Non-Financial Hurdles for Human Capital Accumulation: Landownership in Korea under Japanese Rule

Jun, Bogang

Seoul National University

7 December 2012

Non-Financial Hurdles for Human Capital Accumulation: Landownership in Korea under Japanese Rule

Bogang Jun

Abstract This paper suggests that inequality of landownership is a non-financial hurdle for human capital accumulation. It is the first to present evidence that inequality of landownership had an adverse effect on the level of public education in the Korean colonial period. Exploiting variations in inequality in land concentration across regions in Korea and accounting for unobserved heterogeneity across theses regions, using a fixed effect model, the analysis establishes a highly significant adverse effect of land inequality on education in Korea's colonial period.

Keywords Land inequality, Education, Development, Korean economic history

JEL Classification I25, N35, Q15

Bogang Jun
Technology Management, Economics, and Policy Program, Seoul National University,
Building 37, Gwanak-gu, Seoul, 151746, South Korea
E-mail: bogang33@gmail.com

Acknowledgement I am grateful to Oded Galor for valuable comments. Comments from Francesco Cinnirella, Helene Latzer, and attendances of my presentation at Brown are also gratefully acknowledged.

1 Introduction

Human capital accumulation plays a critical role in Unified Growth Theory, which explains the transition from Malthusian-trapped growth to modern growth with consistent logic (Galor and Weil 2000; Galor 2011). The process of industrialization increases the demand for human capital, which in turn incentivizes individuals to obtain more education. This accumulated human capital further accelerates economic growth. Therefore, circumstances that promote or limit the accumulation of human capital are critical in explaining cross-country differences in the growth path and the timing of the transition to modern growth.

This paper confirms that inequality in landownership adversely effects the establishment of public primary education, which promotes human capital accumulation, as hypothesized by Galor et al. (2009). Using evidence from Korea, I argue that in a society with more equal landownership, institutions that promote human capital accumulation are established sooner, leading, on average, to more education.

Galor et al. (2009) considered the economic interests of the established landed elite, the emerging industrial elite, and common workers during the industrialization process. Because of the complementarity between physical capital and technology, the accumulation of physical capital due to industrialization results in an increased demand for human capital. The emerging industrial elite, therefore, have a friendly attitude toward public education, which can boost human capital accumulation. The landed elite, on the other hand, initially have a negative attitude toward the education policy for two reasons. First, there is little complementarity between land, which is the main input to agricultural production and education, and second, education tends to separate labor from land, resulting in a lower return to land.

The accumulation of human capital requires individuals to make investments in education, but because of capital market imperfections, these investments are suboptimal (Galor and Zeira 1993). Public investment in education, therefore, lessens the financial burden of accumulating human capital and reinforces economic growth. The landed elite initially impede the implementation of policies promoting human capital, as described above. However, as the economy gradually shifts from agriculture to industry, landowners hold more physical capital and thus change their positions on public education. A society with more equally distributed landownership or scarce land, therefore, can implement the optimal education policy earlier. Moreover, this earlier implementation of public education promotes investments in human capital and thus accelerates economic growth.

The aim of this paper is to show evidence of the adverse effect of land inequality on human capital accumulation using Korean data. My results are consistent with Galor et al. (2009) and Cinnirella and Hornung (2011), who used data from the United States and Prussia, respectively.

My empirical analysis uses a panel data set from the *Annual Statistical Report of the Government-General* (i.e., the previous colonial government) to show the existence of an adverse effect of land ownership on education. This panel data allows me to control for unobserved heterogeneity across regions. Through a fixed effects model, I find an exogenous effect of inequality in landownership on education, by controlling for regional differences in the share of agriculture, the share of jobs requiring more human capital, the population growth rate, and the share of Japanese individuals. Moreover, the finding is robust even when I control for the supply side of education. This result implies that the adverse effect of non-financial hurdles, such as land inequality on human capital accumulation, can be generalized to many settings.

Furthermore, Korea's growth path provides an interesting story. After independence, the Korean government implemented land reform that removed tenancy and established equality of landownership in 1950. The following educational reform boosted the accumulation of human capital, after which Korea achieved industrialization and broke the Malthusian trap. Korea who was one of the poorest countries in the world as of 1950, became a member of the Organization for Economic Co-operation and Development (OECD) in 1996 and achieved a gross domestic product (GDP) per capita of $22,424 in 2011 (current US$) (World Bank 2012). Both the timing and the consequences of land reform are important in understanding the fascinating story of Korean development.

The remainder of this paper proceeds as follows. In section 2, I present the related literature. Section 3 presents a simple theoretical model based on Galor et al. (2009). Section 4 provides a historical background of Korea, focusing on the distinctive Korean colonial experience in terms of land inequality and education. Section 5 presents empirical results using the Korean data. Finally, section 6 gives concluding remarks.

