プロジェクト報告

Demographic dynamics in a rice village in the Philippines from 1918 to 2018[1)]

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1. Introduction

Demographic dynamics is one of the fundamental transformations that a society undergoes in the course of economic development. This paper investigates long-term demographic changes in a rice village in the Philippines for a century, from 1918 to 2018, with a particular focus on recent years, from 2000 to 2018. A demographic analysis can be carried out at different levels, ranging from a national or regional level, then to a village or a city level, and further to a household level. We focus in this paper on village-level changes in order to explore how a rural community transformed its demography through the experience of a sequence of developmental events starting from agricultural innovation (e.g., Green Revolution), an increase in

1) We dedicate this paper to the late Professor Yujiro Hayami and Professor Masao Kikuchi for their invaluable contribution to the village-level studies. We also dedicate this paper to the memory of the late Professor Nobuhiko Fuwa who had been working with us for the survey of this village. The authors would like to thank Fe Gascon, Pie Moya, Ester Marciano, and Aramil Raphael and the staff of the Social Sciences Division of the International Rice Research Institute (IRRI) for the survey implementation and useful suggestions.
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4) Sophia University

farm-derived incomes, an improvement in human capital, and then to an increase in non-agricultural employment opportunities, which generates further increases in incomes. As explained later, the village that is considered in this study is located on the outskirts of Metro Manila, and has transformed its structure from a pure agrarian village in the past to a village with abundant non-agricultural employment opportunities. The features of these analyses may be regarded as constituting a transformation that is typical for suburban villages. We examine three major indicators: (1) population growth, (2) births, deaths, and migration rates, and (3) population pyramids.

2. Study Site and Data

2.1. Study Site

The features of the study site are explained in detail in previous studies. A relevant explanation for this study from Kajisa (2007) is shown below, which covered the events until 2001.

"The study village is located about 70 km southeast of Manila, facing the east coast of Laguna de Bay, the largest lake in the Philippines (Figure 1). It was first settled in the 1880s, and continued its history as a rainfed rice monoculture village. Major innovations in agricultural technology began in the late 1960s with the arrival of the Green Revolution at this village, doubling the rice yield in a decade. The continuous release of new modern varieties and their replacement of the older ones kept the momentum of the Green Revolution going until the early 1980s. Throughout this period rice farming continued to be the dominant production activity in this village."

"In the late 1970s, major improvements in highway systems, which connect the village to Manila and other major cities, were made. The villagers were able to access non-agricultural job opportunities available at the newly industrializing area in the west coast of Laguna de Bay (Figure 1)."

"In the 1990s, following the rapid growth in neighboring ASEAN countries, relatively cheap but high quality labor in the Philippines attracted foreign direct

investment in labor intensive manufacturing. This progress was accelerated by the establishment of industrial parks along the coast of Laguna de Bay."

After 2001, the expansion of non-agricultural employment opportunities has continued at a faster pace, particularly since the 2010s. The average annual GDP growth rate, which was 4.5% during the 2000–2009 period, increased to 6.4% during the 2010–2019 period, mainly driven by growth of the service and manufacturing sectors (World Bank, 2020). This has accelerated the outward-migration of educated children from the village to urban areas. At the same time, the village has attracted inward-migration from distant areas, as the location of the village is convenient to commute from to large cities around Metro Manila. Opportunities for overseas work, which has been important for the economy of the Philippines and existed even before the year 2000, became more prominent in the 2000s. Regarding the village infrastructure, a large portion of coconut groves in the village were converted to residential subdivisions in the early 2000s. This accelerated inward-migration to the village, and this inward-migration continued until all lots were sold.

2.2. Data

Table 1 shows the chronology of the surveys conducted in East Laguna Village. The earliest documented survey in the village dates back to 1966, when a Japanese geographer, Hiromitsu Umehara, conducted a complete enumeration survey that was reported in Umehara (1967). Including Umehara's initial survey, 18 rounds of surveys were conducted in the village. Most of the surveys, from the 2nd round in 1974 to the 12th round in 1997, were conducted by Hayami and/or Kikuchi, and were well summarized by Hayami and Kikuchi (2000). In this paper, the chronology and interpretations prior to 1997 are based on their book. The subsequent surveys since the 13th round in 2001 were carried out by younger researchers. Analyses of the data from the 13th round in 2001 to the 18th round in 2018 constitute the new contributions of this paper.

3. Demographic Dynamics

3.1. Population Growth

Table 2 shows the changes in population and paddy areas from 1918 to 2018. The population statistics prior to 1997 were estimated by family reconstruction, based on the recall of existing households in the 1987 survey (Hayami and Kikuchi, 2000). The figures after 2001 are based on the survey data of the specific survey year. The features are summarized as follows.

