Characterization of Rice Market in Madagascar: Focusing on Price and Quality Relationship

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1. Introduction

Rice is the single, most important staple food in Madagascar. It is produced, traded, and consumed almost everywhere in this country. However, long-distant rice trade between surplus areas and deficit/urban areas is still underdeveloped due to several constraints. For example, Miyake and Sakurai (2012) show that Malagasy rice market is not well integrated because of high transportation cost and poor road condition, and Arimoto et al (2013) show that the cost for contract enforcement and product inspection may discourage traders to search for new sellers and buyers in long-distant markets.

The product inspection will include two aspects: one is the quantity traded (i.e. weight or volume) and the other is the quality of the product (e.g. rice varieties, broken grain content, contamination of stones and straws, and so on). The inspection cost arises from the fact that there is no standard for measures and rice quality, although rice has been the most traded commodity in Madagascar. With respect to the quantity measurement, Arimoto et al (2013) reports the diversification of rice bags and rice

measuring cups among 31 major rice markets in Madagascar. On the other hand, in terms of the rice quality, it is little known how it varies among the market and how it is related with rice price. Therefore, this study focuses on the price and quality relation based on our own rice market survey.

2. Methods and Data

The data used in this paper are based on the "Rice Price and Trade Survey" funded by Japan International Cooperation Agency (JICA). The survey covers all the major markets in Madagascar; that is, the main market of 31 district capital cities, including 22 region capital cities and 9 district capital cities in Diana, Sava, Sofia, and Boeny regions, located in the northern parts of the island. Region is the highest administrative unit in Madagascar: there are 22 regions divided into 111 districts and each region and district has a capital city (Figure 1). Data collection was conducted weekly in the 31 markets by enumerators from April 2012 to August 2013. They visited the respective market, randomly selected five retailers and five wholesalers, and interviewed them to obtain information about rice prices and sale quantity on the specific day of their visit including rice varieties and quality. Please note that weekly rice prices in all the 111 districts in Madagascar have been reported since 2007 by Observatoire du Riz (OdR), but our data include information on rice quality and rice purchase (i.e. quantity, price, and place of purchase) so that we can know temporal and spatial variations of rice quality, market margin, and major supply regions. Since the survey data are available only up to December 2012 when this paper is prepared, this paper uses data from April 2012 to December 2012.

3. Rice Prices

First of all, weekly prices recorded at the 31 markets are shown in Figure 2. The prices are average prices of all types of milled rice at which the randomly selected retailers were selling on the day surveyed. As expected, there is clear seasonality in the price movement although the data cover only 8 months from April to December. In general, as the mean price line indicates, rice price is the highest in April, just before the main harvest season, and the lowest in May and June when the main harvest starts. It means that rice production is more or less synchronized in Madagascar. Although rice price is generally low in May and June, we can observe a peak in June. It is the price recorded at Ambovombe market, the capital city of Androy Region. We cannot identify any specific reason of this peak in May 2012, but Androy is located at the southernmost island where rice production is few due to dry weather particularly in the coastal area and rice market is not well integrated with other region due to high transportation cost. Please note that rice is harvested in May and June in this region also, but major staple food of this region is maize and cassava, which are harvested in March and April (SIRSA (2006)).

Other salient points from the figure are as follows. (i) The highest price is 1845 Ar/kg recorded in Sambava market in the week of April 15, and the second highest price is 1770 Ar/kg recorded in Vohemar market in the same week. And the lowest price is 645 Ar/kg recorded in Bealanana market in the week of June 6. All the three districts are located in the northern part of Madagascar; Sambava and Vohemar belong to Sava region on the north-eastern coast, while Bealanana is an inland district located next to them, belonging to Sofia region. In addition, roads condition within Bealanana district and connecting to Sambava and Vohemar is poor. As a result, huge surplus in