2 Theoretical background and related literature

The literature presents several different arguments about the relationship between inequality and human capital accumulation with respect to economic growth. Galor and Zeira (1993) constructed a macroeconomic model showing that inequality, in the presence of credit constraints, has an adverse effect of human capital formation and economic growth in the long-run.

In addition to credit market imperfections, non-financial hurdles can impede the accumulation of human capital. Galor et al. (2009) proposed a theory in which inequality in landownership has a significant effect on economic growth. They show that the differences in education expenditure across states in the U.S. stem from variation in the distribution of landownership. Similarly to Galor and Zeira (1993), this theory explores of the favorable conditions for human capital accumulation, but it differs in that the hurdle for human capital accumulation is not a financial barrier but rather inequality in landownership.

Cinnirella and Hornung (2011) find supporting evidence for the adverse effect of inequality in landownership on the timing of human capital formation using data from nineteenth century Prussia. They argued that landowners delayed the establishment of mass education through the institution of serfdom that restricted labor mobility and therefore the benefit from human capital accumulation. Despite the presence of schools and teachers, regions with higher land concentration had lower education attainment. After the abolition of serfdom and the emancipation of the peasantry, the rise in education enhanced the development in Prussia and permitted its transition to a higher growth path.

3 The Model

In their seminal work, Galor et al. (2009) and Galor (2011) stressed on the importance of human capital in the growth process, and underlined the non-monotonic relationship between inequality and growth. Using their framework, I can derive a simple model in the spirit of Galor et al. (2009).

Consider an overlapping generations model in which each individual lives two periods and has one parent and one child. In this model, there are two production sectors, agriculture and manufacturing, which produce the same homogenous good that is used in consumption and investment. That is,

$$y_t = y_t^A + y_t^M \tag{1}$$

where y_t^A is the aggregate output in the agricultural sector and y_t^M is the aggregate output in the manufacturing sector.

Both sectors have a neo-classical, constant-returns-to-scale, strictly increasing, and concave production function. Specifically, the production function of the manufacturing sector is a Cobb-Douglas production function. Thus,

$$y_t^A = F(X_t, L_t) \tag{2}$$

$$y_t^M = K_t^{\alpha} H_t^{1-\alpha} = H_t k_t^{\alpha}, \quad k_t = K_t / H_t, \quad \alpha \in (0,1) \tag{3}$$

where X_t is land, L_t is the number of workers employed by the agricultural sector in period *t*, K_t is the quantity of physical capital, and H_t is the quantity of human capital (measured in efficiency units) employed in production in period *t*. Physical capital fully depreciates after one period.

The inputs are different in each production function. In the agricultural sector, the inputs are land, which is fixed over time, and labor, whereas in the manufacturing sector, the inputs are capital, which is accumulated over time, and labor. Furthermore, human capital is independent of labor productivity in the agricultural sector, whereas in the industrial sector, human capital has a positive effect on labor productivity. Because the markets in both sectors are perfectly competitive, the result of profit maximization is as follows.

$$w_t^A = F_L(X_t, L_t), \quad \rho_t = F_X(X_t, L_t) \tag{4}$$

$$R_t = \alpha k_t^{\alpha-1} \equiv R(k_t), \quad w_t^M = (1-\alpha)k_t^{\alpha} \equiv w^M(k_t) \tag{5}$$

where w_t^A is the wage rate per worker in the agricultural sector, ρ_t is the rate of return to land, R_t is the rate of return to capital, and w_t^M is the wage rate per efficiency unit of labor.

Recall that individuals in this model live two periods and have one parent and child. Each individual has the same preferences, so individuals only differ in their initial wealth. The utility function of individual *i* in period *t* is a log-linear utility function as follows.

$$u_t^i = (1-\beta)\ln c_{t+1}^i + \beta \ln b_{t+1}^i \tag{6}$$

where c_{t+1}^i is second-period consumption, b_{t+1}^i is a transfer to an individual's offspring, and $\beta \in (0,1)$. In the first period of an individual's life, he spends his time accumulating human capital. A fraction, $\tau_t \geq 0$, of his capital transfers from his parent, b_t^i, is collected by the government for the public education system, and a fraction, $1-\tau_t$, of these capital transfers is saved for future income. In the second period, he earns income, which includes wages, w_{t+1}, returns on capital, $b_t^i(1-\tau_t)R_{t+1}$, and returns on land, $x^i\rho_{t+1}$, and he allocates this income to consumption and bequests to his child. The entire stock of land that he receives from his parent is transferred to his child. Therefore, the second period income, I_{t+1}^i, of individual *i* is as follows.

$$I_{t+1}^i = w_{t+1} + b_t^i(1-\tau_t)R_{t+1} + x^i\rho_{t+1} \tag{7}$$

The optimal transfer of individual *i* born in period *t* is $b_{t+1}^i = \beta I_{t+1}^i$, and the optimal consumption of individual *i* born in period *t* is $c_{t+1}^i = (1-\beta)I_{t+1}^i$.

