (2) ecological variables (e.g. education resource, level of medical service accessibility, availability of welfare, employment growth, unemployment level, income/wage level, housing and living costs, environmental amenity, cultural similarity, etc). It is worthy of emphasizing that although the research does not utilize the aforementioned models, research framework has reflected the logic and thought of the aforementioned migration models.

Individual income information is not available in research data. Based on the general information from Taiwan Household Incomes Survey, the research divides Taiwan into four categories that represents different level of poverty and inequality. As illustrated in Figure 4, they include the following categories: (1) HP-LI (high poverty-lowest inequality) in central mountain areas; (2) MP-LI (moderate poverty-lower inequality) represents Hualien-Taitung areas of eastern Taiwan; (3) LP-MI (lower poverty-moderate inequality) that refers to other rural areas; (4) LP-HI (lowest poverty-highest inequality) that represents metropolitan areas. Based on the aforementioned research framework and methodology, the research thus can distinguish interrelationship of each type of migration with poverty and inequality proxy variables.

4 Population Dynamics, Poverty, and Inequality: An Overview from 2013 to 2018

Before examining the mutual relationship of migration dynamics, poverty, and inequality, the research at first presents the outcomes of population dynamics in a hope of offering a general picture about the whole dynamic process. Table 1 demonstrates computing results of 6-year-period and one-year-period population dynamics. 6-year-period population dynamics from 2013/03 to 2018/08 are demonstrated by figures in the first column of Table 1. During the 6-year-period, the volumes of decreased, increased, and intact population are of 26,068, 62,136, and 501,709, respectively. By decomposing the decreased, increased, and intact populations into the corresponding components (death and emigration, birth and immigration/indigenous status change, and stay-put and making internal migration), the main features of 6-year-period population dynamics are twofold. First, the net population growth rate is 6.8%, with natural increase rate and social increase rate being 3.2% and 3.6%, respectively. Second, the rate of intact population who made internal migration is 26.6%.

Table 1 also offers detailed statistics on six one-year-period population dynamics from 2013 to 2018. The statistics for each of the six one-year-period population dynamics suggest the following features of TIPs population dynamics. First, TIPs population is growing, with an annual rate of about 1.1%. Second, the average annual rate of natural increase and social increase is about 0.5% and 0.6%, respectively. Third, the annual rate of internal migration for intact population is about 7.0%.

Table 1. Population Dynamics of Taiwan Indigenous Peoples in 2013-2018: 1-Year Period and 6-Year Period

Components of Population Dynamics	Populatin Dynamics						
	6-year Period	1-year Period					
Time Point 1 (=T1) (persons)	2013/03	2013/03	2014/01	2014/12	2015/11	2016/10	2017/09
Time Point 2 (=T2) (persons)	2018/08	2014/01	2014/12	2015/11	2016/10	2017/09	2018/08
P1. Total Popn. at T1 (=A+C) (persons)	527,777	527,777	533,827	539,585	545,873	552,417	558,101
P2. Total Popn. at T2 (=B+C) (persons)	563,845	533,827	539,585	545,873	552,417	558,101	563,845
A. Decreased Popn. (=A1+A2) (persons)	26,068	4,546	3,943	4,452	4,982	4,774	4,720
Death (A1)	26,018	4,534	3,934	4,434	4,969	4,757	4,704
Emigration (A2)	50	12	9	18	13	17	16
B. Increased Popn. (=B1+B2) (persons)	62,136	10,596	9,701	10,740	11,526	10,458	10,464
Birth (B1)	42,866	6,501	6,198	7,145	8,181	7,490	7,771
Move to indigenous status or immigration (B2)	19,270	4,095	3,503	3,595	3,345	2,968	2,693
C. Intact Popn. (persons)	501,709	523,231	529,884	535,133	540,891	547,643	553,381
Stay-put (C1)	361,166	483,996	492,246	494,628	503,237	511,284	512,243
Internal migration (C2)	140,543	39,235	37,638	40,505	37,654	36,359	41,138
D. Natual Increase							
Volume (D=B1-A1) (persons)	16,848	1,967	2,264	2,711	3,212	2,733	3,067
Rate (=D/P1*100) (%)	3.2	0.4	0.4	0.5	0.6	0.5	0.5
E. Social Increase							
Volume (E=B2-A2) (persons)	19,220	4,083	3,494	3,577	3,332	2,951	2,677
Rate (=E/P1*100) (%)	3.6	0.8	0.7	0.7	0.6	0.5	0.5
F. Net Popn. Growth							
Volume (F=D+E) (persons)	36,068	6,050	5,758	6,288	6,544	5,684	5,744
Rate (=F/P1*100) (%)	6.8	1.1	1.1	1.2	1.2	1.0	1.0
G. Internal Migration Rate (=C2/P1*100)	26.6	7.4	7.1	7.5	6.9	6.6	7.4

It is important to stress that I adopt the term “move to indigenous status or immigration” instead of using exclusively the term “immigration” as a component of increased population. Reasons are as follows. Similar to the situation of emigration, immigration is not crucial in affecting TIPs population size. In the past decade, a number of policies have been proposed and implemented (e.g., national apology to TIPs, national health insurance premium waiver, income tax reduction, lowering university entrance standard, various welfare offerings, etc.) aiming to improving the disadvantaged status of TIPs. These policies have an effect of encouraging people with indigenous linage to reclaim their indigenous status in civil registration system. In other words, reclaiming and moving into indigenous status in civil registration contribute a lot in the part of “increased population”.

To distinguish the relationship of population dynamics with poverty and inequality, I summarize computing results in Table 2 which offers the statistics on the components of 6-year-period population dynamics with different level of poverty and inequality in 2013/03 and 2018/08. The heading of Table 2 consists of four categories that represents areas with different combination of poverty and inequality. As shown in Figure 4, they include HP-LI (highest poverty-lowest inequality) are, MP-LI (moderate poverty-lower inequality) area, LP-MI (lower poverty-moderate inequality) area, and LP-HI (lowest poverty-highest inequality) area. The sequence of HP-LI, MP-LI, LP-MI, and LP-HI indicates the trend of decreasing poverty along with increasing inequality.

In Table 2, the first panel shows the corresponding statistic figures of population dynamics components with respect to the aforementioned classification of poverty-inequality, the second panel demonstrates percentage share of population in 2013/03 by

components of population dynamics with respect to each category of poverty-inequality classification, while the third panel summarizes percentage share of composition by each category of poverty-inequality classification with respect to the components of population dynamics.

