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PROPERTY RIGHTS AND FINANCIAL DEVELOPMENT:  
THE LEGACY OF JAPANESE COLONIAL INSTITUTIONS

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### **ABSTRACT**

Several studies link modern economic performance to institutions transplanted by European colonizers and here we extend this line of research to Asia. Japan imposed its system of well-defined property rights in land on some of its Asian colonies, including Korea, Taiwan and Palau. In 1939 Japan began to survey and register private land in its island colonies, an effort that was completed in Palau but interrupted elsewhere by World War II. Within Micronesia robust economic development followed only in Palau where individual property rights were well defined. Second, we show that well-defined property rights in Korea and Taiwan secured land taxation and enabled farmers to obtain bank loans for capital improvements, principally irrigation systems. Our analytical model predicts that high costs of creating an ownership updating system and a citizen identity system discourage a short-sighted government from implementing these crucial components, the absence of which gradually makes land registration obsolete. Third, considering all of Japan's colonies, we use the presence or absence of a land survey as an instrument to identify the causal impact of new institutions. Our estimates show that property-defining institutions were important for economic development, results that are confirmed when using a similar approach with British Colonies in Asia.

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## 1. Introduction

When and why developed nations became rich are central questions in economics and history. The process was undoubtedly complex, involving many factors such as government policies, investments in infrastructure, terms of trade, legacies of colonialism, natural resources, climate, and luck. Differential economic progress around the globe over the past half century has stimulated a search for fundamental conditions that trigger and sustain the process of development and modernization.

Many researchers now recognize the importance of institutions that protect property rights for economic development (La Porta et al. 1997, 1998; Acemoglu et al. 2001, 2002; Engerman and Sokoloff 1997, 2002; Banerjee and Iyer 2005; Nunn 2008). Economic agents are less willing to invest if others can seize the returns of their investments (Demsetz 1967, Alchian and Demsetz 1973). Research on the institutional roots of economic development often pays homage to the work of Douglass North and collaborators, who were trying to understand the onset and geographic spread of industrialization within Europe (North 1990, North and Weingast 1989). They linked England's head start, for example, to the Glorious Revolution of 1688, which limited the confiscatory power of the Crown and strengthened rights in private property. In their view, the commitment to property rights lowered interest rates on public and private investments that became the building blocks of industrialization. While the pathway is plausible, the historical data available to confirm the linkage to British industrialization is modest.

This paper contributes by clarifying the pathways between property-defining institutions and growth, and by incorporating work on a neglected continent, Asia. We divide property rights into two categories: institutions that 'define' property rights such as a land survey system and a land registration system and those that 'protect' property rights such as land expropriation laws or constitutional safeguards against property takings. We assess the economic legacy of institutional change imposed by Japan on its Asian colonies which were acquired through an opportunistic process of territorial expansion. We argue that decisions to colonize were exogenous to late twentieth century growth, a point substantiated by results from the quasi experiment in Micronesia. We return to the issue of exogeneity later in the paper. Prior to colonization these countries had complex systems of land tenure that impeded

transactions, including multiple ownership, clan or lineage ownership, poorly defined boundaries, and lack of official titles. In an effort to generate tax revenue, Japanese colonial administrators abolished these complex systems in favor of single ownership, official titles, updated land registers and boundaries established by clear survey maps. A new system made plain who was responsible to pay taxes.

Our inquiry is inspired by rates of economic growth that were vastly different across Asia, where Japan was the only Asian country to successfully begin industrialization in the late nineteenth century. Asian tigers (South Korea, Taiwan, Hong Kong, and Singapore) successfully industrialized in the second half of twentieth century while other countries in the region are currently underway or have yet to begin. The ratio of per capita GDP between the most developed country and the least developed country in Asia is over 25:1. We ask to what extent might contrasting systems of property rights account for differential growth?

The case of Palau – an island country in Micronesia – provides a quasi-experimental setting, which shows that secure private property defining institutions provided a foundation for economic development. Japan controlled Micronesia from 1914 to 1945, and in Palau surveyed and registered private ownership from 1939 to 1941, classifying land into four categories: public, clan, lineage, and individual. In 1941 Japan began to survey other Micronesian countries, but the process was interrupted by World War II. After the war the U.S. controlled Micronesia, and in Palau, American judges upheld land titles originating from the Japanese land registers. The American judges consistently concluded that clans or lineages did not have any authority over private land. In other Micronesian countries, the American judges lacked legal proof of private ownership and following the tradition of common law, upheld customary ownership rights that allowed a village or clan leaders to confiscate or deny land-use rights if a resident neglected customary obligations to the village. As a result foreigners only invested in private lands that were protected in an absolute way, as in Palau. In 2007, Palau was three times richer than other Micronesian countries.

The Asian experience suggests that the Japanese land survey was initially motivated by public finance. Land has two special characteristics which distinguish it from other assets: it is "immovable" and

"everlasting." Generally it is easier for the government to tax land as opposed to other assets that can be readily "hidden." Effective land taxation, however, requires registers and maps to identify parcels, as well as a system linking taxpayers to the registers (Cho 2003). In many countries, land taxes are evaded because the government cannot link registers, maps, and taxpayers. The Japanese land survey and registration system secured land taxation and thus promoted public finance.

The solution of a public finance problem eventually was important for private finance. The characteristics of land make it attractive to banks as collateral for loans. Our analysis shows, however, that banks accept land as collateral only if secure title and well-defined boundaries were part of a central ownership verification system. The Japanese land registration system was designed to preempt ownership and boundary disputes and was well integrated to the ownership updating system and the citizen identity system.<sup>1</sup> Thus, it promoted private capital markets. Because land was the most abundant and important asset in these agricultural economies, its collateralization provided a major boost for economic development. Especially, when farmers obtained access to credit, they invested in irrigation systems that increased agricultural productivity.

A review of the history of land reforms shows that establishing a good land tenure system was more difficult than one might expect. First, reforms had to contend with rough boundaries used in the past. Landowners tended to exaggerate the size of their land parcels in private land transactions, thus most plots carried a history of boundary disputes. Second, the core of secure land transactions and collateralization is a centralized ownership verification system, which required not only land registration, but also a citizen identity system and an ownership updating system. Most governments, however, did not fully understand the importance of these components. Finally, land reforms usually change the whole structure of a society, and thus governments potentially face huge costs from socioeconomic and political destabilization.

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<sup>1</sup> Feder et al. (1986), SMERU Research Team (2002), Do and Iyer (2008) find that land titling has positive impacts on credit markets but some studies ignore the importance of secure title and central verification, and reach the opposite conclusion, as do Boucher, Barham, and Carter (2002), Field and Torero (2004), and Galiani and Schargrofsky (2006).

In order to understand the conditions under which governments undertake effective land reforms that can promote long-run growth, we construct a simple model. The analytical model based on the stylized facts of land reforms shows that a short-sighted government chooses an interior solution, surveying only a portion of land, and does not create a citizen identity system or an ownership updating system. In sharp contrast, a far-sighted government chooses a corner solution having all the major components of well-defined property rights. The model shows that the main difference between the short-sighted reform and the far-sighted reform is future tax revenue. The real tax revenue from the interior solution without the updating system decreases over time because state's land registers gradually become obsolete. Conversely, the real tax revenue from the corner solution is stable because the updated land registers and the citizen identity system maintain current information for tax collection. The model also shows that stable tax revenue enables the government to reduce tax rates, to be less arbitrary, and to engage in long-range planning. Moreover, the creation of the updating system and the citizen identity system provides the institutional foundation for land collateralization.

Finally, the paper estimates the impact of institutions on economic growth by using 2 Stage Least Squares (2SLS) and an instrumental variable that is directly related to the property defining institutions. Japan acquired its colonies through wars from the 1890s to the early 1940s, including Taiwan and South Korea. Japan lost all of these colonies after World War II and its land survey was interrupted in some places by the war. We argue that whether Japan conducted and completed a formal land survey is an appropriate instrument for property defining institutions (i. e. land tenure system). Our estimates show that property-defining institutions stimulated financial markets that contributed to economic development.<sup>2</sup> Our results are confirmed when using a similar approach with British Colonies in Asia.

## **2. The Evolution of Property Rights in Japan and its Colonies**

According to Wakita (1991), the Taiko land survey of the late sixteenth century established a secure land tenure system in Japan, whose main purpose was separation of the warrior and peasant classes (Asao 1991). Before unification by Toyotomi Hideyoshi in the 1590s, a samurai owned peasants

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<sup>2</sup> We have research underway on Taiwan and Korea, which substantiates our argument based on micro-level data.

in his fief. Thus, the samurai could turn the peasants into soldiers, which provoked many revolts. In order to prevent the frequent rebellions, Toyotomi Hideyoshi separated the two classes. Because the warrior class collected taxes in his fief, the separation required a new tax collection system. Therefore, the Taiko land survey identified the cultivator for every plot, which made clear who was responsible to pay the tax.

About 300 years later Japan further modernized the land tenure system. New tax laws promulgated in 1873 provided a uniform land tax, which was payable in money rather than rice and was assessed on the value of land, not the size of the harvest. Thereafter, peasants not only received title to the land, but gained the ability to buy and sell land, grow vegetables or fruit instead of rice as they saw fit, and even abandon their land if they wished (Duus 1976).

Between 1895 and World War II Japan occupied dozens of countries or territories in Asia. The map given in figure 1 presents a rough time line of territorial acquisitions<sup>3</sup>, beginning with Taiwan, acquired at the conclusion of the Sino-Japanese war in 1895. Japan invaded the Liaodong peninsula during the Russo-Japanese war of 1904-1905, and by terms of the Treaty of Portsmouth retained Liaodong peninsula and the southern portion of Sakhalin Island. In 1905 Japan declared Korea as a protectorate, and completed the process of colonization by annexation in 1910. Japan supported the Allies in World War I and was later rewarded with Germany's colonies in the Pacific (Palau, the Northern Mariana Islands, the Marshall Islands, and the Federal States of Micronesia). Japan became increasingly militaristic in the 1930s and 1940s, invading Manchuria in 1931 and occupying the remaining territories in the south, from the Philippines to Indonesia and Indochina, during World War II.

Table 1 summarizes important aspects of pre-colonial land rights in Taiwan and Korea. The first column repeats the salient features of the modern Japanese system: single owner; universal land registration that is updated as transactions occur; titles linked to a central registration system; and cadastral surveys (i. e. official boundary surveys). Other areas that became Japanese colonies might have had single owners (Korea) but much of the land was either unregistered or the registers were outdated,

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<sup>3</sup> Japan acquired Okinawa, the Kuril and other islands from 1886 - 1895.

titles were not linked to a central system and surveys were based on landmarks. The systems in Taiwan had similar problems and were even more complex than found in Korea with separate top-soil and sub-soil owners.

Japanese colonial governments completed land surveys in Taiwan (1898 - 1905) and Korea (1911 -1918) by which land ownership was identified and registered. After the survey, registered land increased by 215% in Taiwan (Ka 1995) and by 80% in Korea (Kwon 1989). The main purpose of these land surveys was to facilitate tax collection, which was needed to offset costs of colonial administration. Two years after the completion of the land survey, tax revenue increased more than three fold in Taiwan (Ka 1995) and two fold in Korea (Kwon 1989).

### **3. A Natural Experiment in Micronesia**

One might suspect that we emphasize the completion of a land survey in Taiwan and South Korea because these countries later became rich. In identifying the long-run economic effects of property rights, one must consider the problem of reverse causality, i. e. secure property rights can be a result of economic development.

Reverse causality is not an issue in the case of Palau, a Pacific island that enjoys three times the GDP per capita (\$7,600 in 2007) compared to other countries in Micronesia (the Marshall Islands, \$2,900 and the Federated States of Micronesia, \$2,300 in 2007). The case of Palau is illustrative because the Pacific islands have quite similar initial economic conditions (isolated geographic location and extremely limited land area) and a tradition of clan ownership.

Arguably Palau can be interpreted as an outcome of a natural experiment. Because of its favorable geographic location – for observing British activities in New Guinea as well as American activities in Guam and the Philippines – relative to other Japanese interests in the region, Palau became the civil headquarters of Micronesia in 1922 (Mangefel and Caldwell 2005, 41). One might suspect that Palau was chosen for its economic potential. This was not the case. Japanese evaluation of Micronesia in 1916 failed to mention economic potential (Purcell 1967, 153). As a matter of fact, during the German era (1899 – 1914) the Marshall islands, which had abundant coconuts, was the economic center of



Micronesia, and Truk (a state of the Federated States of Micronesia) had a large population based on favorable fishing conditions. Moreover, the Germans dug a canal and installed an undersea cable station in Yap (a state of the Federated States of Micronesia next to Palau), but neglected development in Palau (Etpison 2004).

In Micronesia, the Japanese colonial government first identified the boundaries between public lands and private lands from 1923 to 1937. Then, Japan identified owners and boundaries of private lands and made land registers in the Northern Mariana Islands from 1937 to 1939 and in Palau from 1939 to 1941 (Purcell 1967). However, in the Federated States of Micronesia and the Marshall islands, the Japanese land survey, begun in 1941, was curtailed and eventually stopped by the onset of World War II (Damas 1994, McGrath and Wilson 1971). Consequently, the Federated States of Micronesia and the Marshall islands still operate under the clan ownership system.