I assume there are only three homogenous groups of individuals in period 0, landowners, capitalists, and workers, who have the same preferences but have different initial

levels of wealth and landownership. Landowners own the entire stock of land X in the economy, and the fraction of all individuals who are landowners is given by $\lambda \in (0,1)$. Because all land holdings are transferred from parents to children, the distribution of landownership is constant over time, and each landlord possesses X/λ units of land. Capitalists possess the entire initial stock of physical capital, and their fraction in the population is given by $\mu \in (0,1)$. The rest of the individuals, whose fraction is given by $1-\lambda-\mu \in (0,1)$, are workers who own neither land nor physical capital. Because every individual has one parent and one child, the fraction of each type of worker does not change over time. As this economy develops, however, every individual can accumulate physical capital.

I further assume that landowners are the pivotal force in determining the implementation of public education policy. This assumption is not strong considering modern history. Then, I focus on the landowner's income evolution. The second period income of a landowner is

$$I_{t+1}^{L} = w(y_t, \tau_t; X) + (1-\tau_t)R(y_t, \tau_t; X)b_t^{L} + \rho(y_t, \tau_t; X)X/\lambda \qquad (8)$$

and his transfer to his child is

$$b_{t+1}^{L} = \beta[w(y_t, \tau_t; X) + (1-\tau_t)R(y_t, \tau_t; X)b_t^{L} + \rho(y_t, \tau_t; X)X/\lambda] \equiv b^{L}(y_t, b_t^{L}, \tau_t; X, \lambda) \quad (9)$$

As Galor et al. (2009) showed, theoretically, there exists a critical level of total capital transfers to all landowners, $\hat{B}_t^{L} = \lambda b_t^{L}$, such that the implementation of public education becomes more profitable for landowners despite the cost of tax. In other words, as the economy develops, the share of land in aggregate output decreases, and the stakes of landowners in other sectors increase. Because of these changes in landowners' economic interests, their opposition to public education decreases until eventually, they support public education instead. Therefore, an economy that has a powerful landed elite, which is akin to having higher inequality in landownership, tends to accumulate human capital slowly. Thus, inequality in landownership can have an adverse effect on human capital accumulation.

4 Historical Background

The main hypothesis of this paper is that land inequality has a negative effect on the timing of educational reform, which is measured by the proportion of public elementary school students during the period of industrialization. So far, this hypothesis has only been tested using data from the U.S. and Prussia (Galor et al. 2009, Cinnirella and Hornung 2011). All these countries experienced spontaneous industrialization that was driven by the

economic development of their own countries. Korea's development in the early twentieth century, however, occurred in a different context from these countries because Korea was under Japanese occupancy from 1905 to 1945, and its economy was determined by the Japanese economy.

Under Japanese rule, land distribution became skewed, and the ratio of tenants to all farming households grew from 42 percent in 1913 to 70 percent in 1945 (Eckert et al. 1991). The following policy of Japan and the Government-General, the chief colonial administrator, promoted this change. From the beginning of colonial period, the Japanese government encouraged migration from Japan to Korea and suggested that becoming a landlord was the ideal pattern of Japanese settlement in Korea (Kikkawa, 1904). In 1907, the Oriental Development Company, a semi-governmental Japanese company, began to purchase large amounts of land to entice Japanese settlers to Korea and eventually became the biggest landlord in Korea (Moskowitz 1974; Eckert et al. 1991). In 1912, the Japanese Land Survey on Korean Land also encouraged the increase in the tenancy rate because it strengthened the legal rights of landowners and increased Japanese investment in land. The interaction between strong landowners' rights, market forces, and increased population led to a higher tenant ratio (Kim et al. 1989; Shin 1982; Eckert et al. 1991).

Japanese rule also played a major factor in Korean industrialization. The Government-General intended to mold the Korean economy to fit Japan's needs by prohibiting the development of Korean industries and companies, promoting an agricultural economy in Korea, and selling Japanese industrial goods in the Korean market. However, because Japan was substantially industrialized after the First World War and because the Korean Peninsula is located between Japan and China, Japan began to promote some industry in Korea so as to establish a supply base to invade China, especially after the Japanese occupation of Manchuria. Korean industrialists, who were educated in the language and skills of entrepreneurs, did begin to appear after 1919. Nevertheless, Japanese colonial policy is the most important factor in understanding Korean industrialization under Japanese rule (Eckert et al. 1991).

