Do Good Intentions Make Good Policy? Farmland Ownership Regulations in South Korea

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Abstract: Thin markets and high prices are typical impediments to farmland access. Access is further restricted in South Korea: regulations prohibit non-operator ownership and most farmland renting. Nonetheless, nominally illegal renting is common, introducing tenure insecurity for tenant farmers. In this paper, we model the incentive structure of these landlords and tenants. We use an exogenous policy shock and farm-level panel data to uncover the unobserved illegality of rental contracts, estimating farm-level likelihood of illegal tenure. We find 42% of farmers with a high likelihood of illegal tenure. We then examine the effect of this on government payments and rental-contract terms.

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1. Introduction

Concerns about farmers' access to farmland are widespread in both developing and developed countries. In less-developed countries, unsettled individual property rights can lead to insecure farmland tenure. It is well understood that this tenure insecurity has significant, and often negative, impacts on farm investment decisions, environmental sustainability, poverty, and migration choices (e.g. Feder and Onchan, 1987; Besley, 1995; Linkow, 2016; Giles and Mu, 2018). At the same time, farmland is becoming unaffordable in developed countries, driven by development pressure which pushes prices above the agricultural use value of farmland (e.g. Falk and Lee, 1998; Nickerson et al., 2012; Kauffman, 2013; Baker et al., 2014; Borchers et al., 2014; EC, 2017). Governments' response to these issues of access and affordability have ranged from redistributing privately owned land to actual operators on one extreme (Prosterman, 1970; Joshi, 1974; Apthorpe, 1979; İşcan, 2018) to less direct interventions like market support mechanisms. In the United States, for example, farmers can access credit and loans at better-than-market terms for farmland purchases; some European countries and Japan use regulatory measures to prevent non-operator ownership to different extents (Baughman, 1952; SSB, 1991; Dodson and Koening, 2007; OECD, 2009; Katchova and Ahearn, 2016). These measures, in turn, impact farmland markets: as one example, farmland prices rose about 1.9% to 3.1% in the Canadian province of Saskatchewan after ownership restrictions for non-residents were relaxed there (Lawley, 2018).

In this paper, we examine South Korea's particular means of keeping farmland in the hands of farm operators. The principle of "Land-to-the-Tillers" is constitutionally mandated with roots in South Korea's history; the constitution dictates that farmland must be owned by those who cultivate the land, prohibiting both non-operator ownership and most farmland leasing, with some exceptions. Despite stringent regulations and incentive structures, enforcement has been

ineffective (Kim et al., 2008; Chae et al., 2016). As a result, farmland rental is common, with one survey finding that more than half of all farmland is rented out, both legally and illegally, and that 85% of rented-in land is owned by non-operator owners (Chae et al., 2016; KOSTAT, 2022a). Ironically, the benefits for owner-operators grounded in the Land-to-the-Tillers principle discourage landlords from making official rental agreements. National attention on the subject has increased since 2021, when a farmland ownership scandal revealed widespread landlord absenteeism, triggering a major revision of the farmland laws with tightened enforcement (MAFRA, 2022).

Tenants' property rights are inherently insecure on land that is owned or is being rented-out illegally. Thus, South Korea, an advanced economy well into the post-manufacturing phase of structural transformation, faces a tenure insecurity problem that is typically associated with developing economies.[1] This insecurity manifests both through short rental contract terms and unofficial rental agreements that are easier to terminate. Landlords often falsely report that they are operating the land and then illegally rent it out without a legitimate lease. These informal contracts lack legal protection, and laws mandate a minimum rental duration. With no legal recourse, tenants of illegal landlords are susceptible to eviction and short-term arrangements, which ultimately discourages investment by operators (e.g., Feder, 1987; Besley, 1995; Deininger and Ali, 2008; Holden et al., 2009; Deininger et al., 2013). Financial incentives for such false reporting include a capital gains tax exemption, which is given to farmland that is owner-operated for at least eight years to encourage owner-operation.

Furthermore, tenants of illegal landlords have reduced access to farm subsidies, such as when these landlords appropriate farm subsidies intended for the operator (Cho, 2015; Chae et al., 2016). This is particularly true for direct payment programs, which require tenants to have legitimate rental arrangements to receive payments for rented land. This direct accrual of

subsidies by landlords contrasts with other developed countries, where subsidies are capitalized into higher rents and land values (e.g., Goodwin et al., 2003; Kirwan, 2009; Zhang et al., 2020). In contrast, An et al. (2006) and Chae (2007) highlight that landlords' direct appropriation of government payments may be linked to the low capitalization rate of these subsidies into rents observed in South Korea. Rental rates increase by only about 0.1% when there is a 1% increase in direct payments (Chae, 2007). In other developed economies, much more of the subsidy payment is capitalized into higher rents: e.g., 20-28 cents in rental rate per dollar increase in direct payment (U.S.: Kirwan and Roberts, 2016); 0.38 cents per euro (Germany: Breustedt and Habermann, 2011); and 0.45-0.65 cents per dollar (U.S.: Boussios et al., 2022).

In our paper, we examine how the widespread prevalence of tenure insecurity impacts the functioning of the farmland rental market in an otherwise typical developed country context, with complete insurance and credit markets and robust legal and social institutions. We focus on paddy rice farms, which occupy more than half of the total arable land in South Korea and received about 80% of the government's total direct payment budget in 2016 (MAFRA, 2016). We motivate our research with a model of how landlords and tenants interact and bargain. When enforcement is lax, the expected benefits of illegal renting outweigh the expected costs, due to high capital gains and tax benefits from nominally retaining farmland. Tenant farmers are indifferent between legal and illegal contracts when rent for an illegal contract is discounted to compensate for the loss of direct payments and for the risks inherent in illegal renting. Using official government farm-level panel data, we develop an empirical approximation of the likely extent of illegal rental contracts in an operation's portfolio of operated land, using an externally imposed policy change which only affected those contracts. We then estimate whether (1) tenants of illegal landlords face limited access to direct payments, (2) these tenants pay lower rental rates than legal tenants, and (3) these tenants face more rental contract instability.

We find 42% of rice farmers with a high likelihood of renting-in land from a landlord who owns and/or is renting out that land illegally. Mean comparison tests show that those tenant farmers with a high likelihood of illegal status are older, with a smaller average farm size and a lower share of rented hectares. Our results show that these farmers receive direct payments on only 60% of their rented land, while likely legal tenant farmers receive payments on 80%. We find empirical evidence that illegal landlords compensate them for this loss, assuming no additional private transfer, by discounting rent up to 25%, which suggests that tenants and landlords bargain over these terms. In addition, the likely illegal tenant farmers experience higher annual termination rates for their rental contracts compared to their counterparts. The limited access to direct payments and subsidies belies the distorting impact of illegal tenure status on the implementation of farm policies and government support programs in South Korea.

Our findings contribute to the literature on the long-term effects of land reform and farmland tenure insecurity. Papers in this literature are often complicated by the context where insecure land rights are prevalent: in many of these places it is difficult to isolate tenure insecurity from other forms of institutional and market-related instability. On a more practical note, there is often limited access to detailed panel data, particularly on financial performance, in these contexts. We are also able to observe participation in government support programs. Little is known about how government support for agriculture, particularly direct payments, interacts with insecure property rights. We provide evidence for that interaction, while addressing the implications of officially promoting owner-operation without strict enforcement of that policy. The consequences are particularly meaningful to tenants, who are excluded from accessing production-related subsidies and likely reduce investment in this land as well. Our research also contributes to the growing policy debate on land ownership regulations. Societal concerns about the growing number of non-operator owners are not limited to Korea. For example, EU law

acknowledges the necessity of regulating farmland sold to non-farmers instead of local farmers to prevent land speculation (EC, 2017). Some countries, such as Switzerland and Japan, have already implemented strict regulations on non-operator ownership (SSB, 1991; OECD, 2009). This study provides a unique opportunity to look at the implications of perhaps the strictest form of land ownership restriction: a constitutional mandate prohibiting most non-operator ownership and curtailing rental arrangements.

2. Background

Land tenure system in Korea

Farmland leasing is fundamentally prohibited in South Korea by the Land-to-the-Tillers doctrine, which was first introduced by the Land Reform Act (1949) and was prescribed in the Constitution as Article 121 in 1987.[2] The principle dictates that farmland must be owned by its operator; if the owner can no longer operate the land, it must be transferred someone who can. The intent is to protect farmers from landlords, who, prior to the reform, routinely exploited their tenant farmers (Mitchell, 1948). The Land Reform Act (1949) was largely limited to land redistribution, lacking enforcement measures to curtail non-operator ownership.[3] Due to limited enforcement, the share of rented farmland grew to about 40% in the early 1990s.

Regulatory ambiguity continued until the enactment of the Farmland Act in 1994, which delineated further restrictions and regulations on farmland ownership.[4] In particular, it stipulates explicitly that farmland ownership is restricted to those who operate or will operate the land for agricultural purposes with few exceptions. Non-operator landlords could only own and legally lease land through these exceptions.[5] Although non-operator farmland ownership and renting is the most straightforward violation of the Farmland Act, not all rental arrangements made by operators are necessarily legal if the letter of the law is followed exactly. To avoid asking

landowners to admit to illegal behavior, there are no official estimates of the prevalence of illegal leases. Estimates therefore come from survey work, such as Chae et al. (2016). This work found that illegally rented land accounted for 58% of the total rented area in their survey area: of that illegally rented land, 29% is rented out by non-operators with no farming experience and about 10% is rented out by not-yet-retired farmers.[6]

Past work has also examined whether various enforcement measures, which are described in more detail in Appendix B.1 and summarized in figure B1, have been effective. Kim (2011) describes how one enforcement mechanism, disposal orders, functions in practice.[7] They find that local officers' enforcement capacity is limited. These officers estimate that only about 20% of all arable land is evaluated for illegal ownership or leasing each year and they can identify less than 10% of the total area of illegally owned land. Legal punishments for illegal acquisition have also not been effective, as the courts often struggle to prove whether the allegedly illegal owners purchased the land for farming purposes or for capital gains. Yoon and Kim (2021) analyze 1,226 cases that were convicted of a Farmland Act violation between 2013 and 2020 and find that only 6.1% were related to acquisition for speculation; those cases usually involved multiple land transactions with a substantial arbitrage profit. In addition, violations of the Farmland Act alone are rarely prosecuted; 98.7% of the cases analyzed are associated with other crimes such as theft, waste dumping, and obstruction of business.