Legal cases in Micronesia clearly show the legacy of the Japanese land registration system. From 1945-1981 Micronesian countries became the Trust Territory of the United States and during this era courts consistently upheld land rights defined by the Japanese land survey in Palau. The American judges consistently concluded that clans or lineages did not have any authority over private land. (*Orrukem v. Kikuch*, Trust Territory Reports (T.T.R.) vol. 2, 533).<sup>4</sup>

In sharp contrast, in the Federated States of Micronesia and the Marshall Islands, American judges were unable to find any basis or evidence of private land ownership and therefore customary land law applied. In Micronesia land tenure was based on clan, lineage or group ownership and most customary law allowed the chief to confiscate (customarily assigned) land if an individual violated village traditions. Consequently, the courts allowed (or sometimes enforced) the confiscation of land if a plaintiff provided clear evidence of violation of the customs by, for example, failing to attend important village activities (for example, *Amon v. Tobeke* T.T.R. vol. 6, 36; *Tamaggimed v. Bathin*, T.T.R. vol. 2, 499; *Phillip v. Carl*, T.T.R. vol. 3, 330; *Mita v. Piriska*, T.T.R. vol. 3, 168). With the exception of Palau,

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<sup>4</sup> See also *Ngiruhelbad v. Merii, Imesei, and Tarkong*, T.T.R. vol. 1, 367; the opinion of the Appellate Division in that action affirming the decision of the Trial Division, T.T.R. vol. 2, 631; the opinion in the case of *Lusii Orrukem v. Kikuch and Issak*; Palau District Civil Action No. 194.

this kind of legal tradition remains in Micronesia. In Yap, Civil Action No. 2008-043 states that “Generally, land titles in Yap ... do not have the same meanings as land titles held elsewhere. ... the titles are generally subject to various conditions or interests whether or not the conditions or interests are mentioned in the certificates of title” and the municipal judges can nullify land titles if the land owner violates the traditional customs (Yap state government, Section 7 of Yap State Law 2-38).

One might suspect that other factors such as education, health or infrastructure investments that were either unique or relatively more important to Palau led its economic growth. However, from 1945 to 1981, U. S. policy treated these countries as one political entity, the Trust Territory of the Pacific Islands.<sup>5</sup> In fact, Japan and the United States built and repaired roads, harbors, and airfields not only in Palau but also in the Marshall Islands and the Federated States of Micronesia (Close up Foundation 2000, Boecker 1993). Moreover, there was a large expansion of American-style education<sup>6</sup> and significant sanitation improvements in Palau, the Marshall Islands, and the Federated States of Micronesia after 1945. Economic growth, however, was robust only in Palau where Japan transferred its land tenure system completely.

One can also study the relationship between secure land tenure and development within Palau. Three of the 16 states in Palau – Aimeliik, Airai, and Ngardmau – lack the Japanese land registers because they were apparently misplaced in storage or lost in transit to Guam (Trust Territory of the Pacific Islands Office of Land Management, Note on Duplication 1967). Court records from 2000 to 2010 show that in Babledaob Island, where ten out of sixteen states are located, the three states lacking the Japanese land registers have more disputes (58.9%) in issuing land certificates than other states (27.2%) (table 2).

The relationship between the lack of a land register and low development is most clearly observed in the state of Ngardmau, which sank from one of the most to the least developed states in Palau after the land registers were lost. During the colonial era the state became relatively prosperous after the

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<sup>5</sup> Palau and the Marshall Islands voted for independence, declining to join the Federated States of Micronesia.

<sup>6</sup> The U. S. navy estimated that about 90% of primary school age children were enrolled in schools and 95% of them were attending in 1950s (Mangefel and Caldwell 2005).

Japanese opened bauxite mines. In the 1960s, many Japanese companies wanted to reopen the mines, but the unclear boundary between public and private lands discouraged this (Petrosian-Husa, Miko, Smaserui 2002). Vague boundary and the slow process of land titling were the main obstacles to reopening the mines and invigorating economic development.<sup>7</sup>

#### **4. Comparison of Land Reforms**

Comparing the traditional land tenure system of Taiwan during the Qing period and colonial land tenure system of Taiwan during the Japanese colonial period helps to identify the relationship between secure land tenure and economic development. According to Lin (2008), although the Qing government supported economic development, its system had little success in attracting outside capital and modern technology due to insecure and complex property rights. In southern China and Taiwan, custom recognized top-soil and sub-soil rights. The former were permanent tenancy contracts that the community recognized as a kind of property (the tenant leased the land for three or four generations). Both top-soil and sub-soil rights could be leased. The dual owner system provided security for tenants, but made land transactions and tax collection very difficult (Macauley 2009). Only the native Taiwanese could control every aspect of complex property rights: multiple owners and potentially numerous rental contracts (Ka 1995).

From June of 1886 to December of 1889 (10 years before the Japanese occupation), a Chinese general Liu Ming-chuang reformed the land tenure system of Taiwan, an effort that cost 426,635 ounces of silver. Notably the general did not create an updating system to register land sales, new land reclamation or other changes from that point onward. Consequently, this new system gradually lost its effectiveness, as had happened with earlier reforms. Their priority was to determine which landowner should be taxed under the new system (Lin 2008).

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<sup>7</sup> One may suspect that destruction during World War II might be the cause of slow development in Ngardmau, which is one of the states on Babeldaob island. In 1947, the U. S. Geological survey evaluated Ngardmau's potential for bauxite mining (Petrosian-Husa, Miko, and Smaserui 2002). They concluded that the principle asset remaining were the roads and railway grades, which could be restored and used to good advantage. The water mains, reservoirs, causeway, pier and also possibly the aerial tramway could be rehabilitated at moderate expense. In Palau, war destruction was heaviest in the adjacent islands of Peleliu and Angaur, which were the only areas of Palau the United States invaded.

In contrast, the Japanese colonial government introduced the modern, single owner, land tenure system based on accurate cadastral surveys. Its total expenditures in surveying land and making registers were about 4,230,905 ounces of silver (ten times of the expenses of Liu's reform; the original expenditure was 5,357,188 yen; the annual budget of the traditional Taiwanese government was about 1 million yen). More importantly, coupled with a series of land registry regulations, household registry rules, and other administrative measures, the government could now record all changes in land distribution and household composition (Lin 2008). In order to introduce a single ownership system, the Japanese colonial government bought all sub-soil rights and gave legal title to top-soil owners, at a of about 2 million yen (Ka 1995).

After the land reform, land yields and agricultural productivity increased by 81% from 1901 through 1938 (Lin 2008) and Taiwanese landlords who benefited from the land-tax reform continued to save and to invest in commercial enterprises such as sugar and rice processing (Ka 1995). Moreover, a large amount of Japanese capital flowed to Taiwan (Myers and Peattie 1984).

The comparison of Japanese and American land reforms in Micronesia also helps to identify the conditions crucial to success. Japan occupied Micronesia from 1919 to 1945 and the U. S. succeeded from 1945 to 1981. After occupation, Japan implemented a citizen identity system that included finger prints, a land reform, and a tax reform, as they had done earlier in Taiwan and Korea. When Japan officially occupied Micronesia in 1919, they conducted a complete census on October 1, 1920. In fact, Japan was so adamant about accuracy, it was made a general rule to carry out the census twice and double-check the results. Japan also introduced a system to register titles and update the register following transactions. When the Japanese colonial government introduced land registration in Micronesia, they compensated or planned to compensate chiefs. Consequently, Japan's land reform in Micronesia was more successful than the one undertaken by Germany (occupied 1899 – 1914), which surveyed only prosperous areas such as coconut and pineapple plantations, and prohibited land transactions.

In contrast, after occupying Micronesia, the U. S. faced difficulties in implementing an effective citizen identity system and a land tenure system. The Trust Territory government clearly acknowledged

the critical roles of 'land surveying' and 'registration and updating' for secure land tenure. For example, Trust Territory Policy Letter, P-1, clearly states "the long range plan includes cadastral survey of all land, registration of titles, and recording of all land transfers" (Wright 1947, 55). At the planning stage, however, the government did not recognize the importance of citizen identity system. After the initiation of land registration, the American promoters realized that "Micronesians as a whole do not appreciate the need for signatures and correct spelling of names" (Trust Territory of the Pacific Islands 1971, 23). The first land registration project in Micronesia was abandoned by 1951 (McGrath 1971). In the 1970s, the Trust Territory government reinstated a land reform, but its speed was painfully slow (McCutcheon 1981).

## **5. Land Surveys Contribute to Public and Private Finance**

Generally it is easier for the government to tax land because it cannot be readily "hidden" as other assets could be. However, effective land taxation requires registers and maps to identify parcels, as well as a system linking taxpayers to the registers (Cho 2003). In many countries, land taxes are evaded because the government cannot link the three together. Governments appoint local authorities to make the links based on local information, giving them a percentage of the tax receipts as payment. This remedy is imperfect, however, because principal-agent problems often lead to corruption.

Traditionally Asian countries had land registers, but given the lack of surveys and ownership updates, the land registers were not very useful in collecting land taxes directly from the taxpayers. Sng (2009) argues that it was difficult for the central government to increase tax revenues assigned to local authorities because the poor usually shouldered a heavy tax burden. The Japanese land survey linked the registers, maps, and taxpayers. Moreover, the Japanese colonial government also introduced a citizen identity system in Korea and Taiwan as a way to control the population, but this facilitated tax collection by identifying particular individuals as taxpayers. The Japanese colonial governments faced large budget deficits during the land reform, but the new land tax system was cost effective and much more successful than expected. The total cost of land reform in Taiwan was 5.3 million yen, but the annual land tax

revenue increased by 2 million yen.<sup>8</sup> In Korea, the Japanese colonial government was able to decrease the land tax rate from 3% (planned) to 1.5% as a result of higher-than-expected revenues. Finally, it should be noted that stable tax revenue expands the state's ability to undertake public projects by selling bonds (Ferguson 2001). Government can issue bonds only if they have predictable tax revenue.

Interestingly, the solution of a public finance problem eventually was important for private finance. Because land is immovable and everlasting, banks are more willing to accept it as collateral relative to other assets that can be stolen, hidden, or readily destroyed. Tapping land as collateral, however, is more difficult than one might expect. Legally, land ownership is an abstract concept and what the seller of land owns and offers is "the right to sell" (tenants and squatters have the right to use but lack the right to sell). However, "the right to sell" is justified only by the law (Simpson 1976). In most cultures, traditionally land was considered to be held either directly or indirectly from the King. Therefore to prove ownership the title had to be traced back to the original Crown grant (or state grant). For example, in the U. S., title insurance links the deed through an unbroken chain to the original state grant. Therefore, a centralized information exchange system such as a record of deeds or registration of title is a very efficient way of proving ownership. Moreover, land ownership has a very special problem, i. e. boundary disputes. Therefore, banks are more willing to accept land as collateral if secure title and well-defined boundaries are part of a central ownership verification system. A land survey clarifies the boundary and makes abstract land ownership more concrete and secure by reducing boundary disputes.

Experiences in Asia suggest that the following are effective links of a chain: land surveys, a citizen identity system, land titles, recording of deeds or registration of titles, and acceptable collateral. First, banks are reluctant to accept land titles as collateral if the document does not clearly specify the boundaries. In developing countries, many land titles vaguely describe the boundaries, often based on landmarks, not a cadastral survey. Thus, if the landmark is destroyed or moved, boundary disputes follow. Without clear boundaries, the size and value of land is vague and consequently using land as collateral becomes risky. For example, in Thailand 55 percent of land is held under a certificate of

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<sup>8</sup> The land tax revenue increased from 0.92 million yen in 1903 to 2.98 million yen in 1905.

utilization, which is a quasi-formal land title having rough boundaries, but banks do not accept this as collateral. In Thailand, only 15 percent of land has a legal title based on a cadastral survey acceptable to banks (Angus-Leppan and Williamson 1985).

Second, governments must provide a centralized ownership verification system. Korea's legal history provides a good example. Prior to 1918 there was no official registration system and Koreans could not register titles in land transactions. Before this step, the Japanese colonial government issued a verification letter for land transactions. The law, however, implicitly stated that the letter did not guarantee ownership to a third person (Cho 2003). Foreigners could buy land in Korea after 1905<sup>9</sup> and the colonial government tried to promote land transactions by verification letters, but ownership was not fully guaranteed. After the land survey, the registration-of-title system started and the law explicitly indicated that the government guaranteed ownership of such land. Consequently, banks began to accept land titles as collateral with more confidence.

Finally, it should be noted that a well established citizen identity system should be combined with a centralized ownership verification system. In many cultures, people have multiple names for different purposes. For example, in traditional Korea a man was given names at birth, as an adult, an official name for governments, a name for the family history, and a nickname. Thus, the Korean government had difficulty in identifying the owner of land from the name used on the traditional land register. Without a system that identifies a person with a single name, land cannot be used as secure collateral.

At the time of Japanese conquest, Korea and Taiwan were heavily agricultural and land was the most abundant asset. By accepting land as collateral, banks solved a problem of private finance. In Korea, for example, Chosun bank – which played a major role in the 1910s – depended mainly on credit collateral and faced many loan default problems in the 1920s, and thereafter decreased its credit loans. In contrast, Siksan bank – which played a major role in the 1920s – required land as collateral and did not face such problems (figure 2) (Oh 1996). After the official land registration system was operational, access to credit became easier and interest rates declined. The total amount of collateralized loans from

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<sup>9</sup> The Japanese colonial government also introduced laws for house and land collateral in 1905.

banks increased in Korea (table 3) after 1918 and the total number of collateralized parcels of land increased in Taiwan after 1905 (table 4) because land titles became reliable. After the Japanese land survey and registration in Korea, the private interest rate decreased to 30% and kept falling over the next 20 years (figure 3a).<sup>10</sup> A similar pattern is observed in Taiwan (figure 3b). Figure 2 shows that the total amount of bank loans increased in Korea and figure 4 shows that value added in the financial sector increased dramatically after the land survey was completed.

Various features of land tenure explain why land titling might have little impact on credit markets in some cases. Many African countries do not require a clear boundary map in land titling (Dale 1976) and fail to provide a centralized ownership verification system. It is worth noting that limited impacts on credit markets are reported in land titling for squatters in urban areas (Field and Torero 2004, Galiani and Schargrotsky 2006). Land titles issued to squatters are intrinsically less secure because ownership disputes can occur between the original legal owners and squatters who obtained land titles (or ownership can be restored to the original legal owners by political changes). In fact, Galiani and Schargrotsky (2006) report disputes between the original legal owners and the government in the processes of land titling and land expropriation from original legal owners. Thus, it is plausible that banks are less willing to accept recently issued land titles to the squatters in the short run. Additional barriers to credit markets originate from a poor citizen identity system, and lack of an updating system and a reliable centralized ownership verification system.