The implementation of the public education system in Korea under Japanese rule also differed from that of the U.S. or Prussia in the nineteenth century. The purpose of public education under Japanese occupancy was to condition Koreans to be good citizens of the Japanese Empire, by teaching them Japanese culture and language. The public education system operated by the Government-General did coexist with Korean private schools, but these schools were oppressed. Moreover, the public education system was an unequal system differentiated by the quality of instruction. Korean students received a minimal level of schooling, whereas Japanese students received a more advanced education. The historical

context is, therefore, necessary for understanding the Korean public education system as well (Eckert et al. 1991; Kim 1999).

Despite the distinctive Korean colonial experience, however, the relationship between inequality in landownership and the public education system can be generalized in my model. Every local area reacted differently to the public education policy of the central government because of differences in characteristics, such as the degree of industrialization, urbanization, culture, geographical character, and inequality in landownership. Moreover, landowners were superior to tenants, controlled their tenants' farming, and could affect tenants' individual lives through their ruling power, as in serfdom in early nineteenth century Prussia (Soh 2005). Therefore, the level of elementary education could vary with respect to the degree of inequality in land distribution. Accordingly, this paper focuses on the variations in the reactions to educational policy across different regions.

Although this paper only examines the period before independence in 1945, the Korean historical context could allow a further investigation into the effect of land reform on education policy only after independence in 1945. After independence, Korea was divided into South Korea and North Korea, and land reform was included in the Constitution of the Republic of Korea (South Korea) in 1948. The Agricultural Land Reform Amendment Act was implemented in 1950, just before the Korean War. The Act stated that only farmers who cultivated the land could possess it and that each farmer could have at most three *jung-bo*, or around 30,000 m^2, of land. Furthermore, tenancy was prohibited. Land reform reallocated land, and the ratio of tenants to landowners officially became zero in 1950. The number of agricultural households that owned their own land jumped from 349,000 in 1949 to 1,812,000 in 1950 (Jeon and Kim 2000).

Soaring expenditures on education accompanied land reform. South Korea regarded literacy as vital for establishing democracy, and there was a campaign to increase the literacy rate. As a result, the illiteracy rate dropped from 78 percent in 1945 to 42 percent in 1948. In 1949, a new education law was passed in South Korea that aimed to supply public education to everyone and build a skilled workforce for industrial work. The implementation of this law was postponed until 1954, however, with the start of the Korean War in 1950. Thereafter, its implementation allowed the elementary school enrollment rate to grow from 54 percent to 96 percent in 1959. Koreans also recognized the importance of a nation's technical power through their experience with Japanese rule, and thus tried to build an education system with an emphasis on technical training and science. To do so, they founded a bureau under the direct control of the president that managed education in science and technical training and established a five-year plan for practical training to fortify industrial human capital (Ministry

of Education 1988). As a result, Korea industrialized quickly and is now a member of the OECD.

Despite Korea's unique colonial experience, its history in the twentieth century gives us a good opportunity to explore the relationship between inequality in landownership and education. First, given that under Japanese occupancy, tenancy prevailed and reactions to public education policy varied widely, I can analyze the relationship between the two. Second, after independence in 1945 and the implementation of land reform in 1950, the soaring enrollment rate in elementary schools supplied accumulated human capital to power Korean industrialization. Therefore, I can also analyze the different reactions to public education policy for the period from independence in 1945 to the implementation of the education law in 1954, with respect to the local tradition of landownership, even though tenancy was officially abolished after land reform in 1950. In this paper, however, I focus only on the period of Japanese occupancy and leave the period after independence to future studies. Given the controlling colonial factors, I can test the relationship between land inequality and education.

5 Empirical Analysis

5.1 Data description

The data in this paper are sourced from the *Annual Statistical Report of the Government-General*. The Government-General, which formed the Japanese colonial government in Korea from 1910 to 1945, published the Report annually during their rule of the Korean Peninsula until 1943. As the name suggests, the Report was a compilation of the most important statistical information. These data were first collected in 1907 by the Residency-General (i.e., the data supplied information from 1906). The investigated items changed over the Japanese ruling period, but they remained consistent for the time period I consider in this paper (i.e., 1934 to 1942). My data include items such as land and weather, population and households, agriculture, manufacturing, fishery, forestry, money and banking, education, religion, finance, etc. (Park and Seo 2003).

5.2 Empirical specification and results

The empirical analysis in this paper examines the effect of equality in the distribution of landownership on the level of education. Equality in the distribution of landownership,

$LandEquality_{i,t-1}$, is measured as the ratio of the number of farmers who cultivated their own land to the total number of farmers in province *i* in period *t* − 1. The reason that I use equality rather than inequality is that it is difficult to measure the level of inequality in landownership because there was variation in tenancy. For example, some farmers cultivated leased land and their own land simultaneously. The level of education, $Education_{i,t}$, is measured as the number of public elementary school students per person in province *i* in period *t.* The data cover eight periods of observation from 1934 to 1942 and 13 provinces. A period of observation is one year, so that when *t* is 1935, *t* − 1 is 1934, and so on through 1942.

