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# **A New Database on Education Stock in Taiwan**

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## 1 Introduction

This paper provides long-term detailed estimates for Taiwan's education stock. The average number of years of schooling per person (henceforth "average schooling") by gender, age group, and level and type of education are estimated for 1888–1940 and 1947–2000.

This is the first extension of Godo's (2011) dataset, which contains nearly 100-year annual estimates on education stock for Japan, Korea, and the US. The definition and methodology in this paper follow those of Godo (2011).

The US has led the world economy since the late 19<sup>th</sup> century. Japan was the first non-western nation that succeeded in economic catching-up with the advanced nations. Korea and Taiwan also achieved miraculous economic successes in only 15-20 years after Japan. Thus, those four countries comprise a perfect combination of characteristics for analyzing the relationship between education and economic development.

The rest of the paper is organized as follows. Section 2 reviews the definition of average schooling. Section 3 presents the details of the estimation procedure. Section 4 provides the detailed tables of new estimates on education stock. The appendix presents the estimation of conventional inputs (labor and physical capital).

## 2 Definition of education stock

"Average schooling" can be calculated by accumulating the "total enrollment" of corresponding years and ages after adjusting for changes in the population due to immigration and mortality. For simplicity, we assume that there are no differences in the education levels between immigrants and domestic citizens and no correlation between school carrier and mortality. Then, average schooling is determined by the following equations:

$$(1) \quad AS_{x-y,t} = \frac{\sum_{u=x}^y \sum_{w=0}^{u-1} \left( \frac{G_{u,t}}{G_{w,t+w-x}} \right) N_{w,t+w-x}}{\sum_{u=x}^y G_{u,t}}$$

or

$$(1') \quad AS_{x-y,t} = \frac{\sum_{u=x}^y \sum_{w=0}^{u-1} G_{u,t} R_{w,t+w-\chi}}{\sum_{u=x}^y G_{u,t}}$$

where,

$AS_{x-y,t}$  = Average schooling for persons aged  $x$ - $y$  years in year  $t$

$N_{w,t}$  = Total enrollment of persons aged  $w$  years in year  $t$

$G_{w,t}$  = Total number of persons aged  $w$  years in year  $t$ ; and

$R_{w,t}$  = Enrollment ratio for persons aged  $w$  years in year  $t$  ( $= N_{w,t}/G_{w,t}$ ).

While equations (1) and (1') are mathematically equivalent, the data requirement for each differs. Because of some problems in Taiwan's official population statistics as mentioned below, we sometimes estimate  $R_{w,t}$  without estimating  $N_{w,t}$  and  $G_{w,t}$ . Thus, for the purposes of this paper, we choose equation (1').

For simplicity, we use grades 1–12 for primary and secondary education (i.e., the grade ascends one by one according to promotion, starting at 1 for the entrance to elementary school). The classification of levels of education differs according to researchers. Godo (2011) followed the format of school statistics from the US Department of Education, in which grades 1–8 are counted as primary education, grades 9–12 as secondary education, and beyond grade 12 as tertiary education. In Taiwan today, it is more popular to consider grades 1–6 as primary education, grades 7–12 as secondary education, and beyond grade 12 as tertiary education. In this paper, we estimate average schooling by levels of education using both methods.

As various schools specialize in vocational training, we also estimate the average schooling of vocational education.

Males generally have higher mortality rates and enrollment ratios than females. Applying equations (1) or (1') for males and females inclusively will bring an upper bias in the estimates. Thus, we first estimate average schooling by gender. Then, we take the weighted average of males' and females' average schooling (weighted by population).

### 3. Methodology and data sources

#### 3.1 1950–2000

##### Overview

The basic structure of Taiwan's education is a 6-3-3-4 system: 6 years of elementary school, 3 years of middle school, 3 years of high school, and 4 years of university. The 9-year schooling at elementary and middle schools is compulsory (middle school education became compulsory in 1971). In addition to the typical 6-3-3-4 schools, there are various schools such as the normal schools, supplementary schools, special schools, and technical schools (which are described later in this section).

The most popular statistics on the Taiwanese population is the *Taiwan-Fukin Demographic Fact Book*, published annually by the Ministry of Interior. The *Taiwan-Fukin Demographic Fact Book* provides data for the population for each year of age for 1947–56, 1966, and 1969–2000 and for 5-year age groups for 1957–65 and 1967–68.

The Ministry of Education annually publishes the *Education Statistics of the Republic of China*. Despite occasional changes in the survey items and report formula, the *Education Statistics of the Republic of China* provides the most comprehensive school data.

In these two official statistics, two points require careful treatment. First, while the official age of entering grade 1 is 6 years old, some children enter elementary school earlier or later. Another serious problem comes from the cross-border population movements. It is not rare for Taiwanese students to move to (or from) foreign schools. Since the residential records sometimes remain for nearly 6 months after they leave Taiwan, the population data in *Taiwan-Fukin Demographic Fact Book* have an upper bias.

##### Elementary school

While we are aware of the two serious problems mentioned above, we start with estimating the elementary school enrollment ratio based on the two official statistics.

The *Education Statistics of the Republic of China* provides the data for elementary school enrollment for each year of age for 1967 onward. For 1958–1966, the

*Education Statistics of the Republic of China* contains data on enrollment by grade. For these 9 years, we assume that the enrollment for grades 1–6 correspond to those of children aged 6–11 respectively. For 1950–1957, only total enrollment (inclusive of grades 1–6) is available. For these 8 years, we assume that the percentage composition of elementary school enrollment among grades 1–6 is the same as that for 1958.

For 1969 onward, the *Taiwan-Fukin Demographic Fact Book* provides data for population for each year of age. For 1950–1968, we estimate the enrollment ratio from the following equations:<sup>1</sup>

$$(2-1) \quad R_{w,t} = \frac{N_{w,t} G_{5-9,1969}}{G_{5-9,t} N_{w,1969}} R_{w,1969} \quad (w = 5, \dots, 9; \quad t = 1950, \dots, 1968)$$

$$(2-2) \quad R_{w,t} = \frac{N_{w,t} G_{10-14,1969}}{G_{10-14,t} N_{w,1969}} R_{w,1969} \quad (w = 10, \dots, 11; \quad t = 1950, \dots, 1968)$$

where,

$G_{v-w,t}$  = Total number of persons aged  $v - w$  years in year  $t$ .

In this way, we obtain the elementary school enrollment ratio by age for 1950–2000 on the basis of the *Education Statistics of the Republic of China* and the *Taiwan-Fukin Demographic Fact Book*. Hereafter, we call these ratios “official” elementary school enrollment ratios. Some of these official ratios sometimes have unusually low figures because of the upper bias of the population as mentioned above. For example, the elementary school enrollment ratio for females aged 10 years is 0.97 in 2000. This contradicts the common view that primary education has been universal for at least a couple of decades in Taiwan.

Thus, we adopt special data processing on these official enrollment ratios. Looking at their movement, we find that the ratios were on an upward trend until around 1967 and have been almost stable thereafter. Thus, we assume that the elementary school became universal in 1967.

For simplicity, we also assume that only children aged 6–11 years attend

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<sup>1</sup> We find that the population data for 1958 and 1959 in the *Education Statistics of the Republic of China* have abnormally small figures compared to those for the neighboring years. Thus, we estimate the enrollment ratios for those two years by taking linear interpolations between the enrollment ratios in 1957 and those in 1960.

elementary school. These two assumptions enable us to assume 1.0 for the enrollment ratio for children aged 6–11 years for 1967–2000. Using the inverses of the official enrollment ratios in 1967 as multipliers, we estimate the enrollment ratios for 1950–1966.

### Middle school

The *Education Statistics of the Republic of China* reports the percentage of graduates from elementary school that go for further schooling. These data are available for 1950 onward. We estimate the enrollment ratio for grade 7 (or for persons aged 12 years) from the following equations:

$$(3-1) \quad R_{12,t} = \frac{1}{5} R_{11,t-1} \sum_{k=t-2}^{t+2} U_{11-12,k} \quad (t = 1952, \dots, 2000)$$

$$(3-2) \quad R_{12,t} = \frac{N_{12-14,t} G_{12-14,1952}}{G_{12-14,t} N_{12-14,1952}} R_{12,1952} \quad (t = 1950, 51 \dots)$$

where,

$U_{11-12,t}$  = Percentage of graduates from elementary school who go for further schooling in year  $t$ ; and

$N_{12-14,t}$  = Enrollment for persons aged 12–14 years (enrollment of middle school, inclusive of all grades) in year  $t$ .

There are two reasons for taking a 5-year moving average of  $U_{11-12,t}$  in equation (3-1). First, we want to smooth out the unusual fluctuations in the original data of  $U_{11-12,t}$ . Second, because some Taiwanese children actually graduate from elementary school earlier or later than the official age (11 years old), we opted to be more circumspect by using the data of the neighboring years.

The *Education Statistics of the Republic of China* provides the data for the percentage of students promoted to the upper grades for 1960 onward. Just as in the case of the enrollment ratio for persons aged 12 years, we estimate the enrollment ratio for persons aged 13 and 14 years from the following equations:<sup>2</sup>

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<sup>2</sup> For 1957–1960, for which the *Taiwan-Fukin Demographic Fact Book* does not provide population for each year of age, we estimate  $G_{12-14,t}$  by taking the log-linear interpolations between 1956 and 1961 for the corresponding cohorts.

$$(4-1) \quad R_{13,t} = \frac{1}{5} R_{12,t-1} \sum_{k=t-2}^{t+2} U_{12-13,k} \quad (t = 1961, \dots, 2000)$$

$$(4-2) \quad R_{13,t} = \frac{N_{12-14,t} G_{12-14,1961}}{G_{12-14,t} N_{12-14,1961}} R_{13,1961} \quad (t = 1950, \dots, 60)$$

$$(5-1) \quad R_{14,t} = \frac{1}{5} R_{13,t-1} \sum_{k=t-2}^{t+2} U_{13-14,k} \quad (t = 1962, \dots, 2000)$$

$$(5-2) \quad R_{14,t} = \frac{N_{12-14,t} G_{12-14,1962}}{G_{12-14,t} N_{12-14,1962}} R_{14,1962} \quad (t = 1950, \dots, 61)$$

where,

$U_{12-13,t}$  = Percentage of students promoted from grade 7 to 8 in year  $t$  and

$U_{13-14,t}$  = Percentage of students promoted from grade 8 to 9 in year  $t$ .