## **6. Pathways between Property Rights and Economic Growth**

Historical evidence suggests that good property defining institutions stimulate land transactions; capital investment; lower interest rates through the development of financial markets; improve the inflow of outside capital; and facilitate the transfer of technology.

On the first point, good property defining institutions facilitate land transactions and mortgaging. A well established land registration system allows sub-division of land, which helps to match parcel size with collateral needs. This might seem unimportant, except under many customs and laws, all of the

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<sup>10</sup> Traditionally, the private interest rate was about 50% in Korea.



collateralized property can be forfeited to the creditor, regardless of the difference between the value of the property and the amount of the debt (Kim 2008). In addition, with effective land transactions, land values tend to rise because the size of the market increases and resources are more likely to flow into their highest valued use (Alston, Libecap and Mueller 1999).

Second, the inflow of outside capital is very sensitive to property defining institutions as illustrated by the case of Hawaii. In Hawaii most land was owned by the government or a small number of landlords. Before 1967, most people leased property for 55 years rather than buying the land and houses (La Croix 1995). Consequently, mainland Americans were reluctant to invest in Hawaii because the land tenure system was unfamiliar and perhaps subject to arbitrary change. Similarly, Etpison (2004) explicitly describes that “land title disputes scared off legitimate investors, and make high-end hotel development a real challenge [in Micronesia].”

Finally, transfer of technology is also sensitive to property defining institutions. Observers have suggested, for example, that the collective land tenure system in Africa is an obstacle to adapting Western irrigation technology, which operates most efficiently on a large scale. Collective ownership of land complicates decision making by creating hold outs and assorted groups with diverse if not adversarial interests. Customary (tribal) law, therefore, impedes the adoption of this complex and expensive technology (Slabbers 1990).

The process of irrigation investment in Korea illustrates a clear pathway from a secure land tenure system to economic development. According to Rhee et al. (1992) irrigation investment was possible because the land survey clearly identified the boundaries and owner of the land. After the land survey, the board for the new irrigation system could use the land register to identify and gain permission from the relevant land owners.<sup>11</sup> Moreover, the board could identify the land owners who needed compensation resulting from making new reservoirs and water distribution ditches. When the permission and compensation processes were finished, the relevant farmers could finance the cost for the new

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<sup>11</sup> In order to create a cooperative, the board was required to obtain permissions from a majority of land owners who owned at least two-thirds of the land area. Free riding was not a problem in setting up the cooperative because large landlords received the greatest benefit.

irrigation system by getting loans from banks. Banks founded by Japanese capital accepted land titles as collateral and the farmers received a low interest rate (However, the irrigation investments were such big projects that farmers often paid back their loans over twenty to thirty years).

After the completion of irrigation projects and subsequent adjustments<sup>12</sup>, agricultural productivity in paddy land increased by 67 to 200 percent in Korea (Rhee et al. 1992).<sup>13</sup> On average, there was a drought every eight years (figure 5) and extremely severe drought every twenty five years in Korea (Rhee and Cho 2005, Rhee 2009). Thus, it is clear why the farmers invested in the irrigation system when they first obtained access to credit. After 1918 one can observe that agricultural loans increased (figure 6) and the portion of land as collateral also grew (figure 7). The irrigation investments in Taiwan doubled the quantity of arable land from 1898 to 1940 (Ka 1995).

The case of Korea shows why the transfer of a western irrigation system is very difficult under conditions faced in many African countries. Even though an irrigation project may be financed by international organizations, the permission and compensation processes are stymied by the clan ownership system.

## **7. Stylized Facts of Land Reforms**

Why do many developing countries fail to implement a secure land tenure system that solves public and private finance problems and leads to economic development? According to Simpson (1976)

“[Land registration] is a device which may [be] essential to sound land administration but it is merely part of the machinery of government. It is not some sort of magical [device] which will automatically produce good land use and development; nor is it a system of land holding; it is not even a kind of land reform, though it may be a valuable administrative aid to land reform. In short, land registration is only a means to an end. It is not an end itself. Much time, money, and effort can be wasted if that elementary truth be forgotten (Simpson 1976, 3).”

Unfortunately, a review of the history of land reforms suggests that many governments either did not learn or forgot this elementary truth, and thus waste much time, money, and effort.

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<sup>12</sup> Agricultural productivity does not increase immediately partly because micro-organisms in the soil must adjust to more water.

<sup>13</sup> Land reforms that led to irrigation investments and rising agricultural productivity are also reported in Botswana (Machacha 1986) and Kyrgyzstan (Akramov and Omuraliev 2009).

The review identifies some stylized facts that underlie land reforms. First, the variable cost function is convex, but most promoters of reform do not recognize this structure at the outset. Instead they may anticipate a concave function because the administrative effort of registering a parcel of land decreases with volume. The realized function, however, is convex because the most costly aspect is surveying the boundaries, which increases convexly. In the example of figure 8, one can observe that the number of boundaries to be identified increases by  $n^2-2n$  where  $n$  is the total number of parcels. For example, if there are 4 parcels of land, then the surveyor needs to identify 4 boundaries between 4 parcels. However, for 9 parcels it is 12 boundaries and for 16 parcels it is 24 boundaries. In short, if the number of parcels increases by one, then the number of boundaries to be identified increases by one or more.

Second, creating and implementing an updating system and a citizen identity system are very difficult and costly. Governments understand the importance of an ownership updating system but typically underestimate or do not want to bear the cost. The simplest (and cheapest) system periodically resurveyed ownership by visiting the plot, as was done in China and Korea every five years. However, the resurveyed register gradually lost its information value as transactions made it obsolete. Moreover, given a principal-agent problem, government officials frequently copied and resubmitted the old land registers rather than expending effort to resurvey ownership.

A record of deeds—sometimes called an abstract of title that shows the history of transactions-- is a better system but also has limitations. Over time it may become obsolete unless ownership is systematically verified after transactions occur.<sup>14</sup> A central registration of titles is the most effective system, but it was not implemented until the mid nineteenth century.<sup>15</sup> A record of deeds and registration of title require centralized recording, a systematic coordination system, and legal regulations that update the validity of ownership. Moreover, transferring old records to a new system was not a simple task. In

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<sup>14</sup> A deed does not in itself prove title; it is merely a record of an isolated transaction. A deed does not confirm that the parties were legally entitled to carry out the transaction and by itself does not prove the transaction valid. It follows therefore that investigation of its validity and legal effect will still be necessary before any further transactions can be safely conducted on the strength of it (Simpson 1976, 15).

<sup>15</sup> A register of title is an authoritative record kept in a public office. The register is at all times the final authority and the State accepts responsibility for the validity of transactions, which are affected by making an entry in the register and only by this means (Simpson 1976, 15-16).

many cases the importance of a citizen identity system was not recognized until land reform was well underway. Consequently, the unexpected high costs discouraged complete implementation of systems that were critical for centralized ownership verification.

Third, the land reform usually changed the whole structure of a society, imposing political costs. Most land reforms in developing countries created individual ownership from communally owned land, which heavily affected not only current but future economic activities. This confronted traditions of multiple or clan ownership.<sup>16</sup> With the exception of the new registered owners, other traditional owners of land lost use rights forever. Eliminating clan ownership meant that the chief – the political leader – would lose his control in managing the clan’s land. The experience in Yap in 1970s shows how the political leaders fought the change and nullified the effect of land reform (Marksbury 1979). In addition, landowners who were unsatisfied with the boundaries were against the land reform. The review suggests that these political costs existed for colonizers but were much higher or difficult to overcome if undertaken by traditional governments.<sup>17</sup> Colonizers that succeeded in imposing land reform, such as Japan, compensated the chiefs and other traditional land owners who lost land-use rights.<sup>18</sup>

Finally, the review shows that whether a government is short-sighted or far-sighted is critical for the success of a land reform. A short-sighted government can be defined as one that is interested in short-term tax revenue. In contrast, a far-sighted government promotes long-run economic growth. For example, the conflict between Pierre Poivre and the French mercantilists shows the different viewpoints between the short-sighted and far-sighted government. From 1767 to 1772, Pierre Poivre served as governor in Mauritius. He accurately estimated population and the island’s natural resources and instituted a land tribunal to survey and adjudicate concessions (Vaughan 2005, 69). “Poivre brought the island to self-sufficiency, in opposition to the prevailing mercantilist doctrine that colonies should be exploited for the benefit of the mother country. By the time he left Mauritius in 1772, Poivre and his

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<sup>16</sup> In fact, the duality of ownership in land even existed in the sixteenth century England, as a way to avoid feudal dues.

<sup>17</sup> Many colonizers tried to implement land registration systems. For example, the first land register of England – the Domesday Book – was made by the William who conquered England in 1066.

<sup>18</sup> Similarly, when the Hawaiian government introduced the land registration, the government compensated chiefs.

supporters were finding themselves outmaneuvered by mercantilist governors and ministers who were more interested in short-term profits than long-term prosperity” (Maverick 1941).

When short-sighted governments realized it was very costly in the near term to survey, register and update all land ownership, they restricted the process to prosperous areas. For example, the Germans surveyed and registered only coconut and pineapple plantations in Micronesia and the British did the same only for white settler’s farm land in sub-Saharan Africa. Limited and isolated surveys required less investment in boundary identification. Moreover, these limited surveys usually did not heavily depended on creating an updating system, because transactions occurred infrequently or were prohibited by the colonizers.

## 8. A Model of Land Reform

We construct a simple model based on the stylized facts. The goal is to understand the conditions under which governments undertake effective land reforms that can promote long-run growth.

### 8.1. Cost and Revenue Functions of Land Reform

The cost function of a land reform is defined as follows:

$$\text{Cost} = a + cL^2 + UP + ID + PC(1 - PD)$$

where  $a$  denotes a fixed cost of implementing land reform ( $a > 0$ ),  $L$  denotes total amount of registered land by the land reform ( $L > 0$ ),  $UP$  denotes the cost of creating an updating system ( $UP > a$ ),  $ID$  denotes the cost of creating a citizen identity system ( $ID > a$ ),  $PC$  denotes a political cost, and  $PD$  denotes the degree of political dominance ( $PC > a; 0 \leq PD \leq 1$ ).

For simplicity, we assume a linear tax revenue function (the analysis is consistent with a concave revenue function). The revenue function of the land reform is defined as follows:

$$\text{Revenue} = tLP$$

where  $t$  denotes tax rate ( $t > 0$ ),  $P$  denotes the average price of registered land, which is normalized  $P = 1$ .

$T_{old}$  denotes tax revenue under the current taxation system, and  $R_{min}$  denotes minimum tax revenue that the government desires to collect.  $r$  denotes the portion of valid information of the land register in the following year. With the updating and identity systems  $r = 1$  (all information in the land register is valid and is linked to the taxpayers). Without two systems,  $r < 1$  (the land register becomes obsolete over time).  $\beta$  is the discount factor of the short-sighted government,  $\delta$  is the discount factor of the far-sighted government, and  $\pi$  is one plus the rate of inflation. We assume that the average price of registered land increases by the rate of inflation. For a simple calculation, we assume that the discount factor of the far-sighted government is  $\delta = \frac{1}{\pi}$  for both of the tax revenue and the deficit. Moreover, we assume that  $\beta_d = \delta$  for the deficit, but  $\beta_r = \mu\delta$  for the tax revenue where  $\mu < 1$ .  $L_{max}$  denotes the total area of land in the country,  $L^*$  denotes the optimal level of land registration, and  $N(L^*)$  denotes the number of years required to complete the land reform, which is an increasing function of  $L^*$ . We assume that the government collects  $T_{old}$  before the completion of the land reform and collects  $tL^*$  after the completion of the land reform.

## 8.2. Interior Solution of Short-sighted Government

Historically, land was the main source of wealth, thus the main source of revenue. When the tax revenue under the current taxation system ( $T_{old}$ ) becomes smaller than the minimum tax revenue that government desires to collect ( $R_{min}$ ), a government considers a land reform to increase its income.

The marginal revenue of land reform is  $t$  and the marginal cost of land reform is  $2cL$ . Assuming the existence of an interior solution, the short-sighted government chooses  $L^* = \frac{t}{2c}$  (figure 9).

After determining the optimal level of land registration, the government considers three factors: the cost, the budget deficit during the reform, and the increased revenue after completion. First, the cost of land reform for the short-sighted government – only interested in a short term profit – is

$$\begin{aligned}
 & a + c(L^*)^2 + PC(1 - PD) \\
 = & \frac{1}{N(L^*)} [a + c(L^*)^2 + PC(1 - PD)] + \beta_d \pi \frac{1}{N(L^*)} [a + c(L^*)^2 + PC(1 - PD)] + \dots
 \end{aligned}$$

$$+\beta_d^{N(L^*)-1}\pi^{N(L^*)-1}\frac{1}{N(L^*)}[a+c(L^*)^2+PC(1-PD)]$$

because it is unwilling to spend much money for creating the updating system and the citizen identity system and the discount factor of the deficit ( $\beta_d$ ) is  $\delta = \frac{1}{\pi}$ . Second, the deficit of the short-sighted government during  $N(L^*)$  years of land reform is

$$N(L^*)R_{min} - T_{old} \frac{1-r^{N(L^*)}}{1-r}$$

$$= [R_{min} - T_{old}] + \beta_d \pi [R_{min} - T_{old}r] + \dots + \beta_d^{N(L^*)-1} \pi^{N(L^*)-1} [R_{min} - T_{old}r^{N(L^*)-1}]$$

Finally, the present value of increased tax revenue after the completion of land reform is,

$$\beta_r^{N(L^*)} \frac{tL^* - T_{old}\pi^{N(L^*)}r^{N(L^*)}}{1-\mu r}$$

$$= \beta_r^{N(L^*)} [tL^* - T_{old}\pi^{N(L^*)}r^{N(L^*)}] + \beta_r^{N(L^*)+1} [tL^*r\pi - T_{old}\pi^{N(L^*)+1}r^{N(L^*)+1}] + \dots$$

because the discount factor of tax revenue ( $\beta_r$ ) is  $\mu\delta$ .

