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Direct payments to Japanese farmers: Do they reduce rice income inequality? Lessons for other Asian countries

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Abstract

This study investigates the income-equalizing effect of direct payments on rice income inequality in Japan using the Gini decomposition and the concentration curve. The results indicate that the direct payments in Japan are highly concentrated but they nevertheless reduce rice income inequality. However, the equalizing effect of direct payments is less than that in other countries because the Japanese payments are linked to participation in an acreage reduction program and are not fully decoupled. To pursue greater income equality, policymakers should decouple the payments and introduce mechanisms to decrease or limit the amount of support to the largest beneficiaries.

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1. Introduction

In many developed countries, government farm payments are highly concentrated on larger farms (Bekkerman, Belasco, & Smith, 2019; European Commission, 2017). As a result, in many cases, mechanisms to decrease or limit the amount of support to the largest beneficiaries have been implemented, such as the progressive reduction of payments (modulation) and redistributive payments in EU countries (European Commission, 2017) and payment limits in the USA (Zulauf, 2012). Furthermore, it is argued that decoupling payments could achieve a more equitable income distribution (Severini & Tantari, 2015).

As in other developed countries, market price support in Japan has declined, and the share of direct payments in Japan's producer support estimate has increased in recent years (OECD, 2019a). Historically, Japanese agriculture has been characterized by a predominance of small-scale farm households, with the average farm size increasing from 1.4 to 2.2 ha between 1990 and 2015 (OECD, 2009, 2019a). However, despite the slow increase in average farm size, the concentration of land use to form large farms has accelerated in the last decade (OECD, 2019a). The size of crop farms in Japan has increased faster than in other OECD countries (Canada, the USA, France and the Netherlands), and the size distributions of crop farms have become more dispersed (Bokusheva & Kimura, 2016).

This paper focuses on the distribution of rice income in Japan and the distributional impact of direct payments granted to rice farmers. Because the role of direct payments differs according to farm type (Severini & Tantari, 2013a, 2013b), by focusing on a single crop, rice, and income from this crop, we can remove the effects of crop differences and thereby appropriately address the distributional impact of direct payments. Given that rice is one of Japan's most important agricultural commodities, rice policy is a central aspect of its agricultural policies. Indeed, rice-related policies account for close to 40% of Japan's producer support estimate (OECD, 2019a).

In 2010, the Japanese government introduced two types of income support direct payment programs for the purpose of ensuring farm viability and maintaining domestic production potential (MAFF, 2011). First, new income support direct payments were introduced for all rice farms that met a specified production quota of rice (OECD, 2011). This new program consisted of two components: a predetermined fixed-rate direct payment for rice production (hereafter, DPr) and a price-contingent payment for rice. The amount of DPr was based on the current planted area of staple rice, with the payment rate set at JPY 15,000 (USD 128) per 0.1 ha of rice planted area. Second, the government reformed the existing diversion subsidies to create direct payments that were granted directly to all farms that cultivated non-staple rice products (e.g. feed rice, rice flour, wheat, soybeans) in paddy fields (Hattori, 2012; Kobari, 2018). This payment was called a direct payment for the utilization of paddy fields (hereafter, DPu). DPu was granted to farms based on the current area of paddy planted with non-staple rice products, and the payment rate was JPY 20,000 (USD 171)–JPY 80,000 (USD 683) per 0.1 ha, with payments fixed for each crop. In 2014, the price-contingent payment for rice was eliminated and the predetermined rate of DPr was halved to JPY 7,500 (USD 64) per 0.1 ha. Then, in 2018, DPr was eliminated (OECD, 2019a). Only DPr and DPu are considered in this paper because the price-contingent payment was not triggered during our analysis period (2012–2016).

