

Land Reform, its Effects on the Rice Sector, and
Economic Development:
Empirical Case Study in Taiwan

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Abstract

Land reforms in developing countries provide a good experiment for study on development economics, and in the case Taiwan the land reform provides specific historical context for us to closely examine the relationship between redistribution and growth. In this paper, we use panel data on the fifteen counties of Taiwan around 1950s and 1960s to empirically evaluate whether redistributive land reform has had significant positive influence on land productivity and real capital accumulation. The main finding is that such a land reform incentivized landowner cultivator to improve rice productivity and indirectly financed national industrialization

Introduction

Political economy, you think, is an enquiry into the nature and causes of wealth. I think it should be called an enquiry into the laws which determine the division of the produce of industries amongst the classes who concur in its formation.¹

David Ricardo (in a letter to Thomas Malthus)

The struggle between accumulation and distribution and the trade-off between efficiency and equity seem no longer to be myth to us. Can an economy achieve a both fast and equitable growth? Or must we sacrifice equity in order to gain the initial momentum in economic takeoff? Questions like these are among the most debated issues in development economics in the last twenty years. Now thanks to the many theoretical and empirical works of social scientists in the past two decades, we are enlightened of the complementary relationship between efficiency and equity. In addition, the equitable economic miracle of many East Asian countries shed new light on this complementary relationship.

Most of the time before the Industrial Revolution human beings had been almost solely dealing with scarcity. It is no wonder, despite such conspicuous wealth inequality as exemplified by Robber Barons in the US, people's interest in Ricardo's argument lapsed for some time. Although a few great minds like Karl Marx continued on Ricardo's interest after him, it is not until after the Second World War when many developing countries started to show pattern of exceptionally fast and yet very equitable growth that a large number of people in economics started to seriously rationalize and quantify the relationship between equity and growth.

¹ Piero Sraffa (ed.), *The Works and Correspondence of David Ricardo*, Cambridge, 1953, Vol.8 p. 273.

Statistically that pattern can be simply summarized as fast growth in GDP and at the same time, with no delay, amazing decline in Gini coefficient. However, the much more complicated story behind these national level statistics is how governments modified policies to produce a more equitable distribution of the benefits of economic growth and then to make such equity the fuel for the next cycle of fast growth. As a successful example on both ends, Taiwan's experience constitutes the focal point for this paper.

This paper focuses on the case study of Taiwan land reform in the early 1950s. The transition from agrarian economy to an industrial one marked a vital stage for most developing countries right after the Second World War. Successful agricultural policy is the backbone for any attempt of industrialization. Tenancy reform as a particular type of land reform featuring the transfer of property right from rich to poor allows us to closely study the question of whether there is an inevitable trade-off between efficiency and equity. In this particular case of Taiwan, its land reform in the 1950s has been widely acknowledged as the central strategy to relieve poverty and increase agricultural production.

Taiwan is an important case study of land reform. First of all, it had shared colonial experience as many other developing countries did during the Second World War. In addition, it also saw enormous population increase following the closure of the civil war in Mainland China so land redistribution was a very necessary policy to relieve land scarcity problem. Last but not the least, compared to other successful land reform example, such as India, Taiwan's reform had a much more comprehensive package and the government enjoyed much more executive power to carry out its entire plan. In India, the new communist party did not have the national support to carry out the kind of radical redistribution of land, but in Taiwan significant political changes,

such as decolonization and civil war, afforded the government the opportunity to carry out comprehensive land reform with fairly small resistance.

This paper takes advantage of the existence of county level agricultural records available from 1950 to 1970 in Taiwan. It strives to uncover a story about Taiwan's land reform as a redistribution policy that is much richer than the overall national effect. Even for a region as small as Taiwan, county level variance still had noticeable influence on the overall effectiveness of land reform at addressing income inequality and growth. Our principal finding is that land reform did produce a large increase in agricultural production, but its effect varied across counties, and this difference was largely determined by the initial land distribution condition in each specific county. This finding is robust to a number of different estimation methods and control variables.

Historical Perspective

The general outcome of Taiwan's economic development during the postwar period was relatively well known. The most noticeable achievement is the good balance between rapid rates of economic growth and income distribution. The overall strategy can be summarized as modernizing agriculture, generating an agricultural surplus, accumulating real capital to provide industrial employment, and reallocating labor from agriculture to nonagricultural sectors.² As the first step of this strategy, the land reform conducted in early 1950s has been widely accredited with being the foundation for later economic boom. The overall package of the land reform was very broad. For example, rebuilding farmers' association and other rural financial infrastructure was certainly a part, and the construction of irrigation system was also carried out. However,

² John C.H. Fei, Gustav Ranis, and Shirley W.Y. Kuo, *Growth with Equity: the Taiwan Case*, (Washington: Oxford University Press, 1979), 4.

what characterized as the redistributive policy was the three-stage program to transfer land to tenants.