The short-sighted government completes the land reform if

$$\beta_r^{N(L^*)} \frac{tL^* - T_{old}\pi^{N(L^*)}r^{N(L^*)}}{1-\mu r} - [a+c(L^*)^2+PC(1-PD)] - [N(L^*)R_{min} - T_{old} \frac{1-r^{N(L^*)}}{1-r}] > 0$$

and

$$\left| \pi^{N(L^*)-1}r^{N(L^*)-1}T_{old} - \pi^{N(L^*)-1}R_{min} - \pi^{N(L^*)-1}\frac{1}{N(L^*)}[a+c(L^*)^2+PC(1-PD)] \right|$$

$< \text{Deficit tolerance of the short sighted government.}$

In other words, the expected profit of the land reform should be positive and the annual deficit of the government during the land reform should be lower than the deficit tolerance level of the government.

Otherwise, the government stops the land reform.

The first condition explains why the colonial governments or conquerors are more likely to implement land reforms than traditional governments. The degree of political dominance ( $PD$ ) of colonizers is more likely to be larger than that of traditional governments because military power accompanied colonization. Moreover, the tax revenue from the old system ( $T_{old}$ ) for a colonizer can be,

in effect, zero. Thus, the first condition is more likely to be satisfied. In addition, the colonial government cannot but endure the deficit after the colonization.

Two conditions of the land reform also explain why the short-sighted government is less likely to create the updating and identity systems. Creating two systems increases the costs of land reform significantly, increasing the annual deficit. Moreover, the government is very likely to face higher political costs due to the loss of political support after the initiation of the land reform. Thus, even if the government realized the importance of those two systems after the initiation of the land reform, it is unable to impose those two systems.

### 8.3. The Corner Solution of the Far-sighted Government

A far-sighted government is interested in long-term growth, and thus creates both the updating system and the citizen identity system, if it realizes the importance of those systems.

The cost of land reform of the far-sighted government is

$$a + cL^2 + UP + ID + PC(1 - PD)$$

However, the revenue structure from the land reform depends upon the package adopted. The updating and identity systems continuously validates the land register and taxpayers ( $r = 1$ ). Sng (2009) argues that increasing tax revenue for traditional governments is very difficult due to a principle-agent problem.

Under a corrupt tax collection system operated by local authorities, the poor shouldered heavy burdens and a riot could ensue if the government imposed higher tax rates. With the updating and identity systems, the government can collect revenue directly from taxpayers. Therefore, the tax system becomes relatively fairer and the government is effectively able to grow tax revenue by the rate of inflation.

The present value of revenue of the land reform is

$$\delta^{N(L)}[tL + tL\delta\pi + \dots] = \delta^{N(L)}[tL + tL\delta\frac{1}{\delta} + \dots] = \infty$$

In other words, after the completion of the land reform, the government's real tax revenue does not decrease over time. In this case, the conditions of performing the land reform are



$$\delta^{N(L)} \left[ (tL + tL + \dots) - \frac{T_{old} \pi^{N(L)} r^{N(L)}}{1 - \mu r} \right] - [a + cL^2 + UP + ID + PC(1 - PD)] - [N(L)R_{min} - T_{old} \frac{1 - r^{N(L)}}{1 - r}] > 0$$

and

$$\left| \pi^{N(L)-1} r^{N(L)-1} T_{old} - \pi^{N(L)-1} R_{min} - \frac{\pi^{N(L)-1}}{N(L)} [a + cL^2 + UP + ID + PC(1 - PD)] \right|$$

*< Deficit tolerance of the far sighted government.*

The first condition is always satisfied even though  $cL^2 + UP + ID$  is very large. Thus, the government registers all land ( $L = L_{max}$ ) to maximize the real tax revenue (figure 9). In addition, the review of land reforms indicates that the updating system works more efficiently when all land is registered. The government, however, endures a larger deficit for a longer period of time in the interim.

#### 8.4. Tax Rate and Discount Factor

In the previous section, the tax rate is assumed to be exogenous. Experience in Asia, however, suggests that after the completion of the land reform, the far-sighted government is able to lower its tax rates because the registered land in the corner solution is larger than that of the interior solution ( $L_{max} > L^*$ ). In this section, we assume that the probability of a riot is an increasing function of the tax rate and the discount factor of the government is a function of the probability of a riot. In other words, a high tax rate decreases the discount factor of the government. For example, we may suppose that

$$\beta_r(t) = \mu(t)\delta = \frac{\delta}{1 - g\sqrt{\max(0, t - t_{no-riot})}}$$

where  $t_{no-riot}$  denotes the tax rate that government will not face any riot. For the far-sighted government, if  $t_{far} < t_{no-riot}$ , then, the discount factor of the far-sighted government becomes  $\delta = \frac{1}{\pi}$ . In contrast, the tax revenue of the short-sighted government keeps decreasing over time as the land register becomes obsolete. When the tax revenue becomes less than its minimum spending level ( $R_{min}$ ), the short-sighted government needs to increase its tax rate, suggesting that the government faces a higher

probability of potential resistance and becomes more short-sighted over time (or the government becomes more arbitrary in taxation to increase its tax revenue).

### **9. Empirical Estimation: Two State Least Squares**

In this section, we estimate the long-term effects of good property defining institutions. We address reverse causality by using instrumental variables that measure the degree of institutional transfer. We argue that whether Japan conducted and completed a formal land survey is a valid instrument because the Japanese occupation and the completion of the land surveys were determined opportunistically, and Japan abruptly lost all of its colonies after World War II.<sup>19</sup> We maintain that the new property defining institutions (i.e. Japanese land tenure system) persisted. In fact, the current land tenure systems of Taiwan, South Korean, and Palau are based on Japanese land surveys. For example, in South Korea the original Japanese land registers are still in daily use (Gragert 1994). Consequently, the completion of a Japanese land survey affects current GDP per capita only through institutions of land rights.

In Asia, secure land tenure systems are found not only in Taiwan, Korea, and Palau, but also in Hong Kong and Singapore. In the latter cases the British colonial government transferred institutions of land rights. These historical facts enable us to extend the scope of institutional analysis and provide a consistent explanation for the origins of economic growth in Asia.

Hong Kong and Singapore began as British colonies, with British legal and administrative systems. Both are densely populated cities and land is a scarce resource. However, less well known is the fact that the state owns all the land in Hong Kong, and four-fifths of the land in Singapore (Phang 2000).

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<sup>19</sup> Japan's early interest in Taiwan, Korea, and Palau had little to do with industrial potential. Taiwan was acquired largely for reasons of honor and prestige from the Sino-Japanese War. In 1895 Taiwan was viewed "as unimportant to China and as quite abhorrently un-Chinese" (Hong and Murray 2005, 61). In fact, the Chinese general Li Hongzhang, who ceded Taiwan to Japan, informed the Emperor that the loss was trivial because it was a land of brigands, murderers, and pirates (Hong and Murray 2005). Korea was acquired largely because Japan felt that another power having a military presence on the peninsula would have been detrimental to Japanese national security. At that time Korea was described as "a dagger pointed at the heart of Japan." Also, it is clear that Japan was not able to predict the division of Korea in 1945 and the consequent poor economic performance of North Korea. Japan occupied Micronesia including The Northern Mariana Islands and Palau because the British requested them to attack the German naval bases in Asia during World War I. Finally, Japan's loss of all colonies after World War II makes the end of occupation an exogenous event in the colonies.

In Hong Kong and Singapore, the governments own and lease property. If the leasing contracts provided good property defining institutions for land, then we can apply the analysis of land tenure to these places. The following excerpt from Phang (2000) shows that British colonial leases, in fact were secure.

The British government, on taking over Hong Kong Island in 1841, recognized immediately the importance of controlling land. In 1843, it proclaimed that all land belongs to the Crown and that the government would not allow any private ownership of land. Leases were sold at public auctions or granted directly for the payment of an annual rent. Enforcement powers for land use decisions are found in the Building Ordinance and contractual powers in Crown leases.

In 1826, English statutes in force on November 26, 1826, and the principles of common law and equity were received as part of the law in Singapore. This meant that English doctrines of tenure and estates operated in Singapore. (Phang 2000)

In contrast, the British occupied India, Bangladesh, Pakistan, and Sri Lanka for an extended period, but their colonial government failed for some time to transfer the British land tenure system. A history of Sri Lanka's cadastral survey clearly shows that the British failed to transfer its land tenure system.

After the occupation of the country by the British, several attempts had been made for the establishment of a cadastre based on cadastral surveys. The proclamation by Governor North in the year 1800 for land owners to appear before the 'Land raad' (a judicial official) to produce evidence of title and get their lands surveyed was the first attempt. This failed.

Systematic cadastral surveys commenced in three sub urban villages within the capital Colombo itself based on an Act passed in 1877 for the purpose. However, this activity was abandoned in 1891, after three years of operation, mainly due to the high costs involved. Subsequent attempts in the form of several studies, recommendations and draft acts prepared for the purpose did not borne fruit.

There is at present, what can be described as, a limited cadastre. About eighty percent of the country is covered by village plans prepared by the Surveyor General demarcating State (Crown) land. These plans are [...] prepared after 1910.

Source - Cadastral Template, Country report: Sri Lanka (2003)  
<http://www.cadastraltemplate.org>

As the above excerpt shows, the British colonial government attempted to implement a modern land tenure system in Sri Lanka, but it failed in 1800, and failed again in 1891 due to the high cost.

Although the British occupied Sri Lanka for 153 years, the British colonial government could not transfer

the crucial British institutions (i. e. the land tenure system based on cadastral surveys) for 114 years. Thus a huge difference existed between Sri Lanka and the two city-states, Hong Kong and Singapore.

Considering this difference, we suggest two more instruments. The first is whether a country is a city-state (CITY) that has a small land area to survey and register. The second instrument is the number of years of British occupation after the successful introduction of the British land tenure system (REVISED LENGTH OF BRITISH OCCUPATION), which is directly related to the transfer of a land registration system and operational experience. For example, if we count the number of years of British occupation in Sri Lanka after 1910 (when the village plans enabled a limited cadastre), REVISED LENGTH OF BRITISH OCCUPATION for Sri Lanka is 39 years. Since most of the countries clearly recorded when the laws for the land tenure system were enacted, REVISED LENGTH OF BRITISH OCCUPATION can be calculated with less concern of subjectivity (See appendix 2).

By using the completion of a Japanese land survey, whether a country is a city-state, or revised length of British occupation as instruments, we can estimate the impact of institutions on economic growth without concern for reverse causality and measurement errors of institutional quality. Table 5 contains the basic information on 30 former Japanese and British colonies in Asia. Thailand, a Southeast Asian country that did not experience any colonial occupation, is also included in the regression.<sup>20</sup> Data on the log of GDP per capita (Purchasing Power Parity) are taken from the CIA World Fact Book (2007), which covers all of the Pacific Islands. The World Bank and IMF's GDP per capita (PPP) figures, however, are very similar to the CIA World Fact Book estimates.

We consider various measures of current institutional quality assembled under the auspices of the World Bank (Kaufmann, Kraay, and Mastruzzi 2007). The World Bank's governance indicators provide annual measures of six institutions, which we averaged over the years 1996-2007:

A. Voice and Accountability; B. Political Stability & Absence of Violence/Terrorism; C. Government Effectiveness; D. Regulatory Quality; E. Rule of Law; F. Control of Corruption.

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<sup>20</sup> Since Japan colonized only parts of China and Russia, those countries are excluded (robustness checks are discussed later).

Measure E, Rule of Law – measuring perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence – is used as the main measure of institutions. The other measures are used to check for robustness, which is confirmed.

In this paper, we replicated the methodology of Acemoglu, Johnson, and Robinson (2001) who emphasized property protecting institutions, because one of our main purposes is showing that property defining institutions are equally important in the long run. However, we use instruments that are directly related to the property defining institutions (i. e. LAND SURVEY, CITY, or REVISED LENGTH OF BRITISH OCCUPATION) to avoid pitfalls of weak instruments. Mortality rates and population density that are relevant to migration and transfer of institutions are not used as instruments because we believe land is a more fundamental and concrete determinant than those two variables, given that most migrants were farmers.<sup>21</sup> For example, Ferguson (2003) clearly describes that “the lure [of migration] was the offer of 160 acres of virgin real estate in Saskatchewan, free of charge.” The history of Japanese migration also indicates that the land was the most important motivating factor (Purcell 1967).

The first task is to estimate the relationship between institutions and GDP per capita, for which we use the following specification:

$$\text{LGDP} = a_1 + a_2 \text{INSTITUTION} + a_3 \text{PACIFIC ISLAND} + e \quad (1)$$

where LGDP is the log GDP per capita (PPP in 2007) of the country, INSTITUTION is the governance indicator of the country (E. Rule of Law; high score denotes secure property rights in the standard normal distribution setting), and PACIFIC ISLAND equals one if the country is a Pacific island, zero otherwise.

The specification is motivated by work of Hall and Jones (1999) who maintain that institutions are the primary and fundamental determinant of economic growth. This conviction is based in part on the finding that human capital and physical capital explain a modest portion of cross-country differences in productivity. They observe, for example, that of the 35-fold difference in output per worker between the

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<sup>21</sup> REVISED LENGTH OF JAPANESE OCCUPATION is not used because its correlation with LAND SURVEY is 0.974

United States and Niger, only a factor of 1.5 is explained by physical capital and only a factor of 3.1 is explained by human capital. The remaining difference - a factor of 7.7 – is a productivity residual.