Despite the legal attention the subject receives and media concern about the implications of widespread illegal tenure status, there is surprisingly little research on this issue in South Korea. The most relevant studies are two policy research reports by the Korea Rural Economic Institute. Kim et al. (2008) estimate that 42-57% of rented land is illegally rented out, based on three village surveys covering 203 farms. One-third of the surveyed farmers identify illegal land leasing as the primary "major problem" of the current leasing system, showing the salience of

this issue among farmers. Chae et al. (2016) provide a more comprehensive picture of illegal leasing based on 23 village surveys nationwide. In addition to their estimate that 58% of land is illegally rented, they found that the amount of rented farmland is strictly under-reported in official records compared to interview results. They estimated that the actual number of rented plots may be as high as triple the number of officially registered rented plots. They also how absentee landlords are more likely to offer "insecure contracts" in the Korean rental market: they find that non-resident landlords are more likely to have verbal contracts (58% of respondents) and one-year contracts (28%) versus any landlords (52% and 7.8%), respectively.[8] Both studies indicate that proximity to urban centers increases the prevalence of illegal leasing, strongly implying an underlying mechanism of nonoperator ownership for investment purposes. Despite these pioneering contributions, both studies are limited to providing descriptive statistics about the extent of illegal leasing and some qualitative evidence of possible adverse effects. Ultimately, little is known about these illegal contracts and the literature lacks quantitative evidence about the impacts of this tenure insecurity.

To explain the prevalence of illegal farmland leasing, we model the underlying motivations of landlords and tenants in this context. Appendix B.1 presents a conceptual model that first describes the behavior of non-operator farmland owners, who supply land illegally to the rental market. We then model the behavior of tenant farmers on the demand side. As our model shows, landowners' expected wealth increases with farmland investment through capital gains, rents, and government payments. However, this increase in expected wealth is subject to the probability of being caught illegally leasing out land and the intensity of punishment. A key feature of this model and context is that law targets and punishes illegal farmland transactions only on the supply, or landlord, side.[9] Therefore, to discourage illegal rental arrangements, the disincentive created by the probability of being caught should be significant enough to

counterbalance the financial gains from illegal land ownership. Kim (2011) and Yoon and Kim (2021) suggest that this is not the case: the probability of being caught and the intensity of punishment is very low. Furthermore, the amount that would be incurred as a fine is very small relative to the economic incentives of illegal land investment. These include the value of farmland, which has doubled in real terms in the last 20 years and appreciated more rapidly than the value of residential or industrial land (KRERI, 2022). Another important incentive is that qualified owner-operated holdings are fully exempted from the capital gains tax for farmland assets worth less than 100 million KRW. Importantly, the probability of being caught illegally owning farmland is higher when the land is idle; as a result, renting out land is preferable for illegal owners (Kim, 2011). Therefore, the prevalent illegal ownership and the subsequent renting out of that illegally owned land are clear consequences of this incentive and enforcement structure.

On the demand side, Sung et al. (2019) and Kim and Lee (2000) show that larger rice farms in Korea are more profitable and productive. This economic incentive leads farmers to expand their operations by buying or renting in more land. High farmland sale prices, especially when above agricultural use values, make land leasing more profitable than purchasing (Chae et al., 2016). The limited supply of farmland in legal rental markets thus facilitates farm expansion through illegally rented land. Because enforcement occurs only on the supply side, farmers are indifferent in principle as long as they receive the same marginal profit from a legal versus an illegal rental contract. The difference in rental rates, the eviction risk, and the direct payments determine farmers' leasing choices between legal and illegal contracts. It implies that the rental rates of illegal contracts should be lower than those of legal contracts to compensate for the loss of direct payments and the potential loss of revenue associated with the risk of being evicted.[10]

The Korea organic fertilizer subsidy program

Very few agricultural or rural policies in Korea are unaffected by ubiquity of illegal rental contracts; we focus here on the Korea organic fertilizer subsidy program. This program was started in 1999 to tackle complementary environmental problems faced by the livestock and agricultural sectors: the increasing amount of livestock waste on the one hand and soil erosion, which can be improved through manure application (Assefa and Tadesse, 2019), and soil acidification, which is caused by inorganic fertilizer application, on the other (Minasny et al., 2016). Through this program, farmers are provided with organic (livestock manure-based) fertilizer at discounted prices; the central government sets the total quantity of organic fertilizer to be subsidized and the subsidy rates (KRW/20kg) each year.[11] Farmers purchase the pre-determined quantity of organic fertilizer in-kind at a discounted rate (the market price net of the subsidy rate) from their choice of suppliers that are registered in the subsidy program. Local governments and the farmers' cooperative, Nonghyup, ultimately manage distribution, while the suppliers deliver the fertilizer directly to the plots' locations specified by each applicant. Plot characteristics such as proximity therefore do not affect program participation or eligibility.

The program's budget and subsidy rate has increased over time (see figure 1). The total budget increased from 21 to 160 billion KRW between 2003 and 2017, with an equivalent quantity increase of 0.6 to 3.2 million tons. Although it varies by fertilizer type, the subsidy rate, in general, has risen from 750 to 1600 KRW per 20kg package during the same period. In 2015, the subsidy program subsidized about 20% of the market sales, and the subsidized quantity accounted for 70-80% of the total traded quantity on the market (Choi and Gouk, 2017).

<< Figure 1 about here >>

Eligibility for the program underwent significant changes in 2015 and 2016. Until 2014, any farmer or farm corporation was eligible for the subsidy. In 2015, the program switched from

being managed via a standalone system to being implemented through the Korean Farm Business Management System, a centrally managed administrative system introduced in 2008 to manage individual farm information more effectively. The government requires farms to be registered to participate in most government-support schemes, including direct payments and loans and so registration in this system is widely considered nearly universal.[12] As a consequence of this change, operation-level eligibility for the organic fertilizer subsidy changed to any "farm business registered to the Korean Farm Business Management System." Given the pre-existing familiarity with this system, this change was likely not disruptive and may have even improved access.

However, a year later in 2016, eligibility for the organic fertilizer subsidy changed again. Instead of any registered operator being able to request subsidized fertilizer for all the land s/he operated, only "farmland registered to the [management system] under the applicant's name" (i.e., legally owned or rented farmland) could receive the subsidized fertilizer. As a result, tenant farmers could not apply for the subsidy for their rented land if their landlord did not agree to register the rented land under the tenant's name; the previous, pre-2016 system allowed applicants to request subsidized fertilizer for all their operated areas regardless of ownership status.[13] Owner-operators' access to the subsidized fertilizer was unchanged.[14] Given the likelihood of differential investment by tenancy status, we check whether there are differences in organic fertilizer application between owner-operators and tenant farmers prior to the policy change. We find that tenants applied significantly more purchased organic fertilizer than owner-operators.[15] This is not necessarily surprising: organic fertilizer application in the pre-period is not a difficult or costly investment, as it is heavily subsidized and easily accessible. In addition, although organic fertilizer does have long-term soil health benefits, it also has been shown to increase yields by studies done around the world (e.g., Siavoshi et al., 2011), including in South

Korea (Cho et al., 2009). These yield bumps incentivize its application by tenant farmers and not just owner operators.[16]

Therefore, the eligibility change in 2016 unexpectedly affected tenant farmers who do not have legal rental arrangements. That year, the subsidy plan, including the change in eligibility, was announced only five weeks before the application period ended. Because the updated eligibility rules required operators to register their land with the Farm Business Management System before applying, tenants with illegal rental arrangements had limited time to negotiate with their landlords. In addition, the urgency to do so would be somewhat limited, as organic fertilizer is not as agronomically important for rice production as it is for growing other crops in Korea. Without easy access to the subsidy, rice farmers typically default to skipping application rather than figuring out how to secure organic fertilizer. Therefore, in the first year of the new policy, it is unlikely that these operators were either adequately prepared for the application deadline and/or sufficiently motivated to strategize to secure access to fertilizer in response to the initial change. In 2017, however, the change was no longer a "shock", and operators were more likely to have adjusted, possibly through bargaining between landlords and tenants with unofficial contracts. Landlords could use provision of fertilizer as a bargaining chip, helping to maintain their informal contracts while allowing their tenants to circumvent the eligibility change and access subsidized fertilizer.

3. Data

Sampling

This study combines two official government data sets: the Farm Household Economy Survey (FHES) and the Agricultural Production Cost Survey (APCS).[17] Both data sets are publicly available from 2003-2017; they are divided into three waves of five-year panels as the survey

sample changes every five years. We restrict our sample to the 2013-2017 panel to observe eligibility change for the organic fertilizer subsidy program.

The FHES provides the most comprehensive annual farm-level data in South Korea.[18] The survey offers rich information about farm household demographics, income, expenditure, assets, and debt, including a farm equipment inventory. The sample is derived through a systematic stratified sampling method, with stratification by crop and region. The survey uses self-reported questionnaires and in-person interviews to collect information. Once selected, farm households are required to record their income and expenditure on a monthly basis and to report assets and debt annually. Local enumerators assist respondents in-person at least twice a month. The sample attrition rate is about 5-6% every year due to death, illness, or migration. These missing observations are replaced by farm households with similar characteristics.