Bealanana after the harvest will not make price lower during the lean period in Sambava and Vohemar. Figure 3 compares price movement among the three districts, i.e. Sambava, Vohemar, and Bealanana. It shows that the level and the movement of rice price are quite similar in Sambava and Vohemar. The pattern of rice price movement in Bealanana is also similar to those of Sambava and Vohemar, but rice price is always lower in Bealanana than in the other districts. (ii) If seasonal price variability is assessed by coefficient of variation of the price, the highest are Ambilobe market (0.167) and Vohemar market (0.154), while the lowest are Antsirabe market (0.033), Manakara market (0.038) and Toamasina market (0.039). Ambilobe and Vohemar are neighboring districts located in the northern part of Madagascar; Ambilobe is on the western coast, while Vohemar is on the eastern coast. As shown in Figure 3, price movements are not similar in these two districts. As for the markets with the lowest price variability, price movements of those districts are shown in Figure 4. They are much less variable than those shown in Figure 3 and the mean price shown in Figure 4. Antsirabe is the second largest city in Madagascar and located in the midst of rice producing central highland, and hence it has good access to several different rice surplus areas that may contribute to the low price variability. Unlike Antsirabe, however, Manakara and Toamasina are coastal regions and do not produce enough rice. Since Toamasina has the largest port in Madagascar, import rice probably stabilizes the rice price, and Manakara is located in the south of Toamasina and connected to Toamasina by a coastal road.

4. Rice Varieties

Rice varieties in Madagascar are categorized into four groups in the market: vary gasy, tsipala, makalioka, and importé. Vary gasy literally means Malagasy rice, and

hence includes any locally produced rice other than tsipala and makalioka. Some of them may be improved varieties introduced from outside the country, but their origins are not known. On the other hand, tsipala and makalioka are very specific although they do not seem to be single varieties in the agronomic sense. We assume that both are improved varieties introduced by donors or ministry of agriculture. But their appearances are quite different and they are easily distinguished in the market. Tsipala is relatively short and round, while makalioka is relatively long. Makalioka is considered to be high grade rice, and cleanly processed makalioka is the most expensive rice in Madagascar. They are packed in branded packages and sold in supermarkets in cities. Importé is imported rice, usually from Pakistan. It constitutes low grade rice in Madagascar.

As shown in Table 1, out of 11852 observations of milled rice sold in the market, 8101 observations (i.e. about 68%) are categorized as vary gasy. The number of other categories is relatively small. Please note that tsipala category includes almost only one type of rice called tsipala. This may imply that tsipala was introduced and disseminated relatively recently under the name of tsipala, and hence it is recognized as NOT a Malagasy indigenous rice and its name has not been diversified among farmers.

In terms of the name of vary gasy (that is, how retailers call them in the market), there is so much variation: As shown in Table 1, our survey found 259 different names under the vary gasy category. Some of them are used in a particular market, but others are commonly used in several markets. Obviously vary gasy category is a mix of genetically different rice varieties: for example, some are red rice, while others are white rice. But on the other hand, we imagine that some varieties should have more than one name although we do not have any agronomic evidence yet. Table 2 lists frequently

recorded names under vary gasy. We choose 24 names from 259 names found in the survey (i.e. 9.3%). Total number of observations with the 24 names is 5808 as shown in Table 2. Its share in the total observations is 71.7%. It means that there are so many minor names used in the market. On the other hand, more than one fourth of vary gasy is simply called "gasy", although it may not be a single, uniform variety. The lack of common names for local rice is the evidence of rice market segmentation in Madagascar. Or in other words, the lack of common names makes it difficult to conduct long distant trade.

5. Regression Analysis on Price

Our concern is if characteristics of rice such as quality and name affect milled rice price in retail market even after controlling for the huge temporal and spatial price variation presented in Figure 2. In order to answer this question, we estimate the following multiple regression model.

$$P_{mt} = \alpha + \sum_r \beta_r R_r + \sum_v \gamma_v V_v + \sum_m \delta_m M_m + \sum_t \mu_t D_t + \varepsilon_{mt} \quad (1)$$

where the dependent variable P_{mt} is retail price (Ar/kg) of milled rice recorded in market m, week t. Each time we randomly selected 5 retailers in one market, and recorded the price of all the milled rice that the selected retailers were selling. Therefore, the maximum number of observations in each market (m) and week (t) varies. As for the explanatory variables, R_r includes variables for rice characteristics namely red color dummy, white color dummy (reference is red and white mixture), long grain dummy, short grain dummy (reference is long and short mixture), machine-milled rice dummy

