

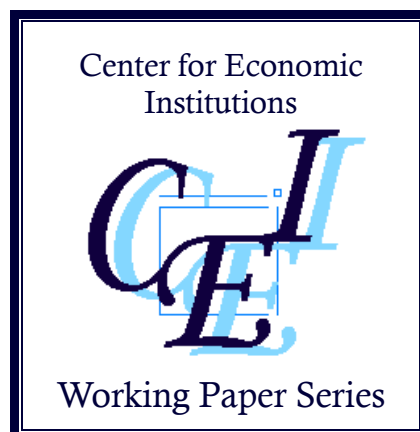
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**“A Consequence of Coerced Free Trade:
Biological Living Standards of Korea
during the Port-Opening Period, 1876–1910”**

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A Consequence of Coerced Free Trade: Biological Living Standards of Korea during the Port-Opening Period, 1876-1910

Abstract

After several hundred years of closed-door policy, Korea finally opened its ports in 1876. Historians have traditionally claimed that the port-opening was coerced by foreign countries, deteriorated the Korean economy, and made Korea become a colony. We examined this traditional view by measuring biological living standards and found the opposite. The height of the *Hangryu* Deceased, who died on the street but no one claimed their body, increased by 0.82 cm in this period. This finding implies that the colonization of Korea originated from political impotence that could not realize the benefit of foreign trade. This result also proposed that economic growth during the colonial period could be more related to free trade than colonial policies or new institutions.

1. Introduction

The confrontation of Western powers in the mid-19th century was the most decisive event determining the modern history of East Asia. Unlike the American continents where they populated their people or conquered the indigenes, Western powers used a commercial approach in East Asia. They threatened China, Japan, and Korea with guns and fleets to open ports.¹ Since then, East Asian countries have been exposed to an unprecedented amount of new knowledge, capital, foreigners, and commodities.

Consequences of the port-opening differed across countries. Japan achieved successful economic growth by absorbing the inflow from the West and finally became a member of imperial powers at the turn of the century. Korea and China, unfortunately, could not follow on this path. If we focus on Korea, she opened ports in 1876, but the nation became a colony of Japan in 1910. Explaining this economic and political divergence is a fundamental subject of Korean history and East Asian history.

Many historians of Korea have commonly blamed the port-opening and subsequent events as the main cause of colonization. Imports of high-quality manufacturing products and exports of crops at low prices ruined Korean industries and agriculture. Foreigners unjustly obtained patents to develop gold mines, railroads, electricity, and telegraph, and earned enormous profits. To accommodate their exploitation, imperial forces hindered Koreans from building a strong and independent modern state. All these factors weakened the Korean economy and state capacity and ultimately brought about the colonization.

This prevailing traditional view, however, has serious weaknesses. First, it assumes an unrealistic alternative that Korea could have achieved modernization autonomously without the port-opening. Second, no reasonable answer is provided as to why the result of the port-opening differed between Korea and Japan. Last, the scholars claiming this view have not

¹ This commercial approach was not limited to East Asia. "Late nineteenth-century imperialism was notable for a tendency toward the multilateral imposition of free trade". Austin (2014), p.324. A similar characterization can also be found from Fieldhouse (1981), pp.53-60, Foreman-Peck (1995), pp.108-113. For a more recent and comprehensive discussion on the spread of free trade and its impact in the late 19th century, see Williamson (2011).

provided compelling evidence to verify their claim, the economic decline during the port-opening period. They have only implied without much scrutiny that trade with foreign countries, foreign direct investment, inflow of advanced knowledge, and so forth were overall harmful rather than beneficial to the Korean economy.

Did the Korean economy really decrease in this period? Did the political failure of Korea actually originate from and reinforce the economic decline after opening ports? We investigated these questions in this paper. Using the traditional view as the null hypothesis, we examined the possibility that the Korean economy might have grown during the port-opening period. We explored a relatively ignored hypothesis in the literature that the colonization was a result of political impotence that could not fully use economic opportunities from the port-opening and subsequent free trade.

The major difficulty in pursuing this research agenda is the lack of data. Suitable sources are not available to estimate GDP per capita or real income in this period. We resolved this obstacle by measuring biological living standards. We estimated the height of the *Hangryu* Deceased, individuals who died on the street but no acquaintance claimed their body. From long-term trends of their heights, we can get important clues to how the port-opening affected Korean living standards in general.

Estimation of living standards in the port-opening era can also provide insights into the Korean economy after the annexation to Japan. Quantitative studies on the last three decades have shown that the Korean economy grew steadily during the colonial period (1910–1945). However, the interpretation of this information has been limited due to the lack of information prior to 1910. The *Hangryu* Deceased data provides a consistent measure of living standards from the 1880s to the 1940s and enables us to view the colonial period more comprehensively in connection with the previous period.

Last, our case study of Korea contributes to recent studies on the economic history of East Asia from the mid-19th century to the early 20th century. Various studies measuring the long-term pattern of income or biological living standards of East Asian countries have suggested that the mid-19th century was a watershed in long-term growth and the port-opening had critical

influences on this change.² The Korean case can enrich this stream of literature and broaden the perspective on the long-term growth of East Asia.

2. History and Literature Review

In terms of international trade and diplomacy, the establishment of the Chosun Dynasty in 1392 was a critical turning point in Korean history.³ Before the Chosun Dynasty, Korean merchants had traded actively with various countries for one hundred years. However, since its establishment, the Chosun Dynasty had prohibited private foreign trades. Only allowed were government trades for diplomacy and very limited private trade under government control with China, Japan, and a few, small, neighboring countries.⁴ As China and Japan also made similar changes in approximately the same period, the East Asian countries isolated themselves from the rest of the world for several hundred years.

Western powers challenged the closed-door policy of East Asian countries with military forces in the mid-19th century. In the case of Korea, fleets from the United States and France invaded and requested a treaty on commerce in 1861 and 1866, respectively. Instead of negotiating, the Korean government fought back and drove them out. Lee Ha-ung, the father of King Kojong and *de facto* ruler of Korea, claimed that he would not allow any diplomatic relations or economic transactions with “Western barbarians.” Most of *Yangban*, the ruling class, who were preoccupied with Confucian *Weltanschauung*, supported his policy.