The Ordinary Least Squares (OLS) regressions are given in table 6. As can be seen, INSTITUTION and PACIFIC ISLAND are significant at the 1% level.

Next, we address the reverse causality and measurement error problems using the completion of a Japanese land survey, whether or not the entity is a city-state, and revised length of British occupation as instruments for estimating the degree of institutional transfer. We also use the length of British occupation for a comparison. The equations for the first stage are as follows:

$$\text{INSTITUTION} = b_1 + b_2 \text{ LAND SURVEY} + b_3 \text{ PACIFIC ISLAND} \\ + b_4 \text{ CITY} + u \quad (2a)$$

$$\text{INSTITUTION} = c_1 + c_2 \text{ LAND SURVEY} + c_3 \text{ PACIFIC ISLAND} \\ + c_4 \text{ REVISED LENGTH OF BRITISH OCCUPATION} + t \quad (2b)$$

$$\text{INSTITUTION} = d_1 + d_2 \text{ LAND SURVEY} + d_3 \text{ PACIFIC ISLAND} \\ + d_4 \text{ LENGTH OF BRITISH OCCUPATION} + n \quad (2c)$$

where LAND SURVEY equals one if the Japanese colonial government completed a land survey in the country, CITY equals one if a country is a city-state, REVISED LENGTH OF BRITISH OCCUPATION is the number of years of British occupation of the country after the successful introduction of the British land tenure system, and LENGTH OF BRITISH OCCUPATION is the number of years of British occupation.

The first stage regression results are given in table 7. In order to check the strength of instruments, this paper uses four weak instrument tests suggested by recent econometric studies: 1) Shea's Partial R-squared (a weak instrument test, low R-squared means weak instruments); 2) Anderson's Canonical Correlation LM statistic (an under-identification test,  $H_0$ : under-identified); 3) Stock-Yogo statistics (a weak instrument and size distortion test); and 4) Sargan statistics (an over-identification test,  $H_0$ : instruments are valid). These tests suggest that LAND SURVEY, CITY, and REVISED LENGTH OF BRITISH OCCUPATION are valid instruments.

As can be seen in table 6, the effect of institutions is greater in the 2SLS regression if LAND SURVEY and REVISED LENGTH OF BRITISH OCCUPATION are used as instruments (regression results are similar when LAND SURVEY and CITY are used). The coefficient on institutions from the OLS estimates is 1.102 (significant at 1% level) and from the IV estimate is 1.421 (significant at 1% level). A Hausman test confirms that there is a systematic difference (at 5% level) between OLS and IV estimates.<sup>22</sup> This empirical result is consistent with the findings of Acemoglu, Johnson, and Robinson (2001) who focus on property protecting institutions and shows that property defining institutions were important in Asia.

Our empirical results also indicate that the methodology suggested by Hall and Jones (1999) and Acemoglu, Johnson, and Robinson (2001) should be adopted with caution. For example, using LENGTH OF BRITISH OCCUPATION, which is possibly related to property rights institutions may lead to a different conclusion. Here, we suggest that focusing on property defining institutions is a better strategy in finding reliable instruments.

## **10. Concluding Remarks**

The historical record provides an excellent laboratory for study of institutions and economic growth, but existing work tends to exclude Asia and focuses on property protecting institutions.

Japan began to establish a secure land tenure system in the late sixteenth century and completed the process in 1873. Its colonial governments transferred the Japanese land tenure system to Taiwan and Korea – two growth miracles – and Palau – a leading economy in the Pacific. Abundant and reliable data in Asia from the early twentieth century allow us to identify the mechanism linking property defining institutions to economic growth. Instrumental variable estimates suggest that secure property rights stimulated economic growth.

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<sup>22</sup> The regression result is roughly similar when we control for the length of American, French, German, Portuguese, Spanish occupation in Asia. However, those colonizers were not effective in transferring their land tenure systems (the coefficients are insignificant and very close to 0 in the first stage), thus we did not control for other colonizers in the main regression. Also, Stock, Wright, and Yogo (2002) report that a combination of strong and weak instruments can be weak.

Historical analysis shows that a thorough land tenure system solves a public finance problem by linking land registers, maps, and taxpayers. Moreover, the solution to a public finance problem spills over to private finance. A proper land survey defines boundaries and registration of titles enables banks to readily verify ownership. Because land is the most abundant asset in agricultural economies, its collateralization can provide a major boost for financial markets that nurture economic development. In Asia, a secure land tenure system combined with financial market developments encouraged investment, promoted new technology such as irrigation systems, and consequently increased agricultural productivity.

The identified pathways in Asia suggest that property defining institutions were a major stimulus to economic development. Although property defining institutions and property protecting institutions are closely related, we think the reverse causality problem is less severe in property defining institutions. The motivation of land reform was solving a budget deficit and raising tax revenue. In order to solve the budget problem, the government surveyed available assets such as land and population. The survey and updating system made the economy of country more manageable by the government. Historical and political viewpoints on the emergence of modern nation-states also emphasize increasing the taxation capacity of governments (Tilly 1990, Furgerson 2001, and Besley and Persson 2009).

Our review of the history of land reforms suggests that success requires a clear understanding of the importance of clear boundary lines, the citizen identity system, and the ownership updating system. The analytical model shows that a far-sighted land reform is more costly than the short-sighted version but solves the long-term problem of public finance. The review suggests that the skills to establish and maintain a secure land system are a form of institutional capital.



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Figure 1. Japanese Colonies and a map of Micronesia

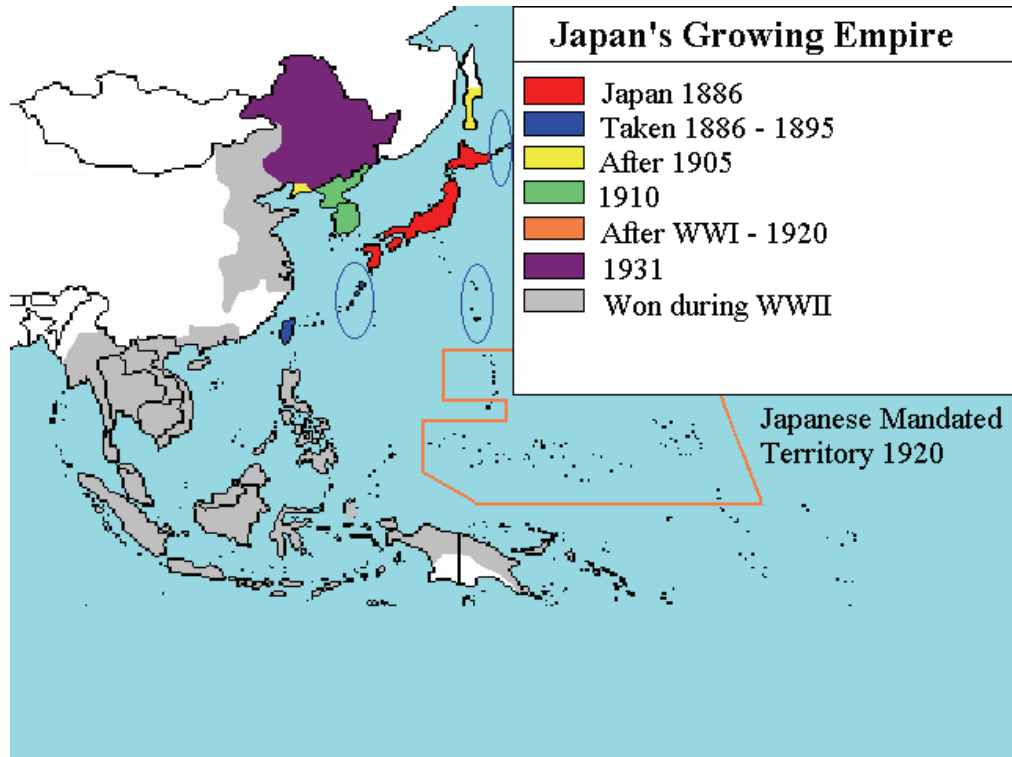
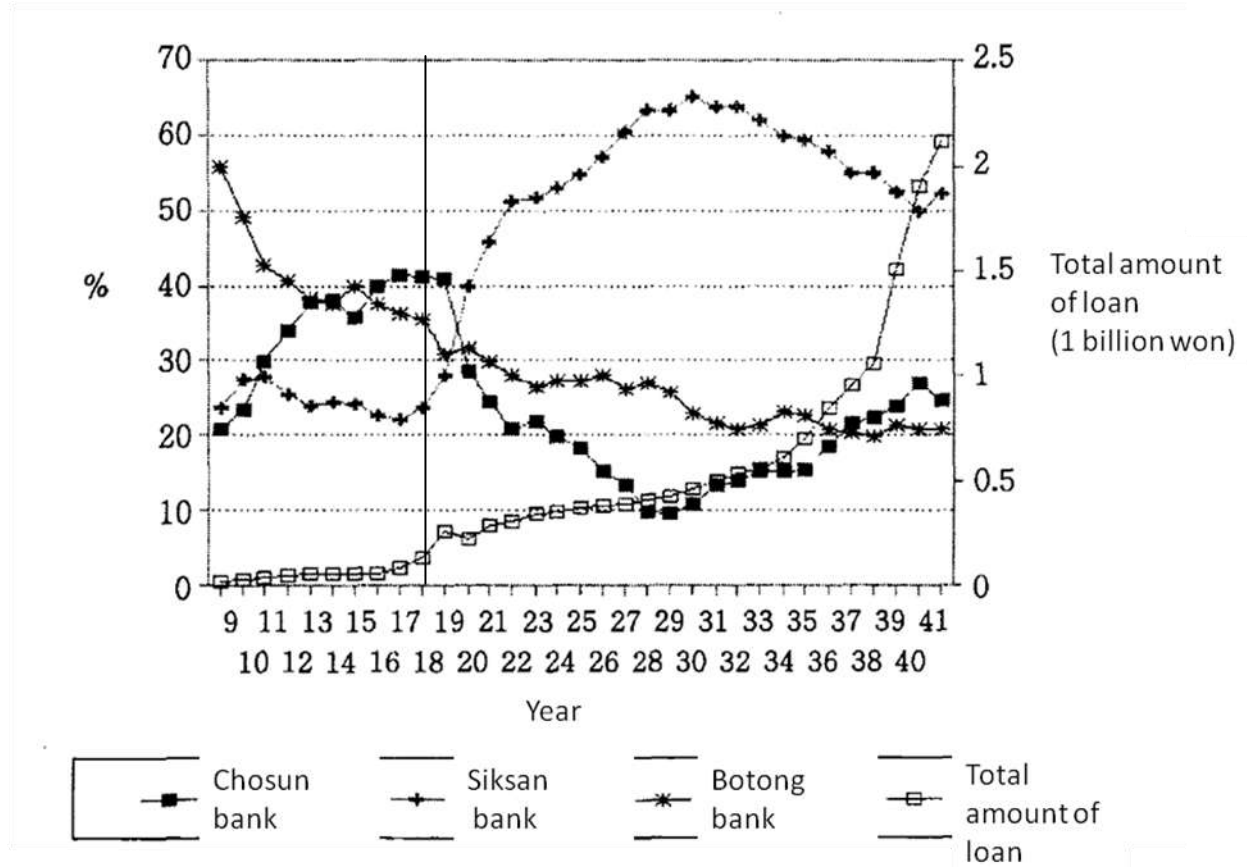
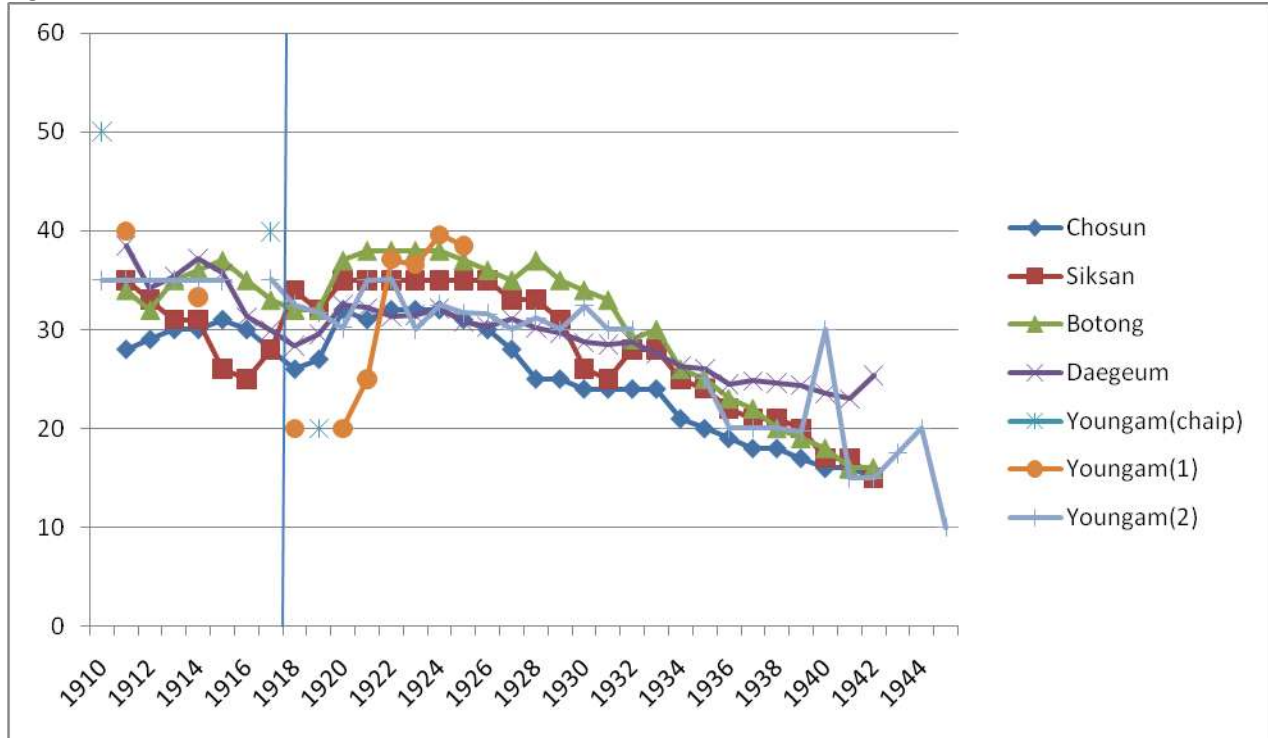