### Upper secondary school

Various types of schools provide upper secondary education for graduates from middle school. The majority provide 3-year schooling (namely, high school, normal school, supplementary school, and higher vocational school). Only technical schools provide 5-year schooling. We estimate the enrollment ratio of technical schools and those of other schools separately in the following.

The *Education Statistics of the Republic of China* provides the data for the percentage of graduates from middle school who go for further schooling for 1950 onward. Just as in the case of the enrollment ratio for persons aged 12 years, we estimate the total enrollment ratio (all types inclusive) for persons aged 15 years from the following equations:

$$(6-1) \quad R_{15,t} = \frac{1}{5} R_{14,t-1} \sum_{k=t-2}^{t+2} U_{14-15,k} \quad (t = 1952, \dots, 2000)$$

$$(6-2) \quad R_{15,t} = \frac{N_{15-17,t} G_{15-17,1952}}{G_{15-17,t} N_{15-17,1952}} R_{15,1952} \quad (t = 1950, 51)$$

where,

$U_{14-15,t}$  = Percentage of graduates from middle school who go for further schooling in year  $t$  and

$N_{15-17,t}$  = Total enrollment of 3-year upper secondary education in year  $t$ .

The total enrollment ratio consists of two components: enrollment ratio of 3-year upper secondary education (denoted by  $RST$ ) and that of 5-year upper secondary education (denoted by  $RSF$ ). The *Education Statistics of the Republic of China* provides the enrollment by grade for all upper secondary schools for 1970 onward. For 1950–1969, only total enrollment by types of school (inclusive of all grades) is available. Thus, we estimate  $RST$  and  $RSF$  from the following equations:

$$(7-1) \quad RST_{15,t} = \frac{EST_{15,t}}{EST_{15,t} + ESF_{15,t}} R_{15,t} \quad (t = 1970, \dots, 2000)$$

$$(7-2) \quad RST_{15,t} = \frac{25 \sum_{k=t}^{t+3} EST_{15-17,k}}{25 \sum_{k=t}^{t+3} EST_{15-17,k} + 9 \sum_{k=t}^{t+5} ESF_{15-19,k}} R_{15,t} \quad (t = 1950, \dots, 1969)$$

$$(7-3) \quad RSF_{15,t} = R_{15,t} - RST_{15,t} \quad (t = 1950, \dots, 2000)$$

where,

$RST_{w,t}$  = Ratio between enrollment of 3-year upper secondary education and total population for persons aged  $w$  years in year  $t$

$RSF_{w,t}$  = Ratio between enrollment of 5-year upper secondary education and total population for persons aged  $w$  years in year  $t$

$EST_{15,t}$  = Enrollment of persons at grade 10 in 3-year upper secondary education in year  $t$

$ESF_{15,t}$  = Enrollment of persons at grade 10 in 5-year upper secondary education in year  $t$

$EST_{15-17,t}$  = Enrollment of 3-year upper secondary education (inclusive of all grades in year  $t$  and

$ESF_{15-19,t}$  = Enrollment of 5-year upper secondary education (inclusive of all grades) in year  $t$ .

Just as in the case of middle school, we estimate the enrollment ratio for the other grades of upper secondary education as follows:

$$(8-1) \quad RST_{16,t} = \frac{1}{5} RST_{15,t-1} \sum_{k=t-2}^{t+2} STU_{15-16k} \quad (t = 1961, \dots, 2000)$$



$$(8-2) \quad RST_{16,t} = \frac{STN_{15-17,t} G_{15-17,1961}}{G_{15-17,t} STN_{15-17,1961}} RST_{16,1961} \quad (t = 1950, \dots, 60)$$

$$(9-1) \quad RST_{17,t} = \frac{1}{5} RST_{16,t-1} \sum_{k=t-2}^{t+2} STU_{16-17,k} \quad (t = 1962, \dots, 2000)$$

$$(9-2) \quad RST_{17,t} = \frac{STN_{15-17,t} G_{15-17,1962}}{G_{15-17,t} STN_{15-17,1962}} R_{14,1962} \quad (t = 1950, \dots, 61)$$

$$(10-1) \quad RSF_{16,t} = \frac{1}{5} RSF_{15,t-1} \sum_{k=t-2}^{t+2} SFU_{15-16,k} \quad (t = 1961, \dots, 2000)$$

$$(10-2) \quad RSF_{16,t} = \frac{SFN_{15-19,t} G_{15-19,1961}}{G_{15-19,t} SFN_{15-19,1961}} RSF_{16,1961} \quad (t = 1950, \dots, 60)$$

$$(11-1) \quad RSF_{17,t} = \frac{1}{5} RSF_{16,t-1} \sum_{k=t-2}^{t+2} SFU_{16-17,k} \quad (t = 1962, \dots, 2000)$$

$$(11-2) \quad RSF_{17,t} = \frac{SFN_{15-19,t} G_{15-19,1962}}{G_{15-19,t} SFN_{15-19,1962}} RSF_{17,1962} \quad (t = 1950, \dots, 61)$$

$$(12-1) \quad RSF_{18,t} = \frac{1}{5} RSF_{17,t-1} \sum_{k=t-2}^{t+2} SFU_{17-18,k} \quad (t = 1963, \dots, 2000)$$

$$(12-2) \quad RSF_{18,t} = \frac{SFN_{15-19,t} G_{15-19,1963}}{G_{15-19,t} SFN_{15-19,1963}} RSF_{18,1963} \quad (t = 1950, \dots, 62)$$

$$(13-1) \quad RSF_{19,t} = \frac{1}{5} RSF_{18,t-1} \sum_{k=t-2}^{t+2} SFU_{18-19,k} \quad (t = 1964, \dots, 2000)$$

$$(13-2) \quad RSF_{19,t} = \frac{SFN_{15-19,t} G_{15-19,1963}}{G_{15-19,t} SFN_{15-19,1963}} RSF_{19,1964} \quad (t = 1950, \dots, 63)$$

where,

$STU_{v-w,t}$  = Percentage of students promoted from grade  $v$  to  $w$  in 3-year upper secondary schools in year  $t$

$SFU_{v-w,t}$  = Percentage of students promote from grade  $v$  to  $w$  in 5-year upper secondary schools in year  $t$

$STN_{15-17,t}$  = Total enrollment in 3-year upper secondary schools (inclusive of all ages and grades) in year  $t$  and

$SFN_{15-17,t}$  = Total enrollment in 5-year upper secondary schools (inclusive of all ages and grades) in year  $t$ .

## University

The *Education Statistics of the Republic of China* provides data for domestic university enrollment by age (including graduate courses) for 1967 onward. For

1950–1966, The *Education Statistics of the Republic of China* provides data for total enrollment in domestic universities inclusive of all ages only.

For 1950–1988, the *Education Statistics of the Republic of China* reports the number of students who entered foreign universities. We estimate the total enrollment of Taiwanese students in foreign universities by taking a summation of the number of students who entered foreign universities in the previous 6 years, that is,

$$(13-1) \quad TFA_t = \sum_{k=0}^5 TFE_{t-k} \quad (t = 1956, \dots, 1988)$$

where,

$TFA_t$  = Enrollment of Taiwanese students in foreign universities in year  $t$  and  
 $TFE_t$  = Enrollment of Taiwanese students who entered foreign universities in year  $t$ .

The average of the ratio between the estimated enrollment in foreign universities and the total enrollment in domestic universities for 1956–1988 is calculated to be 0.152. Using this ratio, we estimate the total enrollment of Taiwanese students in foreign students ( $TFA$ ) for 1950–1955 and 1989–2000 from the following equation:

$$(13-2) \quad TFA_t = 0.152TDA_t \quad (t = 1950, \dots, 55; 1989, \dots, 2000)$$

where,

$TDA_t$  = Enrollment of students in domestic universities (inclusive of all ages) in year  $t$ .

Assuming that the age structure of Taiwanese students in foreign universities is the same as that in domestic universities, we estimate the enrollment ratio of tertiary education as follows:<sup>3</sup>

$$(14-1) \quad TR_{w,t} = \frac{TDA_t TDN_{w,t} + TDN_{w,t} TFA_t}{TDA_t G_{w,t} + TDN_{w,t} TFA_t} \quad (t = 1967, \dots, 2000)$$

$$(14-2) \quad TR_{w,t} = \frac{(TDA_t + TFA_t)G_{1967}}{(TDA_{1967} + TFA_{1967})G_t} TR_{1967,t} \quad (t = 1950, \dots, 66)$$

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<sup>3</sup> In the denominators of equations (14-1) and (14-2), we add the enrollment of Taiwanese students in foreign universities to the number of persons in Taiwan.

where,

$TDN_{w,t}$  = Enrollment of students aged  $w$  years in domestic universities in year  $t$ .

### Vocational education

We consider three types of vocational education: 3 years in lower secondary vocational school, 3 years in upper secondary vocational school, and 5 years in upper secondary school. As discussed previously, we take all the enrollment in 5-year upper secondary school as vocational education. We separate the enrollment in 3-year lower secondary education and 3-year upper secondary education into that of general education and that of vocational education from the following equations:

$$(15-1) \quad RMV_{w,t} = \frac{1}{3} R_{w,t} \sum_{k=t-w+12}^{t-w+14} \left( \frac{VMN_k}{NMN_k + VMN_k} \right)$$

$$(16-1) \quad RHV_{w,t} = \frac{1}{3} RST_{w,t} \sum_{k=t-w+15}^{t-w+17} \left( \frac{VHN_k}{NHN_k + VHN_k} \right)$$

where,

$RMV_{w,t}$  = Ratio between enrollment of vocational education in 3-year secondary school and total population for persons aged  $w$  years in year  $t$

$VMV_t$  = Enrollment of vocational middle school (inclusive of all ages and grades) in year  $t$

$NMV_t$  = Enrollment of ordinal middle school (inclusive of all ages and grades) in year  $t$

$RHV_{w,t}$  = Ratio between enrollment of vocational education in 3-year upper secondary school and total population for persons aged  $w$  years in year  $t$

$VHV_t$  = Enrollment of vocational high school (inclusive of all ages and grades) in year  $t$  and

$NHV_t$  = Enrollment of ordinal high school (inclusive of all ages and grades) in year  $t$ .