This resistance, however, ended in 1876. Japan, who was forced to open its ports by the United States in 1854, had strengthened economic and military power and applied the same tactic to Korea. The Korean government could not fight back further and signed a treaty on

² Representative are Allen et al (2011), Xu et al (2017), Broadberry, Guan, and Li (2018), Bassino et al (2019), Morgan (2004), Baten et al (2007), and Jia (2014)

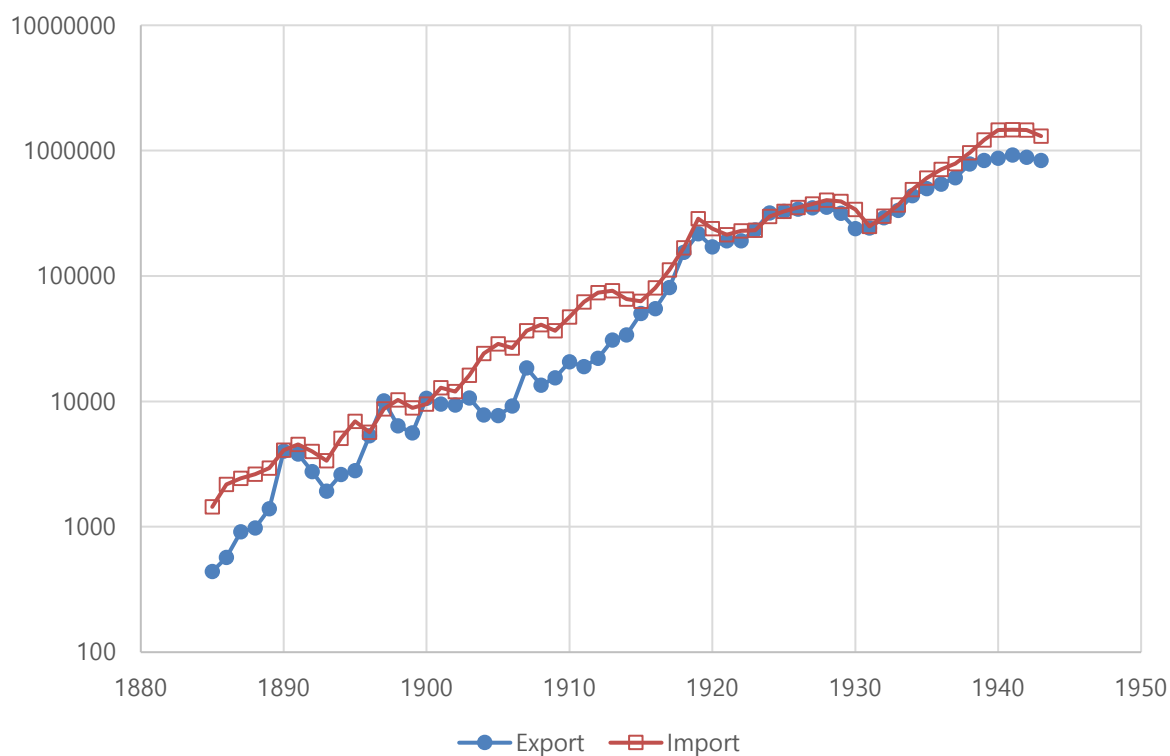
³ English readers can refer to Eckert et al (1990) or Lee (1984) for textbook-level information of the Korean history discussed in this section.

⁴ For the structure of the tribunal system in East Asia, see Lee and Temin (2010).

commerce with Japan in February 1876. Subsequently, Korea signed treaties with China (1882), the United States (1882), the United Kingdom (1883), and Germany (1883), respectively. By the late 1880s, Korea had opened its market to almost every major country.

An immediate consequence of these commercial treaties was, of course, an increase of foreign trade (Figure 2-1). From 1885 to 1910, the total volume of trade soared from 1.8 million won to 67.0 million won, and this trend continued even after the annexation to Japan.⁵ Korea mainly exported agricultural products and imported cotton goods from Britain and Japan.⁶

Figure 2-1. Export and Import of Korea, 1885–1943 (Thousand won).



Source: Park and Kim (2009), p.169.

⁵ Trade volume of 1910 increased to approximately 20% of total GDP. The GDP estimate is from Kim et al (2006). Lee (2014), p.259 guessed that the share of trade in the mid-19th century was approximately 1.5%.

⁶ Han (1970), Kajimura (1983), Kim (1994), Ha (2009), and Song (2010) dealt with the pattern of trade after the port-opening,

Rapid expansion of foreign trade was only a part of the explosive increase in Korea's interactions with other countries. Many people from Japan and Western countries visited Korea. These visitors were involved in trade activities and invested in land, railroads, telegraphs, and mines.⁷ Modern Western knowledge including science, engineering, social sciences, and philosophy was propagated through books and missionary schools.⁸ Western medicine and vaccines were prescribed in newly built Western hospitals.⁹ The Korean government also attempted to adopt Western institutions, laws, military systems, and government structures. All these factors had a profound influence on everyday life of the Korean people.

Broadly, nationalistic scholars have emphasized the negative sides of this historic transformation and following events. Importation of high-quality cotton goods destroyed the livelihood of traditional Korean producers.¹⁰ Rice exports to Japan raised the rice price and resulted in the impoverishment of the Korean people.¹¹ Korean merchants lost their markets to Japanese and other foreign merchants.¹² Foreign investors obtained patents on gold mines and railroad construction from the government and earned an enormous profit.¹³ The suffering Korean people resisted in various ways but were ultimately unsuccessful.¹⁴ The coerced port-opening, according to them, essentially rendered the imperial forces unlimited opportunities to exploit the Korean people and their wealth. The exploitation devastated the Korean economy, worsened Korean living standards, and ultimately resulted in annexation to Japan. Under the Japanese occupation, the living standards of Korean people continued to worsen.¹⁵

This prevailing traditional view, however, has fatal problems. First, it assumes an unrealistic alternative that Korea could have achieved economic development and

⁷ Lee (1989), Chung (1999).

⁸ Hwang (2014)

⁹ Shin (1997) and Hwang (2014).

¹⁰ Kajimura (1983), Kwon (1989), Ch.2.

¹¹ Han (1970), Part II, Ch.2, Kim (1994), Ha (2003; 2009), Kang (1994).

¹² Han (1970), Part I, Ch.2, Kim (1994)

¹³ Chung (1999) for railroad, Lee (1989) for mining.

¹⁴ Korean History Research Association (2003)

¹⁵ Huh (2005)

modernization autonomously even if it had sustained its closed-door policy. “The theory of endogenous development,” proposed in the 1960s and 1970s, suggests that Korea was developing toward a modern capitalist economy in the 18th and 19th century but was unsuccessful due to foreign invasion. Because of the lack of empirical evidence, the original version of the theory has been universally contested; however, nationalistic scholars have continued to perpetuate its basic idea.¹⁶

Second, scholars with the traditional view have disregarded the potential positive impacts of the conversion to an open economy. Although the expansion of foreign trade, introduction of foreign direct investment, and import of new knowledge and technology could contribute to economic growth, this possibility was mostly ignored. In other words, they did not provide a reasonable answer to why Japan could take advantage of the benefit from the port-opening but Korea could not.