The APCS is the annual crop-level survey for commonly grown crops. These crops include rice, barley, pepper, garlic, onions, sesame, and soybeans; rice accounts for about 60% of the sample. Every year, the APCS randomly selects its sample from the FHES farms that meet the minimum crop-level cultivated area requirement; the two surveys are then linked through each farm's identification number. This survey provides detailed information at the crop level about the production inputs, including the total cultivated area, rented area, self-supplied organic fertilizer, and purchased organic fertilizer (POF). In addition, the survey records yield, revenue, rental rate, and whether the plot is owned and self-operated, rented-in, or rented-out for every plot that respondents operate. Researchers can therefore identify owner-operators, who own every plot they operate and have no plots rented-in, as well as non-participants who do not rent any land in or out.[19]

Our study exclusively focuses on rice farms for two reasons in addition to their importance for the South Korean agricultural economy. First, these farms use organic fertilizer in

a way that is meaningfully different from non-rice operations. Organic fertilizer is less important for rice production and rice farmers' demand for it is consequently more elastic. When eligibility for the organic fertilizer subsidy changed in 2016, non-rice farmers would have therefore been much more motivated to find ways to circumvent the eligibility restrictions and maintain access to the subsidized fertilizer. This would complicate and possibly derail our strategy, described below in more detail, that uses the resulting drop in fertilizer use as a means of identifying farms with illegal rental contracts. The second reason is that direct payments play a more significant role in rice farms' operational decisions. Direct payments for rice have a longer institutional history and are larger in absolute and per-ha terms than payments for other crops. We provide more details about the direct payment programs in Appendix B.3. Bargaining over these payments is likely to be more meaningful and relevant to the rental contract negotiation process.

We select our sample of farms by first collecting all 5,806 farm-year observations recorded in the crop-level APCS as rice farms. The APCS definition of a rice farm is cultivating more than 1,980m^2 (about 0.5 acres) of rice per year. Most (92%) of rice farms in the survey are recorded for at least four years, with 73% observed for all five years. Rice, unlike other crops in the APCS, is grown on flooded paddy fields and the costs of transitioning land into and out of rice production are high.[20] We then drop farms not observed at least once before and after the 2016 eligibility change, which leaves 83% of the original 5,806 observations. We further restrict our sample to farmers who have used POF at least once before the policy change, retaining 40% of rice farms from the last step. Geographically, the distribution of the final sample remains largely consistent with the original sample distribution.[21] This process leaves us with 1,907 farm-year observations from 411 rice farms, including 3,323 and 10,683 field-year and plot-year observations, respectively.

Summary statistics

Farm-level data

Table 1 reports farm household characteristics for our sample. The demographic characteristics capture the aging farmer population, a fact which precipitates concerns about farm consolidation and land scarcity. Farm operators are less educated compared to the national average, even when accounting for age. About 33% of these farmers hold a high school diploma or above, while 45% have less than an elementary school education. In contrast, 57% of the national population aged 6569 completed high school or above, and only about 10% received less than an elementary school education (KOSTAT, 2015). Farmers in our sample cultivate 1.5 ha for rice 0.8 ha for other crops; 45% of their rice fields are rented, legally or illegally. Despite the level of detail in both surveys, neither records information on the legitimacy of the rental contracts.[22]

Landlords and tenants in this context may bargain over government support, including the direct payments received by each farm operation. In the data, we observe these direct payments categorized into two types: fixed direct payments and variable direct payments. In the publicly available data set, each type of direct payment is recorded with additional government subsidy payments.[23]

<< Table 1 about here >>

Total farm asset growth rate and the debt-to-asset (DTA) ratio capture farms' investment behavior. The former is calculated as the percentage of the current farm asset value compared to the previous farm asset value in year $t-1$, after deducting depreciation costs. Farm assets include land, buildings, equipment, and livestock. On average in our sample, farms' asset value slightly decreases by 4% each year, indicating the relative stability of assets over our study period. DTA values indicate the percentage of farm assets that are being financed with farm debt. The average DTA is 0.17, implying low debt financing for farm investment activities. Lastly,

farms' unexpected agricultural losses are proxied by changes in livestock and poultry asset values, measured as the difference in the value of that asset between the beginning and the end of the year.

Plot- and field-level data

In addition to the farm-level data, we take advantage of plot- and field-level data from the APCS and the FHES, respectively. Crucially for our analysis, every plot and field operated by the farm is recorded in the survey and tracked over time. Our data include 10,822 rice plots from 1,532 farms, 59% of which are rented.[24] Table 1 reports the summary statistics. On average, rice farmers operate 7 plots: 3 owned and 4 rented. We compare the plot-level characteristics by rental status (see appendix table A1). This comparison reveals that rented plots are significantly larger and, possibly due to the larger size, have significantly higher "value" (imputed or actual rent). The difference in plot-level revenue is not statistically significant. Taken together, these differences speak to broad similarities between owned and rented plots in our sample.

The field-level data record farmland size, value, ownership status, and land use at the beginning and the end of the year.[25] Land use indicates farmland types, including paddy fields and other types of land. Farmers have 1.74 fields on average, almost evenly split between owned fields and rented ones. We measure termination of operatorship for rented fields by the area of returned land: the difference between the amount of rented land in January and in December. For owned fields, termination measures the amount of land sold between those months. We define termination indicator equal to one when the land size is reduced (through either mechanism) during a given year. On average, 10% of the fields (representing 375m^2) are either returned or sold annually.

4. Quantifying the likelihood of illegal rental contracts

An empirical puzzle

Quantifying the impact of illegal rental contracts would be more straightforward if researchers were able to observe $\text{tenure status}_{jit} \in \text{Owned; Legally rented; Illegally rented}$ for each plot j of farm i in year t. As is typical of illegal markets, or even markets that deal with legal "gray areas," however, operators in this context may not be willing to disclose whether they hold illegal rental contracts, and the survey instrument does not solicit this information. Instead, we must estimate a proxy measure that captures the likelihood of illegal renting at the farm level; this proposed answer to an empirical challenge caused by the difficulty in studying underground markets is one unique contribution of our paper.

We do so using the externally imposed changes in eligibility for the organic fertilizer subsidy program. Because those changes meant less POF was available to operations with illegally rented land, operations we observe reducing their POF use in 2016 are more likely to have illegal contracts than those whose POF use did not decrease. Further, because the subsidy was area-based, operations with more illegally rented land would be more affected, such that their decrease in POF use could proxy for their change in subsidy access. An operator who, prior to the 2016 eligibility change, was reporting more illegally rented land would face a larger reduction in POF access than an operator who was reporting a smaller area. We therefore approximate the farm-level proportion of illegally rented land through the policy-induced change in the amount of POF applied per square meter. Because this affected farms in a way that is proportional to the extent of illegally rented land in their operation, an operation with no illegally rented land would not be affected by the policy change, and one with 50% illegally rented land would be affected less than one where all their land was illegally rented. Thus, we have:

$$\text{Likelihood of illegal tenure status}_i \ (\%) \approx \mathbb{E}\left[\frac{POF_{i,t\geq 2016} - POF_{i,t<2016}}{POF_{i,t<2016}}\right]$$

The quality of the approximation depends on a few factors. First, it is increasing in the accuracy of reporting behavior in the pre-period. The approximation would be closer to the actual proportion if farmers did not over-report their cultivated area during the pre-period or, at least, if over-reporting behavior is not correlated with tenure status. Second, the approximation assumes that the government strictly enforced the new policy restricting subsidy access to only legally held plots; this assumption is supported by the use of verification via the digital Farm Business Management System for enforcement. Finally, approximating illegally rented land in this way assumes that the amount of POF stock passing to the next year is trivial, especially between 2015 and 2016. A violation of the first assumption would overestimate the likelihood of illegal tenure status, while violations of the latter two assumptions lead to underestimation.

Figure 2 shows the amount of applied POF based on ownership status: owner-operators (with no rented fields), part-tenants (renting ≤ 50% of total paddy fields), and full-tenants (renting > 50%). There were substantial decreases in POF use in 2016 and 2017, with tenant farmers showing more pronounced drops compared to owner-operators.[26] These summary figures also do not indicate that stockpiling in anticipation of the change was an issue.[27]

<< Figure 2 about here >>

Equation (1) presents the main model specification that estimates the farm-level likelihood of illegal tenure status as a function of the farm's sensitivity to the 2016 policy change.

$$POF_{it} = \kappa + \sum_{j=i\neq r} \alpha_{j,\text{post}}(\gamma_i \times \text{post}_t) + \gamma_i + \tau_t + \beta \boldsymbol{A_{it}} + \epsilon_{it} \quad [1]$$

The outcome of interest is the estimates for $\alpha_{i,\text{post}}$: the effect of farm i in the entire sample $\mathbb{I}$ being in the post-policy change period post on POF_{it}, the amount of POF applied per square meter by that farm in that period. The farm-fixed effect γ_i allows us to capture the intensity of

exposure to the policy, wherein we assume higher reductions in POF use approximate a higher concentration of illegally rented land. τ_t are year fixed effects, which control for the common shocks that affect all farms, regardless of their tenure status; this helps to reduce the bias caused by the potential over-reporting behavior described above. $\boldsymbol{A_{it}}$ includes other control variables that can affect farmers' fertilizer investment decisions as observed in the literature (e.g. Abdoulaye and Sanders, 2005; Chibwana et al., 2014; Kousar and Abdulai, 2016; Wang et al., 2018; Daadi and Latacz-Lohmann, 2021). The control variables are cultivated area, mechanization rate, current ratio, off-farm income, livestock assets, and fertilizer prices. Appendix table A2 provides summary statistics and justification for these control variables.