The land-transferring program was carried out in three different stages. The first stage featured an island-wide rent reduction to 37.5% for all farm tenants. This policy started to be enforced in 1949 and set an island-wide standard rent of 37.5% of annual yield.³ The second stage was the major sale of public lands to tenanted farmers. The sale was announced in December 1951 and within a month a total of 59,529 tenant farmers bought 27,620 hectares of public land, averaging around 0.45 hectare for each purchase.⁴ The last stage also the most significant stage was the land-to-the-tiller program. By the end of the 1952, it was proposed that all tenanted farmland shall be purchased by the government and then be resold to tenant farmers. In other words, this policy aimed to transfer property right from the absentee landlord to the actual tenant tiller. By the end of the 1953, a total of 143,568 hectares land had been transferred from 106,049 landlords to 194,823 tenant purchasers.⁵

Although the first two steps did not transfer land from rich to poor, they set the stage for the land-to-the-tiller program. Right after the first reduction policy, the entire island saw a drastic drop in market value of tenanted land as distinct from owner-cultivated land. According to official records, “the investigation by the Chinese Cabinet Inspection Team in December 1950 showed that the land prices had dropped by one-third to one-half as compared with those before

³ *General Report of the Joint Commission on Rural Reconstruction*, (Taiwan: annual volume from 1948 to 1976), 1948-1950, 68. This program consisted of four parts: the first was rent reduction to 37.5% of main crop. The second part was to release extra burdens from the tenant farmers. The third part ensured security of tenure to the tenant farmers by providing for a definite period of tenure ranging from the minimum of three to the maximum of six years. Finally the program provided for registration and re-conclusion of farm lease contracts.

⁴ JCRR1951-1952, p153. According to this program, the purchase price was fixed at 2.5 times the value of the main crop yield on the land to be amortized in 10 annual installments with each annual installment not more than the amount of 37.5% rent. JCRR 1950-1951,p121.

⁵ JCRR 1953-1954, p150. Government payments issued to landlords were mostly in the forms of rice bonds, sweet potato bonds and money from public land sale. 30% of the total land purchase price was paid with the stocks of five state enterprises.

the rent reduction.”⁶ A direct consequence of such a drop in value was that landlord become less attached to their land as their primary form of investment. In addition, the drop in land value combined with the drop in rent enabled increasingly more tenants to purchase land from their landlords. The sale of public land demonstrated the determination of government to redistribute land and helped to quiet down resistance for the land-to-the-tiller program. All the proceeds from the sale of public land would later be used for the purchase of private land from large landlords.⁷

Land reform was initiated and successfully carried out for several reasons and the most notable ones were legacy from previous colonial experience and civil war in Mainland China. Ever since Taiwan was ceded to Japan in 1895, Taiwan had become the agricultural base for Japan’s industrialization. According to official documents, compared to other Asian countries Taiwan had much better farmers’ association and agricultural infrastructure since the start of postwar reconstruction due to colonial rule.⁸ A much more important colonial legacy, according to Fei, Ranis and Kuo, was that the overwhelmingly Japanese ownership of manufacturing enterprises contributed to a more equal distribution of income in two ways: it reduced the concentration of industrial assets in private Taiwanese hands in the period immediately after the independence, and it provided a source of industrial assets that could be distributed as compensation to landowners under the land reform.⁹ Immediately after the closure of civil war in Mainland China, Taiwan saw a large inflow of population from the Mainland. The competition for the already scarce land suddenly became so severe that the stable rule of the Nationalist party hinged on a successful redistribution of land.

⁶ JCRR 1950-1951, p96

⁷ JCRR 1950-1951, p121

⁸ JCRR 1948-1950, p92

⁹ John C.H. Fei, Gustav Ranis, and Shirley W.Y. Kuo, 37.

The entire reform was designed and implemented by the Sino-American Joint Commission on Rural Reconstruction (JCRR). JCRR was a technical collaboration program in agriculture and forestry established in Nanking in October 1948. It was composed of two members appointed by the President of the United States and three members appointed by the President of China. The basic working principal of the JCRR was not to build a new institution from the outside. Acting as a sponsoring agency, it sought to work closely with institutions that had already been growing in the rural areas. For example, the JCRR brought US financial aid to train personnel for the original farmers' association.¹⁰

Literature Review

As mentioned above, this paper draws upon scholarships from two independent fields. As far as the research subject is concerned, the work in this paper builds on the scholarship in political economy that focuses on Taiwan's postwar economic miracle. Previous works in this field lay the historical foundation for our analysis. In terms of methodology, our effort builds on the still ongoing economic debate on equality vs. growth. Overall, this study attempts to bridge together these two bodies of scholarship by situating the economic analysis into the historical context of Taiwan's land reform in the 1950s.

The many literatures on Taiwan's postwar economic development are largely part of the vast scholarship on East Asian postwar miracle. What Chalmers Johnson characterized as "development state" stimulated huge interest in the West where people rushed to rationalize state policies in East Asia. As a major sponsor of researches on this topic, the World Bank published a very comprehensive book in 1993, *The East Asian Miracle: Economic Growth and Public Policy*. At the time of its publishing, the debate between the neoclassical economics and newly

¹⁰ JCRR 1948-1950, p6

rising state-led model was at its peak. Therefore, the main methodology of this book is first to evaluate the fundamentals of an economy, as the neoclassical school would value, and then to investigate the effectiveness of various state interventions in certain East Asian countries. Specifically about state intervention in agriculture, the book argues that the good coordination between agricultural sector and manufacturing sector set the stage of shared growth and the good fundamentals. As the book observes, “as in other economies, agricultural sectors in the HPAEs were a source of capital and labor for the manufacturing sector. But in East Asian these resources were pulled into manufacturing by raising wages and returns, rather than squeezed out of agricultural by high taxes and stagnant or declining incomes. As a result, rural-urban income differentials were smaller in the HPAEs than in most others.”¹¹ Then the book goes on suggesting that shared growth set the stage for universal education, high saving rates and high investment rates. Although all these evaluations are merely observation without quantitative analysis, we can still see how important agriculture sector is for setting the stage for everything ensuing. This paper builds on this initial judgment and attempts to study the agricultural sector more empirically.