Third, these traditional scholars have not provided concrete evidence of the economic downturn they assumed. Recent quantitative studies, by contrast, have implied a positive aggregate impact of the port-opening. For instance, Cha and Lee (2004) found that the real price of arable land and land productivity increased in this period. Park and Cha (2003) uncovered that the population started to increase directly after the port-opening. Kye and Park (2019) showed that social mobility improved significantly during this period. Based on these results, some scholars have proposed revisionist conjecture that the Korean economy stagnated or declined in the early and mid-19th century but started to recover and grow from around the 1880s.¹⁷

Further evidence is thus necessary. To pursue this evidence, we could examine a specific effect caused by the port-opening and estimate the magnitude. Accumulation of such micro-studies can ultimately provide a big picture. We could also use a comprehensive approach, that is, infer the overall impact of the port-opening and subsequent changes by estimating macro-level variables. We used the latter approach in this paper because the port-opening incurred

¹⁶ For last two decades, numerous quantitative studies have suggested a new perspective on the economic history of the late Chosun Dynasty. English leaders who are interested in this new literature can get a brief survey from Kim and Park (2012) and Rhee (2014).

¹⁷ Kim and Park (2012), Park (2009), Kim (2016).

various effects together, and they interacted with each other.

Instead of identifying the marginal contribution of individual events, we attempted to estimate the overall impact of the openness putting negative growth or no growth implied from the traditional view as the null hypothesis. Thus, we explored changes in biological living standards by using height information. If the heights and monetary measures such as GDP per capita or real income are all available, they can complement with each other for understanding the economic condition of society. Unfortunately, monetary measures were difficult to obtain because of limit of data.¹⁸ Therefore, we used height as a substitute for the traditional measures of living conditions.¹⁹

Our estimation also enabled us to combine the port-opening period (1876–1910) and the colonial era (1910–1945) and conduct a comprehensive overview of them. Quantitative studies from the last three decades have demonstrated that the Korean economy grew steadily during the colonial period. The population increased from approximately 15 million to 25 million, and the mortality rate had declined. GDP per capita increased by 2.4%, and biological living standards improved.²⁰ However, the possibility that this growth might have originated from the port-opening and its aftermath has not been examined systematically. More specifically, was colonial growth a reversal from the decline of the previous period or a continuation from the port-opening era? The former implies that policies of the colonial government played a critical role for Korean economic growth in the early 20th century, but the latter suggests that openness rather than policies of the colonial government might be the main factor that determined economic growth during the colonial era.

¹⁸ GDP estimate is available from 1910. Kim et al (2006).

¹⁹ Height has been used and regarded as a standard measure of living standards in economic history for the last four to five decades. Meta analyses by Steckel (2008) and Baten and Blum (2012) have demonstrated a strong positive correlation between heights and GDP, which supports our approach. Of course, anthropometric studies on the United States during the 19th century have reported the “antebellum puzzle,” that is, height declined despite improvement in per capita GDP in the early stage of industrialization. However, this pattern is rather unique in the United States, and height and GDP per capita is regarded as related in most countries. See also debate between Bodenhorn, Guinnane, and Mroz (2017) and Zimran (2019) on the possibility that the antebellum puzzle was from a sample selection problem.

²⁰ Kim et al (2006), and Kim and Park (2011).

The impact of the port-opening in East Asia has been studied directly or indirectly. Allen et al (2011); Xu et al (2017); Broadberry, Guan, and Li (2018); and Bassino et al (2019) have estimated the long-term pattern of income of East Asian countries and showed that the mid- or late 19th century was a watershed of long-term growth. Studies on biological living standards such as Morgan (2004) and Baten et al (2007) have proposed similar implications. Adding the Korean case can enrich this stream of literature.

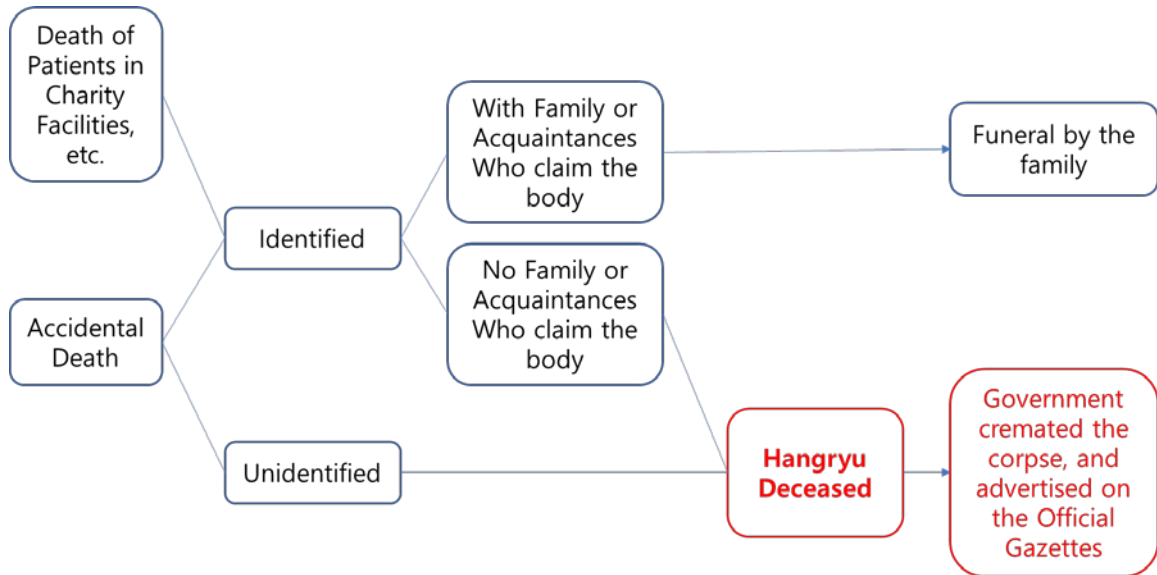
Jia (2014) focused on the impact of the port-opening on the economic growth of China in the long run. Although influenced by her seminal work, our study differs from hers in two aspects. First, whereas she focused on the comparison between treaty ports and other regions, we examined the nationwide impact of the port-opening. Second, in the investigation of the immediate impact of the port-opening, she used size of the population rather than measures of living standards. Our work estimated biological living standards directly.