Figure 2. Total amount of loan and the decomposition of loan amount by banks



Source. – Oh (1996)

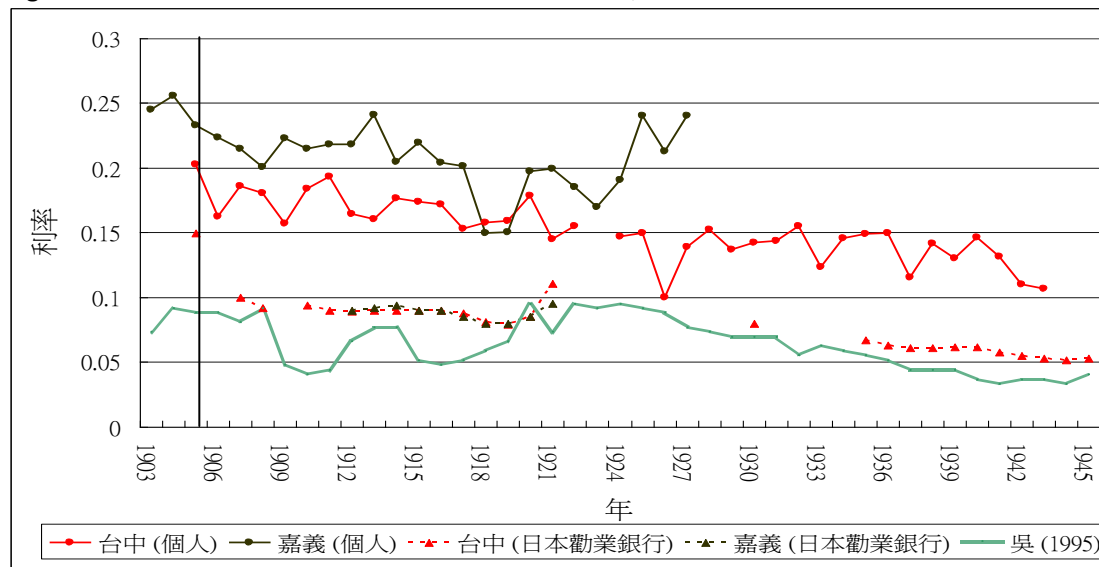
Figure 3a. Public and Private interest rates (%) in Korea, 1910 – 1944



Source. – Kim and Park (2004)

Note. – Public interest rate: Chosun, Siksang, Botong; Private interest rate: Daegeum, Youngam(chaip), Youngam(1), Youngam(2); Inflation was high in early 1920s due to aftermaths of World War I.

Figure 3b. Public and Private interest rates in Taiwan, 1903 – 1945

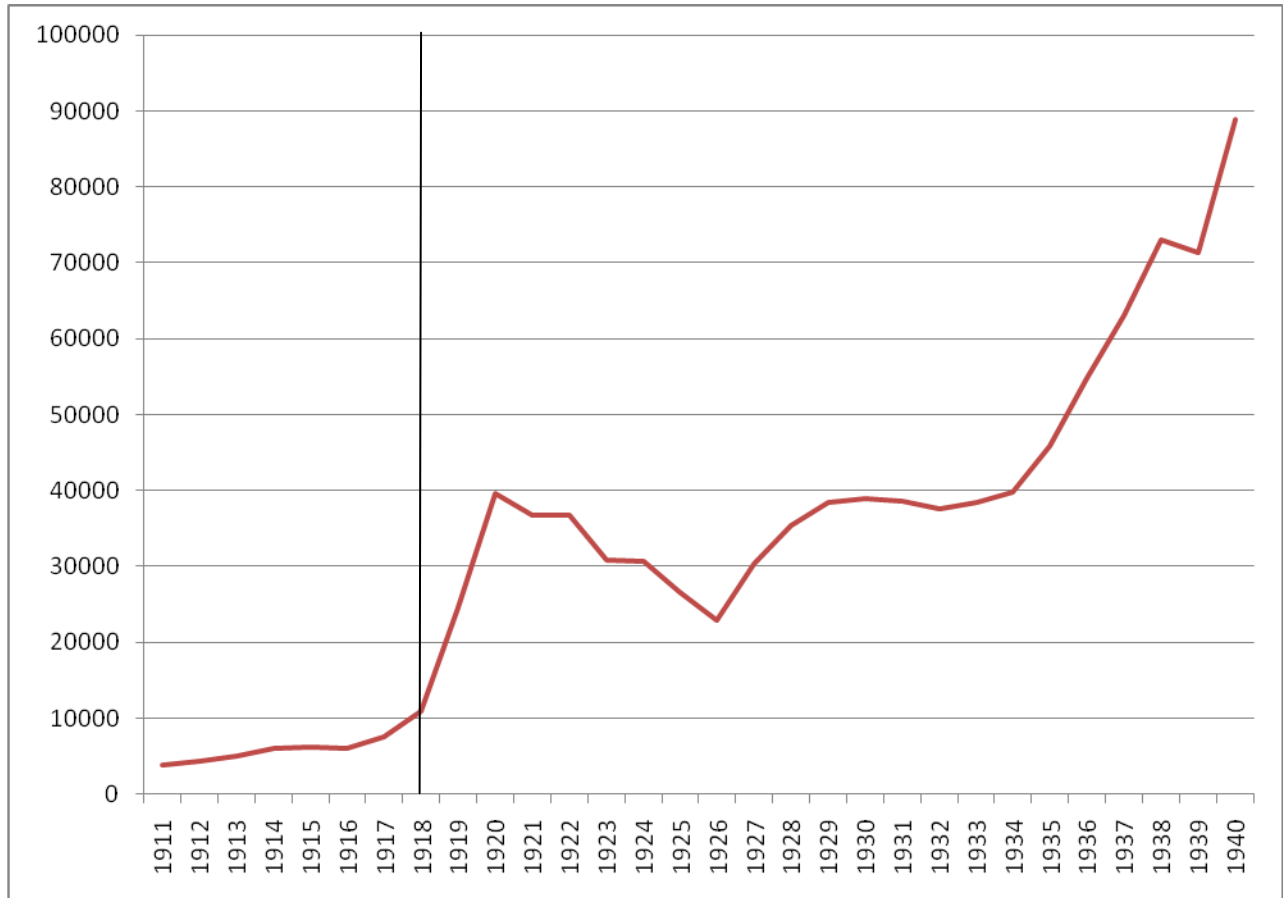


Source. – Olds (2010)

Note. – Private interest rate: 個人; Public interest rate: 日本勸業銀行, 吳; Inflation was high in early 1920s due to aftermaths of World War I.

Figure 4. Value-added by Year in Finance Services in Korea

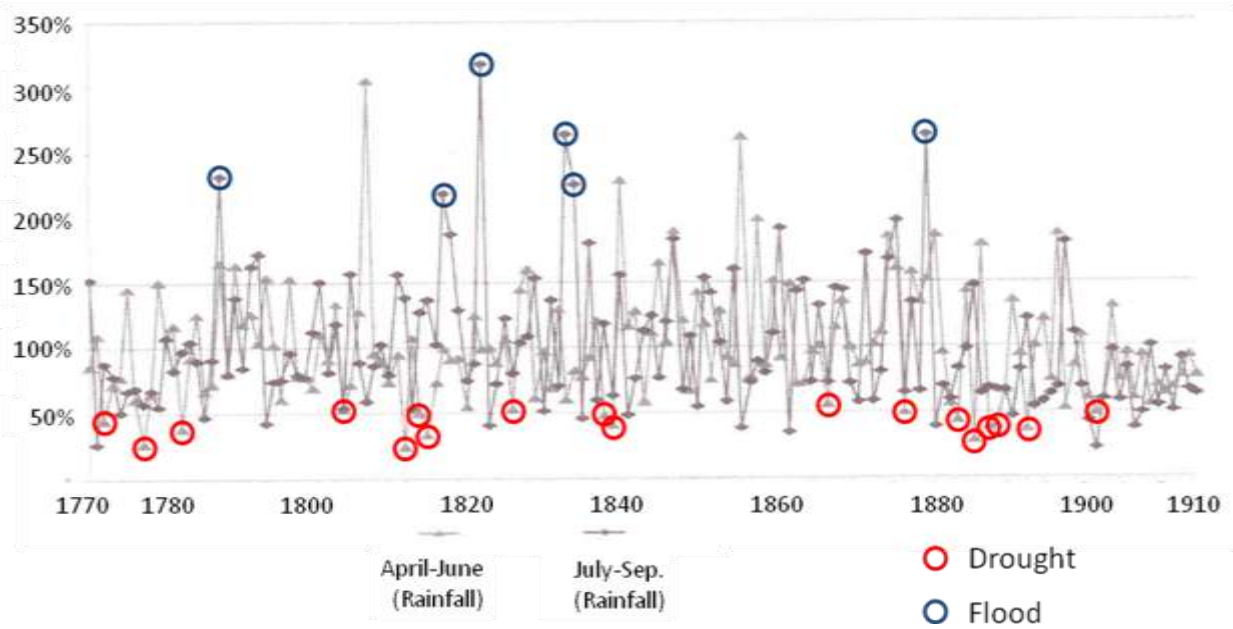
(Unit: Thousand Yen)



Source. – Joo (2005)

Note. – Sub-total of valued added in finance services including special banks, commercial banks, oriental reclamation company, financial cooperative, moneylenders and pawnshops, stock exchange, trusts, other financial companies

Figure 5. Rainfall 1770-1910 in Korea

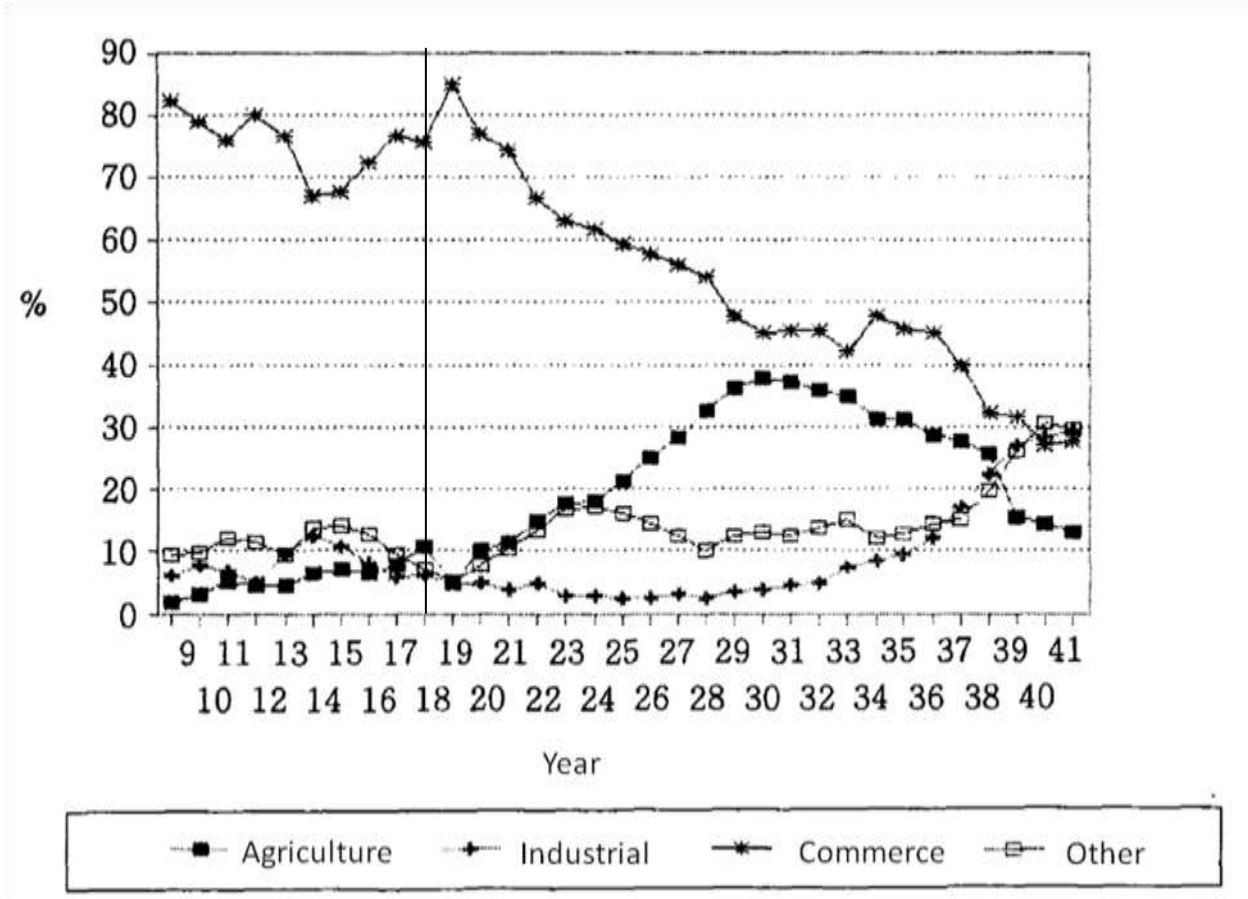


Source.— Rhee (2009)

Note.— 100% denotes the average rainfall from 1770 to 1990. Drought is defined as 50% of the average rainfall from April to June. Flood is defined as more than 200% of the average rainfall from July to September.