(reference is hand-milled rice), and V_v are dummies for rice category/name: 14 major vary gasy varieties with more than 100 observations shown in Table 2 except for gasy, 3 makaioka varieties, tsipala category (including all the varieties in this category), and importé category (including all the varieties in this category) having the most common variety "gasy" plus other relatively minor vary gasy varieties as the reference. In addition, M_m are dummies for market (m=1 – 30) and D_t are dummies for week (t=1-38). There are 30 market dummies except for Antananarivo-Renivohitra, the market in Madagascar's national capital city. As for the weekly dummy, there are 39 weeks but the last week (2012/12/24) is excluded and used as the reference week. The coefficients to be estimated are β, γ, δ, μ, and α (constant), and ε is error term. Equation (1) is estimated by OLS with robust standard errors clustered by the markets. Since equation (1) has so many variables, regression results will be presented in several tables separately. R^2 is 0.65 indicating that the variables explain the price movement quite well. Please note that R^2 not shown in each table.

Table 3 shows estimated coefficients for the market dummies. As expected from Figure 2, there is huge spatial variation over the country. Price difference is relatively small among major cities in the country, namely Antananarivo-Renivohitra (central highland), Mahajanga I (western coast), Toamasina I (eastern coast) and Fianarantsoa I (central highland) except for Antsirabe I (central highland), Antsiranana (northernmost location), and Toliara I (southernmost location). Although Antsirabe I is the second largest city in Madagascar and located in the central highlands between Antananarivo-Renivohitra and Fianarantsoa I, the mean price in Antsirabe I is relatively higher than that in the other two cities. But its reason has not been identified. Three regions Tsiroanomandity, Maevatanana, and Miarinarivo have relatively small price

difference from the reference, because they are regions close to the national capital Antananarivo-Renivohitra and supply rice to the most populated region. Three more eastern coastal districts (Vohemar, Sambava and Fenoarivo Atsinanana) also have relatively small price difference from the reference. Probably the markets in those districts are well integrated with Toamasina I. On the other hand, rice price is high in districts/regions located in northern or southern part of the island due to poor infrastructure and poor rice production, while rice price is low in rice producing districts/regions particularly in the inland districts in Sofia region. The spatial price difference is about +20% and -20% from that in the country's capital.

Figure 4 is the results of weekly dummies, demonstrating the movement of average retail price of milled rice over the 39 weeks. As expected, average price sharply drops at the end of April when rice harvest starts in the majority of districts, and then average price gradually recovers up to the beginning of October. It is interesting that average prices are not significantly different from October to December although weekly price gradually increases in this period. In order to do more detailed discussion, we need to have at least one-year data. The temporal price difference is about -13.5% from that at the end of December. If we have price data from January to March, average price in March will be much higher than that at the end of December.

Table 4 shows the estimated coefficients for rice categories and names. We find that average price of taya, manga fofotra, and sebota are relatively higher than the common vary gasy. We do not have enough information to describe the characteristics of those varieties, but they are generally found in the market in northern and north-western part of Madagascar (Sofia, Diana, Boeny regions). On the other hand, the price of rice called "bealanana" is significantly much lower than the common vary gasy.

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The rice is probably produced in Bealanana district although no evidence is given. As shown in Table 2, average milled rice price in Bealanana market is significantly much lower than that that in Antananarivo-Renivohitra. In addition, Table 4 shows that price of rice called bealanana (probably produced in Bealanana district) is significantly much lower on average in Madagascar (that is, low price even in other markets). This finding is consistent with the fact that Bealanana is known as the district supplying low quality and low price rice to other districts, particularly in the market in Antananarivo. Also as expected, the price of makalioka rice is significantly higher than the common vary gasy. On the other hand, the price of tsipala and import rice is not significantly different from the common vary gasy.

With respect to rice characteristics, as shown in Table 5, white rice is significantly more expensive than others on average and long grain rice is significantly more expensive than others on average. On the other hand, milling method does not make any price difference on average. However, it is known that consumer preference on rice varies over the country. In order to examine the regional difference in rice preferences, we divide the island into 5 zones as shown in Figure 5 based on market integration (i.e. road connections), production environment (i.e. total amount and seasonal distribution of rainfall), and ethnic groups (highland ethnics and coastal ethnics). Then, average prices of milled rice of vary gasy category only are compared by t-test. Table 6 shows the case of rice color. White rice is significantly more expensive in zones 3 and 5 as is the case of whole country. But in zones 1 and 4, red rice is more expensive being opposite to the whole country case. The results about rice grain shape are shown in Table 7. In all the zones except for zone 2, long rice is significantly more expensive than short rice as is the case of whole country. But in zone 2, short rice is