Both of these direct payments were made based on the current area planted and, thus, were not fully decoupled from production. When support was tied to production, distribution of the support was necessarily very unequal, with large farms receiving most of it (OECD, 1999). Furthermore, mechanisms to decrease or limit the amount of support to the largest beneficiaries—such as the

progressive reduction of payments, redistributive payments and payment limits, which are popular in EU countries and the USA—have not been implemented in Japan. Thus, the concentration of direct payments in Japan is likely to be very high.

A sizeable literature has examined the role played by government payments on farm income distribution, with most analyses finding that government payments reduce income inequality. However, to our knowledge, no study has investigated the income-equalizing effect of direct payments in Japan. Given that the concentration of direct payments in Japan is likely to be very high, the equalizing effect of direct payments on income distribution may be reduced or eliminated.

The purpose of this paper is to investigate the impact of direct payments on rice income inequality in Japan by asking the following research question: do direct payments reduce rice income inequality in Japan? We address this question using the Gini decomposition and the concentration curve.

The results of the analysis provide policy implications relevant to future direct payment policies in Japan and other countries. They are particularly relevant to Asian countries, as their domestic rice policies have strong similarities to those of Japan (Tobias, Molina, Valera, Mottaleb, & Mohanty, 2012), and some Asian countries have introduced or extended direct payments (OECD, 2019b). Further, if the answer to the research question is positive, reductions or eliminations of direct payments could be expected to increase income inequality in Japan.

2. The role of direct payments in the generation of rice income

The income parameter considered is total rice income (TRI), which is defined as income from rice farming. TRI is made up of two components: market rice income (MRI) and total direct payments (TDP). MRI is obtained by subtracting the remuneration for inputs that are not the property of the holder from gross receipts for rice production. TDP is the sum of DPr and DPu. Following Severini and Tantari (2013a, 2013b), income inequality is preliminarily assessed by ranking farms according to TRI levels and dividing them into decile groups. The first decile includes the 10% of rice farms earning the least, the second decile the next 10% and so on (Table 1). Farms belonging to the top two deciles always earned 79–94% of the TRI, whereas the bottom decile includes farms with negative TRI.

Direct payments are highly concentrated. The rice farms in the two top deciles of TRI received 68–74% of the TDP distributed in the sample (Table 1). For the rice farms included in the *Production Cost of Rice, Wheat and Barley* dataset, DPr accounts for more of the TRI than does DPu during the analysis period 2012–2016 (Table 2).

TRI decreased in 2014 and 2015 relative to the other years because of a decrease in MRI and DPr (Table 2), and this increased the extent of negative incomes (Table 1). MRI decreased because of a significant decrease in the market price of rice in 2014 and 2015 (Fujibayashi, 2015; Kobari, 2018). Moreover, because the predetermined rate of DPr was halved, the amount of DPr decreased in 2014, whereas DPu slightly increased. Table 2 indicates that TRI recovered to around two million yen (17,930 USD) in 2016 because of the rise in MRI. Thus, 2014 and 2015 differ from the typical situation.

3. Literature review

In general, the income inequality between individuals or households is of the highest societal and political importance (for example, see Aristei & Perugini, 2010; Bittencourt, Chang, Gupta, & Miller, 2019; Lau, Yotopoulos, Chou, & Lin, 1981; Lee, 2006; Levy, 1987; Taylor, 1992). In regard

Table 1

Distribution of rice income and direct payments by deciles of income classes in 2012–2016 (%).

	Total rice income (TRI)					Total direct payments (TDP)				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Decile groups										
Bottom	−1.35	−1.95	−7.63	−4.86	−2.26	1.10	1.28	5.25	3.41	1.52
2	−0.23	−0.28	−2.53	−1.43	−0.47	0.78	1.24	1.93	1.15	0.75
3	0.32	0.29	−1.17	−0.45	0.10	0.90	1.05	1.05	1.15	0.83
4	0.90	0.87	−0.22	0.15	0.58	1.28	1.27	1.32	1.08	1.09
5	1.65	1.82	0.73	0.96	1.45	2.40	2.08	1.99	1.77	1.90
6	3.02	3.46	2.17	2.47	3.08	3.40	4.01	3.47	4.39	3.19
7	5.75	5.93	4.70	5.24	5.93	5.68	6.08	5.87	5.58	5.23
8	11.38	10.85	9.60	9.90	10.51	11.05	11.84	11.06	10.59	11.68
9	23.52	22.53	23.30	23.10	23.20	22.49	24.22	21.84	20.09	21.42
Top	55.04	56.48	71.06	64.92	57.87	50.91	46.92	46.22	50.80	52.40
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The values in Table 1 are calculated by dividing the total amount of TRI or TDP within each decile group by the sample.