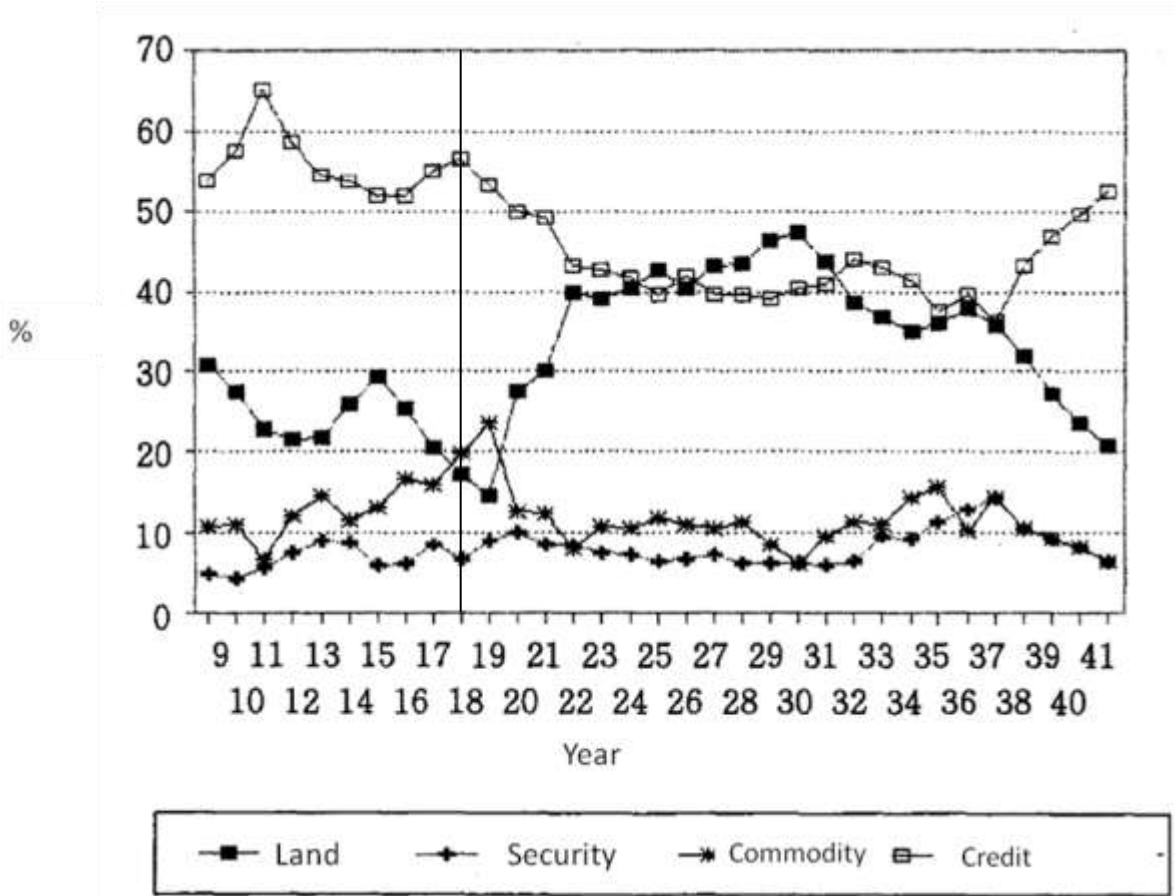
Figure 6. Purpose of Loans



Source. – Oh (1996)

Note. – In order to prepare World War II, Japan focused on industrial investments in the late 1930s in Korea.

Figure 7. Decomposition of Collateral in Korea



Source. – Oh (1996)

Note. – Loans for industrial investments in the late 1930s were given without collateral because it was given for World War II preparation.

Figure 8. The number of boundaries to be identified

|   |   |
|---|---|
| 1 | 2 |
| 3 | 4 |

Total number of boundaries between parcels = 4 (the number segments of solid lines)

|   |   |   |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |

Total number of boundaries between parcels = 12

|    |    |    |    |
|----|----|----|----|
| 1  | 2  | 3  | 4  |
| 5  | 6  | 7  | 8  |
| 9  | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 |

Total number of boundaries between parcels = 24

If the number of parcels increases by 1, then the number of boundaries to be identified increases by 1 or more.

Figure 9. Costs and Benefits of Land Reforms

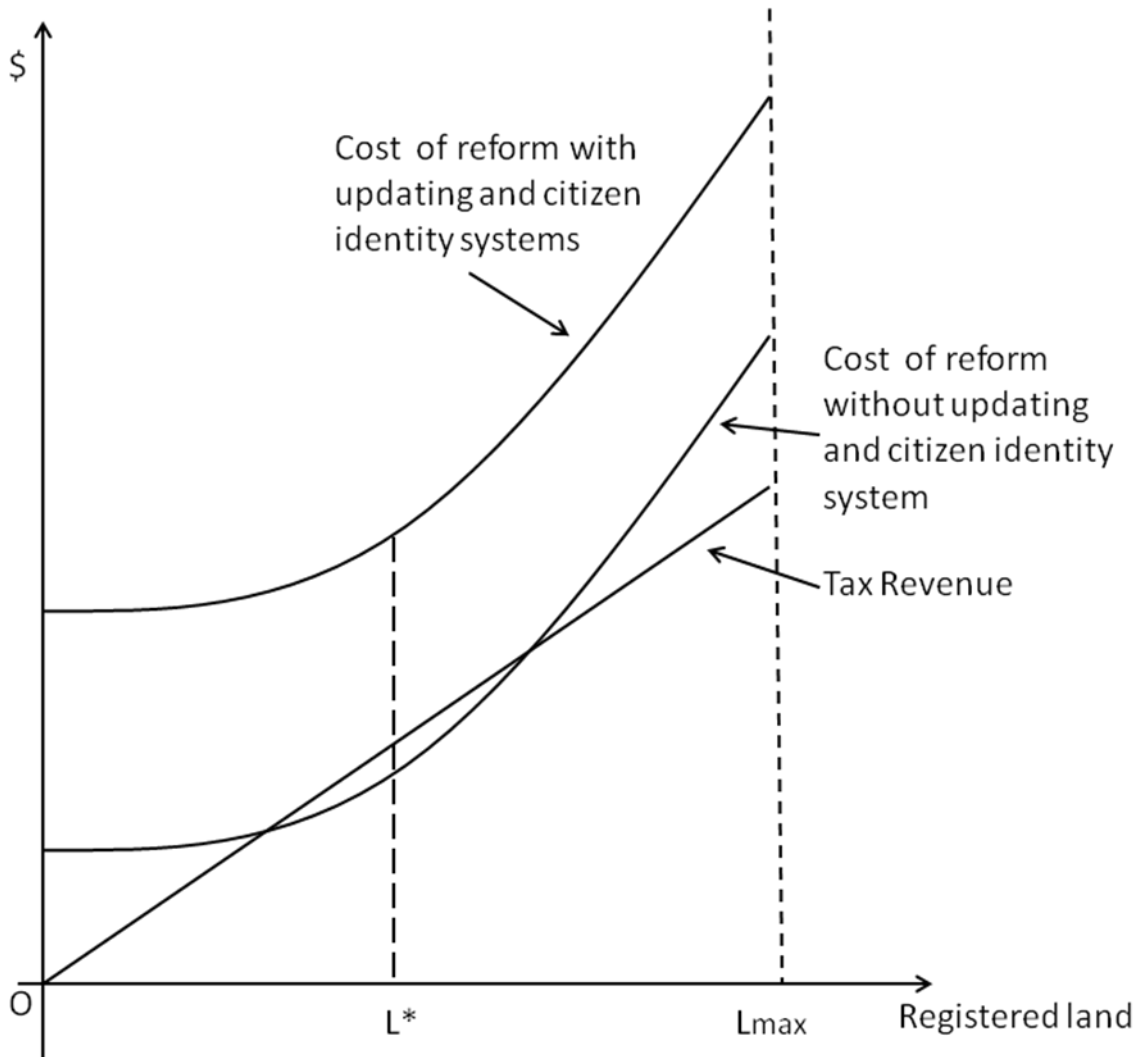


Table 1. A comparison of land tenure systems

| Country         | Japan<br>(1873)  | Korea<br>(before 1918)  | Taiwan<br>(before 1905)   |
|-----------------|--|---|---|
| Ownership       | Single owner   | Single owner  | Multiple owner<br>(sub-soil owner, top-soil owner)                                    |
| Land register   | Official registers<br>(100% of land was registered)                  | Official registers for tax<br>(50% of land was registered)                            | Official registers for tax<br>(30% of land was registered)                            |
| Updating system | Yes;<br>Registers were updated and connected to taxpayers            | No;<br>Registers were outdated and not informative to indentify taxpayers             | No;<br>Registers were outdated and not informative to indentify taxpayers             |
| Title           | Official titles;<br>All titles were linked to a centralized system   | Official and private title;<br>Private titles were not linked to a centralized system | Official and private title;<br>Private titles were not linked to a centralized system |
| Boundary (map)  | Taiko survey (1590s);<br>Cadastral survey (1873)                     | Boundary was described vaguely based on landmarks                                     | Boundary was described vaguely based on landmarks                                     |
| Tax system      | Based on the value of land;<br>Payable in money;<br>Uniform tax rate | Based on the size of the harvest;<br>Payable in rice;<br>Tax rate varied locally      | Based on the size of the harvest;<br>Payable in rice                                  |

Source. – Duus (1976), Lin (2008), Rhee et. al. (2004)

Table 2. Disputed and undisputed cases in issuing land titles in Babeldaob 2000 – 2010

|   | Disposed   |            | Pending    |            | Disposed + Pending |            | Total      | % of Disputed |
|---|------------|------------|------------|------------|--------------------|------------|------------|---------------|
|   | Disputed   | Undisputed | Disputed   | Undisputed | Disputed           | Undisputed |            |               |
| <b>States with the Japanese land registers in Babeldaob island</b>    |            |            |            |            |                    |            |            |               |
| Ngchesar  | 17         | 50         | 16         | 29         | 33                 | 79         | 112        | 29.5          |
| Ngaremlengui  | 11         | 14         | 2          | 7          | 13                 | 21         | 34         | 38.2          |
| Ngarchelong   | 46         | 154        | 7          | 5          | 53                 | 159        | 212        | 25.0          |
| Ngaraard  | 24         | 234        | 57         | 4          | 81                 | 238        | 319        | 25.4          |
| Melekeok  | 5          | 15         | 7          | 3          | 12                 | 18         | 30         | 40.0          |
| <b>Total</b>  | <b>103</b> | <b>467</b> | <b>89</b>  | <b>48</b>  | <b>192</b>         | <b>515</b> | <b>707</b> | <b>27.2</b>   |
| <b>States without the Japanese land registers in Babeldaob island</b> |            |            |            |            |                    |            |            |               |
| Airai   | 4          | 48         | 94         | 19         | 98                 | 67         | 165        | 59.4          |
| Aimeliik  | 24         | 10         | 7          | 1          | 31                 | 11         | 42         | 73.8          |
| Ngardmau  | 4          | 27         | 19         | 1          | 23                 | 28         | 51         | 45.1          |
| <b>Total</b>  | <b>32</b>  | <b>85</b>  | <b>120</b> | <b>21</b>  | <b>152</b>         | <b>106</b> | <b>258</b> | <b>58.9</b>   |

Source. – Palau Land Court

Note. – Two states that have fewer than five cases are excluded.

Table 3. Total amount of collateralized loan (collateral type: land) in Korea, 1918 – 1930

(Unit: 1,000 yen)

|      | Collateralized (land) regular loan |          |        | Collateralized (land) Short-term loan |        |        | Total   |
|------|------------------------------------|----------|--------|---------------------------------------|--------|--------|---------|
|      | Siksan                             | Dongchuk | Geumjo | Choeun                                | Siksan | Botong |         |
| 1918 | 6,621                              | 11,371   | 1,253  | 5,049                                 | 3,320  | 6,590  | 34,204  |
| 20   | 28,216                             | 30,571   | 10,639 | 12,037                                | 5,820  | 17,557 | 104,840 |
| 22   | 61,326                             | 37,927   | 18,128 | 19,438                                | 12,426 | 28,164 | 177,407 |
| 24   | 70,075                             | 39,806   | 18,749 | 21,417                                | 14,813 | 32,253 | 197,113 |
| 26   | 83,817                             | 35,609   | 25,518 | 17,003                                | 15,520 | 36,033 | 213,600 |
| 28   | 110,399                            | 38,743   | 25,642 | 9,070                                 | 16,669 | 34,429 | 234,952 |
| 30   | 140,120                            | 44,430   | 38,076 | 20,538                                | 8,996  | 46,423 | 298,583 |

Source. – Hori (1982)

Note. – 1) Siksan, Dongchuk, Geumjo, Choeun, and Botong are the names of financial institutions.

2) The formal land survey was completed on November 1918.

Table 4. Land transaction in Taiwan (Collateralization / Sales)

| Year | Parcels of land registered as collateral in Taiwan | Parcels of land registered as changing hands through sales in Taiwan |
|------|--|--|
| 1905 | 4848   | 4499   |
| 1906 | 43731  | 51137  |
| 1907 | 38040  | 62043  |
| 1908 | 39798  | 64210  |
| 1909 | 46279  | 68466  |
| 1910 | 54474  | 74815  |
| 1911 | 53718  | 86286  |
| 1912 | 67335  | 151125   |
| 1913 | 83341  | 121328   |
| 1914 | 92130  | 93759  |

Source. – Statistics on Land Registration in Taiwan (臺灣土地登記集計表) (1915)

Note. – Registration began in July of 1905.