Taiwan’s state policies on agricultural sector have been widely acknowledged as one of the most successful state interventions among the developing countries. Based on national-level statistics, Anthony Y.C. Koo observes the increase in income due to rent reduction program and the more equal distribution of land due to land transfer.¹² In a more recent work, using theoretical modeling Fei, Ranis and Kuo (1979) study the interaction between Gini coefficient and growth in the case of Taiwan. In this particular study, Kuo et al. aimed to refute the inverse U-shaped

¹¹ The World Bank, *The East Asian Miracle: Economic Growth and Public Policy*, (NY: Oxford University Press, 1993), 352.

¹² Anthony Y.C. Koo, *The Role of Land Reform in Economic Development*, (NY: Frederick A. Praeger Publishers, 1968), 53.

relation between growth and equity observed by people like Kuznets. According to the inverse U-shaped relation between growth and equity, as income increases from low levels the distribution of income must first worsen before it can improve. Kuo et al. uses Taiwan as a living counterexample to such U-shaped relation.¹³ In their modeling, they divided overall phase of transition into subphases and in each subphase the model takes into consideration the changes in the endowment of resources and the effective packages of policies. Their results show a complimentary relationship between Gini coefficient and growth.

Among the many literatures on equality and growth, the research by Torsten Persson and Guido Tabellini (Persson and Tabellini, 1994) inspires the methodology of our work most. The main objective of their work is also to disprove the Kuznets curve. Their theoretical modeling bases on the argument that accumulation and growth hinge on adequate private appropriation and builds an overlapping-generations model with constant population where non-altruistic individuals live for two periods.¹⁴ With this assumption, they prove their proposition with cross-country data. In their empirical model, the proxy for income inequality is the income share accruing to the third quintile, which measures the relative position of the middle-income quintile. Their results indicate a strong and positive relationship between this measure of income equality and growth.¹⁵ However, the major imperfection lies in the data part of this study. Since this study uses cross-country time series data of both much earlier time and postwar time periods, so many differences among countries and across time have been generalized and ignored. In addition, the Kuznets curve specifically focuses on the initial stage of an economy's development. Therefore,

¹³ Fei, Ranis, and Kuo, 3.

¹⁴ Torsten Persson and Guido Tabellini, "Is Inequality Harmful for Growth", in the *American Economic Review*, Vol.84, June 1994, 600.

¹⁵ Torsten Persson and Guido Tabellini, 612

in order to empirically evaluate Kuznets curve, we need to closely study an economy at the initial takeoff stage. That is why Taiwan is the focal point of our study.

Before we move to the model section of this paper, we need to compare our study to similar studies on agricultural reform done in other countries, in order to highlight the uniqueness about Taiwan's experience. Timothy Besley and Robin Burgess did a study with similar focus on India in 2000. In their "Land Reform, Poverty Reduction, and Growth: Evidence from India", they closely study the effectiveness of India's land reform on poverty reduction and economic growth. Similar to our study, their analysis relies on a panel data on the sixteen main India states from 1958 to 1992. Their methodology is also a fixed effect study to quantify the effect land reform had on rice output. In their conclusion, they find robust link between poverty reduction and land reform policies.¹⁶ However, as mentioned in their paper, partly the reason why they use data covering so long a time period is that "while land reform legislation abounds, the real impact on the conditions of the poor is muted by unenthusiastic implementation of proposed changes."¹⁷ In addition, Besley and Burgess made extra effort to read the policy contents specific to each states and created detailed categories of different kinds of reform in different states. Land reform in India is not a nationwide reform designed by the central government, and instead each state has great autonomy in terms of which policies to implement and when to implement. Consequently, land reform can mean different things in different states and the starting dates are also ambiguous. In contrast, land reform in Taiwan was designed by the central government and implemented island-wide without much variation and resistance. Therefore, Taiwan land reform is much closer to a natural experiment for us to study.

¹⁶ Timothy Besley and Robin Burgess, "Land Reform, Poverty Reduction, and Growth: Evidence from India", in *The Quarterly Journal of Economics*, (May, 2000), 424.

¹⁷ Timothy Besley and Robin Burgess, 390

Although no two countries are exactly alike, and our analysis on the case of Taiwan may not have the external validity to be applied to other developing countries, a close examination of the relationship between growth and equality in a specific historical context can turn out to be very fruitful. With specific historical context, we can avoid many unnecessary generalizations, isolate as many mechanics as data allow us, and make judgment about through what channel and circumstance equity can actually make positive contribution to the overall growth.