Source: own elaboration of the *Production Cost of Rice, Wheat and Barley* data.

Table 2

Average values of total rice income and its components: market rice income and direct payments (thousand JPY) (thousand USD in parentheses^a).

	2012	2013	2014	2015	2016
Total rice income (TRI)	2816.82 (24.06)	2404.71 (20.54)	1201.28 (10.26)	1487.42 (12.70)	2099.92 (17.93)
Market rice income (MRI)	2146.10 (18.33)	1732.37 (14.79)	807.66 (6.90)	1089.55 (9.30)	1682.54 (14.37)
Direct payment for rice production (DPr)	546.22 (4.66)	568.83 (4.86)	278.13 (2.38)	269.66 (2.30)	275.23 (2.35)
Direct payment for the utilization of paddy fields (DPu)	124.50 (1.06)	103.51 (0.88)	115.49 (0.99)	128.21 (1.09)	142.15 (1.21)

^a 1 JPY = 0.00854 USD as of December 30, 2016.Source: own elaboration of the *Production Cost of Rice, Wheat and Barley* data.

to the farming sector, the effect of agricultural policies on income distribution has been extensively explored in studies in the USA (Ahearn, Johnson, & Strickland, 1985; Gardner, 1969; Keeney, 2009; Mishra, El-Osta, & Gillespie, 2009), Europe (Allanson, 2006, 2008; Allanson & Rocchi, 2008; Ciliberti & Frascarelli, 2018; Deppermann, Grethe, & Offermann, 2014; Deppermann, Offermann, & Grethe, 2016; El Benni & Finger, 2013; El Benni, Finger, Mann, & Lehmann, 2012; Hansen & Offermann, 2016; Kaditi & Nitsi, 2011; Keeney, 2000; Schmid, Hofreither, & Sinabell, 2006; Severini & Tantari, 2013a, 2013b, 2015; Tantari, Pierangeli, & Cardillo, 2019; von Witzke, 1979; von Witzke & Noleppa, 2007) and Asia (Chang, 2013; Fang & Rizzo, 2011; Lee, 2005; Li, Feldman, Li, & Daily, 2011; Luh & Wei, 2018). The majority of these studies have found that government farm payments cause income inequality to decrease.¹

¹ The effect of agricultural policies on other aspects of income has been extensively explored (for example, see Mishra & Cooper, 2017; Severini, Biagini, & Finger, 2019).

Most of the analyses in the existing literature were developed by calculating the Gini coefficient of income for samples of individual farm data. Recently, an increasing number of studies have analysed the effect of government payments on income distribution within the agricultural sector by decomposing the Gini coefficient by its income components (Ahearn et al., 1985; Chang, 2013; Ciliberti & Frascarelli, 2018; El Benni & Finger, 2013; El Benni et al., 2012; Fang & Rizzo, 2011; Hansen & Offermann, 2016; Kaditi & Nitsi, 2011; Keeney, 2000; Li et al., 2011; Mishra et al., 2009; Severini & Tantari, 2013a, 2013b, 2015; Tantari et al., 2019). This Gini decomposition approach (Lerman & Yitzhaki, 1985; Pyatt, Chen, & Fei, 1980; Rao, 1969) has often been applied to income inequality in Asian agriculture (Birthal & Singh, 1995; Mandal, Datta, & Lama, 2010; Saiful Nathan & Mohd Rosli, 2016; Singh & Datta, 2013; Singh, 2007; Thapa, Otsuka, & Barker, 1992; Tuyen, 2016).