- This village is relatively new, with settlement having begun in the 1880s. Population growth in the village during early period, from 1918 to 1966, was very high, at an average rate close to 5% per year. "Such a high rate reflected a large inflow of population together with fast natural growth in the settlement process, especially before 1940s, when new lands were brought rapidly into cultivation (Hayami and Kikuchi, 2000)."
- There were two major developmental events in the village in the late 1950s and late 1960s that significantly increased the capacity of the village to feed its people. Firstly, the extension of a national irrigation system to the village in 1958, which transformed the rice system from rainfed single cropping to irrigated double cropping for both the wet and dry seasons. The second event was the onset of the Green Revolution in 1966, the year in which the so-called miracle rice "IR8" was officially released by the International Rice Research Institute. This new technology increased rice yield or land productivity from 1.9 t/ha in 1966 to about 3 t/ha in 1976, with improved water control as a result of the extension of the irrigation system mentioned above.
- Because of these two mutually interacted infrastructural and technological improvements, a high population growth rate continued after the 1960s. During the three decades (from the 1960s to the 1990s) that were covered by Hayami and Kikuchi (2000), the average annual rate of population growth was 3.7% between 1966 and 1997, which was higher than the Philippine national average of 2.7% that was recorded in the 1960-1990 inter-census period. According to Hayami and Kikuchi (2000), " [s]uch an rapid population growth was typical of lowland areas, in which successful intensification of rice production because of

better irrigation and new rice technology significantly increased farm employment and, at the same time, relatively easy access to urban economic activities expanded non-farm employment opportunities (Hayami and Kikuchi, 2000)."

- The population growth rate was at a record high at 6.9% per year during the 1997 – 2003 period. In the early 2000s, the village decided to convert a large portion of its coconut groves to residential subdivisions, which attracted inward-migration not only by migrants who sought agricultural work opportunities around the village but also those who sought a convenient residential location, commutable to large cities around Metro Manila where non-agricultural employment opportunities exist. The number of "pure" non-agricultural households, in which no member engages in farming, has been increasing since this period (Kajisa, 2007).
- Once the migration inflow to the new residential subdivisions slowed, the population growth rate fell to 2.0% per year during the 2003 – 2007 period.
- The village has experienced a sharp decline in the population growth rate to the level of 0.8% per year, which is even lower than the national average of 1.4% per year in 2018. This trend has two implications. First, even the Philippines—which is considered to be a country that continues to have a high birth rate, and is thus somewhat of an exception from the general trend of demographic transition that features declining population growth along with increased economic development—cannot evade this general trend. Note, however, that these changes include not only changes in birth- and death-rates but also migration rates. For more focused discussion on demographic transition, we will look solely at the trends in the birth- and death-rates in the following subsection. Second, East Laguna village exhibits the trend associated with economic development more strongly than the national average, presumably due to a higher living standard relative to the national average.
- In order to measure land resource availability for agricultural production by the villagers, we show paddy area, which is defined as the area cultivated by farmers living in the village—rather than the area within the boundary of the village territory. "It appears that the land resources in this village thus defined increased through land opening to reach the level of about 100 ha at some time in the 1950s

(Hayami and Kikuchi, 2000)."

- Since the land frontier closed in the 1950s, cultivated paddy area has fluctuated for several reasons: the transfer of cultivation rights to farmers in another village, opening of new marginal land near the lake side, and conversion of paddy plots to residential lots. A sharp decline in the area, to the level of 59 ha., occurred between 2003 and 2007 due to the boom in overseas work during this period. To be able to work overseas , resident farmers usually pawned out the whole or a part of their paddy fields to raise money for expenses needed to work abroad, in particular for a placement fee that they have to shoulder before starting to work abroad. Since the pawnees were mostly non-resident farmers from nearby the village, the cultivated paddy area declined during this period. By 2018, some farmers redeemed the pawned parcels and there were also retirees from the village and new residents who acquired farm lots after 2007, resulting in the paddy area increasing once again to 86 ha. by 2018, a level closer to those observed in the 1980s and 1990s.
- As an indicator of land resource availability to the villagers, the population – land ratio is shown in Table 2. Under continuous population growth, the ratio deteriorated continuously from 1.3 (people per ha.) in 1918 to 25.0 in 2018, with some fluctuations. Note, however, that this indicator reflects resource constraints when farming was the main income source for almost all residents. However, as the importance of non-agricultural opportunities has increased, this indicator has become less appropriate as a measure of resource constraint, while, on the other hand, the importance of human capital or education has been increasing.

3.2. Births, Deaths and Migration Rates

Table 3 shows demographic dynamics through changes in births, deaths and migration rates from 1918 to 2018. The features are summarized as follows.

- We can clearly observe the 'theory of demographic transition' in this village. The village is characterized as having had high birth- and death-rates from 1918 – 1940 (4.6% and 2.4%, respectively) with net natural increases of 2.2% per year (Phase 1), then began to show a continuous decline in death-rate while the birth-rate remained high, resulting in the village experiencing higher natural population growth, or a 'population explosion,' from the 1940s to 1980s (Phase 2).

The village then entered the final stage of transition, Phase 3, where the birth rate started to decline, pushing the net natural growth rate down to a historic low.