Data and Model Description

Our agricultural data come from the annual *Taiwan Agricultural Yearbook* covering from 1950 to 1970, collected and published by the Department of Agriculture and Forestry of Taiwan Government. For each specific year, the yearbook contains county level data for all 15 counties of Taiwan on agricultural production and rural household conditions, such as rice output and the percentage of owner-cultivator. Our financial data come from the annual *Taiwan Financial Yearbook* covering from 1951 to 1956, collected and published by the Bank of Taiwan. Within each volume, it contains county level data on savings. With data in both time span and county level, we are able to construct a panel data set for fixed effects analysis on whether land reform has positive effect firstly on agricultural production and secondly on real capital accumulation. Finally, in the annual *General Report of the Joint Commission on Rural Reconstruction*, published by the JCRR, we are able to collect useful data on the implementation of land reform as well. Although these data are not in panel format, they help us to run more tests on our panel data set above.

Our first part is to empirically test whether land reform had a positive influence on agricultural productivity. Our fixed effects model is of the form:

$$Y_{it} = \beta_1 X_{it-1} + \alpha_i + u_{it}, \quad (1)$$

where Y_{it} is the logarithm productivity of rice production in county i at year t . X_{it-1} is the percentage of owner-cultivator in county i at year $t-1$. The notion of owner-cultivator is defined as opposed to tenant-cultivator. Since the ultimate goal of the land reform was about transferring land property right from large absentee landowners to tenant farmers, we expect to see the percentage of tenant-cultivator drop and owner-cultivator increase. α_i is a county fixed effect that does not vary across time. β_1 is the effect of land reform we are interested in.

Equation (1) is a reduced-form model of the impact of land reform, because land reform is used as a regressor. For any policy study, questions like how to assess the effectiveness of the policy and whether the policy is effectively implemented are always important for every researcher to keep in mind. As we mentioned above the overall package of land reform in Taiwan was very broad, but in this study we are only interested in the redistributive effect of the land reform. More specifically, we are interested in how the transfer in ownership can incentivize cultivators to improve their productivity. Similar to Besley and Burgess, we will use the percentage of owner-cultivator as a quantifiable proxy for the effectiveness of land reform. The main advantage for such simplification is that such percentage change not only is readily available in our data source but also measured the direct result of land reform. Therefore, β_1 will be likely to provide a lower bound on the true effect of the implemented land reform. Additionally, in order to allow for any lagging in the impact of the land reform, we have lagged the land reform variable by one year. The dependent variable we are interested in is rice productivity, so we will use the logarithm of rice productivity as our dependent variable. Our explanatory variable is not perfectly exogenous because besides land reform other potential omitted variables could also affect the percentage of owner-cultivator. However, it is exogenous

to our dependent variable because rice productivity was not a cause for change in land ownership.

As for the fixed effects, we will only control entity fixed effects not time fixed effects. In our model we are not concerned with time fixed effect and more importantly we should not control for time fixed effect. First of all, the years between 1948 and 1951 were times of rural reconstructions for Taiwan and therefore imports of agricultural technologies were quite active. However, years after 1951 were supposed to be more static in terms of agricultural technological change. Within a short time span of 20 years, the effect of technological advance should be negligible. More importantly, if controlling for time fixed effect, we are actually weakening the effect of land reform variable. For example, after gaining property rights over land, farmers have more incentive to increase productivity by investing in agricultural machinery. So the gradually increasing usage of machinery is one of the channels through which X_{it} influences productivity. Should we control for time fixed effects, it is very likely that we would exclude this growing usage of machinery.

The second part of our model is to empirically test whether land reform indirectly contributed to the increase in savings. As we mentioned earlier, people believe that successful agricultural reform provided the necessary capital for industrialization. Our fixed effects model is of the form:

$$C_{it} = \beta_1 X_{it-1} + \alpha_i + u_{it}, \quad (2)$$

where C_{it} is the logarithm of saving amount in county i at year t . X_{it-1} is the percentage of owner cultivator in county i at year $t-1$. α_i is a county fixed effect that does not vary across time. β_1 is the effect of land reform we are interested in. With similar logic as above, we choose not to control for time fixed effect. However, due to data availability, Equation (1) has data from 1950

to 1970 but Equation (2) has data from 1951 to 1956. Below here are some summary statistics of our panel data.

Table I

County	Productivity in 1950 (kg/ha)	Productivity in 1970 (kg/ha)	Savings in 1951	Savings in 1956	Percentage of owner-cultivator 1950	Percentage of owner-cultivator 1970	Growth in productivity 1950-1970	Growth in Saving 1951-1956	Growth in percentage of owner-cultivator 1950-1970
1	1669.1	2199.7	81396	761585	33%	68%	32%	836%	106%
2	1869.1	2601.2	93394	615790	31%	64%	39%	559%	106%
3	1609.4	2780.3	81608	668171	25%	81%	73%	719%	224%
4	1763.6	2826.3	177780	968822	31%	81%	60%	445%	161%
5	2069.0	2738.8	100617	559911	34%	76%	32%	456%	124%
6	2242.1	3546.3	149625	879632	28%	75%	58%	488%	168%
7	2122.3	3475.7	156853	692600	29%	84%	64%	342%	190%
8	2084.4	3184.5	119126	552528	40%	72%	53%	364%	80%
9	1952.2	3456.6	145748	556459	42%	90%	77%	282%	114%
10	1741.7	3280.1	190830	1167413	38%	78%	88%	512%	105%
11	1861.9	3141.8	153325	558079	40%	84%	69%	264%	110%
12	1828.5	3306.0	126376	481769	38%	73%	81%	281%	92%
13	1945.9	3794.9	172215	731050	30%	77%	95%	324%	157%
14	1511.8	2973.2	42702	242751	48%	60%	97%	468%	25%
15	1442.1	2926.8	92225	419881	32%	61%	103%	355%	91%