In the Japanese rice sector, policy plays a major role. Japanese rice farms have long been assisted largely by market price supports (Hayami, 1972; Kondo, Yamamoto, & Sasaki, 2017; OECD, 2009, 2019a; Takahashi, 2012). Using the Gini coefficient and aggregated data, Sawada (1977) reported that market price support made the distribution of benefits between regions and farm scales unequal. Several other works have focused on income distribution in the Japanese agricultural sector by applying the Gini coefficient and the Gini decomposition by income source to aggregated data (Rakhine & Chitose, 2012; Mizoguchi, Takayama, & Terasaki, 1977; Okuda & Kuroyanagi, 1976; Saito, 2008). However, to our knowledge, no study has dealt with the equalizing effect of direct payments in Japan,² where the concentration of direct payments is likely to be very high.

4. Method

This paper addresses the income-equalizing effect of direct payments on the inequality in the distribution of TRI. For this purpose, we use a decomposition of the Gini coefficient by income source (Lerman & Yitzhaki, 1985; Pyatt et al., 1980; Rao, 1969).

Ahearn et al. (1985), Chang (2013), Ciliberti and Frascarelli (2018), Fang and Rizzo (2011), Hansen and Offermann (2016), Kaditi and Nitsi (2011), Keeney (2000), Li et al. (2011), Mishra et al. (2009), Severini and Tantari (2013b, 2015) and Tantari et al. (2019) explain that when total income is generated by k components, the Gini coefficient G can be decomposed in the following way:

$$G = \sum_{k=1}^K R_k G_k S_k, \quad (1)$$

where R_k denotes the Gini correlation between the income component k and the rank of total income. This is given by the covariance between income from the k th component and the rank of total income, divided by the covariance between income from this component and the rank of this same income component (Pyatt et al., 1980): $cov(y_k, F)/cov(y_k, F_k)$. Thus, R_k will equal one when an income source k is an increasing function of total income (Lerman & Yitzhaki, 1985), G_k denotes the Gini coefficient for the k th income component and S_k denotes the income share of the k th income source relative to total income.

² The literature explores the effect of direct payments for less-favoured area support and environmental/ecosystem services on preventing farmland abandonment and promoting collective stewardship of common property resources in Japan (Ito, Feuer, Kitano, & Asahi, 2019; Ito, Feuer, Kitano, & Komiyama, 2018; Takayama, Hashizume, & Nakatani, 2020). However, to our knowledge, no study has dealt with the effect of direct payments on income distribution in Japan.

The product between R_k and G_k gives the concentration coefficient of the k th income source (C_k) and measures how income from each source is transferred across a population that is ranked with respect to the level of total income each member received:

$$C_k = R_k G_k. \quad (2)$$

To evaluate the marginal impact of a single income component on income inequality, [Lerman and Yitzhaki \(1985\)](#) derived the following measure of the rate of change of the Gini coefficient with respect to the mean of the k th income component:

$$\frac{dG}{d\mu_k} = \frac{1}{\mu}(C_k - G) = \frac{1}{\mu}(R_k G_k - G). \quad (3)$$

From this, it is possible to derive the elasticity of the Gini coefficient for each income component k (η_k) as follows ([Lerman & Yitzhaki, 1985](#)):

$$\eta_k = \frac{1}{G} \left[\frac{\mu_k}{\mu} (R_k G_k - G) \right] = \frac{1}{G} [S_k (R_k G_k - G)] = \frac{R_k G_k S_k}{G} - S_k. \quad (4)$$

This elasticity (η_k) allows the measurement of the impact of a 1% change of a single income source on the income concentration. If the elasticity of an income component is a negative value, a proportionate increase in the component reduces income inequality. $R_k G_k S_k/G$ accounts for the proportional contribution to inequality of the k th income source (hereafter, P_k).