- The birth rate recorded its highest rate of 5.2% per year during the 1940 – 1960 period. Meanwhile, the death rate declined during the same period. "The decline in the death rate was particularly rapid in the decade following the Second World War, presumably because of the eradication of malaria through the use of DDT (Hayami and Kikuchi, 2000)."
- In addition to a natural increase, a social increase (or net migration) is another force of demographic change in this village. The social increase accounted for more than half of the population growth during 1918 – 1940. "It is very probable that the social increase was more dominant in the settlement process before 1918 (Hayami and Kikuchi, 2000)."
- After the closure of the land frontier in the 1950s, the social increase did not contribute much to the net increase in the village population until the 1990s. The figure shows net rates of less than one percent from the 1940s to the 1990s. However, this does not mean that inflows and outflows were small. The rates of inflow remained as high as, or even higher than, the birth rate in the same period. At the same time, the rates of outflow were also high, at slightly lower rates than the inflow rates. The high outflow rates stemmed from the geographical features of the village. Hayami and Kikuchi (2000) pointed out that a sharp increase in the rate of outflow from the village for construction and other work in urban areas, especially Metro Manila, corresponded to improvements in the highway systems in the late 1970s. Meanwhile, they also pointed out that "the outflow of villagers to urban areas, however, was more than compensated for by the inflow of residents from nearby towns seeking inexpensive residential plots (Hayami and Kikuchi, 2000)."
- The rate of inflow recorded its highest rate at 8.5% per year during the 1997 – 2003 period when the coconut groves were converted to residential subdivisions, resulting in the net social increase of 5.0% per year or 48% of total population growth.
- Outward migration reached a record-high of 6.6% per year during the overseas work boom period (2003 – 2007). This was the first time when the net social

change fell, with decreases of 0.5% per year. The trend of net social decrease continued in the 2007 – 2018 period, resulting in a net total population growth rate that was lower than the net natural growth rate.

3.3. Changes in the Population Pyramid

Figure 2 shows changes in the population pyramid for selected survey years from 1966 to 2018, where those from 1966 to 1987 are taken from Hayami and Kikuchi (2000). A unique feature of the rennet diagrams from Panels D to F is that the age distribution of the population is shown by migration status. In the diagrams, a native is defined as an individual family member whose household head or spouse was born in East Laguna village. Hence, the descendants of a migrant can become a native family if they were born in the village and form a family independent of the original family. Meanwhile, the group specified by period (e.g., before 1979 or 1980 – 1999) indicates a family member whose household head or spouse, whichever was earlier, migrated into the village during the specified period. Migration status information is available only for the surveys in 1997, 2007, and 2018. The features of the population pyramid dynamics are summarized as follows.

- In Phase 2 of the demographic transition of the village (from the 1940s to the 1980s), reflecting continuing high population growth rates as well as high birth rates, the pyramids became wider, keeping the triangular shape of the pyramid.
- Even in Phase 3 (post-1990s), characterized by lower birth rates and thus lower net rates of increase, the shape of pyramid remained similar as a result of offsetting net social increases (see the figure in 1997).
- We can observe two features in the figures by migration status. First, if we take a look at only the shape of the native (the most inward part of the pyramid), the base of the pyramid has become relatively narrower, transforming the pyramid from a triangular shape to an inverted U shape, particularly on the female side. Among the native residents, the phenomenon of having fewer children has already started, although it is offset by the inflow of young migrants, resulting in the entire pyramid maintaining a triangular shape. Second, in 2018, the side line of the triangle for the total population became less straight, and rather vertical for the 20s to 40s age groups (inward indentation in these age groups). This is because the outward-migration for non-agricultural sectors occurred

disproportionally in these age groups.

4. Concluding Remarks

This paper has explored long-term demographic dynamics in a rural village in the Philippines. The data show that a village in the Philippines cannot be an exception from the theoretical forces of demographic transitions, shifting from the traditional demographic pattern of high birth- and death-rates to the modern pattern of low birth- and death-rates. In addition to this natural shift, we find that the social increase/decrease plays an important role in demographic changes. Our future research plans include an analysis on how demographic factors are related with other social and economic factors, and how the interactions among these factors shape the developmental path of the village through changes in its resource scarcities, technologies, institutions, and value systems.

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Table 1：List of Surveys on East Laguna Village

Survey ID	Year	Principal Reseacher in Charge	Availability		Number of Samples	Sample coverage
1	1966	H. Umehara	N.A.		64 (66)	Complete enumeration
2	1974 a	Y. Hayami	***	*Preliminary survey "Anatomy of Peasant Economy"*	95	Complete enumeration
2b	1975-76	Y. Hayami		*Anatomy of Peasant Economy*	12	Selected sample
3	1976 a	Y. Hayami and m. Kikuchi	***	*Laguna land tenure survey*	111	Complete enumeration
4	1980 b	M. Kikuchi	**	*Laguna social mobility and migration survey I*	total = 126, missing Q'S = 94	Complete enumeration
4b	1980-82	M. Kikuchi		*Anatomy of Peasant Economy Phase II*	15	Selected sample
5	1983 b	M. Kikuchi	X	*Laguna village resurvey*	125	Complete enumeration
6	1987 b	Y. Hayami	***	*Laguna land tenure survey*	155	Complete enumeration
7	1993 c	M. Hossain	**	*Technology, income distribution and poverty in the Philippines*	Wet =190 Dry =188 (missing Qs -dry)	Complete enumeration
8	1997 c	M. Hossain	***	*Technology, income distribution and poverty in the Philippines*	Wet =244 Dry =249	Complete enumeration
9	1995 d	Y. Hayami and M. Kikuchi	***	*Laguna village resurvey*	242	Complete enumeration
10	1996 d	Y. Hayami and M. Kikuchi	***	*Laguna village farmer resurvey*	51	Farmers only
11	1997 d	Y. Hayami and M. Kikuchi	***	*Marketing survey*	43	Farmers only
12	1997 d	Y. Hayami and M. Kikuchi	***	*Village population survey*	266	Complete enumeration
13	2001	K. Kajisa	***	*Laguna social mobility and migration survey*	Wet =297 Dry =309	Complete enumeration
14	2003	N. Fuwa	***	*A livelihood system of rural households*	376	Complete enumeration
15	2007	J. Estudillo	*	*Household responses on natural disasters: tropical storm Milenyo in East Laguna Village 2006*	405	Complete enumeration
16	2007	Y. Sawada	***	*Household responses on natural disasters: tropical storm Milenyo in East Laguna Village 2007*	433	Complete enumeration
17	2012-14	Y. Sawada	***	*Household responses on natural disasters: tropical storm Habagat in East Laguna and sorrounding villages 2012*	Both Wet and Dry, Tubuan = 50, other villages = 149	Farmers in East Laguna and sorrounding villages cultivating paddy plots in East Laguna Village
18	2017-18	K. Kajisa	****	*A livelihood system of rural households*	Wet = 489, Dry = 479	Complete enumeration