Table 2. Association of Population Dynamics with Level of Poverty and Inequality Measured in Household Incomes Level: 2013/03 to 2018/08

Components of Popuplation Dynamics	Population	Level of Poverty and Inequality in terms household incomes at 2013/03			
		HP-LI	MP-LI	LP-MI	LP-HI
I. Volume of Popn. (persons)					
A. Decreased Popn. (=A1+A2)	**26,068**	**10,369**	**8,073**	**2,019**	**5,607**
Death (A1)	26,018	10,369	8,073	2,019	5,557
Emigration (A2)	50	0	0	0	50
B. Increased Popn. (=B1+B2)	**62,136**	**13,171**	**10,651**	**7,859**	**30,455**
Birth (B1)	42,866	11,779	7,102	4,648	19,337
Move to indigenous status or immigration (B2)	19,270	1,392	3,549	3,211	11,118
C. Intact Popn.	**501,709**	**150,391**	**117,794**	**49,534**	**183,990**
Stay-put (C1)	361,166	122,062	88,690	32,229	118,185
Internal migration (C2)	140,543	28,329	29,104	17,305	65,805
II. Share of Pop'n in 2013/03 by Components of Pop'n Dynamics (%)					
Population in 2013/03	100.0	100.0	100.0	100.0	100.0
A. Decreased Popn. (=A1+A2)	**4.9**	**6.4**	**6.4**	**3.9**	**3.0**
Death (A1)	4.9	6.4	6.4	3.9	2.9
Emigration (A2)	0.0	0.0	0.0	0.0	0.0
B. Increased Popn. (=B1+B2)	**11.8**	**8.2**	**8.5**	**15.2**	**16.1**
Birth (B1)	8.1	7.3	5.6	9.0	10.2
Move to indigenous status or immigration (B2)	3.7	0.9	2.8	6.2	5.9
C. Intact Popn.	95.1	93.6	93.6	96.1	97.0
Stay-put (C1)	68.4	75.9	70.5	62.5	62.3
Internal migration (C2)	26.6	17.6	23.1	33.6	34.7
III. Composition of Popn by Level of Poverty & Inequality (%)					
A. Decreased Popn. (=A1+A2)	**100.0**	**39.8**	**31.0**	**7.7**	**21.5**
Death (A1)	100.0	39.9	31.0	7.8	21.4
Emigration (A2)	100.0	0.0	0.0	0.0	100.0
B. Increased Popn. (=B1+B2)	**100.0**	**21.2**	**17.1**	**12.6**	**49.0**
Birth (B1)	100.0	27.5	16.6	10.8	45.1
Move to indigenous status or immigration (B2)	100.0	7.2	18.4	16.7	57.7
C. Intact Popn.	**100.0**	**30.0**	**23.5**	**9.9**	**36.7**
Stay-put (C1)	100.0	33.8	24.6	8.9	32.7
Internal migration (C2)	100.0	20.2	20.7	12.3	46.8

Note: see Figure 4
1: HP-LI(high poverty-lowest inequality): central mountain areas
2: MP-LI(moderate poverty-lower inequality): Hualien-Taitung areas of eastern Taiwan
3: LP-MI(lower poverty-moderate inequality: other rural areas
4: LP-HI(lowest poverty-highest inequality): metropolitan areas

Figures in the second panel of Table 2 clearly indicate the relationship of population dynamics component with poverty and inequality. For example, the share of

decreased population (mostly deaths) in 2013/03 with respect to HP-LI, MP-LI, LP-MI, and LP-HI is 6.4%, 6.4%, 3.9%, and 3.0%, indicating decreased population is positively associated with poverty but negatively with inequality. In other words, areas with higher poverty but with less inequality have higher incidences of death, while areas with much lower poverty but having high inequality tend to have lower incidences of death.

In terms of the share of increased population in 2013/03 with respect to HP-LI, MP-LI, LP-MI, and LP-HI, the corresponding figure is 8.2%, 8.5%, 15.2%, and 16.1%, respectively. This pattern suggests it is negatively associated with poverty but positively with inequality. It is worthy of highlighting that the components of increased population, i.e., birth and moving into indigenous status/immigration, have slightly different pattern in areas of high poverty and low inequality. In HP-LI areas, the incidences of birth have a level above the average but that of moving into indigenous status/immigration is very low. In terms of intact population, the research finds that the share of intact population who made internal migration in 2013/03 and 2018/08 increases with inequality but decreases with poverty, as suggested by the internal migration rates with respect to the sequence of HP-LI, MP-LI, LP-MI, and LP-HI (17.6%, 23.1%, 33.6%, and 34.7%, respectively). Consequently, both income level and feelings of relative deprivation in triggering migration have their distinct effect. In terms of triggering migration, the effect of income outweighs that of inequality in areas with high poverty but low inequality, while the effect of inequality turns to be much more important than that of income in areas with low poverty but high inequality.

Migration is known as a process that is highly selective of population with distinct demographic characteristics, as well as with socioeconomic and cultural status. Table 3 summarizes computing results about migration selectivity with respect to poverty/inequality, gender, age, educational level, and marital status for intact population who made internal migration in 2013/03 and 2018/08. Figure 5 demonstrates individual flows of primary migration. Appendix Figure illustrates detailed individual migration flows by ethnic groups of TIPs.

Figure 5. Migration of Taiwan Indigenous Peoples in 2013/03-2018/08

As a whole, 28.0% of intact population made internal migration in this period. In terms of the effect of poverty and inequality, Table 3 indicates that migration increases with inequality level, as suggested by the corresponding figures of migration rate with respect to areas of HP-LI, MP-LI, LP-MI, and LP-HI (18.8%, 24.7%, 34.9%, and 35.8%, respectively). It is worthy of emphasizing the effect of poverty is not important. The effect of poverty in triggering migration is far more important than that of inequality in areas of high poverty level.