3. Data

We analyzed height information of the *Hangryu Deceased* during the colonial period. The term “*Hangryu Deceased*” applies to two groups of people (Figure 3-1).²¹ The first group was homeless or vagrant when they died at charity hospitals or institutions. If homeless or vagrants were seriously sick and hospitalized, they were called *Hangryu Patients*, and if they died there, they were called *Hangryu Deceased*. Because most of these people had neither family members nor acquaintances to claim the body, the hospital or facilities buried or cremated their corpse. The second group is related to accidental death. If a dead body was found on the street, the police investigated to determine his or her identity and cause of death. If the police identified the corpse and contact information of his or her family, the police notified them and gave them the corpse. Otherwise, the corpse was classified as *Hangryu Deceased*. Similar to the aforementioned cases, municipalities buried or cremated them within a few days.

²¹ Article 1, *The Act on Handling of the Hangryu Patients and Hangryu Deceased*, enacted in 1899, #93.

Figure 3-1 Definition of *Hangryu* Deceased

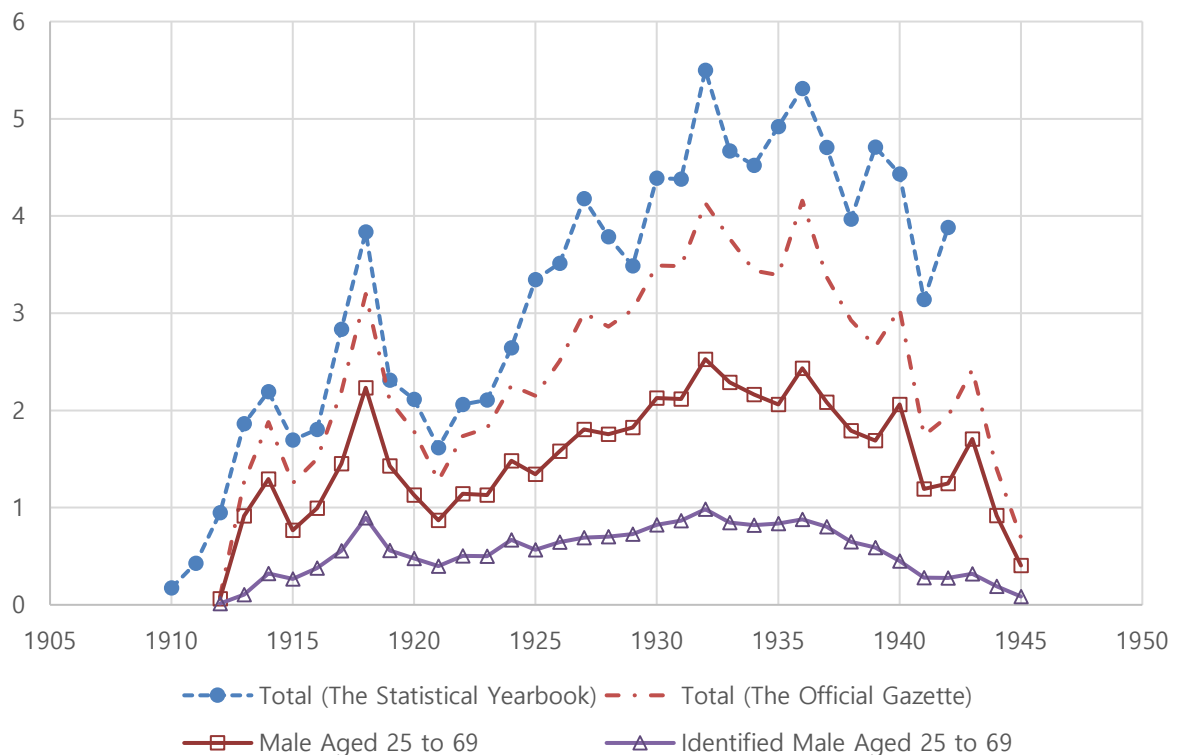


The Japanese government enacted a law on the *Hangryu* Deceased in 1899 and implemented an administrative process related to the *Hangryu* Deceased systematically.²² Two clauses are noteworthy and related to the following analysis. First, the municipalities and institutions had to report to the central government after the handling of *Hangryu* Deceased; then, the central government reimbursed the costs of handling to the municipalities or institutions. The central government collected information on the incidence of *Hangryu* Deceased through this process and reported the related statistics in the *Statistical Yearbook of the Japanese Empire*.

The law was applied to colonial Korea, and the Government-General basically assumed the role of the central government. The colonial government reported statistics on *Hangryu* Deceased and the total expenditure in the *Statistical Yearbook of Governor-General of Korea*. According to the *Statistical Yearbooks*, the total number of *Hangryu* Deceased from 1910 to 1942 was 105,476 (Figure 3-2). The number of *Hangryu* Deceased changed each year but was approximately 0.015 to 0.020% of the total population in the 1930s.

²² *The Act on Handling of the Hangryu Patients and Hangryu Deceased*, enacted in 1899, #93.

Figure 3-2 Number of *Hangryu* Deceased, 1910–1945 (thousand).



Note: Number of Total (The Statistical Yearbook), Total (The Official Gazette), Male Aged 25 to 69, and Identified Male Aged 25 to 69 are 105,476; 89,301; 52,073; 18,532 each.

Source: See the text.

Second, the municipalities advertised to identify the *Hangryu* Deceased in the *Official Gazettes* or newspapers according to the law.²³ The advertisement provided a detailed description of the deceased, for example, their appearance, clothing, and belongings (Table 3-1).²⁴ The ad also reported where and when the deceased was found, the causes of death, and how the corpse was treated. Sometimes, the ad included the name and permanent address of the deceased, and although rare, his or her occupation.²⁵ Detailed individual information was available for a certain portion of *Hangryu* Deceased, especially if they had been

²³ Article 9, *The Act on Handling of the Hangryu Patients and Hangryu Deceased*, enacted in 1899, #93.

²⁴ The format of the advertisement was identical between Japan and colonial Korea.

²⁵ This reason is why *Hangryu* deceased cannot be John Does.

institutionalized before death, lived with other individuals who were vagrant, or resided in a small village, where residents were inevitably acquainted with them.

Table 3-1. Example of an advertisement for *Hangryu* Deceased.