Basically, equations (15-1) and (16-1) are applicable to  $w = 12, \dots, 14$  and  $w = 15, \dots, 17$ , respectively for  $t = 1950, \dots, 2000$ . However, because we do not have enrollment for

1948 and 1949, we cannot obtain  $RMV_{13,1950}$ ,  $RMV_{14,1950}$ ,  $RMV_{14,1951}$ ,  $RHV_{16,1950}$ ,  $RHV_{17,1950}$ , and  $RHV_{17,1951}$ . We estimate these six ratios as follows:

$$(15-2) \quad RMV_{w,t} = \frac{1}{2} R_{w,t} \sum_{k=1950}^{1951} \left( \frac{VMN_k}{NMN_k + VMN_k} \right)$$

$$(16-2) \quad RHV_{w,t} = \frac{1}{2} RST_{w,t} \sum_{k=1950}^{1951} \left( \frac{VHN_k}{NHN_k + VHN_k} \right)$$

Finally, we obtain the enrollment ratio of vocational education by summing up  $RSE$ ,  $RMV$ , and  $RHV$ .

### 3.2 1941–1949

For these years, we found no reliable data on population and enrollment. Thus, we took the log-linear interpolations on enrollment ratios between 1940 and 1950.

### 3.3 1897–1940

We obtained population and enrollment data (Taiwanese only) separately for these years.

#### Population

As mentioned below, we assume that the enrollment ratio for children under 6 years of age is zero. Thus, in order to apply equation (1), we need the population for each year of age from 6 years to 64 years of age.

There are three popular data sources for prewar Taiwan's total population by age:<sup>4</sup> (1) the *Taiwan no Seimei ni kansuru Chosa* (Survey on Life and Death in Taiwan), which provides the Government-General of Formosa's special estimates for 1920–1927, (2) the national censuses, which took place in 1905, 1915, 1930, 1935, and 1940, and (3)

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<sup>4</sup> Before 1920, people's ages are counted by the old Japanese system (of one year old at birth, with one year added at every New Year). To cope with this problem, we assumed "age  $n$  in the original data" as "age  $n-1$  in the current age-counting system" for the pre-1915 years.

the *Taiwan Sotokuhu Tokeisho* (Statistical Book of the Government-General of Formosa), which contains data for 1897–1904. However, many researchers recognize that a large number of *Gaoshanzu*, who are part of the indigenous tribes of Taiwan, are omitted from these surveys. To cope with this problem, we use the estimations by Liu, Saito, and Taniguchi (1999), which provide highly accurate and consistent data on total population (inclusive of all ages) for 1898–1942. More precisely, we first estimate total population by age for 1898–1905, 1915, 1920–27, 1930, 1935, and 1940 by multiplying Liu, Saito, and Taniguchi’s total population (inclusive of all ages) and age-composition percentages of the above-mentioned three data sources. Then, for 1906–1914, 1916–1919, 1928–1929, 1930–1934, and 1936–1939, we take the log-linear interpolations for every cohort.<sup>5</sup> For 1897, we took an extrapolation from 1898 assuming that the mortality rate of each cohort is same as that for 1898–1999.

### **Enrollment**

The *Taiwan Sotokuhu Tokeisho* (Statistical Book of the Government-General of Formosa) provides data on enrollment by major types of school. For most types of school, enrollment is cited by ethnicity (Taiwanese, Japanese, and others).

A problem with the *Taiwan Sotokuhu Tokeisho* is that it contains neither age-distribution nor grade-distribution of enrollment. However, we can solve this problem with the following two steps. By first basing an inference on the literature of prewar Japan’s education system, we assume a “model” pattern of the starting and ending ages for each course and for each year.<sup>6</sup> Second, we distribute the total enrollment of each course into the relevant age cohorts in proportion to the cohorts’ total populations (we have already obtained population by age above).

The following show the “model” patterns we assume for *Taiwan Sotokuhu Tokeisho*.

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<sup>5</sup> The *Taiwan Sotokuhu Tokeisho* cites the annual numbers of live birth for prewar Taiwan. However, just as in the case of population data, this data source fails to capture the demographic movements of the indigenous tribes of Taiwan. In order to cope with this problem, we used Liu, Saito, and Taniguchi’s (1999) estimate of live births in Taiwan for 1915. Using the ratio between Li, Saito, and Taniguchi’s estimate and the *Taiwan Sotokuhu Tokeisho*’s datum for 1915, we estimated the number of annual live births between 1905 and 1909 to take the interpolations for the 6–10 years old cohort in 1915.

<sup>6</sup> Among the various literatures on prewar Taiwan’s education system, we found that Lin (2004), Shou (1993), and Tsurumi (1977) are particularly informative in constructing our “model” patterns.

***Kogakko, Banjin Kogakko, Shiritsu Gakko, Shobo, Takasago-zoku Jido Kyoiku, and Kokugo Denshu-sho***

These provide basic education for ordinal Taiwanese. For 1897–1918, these enrollments are counted as students aged 7–10 years. For 1919–1921, these enrollments are counted as students aged 7–12 years. For 1922–1940, these enrollments are counted as students aged 6–11 years.

***Shogakko***<sup>7</sup>

*Shogakko* provides primary education for Japanese students aged 6–11 years in Taiwan. A limited number of privileged-class Taiwanese children were also allowed to study with the Japanese children there.

***Chugakko, Koko, and Teikoku Daigaku***

Male graduates from *Shogakko* could move to a 5-year *Chugakko* (middle school) and then to a 3-year *Koko* (high school). The *Teikoku Daigaku* (Imperial University of Taiwan) accepts graduates from *Koko* and provides three-year schooling.

***Koto Jogakko***

Female graduates from *Shogakko* could move to a *Koto Jogakko* (girls' high school), which was the highest level of education for girls.

***Kogyo Gakko, No-rin Gakko, and Shogyo Gakko***

These enrollments are counted as students aged 14–16 for the pre-1919 years, aged 13–15 years for 1919–1921, and aged 12–14 years for 1922 onward.

***No-rin Senmon Gakko, Shogyo Senmon Gakko, Koto Kogyo Gakko, and Koto Shogyo Gakko***

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<sup>7</sup> This includes the *Mo-a Gakko* (handicapped school).

These enrollments are counted as students aged 13–15 years for the pre-1921 years and aged 12–16 years for 1922 onward.

### ***Igakko***

This enrollment is counted as students aged 14–17 years for the pre-1919 years and aged 17–20 years for 1919 onward.

### ***Noji Shiken-jo***

This enrollment is counted as students aged 13 years for the pre-1919 years and aged 13–15 years for 1919 onward.

### **Vocational education**

*Kogyo Gakko*, *No-rin Gakko*, *Shogyo Gakko*, *No-rin Senmon Gakko*, *Shogyo Senmon Gakko*, *Koto Kogyo Gakko*, and *Koto Shogyo Gakko* are assumed as vocational education.

### **Taiwanese students in Japan**

Seeking better education opportunities for their children, some Taiwanese parents sent them to Japan. According to Abe and Abe (1971), the number of Taiwanese students in Japan was 20 in 1907, 300 in 1915, and 500 in 1918. For 1921–1926, Lin (2004) provides the number of Taiwanese students in Japan by types of school: elementary school, ordinary middle school, vocational middle school, ordinary high school, vocational high school, technical college, and university.

We estimate the number of Taiwanese students in Japan for 1927–1940 assuming that the ratio between the number of Taiwanese students in Japan and that in Taiwan is the same as the average for 1921–1926 cited in Lin (2004). The composition percentages among the types of school for 1907–1920 and 1927–1940 are assumed to be same as the averages of those for 1921–1926 as cited in Lin (2004). We assume that the age structure of Taiwanese students in Japan's elementary school is same as that in Taiwan. We assume that the age structure of Japan's ordinary middle school is same as that of middle school in Taiwan. We assume that the age structure of Taiwanese students in Japan's vocational middle school is same as that in *Kogyo Gakko*, *No-rin*

*Gakko*, and *Shogyo Gakko*. We assume that the age structure of Taiwanese students in Japan's ordinary high school is same as that in *Koko*. We assume that the age structure of Taiwanese students in Japan's vocational high school is same as that in *No-rin Senmon Gakko*, *Shogyo Senmon Gakko*, *Koto Kogyo Gakko*, and *Koto Shogyo Gakko*. We assume that the age structure of Taiwanese students in Japan's university is same as that in *Teikoku Daigaku*.

### 3.4 Prior to 1897

Since there is no reliable enrollment data for the pre-1897 years, extrapolation from the data of 1897 onward is the best way to estimate the enrollment ratios for these years. However, we found that our enrollment ratios for 1898 and 1899 (obtained above) were unusually high compared with those for 1897 and 1900. Although it is almost impossible to identify the sole and solid reason for this unusual movement, a significant reason is that the government's persuasion for going to *Kogakko* (established in 1898) was extremely high in these years. Thus, we decided to omit the enrollment ratios from extrapolations. Instead, we took log-linear extrapolations of the enrollment ratio by age from our estimates of 1897 and 1900 obtained above.

## 4. Estimation results

The summary of this paper's estimates is shown in Tables 1, 2, 3, and 4. As discussed in Section 2, we developed two ways of classification for levels of education. In Table 2, grades 1–8 and 9–12 are assumed as primary and secondary education, respectively. In Table 3, grades 1–6 and 7–12 are assumed as primary and secondary education, respectively.

[Tables 1, 2, 3 and 4]

Tables 1–4 are only a portion of our dataset. We can provide further details of the dataset upon request. Together with Godo's (2011) estimates on education stock in Japan, Korea, and the US, we hope that various researchers will consider our dataset as a "public good" for analyzing the macroeconomic role of education.