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significantly more expensive than long rice. As for milling method, hand-milled rice is not so common, but the price is significantly different depending on the zone as shown in Table 8. In zones 3 and 5, machine-milled rice is significantly more expensive as is the case of whole county, while in zones 1 and 4 hand-milled rice is significantly more expensive. In zone 2, there is not price difference between machine-milled rice and hand-milled rice. However, considering that there is not significant price difference due to milling method by the multiple regression analysis as shown in Table 5 and that the zone-level difference shown in Table 8 is the same as that in Table 6, it is possible that rice color and milling method are correlated. That is, hand milling keeps more rice bran and as a result makes rice more reddish. Therefore, the results in Table 8 do not necessarily mean that consumers have any preference about milling method.

6. Conclusions

This paper investigates the relationship between price and product characteristics (i.e. quality) of milled rice in 31 retail markets all over Madagascar. In the Malagasy rice market, milled rice can be categorized into 4 types; vary gasy, makalioka, tsipala, and importé. Vary gasy literally means Malagasy rice, and is the most frequently found in this country. Out of 11852 observations in our survey, 8101 are categorized as vary gasy. Our survey data show that vary gasy is quite heterogeneous: 8101 observations of vary gasy have 259 different names. In terms of color, vary gasy includes both white and red rice, and in terms of grain shape, it includes both long and short grain. Our question is if their heterogeneous characteristics affect rice price.

Because we use weekly price data recorded in 31 markets for 39 weeks, spatial and temporal price variations are controlled for in a multiple regression analysis. The

regression analysis reveals that rice categories/varieties affect the price and that rice color and grain shape influence the price. On average, makalioka rice is more expensive than other categories, white rice is more expensive, and long grain rice is more expensive. But in terms of rice color and grain shape, we also find that consumers' preferences about rice characteristics vary depending on zones.

Since vary gasy category is very heterogeneous and even variety names used in local retail markets are very diversified and quite localized, in most cases varietal names do not correspond to specific characteristics such as "red and long." It means that milled rice cannot be traded without physical quality inspection. That is, traders have to check the rice quality each time by themselves. This may be fine as far as rice trade is done only within a district or in a few neighboring districts. But it seems to be a constraint to long-distant trade.

References

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Figure 1: Regions of Madagascar
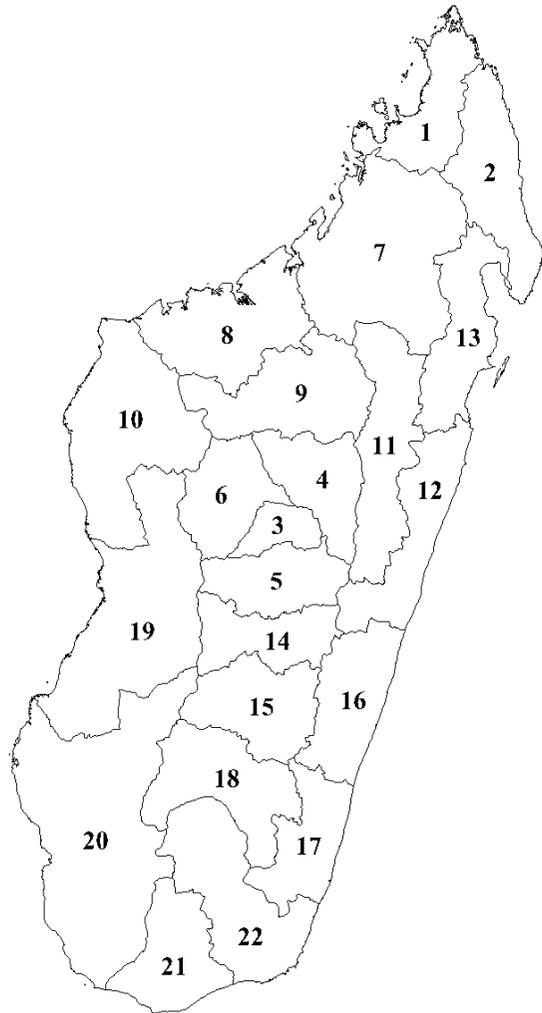
Region Number	Region Name	District Code	District Name
1	DIANA	713	ANTSIRANANA I
1	DIANA	717	AMBILOBE
1	DIANA	719	AMBANJA
2	SAVA	711	SAMBAVA
2	SAVA	716	VOHEMAR
3	ITASY	112	MIARINARIVO
4	ANALAMANGA	101	ANTANANARIVO RENIVOHITRA
5	VAKINANKARATRA	108	ANTSIRABE I
6	BONGOLAVA	111	TSIROANOMANDIDY
7	SOFIA	409	PORT-BERGE
7	SOFIA	410	MANDRITSARA
7	SOFIA	412	BEFANDRIANA AVARATRA
7	SOFIA	413	ANTSOHIHY
7	SOFIA	414	BEALANANA
7	SOFIA	423	MAMPIKONY
8	BOENY	401	MAHAJANGA I
8	BOENY	406	MAROVOAY
9	BETSIBOKA	404	MAEVATANANA
10	MELAKY	421	MAINTIRANO
11	ALAOTRA MANGORO	313	AMBATONDRAZAKA
12	ATSINANANA	301	TOAMASINA I
13	ANALANJIROFO	305	FENOARIVO ATSINANANA
14	AMORON' I MANIA	203	AMBOSITRA
15	HAUTE MAHATSIATRA	201	FIANARANTSOA I
16	VATOVAVY FITOVINANY	210	MANAKARA
17	ATSIMO ATSINANANA	213	FARAFANGANA
18	IHOROMBE	216	IHOSY
19	MENABE	508	MORONDAVA
20	ATSIMO ANDREFANA	501	TOLIARA I
21	ANDROY	516	AMBOVOMBE
22	ANOSY	515	TAOLAGNARO