Links with the Lorenz curve make the Gini coefficient an attractive statistic for the decomposition by income components, as the Lorenz curve graphically represents the Gini coefficient. The concentration coefficient of the k th income source (C_k) with respect to total income is obtained from a concentration curve³ ([Pyatt et al., 1980](#)). The Gini coefficient (or concentration coefficient) cannot be used to rank distributions if the Lorenz curves (or concentration curves) intersect.

Using the Gini decomposition and the concentration curve, this study investigates the income-equalizing effect of direct payments on rice income inequality in Japan.⁴ If the elasticity of TDP is a negative value and the curves for TRI (the sum of MRI and TDP) lie above those for the MRI without intersecting, then the answer to the research question—do direct payments reduce rice income inequality in Japan?—is ‘yes’.

5. Data

The analysis is based on a sample of Japanese rice farms belonging to the *Production Cost of Rice, Wheat and Barley* dataset for 2012–2016, which comprises 820–985 farms in these years.⁵ The sample of the *Production Cost of Rice, Wheat and Barley* dataset consists of individual (i.e.

³ The Lorenz curve is a special case of a concentration curve that plots the relationship between the cumulative percentage of total income corresponding to the cumulative percentage of the population when individual units are ranked in ascending order of income ([Ahearn et al., 1985](#)).

⁴ The concentration of direct payments on larger farms could encourage farmers to expand their farm size. Thus, equalizing the distribution of direct payments could reduce incentives for expanding farm size. Direct payments can affect the rice income distribution through such changes in production behaviour ([Coelho, Pires, Dionísio, & da C. Serrão, 2012](#); [Hennessy, 1998](#)). However, these effects are not accounted for in this study, and should therefore be considered in future research.

⁵ The *Production Cost of Rice, Wheat and Barley* dataset is an instrument managed by the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) that is used as reference material for studies on agriculture policy.

Table 3

Gini decomposition of the total rice income (TRI) in 2012 and 2014.

	Share in TRI, S_k	Gini coefficient, G_k	Gini correlation, R_k	Concentration coefficient, C_k	Proportional contribution to inequality, P_k	Elasticity, η_k
2012						
MRI	0.7619	0.7923	0.9940	0.7875	0.7883	0.0264
TDP	0.2381	0.7243	0.9341	0.6766	0.2117	-0.0264
DPr	0.1939	0.7097	0.9355	0.6639	0.1692	-0.0248
DPu	0.0442	0.9380	0.7804	0.7321	0.0425	-0.0017
TRI	1.0000	0.7611	1.0000	0.7611	1.0000	0.0000
2014						
MRI	0.6723	1.2136	0.9745	1.1827	0.8058	0.1335
TDP	0.3277	0.7308	0.8002	0.5849	0.1942	-0.1335
DPr	0.2315	0.7100	0.7681	0.5454	0.1280	-0.1036
DPu	0.0961	0.9030	0.7530	0.6799	0.0662	-0.0299
TRI	1.0000	0.9868	1.0000	0.9868	1.0000	0.0000

Source: own elaboration of the *Production Cost of Rice, Wheat and Barley* data.

family) rice farms that sold 600 kg or more of rice per year. The analysis focuses on these family farms, excluding all partnerships, corporate and other non-family farms.

Because the role of direct payments differs according to farm type (Severini & Tantari, 2013a, 2013b), by focusing on a single crop, rice, and income from this crop, we can remove the effects of crop differences and thereby appropriately address the distributional impact of direct payments.

The considered income parameter is TRI, which is made up of two components, MRI and TDP. Direct payments have been identified by considering only the annual direct payments granted to rice farms in the context of ensuring the reproduction by rice farms (DPr) and supporting rice farmers who want to shift from the production of rice used as a staple food to other crops (DPu) (OECD, 2019a, 2011).