Table 1. Average years of schooling by age-group

year	Persons age 15-64			Persons in age 15-39			Persons in age 40-64		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1898	0.39	0.73	1.4E-06	0.44	0.83	2.0E-06	0.26	0.49	1.1E-16
1899	0.41	0.74	3.5E-06	0.46	0.85	5.4E-06	0.27	0.50	2.7E-16
1900	0.41	0.77	1.1E-05	0.47	0.88	1.7E-05	0.26	0.51	6.6E-16
1901	0.43	0.79	2.6E-05	0.49	0.90	4.0E-05	0.26	0.52	1.7E-15
1902	0.44	0.81	6.7E-05	0.50	0.92	0.00010	0.27	0.53	4.4E-15
1903	0.44	0.83	0.00021	0.51	0.94	0.00032	0.27	0.54	1.1E-14
1904	0.46	0.86	0.00059	0.53	0.96	0.00086	0.28	0.55	2.6E-14
1905	0.47	0.89	0.0013	0.54	0.99	0.0019	0.27	0.56	5.8E-14
1906	0.48	0.91	0.0026	0.56	1.01	0.0037	0.28	0.57	1.6E-13
1907	0.50	0.93	0.0045	0.57	1.03	0.0064	0.28	0.58	4.0E-13
1908	0.51	0.95	0.0067	0.58	1.06	0.010	0.28	0.58	1.0E-12
1909	0.52	0.97	0.0093	0.60	1.08	0.013	0.29	0.61	3.0E-12
1910	0.53	0.99	0.012	0.61	1.09	0.018	0.30	0.61	7.2E-12
1911	0.54	1.01	0.016	0.62	1.11	0.023	0.30	0.63	1.9E-11
1912	0.61	1.11	0.029	0.66	1.18	0.035	0.31	0.64	4.5E-11
1913	0.56	1.03	0.024	0.64	1.14	0.034	0.32	0.65	1.2E-10
1914	0.56	1.04	0.027	0.65	1.16	0.040	0.33	0.66	3.2E-10
1915	0.58	1.06	0.031	0.66	1.17	0.045	0.34	0.68	8.2E-10
1916	0.58	1.07	0.035	0.67	1.19	0.051	0.34	0.69	2.0E-09
1917	0.59	1.09	0.038	0.68	1.21	0.057	0.35	0.72	5.3E-09
1918	0.60	1.11	0.043	0.69	1.23	0.064	0.36	0.73	1.3E-08
1919	0.61	1.13	0.048	0.71	1.25	0.071	0.36	0.74	3.0E-08
1920	0.63	1.16	0.054	0.73	1.29	0.080	0.37	0.76	7.8E-08
1921	0.65	1.19	0.060	0.75	1.32	0.090	0.37	0.77	1.9E-07
1922	0.68	1.24	0.072	0.79	1.39	0.11	0.38	0.79	5.2E-07
1923	0.72	1.31	0.090	0.86	1.49	0.13	0.39	0.80	1.2E-06
1924	0.77	1.39	0.11	0.93	1.60	0.17	0.40	0.82	3.1E-06
1925	0.81	1.45	0.13	0.98	1.67	0.20	0.41	0.84	7.9E-06
1926	0.85	1.51	0.15	1.03	1.75	0.23	0.42	0.86	1.8E-05
1927	0.89	1.57	0.18	1.09	1.83	0.26	0.43	0.87	4.4E-05
1928	0.94	1.63	0.20	1.15	1.91	0.30	0.44	0.89	0.00012
1929	0.98	1.69	0.22	1.20	1.99	0.33	0.45	0.92	0.00036
1930	1.03	1.76	0.25	1.26	2.08	0.37	0.47	0.94	0.0010
1931	1.08	1.84	0.28	1.33	2.18	0.41	0.48	0.97	0.0021
1932	1.14	1.92	0.31	1.41	2.29	0.45	0.49	0.98	0.0040
1933	1.19	2.00	0.34	1.48	2.39	0.49	0.51	1.01	0.0070
1934	1.24	2.07	0.37	1.54	2.48	0.53	0.52	1.03	0.010
1935	1.30	2.15	0.40	1.61	2.58	0.57	0.53	1.05	0.014
1936	1.35	2.22	0.44	1.68	2.67	0.62	0.55	1.07	0.019
1937	1.40	2.30	0.47	1.75	2.77	0.67	0.55	1.08	0.024
1938	1.46	2.37	0.51	1.82	2.87	0.72	0.56	1.09	0.030
1939	1.52	2.45	0.56	1.90	2.97	0.78	0.57	1.10	0.037
1940	1.58	2.53	0.60	1.98	3.08	0.84	0.58	1.11	0.042
1941									
1942									
1943									
1944									
1945									
1946									
1947	2.09	3.08	1.09	2.75	4.07	1.54	0.74	1.28	0.092
1948	2.23	3.24	1.19	2.90	4.20	1.67	0.78	1.34	0.11
1949	2.38	3.41	1.31	3.05	4.31	1.79	0.84	1.45	0.14
1950	2.54	3.58	1.41	3.22	4.44	1.93	0.91	1.56	0.17

(continued)

Table 1. (concluded)

year	Persons age 15-64			Persons in age 15-39			Persons in age 40-64		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1951	2.65	3.69	1.52	3.34	4.53	2.06	0.97	1.64	0.20
1952	2.74	3.76	1.63	3.43	4.60	2.19	1.03	1.73	0.23
1953	2.84	3.85	1.75	3.53	4.66	2.33	1.09	1.81	0.26
1954	2.93	3.93	1.86	3.62	4.72	2.47	1.15	1.90	0.30
1955	3.02	4.00	1.98	3.73	4.80	2.61	1.22	1.99	0.34
1956	3.12	4.08	2.12	3.82	4.85	2.77	1.29	2.10	0.37
1957	3.24	4.19	2.23	3.95	4.95	2.92	1.37	2.21	0.41
1958	3.36	4.30	2.35	4.08	5.05	3.07	1.46	2.33	0.46
1959	3.47	4.40	2.45	4.21	5.16	3.21	1.54	2.43	0.50
1960	3.57	4.49	2.55	4.33	5.25	3.33	1.62	2.52	0.54
1961	3.66	4.57	2.63	4.45	5.34	3.46	1.69	2.61	0.58
1962	3.76	4.65	2.74	4.57	5.43	3.60	1.77	2.70	0.63
1963	3.87	4.74	2.85	4.69	5.53	3.75	1.87	2.82	0.68
1964	3.99	4.83	2.99	4.83	5.63	3.92	1.95	2.90	0.73
1965	4.12	4.95	3.14	4.99	5.77	4.11	2.04	2.99	0.79
1966	4.29	5.09	3.33	5.19	5.94	4.34	2.15	3.10	0.85
1967	4.46	5.26	3.53	5.41	6.16	4.59	2.22	3.21	0.92
1968	4.66	5.43	3.74	5.65	6.38	4.85	2.35	3.34	1.00
1969	4.86	5.62	3.97	5.90	6.62	5.13	2.47	3.47	1.09
1970	5.09	5.83	4.22	6.19	6.89	5.44	2.60	3.61	1.19
1971	5.33	6.06	4.48	6.48	7.16	5.76	2.74	3.76	1.31
1972	5.57	6.28	4.75	6.77	7.44	6.07	2.87	3.90	1.43
1973	5.80	6.49	5.00	7.07	7.72	6.38	2.98	4.02	1.55
1974	6.04	6.71	5.27	7.36	7.99	6.70	3.08	4.11	1.67
1975	6.27	6.92	5.52	7.64	8.25	7.00	3.19	4.22	1.80
1976	6.49	7.13	5.77	7.91	8.50	7.29	3.29	4.31	1.93
1977	6.71	7.34	6.01	8.16	8.73	7.56	3.39	4.40	2.06
1978	6.92	7.53	6.24	8.41	8.96	7.83	3.49	4.50	2.19
1979	7.13	7.72	6.47	8.65	9.17	8.11	3.58	4.58	2.32
1980	7.32	7.89	6.68	8.89	9.38	8.37	3.68	4.66	2.45
1981	7.51	8.06	6.90	9.11	9.58	8.62	3.79	4.75	2.59
1982	7.70	8.23	7.11	9.33	9.77	8.86	3.90	4.85	2.75
1983	7.88	8.40	7.32	9.53	9.96	9.09	4.02	4.95	2.90
1984	8.06	8.56	7.52	9.73	10.13	9.32	4.15	5.06	3.05
1985	8.24	8.73	7.71	9.92	10.29	9.53	4.29	5.20	3.22
1986	8.42	8.89	7.91	10.11	10.46	9.75	4.39	5.29	3.34
1987	8.60	9.05	8.11	10.32	10.63	9.99	4.47	5.36	3.45
1988	8.78	9.22	8.30	10.52	10.81	10.22	4.57	5.44	3.58
1989	8.95	9.38	8.49	10.73	10.99	10.46	4.69	5.55	3.73
1990	9.12	9.54	8.68	10.93	11.16	10.69	4.84	5.69	3.92
1991	9.30	9.70	8.88	11.13	11.32	10.93	5.00	5.82	4.10
1992	9.48	9.87	9.08	11.32	11.48	11.16	5.24	6.06	4.38
1993	9.66	10.03	9.28	11.50	11.62	11.37	5.50	6.30	4.65
1994	9.84	10.20	9.48	11.66	11.75	11.57	5.75	6.55	4.93
1995	10.02	10.35	9.67	11.81	11.86	11.76	6.02	6.80	5.22
1996	10.18	10.50	9.85	11.96	11.97	11.94	6.32	7.09	5.54
1997	10.35	10.65	10.04	12.10	12.08	12.11	6.65	7.41	5.89
1998	10.52	10.79	10.23	12.25	12.20	12.30	6.93	7.66	6.19
1999	10.68	10.94	10.42	12.41	12.33	12.49	7.22	7.93	6.50
2000	10.86	11.10	10.61	12.58	12.48	12.68	7.51	8.20	6.82