I use the following empirical specification.

$$Education_{i,t} = \beta_0 + \beta_1 LandEquality_{i,t-1} + \boldsymbol{B}\boldsymbol{X}_{i,t-1} + \upsilon_{i,t} \qquad (10)$$

where X is the vector of control variables including the share of farmers in province *i* in period *t* − 1; the share of jobs requiring more human capital, which is the share of workers, such as merchants and public officials, in high human capital occupations in province *i* in period *t* − 1; the rate of population growth in province *i* in period *t* − 1; the share of Japanese individuals in province *i* in period *t* − 1; and the number of public elementary schools per 1,000 people in province *i* in period *t* − 1. This formulation captures the lag in making changes to education with respect to current economic and political conditions. Table 1 provides summary statistics of variables.

(insert Table 1 here)

This paper uses panel data. A primary benefit of panel data is that it can solve the problem of unobserved heterogeneity, whereas it is difficult to control in cross-sectional or time series data. The error term $\upsilon_{i,t}$ can be divided into time invariant unobserved heterogeneity across provinces in the level of education, η_i, and variations in the time effect at the national level, δ_t. That is,

$$\upsilon_{i,t} = \eta_i + \delta_t + \varepsilon_{i,t} \qquad (11)$$

Because data in this paper are not a sample of the population but rather reflect the entire population, it is reasonable to think of $\upsilon_{i,t}$ as a parameter to be estimated instead of a random variable. My model, then, is a two-way fixed effects model.

(insert Figure 1 here)

The positive correlation between land equality and education is apparent in Figure 1. The points in the circle represent data from the GyeongGi province, which includes Seoul, the capital city of Korea. It had both the smallest share of farmers and the highest level of urbanization, which are two variables to be controlled for.

(insert Figure 2 here)

In Figure 2, I remove data pertaining to the GyeongGi province, and I find stronger evidence of a positive correlation between land equality and education.

(insert Table 2 here)

Table 2 depicts the results of this estimation in columns (1)–(6). Lagged land equality has a positive and highly significant effect on education with no controls (column (1)) as well as when controlling for the share of agriculture, the share of jobs requiring a high level of human capital, the rate of population growth, the share of Japanese individuals, and the number of public elementary schools per 1,000 people. As one would expect, column (2) shows that the share of agriculture has a negative and highly significant effect on education, and we continue to observe a positive and significant effect of land equality on education. Similarly, as the theory predicts, the share of jobs requiring more human capital has a positive and highly significant effect on education. Because of collinearity between the share of agricultural jobs and the share of jobs requiring more human capital, I include only the latter in the regressions in columns (4)–(6). The coefficient on the share of jobs requiring a high level of human capital is positive and significant. In columns (4)–(6), the effect of the population growth rate on education is negative and highly significant, reflecting the quantity-quality trade-off in education in this period. The share of Japanese individuals has a positive and highly significant effect, reflecting the fact that Japanese individuals in Korea tended to receive more education. Even controlling for the share of Japanese individuals, the positive and strong effect of land equality on the education holds. It is possible that the significant relationship between land equality and education may not have held when colonial factors were controlled for, if the colonial government had made a decision on land equality and on education simultaneously. However, the levels of land equality and education were not decided upon by the colonial government at the same time. It is true that tenancy did increase

with the colonial government's encouragement towards land inequality during the colonial regime. However, according to Soh (2005), before the 1930s, the tenancy rate had stabilized and land equality during the period being considered in this study was affected by the level of agricultural output of each year. Also, because landowners were superior to tenants and controlled the tenants' production processes and economic conditions, the decision of the tenant's household pertaining to their children's education could not result only from the education policy of the central government. In column (6), I control for the number of schools per 1,000 people to isolate the effect of the supply of schools on education. The coefficient on the number of schools per 1,000 people is not significant, and including this control does not change my coefficient of interest.

(insert Table 3 here)

(insert Table 4 here)

Tables 3 and 4 present robustness checks. In both cases, the effect of land equality on education is positive and highly significant. The main findings in Table 2 are consistent with the findings of Table 3 (lagging land equality by two years) and Table 4 (no lag at all), and are thus robust.

I tried to perform an instrumental variables (IVs) estimation, as done in Galor et al. (2009) and Cinnirella and Hornung (2011). These papers used the following instrumental variables: the relative price of agricultural goods, which reflects the differential effect of agricultural prices over time on the concentration of landownership across regions, and the climatic conditions of each region, which are region-specific but time invariant. However, the outbreak of the Pacific War in 1939 led the Japanese colonial government to control both the price and the distribution system of food. We, therefore, do not have the relevant data to use this identification strategy. Nevertheless, endogeneity is sufficiently controlled in the fixed effects model with panel data.