6. Empirical results

In this section, the research question—do direct payments reduce rice income inequality in Japan?—is addressed according to the empirical results of the decomposition of the Gini coefficient of rice income (Table 3). Due to space limitations, we only show the results for 2012 and 2014 in this paper. The results of the Gini decomposition and the concentration curve for 2013 and 2016 are similar to those for 2012, and the 2015 results are similar to those for 2014. The results for 2014 and 2015 differ from the typical situation because TRI declined, as shown in Table 2.

TRI appears highly concentrated over the period 2012–2016, with Gini coefficients being 0.7611 in 2012 and 0.9868 in 2014 (G_k in Table 3). MRI accounts for 76.19% and 67.23% of TRI in 2012 and 2014, respectively, whereas TDP accounts for 23.81% and 32.77% of TRI in these years, respectively (S_k in Table 3). For this reason, MRI strongly affects the income level and the income distribution and generates around 80% of the overall TRI inequality (P_k in Table 3).

TDP shows an equalizing effect given that the values for the Gini elasticity of TDP are negative in both years. A 1% increase in TDP could reduce the Gini coefficient of TRI by 0.0264% in 2012 and 0.1335% in 2014 (η_k in Table 3). The results for 2014 (and 2015) differ from the typical

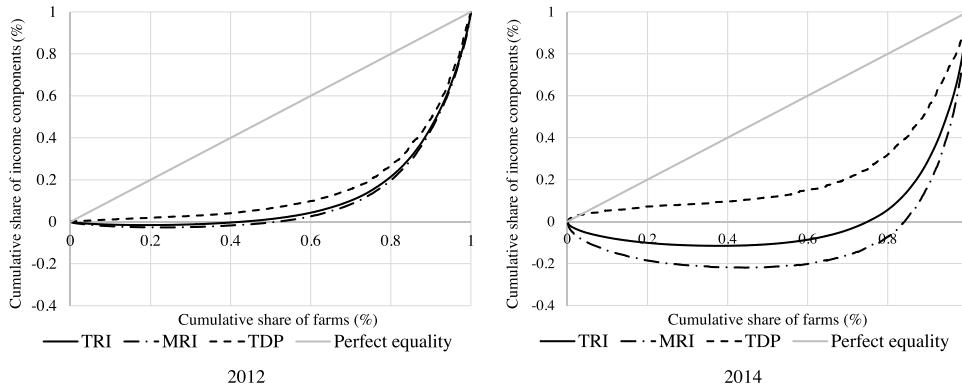


Fig. 1. Concentration curves for the components of total rice income in 2012 and 2014.

Source: own elaboration of the *Production Cost of Rice, Wheat and Barley* data.

situation in that the equalizing effect of direct payments increased because the Gini correlation (R_k) of TDP decreased and the share (S_k) of TDP slightly increased. DPr, like MRI, is concentrated: the Gini coefficient of DPr is 0.7097 in 2012 and 0.7100 in 2014. However, DPr decreases income inequality because the concentration coefficients (C_k) are lower than those for TRI. By contrast, because the income share (S_k) derived from DPu is very low and the Gini coefficient (G_k) is very high, the equalizing effect of DPu is less than that of DPr.

The concentration curve graphically represents the concentration coefficient (C_k). Fig. 1 represents the concentration curves for 2012 and 2014. The curves for TRI (sum of MRI and TDP) lie above those for MRI, thus providing an unambiguous ranking in terms of relative inequality because the concentration curves do not intersect. The concentration curves indicate that a proportionate change in direct payments reduces the inequality of rice income. Therefore, the answer to our research question is ‘yes’. The direct payments are highly concentrated but nevertheless reduce rice income inequality.