Table 2. Average years of schooling by education level (Series A)

year	Primary <sup>a</sup>			Secondary <sup>b</sup>			Tertiary <sup>c</sup>		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1898	0.39	0.73	1.4E-06	0	0	0	0	0	0
1899	0.41	0.74	3.5E-06	0	0	0	0	0	0
1900	0.41	0.77	1.1E-05	0	0	0	0	0	0
1901	0.43	0.79	2.6E-05	0	0	0	0	0	0
1902	0.44	0.81	6.7E-05	0	0	0	0	0	0
1903	0.44	0.83	0.00021	4.6E-05	8.6E-05	0	0	0	0
1904	0.46	0.86	0.00059	1.1E-04	2.1E-04	0	0	0	0
1905	0.47	0.89	0.0013	1.8E-04	3.4E-04	0	0	0	0
1906	0.48	0.91	0.0026	2.5E-04	4.8E-04	0	0	0	0
1907	0.50	0.93	0.0045	3.3E-04	6.3E-04	0	0	0	0
1908	0.51	0.95	0.0067	4.4E-04	8.3E-04	0	0	0	0
1909	0.52	0.97	0.0093	5.4E-04	1.0E-03	0	0	0	0
1910	0.53	0.99	0.012	6.5E-04	1.2E-03	0	0	0	0
1911	0.54	1.01	0.016	7.8E-04	1.5E-03	0	0	0	0
1912	0.61	1.10	0.029	1.3E-03	2.4E-03	0	0	0	0
1913	0.56	1.03	0.024	1.0E-03	2.0E-03	0	0	0	0
1914	0.56	1.04	0.027	1.2E-03	2.3E-03	0	0	0	0
1915	0.57	1.06	0.031	1.4E-03	2.6E-03	0	0	0	0
1916	0.58	1.07	0.035	1.6E-03	3.0E-03	0	0	0	0
1917	0.59	1.09	0.038	1.7E-03	3.3E-03	0	0	0	0
1918	0.60	1.10	0.042	2.5E-03	4.5E-03	4.1E-04	0	0	0
1919	0.61	1.12	0.047	3.2E-03	5.8E-03	4.1E-04	0	0	0
1920	0.62	1.15	0.053	4.3E-03	7.9E-03	4.0E-04	2.2E-04	4.3E-04	0
1921	0.64	1.18	0.060	5.4E-03	1.0E-02	3.9E-04	3.7E-04	7.1E-04	0
1922	0.67	1.23	0.071	6.2E-03	1.2E-02	3.8E-04	4.6E-04	8.9E-04	0
1923	0.72	1.30	0.089	6.8E-03	1.2E-02	5.9E-04	5.4E-04	1.0E-03	0
1924	0.77	1.37	0.11	7.4E-03	1.4E-02	8.4E-04	6.1E-04	1.2E-03	0
1925	0.80	1.43	0.13	8.1E-03	1.5E-02	1.1E-03	6.7E-04	1.3E-03	0
1926	0.84	1.49	0.15	8.9E-03	1.6E-02	1.4E-03	7.2E-04	1.4E-03	0
1927	0.88	1.55	0.17	9.6E-03	1.7E-02	1.8E-03	7.8E-04	1.5E-03	0
1928	0.93	1.61	0.20	1.0E-02	1.8E-02	2.1E-03	8.3E-04	1.6E-03	0
1929	0.97	1.67	0.22	1.1E-02	1.9E-02	2.4E-03	9.0E-04	1.7E-03	0
1930	1.02	1.74	0.25	1.2E-02	2.0E-02	2.8E-03	1.0E-03	1.9E-03	0
1931	1.07	1.82	0.27	1.2E-02	2.1E-02	3.1E-03	1.1E-03	2.1E-03	0
1932	1.12	1.90	0.31	1.3E-02	2.2E-02	3.4E-03	1.1E-03	2.2E-03	0
1933	1.18	1.98	0.34	1.4E-02	2.3E-02	3.7E-03	1.2E-03	2.3E-03	0
1934	1.23	2.05	0.36	1.4E-02	2.4E-02	4.0E-03	1.3E-03	2.5E-03	0
1935	1.28	2.12	0.40	1.5E-02	2.5E-02	4.2E-03	1.3E-03	2.6E-03	0
1936	1.33	2.19	0.43	1.5E-02	2.6E-02	4.5E-03	1.4E-03	2.7E-03	0
1937	1.39	2.27	0.47	1.6E-02	2.7E-02	4.8E-03	1.4E-03	2.8E-03	0
1938	1.44	2.34	0.51	1.7E-02	2.8E-02	5.1E-03	1.5E-03	2.9E-03	0
1939	1.50	2.41	0.55	1.8E-02	2.9E-02	5.5E-03	1.5E-03	3.0E-03	0
1940	1.56	2.49	0.60	1.9E-02	3.1E-02	6.0E-03	1.5E-03	3.0E-03	0
1941									
1942									
1943									
1944									
1945									
1946									
1947	2.03	3.00	1.06	0.043	0.065	0.021	0.011	0.017	0.0049
1948	2.16	3.15	1.16	0.050	0.075	0.024	0.014	0.021	0.0063
1949	2.31	3.30	1.27	0.057	0.085	0.028	0.017	0.025	0.0078
1950	2.46	3.45	1.37	0.066	0.098	0.032	0.020	0.030	0.0091

(continued)

Note a. Schooling of 1st to 8th grades.  
b. Schooling of 9th to 12th grades.  
c. Schooling of beyond 12th grade.

Table 2. (concluded)

year	Primary <sup>a</sup>			Secondary <sup>b</sup>			Tertiary <sup>c</sup>		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1951	2.56	3.55	1.48	0.074	0.11	0.036	0.023	0.034	0.011
1952	2.63	3.61	1.58	0.080	0.12	0.041	0.026	0.039	0.013
1953	2.72	3.68	1.69	0.088	0.13	0.046	0.031	0.045	0.016
1954	2.80	3.73	1.79	0.10	0.14	0.053	0.036	0.051	0.018
1955	2.87	3.79	1.90	0.11	0.16	0.061	0.041	0.060	0.021
1956	2.95	3.84	2.02	0.12	0.17	0.071	0.047	0.067	0.025
1957	3.05	3.92	2.12	0.14	0.20	0.081	0.055	0.078	0.029
1958	3.14	3.98	2.22	0.16	0.22	0.093	0.066	0.096	0.033
1959	3.22	4.05	2.31	0.18	0.25	0.11	0.077	0.11	0.038
1960	3.29	4.10	2.38	0.20	0.27	0.12	0.086	0.12	0.043
1961	3.35	4.15	2.45	0.21	0.29	0.13	0.094	0.14	0.048
1962	3.42	4.20	2.54	0.23	0.31	0.15	0.10	0.15	0.053
1963	3.50	4.25	2.63	0.25	0.33	0.17	0.11	0.16	0.058
1964	3.59	4.32	2.74	0.28	0.35	0.19	0.12	0.17	0.063
1965	3.69	4.39	2.86	0.30	0.38	0.21	0.13	0.18	0.070
1966	3.82	4.49	3.01	0.33	0.41	0.24	0.14	0.19	0.077
1967	3.93	4.59	3.16	0.37	0.46	0.27	0.16	0.21	0.092
1968	4.06	4.70	3.32	0.41	0.50	0.31	0.18	0.24	0.11
1969	4.19	4.81	3.48	0.46	0.55	0.36	0.21	0.27	0.13
1970	4.34	4.93	3.65	0.51	0.60	0.41	0.24	0.30	0.16
1971	4.49	5.06	3.83	0.57	0.66	0.47	0.27	0.34	0.19
1972	4.63	5.17	4.00	0.64	0.73	0.53	0.30	0.37	0.22
1973	4.77	5.29	4.17	0.70	0.79	0.59	0.33	0.41	0.24
1974	4.91	5.41	4.34	0.76	0.86	0.66	0.37	0.45	0.28
1975	5.04	5.52	4.50	0.83	0.92	0.72	0.40	0.48	0.31
1976	5.17	5.63	4.65	0.89	0.98	0.78	0.43	0.52	0.34
1977	5.30	5.74	4.80	0.95	1.04	0.84	0.46	0.55	0.36
1978	5.42	5.85	4.94	1.00	1.10	0.90	0.49	0.59	0.39
1979	5.54	5.94	5.08	1.06	1.15	0.96	0.53	0.62	0.42
1980	5.64	6.03	5.20	1.12	1.20	1.02	0.56	0.65	0.46
1981	5.74	6.12	5.33	1.17	1.26	1.08	0.59	0.69	0.49
1982	5.84	6.20	5.44	1.23	1.31	1.14	0.63	0.72	0.53
1983	5.93	6.28	5.55	1.29	1.37	1.20	0.67	0.76	0.56
1984	6.02	6.35	5.66	1.34	1.42	1.26	0.70	0.79	0.60
1985	6.11	6.43	5.76	1.40	1.47	1.32	0.74	0.83	0.64
1986	6.19	6.50	5.86	1.45	1.53	1.38	0.78	0.87	0.68
1987	6.27	6.57	5.95	1.51	1.58	1.44	0.81	0.91	0.72
1988	6.35	6.64	6.05	1.57	1.63	1.50	0.86	0.95	0.76
1989	6.43	6.70	6.14	1.62	1.69	1.56	0.90	0.99	0.80
1990	6.50	6.77	6.22	1.68	1.74	1.61	0.94	1.03	0.85
1991	6.58	6.83	6.31	1.74	1.79	1.67	0.98	1.07	0.89
1992	6.66	6.90	6.40	1.80	1.85	1.74	1.03	1.11	0.94
1993	6.73	6.96	6.49	1.86	1.91	1.80	1.08	1.16	0.99
1994	6.80	7.02	6.57	1.92	1.97	1.87	1.12	1.20	1.04
1995	6.86	7.07	6.65	1.98	2.03	1.93	1.17	1.25	1.09
1996	6.93	7.12	6.72	2.04	2.09	1.99	1.22	1.29	1.14
1997	6.98	7.17	6.79	2.10	2.14	2.06	1.27	1.34	1.20
1998	7.03	7.21	6.85	2.16	2.20	2.12	1.32	1.39	1.26
1999	7.08	7.25	6.92	2.21	2.25	2.17	1.39	1.44	1.33
2000	7.13	7.29	6.97	2.27	2.30	2.23	1.46	1.51	1.41

Table 3. Average years of schooling by education level (Series B)