6 Conclusion

Human capital accumulation plays a critical role both in the transition from Malthusian stagnation to modern growth and in the timing of modern growth's implementation. Institutions promoting human capital accumulation have contributed to the

great divergence in per capita income across countries. Credit market imperfections provide one well-studied hurdle for the accumulation of human capital, but non-financial hurdles are also important impediment for human capital accumulation.

The historical empirical evidence of the effects of these non-financial hurdles in the current economic literature, however, is limited to Prussia in the nineteenth century and the U.S. in the early twentieth century. These two countries industrialized on their own development paths spontaneously. Korea under Japanese occupancy, by contrast, developed in a different context from these two countries because of its colonial experience. Nevertheless, the adverse effect of inequality in landownership on the accumulation of human capital holds, which means that the model formalized by Galor et al. (2009) can be applied to more general cases.

I used a panel dataset with observations from 13 regions in each year from 1934 to 1942. With panel data, I controlled for unobserved variables using a two-way fixed effects model and solved the endogeneity problem. Although land distribution and the public education system in Korea were driven in part by the colonial powers, reactions to the central education policy varied by region because of differences in the level of inequality of landownership. My results showed that landownership inequality, a non-financial hurdle, had a strongly significant effect on human capital accumulation.

Finally, these results could be strengthened by further research analyzing the effect of inequality in landownership under Japanese occupancy on growth in education after the land reform and education reform laws in 1950 were enacted. This analysis would determine the long-run effects of non-financial hurdles on human capital accumulation, one of the driving forces of Korean economic growth.

References

Cinnirella F, Hornung E (2011) Landownership concentration and the expansion of education. CESifo working paper series No. 3603. CESifo Group Munich

Eckert CJ (1991) *Offspring of Empire: The Koch'ang Kims and the Colonial Origins of Korean Capitalism, 1876–1945*. University of Washington Press, Washington

Eckert CJ, Lee K-B, Lew YI, Robinson M, Wagner EW (1991) *Korea Old and New: A History*. Ilchokak Publishers, Seoul

Engerman SL, Sokoloff KL (2011) *Economic Development in the Americas since 1500: Endowments and Institutions, 1st ed.* Cambridge University Press, Cambridge

Galor O (2005) From stagnation to growth: unified growth theory. In: Philippe A & Steven D (eds) Handbook of economic growth. Elsevier, pp 171–293

Galor O (2011) Unified Growth Theory. Princeton University Press

Galor O (2011) Inequality, human capital formation and the process of development. NBER working paper no. 17058. National Bureau of Economic Research, Inc

Galor O, Moav O (2004) From physical to human capital accumulation: inequality and the process of development. Rev Econ Stud 71: 1001–1026

Galor O, Moav O (2006) Das human-kapital: a theory of the demise of the class structure. Rev Econ Stud 73: 85–117

Galor O, Moav O, Vollrath D (2009) Inequality in landownership, the emergence of human-capital promoting institutions, and the great divergence. Rev Econ Stud 76: 143–179

Galor O, Weil DN (2000) Population, technology, and growth: from Malthusian stagnation to the demographic transition and beyond. Am Econ Rev 90: 806–828

Galor O, Zeira J (1993) Income distribution and macroeconomics. Rev Econ Stud 60: 35–52

Jeon Y, Kim Y (2000) Land reform, income redistribution, and agricultural production in Korea. Econ Dev Cult Change 48: 253–268

Kikkawa S (1904) *Kankoku Nogyokeieiron (Discourse of Management of Korean Agriculture)*. DiaNihon nokai, Tokyo

Kim S, Jeon K, Jang S, Park Y (1989) A study on the history of land reform. Korea Rural Economic Institute, Seoul

Kim J (1999) *The History of Korean Education over a Hundred Years: 1880–1999*. Kyoyooksinmoonsa, Seoul

McNamara DL (2006) *The Colonial Origins of Korean Enterprise: 1910–1945*. Cambridge University Press, Cambridge

Ministry of Education (1988) The history of education over 40 years. Ministry of Education, Seoul

Moskowitz K (1974) The creation of the Oriental Development Company: Japanese illusions meet Korean reality. Occasional papers on Korea, no. 2, 3

Papageorgiou C, Razak NAA (2009) Inequality, human capital and development: making the theory face the facts. MPRA paper no. 18973. University Library of Munich, Germany

Park M, and Seo H (2003) *Colonial Authority and Statistics; Statistical System of the Choson Government-General and Census*. Seoul National University Press, Seoul

Shin Y (1982) *A Survey on the Land Survey Program of Korea under Japanese Colonial Rule*. Jisik Sanup Publication Company, Seoul

Soh SY (2005) Structure and evolution of landowner-tenant relationship in the colonial "Chosun." Korean J Agric Hist 4(2): 65–88

Sokoloff KL, Engerman SL (2000) Institutions, factor endowments, and paths of development in the new world. J Econ Perspect 14: 217–232

Fig. 1 Land equality and education in all regions. The points in the circle represent data from the GyeongGi province, which includes Seoul, the capital city of Korea.