Table 3. Migration Selectivity by Area and Selected Demographic Characteristics: 2013/03 to 2018/08

Migration selectivity by area and demographic characteristics (measured in 2013/03)	Popn. Volume in 2013/03 (persons)	Migration Status in 2013/03-2018/08 (%)			Ratio to average migration rate
		Both	Stay-put	Internal migration	
Total	501,709	100.0	72.0	28.0	100.0
Area by poverty and inequality level					
HP-LI	150,391	100.0	81.2	18.8	67.3
MP-LI	117,794	100.0	75.3	24.7	88.2
LP-MI	49,534	100.0	65.1	34.9	124.7
LP-HI	183,990	100.0	64.2	35.8	127.7
Gender					
Male	243,134	100.0	74.4	25.6	91.3
Female	258,575	100.0	69.7	30.3	108.2
Age					
00-04 Years	28,530	100.0	51.1	48.9	174.7
05-09 Years	35,911	100.0	61.4	38.6	137.8
10-14 Years	42,484	100.0	68.6	31.4	112.0
15-19 Years	49,766	100.0	72.5	27.6	98.4
20-24 Years	45,875	100.0	68.6	31.4	112.2
25-29 Years	40,234	100.0	65.0	35.0	125.0
30-34 Years	43,423	100.0	66.5	33.5	119.6
35-39 Years	38,897	100.0	72.2	27.8	99.1
40-44 Years	36,941	100.0	75.9	24.2	86.2
45-49 Years	36,968	100.0	79.9	20.1	71.8
50-54 Years	33,355	100.0	81.5	18.5	65.9
55-59 Years	27,117	100.0	83.7	16.3	58.3
60-64 Years	17,680	100.0	85.7	14.3	51.2
65-69 Years	9,526	100.0	88.4	11.6	41.4
70+ Years	15,002	100.0	91.7	8.3	29.7
Educational level					
Primary and Less	74,065	100.0	83.6	16.4	58.6
Junior High	81,172	100.0	76.0	24.0	85.8
Senior High	141,081	100.0	72.6	27.4	97.9
Some College	29,316	100.0	68.5	31.5	112.4
University	33,363	100.0	68.4	31.6	113.0
Master+	2,469	100.0	67.8	32.2	115.1
N.A.	140,243	100.0	64.6	35.4	126.3
Marital Status					
Single	271,707	100.0	68.3	31.7	113.3
Spoused	165,940	100.0	76.9	23.1	82.6
Divorced/Seperated	42,989	100.0	70.0	30.0	107.2
Widowed	20,668	100.0	86.8	13.2	47.3
N.A.	405	100.0	30.4	69.6	248.6

Note: see Figure 4

1: HP-LI(high poverty-lowest inequality): central mountain areas

2: MP-LI(moderate poverty-lower inequality): Hualien-Taitung areas of eastern Taiwan

3: LP-MI(lower poverty-moderate inequality: other rural areas

4: LP-HI(lowest poverty-highest inequality): metropolitan areas

In terms of gender selectivity, the internal migration rate with respect to males and females in Table 1 is 25.6% and 30.3%, suggesting internal migration is selective of females. The remaining computing results of migration selectivity with respect to age, educational level, and marital status fall within the theoretical expectation and empirical studies of migration. For example, the pattern of the so-called "migration schedule" (age-specific migration rate) in Table 1 is very similar to that of existing known age-specific pattern of migration: a sharp decline in the age of 0-19 years, but exhibiting a rising pattern with a peak of making internal migration at the age of around 25-29 years, and then going down quickly with age.

In terms of educational selectivity, the migration is selective of those with higher education, as suggested by the migration rate with respect to educational level (16.4% for the primary schooling and less, 24.0% for the junior high, 27.4% for the senior high, 31.5% for some college, 31.6% for university, and 32.2% for mater degree and above). In terms of marital status, the single (31.7%) and the separate (23.1%) are associated with much higher migration rate than the married (30.0%) and the widowed (13.2%).

Table 4. Out-, In-, Net, and Gross Migration Flows between Areas with Different Level of Poverty and Inequality: 2013/03 to 2018/08

Area by poverty and inequality level	Intact population in 2013/03 (persons)	Period from 2013/03 to 2018/08			
		Out-migration (A)	In-migration (B)	Net migration (=B-A)	Gross migration (=B+A)
		Volume (persons)			
Total	501,709	140,543	140,543	0	140,543
HP-LI	150,391	28,329	31,381	3,052	34,433
MP-LI	117,794	29,104	28,451	-653	27,798
LP-MI	49,534	17,305	17,551	246	17,797
LP-HI	183,990	65,805	63,160	-2,645	60,515
		Rate (%)			
Total	100.0	28.0	28.0	0.0	28.0
HP-LI	100.0	18.8	20.9	2.0	22.9
MP-LI	100.0	24.7	24.2	-0.6	23.6
LP-MI	100.0	34.9	35.4	0.5	35.9
LP-HI	100.0	35.8	34.3	-1.4	32.9

Note: see Figure 4

1: HP-LI(high poverty-lowest inequality): central mountain areas

2: MP-LI(moderate poverty-lower inequality): Hualien-Taitung areas of eastern Taiwan

3: LP-MI(lower poverty-moderate inequality: other rural areas

4: LP-HI(lowest poverty-highest inequality): metropolitan areas

After examining the effects of poverty/inequality and selected demographic characteristics (gender, age, educational level, and marital status) on the decision of making migration, we now turn to demonstrate aggregate migration indicators derived from intact population who make migration. As shown in Table 4, aggregate migration indicators are derived from O-D (origin-destination) flows of migrants, including both volume and rate with respect to out-migration, in-migration, net migration, and gross

migration. On the first panel of Table, figures about net migration by poverty/inequality level are noteworthy. HP-LI areas are associated with a net gain of internal migrants, while LP-HI with a net loss. The second panel of Table 4 summarizes rates of out-migration, in-migration, net migration, and gross migration. The net migration rate for HP-LI and LP-HI areas is 2.0% and -1.4%, respectively. Moreover, it is found that (1) areas with high poverty but less inequality and (2) areas with low poverty but high inequality have much higher rates of out- and in-migration, leading to a higher gross migration rate in HP-LI and LP-HI areas. This finding suggests the exchange of population in terms of volume and rate is higher in areas with high poverty or high inequality.

5 Migration Dynamics, Poverty, and Inequality

This section presents finding about the interrelationship of migration dynamics with poverty and inequality. The detailed individual flows of migration sequence, including primary, secondary, return, and onward migrations are demonstrated in Figure 6.