Before we start to discuss the results to equation (1) and (2), we will run some tests on our data set just to get a big picture of it. First of all, we run some cross-sectional regressions on our summary statistics. The two cross-sectional regressions are of the form:

$$\Delta Y_i = \beta_1 \Delta X_i + u_i \quad (3)$$

$$\Delta C_i = \beta_1 \Delta X_i + v_i \quad (4)$$

where ΔY_i is the growth in productivity from 1950 to 1970, ΔC_i is the growth in savings from 1951 to 1956, and ΔX_i is the growth in percentage of owner-cultivator from 1950 to 1970. All the data come from Table I above. The results are below:

Table II
Cross-sectional Regression

growth in prod	growth in sav
(1)	(2)

gocp	-0.079 (0.127)	0.646 (0.904)
Constant	0.779*** (0.168)	3.666*** (1.197)
N	15	15
R2	0.029	0.038
Adjusted R2	-0.045	-0.036
Residual Std. Error (df = 13)	0.233	1.663
F Statistic (df = 1; 13)	0.394	0.510

Notes: ***Significant at the 1 percent level.
 **Significant at the 5 percent level.
 *Significant at the 10 percent level.

From Table II above, we see that neither coefficient on growth in percentage of owner-cultivator is significant. Therefore, we still need the panel regression outlined in Equation (1) and (2) to see the potential effects of land ownership.

Results

Our fixed effect model in Equation (1) is of the form:

$$Y_{it} = \beta_1 X_{it-1} + \alpha_i + u_{it}, \quad (1)$$

where Y_{it} is the logarithm productivity of rice production. The data come from the *Taiwan Agricultural Yearbook*, where rice production is recorded as kilogram and area of cultivator is recorded as hectare. During data entry, we calculated rice productivity as kilogram per hectare. X_{it-1} is the fraction of owner cultivator in county i at year $t-1$. The data also come from *Taiwan Agricultural Yearbook*, where the fraction is recoded as percentage. During data entry we transferred percentage into decimal format.

Table III: Panel Regression for log rice productivity against percentage of owner-cultivator

logprod	
ocpercentt	0.994*** (0.074)
N	240
R2	0.445
Adjusted R2	0.415
F Statistic	179.261*** (df = 1; 224)

Notes: ***Significant at the 1 percent level.
 **Significant at the 5 percent level.
 *Significant at the 10 percent level.

According to Table I, the change in owner-cultivator percentage has a positive and significant influence on rice productivity. As we have expected, the land-transferring program under the land reform does contribute to the increase in agricultural production. The coefficient in Table I indicates that 1% increase in the percentage of owner-cultivator translates into 0.994% increase in rice productivity. This coefficient is statistically significant at 1% significance level. Therefore, this result empirically confirms the many qualitative evaluations on how land reform can improve agricultural productivity.

The fixed effect model in Equation (2) is of the form:

$$C_{it} = \beta_1 X_{it-1} + \alpha_i + u_{it}, \quad (2)$$

where C_{it} is the logarithm of saving amount in county i at year t . The panel saving data are constructed from sources in *Taiwan Financial Yearbook*, where saving amount for each county in each year is recorded in the unit of 1000 Taiwan currency. X_{it-1} is the same with in Equation (1).

Table IV: Panel Regression for log saving against percentage of owner-cultivator

logsaving	
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ocpercentt	2.133***
	(0.210)
N	75
R2	0.636
Adjusted R2	0.501
F Statistic	103.262*** (df = 1; 59)

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

According to Table II, the change in owner-cultivator percentage has a positive and significant impact on the saving amount. The coefficient in Table II indicates that 1% increase in the percentage of owner-cultivator results in 2.133% increase in the saving amount and this coefficient is significant at 1% significance level. Such positive relationship could result from two channels. First of all, the increased land productivity confirmed in Table I generated more wealth and thus more saving. In addition, given that the saving habit of people is unlikely to change within such short time span, the redistributive land reform contributed to more equal income distribution, which in turn led to more saving from ordinary households. Therefore, successful land reform did help to finance the ensuing national industrialization.

We can summarize our findings in this section as follows. First, the land distribution equality has positive contribution to land productivity growth. Second, more equal distribution of land also leads to more savings that could be invested in industrialization programs. One important implication the first finding has is that less concentration in land distribution actually does not lead to large economy of scale loss that might undermine land productivity. Economy of scale loss resulted from redistributive policy has long been the major argument of people who

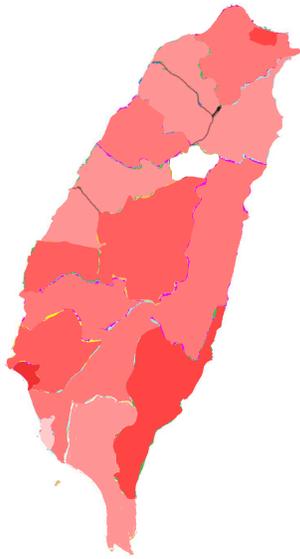
are pessimistic about equality in the initial stage of development.¹⁸ We will discuss more about this in the next section.