Note: In addition to the capital cities of 22 regions shown in the map, 9 district capitals from the regions of 1. Diana, 2. Sava, 7. Sofia, and 8. Boeny were selected for the survey.

Figure 2: Weekly Rice Price in 31 Markets in Madagascar from April to December 2012
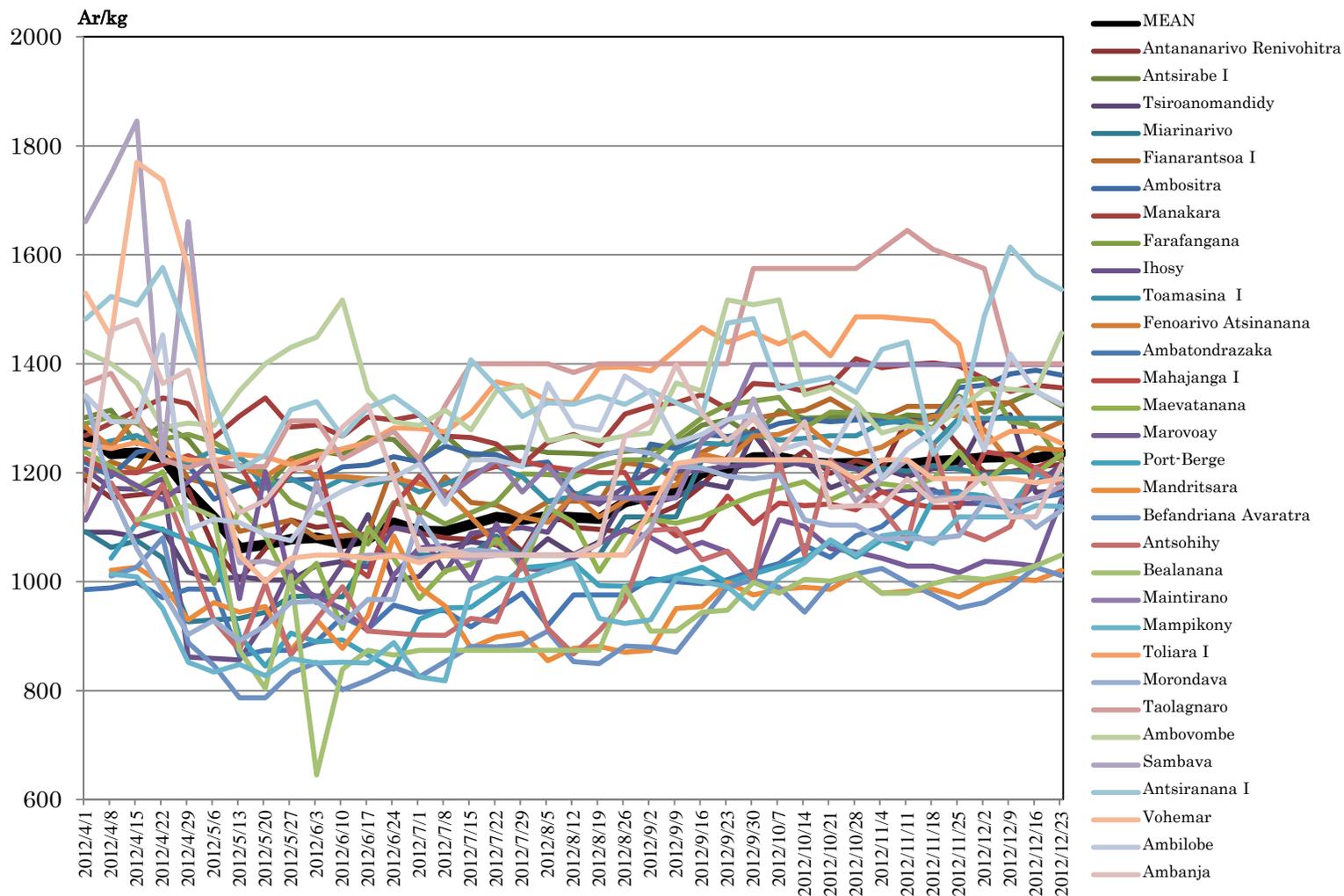
Figure 3 Price Movement in the Northern Districts