year	Primary <sup>a</sup>			Secondary <sup>b</sup>			Tertiary <sup>c</sup>		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1898	0.39	0.73	1.4E-06	0	0	0	0	0	0
1899	0.41	0.74	3.5E-06	0	0	0	0	0	0
1900	0.41	0.77	1.1E-05	0	0	0	0	0	0
1901	0.43	0.79	2.6E-05	0	0	0	0	0	0
1902	0.44	0.81	6.7E-05	0	0	0	0	0	0
1903	0.44	0.83	0.00021	4.6E-05	8.6E-05	0	0	0	0
1904	0.46	0.86	0.00059	1.1E-04	2.1E-04	0	0	0	0
1905	0.47	0.89	0.0013	1.8E-04	3.4E-04	0	0	0	0
1906	0.48	0.91	0.0026	2.5E-04	4.8E-04	0	0	0	0
1907	0.50	0.93	0.0045	3.3E-04	6.3E-04	0	0	0	0
1908	0.51	0.95	0.0067	4.4E-04	8.3E-04	0	0	0	0
1909	0.52	0.97	0.0093	5.4E-04	1.0E-03	0	0	0	0
1910	0.53	0.99	0.012	6.5E-04	1.2E-03	0	0	0	0
1911	0.54	1.01	0.016	7.8E-04	1.5E-03	0	0	0	0
1912	0.61	1.10	0.029	1.3E-03	2.4E-03	0	0	0	0
1913	0.56	1.03	0.024	1.0E-03	2.0E-03	0	0	0	0
1914	0.56	1.04	0.027	1.2E-03	2.3E-03	0	0	0	0
1915	0.57	1.06	0.031	1.4E-03	2.6E-03	0	0	0	0
1916	0.58	1.07	0.035	1.6E-03	3.0E-03	0	0	0	0
1917	0.59	1.09	0.038	1.7E-03	3.3E-03	0	0	0	0
1918	0.60	1.10	0.042	2.5E-03	4.5E-03	4.1E-04	0	0	0
1919	0.61	1.12	0.047	3.2E-03	5.8E-03	4.1E-04	0	0	0
1920	0.62	1.15	0.053	4.3E-03	7.9E-03	4.0E-04	2.2E-04	4.3E-04	0
1921	0.64	1.18	0.060	5.9E-03	1.1E-02	3.9E-04	3.7E-04	7.1E-04	0
1922	0.66	1.21	0.068	1.8E-02	3.0E-02	4.1E-03	4.6E-04	8.9E-04	0
1923	0.69	1.26	0.081	3.0E-02	5.0E-02	8.6E-03	5.4E-04	1.0E-03	0
1924	0.73	1.32	0.10	4.4E-02	7.3E-02	1.4E-02	6.1E-04	1.2E-03	0
1925	0.77	1.37	0.12	4.5E-02	7.4E-02	1.5E-02	6.7E-04	1.3E-03	0
1926	0.81	1.43	0.14	4.6E-02	7.5E-02	1.5E-02	7.2E-04	1.4E-03	0
1927	0.85	1.49	0.16	4.7E-02	7.7E-02	1.6E-02	7.8E-04	1.5E-03	0
1928	0.89	1.55	0.18	4.8E-02	7.8E-02	1.6E-02	8.3E-04	1.6E-03	0
1929	0.93	1.61	0.21	4.9E-02	7.9E-02	1.7E-02	9.0E-04	1.7E-03	0
1930	0.98	1.68	0.23	5.0E-02	8.1E-02	1.8E-02	1.0E-03	1.9E-03	0
1931	1.03	1.75	0.26	5.2E-02	8.3E-02	1.8E-02	1.1E-03	2.1E-03	0
1932	1.08	1.84	0.29	5.3E-02	8.5E-02	1.9E-02	1.1E-03	2.2E-03	0
1933	1.14	1.91	0.32	5.4E-02	8.7E-02	2.0E-02	1.2E-03	2.3E-03	0
1934	1.19	1.98	0.35	5.6E-02	9.0E-02	2.0E-02	1.3E-03	2.5E-03	0
1935	1.24	2.05	0.38	5.7E-02	9.2E-02	2.1E-02	1.3E-03	2.6E-03	0
1936	1.29	2.12	0.42	5.9E-02	9.4E-02	2.2E-02	1.4E-03	2.7E-03	0
1937	1.34	2.20	0.45	6.0E-02	9.5E-02	2.2E-02	1.4E-03	2.8E-03	0
1938	1.40	2.27	0.49	6.1E-02	9.7E-02	2.3E-02	1.5E-03	2.9E-03	0
1939	1.45	2.34	0.53	6.3E-02	1.0E-01	2.4E-02	1.5E-03	3.0E-03	0
1940	1.51	2.42	0.58	6.5E-02	1.0E-01	2.5E-02	1.5E-03	3.0E-03	0
1941									
1942									
1943									
1944									
1945									
1946									
1947	1.97	2.90	1.03	0.112	0.166	0.058	0.011	0.017	0.0049
1948	2.09	3.03	1.12	0.126	0.185	0.066	0.014	0.021	0.0063
1949	2.22	3.17	1.22	0.143	0.207	0.075	0.017	0.025	0.0078
1950	2.36	3.32	1.32	0.162	0.234	0.085	0.020	0.030	0.0091

(continued)

Note a. Schooling of 1st to 6th grades.  
b. Schooling of 7th to 12th grades.  
c. Schooling of beyond 12th grade.

Table 3. (concluded)

year	Primary <sup>a</sup>			Secondary <sup>b</sup>			Tertiary <sup>c</sup>		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1951	2.45	3.40	1.42	0.18	0.25	0.09	0.023	0.034	0.011
1952	2.52	3.45	1.51	0.19	0.27	0.11	0.026	0.039	0.013
1953	2.61	3.52	1.62	0.21	0.29	0.12	0.031	0.045	0.016
1954	2.67	3.56	1.71	0.22	0.31	0.13	0.036	0.051	0.018
1955	2.74	3.61	1.81	0.24	0.33	0.15	0.041	0.060	0.021
1956	2.81	3.66	1.93	0.27	0.36	0.17	0.047	0.067	0.025
1957	2.89	3.71	2.02	0.30	0.40	0.19	0.055	0.078	0.029
1958	2.97	3.76	2.10	0.33	0.44	0.21	0.066	0.096	0.033
1959	3.03	3.81	2.18	0.36	0.48	0.23	0.077	0.11	0.038
1960	3.09	3.84	2.25	0.40	0.52	0.26	0.086	0.12	0.043
1961	3.14	3.87	2.31	0.43	0.56	0.28	0.094	0.14	0.048
1962	3.19	3.91	2.38	0.46	0.60	0.31	0.10	0.15	0.053
1963	3.26	3.94	2.46	0.50	0.64	0.34	0.11	0.16	0.058
1964	3.33	3.99	2.55	0.54	0.68	0.38	0.12	0.17	0.063
1965	3.41	4.04	2.65	0.59	0.73	0.42	0.13	0.18	0.070
1966	3.50	4.11	2.78	0.65	0.79	0.48	0.14	0.19	0.077
1967	3.58	4.17	2.90	0.72	0.88	0.53	0.16	0.21	0.092
1968	3.69	4.25	3.03	0.79	0.95	0.60	0.18	0.24	0.11
1969	3.78	4.32	3.16	0.87	1.03	0.67	0.21	0.27	0.13
1970	3.89	4.40	3.30	0.96	1.13	0.76	0.24	0.30	0.16
1971	4.00	4.48	3.43	1.07	1.24	0.86	0.27	0.34	0.19
1972	4.09	4.55	3.56	1.17	1.35	0.97	0.30	0.37	0.22
1973	4.19	4.62	3.69	1.28	1.46	1.07	0.33	0.41	0.24
1974	4.28	4.69	3.81	1.39	1.57	1.18	0.37	0.45	0.28
1975	4.37	4.76	3.93	1.49	1.68	1.29	0.40	0.48	0.31
1976	4.46	4.83	4.04	1.60	1.78	1.39	0.43	0.52	0.34
1977	4.54	4.89	4.15	1.71	1.89	1.50	0.46	0.55	0.36
1978	4.62	4.95	4.25	1.81	1.99	1.60	0.49	0.59	0.39
1979	4.69	5.00	4.34	1.91	2.09	1.71	0.53	0.62	0.42
1980	4.75	5.05	4.42	2.00	2.18	1.80	0.56	0.65	0.46
1981	4.82	5.10	4.50	2.10	2.28	1.91	0.59	0.69	0.49
1982	4.87	5.14	4.58	2.20	2.37	2.00	0.63	0.72	0.53
1983	4.93	5.18	4.65	2.29	2.46	2.10	0.67	0.76	0.56
1984	4.98	5.22	4.72	2.38	2.55	2.20	0.70	0.79	0.60
1985	5.03	5.26	4.78	2.47	2.64	2.29	0.74	0.83	0.64
1986	5.08	5.30	4.85	2.57	2.73	2.39	0.78	0.87	0.68
1987	5.13	5.33	4.91	2.65	2.81	2.48	0.81	0.91	0.72
1988	5.18	5.37	4.97	2.74	2.90	2.58	0.86	0.95	0.76
1989	5.22	5.40	5.02	2.83	2.99	2.67	0.90	0.99	0.80
1990	5.26	5.44	5.08	2.92	3.07	2.76	0.94	1.03	0.85
1991	5.31	5.47	5.14	3.01	3.16	2.85	0.98	1.07	0.89
1992	5.35	5.50	5.19	3.11	3.25	2.95	1.03	1.11	0.94
1993	5.39	5.53	5.24	3.20	3.35	3.05	1.08	1.16	0.99
1994	5.43	5.55	5.29	3.29	3.44	3.14	1.12	1.20	1.04
1995	5.46	5.58	5.34	3.39	3.53	3.24	1.17	1.25	1.09
1996	5.49	5.60	5.38	3.48	3.61	3.33	1.22	1.29	1.14
1997	5.52	5.62	5.42	3.56	3.70	3.42	1.27	1.34	1.20
1998	5.55	5.63	5.46	3.64	3.77	3.51	1.32	1.39	1.26
1999	5.58	5.65	5.50	3.72	3.85	3.59	1.39	1.44	1.33
2000	5.60	5.67	5.53	3.80	3.92	3.67	1.46	1.51	1.41