	Content
Date of Publication	July 14, 1923
Permanent Address	Anseong, Kyungki-do
Current Address	Unknown
Name	Kwang-Yi Kim
Ethnicity	Korean
Sex	Male
Age	30
Feature	Height 163.6 cm, average shape, nothing special
Belonging	None
Cause of Death	Heart Attack
Place Found	Seoul Buddhist Institute for the Poor
Date of Death	May 18, 1923 (Institutionalized on this date)
Treatment	Temporarily buried at the cemetery of the institute
The Municipality	Seoul

Sources: *The Official Gazette*, July 14, 1923, p.150.

We digitized the major information of all the advertisements in *the Official Gazette of the Governor-General*. The complete database comprised 89,301 observations.²⁶ The total number and yearly distribution shown in Figure 3-2 suggest that most of the *Hangryu* Deceased were advertised in *the Official Gazette*. Using this information, we measured the long-term trends of biological living standards during the port-opening period.²⁷

²⁶ The Governor-General first advertised in November 1912.

²⁷ Kim and Park (2011) estimated biological living standards of Koreans using information on male *Hangryu* Deceased aged 25 to 30 years. As described in section 4, we used the information more broadly in this paper,

4. Estimation Strategy

The advertisement of the *Hangryu Deceased* i contains information on the date of death (D_i), age at death (A_i), height at death (H_i), and other factors (V_i), for example, place of death. Using date of death and age at death, we calculate back the date of birth ($B_i = D_i - A_i$). The height at death (H_i) of the *Hangryu Deceased* should reflect the cumulative net nutrition from year from B_i to D_i .

We basically calculate average heights for each birth cohort and then examine height trends. However, there are two caveats. First is age effect. Human beings' height increases from birth to approximately the age of 25 years. However, the height of *Hangryu Deceased* may differ from this biological pattern. A *Hangryu Deceased* who died at an older age was more likely to be in better health and have survived longer than those who died younger. This possibility implies that age and heights have a strong positive correlation in case of *Hangryu Deceased*, and Appendix 1 supports this inference. As composition of age group differed across birth cohorts, control of age was indispensable to compare heights of birth cohorts and infer patterns of living standards across time.

The second caveat is the socio-economic conditions of death year. Suppose that famine occurred in year D_i . This phenomenon could cause the death of people who might not have died in normal years; thus, the average height of the *Hangryu Deceased* dying in this year could be taller than other years. A simple solution to ameliorate this problem is to control the impact of economic conditions at death years by using year dummies. Unfortunately, due to the linearity between birth year, death year, and age, this method is ineffective. Instead, we ameliorated this problem by using variables reflecting economic condition of the death years such as per capita GDP or death rates of the population.

We resolved the aforementioned concerns and estimated the long-term pattern of

that is, we measured biological living standards of the port-opening period (1880s to 1910s) and the colonial period (1910s to 1940s) together, using information on male *Hangryu Deceased* aged 25 to 69 years.

biological living standards by adopting the following specification for regressions.

$$H_{ijD} = \beta B_i + \alpha A_i + \nu V_{jD} + \xi_j + \varepsilon_{ijD} \text{ --- --- (A)}$$

In equation (A), H_{ijt} is the height at death of a *Hangryu Deceased* i who died in year d in region j . The parameter β of the cohort dummies (B_i) are the key to be estimated. They capture the average height according to birth years and ultimately reveal changes in living standards over time. The age variable (A_i) normalizes the heights of different ages to make β comparable. Socio-economic condition variables (V_{iD}) control the potential impact of the social or economic condition of death year D in region j . In addition, we controlled unobserved time-invariant regional characteristics (province fixed effects, ξ_j). ε_{ijD} is the error term.

Out of all the data, we analyzed information on Korean male *Hangryu Deceased* aged 25 to 69 years. Thus, in the following analysis, we focused on males to avoid the complications of including both sexes. We also dropped males aged younger than 25 years and older than 69 years because their age information could be unreliable. This data enables us to measure the height of people born from 1850 to the 1910s and to infer the change in living standards during the port-opening period (1876–1910) and the colonial period (1910–1945).²⁸

After removing the foreign *Hangryu Deceased* and the deceased with incomplete records, the total number of records that satisfied the aforementioned criteria was 52,073. In Figure 3-1, their distribution is similar to all *Hangryu Deceased* in the database. Table 4-1 shows the basic statistics of the variables examined. Height was originally measured by Chock (30.3cm) and Chon (3.03cm), and we converted this measurement into centimeters. Because a Chon (3.03cm) is a somewhat large unit, rounding could cause inaccuracy or bias. However, Fogel et al (1983) examined similar concerns when analyzing heights measured in inches (2.54cm) and found no serious distortion.

²⁸ The earliest date of an advertisement was in 1913. At that time, people died at an age in their 60s, and they belong to the birth cohort of the 1850s. The latest date is 1945, and the people who died at age 25 to 30 years belong to the birth cohort of the 1910s.

Table 4-1. Basic Statistics: Male *Hangryu* Deceased, Aged 25 to 69 years

Variable	Observations	Mean	Std. Dev.	Min	Max
Individual-level data					
Height (cm)	52,073	161.0	5.4	140.0	187.9
Birth, Age, Death					
Year of Birth (year)	52,073	1883	14	1850	1919
Year of Death (year)	52,073	1930	9	1913	1945
Age at Death (year)	52,073	47	12	25	69
Place of Birth					
North	12,479	1	0	1	1
Middle	20,637	1	0	1	1
South	18,957	1	0	1	1
Identified	52,073	0.36	0.48	0	1
Non-Poverty Death	52,073	0.12	0.33	0	1
Regional Level Data					
GDP per Capita (won)	390	82.9	42.6	23.4	299.7
Male Death Rate (per thousand)	312	46	10.2	25.8	79.7

Note: Regional level data is from 13 provinces.

Source: See the text.

5. Height Growth During the Port-Opening Period and Its Implications

Basic Results

Table 5-1 provides estimation results of the height of male *Hangryu* Deceased by using equation (A). Figure 5-1 presents estimates (3) and (5) of the table. By comparing the heights of birth cohorts of the 1850s and the 1880s, we inferred changes in biological living standards during the port-opening period. The people born in the 1850s became 30 years old and fully grown around the 1880s, implying that their height was determined before or in the early stage of the port-opening period. People born in the 1880s had stopped growing by the 1910s, and their growth was influenced by the port-opening from birth. The difference of height between these two groups was interpreted as the impact of the port-opening on Korean living standards.