*Availability: **** (Encoded data available, no paper based original as surveyed by CAPI (computer assisted personal interview), ***(Encoded data available and original questionnaires storaged) **(Encoded data available but part of original questionnaires missing) *(Encoded data available but all original questionnaires missing) X(Encoded data partially available)*

(a) Anatomy of peasant economy phase I

(b) Anatomy of peasant economy phase II

(c) Technology, income distribution and poverty in the Philippines

(d) IRRI-Japan shuttle project

Table 2 : Changes in population and paddy area, East Laguna Village, 1918 – 2018

Year	Population (no.) Total (survey) (1)	Total (survey)	Economically active [b] (2)	Labor force raio (%) (2)/(1)	Paddy area (ha) [c] (3)	Population / land ratio (person / ha) (1)/(3)	(2)/(3)
1918	47 [a]	52 [d]	32	68	36	1.3	0.9
1940	131 [a]		79	60	na	na	na
1960	305 [a]	349 [d]	154	50	94	3.2	1.6
1966	399 [a]	393 [e]	211	53	104	3.8	20
1974	548 [a]	549 [e]	303	55	105	5.2	2.9
1976	639 [a]	644 [e]	330	52	108	5.9	3.1
1980	707 [a]	698 [e]	363	51	85	8.3	4.3
1983	739 [a]	747 [e]	405 [f]	55	80	9.2	5.1
1987	871 [a]	821 [e]	542 [f]	62	89	9.8	6.1
1995	1,185 [a]	1,141 [e]	772 [f]	65	97	12.2	8.0
1997	1,214 [a, g]	1,209 [e]	772	64	82 [h]	14.8	9.4
2001	1,511 [e]		986	65	69	21.8	14.2
2003	1,815 [e]		1,193	66	59	30.8	20.2
2007	1,962 [e]		1,302	66	59	33.0	21.9
2018	2,146 [e]		1,410	66	86	25.0	16.4
Growth rate (%/ year)							
1918 - 40	4.8		4.2		na		
1940 - 60	4.3		3.4		na		
1960 - 66	4.6		5.4		1.7		
1966 - 76	4.8		4.6		0.4		
1976 - 83	2.1		2.4		-5.8		
1983 - 87	4.2		7.6		2.7		
1987 - 97	3.4		3.6		-0.8		
1997 - 2003	6.9		7.5		-5.3		
2003 - 07	2.0		2.2		0.2		
2007 - 18	0.8		0.7		3.4		

Notes
(a) Estimated by the family reconstruction: the end-of-year poulation unless other wise noted.
(b) Population 13 - 64 years old.
(c) Area cultivated by village residents.
(d) National census data.
(e) Village household survey data.
(f) Estimated by applying the labor force ration at the time of the survey each year.
(g) The year-end population extrapolated using the growth rate between January - October 1997.
(h) Estimated by assuming 2 ha of avarage cultivated size per farmer.
Figures from 1918 to 1997 are from Hayami and Kikuchi (2000)

Table 3：Births, deaths, and migration rates in East Laguna Village, 1918 - 2018（% / year）

	Natural increase			Social increase			Total population
Period	Birth	Death	Net	In	Out	Net	growth
1918 - 40	4.6	2.4	2.2 (44)	3.2	0.4	2.8 (56)	5.0 (100)
1940 - 60	5.2	1.4	3.8 (86)	1.9	1.3	0.6 (14)	4.4 (100)
1960 - 70	4.7	1.4	3.3 (79)	2	1.1	0.9 (21)	4.2 (100)
1970 - 80	4.6	0.8	3.8 (83)	3.5	2.8	0.7 (17)	4.5 (100)
1980 - 90	3.1	0.7	2.4 (74)	4.2	3.4	0.8 (26)	3.2 (100)
1990 - 97	2.6	0.6	2.0 (60)	5.2	3.8	1.4 (40)	3.4 (100)
1997 - 2003	2.8	0.4	2.4 (52)	8.5	3.6	5.0 (48)	7.4 (100)
2003 - 07	2.1	0.2	1.8	6.1	6.6	-0.5	1.3
2007 -18	2.1	0.3	1.8	2.4	3.3	-0.9	0.9