Discussion and Robustness Check

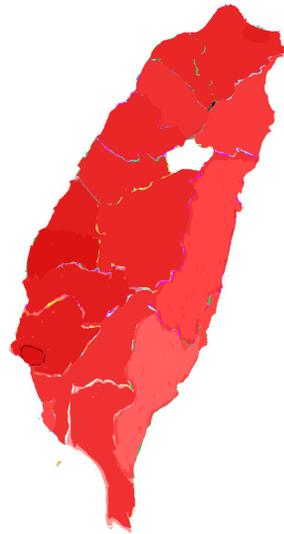
Before we start to check the possible of economy of scale loss, we need to check for any potential cluster and spillover effect among the 15 counties, which are common in panel data. If there were any obvious clusters, we need to test them separately on our models. For example, if we were to find any county or group of counties stand out in terms of percentage of owner-cultivator and land productivity, we then need to include possible spillover effect they might have on their neighbors. The best way to show this is by choropleth map of Taiwan on our key variables.

Figure I

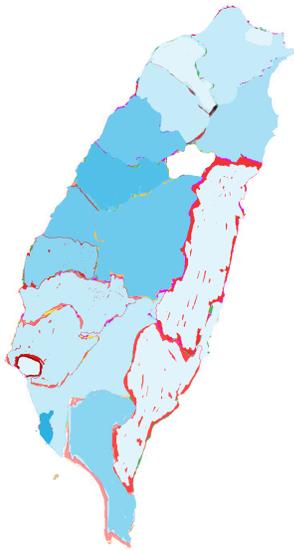
¹⁸ Numerous studies on loss of scale economy during land reform are worth mentioning here. Loss in scale economy can result from various aspects during land transferring. First of all, it could be what Carter and Alvarez called, “disorganized decollectivization”(Carter and Alvarez 1989). In other words, land dividing makes cooperation hard and efficiency drops. In addition, scale loss can also occur when land is transferred from skilled farmers to unskilled landless people. Last but not the least, Klaus Deiniger and Hans Binswanger argue that scale loss is more than just smaller farm size but also the worse condition in the overall agricultural markets. According to their study, to the degree that imperfections in those markets, rather than an inherent productivity advantage of large farm size, are at the source of differences in the shadow price of land across categories of farm size, improvements in these markets through regulation, better information, or cooperatives to reap economies of scale or input supply could lead to productivity gain. Klaus Deiniger and Hans Binswanger, “The Evolution of the World Bank’s Land Policy: Principles, Experience and Future Challenges”, in *The World Bank Research Observer*, vol.14, no2, August 1999, 252.



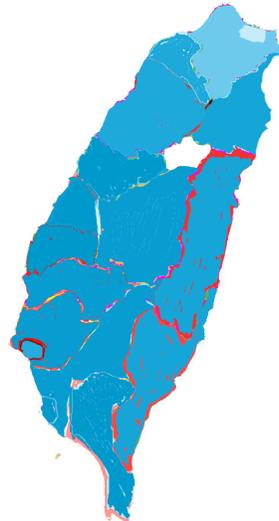
Percentage of Owner-cultivator
1951



Percentage of Owner-cultivator
1968



Rice Productivity
1951



Rice Productivity
1968

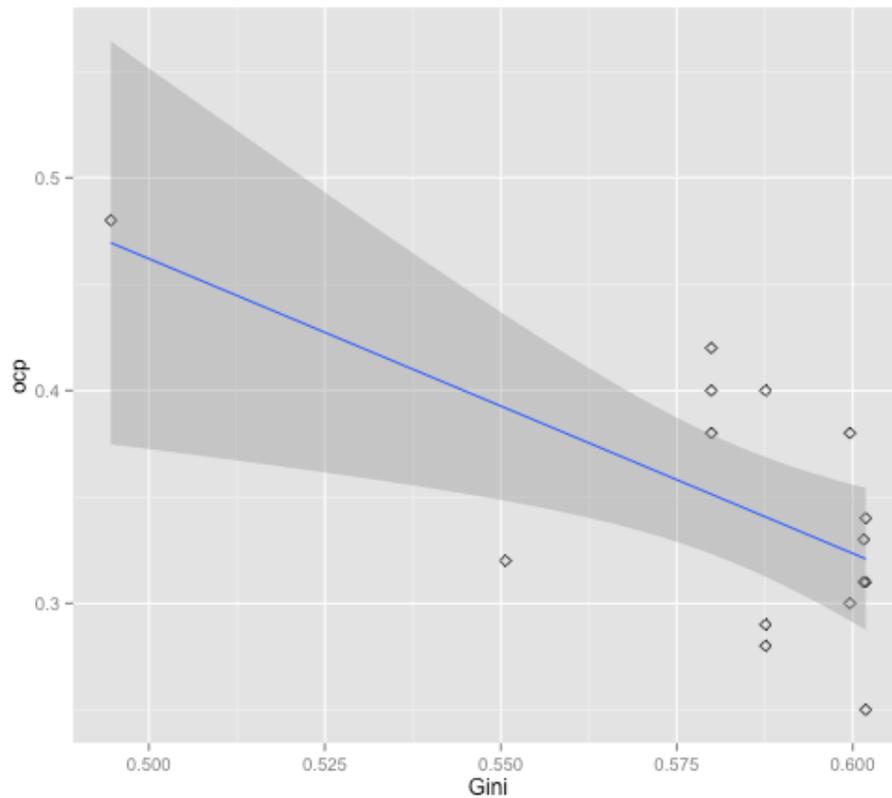
*Darker color indicates higher average value.