Table 5-1 Heights of Male *Hangryu* Deceased According to Birth Year

Dependent Variable = height (cm) of male *Hangryu* Deceased aged 25 to 69 years

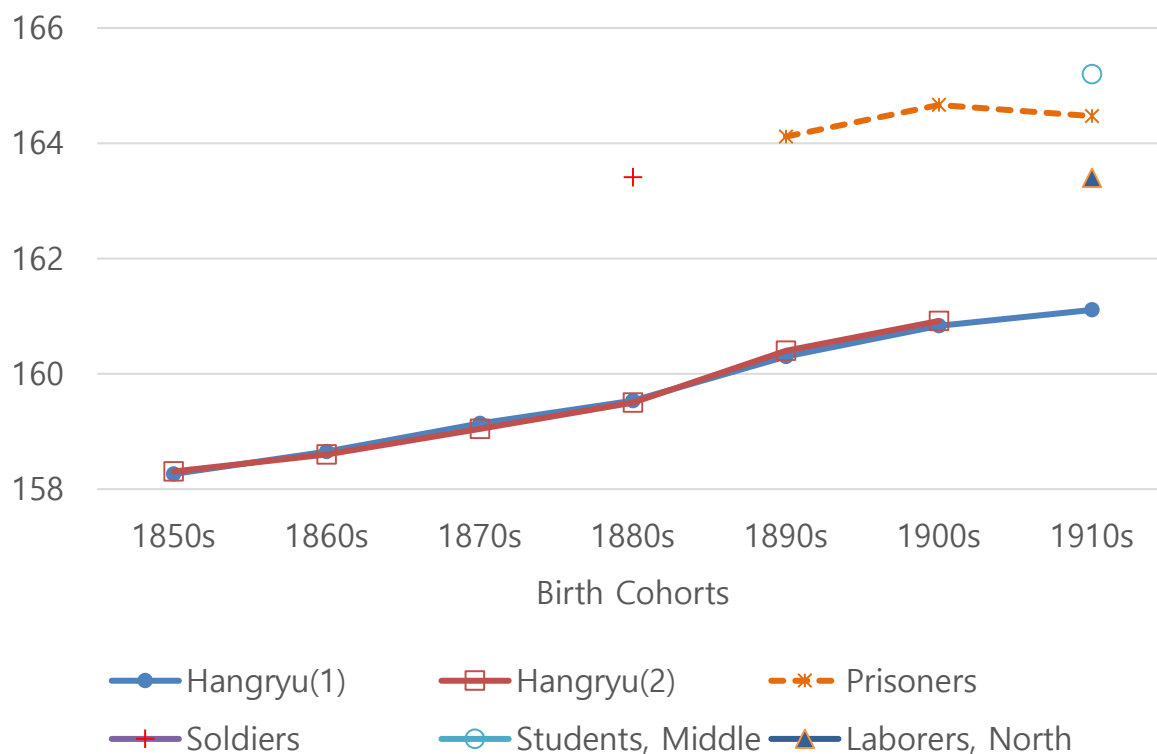
VARIABLES	(1) Total	(2) Total	(3) Identified only	(4) Total	(5) Identified only	(6) Non- poverty death
Birth Cohorts						
1850s	reference					
1860s	0.416*** (0.119)	0.430*** (0.119)	0.319 (0.195)	0.336** (0.136)	0.258 (0.210)	0.777 (0.558)
1870s	0.899*** (0.115)	0.909*** (0.115)	0.624*** (0.193)	0.771*** (0.140)	0.603*** (0.222)	1.036* (0.542)
1880s	1.309*** (0.121)	1.317*** (0.121)	0.822*** (0.208)	1.159*** (0.163)	0.752*** (0.262)	1.225** (0.576)
1890s	2.062*** (0.133)	2.065*** (0.133)	1.413*** (0.239)	1.957*** (0.197)	1.335*** (0.325)	2.319*** (0.635)
1900s	2.615*** (0.154)	2.604*** (0.154)	1.864*** (0.290)	2.384*** (0.243)	1.632*** (0.411)	2.872*** (0.711)
1910s	2.837*** (0.199)	2.816*** (0.200)	2.300*** (0.418)			
ln(age)	3.479*** (0.140)	3.413*** (0.141)	2.850*** (0.269)	3.433*** (0.221)	2.875*** (0.379)	3.112*** (0.558)
Regional Fixed						
Effect	No	Yes	Yes	Yes	Yes	Yes
RGDP per Capita	No	No	No	Yes	Yes	Yes
Death Rate	No	No	No	Yes	Yes	Yes
Constant	146.4*** (0.588)	146.6*** (0.590)	149.7*** (1.128)	146.6*** (0.841)	149.3*** (1.449)	147.3*** (2.182)
Observations	52,073	52,073	18,532	40,291	15,854	5,156
R-squared	0.012	0.016	0.009	0.013	0.008	0.020

Note: In Estimates (4),(5), and (6), observations from 1939 to 1945 cannot be used because death rate was available for only 1914 to 1938. Thus, no estimate for the 1910s birth cohort was provided.

*** p<0.01, ** p<0.05, * p<0.1

Source: See the text.

Figure 5-1 Height of Male *Hangryu* Deceased compared with other statistics: Birth Cohorts from the 1850s to the 1910s



Note: Height of *Hangryu* Deceased of the 1850s birth cohort indicates that the height of people aged 25 years who were born in the 1850s. *Hangryu* (1) and (2) are from estimates (3) and (5) of Table 5-1, respectively.

Sources: *Hangryu* Deceased (1) and (2) are from Table 5-1. Prisoners are from Choi and Schwekendiek (2009), p.260, Table 1. The other statistics are from Kimura (1993).

Estimate (1) in Table 5-1 comprised birth cohort dummies and the age variable. The coefficient estimate of the 1880s birth cohorts shows that a male *Hangryu* Deceased born in the 1880s was 1.3 cm taller than those born in the 1850s, and this difference was statistically significant. Estimate (2) further controlled province dummies for managing regional fixed effect, and this did not result in a big difference. These results imply that biological living standards of Korean improved during the port-opening era. Estimates of the 1860s, 1870s, and 1880s birth cohorts show that this growth was gradual, which further supports the reliability of the estimation. They refute the traditional view, that is, the overall impact of the port-opening

was negative and that the Korean living standard declined during the port-opening period.

Among the questions that can be raised about this basic result, two are the most crucial: the potential distortions due to inaccuracy of age information and reverse causation between heights and economic condition. We next discuss whether the results from the basic analysis were robust to these potential problems.