7. Discussion

As described above, DPr was granted only to farms that met a production quota for rice and, thus, was a benefit of participation in the acreage reduction program (Arahata, 2015). It has been claimed that compared with smaller farms, larger farms are more likely to benefit from voluntary acreage reduction and have greater incentives to participate in such a program (Arahata, 2015). This is because if inputs involving variable costs, such as hired labour and the owner’s labour, can be transferred to other activities when the acreage is idle, the total variable expenses are reduced and the net profit from participation is increased (Gardner, 1987). Such a transfer is easier for larger- than for smaller-scale farms to achieve (Arahata, 2015). However, the results in this paper suggest that even when the payments are a benefit of participation in the acreage reduction program, thereby favouring the larger farms, they nevertheless decrease income inequality.

Next, we compare the results of this paper with studies in the existing literature that use the Gini decomposition approach. The empirical results show that direct payments allow for an income inequality reduction in Japanese rice farms; similar findings have been reported elsewhere (Chang, 2013; Ciliberti & Frascarelli, 2018; Hansen & Offermann, 2016; Kaditi & Nitsi, 2011; Keeney, 2000; Li et al., 2011; Mishra et al., 2009; Severini & Tantari, 2013b, 2015; Tantari et al., 2019).

However, in most cases, the values for the Gini elasticity of TDP (η_k) presented in this paper for 2012 are lower than those in other countries (Table 4) because our Gini correlations (R_k) of direct payments in Japan are higher than those reported for other countries. A high Gini correlation between the government payment and total income indicates that the payment favours the rich (Kaditi & Nitsi, 2011; Mishra et al., 2009). It is argued that decoupling and the progressive reduction of payments (modulation) could decrease the Gini correlation between payments and farm income (Severini & Tantari, 2013a, 2015). Further, as described above, the fact that DPr is a benefit of participating in an acreage reduction program may mean it favours larger-scale farms and increases the Gini correlation.

Hence, this result supports the findings of several previous studies (Kaditi & Nitsi, 2011; Mishra et al., 2009; Severini & Tantari, 2013a, 2015) in that we find that the equalizing effect of direct payments is weaker in Japan than in other countries because the payments in Japan favour the rich and are not fully decoupled. This suggests that decoupling direct payments from rice production and introducing redistributive payments, payment limits and a progressive reduction of payments (modulation) would decrease the Gini correlation, thereby increasing the income-equalizing effect of the direct payments.

In 2014, the equalizing effect of direct payments increased because the Gini correlation (R_k) of TDP decreased and the share (S_k) of TDP slightly increased. The Gini correlation (R_k) fell from 0.9341 in 2012 to 0.8002 in 2014 (Table 3), without a significant change in the Gini coefficient (G_k). This result implies that the decline in the rice price changed the rank of farms according to TRI levels, which suggests that decreasing the Gini correlation can greatly increase the elasticity of direct payments.

8. Policy implications

This paper investigates the impact of direct payments on rice income inequality in Japan. The answer to the research question is ‘yes’, direct payments do reduce rice income inequality in Japan.

The analysis shows that rice income inequality in Japan is high and that direct payments reduce this inequality. The income-equalizing effect of DPr is stronger than that of DPu because the income share derived from DPu is very low and its Gini coefficient is very high. This shows that DPr is a valuable policy measure to reduce income inequality relative to DPu. However, the direct payments—especially DPr, which is strongly correlated with the income level—and the equalizing effect are lower in Japan than in other countries (with the exception of 2014 and 2015, years which differ from the typical situation). This strong correlation could be reduced by decoupling the direct payments from production and introducing redistributive payments, payment limits and the progressive reduction of payments (modulation). In addition, the decline in the rice price reduced this correlation in 2014 and 2015, increasing the equalizing effect.

Some relevant policy implications arise from this analysis. We highlight five that should be carefully considered in shaping direct payments in Japan and other countries, especially Asian countries, in the future: (1) coupled payments to assist certain sectors could have negative consequences for the farm income distribution if the share relative to total income is high. (2) The elimination of DPr in 2018 is expected to result in a less equitable distribution of rice income in Japan. The reason for this is related to the answer of ‘yes’ that we found in response to our research question, that is, we find that DPr and DPu do reduce rice income inequality and, further, that the income-equalizing effect of DPr is stronger than that of DPu. (3) If pursuing income equality is a relevant objective, policymakers should decouple DPr from rice production. This reform could

Table 4
Gini decomposition for government payments reported by the previous literature and our results.