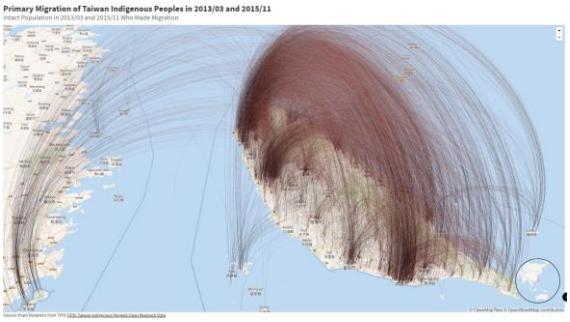


Figure 6.A. Flows of Primary Migratrion

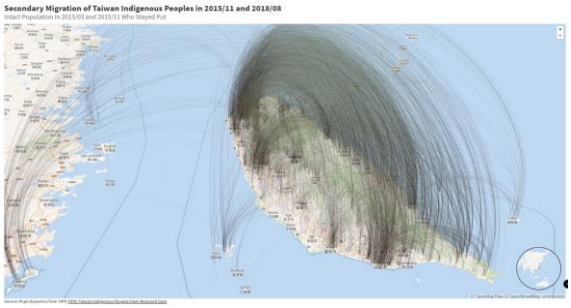


Figure 6.B. Flows of Secondary Migratrion

Figure 6.C. Flows of Return Migratrion

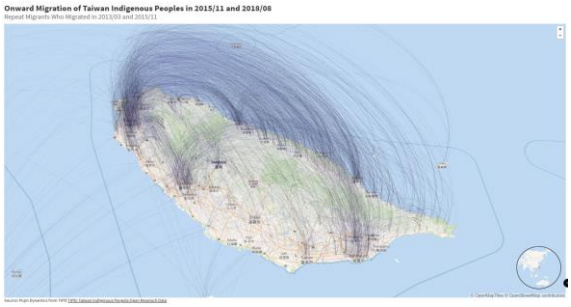


Figure 6.D. Flows of Onward Migratrion

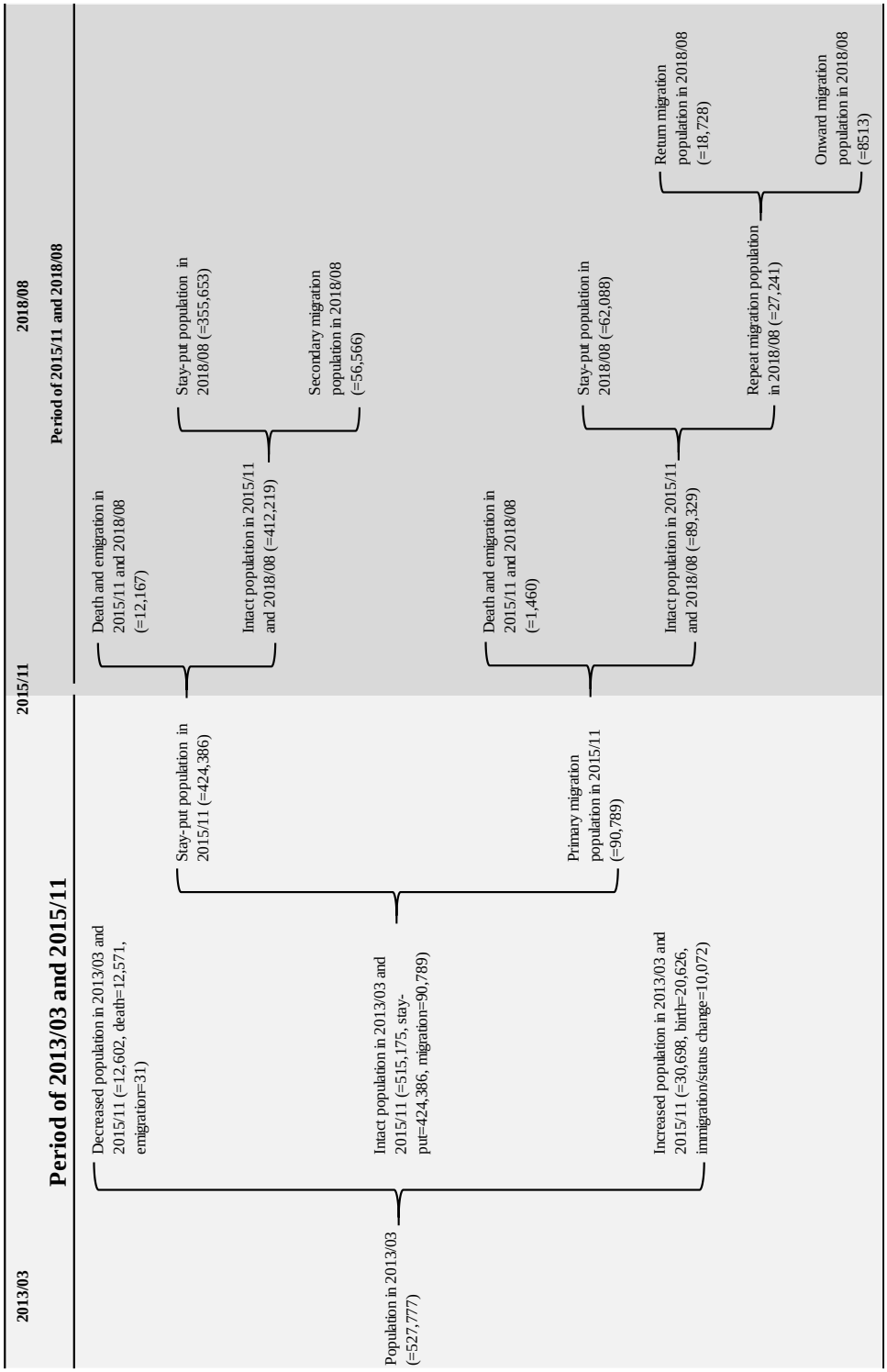
Figure 6. Flows of Migration Dynamics: Primary, Secondary, Return, and Onward Migration

5.1 Primary Migration, Poverty, and Inequality

As part of population dynamics, migration dynamics are summarized in Table 5, including sequences and volumes of primary migration, secondary migration, repeat migration, return migration, and onward migration. As indicated by research framework, primary migration refers to migration made by intact population in 2013/03 and 2015/11; secondary migration is migration made by stay-put intact population in 2013/03 and

2015/11 (i.e. intact population in) 2013/03 and 2015/11 who don't migration in this period) who still survive in 2015/11 to 2018/08; repeat migration is migration made in 2015/11 and 2018/08 by intact population who make migration in 2013/03 and 2015/11. Repeat migration consists of return migration and onward migration. Return migration refers to repeat migrants who migrate to a destination that is less than 10KM in distance to the origin of migration in 2013/03, otherwise repeat migrants are defined as onward migrants.

Table 5. Sequences and Volumes of Migration Dynamics: Primary, Secondary, Repeat, Return, and Onward Migrations



As indicated in Table 5, primary migration in 2013/03 and 2015/11 is associated with a volume of 90,789 persons and a migration rate of 17.6% (=90,789/515,175*100%); secondary migration in 2015/11 to 2018/08 has a volume of 56,566 persons and a migration rate of 13.7% (=56,566/412,219*100%); repeat migrants amount to 27,241 in 2015/11 to 2018/08, with 18,728 return migrants and 8,513 onward migrants. Thus repeat migration rate is 30.5% (=27,241/89,329*100%), return migration rate 21.0% (18,728/89,329*100%), and onward migration rate only 9.5% (8,513=/89,329*100%).