Potential Bias from Inaccurate Age Information

Many *Hangryu* Deceased were individuals living in poverty and were homeless or vagrant. However, village residents would know their basic information such as name or age in many cases. Additionally, because many *Hangryu* Deceased were *Hangryu* patients and died at charity hospitals, the institutes figured out their major information including name and age. Therefore, out of the male *Hangryu* Deceased aged 25 to 69, 36% of their advertisements included name and age information (Table 4-1). The identities of the remaining 64% of *Hangryu* Deceased were unknown, and their age was likely a guess based on appearance. Thus, we posed the following question: Would the inclusion of the *Hangryu* Deceased with inaccurate age cause systematic bias and generate a wrong result, that is, an increase of height in estimation compared with actual decline.

One method to answer this question is an examination of regional patterns. A municipal servant's location should be independent of their age guessing. Therefore, if height differences between ages or growth patterns are similar between regions, the result refutes the possibility that age guessing of the civil servants was haphazard.

Following convention, we divided the Korean Peninsula into three parts—North, Middle, and South—and measured heights according to region. As presented in Appendix 2, the heights of all three regions generally show increasing trends. This finding refutes the possibility that estimates (1) and (2) of Table 5-1 might be a distorted result from unreliable age information.

Another means to check this problem is to use the identified people only, that is, those whose name or birthplace was recorded in the advertisement. As aforementioned, 36% of the advertisement contained information on identity. We considered the reason why such information was provided and assert that their age information is reasonably reliable. Estimate (3) reported regression results using identified male *Hangryu* Deceased only. Their height increased by 0.82 cm during the port-opening era. This finding is smaller than the basic results

but still supports the claim that the Korean living standards improved during the port-opening era.²⁹

Reverse Causation

We inferred living standards from heights based on a positive correlation between the two variables.³⁰ However, this relation might not hold in our case due to the nature of *Hangryu Deceased*. If economic conditions of a year became worse suddenly, people who were relatively poor but making decent lives might lose their jobs, become poor, become vagrant, and die as a *Hangryu Deceased*. The addition of these people should increase the average height of *Hangryu Deceased*. This inference suggests that the increase in height of *Hangryu Deceased* reported in Table 5-1 could originate from secular worsening of the economic condition, not vice versa.

We can check this possibility. First, as aforementioned, various indicators including GDP per capita or death rate show that the average living standards of Korea improved during the data generating period, that is, the colonial era.³¹ This finding is not consistent with the basis of the reverse causation argument that income level declined continuously for three decades and that it increased the number of *Hangryu Deceased* and ultimately their heights.

Of course, worsening inequality can generate this pattern. If income inequality increased even under the rise of GDP per capita, the number of impoverished people could increase, and this could have caused the increase in the height of *Hangryu Deceased* (Table 5-1); however, if it holds, the number of *Hangryu Deceased* should have increased continuously from 1910 to 1945. Figure 3-2 illustrates that the number of *Hangryu Deceased* had a basically inverse-U shape with 1930 as the pick. This non-linear pattern of *Hangryu Deceased* does not support the inference based on increasing inequality.

The economic condition of the year at death may still affect the estimation result. We

²⁹ Estimate (5) shows that this result would not change even if we further control economic conditions of year at death.

³⁰ Steckel (2008), Baten and Blum (2012)

³¹ Kim et al (2006).

ameliorate this factor more precisely by controlling the economic condition of the death year such as GDP per capita and death rate by province. Equations (4) and (5) applied these controls for the whole data and the identified *Hangryu* Deceased, respectively, and the results are similar to the previous results.³²

Last, we checked the robustness of our results by using information on *Hangryu* Deceased who died of non-poverty reasons. Notably, 12% of male *Hangryu* Deceased died of suicide, murder, railroad accidents, drowning, food-poison, and pandemic and (Table 4-1), and their death could be reasonably independent of the economic downturn causing the potential reverse causation. Estimate (6) showed the result, and it supports the robustness of our estimation.

Growth of GDP per Capita Inferred from Height Pattern and Its Implications

The discussion has so far suggested that our results are robust to various potential problems. Out of the estimates in Table 5-1, we prefer to use the conservative lower bound as the representative result. We propose that the height of male *Hangryu* Deceased increased by 0.82 cm during the port-opening era, as suggested by estimation (3) of Table 5-1. This result refutes the traditional view that Korean living standards declined in this period.

Using GDP per capita and heights of various countries from 1870 to 1930, Baten and Blum (2012) estimated correlations between them. If we apply their result, our estimation implies that per capita GDP of Korean people increased at least 0.29% per year during the port-opening period (Table 5-2). Using Maddison data, Jeffrey Williamson suggested that GDP per capita of periphery countries increased by 0.9% per annum from 1870 to 1913.³³ Considering that our estimate is a lower bound, we claim that economic growth of Korea might be somewhat lower but not far behind other contemporary periphery countries during the first globalization period.

Ultimately, the estimation results and comparison with contemporary periphery countries provide a foundation for a novel understanding of the port-opening era. Nationalistic scholars

³² One caveat is that observations from 1939 to 1945 cannot be used because death rate was available only for 1914 to 1938.

³³ Williamson (2011), p.5, Table 1.3. The Table also presented that growth rate of Western Europe for the same period was 1.15%, which is not that different from that of the periphery countries.

have claimed that the port-opening allowed foreign countries to exploit the Korean people, and this weakened the Korean economy and government and ultimately resulted in colonization. Our result suggests that this might not be true. The colonization of Korea in 1910 may not be due to an economic downturn caused by the port-opening but due to political failure that could not fully realize the new opportunities. Koyama, Moriguchi, and Sng (2017) and Pascali (2017) have suggested that state capacity was a crucial determinant of the fate of countries in East Asia or countries in other regions during this period. Our result shows that the Korean case complements these studies and broadens the perspective on the long-term growth of East Asia.

Table 5-2 Height Growth and GDP per Capita Inferred from the Height

	Height growth (cm)	Growth Rate of GDP per capita	
		Inferred from height growth by Baten and Blum (2012)	Kim et al (2006)
1880s-1940s	2.30	0.40%	
1880s-1910s	0.82	0.29%	
1910s-1940s	1.48	0.52%	2.2%

Note: Baten and Blum (2012) suggested $\ln(\text{GDP per capita}) = -10.094 + 0.105 \cdot \text{Height}$.

Sources: see the text.

6. Colonial Economic Growth Mirrored from The Port-Opening Period

The *Hangryu Deceased* data we used in this paper had information on adults born from the 1850s to 1910s. This information enabled us to investigate changes in living standards from the 1880s to the 1940s. The first half of this period (1880s–1910s) coincided with the port-opening period, and the second half (1910s–1940s) coincided with the colonial period. Thus, we have a consistent index of living standards covering the port-opening period and the colonial period.