We estimate this model as if it were a difference-in-differences specification; $\alpha_{i,\text{post}}$ is estimated by comparing the changes in POF before and after the policy shock between farm i and a reference farm $r \in \mathbb{R} \subset \mathbb{I}$, with all else constant. This estimator is sensitive to the choice of a reference farm; hence, we estimate $\alpha_{i,\text{post}}$ with 20 different, randomly selected, reference owner-operator farms and use the average to identify farmers with a higher likelihood of illegal tenure status. For clarity, $\bar{\alpha}_{i,\text{post}}$ represents the average value over 20 individual estimates $\hat{\alpha}_{i,\text{post}}$.[28]

In addition to our preferred two-period model in equation (1), we estimate the likelihood of illegal status using a three-period model that allows for different effects in 2016, the year the policy change went into effect. In this model, time indicators, denoted as τ_{2016} and τ_{2017}, equal one for the respective year and zero otherwise. Estimating $\alpha_{i,2016}$ separately from $\alpha_{i,2017}$ could reduce the downward bias caused by the possibility of lenient enforcement in subsequent years.

$$POF_{it} = \kappa + \alpha_{i,2016}(\gamma_i \times \tau_{2016}) + \alpha_{i,2017}(\gamma_i \times \tau_{2017}) + \gamma_i + \tau_{2016} + \tau_{2017} + \beta \boldsymbol{A_{it}} + \epsilon_{it} \quad [2]$$

Results: Likelihood of illegal tenancy

We present the distribution of $\bar{\alpha}_{i,\text{post}}$ in table 2 for 417 farms. Again, we assume farms that used significantly less POF after the 2016 policy change did so because they lost eligibility for subsidized organic fertilizer for their illegally rented land. We estimated $\alpha_{i,t}$ using three different specifications: first, a naïve two-period model generating $\alpha_{i,\text{post}(n)}$ by estimating equation (1) without considering $\boldsymbol{A_{it}}$; second, generating $\alpha_{i,post}$ by estimating the main two-period model from equation (1) as specified; and third, generating distinct estimates of the $\alpha_{i,t}$ parameter for the years 2016 and 2017 (i.e., $\alpha_{i,2016}$ and $\alpha_{i,2017}$) from the three-period model specified in equation (2).

As shown, $\bar{\alpha}_{i,post}$ is slightly smaller than $\bar{\alpha}_{i,\text{post}(n)}$. The value of $\bar{\alpha}_{i,\text{post}}$ shows that owner operators increase POF by 0.015 kg/m^2 with a standard deviation of 0.17; tenant operators increase by 0.001 kg/m^2 with a standard deviation of 0.17. The three-period estimates ($\bar{\alpha}_{i,2016}$ and $\bar{\alpha}_{i,2017}$) show the diminishing policy effects over time, especially on tenant farmers.[29] In 2016, the first year of the policy change, tenant farmers reduced their POF use by 0.036 kg/m^2 relative to the pre-period; one year later, in 2017, they increase their POF use by 0.021 kg/m^2. This year-by-year change is less noticeable for owner-operators. Further, the difference in the maximum value of $\bar{\alpha}_{i,t}$ is much smaller than the difference in the minimum value between owner-operators and tenants. The absolute value of the minimum $\bar{\alpha}_{i,t}$ for tenants is three times larger than that of owner-operators, whereas the maximum value for tenants is at most 1.4 times larger. These findings support our claim that the policy change adversely affected tenant farmers proportional to their illegal tenure status.

<< Table 2 about here >>

Farmers are divided into a treated group and a control group based on the values of $\bar{\alpha}_{i,t}$. The treated group includes farmers with negative $\bar{\alpha}_{i,t}$, regardless of their ownership status. By

this definition, we place 41% of farmers in the treated group using $\bar{\alpha}_{i,\text{post}(n)}$, 46% using $\bar{\alpha}_{i,\text{post}}$, and 64% using $\bar{\alpha}_{i,2016}$. The group of treated farmers is largely consistent across the models: 97% of farmers who are treated according to $\bar{\alpha}_{i,\text{post}}$ are also treated based on $\bar{\alpha}_{i,2016}$. Moreover, our findings are consistent with the field-survey results (Kim et al., 2008; Chae et al., 2016). One village-level analysis reports that the gap between official and actual rented area ranges from 0 to 33%, and the interviews with farmers further suggest that 58% of rented area could be illegal (Chae et al., 2016). Our estimates fall into this range.

We provide descriptive evidence of the difference between those with and without a high likelihood of illegal tenure status by comparing the characteristics of the two groups in appendix table A3. We use the 42% of farmers identified as treated using both $\bar{\alpha}_{i,\text{post}}$ and $\bar{\alpha}_{i,2016}$. The mean comparison shows that the treated group includes more elderly operators and smaller farms. The treated farmers' operated rice area is smaller by 0.41 ha and 0.56 ha for all farmers and tenant farmers, respectively. The three rental status indicators consistently show that the treated farms are slightly less reliant on rented land than the control farms. Lastly, the unconditional means of the rental contract bargaining outcomes show that the treated group receives lower direct payments, pays less in rent per square meter, and has a lower probability of contract termination.

Notably, we see significant evidence that our treatment indicator is not mistakenly picking up low performing farms, and there is limited evidence that tenants of illegal landlords tend to be lower-performing or that plots rented-in without a legal contract differ in quality. Treated farmers demonstrate higher crop revenue per square meter, indicating greater farm productivity despite operating on a smaller scale. We compare the unconditional means of plot-level revenue and yield between rented plots held by those in our treated group and considered to be illegally rented to those legally rented by our control group. As appendix table A4 shows,

although yield is marginally higher on legally rented plots, there is no difference in terms of plot-level revenue. Instead of being a function of farm performance, by comparing the location of likely illegal and not likely illegal farms in appendix table A5, we see that urban proximity may play a role. Illegal tenancy is more prevalent in provinces closer to South Korea's urban centers characterized by high population density and land prices. This finding aligns with previous research by Kim et al. (2008), who found that illegal ownership is more common in urban areas and that illegally owned plots are typically smaller than their legally owned counterparts.

One potential limitation of our study arises if the reductions in POF application used to quantify the likelihood of illegal tenure status are the result of sample selection rather than a policy effect. Farmers do tend to skip or apply less purchased organic fertilizer when they have done so in recent years. We test this using a pseudo-intervention on the extensive and intensive changes in POF used by farmers from the previous panel (2007-2012); these results and more details are available in Appendix A.2.[30] The result implies that (1) the sample selection alone cannot explain significant drops in the intensity of applied POF (see Appendix A.2.1), and (2) the sample selection effects are randomly distributed across farmers (see Appendix A.2.2). Thus, the selection effects should not threaten the validity of our mechanism to quantify the likelihood of illegal tenure status.

5. Estimating the implications of illegal tenure

Our conceptual model and contextual evidence describe bargaining between landlords and tenants with an illegal rental contract; here, we empirically test the relationship between illegal tenure status and those bargaining terms. Tenants with illegal rental contracts face tenure insecurity only through the effects of illegality on their landlords' behavior and bargaining

position. The tenants themselves are not at risk for prosecution, as only those on the supply side of illegal rental or ownership contracts are legally liable.

Outcomes of interest

We investigate the relationship between farmers' likelihood of holding illegal rental contracts and three outcomes that our theoretical model predicts landlords and tenants would bargain over. These outcomes are direct (i.e., government) payments, rental rates, and contract termination rates. For each, we present two measures of treatment. The first uses $\bar{\alpha}_{i,\text{post}}$ which captures operations that applied less POF on average during 2016 and 2017 compared to the pre-2016 period. The second uses $\bar{\alpha}_{i,2016}$ and captures operations that experienced a significant drop in applied POF in 2016 compared to the pre-2016 period. Thus, the former is a subset of the latter and so we prefer the treatment measure that uses $\bar{\alpha}_{i,\text{post}}$ over the one that uses $\bar{\alpha}_{i,2016}$. We include both for the sake of completeness. Throughout this section, treated farmers are those that have a high likelihood of illegal tenure status and untreated farmers are those that do not.

Access to direct payments

Under the direct (government) payment program, farmers receive a fixed payment for each eligible plot. The government determines the amount of direct payment for each plot as follows:

$$\text{Direct payment}_{jit} = \text{Tenure status}_{jit} \times \text{Payment rate}_t \times \text{Plot size}_{jit} \times \text{Eligibility}_{ji} \quad [3]$$

Plot j of farmer i is eligible for direct payments if the plot was producing rice between January 1, 1988 and December 31, 2000. Payment rate_t is the amount of direct payment per area in year t and includes both fixed and variable payments. The former pays a fixed amount of money to operators annually. The latter annually adjusts the payment per hectare according to the difference between the national average of farm-gate rice prices and the target price set by the

government; it is only paid out when the market price falls below the target price. During our study period, farmers received the variable payments in 2014-2017, but not in 2013. $\text{Tenure status}_{jit}$ indicates whether farmer i is officially enrolled as the operator of plot j in year t. As with the organic fertilizer subsidy program after 2016, these payments are distributed via the Farm Business Management System and tenant farmers who do not hold legal rental arrangements would not be able to receive the payments directly. Therefore, the amount of direct payment received by farmers also indicates their tenure status. Equation (4) shows our empirical specification to test whether the tenant farmers who have a high likelihood of illegal tenure status receive lower amounts of direct payments.

$$Y_{it} = \beta_0 + \beta_1 \text{Owned land}_{it} + \beta_T \text{Treat}_i \times \text{Rented land}_{it} + \beta_2 \boldsymbol{X_{it}} + FE_{rt} + \varepsilon_{it} \quad [4]$$

The dependent variable Y_{it} is the approximate number of hectares that received either 1) the direct payment or 2) the variable payment. We calculate the subsidized area by dividing the recorded fixed payment and the variable payment (both measured in KRW) by each year's fixed and variable direct payment rates (KRW/ha). Owned land_{it} is the hectares of paddy fields owned, but not rented out, by farm i in year t. Rented land_{it} measures the paddy fields that are rented in (both legally and illegally) and operated by farm i in t. By interacting Rented land_{it} with Treat_i, we can separately estimate the average amount of direct payments paid to a unit of rented land for treated and untreated tenant farmers with β_T where $T \in \{\text{legal, illegal}\}$. This specification allows us to check the validity of our assignment of farms' likelihood of illegal tenancy: if accurate, we would expect the following relationship between the coefficients: $\hat{\beta}_1 \geq \hat{\beta}_{\text{legal}} \geq \hat{\beta}_{\text{illegal}}$.