Table 6. Migration Dynamics and Migration Selectivity: Primary Migration of Intact Population in 2013/03 and 2015/11

Selected demographic/poverty-ineqaulity factors (measured in 2013/03)	Population in study (persons)	Primary migration in 2013/03 and 2015/11		
		Migration volume (persons)	Migration rate (%)	Ratio to averge migration rate*100
	(A)	(B)	(C=B/A*100)	
Overall	515,175	90,789	17.6	100.0
Area by poverty and inequality level				
HP-LI	155,669	18,167	11.7	66.2
MP-LI	122,019	18,599	15.2	86.5
LP-MI	50,572	11,303	22.4	126.8
LP-HI	186,915	42,720	22.9	129.7
Gender				
Male	250,857	40,128	16.0	90.8
Female	264,318	50,661	19.2	108.8
Age				
00-04 Years	28,716	9,174	32.0	181.3
05-09 Years	36,034	9,884	27.4	155.7
10-14 Years	42,627	9,786	23.0	130.3
15-19 Years	50,409	7,739	15.4	87.1
20-24 Years	46,366	8,504	18.3	104.1
25-29 Years	40,612	8,874	21.9	124.0
30-34 Years	43,923	9,437	21.5	122.0
35-39 Years	39,521	7,052	17.8	101.2
40-44 Years	37,715	5,659	15.0	85.1
45-49 Years	38,057	4,591	12.1	68.4
50-54 Years	34,579	3,911	11.3	64.2
55-59 Years	28,433	2,827	9.9	56.4
60-64 Years	18,827	1,646	8.7	49.6
65-69 Years	10,464	745	7.1	40.4
70+ Years	18,892	960	5.1	28.8
Educational level				
Primary and Less	80,787	7,930	9.8	55.7
Junior High	83,761	12,365	14.8	83.8
Senior High	143,588	24,112	16.8	95.3
Some College	29,688	5,847	19.7	111.7
University	33,673	6,474	19.2	109.1
Master+	2,505	510	20.4	115.6
Marital status				
Single	275,230	55,588	20.2	114.6
Spoused	171,350	24,379	14.2	80.8
Divorced/Seperated	44,763	8,669	19.4	109.9
Widowed	23,412	1,884	8.1	45.7

Note: see Figure 4

1: HP-LI(high poverty-lowest inequality): central mountain areas

2: MP-LI(moderate poverty-lower inequality): Hualien-Taitung areas of eastern Taiwan

3: LP-MI(lower poverty-moderate inequality: other rural areas

4: LP-HI(lowest poverty-highest inequality): metropolitan areas

Because repeat migration rate is much more higher than secondary migration, this finding supports the long-confirmed hypothesis of "learning by doing" effect in repeat migration study in the sense that those with more migration experience are more likely to make migration again. Another noteworthy finding is return migration rate is much higher than onward migration rate. This is highly likely due to the weak linkage of various socioeconomic and cultural networks between TIPs and non-TIPs.

Table 7. Migration Selectivity by Area and Selected Demographic Characteristics: 2013/03 to 2015/11

Migration selectivity by area and demographic characteristics (measured in 2013/03)	Internal Migration Rate (%)			
	HP-LI	MP-LI	LP-MI	LP-HI
Total	11.7	15.2	22.4	22.9
Sex				
Male	9.7	13.6	22.1	22.1
Female	13.8	16.9	22.6	23.5
Age				
00-04 Years	26.0	32.9	33.6	35.7
05-09 Years	23.9	28.3	29.4	28.6
10-14 Years	16.0	24.2	28.5	24.3
15-19 Years	9.4	13.5	18.7	18.9
20-24 Years	12.9	17.6	22.0	21.7
25-29 Years	15.5	21.3	26.5	26.4
30-34 Years	14.4	20.1	26.4	26.7
35-39 Years	10.0	16.7	22.1	23.7
40-44 Years	8.7	13.2	18.6	20.4
45-49 Years	6.6	10.5	15.9	17.5
50-54 Years	6.4	9.1	15.3	17.5
55-59 Years	6.0	8.3	13.9	15.3
60-64 Years	5.2	7.1	11.2	15.3
65-69 Years	4.9	5.2	12.1	13.4
70+ Years	3.6	4.1	8.0	13.9
Educational level				
Primary and Less	5.5	6.8	14.5	18.3
Junior High	8.6	12.2	18.3	21.3
Senior High	10.5	15.4	21.8	21.8
Some College	14.8	18.1	23.8	23.2
University	14.7	17.8	22.9	21.8
Master+	15.7	18.7	27.6	22.4
MariStus				
Single	14.8	18.5	24.3	23.9
Spoused	8.8	12.3	19.3	19.7
Divorced/Seperated	11.0	15.1	24.6	28.1
Widowed	5.2	5.8	12.7	15.8

Note: see Figure 4

1: HP-LI(high poverty-lowest inequality): central mountain areas

2: MP-LI(moderate poverty-lower inequality): Hualien-Taitung areas of eastern Taiwan

3: LP-MI(lower poverty-moderate inequality: other rural areas

4: LP-HI(lowest poverty-highest inequality): metropolitan areas

Table 6 exhibits the corresponding figures about selectivity of primary migration in 2013/03 and 2015/11 by poverty/inequality level and by selected demographic characteristics. When it comes to the effects of poverty/inequality level, Table 6 suggests that areas with higher poverty and low inequality are associated with low migration rate in comparison to the areas with low poverty and high inequality. It turns out that inequality outweighs poverty in triggering migration in areas with low poverty and high inequality, but poverty outweighs inequality in triggering migration in areas with high poverty and low inequality. Patterns of migration selectivity associated with primary migration in 2013/03 and 2015/11 resemble those of 6-year-period migration selectivity in 2013/03 and 2018/08, as shown in Table 3. In short, the migration selectivity of primary migration is characterized by selective of (1) females in terms of gender, (2) the young population and young population in the age of labor force in terms of age, (3) the better educated in terms of educational level, and (4) the single and the separated/divorced in terms of marital status.

Table 7 aims to compare the difference of migration selectivity by different level of poverty and inequality for the primary migration. Figures in Table 7 suggest the following distinct features of migration selectivity by different level of poverty and inequality. In terms of gender selectivity, females are more migratory than males in areas with high poverty and low inequality, whereas the difference between the migration likelihood of males and females is very small in areas with low poverty and high inequality. In terms of age selectivity, patterns of age-specific migration rate by different level of poverty and inequality are still very similar, with areas with high inequality having higher age-specific rate than areas with higher poverty level. When it comes to educational selectivity of migration, areas with different level of poverty and inequality have the same pattern in the sense that primary migration is selective of the better educated. Nevertheless, it is worthy of stressing that the positive educational selectivity is much more distinct in areas with high poverty and low inequality that that of areas with low poverty and high inequality. In terms of marital selectivity, the single and the separated/divorced are more migratory and the married and the widowed in general, and such selectivity of marital status becomes more prominent in areas with high poverty and low inequality.