According to Estimate (3) in Table 5-1 and Figure 5-1, people born in the 1910s were 2.3

cm taller than those born in the 1850s, and the coefficients between these two endpoints increased gradually over time.³⁴ This finding implies that the living standards of Korean people improved steadily during the period under consideration. Out of this, 36% or 0.82 cm was from the port-opening era, and the remaining 64% or 1.48 cm was from the colonial period (Table 5-2).

This result provides insights that allow a new understanding of the origin and nature of economic growth during the colonial period. Since Mizoguchi and Umemura (1988) and Kim et al (2006) published an estimation of GDP per capita during the colonial period, scholars have debated widely the reliability of this estimation and its implication. Basically, some scholars criticized the estimation and claimed that the Korean living standard worsened, whereas other scholars accepted this result and attempted to explain it in connection with colonial policies such as new institutions or industrial policies.³⁵

Our result sheds a new light on this debate. First, our result is consistent with the estimation showing that the Korean living standard improved during the colonial period. Second, however, the comparison with the port-opening period implies that free trade rather than economic policies or new institutions implemented by the colonial government can be a major source of the improvement in living standards during the colonial era.³⁶ Supporting or refuting, our study at least demonstrated clearly that any attempt to explain the economic growth during the colonial era should consider changes in the port-opening era systematically.

7. Conclusion

The wave of first globalization in the 19th century transformed world economic order

³⁴ The figure also includes available height information of contemporary prisoners, school children, soldiers, workers, and so on. According to the figure, the *Hangryu* Deceased were about 3cm shorter than the others. Considering social and economic status of the *Hangryu* Deceased, this pattern supports the reliability of the data and estimates.

³⁵ Kim and Park (2012) for brief review of this debate.

³⁶ Studies like Cha and Lee (2004), Park and Cha (2003), Kim and Park (2012), Park, Kim (2016) heralded this view.

significantly. Korea maintained autarkic policies in foreign trade for a long time but finally opened its ports in 1876 and joined this movement. Since then, the Korean economy was exposed to a massive inflow of foreign people, commodities, knowledge. Many scholars have tended to view this period pessimistically and have claimed that the Korean economy was harmed and exploited by the foreigners. The damages from the port-opening had weakened the Korean economy and resulted in colonization.

We raised questions on this understanding. To measure the impact of the port-opening, we explored biological living standards of Koreans during the port-opening period by using height information of *Hangryu Deceased*. Our conservative estimates show that from the 1880s to 1910s, the height of male *Hangryu Deceased* increased 0.82 cm. Considering the social and economic status of these people, this result indicates that Korean living standards improved during the port-opening era. These findings also suggest that the colonization of Korea in 1910 could be a consequence of political failure, that is, the government could not fully realize the economic opportunities from the door-opening.

The *Hangryu Deceased* data provides new insights into the colonial period as well. Height of *Hangryu deceased* increased 1.48 cm during the colonial period, which is consistent with estimates of GDP per capita. Notably, this growth was a continuation from the port-opening era rather than a reversal of a stagnant or declining trend of the previous period. This finding implies that economic growth during the colonial era was closely related to gain from free trade rather than colonial policies or transplanted institutions. Further studies on these topics would enhance the understanding of Korean history and East Asian history as a whole.

Appendix 1 Average Heights of *Hangryu* Deceased According to Birth Year and Age at Death

			Age at Death					Total
			25-29	30-39	40-49	50-59	60-69	
Birth Year	1850s	Height (cm)				160.5	160.8	160.8
		Observation				389	2372	2761
	1860s	Height (cm)			160.1	160.7	161.2	160.9
		Observation			403	3087	3929	7419
	1870s	Height (cm)		159.6	160.6	161.1	161.6	161.1
		Observation		367	2742	4213	3978	11300
	1880s	Height (cm)	158.8	160.2	160.9	161.4	161.5	160.9
		Observation	300	2577	4384	4798	762	12821
1890s	Height (cm)	159.6	160.9	161.6	161.6		161.1	
	Observation	1125	3797	4539	1059		10520	
1900s	Height (cm)	160.1	161.4	161.7			161.1	
	Observation	1245	3419	890			5554	
1910s	Height (cm)	160.7	161.0				160.8	
	Observation	1013	685				1698	
Total	Height (cm)	160.0	160.8	161.1	161.1	161.3	161.0	
	Observation	3683	10845	12958	13546	11041	52073	

Source: see the text.

Appendix 2 Heights of Male Hangryu Deceased by Region

Dependent Variable = height (cm) of male Hangryu Deceased aged 25 to 69 years

VARIABLES	(1)			(2)		
	North	Middle	South	North	Middle	South
Birth Cohorts						
1850s	Reference					
1860s	0.712*** (0.243)	0.174 (0.197)	0.456** (0.189)	0.631** (0.260)	0.301 (0.226)	0.201 (0.225)
1870s	1.259*** (0.235)	0.616*** (0.190)	0.940*** (0.184)	1.098*** (0.270)	0.818*** (0.237)	0.583** (0.231)
1880s	1.859*** (0.251)	0.804*** (0.198)	1.486*** (0.193)	1.664*** (0.321)	1.200*** (0.276)	0.917*** (0.264)
1890s	2.851*** (0.279)	1.524*** (0.217)	2.103*** (0.212)	2.573*** (0.394)	2.203*** (0.339)	1.509*** (0.316)
1900s	3.719*** (0.326)	2.013*** (0.246)	2.469*** (0.248)	3.362*** (0.494)	2.706*** (0.419)	1.703*** (0.385)
1910s	3.859*** (0.416)	2.063*** (0.307)	2.889*** (0.347)			
ln(age)	3.900*** (0.307)	2.877*** (0.222)	3.756*** (0.224)	3.677*** (0.463)	3.760*** (0.377)	3.232*** (0.345)
Regional Fixed Effect						
	Yes	Yes	Yes	No	No	No
RGDP per Capita	No	No	No	Yes	Yes	Yes
Death Rate	No	No	No	Yes	Yes	Yes
Constant	144.7*** (1.290)	148.9*** (0.931)	145.2*** (0.938)	144.8*** (1.802)	146.5*** (1.388)	147.1*** (1.321)
Observations	12,479	20,637	18,957	9,992	15,471	14,828
R-squared	0.015	0.009	0.015	0.012	0.010	0.011

*** p<0.01, ** p<0.05, * p<0.1

Source: See the text.

<Reference>

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