Ar/kg
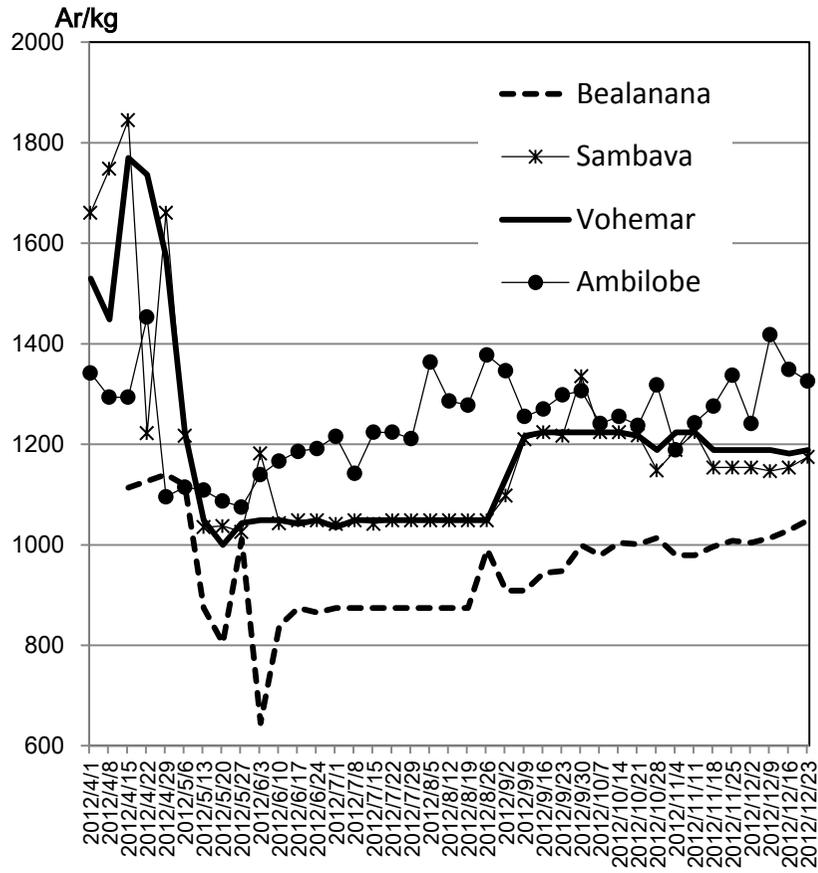
Figure 4 Price Movement in Districts with the Least Variability