Source: the Annual Statistical Report of the Government-General

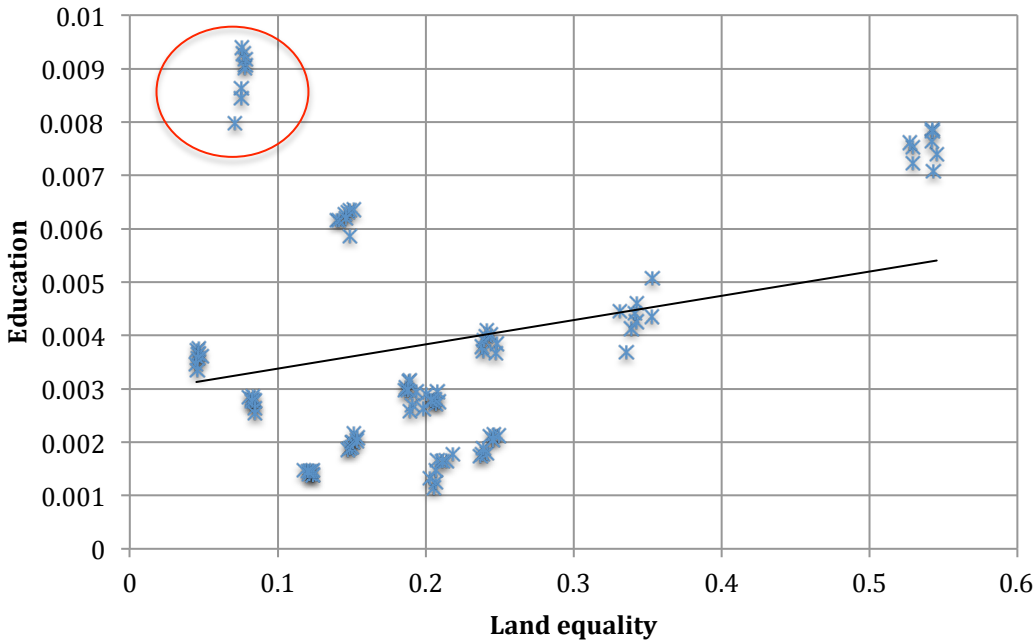

Fig. 2 Land equality and education excluding the GyeongGi province.

Source: the Annual Statistical Report of the Government-General

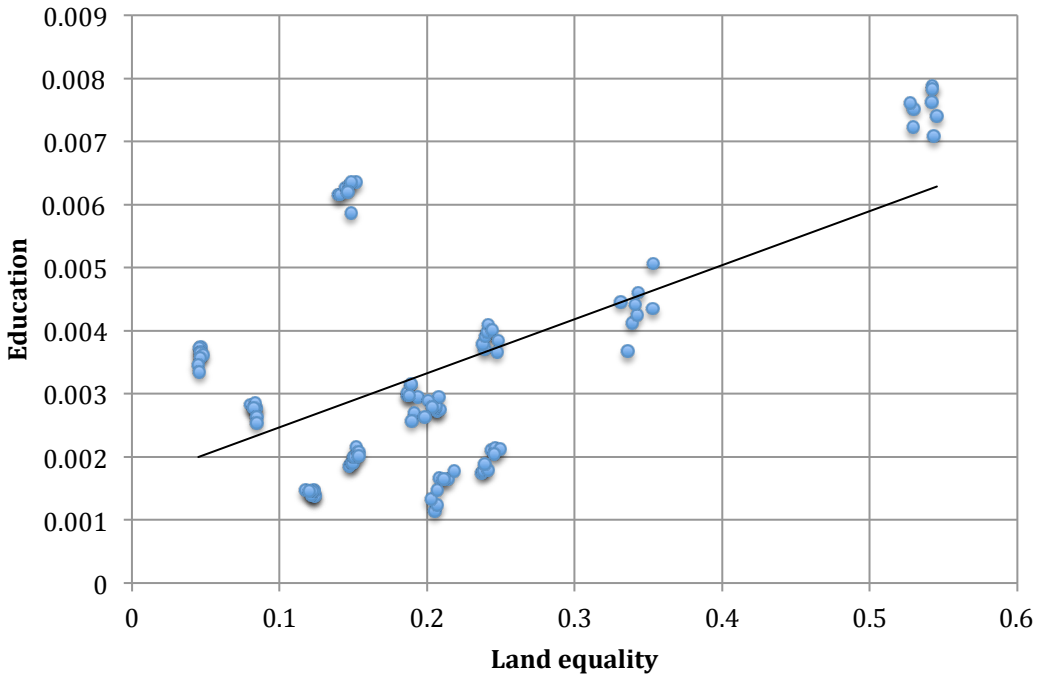

Table 1 Summary statistics

	Mean	Std.dev.	Min	Max
number of elementary school students per person	0.0038	0.0023	0.0011	0.0094
land equality	0.1989	0.1248	0.0450	0.5455
share of agriculture	0.7283	0.1161	0.3612	0.8750
share of jobs requiring more human capital	0.1542	0.0699	0.0774	0.3823
population growth rate	0.0276	0.0273	-0.0194	0.1389
share of Japanese	0.0271	0.0175	0.0087	0.0666
number of schools per population	0.0118	0.0056	0.0033	0.0262