We also include other control variables $\boldsymbol{X_{it}}$ that may influence the payment amounts. These include operator's age, gender, education level, medical expenses (a proxy of health), other owned and other cultivated farmland (for crops other than rice), and the average amount of

POF applied before the subsidy eligibility change. Because both fixed and variable payments (KRW) include other farm subsidies, there is the potential for overestimation of the area that received the payments.[31] Thus, we control for livestock and poultry loss (KRW/year) to account for the livestock indemnity in the variable payment models and similarly, we control for total farm asset growth rate and farm debt-to-asset ratio in the fixed payment models to account for the farm investment subsidies. We include province fixed effects and year fixed effects which capture differential access to other farm subsidy programs, especially local ones.

Rental rates

Next, we test whether illegal tenure status has a relationship with rental rates using a farm fixed effects model with the plot-level data.

$$\text{Rent}_{jit} = \theta_0 + \theta_1 \text{Plot size}_{jit} + \theta_T \text{Treat}_i \times \text{Rental status}_{jit} + \gamma_i + \tau_t + \varepsilon_{jit} \quad [5]$$

Two rent variables are used for plot j in farm i and year t: rental rate, measured in KRW per m^2, and the ratio of the plot's rental rate to its revenue. For owned plots, the rental rate is measured as the estimated amount of rent.[32] Treat_i indicates whether farm i has a high likelihood of illegal tenure status. $\text{Rental status}_{jit}$ indicates whether plot j is owned or rented. The coefficient of interest θ_T with $T \in \{\text{legal}, \text{illegal}\}$ measures the average of within-farm differences in rental rates between owned and rented plots separately for treated and untreated tenant farmers. Equation (B8) from our conceptual model and the anecdotal evidence that points to the strong possibility of bargaining over rents and direct payments suggest that legal tenants are likely to pay higher amounts of rent compared to illegal tenants (Chae et al., 2016). More precisely, the difference between rents paid for rented plots and imputed rents for owned plots is expected to be greater for legal tenants than for illegal tenants, or $\theta_{\text{legal}} \geq \theta_{\text{illegal}}$.

Termination rates

Last, we test whether illegal tenure status is associated with higher risks of eviction using a similar farm fixed effects model.

$$\text{Termination}_{jit} = \omega_0 + \omega_1 \text{Field size}_{jit} + \omega_T \text{Treat}_i \times \text{Rental status}_{jit} + \omega_2 \boldsymbol{W_{it}} + \gamma_i + \tau_t + \varepsilon_{jit} \quad [6]$$

Termination_{jit} is an indicator of a terminated rental contract and serves as a proxy for eviction risks. When field j, or some portion of the field, that was held by farm i in January is returned to its landlord before December in the current year t, $\text{Termination}_{jit} = 1$; otherwise, it is equal to 0. Treat_i and $\text{Rental status}_{jit}$ are defined as in equation (5). The coefficient ω_T with $T \in \{\text{legal}, \text{illegal}\}$ captures the within-farm differences in the likelihood of termination between owned and rented fields operated by farm i separately by treatment status. Equation (B8) and the evidence in the literature once again indicates that illegal tenants will have shorter rental contracts, along with a lack of legal protection, such that $\omega_{\text{illegal}} \geq \omega_{\text{legal}}$ (Chae et al., 2016). $\boldsymbol{W_{it}}$ includes these relevant characteristics: operator's age and gender, household size, and medical expenses.

Results: Does illegal tenancy affect direct payments or contract terms?

Table 3 shows the difference in access to direct payments on rented land between those with and without a high likelihood of illegal tenure status. The coefficient on the "owned paddy" measure in the variable payment specification indicates that about 93% of owned paddy fields receive the variable direct payment. The variable payment rate is lower for legally rented land (79%) and even lower for illegally rented land (61%), as expected. For fixed payments, both $\beta_{T=\text{legal}}$ and $\beta_{T=\text{illegal}}$ are larger than one and $\beta_{T=\text{illegal}}$ is larger than β_1: (1.64>1.40). The coefficient of 1.64 indicates that control tenant farmers receive a "fixed payment" on an equivalent of 164% of their rented paddy fields. Since this dependent variable includes other farm subsidies plus the direct

payments, the larger-than-one coefficient suggests that larger farms tend to attract more farm subsidies for investment purposes compared to smaller farms.

<< Table 3 about here >>

These results confirm that our proxy for the likelihood of illegal tenure likely captures the illegal tenant farmers who are not able to officially register their rented land. While it is possible that the control group contains some tenants of illegal landlords, these results affirm they are more prevalent in the treatment group. Nonetheless, our estimation of the extent of illegal contracts should be interpreted as a lower bound.[33]

Next, the within-farm estimates show the relationship between illegal status and contract-related variables. Table 4 shows that treated tenant farmers pay significantly lower rental rates for their rented plots compared to their owned plots by 11.85 KRW/m^2. This difference is not significant for the legal tenant farmers. The results are consistent when rental rate is measured with rent share (the rent-to-revenue ratio). The rent share for rented plots by likely illegal tenants is significantly lower than that of owned plots. Together, these results suggest that there is significant negotiation in this underground market between illegal landlords and their tenants. Our results could represent either or both the capitalization of illegal status into rental rates and/or the compensation for tenants losing direct payments, observed above in table 3.

<< Table 4 about here >>

Table 5 presents the results on the likelihood of contract termination. An illegal tenant's likelihood of returning some portion of rented land is about 9.3% higher than the likelihood of disposing of their owned land. This gap decreases to 8.6% for legal tenants. The continuous measure of termination shows the consistent result that the tenants with a higher likelihood of illegal rental contracts experience a larger reduction in rented land relative to owned land by 303 m^2. In contrast, tenants without the high likelihood of illegal rental contracts decrease their rented

land by 258 m^2. This result implies that illegal tenants are more prone to eviction or more likely to hold short-term contracts that are reevaluated annually than farmers with legal rental contracts.

<< Table 5 about here >>

Our estimates that find both lower rental rates and lower direct payments reinforce the descriptive evidence of bargaining between illegal landlords and tenants over these terms. The estimates suggest that tenant farmers are paid back about one-third of direct payments through rent discounts. Finally, the higher annual termination rates reflect findings that illegal landowners tend to have shorter contracts than landlords who reside closer to their rented-out land and thus are more likely to be farmers who own and rent out the land legally (Chae et al., 2016).

6. Discussion and conclusion

This paper explores the implications of strict farmland ownership regulations and their effect on the prevalence of illegal tenure status. Our conceptual framework explains how the lack of enforcement and the contradictory tax incentives facilitate non-operators' ownership and leasing of farmland in Korea, even when it is against the law and in violation of the Constitution. Meanwhile, the increasing marginal returns to land incentivize farmers to expand their operations. The limited supply of legally rented-out land coupled with rising farmland prices drives the increasing demand to illegally rent-in land. Ultimately, the profit maximizing behavior of operators leads to bargaining between landlords and tenants who seek to trade off rental rates and direct payments.

While it is relatively straightforward to examine the implications of illegal renting in theory, the difficulty in observing illegal behavior presents researchers with an empirical challenge. Despite the prevalence of these arrangements in South Korea and the well-established universal relationship between secure land rights and investment, direct observation of tenure

insecurity is not currently possible. We must, therefore, make approximations, a limitation to these data that is common to any study of an underground market. In this case, a policy change that affected farmers in proportion to the concentration of their illegal rental contracts provides an external factor that allows for the approximation of that proportion. This is, of course, an indirect measure that presumes some level of dependence on the organic fertilizer subsidy program, which could be impacted by other factors. The short nature of the panel data precludes any study of long-term effects or a systematic analysis of an individual operation's organic fertilizer use over time. The implementation of the subsidy eligibility measure is also more lenient in practice than in principle, which works in favor of illegal tenants and allowed the restrictions to be circumvented relatively quickly. However, we believe that our strategy is the among the best possible ways to study the illegal farmland rental market with publicly available official government data.

We thus classify farmers by how likely they are to be holding illegal rental arrangements based on their observed response to the 2016 eligibility change in the organic fertilizer subsidy program. This change disproportionately affected tenant farmers without legal leases and/or whose landlords were reluctant to make official rental arrangements. We find that about 42% of farmers have a high likelihood of illegal tenure status. Those farmers are characterized as older, with smaller farms that are less reliant on rented land. Notably, these illegal tenants are more commonly located in more urban provinces with higher population densities and farmland prices. Urbanization puts pressure on the land rental market, with those who demand land facing thinner markets with less land available for legal acquisition. We then test whether these likely illegal tenant farmers receive lower direct payments, area-based subsidies that require formal rental arrangements. The results confirm that those tenants indeed receive smaller amounts of rice direct payments, particularly on their rented land. We then find that farmers with a high

likelihood of illegal status pay lower rental rates and experience higher termination rates than other tenant farmers.