Here are some key observations from the choropleth maps above. For both variables, the color darkness changes across time and confirms our expectation that from 1951 to 1968 the percentage of owner-cultivator increased and rice productivity also increased. Besides observation across time, geographically we observe some variations for both variables in 1951

but do not observe much difference across different counties in 1968. Additionally, in both years for both variables, we do not see any obviously outstanding region that could have spillover effect to its neighbor. This could be due to two reasons. First of all, as mentioned above, land reform in Taiwan was designed and implemented by the central government for the entire island, so there was little difference in policy details for each county and the coordination across the entire island was good. Secondly, Taiwan is geometrically small and has little variations in climate conditions, so except cultivation area and soil quality there is unlikely to be any strong cluster effect. With these observations, we are more confident in our model.

Now we discuss how economy of scale loss could play a role in the effectiveness of land reform. First of all, we should notice that the more concentrated land distribution is initially the more economy of scale loss will result from redistributive land policy. In particular, would land reform work less effectively or even adversely on counties with more concentrated initial land distribution? Therefore, our strategy is to divide the 15 counties into two groups based on their initial land distribution equality, the more equal group and the less equal group. Thanks to a land survey done in 1948 before the land reform, we have data on initial land distribution in county level. From these data, we calculated the Gini coefficient on land concentration for each county and then divide these counties into two groups based on their Gini index.

First we will visualize our Gini index by calculating the correlation between Gini and our first year percentage of owner-cultivator. Figure II:



Correlation = -0.6325225

From Figure II above, we can see that there is a strong negative correlation between Gini index on land concentration and percentage of owner-cultivator and the correlation gives a value of negative 0.63. It means that in counties where land distributions were more concentrated, we tend to find smaller percentage of owner-cultivator. This negative correlation agrees with our model and expectation.

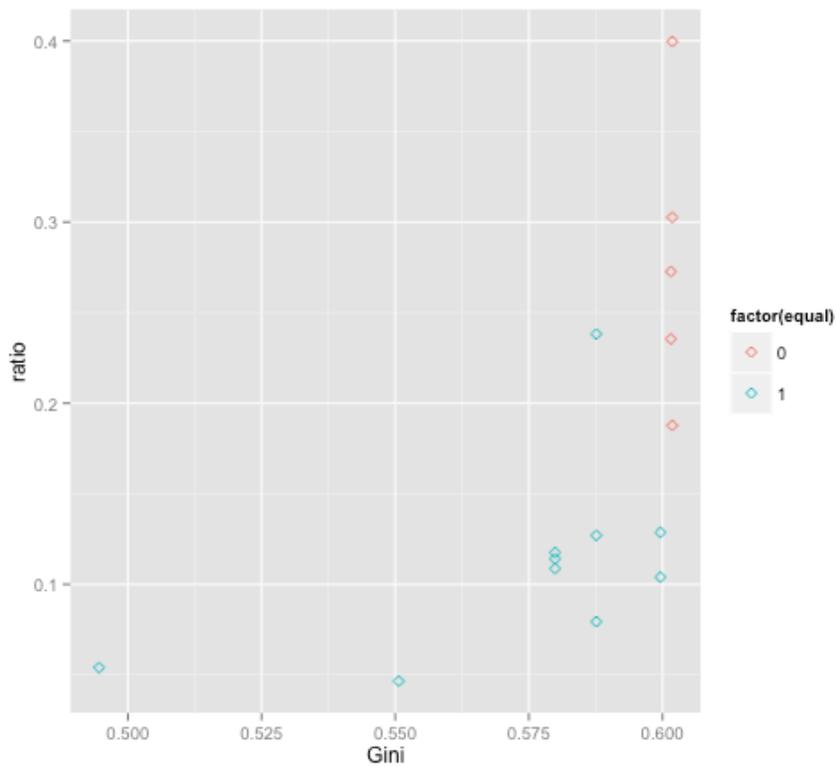
Now, we run our fixed effect models on these two groups separately.

Table V: log rice productivity against percentage of owner-cultivator (Grouping by GINI Index)

logprod		
(1) all	(2) Gini<0.6	(3) Gini>0.6

difference confirms the existence of scale loss during redistribution, and counties with more concentrated initial land distribution did suffer from greater extent of scale loss.