5.2 Secondary Migration, Poverty, and Inequality

Table 8 demonstrates migration selectivity of secondary migration in 2015/11 and 2018/08. Similarly, patterns revealed in Table 8 resemble those seen in primary migration in 2013/03 and 2015/11 and those seen in the 6-year-period migration in 2013/03 and 2018/08. In brief, people in areas with high inequality are much migratory than those in areas with high poverty, as suggested by the migration rates with respect to HP-LI, MP-LI, LP-MI, LP-HI. The migration selectivity of secondary migration resembles that of primary migration. In short, females are more migratory than males, age selectivity is selective of the young population, the better educated are more migratory than the less educated, and the selectivity of marital status is mainly selective of the single and the separated/divorced.

Table 8. Migration Dynamics and Migration Selectivity: Secondary Migration of Stay-put Population in 2013/03 and 2015/11 Who Survive and Make Migration in 2015/11 and 2018/08

Selected demographic/poverty-ineqaulity factors (measured in 2015/11)	Population in study (persons)	Secondary migration in 2015/11 and 2018/08		
		Migration volume (persons)	Migration rate (%)	Ratio to averge migration rate*100
	(A)	(B)	(C=B/A*100)	
Overall	412,219	56,566	13.7	100.0
Area by poverty and inequality level				
HP-LI	132,490	12,461	9.4	68.6
MP-LI	99,490	11,931	12.0	87.4
LP-MI	38,365	6,663	17.4	126.6
LP-HI	141,874	25,511	18.0	131.0
Gender				
Male	203,718	25,292	12.4	90.5
Female	208,501	31,274	15.0	109.3
Age				
00-04 Years	19,361	5,445	28.1	205.0
05-09 Years	26,065	4,981	19.1	139.3
10-14 Years	32,717	4,469	13.7	99.6
15-19 Years	42,114	6,444	15.3	111.5
20-24 Years	37,431	6,470	17.3	126.0
25-29 Years	31,414	5,698	18.1	132.2
30-34 Years	34,072	5,666	16.6	121.2
35-39 Years	31,917	4,152	13.0	94.8
40-44 Years	31,354	3,604	11.5	83.7
45-49 Years	32,496	3,181	9.8	71.4
50-54 Years	29,579	2,549	8.6	62.8
55-59 Years	24,419	1,837	7.5	54.8
60-64 Years	16,132	1,063	6.6	48.0
65-69 Years	8,862	466	5.3	38.3
70+ Years	14,286	541	3.8	27.6
Educational level				
Primary and Less	66,618	5,028	7.6	55.0
Junior High	69,043	7,949	11.5	83.9
Senior High	117,340	16,054	13.7	99.7
Some College	23,580	3,804	16.1	117.6
University	27,440	4,635	16.9	123.1
Master+	2,066	347	16.8	122.4
Marital status				
Single	208,047	32,975	15.9	115.5
Spoused	147,733	16,991	11.5	83.8
Divorced/Seperated	37,564	5,511	14.7	106.9
Widowed	18,808	1,083	5.8	42.0

Note: see Figure 4

1: HP-LI(high poverty-lowest inequality): central mountain areas

2: MP-LI(moderate poverty-lower inequality): Hualien-Taitung areas of eastern Taiwan

3: LP-MI(lower poverty-moderate inequality: other rural areas

4: LP-HI(lowest poverty-highest inequality): metropolitan areas

5.3 Interactions of Return and Onward Migrations with Poverty, and Inequality

As indicated, existing literature points out that factors affecting the decision of making return migration are more complex than that of onward migration. Return

migration is highly related to the effect of location-specific capital (e.g. kinship and friendship networks, familiarity with a place) left in "home". It thus serves as an indicator of community attachment with previous "home". On the other hand, onward migration serves as an indicator of the ability of a repeat migrant in overcoming migration barriers to move to a 'new' place that a repeat migrant is not familiar with before. Table 9 demonstrates the corresponding figures about the effects of poverty/inequality and selected demographic characteristics on repeat migration, return migration, and onward migration.

Figures on the first row of Table 9 indicates that 30.5% of those who migrated in 2013/03 and 2018/08 choose to migrate again in 2015/11 and 2018/08, with 21.0% and 9.5% making return migration and onward migration, respectively. The ratio of return to onward is about 2.2. It suggests that once TIPs migrants decide to make migration again, the likelihood of choosing return far outweighs that of making onward migration. As for the effect of poverty/inequality, areas with low poverty and high inequality are associated with higher rates of repeat, return, and onward migration than areas with high poverty and low inequality. It is worthy of highlighting that by comparing return migration rate with that of onward migration by different level of poverty/inequality, the effect of poverty/inequality on onward migration is more distinguishing than on return migration.

Table 9 provides rates of repeat migration, return migration, and onward migration by different level of previous migration distance (i.e., the migration distance made in primary migration in 2013/03 and 2015/11). Migration is not costless and the ability of migration is subject to the constraint of existing available "budge". Given the constraint of available "budget" to make migration, previous migration distance is used as a proxy variable that represents "budget" has been spent in making previous migration. Thus, the longer previous migration distance is, the less available "budget" is left for a migrant to make repeat migration. As a result, it is expected that previous migration should exhibit a negative effect on making repeat migration.

However, previous migration distance can also serve as a proxy that represents the level of "disappointment" with the outcomes of previous migration (e.g. availability and satisfaction of jog, wage gain, environmental amenity, availability of welfare and medical resources, etc. after migration). Theoretical expectation is that the longer previous migration distance is, the worse the quality of information of previous migration is, and thus the more likely feeling "disappointment" with previous migration outcomes is. Following this logic, previous migration should have a positive effect on making repeat migration. Since previous migration distance is a proxy consisting of the effects of available "budget" to make repeat migration and "disappointment" with previous migration, its effects on return migration and onward migration and thus repeat migration will be different.

Table 9 indicates that previous migration distance has a concave effect on return migration, while exhibits a convex effect on onward migration. It suggests that return migration is selective of primary migrants with shorter or longer previous migration distance. Thus I tend to conclude that return migration is more associated with disappointment hypothesis that with budget constraint. On the other hand, onward migration is selective of primary migrants with shorter previous migration distance. As a result, I will conclude that the ability to make onward migration is mainly subject to the

constraint of available "budget" left after making previous move. Note that repeat migration is a combination of return and onward migrations, repeat migration is seen to be positively associated with previous migration distance.