Land inequality is the ratio of the number of farmers who cultivated their own land to the total number of farmers. Share of agriculture is the share of farmers and the share of jobs requiring more human capital is the share of workers such as merchants and public officials, which are high human capital occupations. The number of schools per population is the number of public elementary schools per 1,000 people.

Source: the Annual Statistical Report of the Government-General

Table 2 The relationship between education and land equality (Fixed effects model with 1-year lag)

Explanatory variables	Dependent variable: number of elementary school students per person					
	(1)	(2)	(3)	(4)	(5)	(6)
land equality	**0.0189*** **	**0.0231*** **	**0.0235*** **	**0.0235*** **	**0.0248*** **	**0.0245*** **
	0.0051	0.0048	0.0046	0.0045	0.0044	0.0045
share of agriculture		**-0.0031*** **				
		0.0007				
share of jobs requiring more human capital			**0.0068*** **	**0.0089*** **	**0.0043***	**0.0045***
			0.0014	0.0017	0.0022	0.0023
population growth rate				**-0.0030** **	**-0.0039*** **	**-0.0039*** **
				0.0014	0.0013	0.0014
share of Japanese					**0.0465*** **	**0.0453*** **
					0.0158	0.0167
number of schools per population						**0.0065**
						0.0251
National time fixed effect	yes	yes	yes	yes	yes	yes
Regional fixed effect	yes	yes	yes	yes	yes	yes
R2 (within)	0.3285	0.4484	0.4761	0.5053	0.5533	0.5537
Observation	104	104	104	104	104	104

Note: ***denotes significance at the 1% level, ** at 5%, and * at 10%.

Table 3 The relationship between education and land equality (Fixed effects model with 2-year lag)

Explanatory variables	Dependent variable: number of elementary school students per person					
	(1)	(2)	(3)	(4)	(5)	(6)
land equality	**0.0148****	**0.0195*****	**0.0208*****	**0.0208*****	**0.0209*****	**0.0213*****
	0.0059	0.0059	0.0059	0.0059	0.0059	0.0062
share of agriculture		**-0.0029*****				
		0.0010				
share of jobs requiring more human capital			0.0059***	**0.0062****	**0.0037**	**0.0036**
			0.0019	0.0024	0.0034	0.0035
population growth rate				**-0.0002**	**-0.0007**	**-0.0008**
				0.0016	0.0017	0.0018
share of Japanese					**0.0221**	**0.0238**
					0.0214	0.0231
number of schools per population						**-0.0069**
						0.0335
National time fixed effect	yes	yes	yes	yes	yes	yes
Regional fixed effect	yes	yes	yes	yes	yes	yes
R2 (within)	0.2707	0.3446	0.3597	0.3599	0.3698	0.3702
Observation	91	91	91	91	91	91

Note: ***denotes significance at the 1% level, ** at 5%, and * at 10%.

Table 4 The relationship between education and land equality (Fixed effects model with no lag)

Explanatory variables	Dependent variable: number of elementary school students per person					
	(1)	(2)	(3)	(4)	(5)	(6)
land equality	**0.0060**	**0.0118*** **	**0.0104** **	**0.0111** **	**0.0142*** **	**0.0108*** **
	0.0048	0.0045	0.0045	0.0045	0.0038	0.0041
share of agriculture		**-0.0037*** **				
		0.0007				
share of jobs requiring more human capital			**0.0069*** **	**0.0083*** **	**-0.0005**	**0.0008**
			0.0015	0.0017	0.0020	0.0021
population growth rate				**-0.0026**	**-0.0040*** **	**-0.0042*** **
				0.0014	0.0012	0.0012
share of Japanese					**0.0911*** **	**0.0829*** **
					0.0149	0.0153
number of schools per population						**0.0413** *
						0.0210
National time fixed effect	yes	yes	yes	yes	yes	yes
Regional fixed effect	yes	yes	yes	yes	yes	yes
R2 (within)	0.2199	0.3844	0.3610	0.3827	0.5603	0.5782
Observation	117	117	117	117	117	117

Note: ***denotes significance at the 1% level, ** at 5%, and * at 10%.