Table 4. Average years of schooling of vocational education by age-group

year	Persons age 15-64			Persons in age 15-39			Persons in age 40-64		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1898	0	0	0	0	0	0	0	0	0
1899	0	0	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0	0	0
1901	0	0	0	0	0	0	0	0	0
1902	0	0	0	0	0	0	0	0	0
1903	0	0	0	0	0	0	0	0	0
1904	0	0	0	0	0	0	0	0	0
1905	0	0	0	0	0	0	0	0	0
1906	0	0	0	0	0	0	0	0	0
1907	9.3E-05	0.00023	0	0.00013	0.00023	0	0	0	0
1908	0.00017	0.00043	0	0.00024	0.00043	0	0	0	0
1909	0.00026	0.00065	0	0.00036	0.00065	0	0	0	0
1910	0.00034	0.00087	0	0.00048	0.00087	0	0	0	0
1911	0.00043	0.0011	0	0.00060	0.0011	0	0	0	0
1912	0.00077	0.0017	0	0.00092	0.0017	0	0	0	0
1913	0.00066	0.0017	0	0.00092	0.0017	0	0	0	0
1914	0.00083	0.0021	0	0.0012	0.0021	0	0	0	0
1915	0.0010	0.0027	0	0.0014	0.0027	0	0	0	0
1916	0.0012	0.0032	0	0.0018	0.0032	0	0	0	0
1917	0.0015	0.0039	0	0.0021	0.0039	0	0	0	0
1918	0.0019	0.0049	0	0.0027	0.0049	0	0	0	0
1919	0.0023	0.0060	0	0.0032	0.0060	0	0	0	0
1920	0.0029	0.0078	0	0.0042	0.0078	0	0	0	0
1921	0.0039	0.010	9.9E-07	0.0056	0.010	9.9E-07	0	0	0
1922	0.0044	0.012	2.0E-06	0.0064	0.012	2.0E-06	0	0	0
1923	0.0048	0.013	2.9E-06	0.0070	0.013	2.9E-06	0	0	0
1924	0.0051	0.014	2.8E-06	0.0075	0.014	2.8E-06	0	0	0
1925	0.0056	0.015	2.8E-06	0.0081	0.015	2.8E-06	0	0	0
1926	0.0060	0.017	2.7E-06	0.0088	0.017	2.7E-06	0	0	0
1927	0.0066	0.018	2.6E-06	0.010	0.018	2.6E-06	0	0	0
1928	0.0072	0.020	2.5E-06	0.010	0.020	2.5E-06	0	0	0
1929	0.0079	0.022	2.4E-06	0.011	0.022	2.4E-06	0	0	0
1930	0.0087	0.024	2.3E-06	0.013	0.024	2.3E-06	0	0	0
1931	0.010	0.026	2.3E-06	0.014	0.026	2.3E-06	5.0E-05	0.00010	0
1932	0.011	0.029	2.4E-05	0.015	0.029	2.4E-05	0.00014	0.00028	0
1933	0.012	0.032	7.5E-05	0.017	0.032	7.5E-05	0.00028	0.00057	0
1934	0.013	0.035	0.00014	0.018	0.035	0.00014	0.00041	0.00082	0
1935	0.014	0.038	0.00022	0.020	0.038	0.00022	0.00053	0.0011	0
1936	0.015	0.041	0.00028	0.021	0.041	0.00028	0.00067	0.0013	0
1937	0.016	0.043	0.00040	0.022	0.043	0.00040	0.00082	0.0016	0
1938	0.017	0.046	0.00057	0.024	0.046	0.00057	0.0010	0.0020	0
1939	0.018	0.049	0.00079	0.025	0.049	0.00079	0.0013	0.0025	0
1940	0.020	0.053	0.0012	0.028	0.053	0.0012	0.0016	0.0031	0
1941									
1942									
1943									
1944									
1945									
1946									
1947	0.041	0.11	0.014	0.058	0.11	0.014	0.006	0.011	9.7E-07
1948	0.046	0.12	0.016	0.065	0.12	0.016	0.007	0.013	1.9E-06
1949	0.051	0.12	0.018	0.071	0.12	0.018	0.007	0.014	2.9E-06
1950	0.058	0.13	0.020	0.079	0.13	0.020	0.008	0.015	2.9E-06

(continued)

Table 4. (concluded)

year	Persons age 15-64			Persons in age 15-39			Persons in age 40-64		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1951	0.062	0.10	0.016	0.085	0.144	0.023	0.0086	0.016	2.90E-06
1952	0.066	0.11	0.018	0.090	0.151	0.025	0.0093	0.017	2.84E-06
1953	0.071	0.12	0.021	0.10	0.160	0.029	0.010	0.019	2.77E-06
1954	0.077	0.13	0.023	0.10	0.171	0.033	0.011	0.021	2.56E-06
1955	0.084	0.14	0.027	0.11	0.185	0.038	0.012	0.023	2.47E-06
1956	0.091	0.15	0.032	0.12	0.199	0.045	0.014	0.026	2.34E-06
1957	0.10	0.16	0.037	0.14	0.218	0.052	0.015	0.028	2.24E-06
1958	0.11	0.17	0.043	0.15	0.235	0.059	0.017	0.031	2.59E-05
1959	0.12	0.19	0.049	0.16	0.251	0.068	0.019	0.034	8.20E-05
1960	0.13	0.20	0.055	0.18	0.267	0.077	0.020	0.037	0.00016
1961	0.14	0.21	0.060	0.19	0.281	0.086	0.022	0.040	0.00023
1962	0.15	0.22	0.067	0.20	0.293	0.096	0.024	0.043	0.00030
1963	0.15	0.22	0.075	0.21	0.30	0.11	0.026	0.046	0.00044
1964	0.16	0.23	0.085	0.22	0.32	0.12	0.027	0.048	0.00061
1965	0.17	0.24	0.097	0.24	0.33	0.14	0.030	0.052	0.00088
1966	0.19	0.25	0.11	0.26	0.34	0.16	0.034	0.057	0.0014
1967	0.20	0.27	0.13	0.28	0.37	0.19	0.037	0.064	0.002
1968	0.22	0.28	0.15	0.31	0.39	0.22	0.044	0.072	0.004
1969	0.25	0.31	0.18	0.34	0.42	0.25	0.049	0.081	0.006
1970	0.27	0.33	0.21	0.38	0.46	0.29	0.056	0.089	0.008
1971	0.30	0.35	0.23	0.41	0.49	0.33	0.062	0.098	0.010
1972	0.32	0.38	0.26	0.45	0.53	0.37	0.067	0.11	0.013
1973	0.35	0.40	0.29	0.48	0.56	0.40	0.072	0.11	0.015
1974	0.38	0.43	0.32	0.52	0.59	0.44	0.077	0.12	0.017
1975	0.40	0.45	0.34	0.55	0.62	0.48	0.082	0.13	0.019
1976	0.43	0.48	0.37	0.59	0.65	0.52	0.087	0.14	0.022
1977	0.46	0.50	0.40	0.62	0.68	0.56	0.092	0.14	0.024
1978	0.48	0.53	0.43	0.66	0.71	0.60	0.098	0.15	0.027
1979	0.51	0.55	0.46	0.69	0.74	0.64	0.10	0.16	0.031
1980	0.54	0.58	0.50	0.73	0.78	0.69	0.11	0.17	0.035
1981	0.57	0.61	0.53	0.77	0.81	0.73	0.12	0.19	0.041
1982	0.60	0.64	0.57	0.81	0.84	0.78	0.13	0.20	0.048
1983	0.63	0.67	0.60	0.85	0.88	0.83	0.14	0.22	0.055
1984	0.67	0.70	0.63	0.89	0.91	0.87	0.16	0.24	0.064
1985	0.70	0.72	0.67	0.93	0.94	0.92	0.17	0.25	0.073
1986	0.73	0.76	0.71	0.97	0.98	0.97	0.18	0.27	0.082
1987	0.76	0.79	0.74	1.01	1.01	1.02	0.19	0.28	0.091
1988	0.80	0.82	0.78	1.06	1.05	1.07	0.20	0.29	0.10
1989	0.83	0.85	0.82	1.11	1.09	1.12	0.22	0.31	0.12
1990	0.87	0.88	0.85	1.15	1.13	1.18	0.23	0.32	0.13
1991	0.90	0.91	0.89	1.20	1.16	1.23	0.25	0.34	0.15
1992	0.94	0.94	0.93	1.24	1.21	1.29	0.28	0.37	0.18
1993	0.97	0.97	0.97	1.29	1.24	1.34	0.31	0.40	0.21
1994	1.01	1.01	1.01	1.33	1.28	1.39	0.34	0.43	0.25
1995	1.05	1.04	1.05	1.38	1.32	1.44	0.38	0.47	0.29
1996	1.08	1.07	1.09	1.42	1.35	1.49	0.42	0.51	0.33
1997	1.11	1.10	1.13	1.46	1.39	1.53	0.46	0.54	0.37
1998	1.15	1.13	1.16	1.50	1.42	1.58	0.50	0.58	0.41
1999	1.17	1.16	1.19	1.54	1.46	1.62	0.53	0.61	0.45
2000	1.20	1.18	1.22	1.57	1.49	1.66	0.57	0.64	0.49



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## Appendix. Data Sources and Estimation Methodology for Conventional Inputs

### Physical capital

Physical capital in this paper is defined as gross non-residential fixed capital at the beginning of the year. When physical capital is measured at the end of year in the original data sources, we assume it as the physical capital at the beginning of the next year.

Timmer and van Ark (2000) provide gross physical capital stock for 1951–1996 at yearend and physical capital formation for 1937–1996. On the website of the Republic of China, the Executive Yuan provides gross physical capital formation for 1960, 1965, 1970, 1975, 1985, and 1990–2000 in million Taiwan dollars (1991 prices). We extrapolate Timmer and van Ark's physical capital formation until 1999 by the following OLS regression:

$$(A-1) \quad \ln I_a = -0.479 + 1.02 \ln I_b \quad R^2 = 0.993$$

$$\quad \quad \quad (-1.85) \quad (73.5)$$

where,

$I_a$  = Physical capital formation data from Timmer and van Ark (2004); and

$I_b$  = Physical capital formation data from the website of the Republic of China, the Executive Yuan.

Based on Timmer and van Ark (2000), we can calculate the depreciation rate of physical capital in year  $t$  ( $\delta_t$ ) from the following equation:

$$(A-2) \quad \delta_t = (K_{t-1} + I_t - K_t) / K_{t-1}$$

where,

$K_t$  = Physical capital stock at the end of year  $t$  and

$I_t$  = Physical capital formation in year  $t$ .

In this way, we obtain the average value of  $\delta_t$  for 1952–1996 as 0.0239. Using this value and the physical capital formation data obtained from (A-1), we estimate physical capital for the yearends of 1997–1999.

For the prewar period, Umemura and Mizoguchi (1988) provide their estimates on physical capital in 1934–1936 yen. According to the dataset of the Research Center for Information, Hitotsubashi University, the 1960-benchmark deflator for capital

formation for 1935 is 0.06408 and the nominal GDP in 1960 is 62,507 million Taiwan dollars. According to Madison (2003), the real GDP (at 1990 prices) in 1960 is 16,725 million US dollars. Thus, by multiplying 4.176 ( $= \frac{16725}{62507 \times 0.06408}$ ), Umemura and Mizoguchi's (1988) physical capital data in 1934–36 yen can be converted into those in 1990 US dollars.