Policymakers may be interested in whether our findings are valid beyond the farmers in our sample, which is composed of rice farmers who use purchased organic fertilizer. Insecure status is still likely to affect tenant farmers who are not in this sample. In terms of non-users, our data show that these operations share common characteristics with illegal tenant farmers, such as being small-scale and relying less on rented land. We also know that non-rice farmers are more reliant on rented land than rice farmers. They should therefore experience the impacts of illegal tenure status more acutely. However, we are hesitant to apply our results to other crop farmers without modification for several reasons. One, vegetable and fruit crops are often cultivated on a smaller scale and are more labor-intensive than rice farms. Second, those crops require more land-attached investment, which implies higher costs for short-term contracts. Third, direct payments are less important to non-rice farmers: the payments for these farmers are much lower and were implemented more recently than the long-standing rice payments. All those factors may influence tenants' choices around whether to enter an illegal contract. Overall, more research is needed to understand the unintended consequences of this form of insecure tenure status on farms' investment decisions and performance, which ultimately affects the economic and environmental consequences of farming.

Altogether, our results highlight the duality of the Land-to-the-Tillers principle and similar policies designed to strictly manage farmland ownership. Despite its good intentions of improving farmers' welfare by restricting ownership to operators, this principle faces challenges of implementation. The realities of implementation facilitate illegal transactions, eventually working against tenant farmers who are the actual operators. A lack of understanding of or attention to the incentives driving the prevalence of illegal tenure status can distort policy effects

as well, redirecting useful or welfare-improve inputs away from the intended recipients who are actually doing the work of agricultural production.

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Table 1: Summary statistics

	Mean	SD	Min	Max
Farm-level data: 1,907 farm-year units				
Demographics				
Operator age	67.03	8.85	38.0	88
Male operator	0.95	0.22	0.0	1
Household size	2.48	0.92	1.0	7
Medical expense in total consumption (%)	0.10	0.10	0.0	1
No formal schooling	0.08	0.27	0.0	1
Elementary school graduate	0.38	0.49	0.0	1
Middle school graduate	0.21	0.41	0.0	1
High school graduate	0.29	0.45	0.0	1
College graduate	0.04	0.20	0.0	1
Operation size				
Cultivated rice fields (ha)	1.50	1.84	0.2	17
Owned rice paddy (ha)	0.69	0.79	0.0	6
Rented rice paddy (ha)	0.86	1.50	0.0	12
Rental status: proportion of rented rice fields (%)	0.45	0.39	0.0	1
Other cultivated fields (ha)	0.79	1.15	0.0	17
Owned other cultivated fields (ha)	0.32	0.47	0.0	5
Farm finances				
Farm subsidies (1000 KRW)	3,297	4,769	0.0	86,664
Agricultural compensation (1000 KRW)	1,331	2,793	0.0	43,542
Total farm asset growth rate (100 = no growth)	96	17	-118	200
Farm debt-to-asset ratio	0.17	1.69	0.0	62
Change in livestock asset value (Mil. KRW/yr)	-1.75	16.54	-232	157
Change in poultry asset value (1000 KRW/yr)	55	2,152	-2,330	92,250
Plot-level data: 10,683 observations (1,508 farm-year units)				
Plot characteristics				
Plot size (ha)	0.21	0.14	0.0	2
Rented plot	0.58	0.49	0.0	1
Rent (KRW/m^2)	263	83	39	2,054
Revenue (KRW/m^2)	948	176	21	3,135
Number of plots by farm				
Operated plots	7.06	8.06	1.0	75
Owned plots	2.93	3.04	0.0	18
Rented plots	4.14	7.07	0.0	69
Field-level data: 3,323 observations (1,907 farm-year units)				
Field characteristics				
Field size (ha)	0.93	1.27	0.0	19
Termination rate (%)	0.10	0.30	0.0	1
Terminated area (m^2)	-369	1,803	-49,175	0
Number of fields by farm				
Operated fields	1.74	0.73	1.0	4
Owned fields	0.93	0.48	0.0	2
Rented fields	0.81	0.59	0.0	2

Table 2: Summary statistics ($\bar{\alpha}_{i,t}$)

	Mean	SD	Min	Median	Max
Owner operators					
(a) $\alpha_{i,\text{post}(n)}$	0.0205	0.1493	-0.4857	0.0198	0.4417
(b) $\alpha_{i,\text{post}}$	0.0151	0.1689	-0.4800	0.0075	0.5134
(c) $\alpha_{i,2016}$	0.0054	0.2125	-0.5173	-0.0116	0.7390
(c) $\alpha_{i,2017}$	0.0111	0.1489	-0.3382	0.0187	0.7292
Observations			112		
Tenant operators					
(a) $\alpha_{i,\text{post}(n)}$	0.0073	0.1535	-1.5675	0.0152	0.6602
(b) $\alpha_{i,\text{post}}$	0.0012	0.1665	-1.5657	0.0079	0.6589
(c) $\alpha_{i,2016}$	-0.0364	0.1787	-1.9214	-0.0189	0.5321
(c) $\alpha_{i,2017}$	0.0208	0.1627	-1.2720	0.0240	0.7033
Observations			299		

[a] We estimated $\alpha_{i,t}$ using three different specifications: (a) a naïve two-period model generating $\alpha_{i,\text{post}(n)}$ by estimating equation (1) without including $\boldsymbol{A_{it}}$; (b) the main two-period model from equation (1) as specified generating $\alpha_{i,\text{post}}$; and (c) the three-period model specified in equation (2) generating distinct estimates of the $\alpha_{i,t}$ parameter for the years 2016 and 2017 ($\alpha_{i,2016}$ and $\alpha_{i,2017}$).

Table 3: The impact of illegal rental contracts on access to direct payments: Equation (4)

	Variable payment (approx. ha)		Fixed payment (approx. ha)	
	Treat ($\bar{\alpha}_{i,\text{post}}$)	Treat ($\bar{\alpha}_{i,2016}$)	Treat ($\bar{\alpha}_{i,\text{post}}$)	Treat ($\bar{\alpha}_{i,2016}$)
	(1)	(2)	(3)	(4)
Rented land (ha) × control: β_{legal}	0.79***	0.80***	1.66***	1.73***
	(0.061)	(0.070)	(0.214)	(0.232)
Rented land (ha) × treat: β_{illegal}	0.59***	0.68***	1.28***	1.35***
	(0.101)	(0.090)	(0.253)	(0.272)
Farmland variables				
Owned rice paddy (ha): β_1	0.93***	0.92***	1.39***	1.35***
	(0.087)	(0.085)	(0.214)	(0.215)
Owned farmland (excl. paddy) (ha)	0.23	0.22	0.17	0.16
	(0.175)	(0.174)	(0.384)	(0.373)
Other cultivated fields (ha)	0.07	0.07	0.90**	0.90**
Farm and operator characteristics: X_{it}	(0.050)	(0.049)	(0.303)	(0.291)
Total farm asset growth rate			0.03*	0.03*
			(0.012)	(0.012)
Farm debt-to-asset ratio			0.06	0.06
	-0.00	-0.00	(0.035)	(0.034)
Change in livestock asset value (Mil. KRW/yr)	(0.003)	(0.003)		
	-0.00*	-0.00*		
Change in poultry asset value (1000 KRW/yr)	(0.000)	(0.000)		
	-0.01*	-0.01*	-0.02	-0.03
Operator age	(0.006)	(0.006)	(0.016)	(0.016)
	-0.37*	-0.37*	-0.17	-0.17
Elementary school graduate	(0.168)	(0.163)	(0.285)	(0.271)
	-0.52**	-0.52**	-0.50	-0.54
Middle school graduate	(0.190)	(0.188)	(0.367)	(0.358)
	-0.48*	-0.46*	-0.11	-0.09
High school graduate	(0.196)	(0.194)	(0.378)	(0.369)
	-0.57*	-0.54*	0.08	0.13
College graduate	(0.271)	(0.258)	(0.805)	(0.775)
	0.16	0.14	0.68*	0.64*
Male operator	(0.108)	(0.103)	(0.306)	(0.305)
	-0.05	-0.07	0.28	0.26
Household size	(0.049)	(0.049)	(0.175)	(0.173)
	-0.13	-0.11	-0.13	-0.11
Medical expense in total consumption (%)	(0.297)	(0.294)	(0.564)	(0.569)
	-0.11	-0.23	0.17	0.12
Pre-policy POF (kg/m^2)	(0.216)	(0.233)	(0.839)	(0.806)
Province-by-year FE	YES	YES	NO	NO
Province FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES
Observations	1,187	1,187	1,907	1,907
Adjusted R^2	0.69	0.69	0.48	0.48

[a] *** p<0.001, ** p<0.01, * p<0.05

[b] Standard errors in parentheses are clustered by farm. We present these results estimated with a) standard errors computed using wild cluster bootstrapping, clustered at the province level and b) heteroskedasticity robust standard errors in appendix table A16.

[c] Variable payment (approx. ha) and fixed payment (approx. ha) represent the approximate area of operated land that receives the relevant direct payment. Each variable is calculated by dividing the variable (fixed) payment (KRW) by the centrally determined variable (fixed) direct payment rate (KRW/ha) for each year. Please note that the variable and fixed payment variables (KRW) include other farm subsidies apart from direct payments, which may result in an overestimation of the eligible land.

[d] The coefficients of interest β_{legal} and β_{illegal} are significantly different from each other at the 5% level. See appendix table A19 for more details.

[e] We present these results estimated with inverse probability weights (IPW) in appendix table A10.