Authors	Case study	Period	Considered income parameter	S_k	G_k	R_k	η_k
Our results in 2012	Japan	2012	Rice income	0.2381	0.7243	0.9341	-0.0264
Our results in 2014	Japan	2014	Rice income	0.3277	0.7308	0.8002	-0.1335
Fang and Rizzo (2011)	China	1991 to 2006	Farm household income	0.0148 to 0.0581	0.8196 to 0.9585	0.5718 to 0.8276	0.0068 to 0.0235
Ciliberti and Frascarelli (2018)	Italy	2014 and 2015	Farm income	0.058 to 0.110	0.711 to 0.731	0.648 to 0.710	-0.049 to -0.022
Severini and Tantari (2013b)	Italy	2006-2007	Farm income	0.175	0.790	0.686	-0.038
Tantari et al. (2019)	Italy	2014 and 2019	Farm income	0.208 to 0.231	0.659 to 0.732	0.607 to 0.657	-0.102 to -0.089
Kaditi and Nitsi (2011)	Greece	1998, 2002 and 2007	Farm income	0.215 to 0.269	0.524 to 0.547	0.558 to 0.628	-0.041 to 0.012
Chang (2013)	Taiwan, China	2007 and 2009	Farm household income	0.094 to 0.120	0.338 to 0.367	-0.140 to 0.045	-0.114 to -0.107
Severini and Tantari (2015)	Italy	2011	Farm household income	0.210	0.710	0.486	-0.074
Hansen and Offermann (2016)	German	2013	Farm income	0.477	0.438	0.474	-0.263
Keeney (2000)	Ireland	1992 and 1996	Farm income	0.293 to 0.593	0.485 to 0.571	0.390 to 0.583	-0.287 to -0.189
Mishra et al. (2009)	US	1996 to 2001	Farm household income	0.050 to 0.110	0.856 to 0.878	0.131 to 0.354	-0.083 to -0.031
Li et al. (2011)	China	2007	Farm household income	0.02711 and 0.13833	0.30608 and 0.39969	0.32484 and 0.32644	-0.02172 and -0.09960

Only studies that report values for S_k , G_k and R_k are listed in the table. When the results of aggregated total payments are available, the range of results for the total payments S_k , G_k , R_k and η_k over the analysis period is shown in this table. When only the results of each component of the payments are available, the results for the payment with the largest share are shown.

Source: Chang (2013), Ciliberti and Frascarelli (2018), Fang and Rizzo (2011), Hansen and Offermann (2016), Kaditi and Nitsi (2011), Keeney (2000), Li et al. (2011), Mishra et al. (2009), Severini and Tantari (2013b), Severini and Tantari (2015) and Tantari et al. (2019).

reduce income inequality without increasing the budget. (4) Introducing redistributive payments, payment limits and the progressive reduction of payments would effectively increase the income-equalizing effect of the direct payments in Japan. (5) Market forces strongly affect both the level and distribution of farm income. Market income fluctuations do not affect the level or distribution of direct payments, but they do affect the equalizing effect of direct payments by changing the correlation of the payments with the income level.

A number of other issues remain to be addressed in future work. First, whether introducing redistributive payments, payment limits and a progressive reduction of payments (modulation) will improve the equalizing effect of direct payments is an interesting empirical problem. Ex ante simulation analysis, such as that conducted by Ciliberti and Frascarelli (2018), Deppermann et al. (2016) and Severini and Tantari (2013b), is required in the Japanese context. Second, whether the main policy objective of direct payments, which is to stabilize farm income, is achieved requires verification by empirical analysis.

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