Table 9. Migration Dynamics and Migration Selectivity: Repeat Migration of Migranting Population in 2013/03 and 2015/11 Who Survive and Make Migration Again in 2015/11 and 2018/08

Selected demographic/povert y-ineqaulity factors (measured in 2015/11)	Population in study (persons)	Repeat migration in 2015/11 and 2018/08			Repeat migration Rate in 2015/11 and 2018/08		
		Repeat Migration (persons)	Return Migration (persons)	Onward Migration (persons)	Repeat Migration (%)	Return Migration (%)	Onward Migration (%)
	(A)	(B=C+D)	(C)	(D)	(E=B/A*100)	(F=C/A*100)	(G=D/A*100)
Overall	89,329	27,241	18,728	8,513	30.5	21.0	9.5
Area by poverty and inequality level							
HP-LI	18,687	4,096	2,973	1,123	21.9	15.9	6.0
MP-LI	17,841	5,038	3,345	1,693	28.2	18.7	9.5
LP-MI	11,559	4,127	2,839	1,288	35.7	24.6	11.1
LP-HI	41,242	13,980	9,571	4,409	33.9	23.2	10.7
Distance of previous migration							
0 - 80	67,784	20,244	15,903	4,341	29.9	23.5	6.4
80 - 160	10,038	3,321	1,300	2,021	33.1	13.0	20.1
160 - 240	6,860	2,136	887	1,249	31.1	12.9	18.2
240 - 320	4,115	1,355	547	808	32.9	13.3	19.6
320 - 400	526	182	89	93	34.6	16.9	17.7
400+	6	3	2	1	50.0	33.3	16.7
Gender							
Male	39,347	11,797	8,101	3,696	30.0	20.6	9.4
Female	49,982	15,444	10,627	4,817	30.9	21.3	9.6
Age							
00-04 Years	9,115	3,623	2,297	1,326	39.7	25.2	14.5
05-09 Years	9,838	3,981	2,925	1,056	40.5	29.7	10.7
10-14 Years	9,750	3,023	2,331	692	31.0	23.9	7.1
15-19 Years	7,639	2,115	1,482	633	27.7	19.4	8.3
20-24 Years	8,423	2,652	1,815	837	31.5	21.5	9.9
25-29 Years	8,811	2,776	1,722	1,054	31.5	19.5	12.0
30-34 Years	9,338	2,762	1,826	936	29.6	19.6	10.0
35-39 Years	6,968	1,902	1,227	675	27.3	17.6	9.7
40-44 Years	5,572	1,415	984	431	25.4	17.7	7.7
45-49 Years	4,466	1,013	702	311	22.7	15.7	7.0
50-54 Years	3,760	798	545	253	21.2	14.5	6.7
55-59 Years	2,691	577	414	163	21.4	15.4	6.1
60-64 Years	1,544	326	250	76	21.1	16.2	4.9
65-69 Years	664	128	97	31	19.3	14.6	4.7
70+ Years	750	150	111	39	20.0	14.8	5.2
Educational level							
Primary and Less	7,531	1,842	1,321	521	24.5	17.5	6.9
Junior High	12,038	3,292	2,151	1,141	27.3	17.9	9.5
Senior High	24,086	6,879	4,633	2,246	28.6	19.2	9.3
Some College	5,857	1,643	1,136	507	28.1	19.4	8.7
University	7,030	2,017	1,298	719	28.7	18.5	10.2
Master+	579	158	102	56	27.3	17.6	9.7
Marital status							
Single	47,531	15,634	10,886	4,748	32.9	22.9	10.0
Spoused	29,732	7,973	5,462	2,511	26.8	18.4	8.4
Divorced/Seperated	10,412	3,252	2,100	1,152	31.2	20.2	11.1
Widowed	1,636	378	278	100	23.1	17.0	6.1

Note: see Figure 4

1: HP-LI(high poverty-lowest inequality): central mountain areas

2: MP-LI(moderate poverty-lower inequality): Hualien-Taitung areas of eastern Taiwan

3: LP-MI(lower poverty-moderate inequality: other rural areas

4: LP-HI(lowest poverty-highest inequality): metropolitan areas

Repeat, return, and onward migrations are selective distinctive demographic characteristics. In terms of gender selectivity, the research does not find significant difference between male and female primary migrants in making either return or onward migration. Thus gender selectivity in repeat, return, and onward migration is not crucial. In terms of age-specific migration rate, repeat, return, and onward migration share similar pattern of "migration schedule". But return migration tends to be selective of the younger primary migrants, while onward migration is selective of the older primary migrants. This finding supports "learning-by-doing" hypothesis in the sense that inexperienced primary migrants are more likely to feel disappointment with previous migration outcomes and thus are more likely to choose return migration, whereas older primary migrants tend to have more experience in migration and thus are less likely to be disappointed with previous migration outcomes. In terms of educational selectivity, Table 9 indicates that educational selectivity of return migration is not as distinct as that of onward migration. Return migration is slightly selected those with better education, but onward migration is distinctly selective of the best educated. As a result, repeat migration exhibits a positive educational selectivity. As for the selectivity of marital status, repeat, return and onward migrations share the same pattern, being selective of the single and the separated/divorced.

Table 10 summarizes and compares indicators of migration flows by poverty/inequality level with respect to each migration sequence (i.e., primary, secondary, repeat, return, and onward) in migration dynamics. The aggregate indicators of migration flows in Table 10 include out-migration, in-migration, net migration, gross migration, and migration efficiency. Using in-migration and out-migration information, net migration enables us to quickly examine the role of migration in redistributing population. Derived from net migration and gross migration, migration efficiency allows us to see population redistribution efficiency through the process of migration.

In terms of net migration and migration efficiency, primary migration and secondary migration have similar patterns, but repeat migration, return migration, and onward migration differ substantially from those observed from primary migration and secondary migration. The differences are as follows.

First, in terms of net migration for primary migration and secondary migration, HP-LI and LP-MI areas have net gain, while HP-LI and LP-HI areas have net loss of migrants. For repeat migration, by contrast, net migration is characterized by substantially net gain in HP-LI and moderate net gain in MP-LI areas, but substantially net loss in LP-HI and moderate net loss in LP-MI areas. This situation is particularly evident for return migration. Table 10 indicates areas with high poverty and low inequality are exclusively associated with net gain, with other areas being associated with net loss. Second, when it comes to migration efficiency, as shown in the last column in Table 10, primary migration and secondary migration have relatively low migration efficiency in comparison to repeat migration. The research finds that return migration and onward migration have higher migration efficiency. It is worthy of stressing that areas with high poverty and low inequality are associated with very high migration efficiency for both return and onward migrations.