Notes Figures from 1981 to 1997 are from Hayami and Kikuchi (2000)
Figures from 1997 to 2018 are from original data.
Percentage to totals are in parentheses
Source Appendix 1

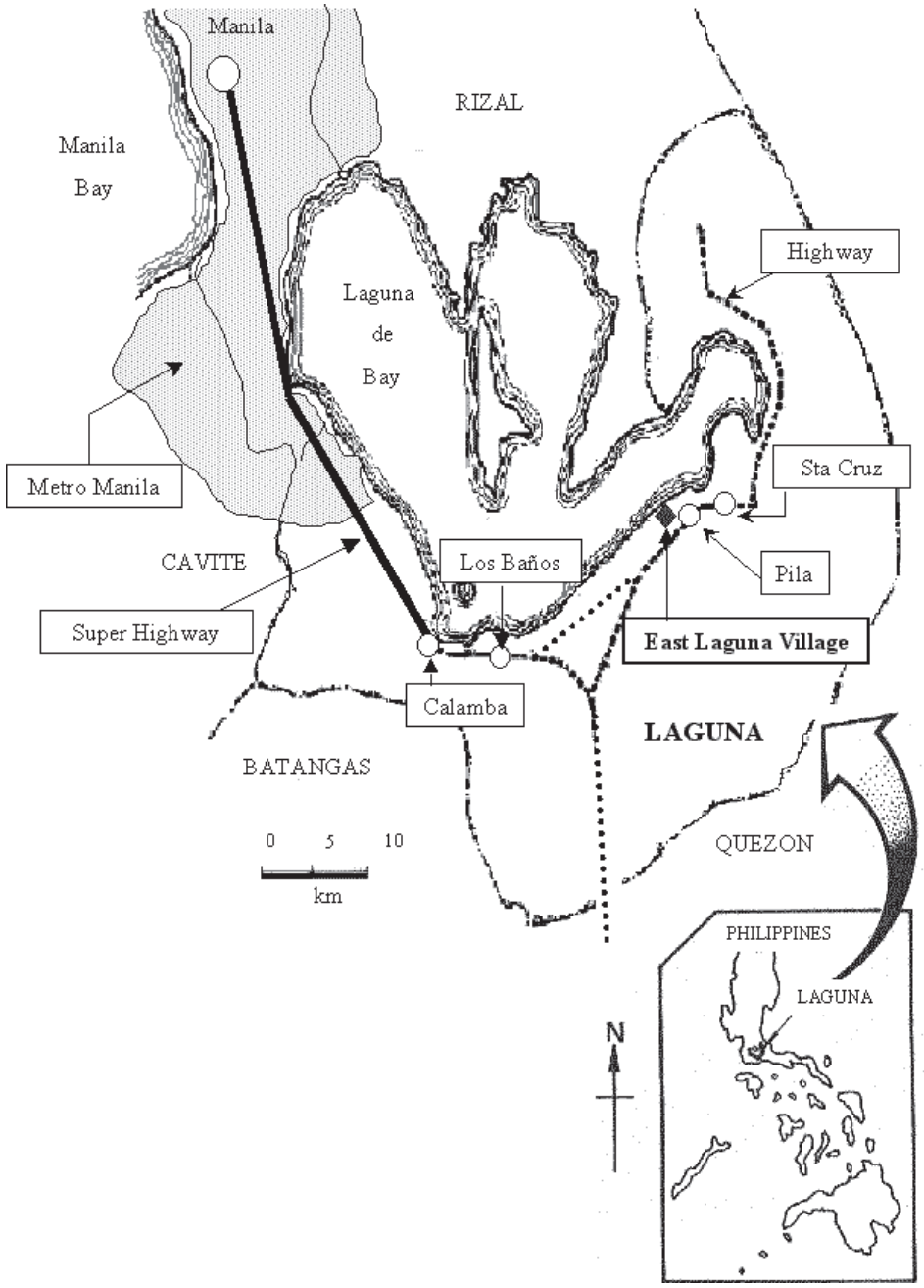
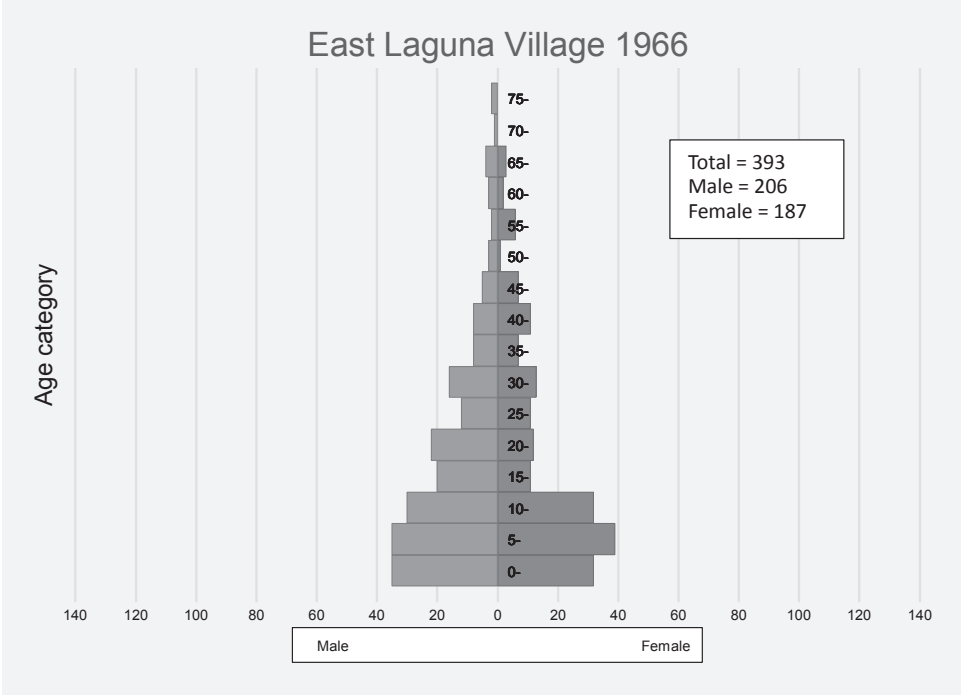
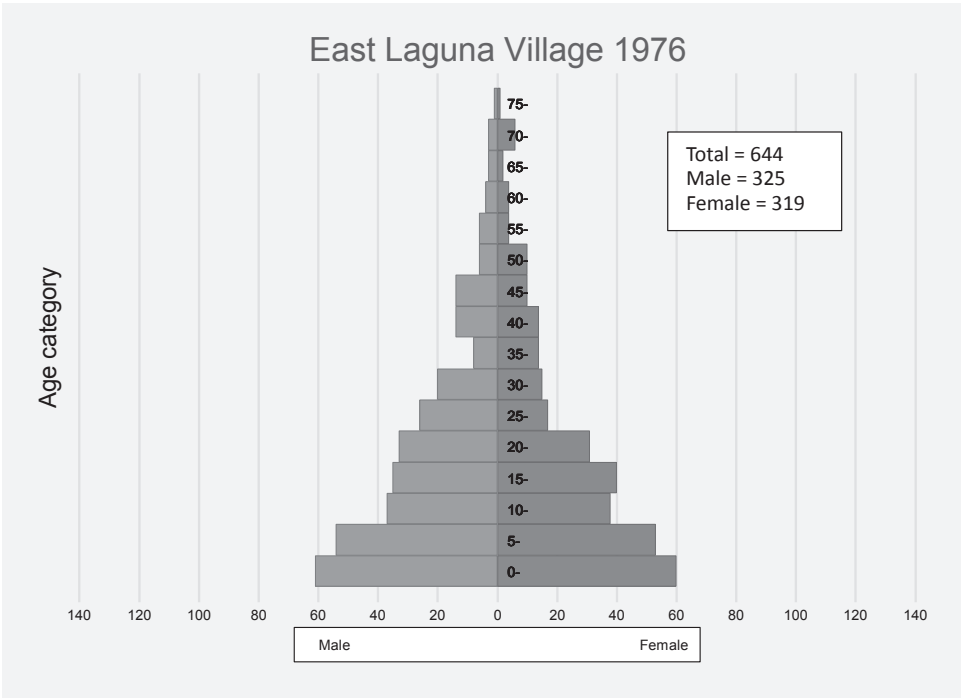