Our analysis above needs a further robustness check before conclusion, because there is another possible explanation to why such difference existed between the two groups of counties. Firstly, in counties with less equal initial distribution, the implementation of land reform might be less effective. For example, the more large landowners in those counties might have resisted land redistribution more severely. In other words, although on the national level Taiwan's land reform had been carried out with fairly less resistance, the enforcement might have run into more resistance in those counties. Consequently, the total amount of land transferred would be smaller in those counties. To empirically test this possible mechanism, we have data from JCRR reports on the total amount of land transferred for each county in 1953. Figure III:



In Figure II above, X-axis marks the Gini coefficients on land for the 15 counties in Taiwan, and Y-axis marks the ratio of total land transferred/ total cultivated area. All the red circles mark counties of less equal initial distribution and blue circles mark counties with more equal initial distribution. The overall picture is obvious. Counties with less equal initial distribution actually got more land redistribution. Therefore, the difference in the effectiveness of land reform between the two groups of counties is not caused by the actual implementation of the reform. Then the only mechanism we have is that counties with less equal initial distribution did suffer from greater scale loss. Therefore, there exists economy of scale loss during land reform.

Last but not the least, above we have argued that we should not control for time fixed effects and now we should test our model with both time and individual fixed effects. Then the new fixed effects models would be of the form:

$$Y_{it} = \beta_1 X_{it-1} + \alpha_i + \theta_t + u_{it} \quad (5)$$

$$C_{it} = \beta_1 X_{it-1} + \alpha_i + \theta_t + u_{it} \quad (6)$$

where everything is the same with Equation (3) and (4), except that θ_t represents the time fixed effects for the many years. The regression results are below:

Table VII

	logproductivity		
	(1) all	(2) Gini<0.6	(3) Gini>0.6
ocpercentt	-0.163** (0.079)	-0.140* (0.075)	0.209 (0.173)
N	240	160	80
R2	0.020	0.026	0.024
Adjusted R2	0.018	0.021	0.018
F Statistic	4.295** (df = 1; 209)	3.507* (df = 1; 134)	1.460 (df = 1; 59)

Notes:

***Significant at the 1 percent level.
**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table VIII

	logsaving		
	(1) all	(2) Gini<0.6	(3) Gini>0.6
ocpercentt	0.116 (0.263)	0.146 (0.470)	-0.335 (0.461)
N	75	50	25
R2	0.004	0.003	0.034
Adjusted R2	0.003	0.002	0.020
F Statistic	0.196 (df = 1; 55)	0.096 (df = 1; 35)	0.529 (df = 1; 15)

Notes: ***Significant at the 1 percent level.
 **Significant at the 5 percent level.
 *Significant at the 10 percent level.

From Table VII above, we see that column (1) and (2) actually give a negative coefficient on our regressor, the percentage of owner-cultivator. However, column (3) does not give a significant coefficient and the same with Table VIII. As we argued above, taking out time fixed effect will actually weaken the effect of land ownership, because the incentive impact of land ownership work through time fixed effects such as growing use of machinery. Indeed, our model in Equation (1) and Equation (2) suffer from potential omitted variable bias such as technology change over time. We still need to be careful when control for time fixed effects, because we only want to control for those that are not correlated with land ownership change, such as technology and climate change. For future efforts, our model will benefit greatly if we can include those uncorrelated time fixed effects as individual variables in our model, so that the coefficient on the percentage of owner-cultivator will only show the impact of land ownership change. For now due to data unavailability, our model will still assume that technological and climate change is not large within a short 20-year span.

To summarize, although economy of scale loss can partly offset the positive influence of land reform, we still see equality bring in higher land productivity and indirectly contribute to higher saving amount. In other words, equality is a much stronger positive impact than the offsetting force of scale loss. The above discussion about scale loss does suggest that it may be worthwhile to explore the complicated role played by economy of scale during redistribution with better data.

Conclusion

Drawing on the principle that national growth hinges on the ability of individual to appropriate the fruits of their work, in the paper we first construct a simple panel format of fixed effect model. By controlling for entity fixed effects, this model captures how land ownership to the cultivators can not only encourage growth in agricultural sector but also stimulate growth in saving amount. Next, we confront the model's empirical implication about economy of scale loss. The main empirical result is that economy of scale loss does exist during redistribution but is not large enough to totally offset the contribution of redistribution. The main contribution of this paper is in twofold. First of all, as a policy study, this study empirically tests whether Taiwan's land reform in the 1950s functioned as people have imagined. Our finding supports the belief that Taiwan's land reform first generated more agricultural surplus and then accumulated real capital for industrialization. In addition, Taiwan's land reform was after all a redistributive experiment, so our study also contributes to the debate between equality and growth. Our confrontation with economy of scale loss further supports the strong contribution equality has for overall growth.

However, our study restricts land reform to be in the form of land ownership transferring from large absentee landlords to tenants. Therefore, our empirical results may not be applicable to a more general definition of land reform. Although in the case of Taiwan's land reform, the economy of scale loss could only partly offset the effects of redistribution, this might not be the case for other redistributive policies in other countries. Future researches with similar focus could benefit from a more detailed categorization of different land reform policies and from a more detailed specification on when and how well these various policies are implemented at local level. Our understanding about the role played by economy of scale loss will undoubtedly benefit even more from future efforts to quantify the amount of economy scale loss during land redistribution.

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