Table 10. Indicators of Migration Flows by Areas of Poverty and Inequality

Areas of Poverty and Inequality by Category of Migration Dynamics	Indicators of migration flows				
	Out-migration (A, persons)	In-migration (B, persons)	Net migration (C=B-A, persons)	Gross Migration (D=B+A, persons)	Migration efficiency (E=abs(C)/D*100, %)
Prymary Migration					
Overall	90,789	90,789	0	181,578	0.0
HP-LI	18,167	19,020	853	37,187	2.3
MP-LI	18,599	18,190	-409	36,789	1.1
LP-MI	11,303	11,717	414	23,020	1.8
LP-HI	42,720	41,862	-858	84,582	1.0
Secondary Migration					
Overall	56,566	56,566	0	113,132	0.0
HP-LI	12,461	12,868	407	25,329	1.6
MP-LI	11,931	11,462	-469	23,393	2.0
LP-MI	6,663	7,214	551	13,877	4.0
LP-HI	25,511	25,022	-489	50,533	1.0
Repeat Migration					
Overall	27,241	27,241	0	54,482	0.0
HP-LI	4,096	5,925	1,829	10,021	18.3
MP-LI	5,038	5,282	244	10,320	2.4
LP-MI	4,127	3,418	-709	7,545	9.4
LP-HI	13,980	12,616	-1,364	26,596	5.1
Return Migration					
Overall	13,821	13,821	0	27,642	0.0
HP-LI	2,065	3,182	1,117	5,247	21.3
MP-LI	2,744	2,719	-25	5,463	0.5
LP-MI	2,020	1,386	-634	3,406	18.6
LP-HI	6,992	6,534	-458	13,526	3.4
Onward Migration					
Overall	13,420	13,420	0	26,840	0.0
HP-LI	2,031	2,743	712	4,774	14.9
MP-LI	2,294	2,563	269	4,857	5.5
LP-MI	2,107	2,032	-75	4,139	1.8
LP-HI	6,988	6,082	-906	13,070	6.9

Note: see Figure 4

1: HP-LI(high poverty-lowest inequality): central mountain areas

2: MP-LI(moderate poverty-lower inequality): Hualien-Taitung areas of eastern Taiwan

3: LP-MI(lower poverty-moderate inequality: other rural areas

4: LP-HI(lowest poverty-highest inequality): metropolitan areas

6 Preliminary Findings and Policy Relevance

With detailed population dynamics data being constructed at individual level, the patterns and determinants of population dynamics regarding the population of Taiwan Indigenous Peoples become clear. The research at first presents 6-year-period and 1-year-period population dynamics from 2013 to 2018. The volume of TIPs population is increasing at an annual rate of about 1.1%. Because international migration (both immigration and emigration) is not crucial, the main components that shape population dynamics of TIPs are birth and death. Research findings regarding pattern of the association of poverty and inequality with population dynamics are as follows. Areas

with higher poverty but with less inequality have higher incidences of death, birth, and migration. But areas with low poverty and high inequality are associated much lower incidences of death, but higher incidences of birth and migration. In the past decade, a number of policy measures that favor TIPs are proposed and implemented. People with indigenous lineage tend to reclaim their indigenous status. It is not surprised to find that share of reclaiming indigenous status in increased population is about 28%. Thus, policy plays a crucial role in changing ethnic identity and in affecting population size.

The research finds that both income level and income inequality in triggering migration have their distinct effect. Income inequality can be regarded as a proxy for feelings of relative deprivation. In terms of triggering migration, the effect of income outweighs that of inequality in areas with high poverty but low inequality, while the effect of inequality turns to be much more important than that of income in areas with low poverty but high inequality. migration selectivity of both primary and secondary migrations is characterized by being selective of females, the young population and young population in the age of labor force, the better educated, and the single and the separated/divorced. But migration selectivity associated with return and onward migrations are different to a certain extent. Both return and onward migrations don't have distinct gender selectivity. Return migration tends to select younger repeat migrants, while onward migration is selective of older repeat migrants.

Findings from repeat migration suggest that both return and onward migrations, particularly return type, are characterized by a net gain of migrants moving from low poverty but high inequality areas into areas with high poverty and low inequality areas. More noteworthy is that onward migration of TIPs counters existing findings about onward migration. A rich body of literature on onward/return migrations finds that onward migrants, in comparison to return migrants, are characterized as the migrants with abundant migration experience and human capita, and being aggressive and capable of moving to places they are unfamiliar with.

In the end, by synthesizing findings from primary, secondary, return, and onward migrations, I would like to conclude that migration of TIPs is characterized by a circle of migration between areas of high incomes and high inequality and areas of low income and low inequality. Findings from repeat migration of TIPs mostly support "learning-by-doing hypothesis" and "disappointment hypothesis. But onward migration of TIPs is different from existing empirical findings. TIPs consist of 16 ethnic groups. Because TIPs are not homogenous in terms of culture, family system, and social network, being less able to migrate onward to other places might be a result of weak connection of ethnic social network with non-TIPs. The policy implication derived from the research is: strengthening intra- and inter-ethnic relationship and connection might be an effective measure to overcome poverty trap and improve inequality, and thus promote social mobility.

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Appendix Figure_1. Migration of Ethnic Amis in 2013/03-2018/08

Appendix Figure_2. Migration of Ethnic Atayal in 2013/03-2018/08

Appendix Figure_3. Migration of Ethnic Bunnun in 2013/03-2018/08

Appendix Figure_4. Migration of Ethnic Paiwan in 2013/03-2018/08

Appendix Figure_5. Migration of Ethnic Dao in 2013/03-2018/08

Appendix Figure_6. Migration of Ethnic Kavalan in 2013/03-2018/08

Appendix Figure_7. Migration of Ethnic Puyuma in 2013/03-2018/08

Appendix Figure_8. Migration of Ethnic Rukai in 2013/03-2018/08

Appendix Figure_9. Migration of Ethnic Saisiyat in 2013/03-2018/08

Appendix Figure_10. Migration of Ethnic Tsou in 2013/03-2018/08

Appendix Figure_11. Migration of Ethnic Sakizaya in 2013/03-2018/08

Appendix Figure_12. Migration of Ethnic Sediq in 2013/03-2018/08

Appendix Figure_13. Migration of Ethnic Sediq in 2013/03-2018/08

Appendix Figure_14. Migration of Ethnic Thao in 2013/03-2018/08

Appendix Figure: Migration of Taiwan Indigenous Peoples in 2013/03 and 2018/08 by Ethnic Groups