Table 5. Former Japanese Colonies and British Colonies, Descriptive statistics

| Country                              | GDP<br>per capita<br>(\$, PPP)<br>in 2007 | INSTITUTION | PACIFIC<br>ISLAND | JAPANESE<br>LAND<br>SURVEY | CITY | LENGTH OF<br>BRITISH<br>OCCUPATION | REVISED<br>LENGTH OF<br>BRITISH<br>OCCUPATION |
|--------------------------------------|---|-------------|-------------------|----------------------------|------|------------------------------------|---|
| Bangladesh                           | 1300                                      | -0.84       | 0                 | 0                          | 0    | 172                                | 44  |
| Brunei                               | 51000                                     | 0.47        | 0                 | 0                          | 0    | 93                                 | 86  |
| Cambodia                             | 1800                                      | -1.10       | 0                 | 0                          | 0    | 0                                  | 0   |
| Cook Islands                         | 9100                                      | 0.84        | 1                 | 0                          | 0    | 83                                 | 81  |
| Fiji                                 | 5500                                      | -0.14       | 1                 | 0                          | 0    | 97                                 | 96  |
| Hong Kong                            | 42000                                     | 1.25        | 0                 | 0                          | 1    | 157                                | 155   |
| India                                | 2700                                      | 0.12        | 0                 | 0                          | 0    | 191                                | 44  |
| Indonesia                            | 3700                                      | -0.79       | 0                 | 0                          | 0    | 5                                  | 0   |
| Kiribati                             | 3600                                      | 0.43        | 1                 | 0                          | 0    | 88                                 | 44  |
| Laos                                 | 2100                                      | -1.06       | 0                 | 0                          | 0    | 0                                  | 0   |
| Macau                                | 28400                                     | 0.67        | 0                 | 0                          | 1    | 0                                  | 0   |
| Malaysia                             | 13300                                     | 0.51        | 0                 | 0                          | 0    | 128                                | 76  |
| Marshall Islands<br>Federated States | 2900                                      | -0.18       | 1                 | 0                          | 0    | 0                                  | 0   |
| of Micronesia                        | 2300                                      | 0.21        | 1                 | 0                          | 0    | 0                                  | 0   |
| Myanmar                              | 1900                                      | -1.46       | 0                 | 0                          | 0    | 60                                 | 29  |
| Nauru                                | 5000                                      | 0.73        | 1                 | 0                          | 0    | 52                                 | 41  |
| Pakistan                             | 2600                                      | -0.81       | 0                 | 0                          | 0    | 105                                | 44  |
| Palau                                | 7600                                      | 0.64        | 1                 | 1                          | 0    | 0                                  | 0   |
| Papua New Guinea                     | 2000                                      | -0.86       | 0                 | 0                          | 0    | 77                                 | 2   |
| Philippines                          | 3400                                      | -0.45       | 0                 | 0                          | 0    | 2                                  | 0   |
| Singapore                            | 49700                                     | 1.68        | 0                 | 0                          | 1    | 141                                | 134   |
| Solomon Island                       | 1900                                      | -1.05       | 1                 | 0                          | 0    | 80                                 | 10  |
| South Korea                          | 24800                                     | 0.73        | 0                 | 1                          | 0    | 0                                  | 0   |
| Sri Lanka                            | 4100                                      | 0.02        | 0                 | 0                          | 0    | 153                                | 39  |
| Taiwan                               | 30100                                     | 0.81        | 0                 | 1                          | 0    | 0                                  | 0   |
| Timor Leste                          | 2500                                      | -0.97       | 0                 | 0                          | 0    | 0                                  | 0   |
| Tonga                                | 5100                                      | 0.15        | 1                 | 0                          | 0    | 71                                 | 54  |
| Tubalu                               | 1600                                      | 1.28        | 1                 | 0                          | 0    | 88                                 | 44  |
| Vanuatu                              | 3900                                      | 0.07        | 1                 | 0                          | 0    | 37.5                               | 6   |
| Vietnam                              | 2600                                      | -0.53       | 0                 | 0                          | 0    | 0                                  | 0   |
| Thailand                             | 8200                                      | 0.20        | 0                 | 0                          | 0    | 0                                  | 0   |

Source. - CIA World Factbook (2007), Kaufmann, Kraay, and Mastruzzi (2007)

Table 6. OLS and 2SLS regression

Dependent variable: LogGDP per capita

|   | OLS                 | 2SLS   |  |  |
|---|---------------------|--|--|--|
|   |                     | instruments: LAND SURVEY<br>PACIFIC ISLAND<br>CITY | LAND SURVEY<br>PACIFIC ISLAND<br>REVISED LENGTH OF<br>BRITISH OCCUPATION | LAND SURVEY<br>PACIFIC ISLAND<br>LENGTH OF BRITISH<br>OCCUPATION |
| INSTITUTION (B)                             | 1.102**             | 1.449**  | 1.421**  | 1.122**  |
| (S.E)                                       | (.149)              | (.228)   | (.222)   | (0.303)  |
| PACIFIC ISLAND                              | -.929**             | -1.064**   | -1.053**   | -.937**  |
| (S.E)                                       | (.250)              | (.268)   | (.264)   | (.260)   |
| Adj R-square                                | 0.6534              | -  | -  | -  |
| <b>Weak Instruments Tests</b>               |                     |  |  |  |
| Shea Partial R-square in the 1st stage      |                     | 0.4642   | 0.4766   | 0.2199   |
| Anderson canonical correlation LM statistic |                     | 14.389   | 14.776   | 6.817  |
| H0: Under-identified (p-value)              |                     | (0.0008)   | (0.0006)   | (0.0331)   |
| Cragg-Donald Wald F statistic               |                     | 11.695   | 12.294   | 3.806  |
| Stock-Yogo weak ID test critical values:    | 10% maximal IV size | 19.93  | 19.93  | 19.93  |
|   | 15% maximal IV size | 11.59  | 11.59  | 11.59  |
|   | 20% maximal IV size | 8.75   | 8.75   | 8.75   |
|   | 25% maximal IV size | 7.25   | 7.25   | 7.25   |
| Sargan statistic                            |                     | 0.243  | 0.311  | 2.36   |
| H0: Instruments are vaild (p-value)         |                     | (0.6223)   | (0.5770)   | (0.1245)   |
| Number of observations                      | 31                  |  | 31   | 31   |

NOTE. - \* p &lt; .05; \*\* p &lt; .01

Table 7. First stage regression

| Dependent variable: INSTITUTION      | (2a)              | (2b)               | (2c)              |
|--------------------------------------|-------------------|--------------------|-------------------|
| LAND SURVEY                          | .978*<br>(.373)   | 1.236**<br>(.380)  | 1.126*<br>(.474)  |
| PACIFIC ISLAND                       | .650**<br>(.236)  | 0.384<br>(.226)    | 0.450<br>(.278)   |
| CITY                                 | 1.669**<br>(.385) | -                  | -                 |
| REVISED LENGTH OF BRITISH OCCUPATION | -                 | 0.012**<br>(0.003) | -                 |
| LENGTH OF BRITISH OCCUPATION         | -                 | -                  | 0.005*<br>(0.002) |
| R-squared                            | 0.4835            | 0.5053             | 0.2626            |
| Shea Partial R-square                | 0.4642            | 0.4776             | 0.2199            |
| F statistics (partialed out)         | 11.69**           | 12.29**            | 3.81*             |
| Number of observations               | 31                | 31                 | 31                |

NOTE. - \* p < .05; \*\* p < .01

## Appendix 1. Japanese Occupation

| Country          | JAPANESE OCCUPATION PERIOD                    | BRITISH OCCUPATION PERIOD |
|------------------|---|---------------------------|
| Brunei           | 1941.12.22-1945.6.10                          | 1888 - 1984               |
| Cambodia         | 1945.3.9-1945.8.15; troop 1940.9.22-1945.8.15 |                           |
| China            | 1932-1945 (Manchuria)                         |                           |
| Hong Kong        | 1941.12.25-1945.8.15                          | 1841-1997                 |
| India            | 1945 (Andaman and Nicobar Islands)            | 1757-1947                 |
| Indonesia        | 1942.3.8-1945.8.17                            | 1811-1816                 |
| Kiribati         | 1941.12.9-1943.11.23                          | 1892-1979                 |
| Laos             | 1945.3.9-1945.8.15; troop 1940.9.22-1945.8.15 |                           |
| Macau            | 1943.8-1945.8.14                              |                           |
| Malaysia         | 1942.1.31-1945.9.11                           | 1826-1957                 |
| Marshall Islands | 1914.10.3-1944.2                              |                           |
| Micronesia       | 1914.10.7-1944.2                              |                           |
| Myanmar          | 1942.8.1-1945.5.3                             | 1886-1948                 |
| Nauru            | 1942.8.26-1945.9.13                           | 1914-1920                 |
| Palau            | 1914.10.8-1944.10.11                          |                           |
| Papua New Guinea | 1942.1.21-1944.8                              | 1914-1921                 |
| Philippines      | 1942.1.2-1945.10.14                           | 1762-1763                 |
| Russia           | 1918-1927 (Sakhalin)                          |                           |
| Singapore        | 1942.2.15-1945.9.11                           | 1819-1963                 |
| South Korea      | 1910.8.29-1945.8.15                           |                           |
| Taiwan           | 1895.5.8-1945.10.25                           |                           |
| Timor Leste      | 1942.2.20-1945.9.11                           |                           |
| Tubalu           | 1941.12.9-1943.11.23 (not occupied)           | 1892-1979                 |
| Vietnam          | 1945.3.9-1945.8.15; troop 1940.9.22-1945.8.15 |                           |

Note. - Kiribati and Tubalu were the same country (Gilbert and Ellice Islands) in the 1940s. Japan did not occupied Ellice Islands (Tubalu)

Appendex 2. British occupation dates and the year of introducing the British land tenure system

| Country   | Date (BRITAIN)                       | Year Law, Survey, or Committee  |
|---|--------------------------------------|---|
| Brunei  | 1888 - 1984; autonomy 1959           | 1909 The Land Code  |
| Saunders (1994), A History of Brunei, p.114-115   |                                      |   |
| Cook Islands  | 1888-1900                            | 1891 To settle disputes about Land (Aitutaki) - IC.                     |
| Croccombe (1964), Land Tenure in the Cook Islands   |                                      |   |
| Fiji  | 1874-1970                            | 1876 The Real Property Ordinance (Torrens Systems)                      |
| <a href="http://www.cadastraltemplate.org/fielddata/a4.htm">http://www.cadastraltemplate.org/fielddata/a4.htm</a>   |                                      |   |
|   |                                      | 1875 The very first Department of Lands and Immigration was established |
| Hong Kong   | 1841-1997                            | 1844 The Land Registration Ordinance                                    |
| <a href="http://www.cadastraltemplate.org/fielddata/a4.htm">http://www.cadastraltemplate.org/fielddata/a4.htm</a>   |                                      |   |
| India   | 1757-1947                            | 1904 The recommendation of the 1904 Committee of Govt.                  |
| Mishra, Cadastral surveys in India: A critique; <a href="http://www.gisdevelopment.net/application/lis/policy/lisp0001.htm">http://www.gisdevelopment.net/application/lis/policy/lisp0001.htm</a>   |                                      |   |
| Kiribati  | 1892-1979; 1877 British jurisdiction | 1936 The first Lands Commission   |
| From Tuvalu; Kiribati and Tuvalu were the same country until 1975   |                                      |   |
| Malaysia  | 1826-1957                            | 1879 Introduction of the Torrens system                                 |
| <a href="http://www.cadastraltemplate.org/fielddata/a4.htm">http://www.cadastraltemplate.org/fielddata/a4.htm</a>   |                                      |   |
| Myanmar   | 1886-1948                            | 1907 The Settlement and Land Records Department                         |
| <a href="http://mission.itu.ch/MISSIONS/Myanmar/e-com/Agri/expind/agri-index/myanmar.com/Ministry/agriculture/Organi/slrd.htm">http://mission.itu.ch/MISSIONS/Myanmar/e-com/Agri/expind/agri-index/myanmar.com/Ministry/agriculture/Organi/slrd.htm</a> |                                      |   |
| Nauru   | 1914-1920; 1921-1968 Australia       | 1928 The Nauru Lands Committee; Given legislative backing in 1956       |
| MacSporrán (1995), Land Ownership and Control in Nauru  |                                      |   |
| Papua New Guinea  | 1884-1906; 1906-1971 Australia       | 1969 Surveying Ordinance  |
| 3rd FIG Regional Conference for Asia and the Pacific; <a href="http://www.fig.net/pub/jakarta/programme.htm">http://www.fig.net/pub/jakarta/programme.htm</a>   |                                      |   |
| Curley and Boydell (2004), The Regulation, Registration and Representation of Surveyors in the Pacific Islands Countries  |                                      |   |
| Singapore   | 1819-1963                            | 1826 English statutes in force  |
| Phang (2000), Hong Kong and Singapore   |                                      |   |
| Solomon Island  | 1893-1978                            | 1969 The Land and Titles Act  |
| Sullivan (2007), Recognition of Customary Land in the Solomon Islands   |                                      |   |
| Sri Lanka   | 1796-1948                            | 1910 village plans  |
| <a href="http://www.cadastraltemplate.org/fielddata/a4.htm">http://www.cadastraltemplate.org/fielddata/a4.htm</a>   |                                      |   |
| Tonga   | 1900-1970                            | 1927 An Act Relating To Land  |
| Seminar on "Good Governance in Land Tenure and Administration", Country Report Tonga; <a href="http://www.usp.ac.fj/index.php?id=7061">http://www.usp.ac.fj/index.php?id=7061</a>   |                                      |   |
| Tuvalu  | 1892-1979                            | 1936 The first Lands Commission   |
| Seminar on "Good Governance in Land Tenure and Administration", Country Report Tuvalu; <a href="http://www.usp.ac.fj/index.php?id=7061">http://www.usp.ac.fj/index.php?id=7061</a>  |                                      |   |
| Vanuatu   | 1906-1980                            | 1974 A Land Trust Board   |
| Burlo (1989), Land Alienation, Land Tenure, and Tourism in Vanuatu  |                                      |   |