Figure 1：Location of East Laguna Village



Panel A



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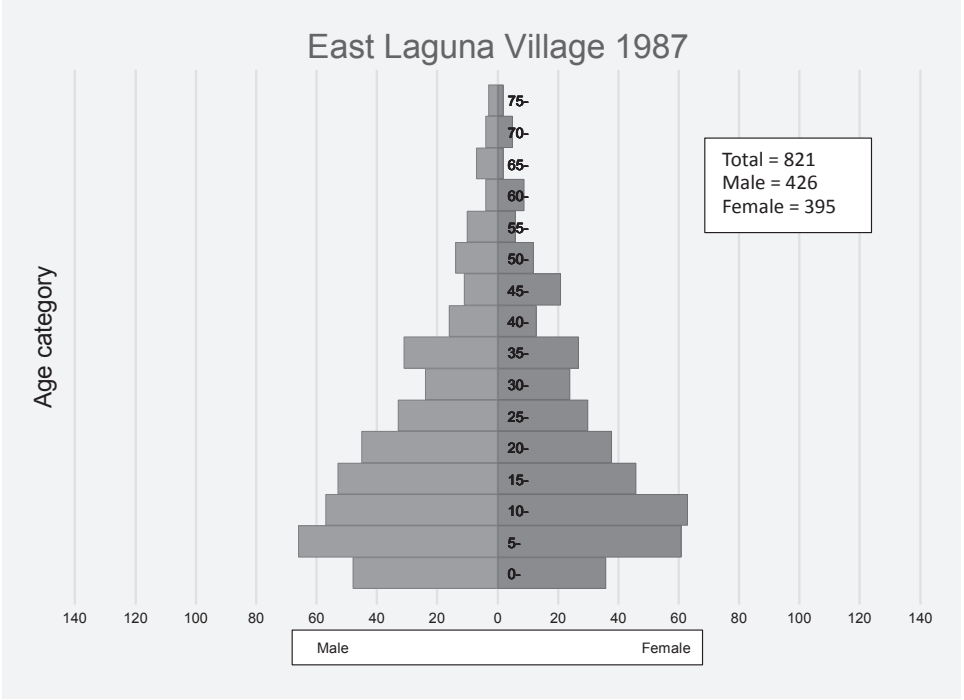