## Labor

Abe and Abe (1971) provide employment by occupation for the following sectors—agriculture, mining, manufacturing, transportation, commerce, public service, and others—for 1905, 1908, 1920, and 1930. Mizoguchi and Umemura (1988) provide the number of farm households for 1898 onward, that of miners for 1898–1936, that of factory laborers (blue-collar only) for 1910–1938, and that of public servants for 1897–1938. For 1912–1919 and 1921–1929, we interpolate Abe and Abe's (1971) discrete data using Mizoguchi and Umemura's (1988) annual data based on the following equations:

$$(A-3-1) \quad LA_t = FH_t \left( \frac{ALA_{930} \cdot \frac{1940-t}{10} - ALA_{940} \cdot \frac{t-1930}{10}}{FH_{930}} \right) \quad (t=1930\dots1933)$$

$$(A-3-2) \quad LA_t = FH_t \left( \frac{ALA_{920} \cdot \frac{1930-t}{10} - ALA_{930} \cdot \frac{t-1920}{10}}{FH_{920}} \right) \quad (t=1920\dots1930)$$

$$(A-3-3) \quad LA_t = FH_t \left( \frac{ALA_{908} \cdot \frac{1920-t}{12} - ALA_{920} \cdot \frac{t-1908}{12}}{FH_{908}} \right) \quad (t=1912\dots1920)$$

$$(A-4-1-1) \quad LM_t = MQ \left( \frac{ALM_{930} \cdot \frac{1940-t}{10} - ALM'_{1934} \cdot \frac{t-1930}{10}}{MQ_{930}} \right) \quad (t=1930\dots1933)$$

$$(A-4-1-2) \quad ALM'_{1934} \equiv ALM_{1930}^{0.6} \cdot ALM_{1940}^{0.4}$$

$$(A-4-1-3) \quad MO'_{1934} \equiv \sqrt[5]{MO_{1936} \cdot MO_{1935} \cdot MO_{1934} \cdot MO_{1933} \cdot MO_{1932}}$$

$$(A-4-2) \quad LM_t = MQ \left( \frac{ALM_{920} \cdot \frac{1930-t}{10} - ALM_{930} \cdot \frac{t-1920}{10}}{MQ_{920}} \right) \quad (t=1920\dots1930)$$

$$(A-4-3) \quad LM_t = MQ \left( \frac{ALM_{908} \cdot \frac{1920-t}{12} - ALM_{920} \cdot \frac{t-1908}{12}}{MQ_{908}} \right) \quad (t=1912...1920)$$

$$(A-5-1-1) \quad LI_t = IO_t \left( \frac{ALI_{930} \cdot \frac{1940-t}{10} - AII'_{1936} \cdot \frac{t-1930}{10}}{IO_{930}} \right) \quad (t=1930...1933)$$

$$(A-5-1-2) \quad ALI'_{1936} \equiv ALI_{1930}^{0.4} \cdot ALI_{1940}^{0.6}$$

$$(A-5-1-3) \quad MI'_{1936} \equiv \sqrt[5]{MI_{1938} \cdot MI_{1937} \cdot MI_{1936} \cdot MI_{1935} \cdot MI_{1934}}$$

$$(A-5-2) \quad LI_t = IO_t \left( \frac{ALI_{920} \cdot \frac{1930-t}{10} - ALI_{930} \cdot \frac{t-1920}{10}}{IO_{920}} \right) \quad (t=1920...1930)$$

$$(A-5-3) \quad LI_t = IO_t \left( \frac{ALI_{908} \cdot \frac{1920-t}{12} - ALI_{920} \cdot \frac{t-1908}{12}}{IO_{908}} \right) \quad (t=1912...1920)$$

$$(A-6-1) \quad LO_t = \left( \frac{ALE_{1940}}{ALE_{1940} - ALF_{1940} - ALM_{1940} - ALI_{1940} - PS_{1940}} \cdot \frac{t-1930}{10} \right.$$

$$\left. - \frac{ALE_{1930}}{ALE_{1930} - ALF_{1930} - ALM_{1930} - ALI_{1930} - PS_{1930}} \cdot \frac{1940-t}{10} \right) \cdot (ALF_t + ALM_t + ALI_t + PS_t)$$

(t=1930,...,1933)

$$(A-6-2) \quad LO_t = \left( \frac{ALE_{1930}}{ALE_{1930} - ALF_{1930} - ALM_{1930} - ALI_{1930} - PS_{1930}} \cdot \frac{t-1920}{10} \right.$$

$$\left. - \frac{ALE_{1920}}{ALE_{1920} - ALF_{1920} - ALM_{1920} - ALI_{1920} - PS_{1920}} \cdot \frac{1930-t}{10} \right) \cdot (ALF_t + ALM_t + ALI_t + PS_t)$$

(t=1920,...,1930)

$$(A-6-3) \quad LO_t = \left( \frac{ALE_{1920}}{ALE_{1920} - ALF_{1920} - ALM_{1920} - ALI_{1920} - PS_{1920}} \cdot \frac{t-1908}{12} \right.$$

$$-\frac{ALE_{1908}}{ALE_{1908} - ALF_{1908} - ALM_{1908} - ALI_{1908} - PS_{1908}} \cdot \frac{1920-t}{12} \cdot (ALF_t + ALM_t + ALI_t + PS_t)$$

( $t=1912, \dots, 1920$ )

(A-7)  $TE_t = LA_t + LI_t + LM_t + LO_t$

where,

$ALA_t$  = Abe and Abe's (1971) data on employment in the agricultural sector for year  $t$

$ALI_t$  = Abe and Abe's (1971) data on employment in the manufacturing sector for year  $t$

$ALM_t$  = Abe and Abe's (1971) data on employment in the mining sector for year  $t$

$FA_t$  = Mizoguchi and Umemura's (1988) data on the number of farm households for year  $t$

$IO_t$  = Mizoguchi and Umemura's (1988) data on the number of factory laborers for year  $t$

$MO_t$  = Mizoguchi and Umemura's (1988) data on the number of miners for year  $t$

$LA_t$  = Our estimates on employment in the agriculture sector for year  $t$

$LI_t$  = Our estimates on employment in the manufacturing sector for year  $t$

$LM_t$  = Our estimates on employment in the mining sector for year  $t$

$LO_t$  = Our estimates on employment except for the agriculture, manufacturing, mining and public service sectors for year  $t$

$PS_t$  = Mizoguchi and Umemura's (1988) data on the number of public servants for year  $t$  and

$TE_t$  = Our estimates on total employment for year  $t$ .

For 1951 onward, employment data are available from the annual reports from the Republic of China, Council for Economic Planning and Development.

### Estimation results

The estimation results are shown in Table A.

[Table A]

Table A. Conventional inputs and GDP

year	Tangible Capital (millions of 1990 US \$)	GDP (millions of 1990 US \$)	Labor Input (1000 persons)	Population (1000 persons)	year	Tangible Capital (millions of 1990 US \$)	GDP (millions of 1990 US \$)	Labor Input (1000 persons)	Population (1000 persons)
1898									
1899									
1900					1950		7,378		7,554
1901					1951		8,179	2,893	7,869
1902					1952	6,528	9,093	2,929	8,128
1903				2,998	1953	6,769	10,092	2,964	8,438
1904				3,046	1954	7,139	10,927	3,026	8,749
1905			1,364	3,123	1955	7,573	11,853	3,108	9,078
1906				3,157	1956	7,964	12,481	3,149	9,390
1907				3,186	1957	8,325	13,360	3,229	9,690
1908			1,565	3,214	1958	8,736	14,510	3,340	10,039
1909				3,250	1959	9,256	15,871	3,422	10,431
1910				3,229	1960	9,969	16,725	3,473	10,792
1911	1,161			3,369	1961	10,892	17,931	3,505	11,149
1912	1,226	2,456	1,658	3,435	1962	11,916	19,453	3,541	11,512
1913	1,315	2,591	1,547	3,502	1963	12,983	22,150	3,592	11,884
1914	1,366	2,634	1,524	3,554	1964	14,178	24,971	3,658	12,257
1915	1,391	2,725	1,630	3,570	1965	15,546	26,688	3,763	12,628
1916	1,401	3,449	1,511	3,596	1966	17,185	29,378	3,856	12,993
1917	1,457	3,826	1,517	3,647	1967	19,219	32,688	4,050	13,297
1918	1,538	3,384	1,617	3,670	1968	21,715	35,447	4,225	13,650
1919	1,589	3,624	1,561	3,715	1969	24,757	38,651	4,390	14,335
1920	1,706	3,581	1,545	3,758	1970	28,347	43,509	4,576	14,676
1921	1,894	3,316	1,489	3,836	1971	32,502	49,591	4,738	14,995
1922	2,071	3,793	1,476	3,905	1972	37,378	57,358	4,948	15,289
1923	2,181	4,046	1,501	3,976	1973	43,199	63,519	5,327	15,565
1924	2,303	4,110	1,534	4,042	1974	49,877	62,384	5,486	15,852
1925	2,379	4,502	1,606	4,147	1975	57,408	63,818	5,521	16,150
1926	2,498	4,314	1,645	4,242	1976	66,328	75,108	5,669	16,508
1927	2,618	4,337	1,692	4,337	1977	76,294	84,267	5,980	16,813
1928	2,759	5,315	1,751	4,438	1978	86,531	94,833	6,231	17,136
1929	2,919	5,149	1,801	4,549	1979	97,443	101,759	6,432	17,479
1930	3,148	5,073	1,790	4,679	1980	109,681	104,753	6,547	17,805
1931	3,290	5,055	1,797	4,804	1981	123,639	113,222	6,672	18,136
1932	3,451	5,747	1,784	4,930	1982	138,724	119,254	6,811	18,458
1933	3,642	5,288	1,827	5,061	1983	153,915	132,294	7,070	18,733
1934	3,877	5,677	1,878	5,195	1984	168,815	148,650	7,308	19,013
1935	4,154	6,807		5,316	1985	183,425	156,878	7,428	19,258
1936	4,567	6,639		5,452	1986	197,121	177,721	7,733	19,455
1937	5,003	6,986		5,609	1987	210,623	190,493	8,022	19,673
1938	5,242	7,395		5,747	1988	226,133	192,229	8,107	19,904
1939	5,529	8,094			1989	244,174	195,311	8,258	20,107
1940		8,064	2,099		1990	265,133	200,477	8,283	20,353
1941		8,871			1991	289,386	215,622	8,439	20,557
1942		9,524			1992	317,041	230,203	8,632	20,752
1943		6,492			1993	348,331	244,747	8,745	20,944
1944		4,459			1994	382,021	262,124	8,939	21,126
1945		4,849			1995	417,001	278,900	9,045	21,304
1946		5,274			1996	454,100	295,913	9,068	21,471
1947		5,736		6,498	1997	493,826	315,739	9,176	21,683
1948		6,238		6,808	1998	532,480	330,263	9,289	21,871
1949		6,784		7,397	1999	574,160	348,097	9,385	22,034
1950					2000	616,122	368,635	9,491	22,216