Table 4: The impact of illegal rental contracts on rental rates: Equation (5)

	Rental rate (KRW/m^2)		Rent share (%)	
	Treat ($\bar{\alpha}_{i,\text{post}}$)	Treat ($\bar{\alpha}_{i,2016}$)	Treat ($\bar{\alpha}_{i,\text{post}}$)	Treat ($\bar{\alpha}_{i,2016}$)
	(1)	(2)	(3)	(4)
Rented plot × control: θ_{legal}	-3.38	-5.15	-0.01	-0.01
	(4.226)	(5.264)	(0.005)	(0.006)
Rented plot × treat: θ_{illegal}	-10.89**	-6.83*	-0.01**	-0.01*
	(3.927)	(3.397)	(0.004)	(0.004)
Plot size (m^2): θ_1	-0.00*	-0.00*	-0.00	-0.00
	(0.001)	(0.001)	(0.000)	(0.000)
Constant	278.21***	278.37***	0.29***	0.29***
	(3.205)	(3.191)	(0.003)	(0.003)
Farm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	10,619	10,619	10,626	10,626
Adjusted R^2	0.64	0.64	0.55	0.55

[a] *** p<0.001, ** p<0.01, * p<0.05

[b] Standard errors in parentheses are clustered by farm. We present these results estimated with a) standard errors computed using wild cluster bootstrapping, clustered at the province level and b) heteroskedasticity robust standard errors in appendix table A17.

[c] Rent share is the rent-to-revenue ratio.

[d] We present these results estimated with inverse probability weights (IPW) in appendix table A11.

Table 5: The impact of illegal rental contracts on termination rates: Equation (6)

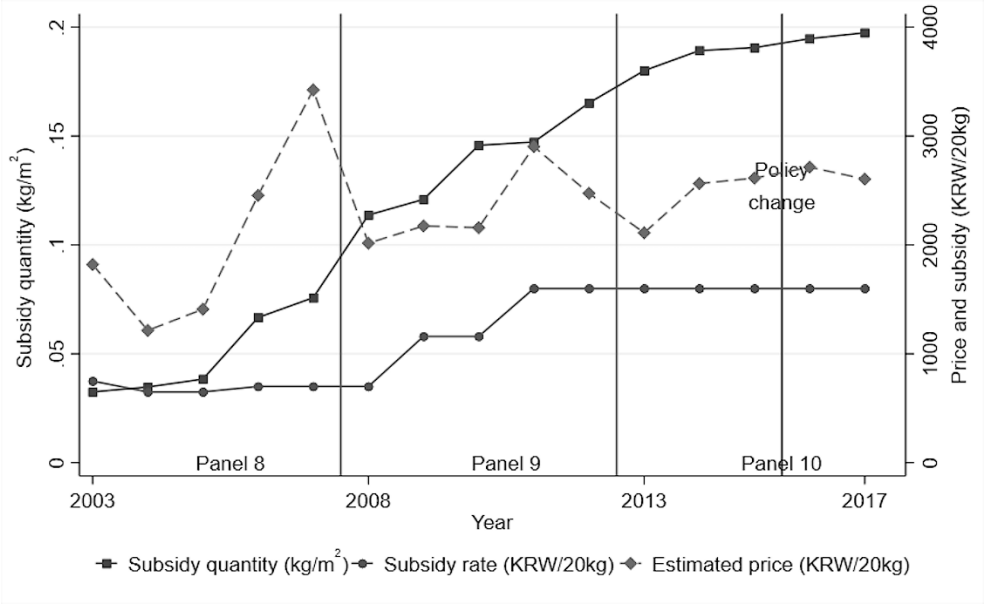
	Termination indicator		Terminated area (m^2)	
	Treat ($\bar{\alpha}_{i,\text{post}}$)	Treat ($\bar{\alpha}_{i,2016}$)	Treat ($\bar{\alpha}_{i,\text{post}}$)	Treat ($\bar{\alpha}_{i,2016}$)
	(1)	(2)	(3)	(4)
Rented plot × control: ω_{legal}	0.083***	0.065**	-260.144*	-201.139
	(0.018)	(0.020)	(105.305)	(129.539)
Rented plot × treat: ω_{illegal}	0.094***	0.102***	-310.971***	-330.734***
	(0.017)	(0.016)	(86.742)	(78.102)
Farm and operator characteristics: W_{it}				
Field size (m^2)	0.000**	0.000**	-0.044**	-0.044**
	(0.000)	(0.000)	(0.014)	(0.014)
Operator age	-0.008	-0.008	27.411	27.223
	(0.010)	(0.010)	(32.914)	(32.714)
Male operator	0.119	0.120	191.284	189.643
	(0.113)	(0.113)	(657.235)	(656.077)
Household size	-0.007	-0.007	-49.886	-49.421
	(0.016)	(0.016)	(146.013)	(145.865)
Medical expenses in total consumption (%)	0.105	0.105	-315.513	-316.203
	(0.085)	(0.085)	(314.650)	(314.925)
Constant	0.390	0.388	-1356.183	-1341.997
	(0.556)	(0.552)	(1790.214)	(1785.393)
Farm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	3,323	3,323	3,323	3,323
Adjusted R^2	0.08	0.08	0.08	0.08

[a] *** p<0.001, ** p<0.01, * p<0.05

[b] Standard errors in parentheses are clustered by farm. We present these results estimated with a) standard errors computed using wild cluster bootstrapping, clustered at the province level and b) heteroskedasticity robust standard errors in appendix table A18.

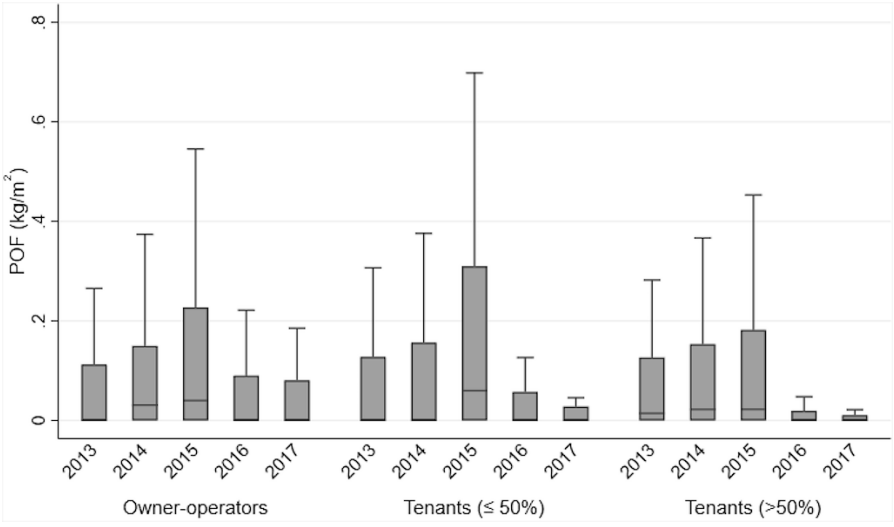
[c] We present these results estimated with inverse probability weights (IPW) in appendix table A12.

Figure 1: Trends in the organic fertilizer subsidy rate and quantity



Note: The subsidy quantity is the estimated subsidized fertilizer amount (kg/m^2) allocated to a farmer. The subsidy rate is the discounted rate per 20kg package. The estimated price is the estimated organic fertilizer price paid by a farmer with subsidy benefits.

Figure 2: Changes in POF by land ownership status



Note: (1) The graph excludes outliers defined as values larger than the upper quartile plus 1.5 times the interquartile range. (2) Owner-operators are those who do not rent in any paddy fields. Part-tenants (≤ 50%) rent less than or equal to 50% of their cultivated land for rice and full-tenants (>50%) rent more than 50%.

Endnotes

[1] As is typical of countries in this phase, 5% of Korea's workforce is employed in agriculture, versus 79% in industry (which includes services) and 16% in manufacturing. This development happened rapidly since 1961, the earliest year these data are easily accessible, when those figures were 80%, 15%, and 5%, respectively (KOSTAT, 1961; KOSTAT, 2021).

[2] The exact language of Article 121 of the Constitution of the Republic of Korea, translated by the Korea Legislation Research Institute, an official government agency, is as follows.

> "(1) The State shall endeavor to realize the Land-to-the-Tillers principle with respect to agricultural land. Tenant farming shall be prohibited. (2) The leasing of agricultural land and the consignment management of agricultural land to increase agricultural productivity and to ensure the rational utilization of agricultural land or due to unavoidable circumstances, shall be recognized under the conditions as prescribed by Act."

Note that consignment management is understood to mean custom farming. (ROK Const., art. 121)

[3] Early land redistribution measures were successful: the share of leased land fell sharply from 66% to 8% and the proportion of tenant farm households went from 86% to 8% in only five years between 1945 and 1950 (İşcan, 2018; Park et al., 2019).

[4] The Farmland Act (1994) is an overarching law that governs all farmland-related issues. Future Farmland Acts, e.g., the Farmland Act of 2016, can be loosely thought of as iterations of or updates to this "original" act.

[5] These exceptions included a limited amount of inherited farmland, land owned by farmers who exited farming, land for recreational uses, and land acquired before 1996.

[6] This estimate of the illegally rented area relies on tenant farmers' responses about their landlords' characteristics: e.g., whether those landlords have farming experience or not.

[7] Disposal orders involve first identifying illegal holders; if illegal ownership is discovered, the owners are obligated to dispose of the illegal holdings within one year (i.e., disposal obligation). If this does not occur, a disposal order is issued, commanding the disposal of illegal holdings within six months. See Appendix B.1 for more details.

[8] The incidence of verbal farmland rental contracts in other developed country contexts is lower: 31% of cash leases in Kansas (Li and Tsoodle, 2020) and 36% of cash leases in Iowa were verbal (Zhang et al., 2018). In the U.S. overall, it is most common to renew a farmland lease annually (70% of lease agreements); however, the rental relationships are longstanding even if the contract is negotiated annually. Non-operator landlords have rented 84% (41%) of rented acres to the same tenant for over three (ten) years (Bigelow et al., 2016).

[9] Therefore, it is always and only the landlord who is legally liable for either owning or renting-out farmland without legal authorization to do so. Thus, throughout the draft, when we say "illegal tenant farmers" that is the equivalent of "farmers who are tenants of illegal landlords." The former is used for brevity.