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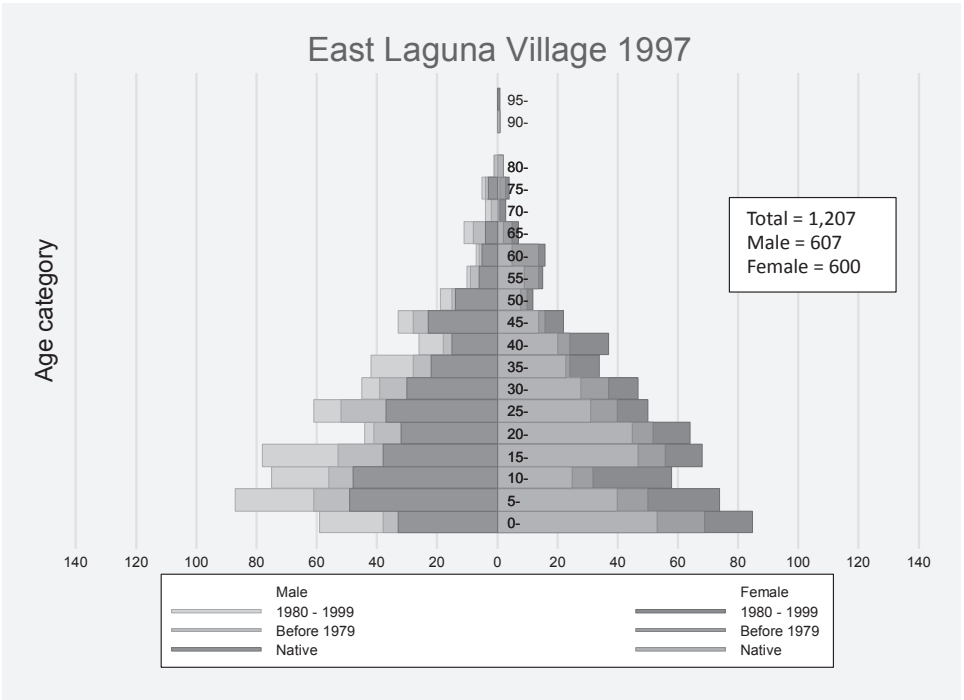

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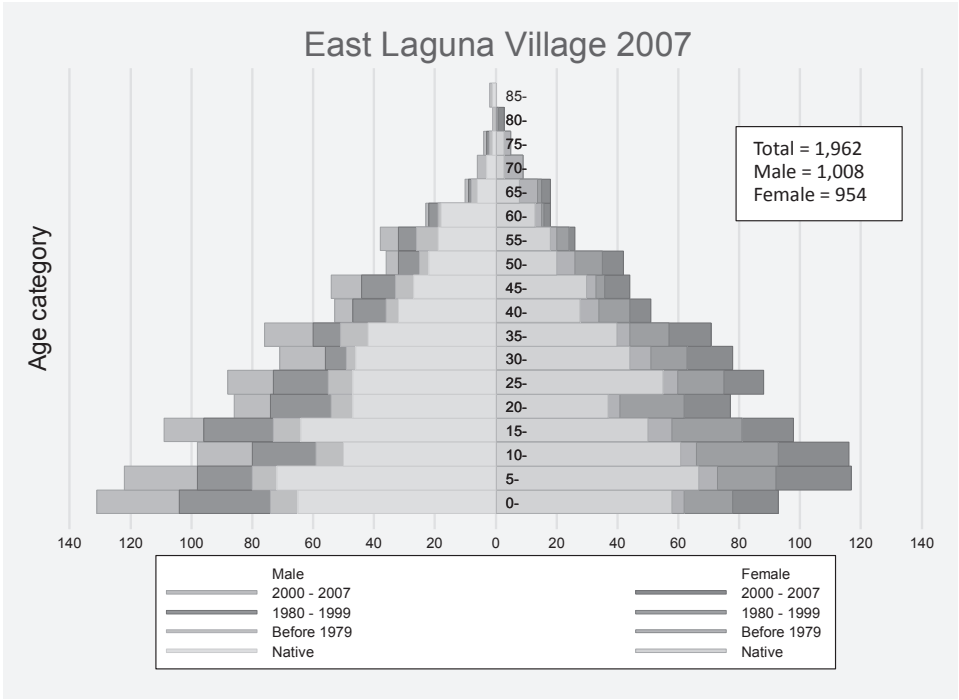
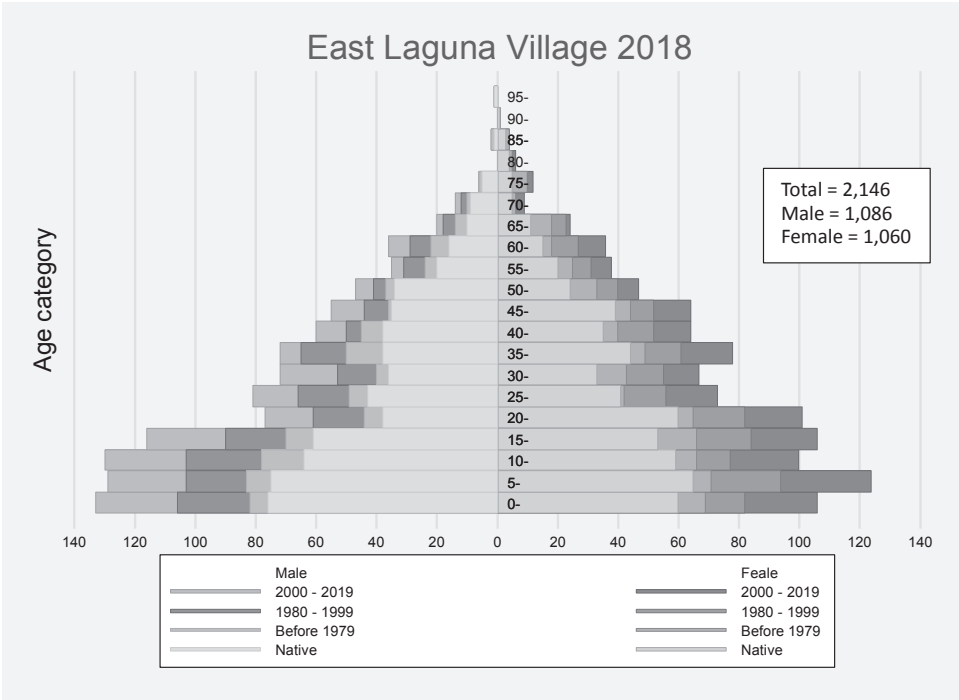


Panel E



Panel F

Source: Hayami and Kikuchi (2000) for Panels A -C, Original data for Panels D-F.

Figure 2: Population pyramid, East Laguna Village, 1966 – 2018

Appendix 1：Reconstruction of Births, Deaths, and Migration, East Laguna village

Selected survey years

	Number							Annual Perecentage Rate [a]								
Year	Pop at end point	Birth	Death	New villagers	In-migration	Out-migration	Check of change	Birth	Death	Net	% in total	In-migration	Out-migration	Net	% in total	Overall net
1997	1,214															
2003	1,894	220	27	991	771	284	1,894	2.8	0.4	2.4	33	8.5	3.6	5.0	67	7.4
2007	1,991	162	19	665	503	549	1,991	2.1	0.2	1.8	138	6.1	6.6	-0.5	-38	1.3
2018	2,179	518	66	1118	600	864	2,179	2.1	0.3	1.8	199	2.4	3.3	-0.9	-99	0.9

All survey years

	Number							Annual Perecentage Rate [a]								
Year	Pop at end point	Birth	Death	New villagers	In-migration	Out-migration	Check of change	Birth	Death	Net	% in total	In-migration	Out-migration	Net	% in total	Overall net
1997	1,214															
2001	1,506	139	20	480	341	168	1,506	2.7	0.4	2.3	43	6.4	3.3	3.1	57	5.4
2003	1,894	81	7	511	430	116	1,894	2.7	0.2	2.4	20	13.4	3.8	9.6	80	12.0
2006	1,920	115	13	418	303	379	1,920	2.0	0.2	1.8	315	5.1	6.3	-1.2	-215	0.6
2007	1,991	47	6	247	200	170	1,991	2.4	0.3	2.1	58	10.4	8.9	1.6	42	3.7
2017	2,227	474	62	1037	563	739	2,227	2.2	0.3	1.9	159	2.5	3.2	-0.7	-59	1.2
2018	2,179	44	4	81	37	125	2,179	2.0	0.2	1.8	-83	1.7	5.6	-4.0	183	-2.2

Notes

(a) Averaging to annual rate by the compounding method

Definitions

Birth：the number of children who were born anywhere—not only this village but also other villages—between the previous survey years and the current survey year, and were still alive in the current survey year (including babies who migrated in). Hence, this figure can overestimate the rate due to the inclusion of migrant babies, who are supposed to be counted as in-migrants. On the other hand, this figure can under estimate the rate due to babies who were born but died between two survey years not having been recorded.

Death：the number of deaths of residents. This figure can under estimate the rate because new-born babies who died between the previous survey year and the current survey year are not recorded.
New villagers：This category consists of new-born babies in this village, the number of individuals who migrated into this village between the previous survey year and current survey year, and still live in the village in the current survey year, including babies who were born in another village and migrated into this village.
In-migration：New villagers（defined above） minus births which include the in-migrant babies as defined above. Hence, this figure may underestimate the rate because we deduct in-migrant babies.
Out-migration：the number of individuals who migrated to another location between the previous survey year and the current survey year.

Remarks
Birth rate and death rate cannot reflect those who were born but died between survey years. Hence, the former tends to be an underestimation and the latter tends to be an overestimation. However, the net change between survey years is not affected.
Our data set does not contain appropriate information to distinguish babies who were born in this village and the babies who migrated in between survey years. Hence, we count all babies as births, assuming all were born in this village. For example, between 1997 and 2001, all individuals aged between 0 and 4 are counted in births. This may overestimate births but we assume that there are a small number of migrant of new-born babies. Moreover, it is not seriously misleading even if we regard migrant babies as ‘almost’ native and include them in births.
The number of ‘In-migrants’ is estimated by subtracting births from ‘New villagers’, albeit the abovementioned limitation and a possible underestimation. Note, however, that the net overall changes is not affected because the underestimation of in-migrant is cancelled out by the overestimation in births which include in-migrant babies.