[10] Because the landlord and not the tenant would be held legally liable in any illegal rental situation, it is also possible that lower rental rates may also serve as compensation for not reporting the landlord's illegal behavior. However, given low levels of enforcement and prosecution, it is unlikely that this is a major source of bargaining power for the tenants. While the exact nature of bargaining power in this context is difficult to observe, anecdotal and sociological observation indicates that bargaining power is heavily influenced by social pressure and network effects, along with the landowner's recognized need for the land to remain in production to avoid detection. Illegal landowners, particularly absentee or non-operator ones, often retain social or familial connections in the places their land is located and illegally rented out, further complicating the bargaining arrangement between these parties.

[11] Local governments at the sub-province level then determine the specific quantity an individual operator will receive based on their cultivated area and crop type. While the subsidy rates are first determined by the central government, local governments can also offer additional subsidies from their budgets. South Korea's nine provinces are further divided into cities (*si*), counties (*gun*), and districts (*gu*) according to their population. Cities and counties are further divided into three types of townships (*eup*, *myeon*, *dong*) depending on their population. Which of these entities ultimately validates an operator's subsidized quantity will vary based on the size, population, and geography.

[12] In addition, registration eligibility is extremely broad, as anyone that meets the definition of a farm operator is eligible to register. A farm operator is defined as one of the following: (1) those who cultivate more than 0.1 ha, (2) those who work on-farm for more than 90 days during a year, (3) those who produce agricultural products in facilities larger than 330m^2, or (4) those whose agricultural sales exceed 1.2 million KRW (960 USD) per year.

[13] Before 2016, operated area was completely self-reported, without apparent measures to prevent over-reporting during the application process. However, the individual subsidy amount was ultimately determined by a local subsidy committee, which helped to mitigate the risk of over-reporting and to ensure that the subsidy is allocated realistically.

[14] As an example, imagine tenant farmer A operates 10 ha in total, including 3 ha of rented land from landlord B and 2 ha from landlord C. If landlord C, keen to maintain his inheritance tax exemption, refuses to register the rented land under tenant A's name and instead rents to him illegally, tenant A have only 8 ha registered in the Farm Business Management System under his name. In 2016 and after, he would receive a subsidy for 8 hectares; prior to 2016, he would have been able to request subsidized fertilizer for the full 10 ha he actually operates.
[15] These results are reported in Appendix B.2.1.
[16] It is also possible that tenants have a longstanding tenure relationship and so are incentivized to make these investments through tenure length. Unfortunately, the data do not record the length of the rental relationship.
[17] These surveys are conducted as per the enforcement decree of the Statistics Act (Art. 9), and Statistics Korea, the official national statistical organization under the Ministry of Strategy and Finance, is responsible for collecting, managing, and distributing the survey data in accordance with the Act's regulations (ROK EDS., art. 9). These data sources are widely used by policymakers and researchers in agricultural economics and other fields (e.g., Hyun et al., 1979; Ahn et al., 1981; Ro et al., 1981; Kulkarni and Rossi, 2022).
[18] The FHES began in 1953 and has continued through the present. Each wave is a 5-year-long panel; thus the 2013-2017 panel represents the 10th iteration of the FHES. The three most recent surveys (2003-2007, 2008-2012, and 2013-2017) are accessible through the Microdata Integrated Service of Statistics Korea. The survey results are available in May of the year following each survey year.
[19] Incentives for false reporting rental status in the APCS survey are relatively minimal. Because punishment occurs on the supply side of renting land, there are no legal consequences to reporting land as rented-in. There is also limited concern about respondents avoiding reporting land as rented-out. The survey is only given to farm operators. Nonoperator farmland ownership and renting out is the most egregious form of illegal rental arrangements and the one that is most closely monitored and punished. Because no survey respondent falls into that category, it is a) more unlikely that their renting-out arrangement would be illegal and b) even more unlikely that if it was illegal that it would be discovered or prosecuted. Thus, most operators would not feel the need to misrepresent their rented-out land's status. Indeed, the majority of owner-operators in our sample report renting out land, which indicates there are limited concerns about enforcement and/or need for misreporting.
[20] Sample attrition is therefore unlikely to be related to an operation no longer meeting the definition of a rice farm; instead, it likely reflects farm exit and/or typical difficulties related to survey follow-ups.
[21] As more than half of rice farmers are removed from the sample in this stage, we checked whether there are significant differences between POF users and non-users. POF users tend to be more educated, more active in farm investment, and operate on a larger scale. See Appendix B.2.2 for the detailed comparison. We also estimate our results using inverse probability weights to reflect the original set of observations as a robustness check. These results are available in appendix tables A10, A11, and A12.
[22] One possible concern is that farmers may not report rented land honestly when illegal contracts are prevalent. We argue that the FHES and the APCS provide accurate estimates of one's rented area and farmers do not exclude their illegally rented plots. For one, the current Farmland Act punishes landlords, not tenant farmers, for illegal leasing. In addition, data on land from FHES show a larger rented area than any other official land records, including the land registry and the Farm Business Management System (Chae et al., 2016).
[23] Specifically, the variable "fixed payments" includes fixed direct payment aggregated with other farm investment-oriented subsidies, while "variable payments" includes the variable direct payments plus other forms of compensation, such as price adjustments and livestock indemnities. See Appendix B.3 and Section 5.1.1 for more information on the direct payment program.
[24] The plot-level data does not include 2015 because the 2015 plot data uses different farmer identifiers, possibly through administrative error.
[25] The term "field" in this context does not carry a uniform meaning. It is determined by how individual farms record their farmland in the FHES farmland registry. At a minimum, farms record their land's ownership status and land use annually. The ownership variable specifies whether the land is owned, rented-in, or rented-out, while land use encompasses categories like paddy field, non-paddy field, forest, and others.
[26] In this figure, owner-operators also reduce their POF use. One reason could be that farmers, regardless of tenure status, exhibit path dependency in their OF application: farmers who applied OF one year prior may forgo OF application in the current year because nutrients from last year's application continue to have an impact. The data show that in 2015 55% of owner-operated farms and 56% of tenant operations applied OF. Thus, we would expect to see a decline in application for agronomic reasons that are unrelated to ownership status; the additional decline among tenant farmers in 2016 can be attributed to the policy. We describe this in more detail in Appendices A.2.1 and A.2.2.
[27] Our estimation strategy builds on the subsidy-induced effects of organic fertilizer (OF) demand. Thus, we first establish that there is a valid observable relationship between the subsidy and consumption of OF. The details and full results from this analysis are available in Appendix B.2.3. As we would expect, there is a significantly positive

impact of the subsidy on OF application (see appendix table B4). A 1% increase in the quantity subsidized raises the intensity of POF use by 1.2% and the probability of applying POF by 0.2%, holding other relevant variables constant. Meanwhile, we also observe substitution effects as expected: as the subsidy program expands, operators use less inorganic fertilizer.

[28] We randomly assign numbers to owner-operated farms. Each farm's $\alpha_{i,\text{post}}$ is then estimated using each of the 20 reference farms as a control in turn; we take the average of the resulting 20 individual estimates $\hat{\alpha}_{i,\text{post}}$. For farms where $\alpha_{i,\text{post}}$ is not significant at the 0.05 level, we treat it as 0. In Appendix A.2.4, we test the sensitivity of our results to relaxing this definition and using the actual value of insignificant estimates of $\alpha_{i,\text{post}}$ rather than setting them to 0. Our main findings are unchanged with this specification (see appendix tables A13, A14, and A15). This process is repeated for every farm in our final sample, including both owner-operators and tenants. When estimating $\bar{\alpha}_{i,\text{post}}$ for one of the 20 reference farms, we remove that operation from the average, such that the average for these operations is made up of 19 (rather than 20) estimates of $\alpha_{i,\text{post}}$ to estimate $\bar{\alpha}_{i,\text{post}}$. After trying different numbers of reference farms, we find that using 20 farms gives a fairly stable value of $\bar{\alpha}_{i,\text{post}}$ without imposing heavy computational work.

[29] This trend supports the anecdotal evidence, described above in section 2.2, that it was only the initial change in 2016 that constituted a shock to producers' behavior. By 2017, the bargaining positions of landlords and tenants may have adjusted to reallocate POF back to operators or operators may have found other means of accessing fertilizer.

[30] We test how the sample selection affects the level change of applied POF by comparing panel 9 (2008-2012) with panel 10 (2013-2017). Panel 9 did not experience any policy change in terms of POF use, while panel 10 went through the eligibility change. We restrict both samples to those who had applied POF before 2011 (panel 9) and 2016 (panel 10). Then we assess the within-farm variation in the intensity of POF associated with 2011 or 2016 across tenancy quintiles, ranging from owner-operators to full tenants. Significant reduction in POF is observed among tenant farmers in 2016, while changes in POF for 2011 are mostly insignificant.

[31] In the data, direct payments are recorded as the sum of direct payments plus other farm investment-oriented subsidies, and variable payments are recorded as the sum of variable payments plus other types of agricultural compensation. While the fixed direct payment is disbursed in each survey year, the variable direct payment is paid out in the following year, as the payment rate is determined in late October (see Appendix B.3).

[32] This is reported in the APCS and represents the respondent's imputed estimate for how much the owned land would earn if it were rented out.

[33] While we cannot observe whether an individual field is eligible for direct payments, we are not concerned about the significant relationship between tenure status and eligibility. For one, the direct payment program covers about 90% of the nation's rice fields, and the total operated area of paddy fields has only decreased since 2001. Furthermore, non-operator owners and tenants would not have particular incentives to convert other farmland to paddy fields in order to gain access to these payments, due to limited access to irrigation facilities and the relatively low profitability of rice.