Ar/kg
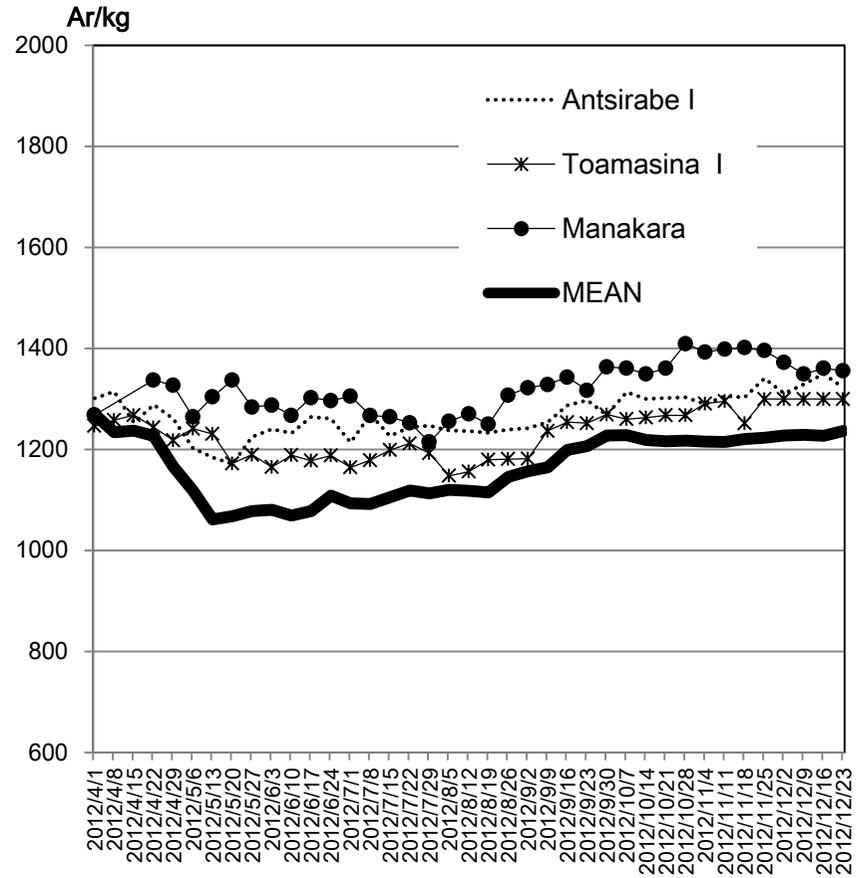
Table 1 Rice Categories Recorded by the Survey

Category	Number of Names Recorded	Number of Observations Recorded	Typical Names under this Category
Vary gasy	259	8101	Vary Gasy, X, Mena, Sebota, Botry
Tsipala	5	1302	99% is Tsipala
Makalioka	6	1556	Makalioka, Dista, Tsemaka
Importé	9	893	Stock, Pakistan, Importé
Total	279	11852	

Table 2 Frequently Recorded Names under Vary Gasy Category

Name	Number of Observation
Gasy	2211
X	395
Mena	381
Sebota	358
Botry	294
Manga Fofotra	284
Bealanana	163
Taya	134
An-Tanety	130
Rojo	121
Fianara	120
Mifangaro	116
Fotsy	114
Sitilo	110
V5	108
Tc	99
Tsy Fantatra	98
Kimoja	89
Dadiva	87
Lava	84
Mamoroforo	83
Ambatoria	79
Semence	78
Chantal	72
Total	5808

Note: As shown in Table 1, total number of observations of vary gasy is 8101.

Table 3 Regression Results: Spatial Price Variation

District	Price Difference (Ar/kg)	Significance Level
Antananarivo-Renivohitra	0	Reference
Taolagnaro	249.1	1%
Antsiranana	240.9	1%
Ambovombe	198.9	1%
Manakara	186.9	1%
Toliara I	174.8	1%
Maintirano	123.3	1%
Antsirabe I	117.7	1%
Ambanja	102.6	1%
Ambositra	101.6	1%
Ambilobe	100.6	1%
Farafangana	90.7	1%
Toamasina I	76.1	1%
Sambava	65.8	1%
Fenoarivo Atsinanana	65.2	1%
Vohemar	59.0	1%
Fianarantsoa I	56.5	1%
Mahajanga I	-9.6	Not significant
Tsiroanomandidy	-15.2	Not significant
Maevatanana	-23.1	5%
Miarinarivo	-41.7	1%
Morondava	-50.4	1%
Ihosy	-88.4	1%
Marovoay	-110.4	1%
Antsohihy	-125.6	1%
Port-Berge	-135.1	1%
Ambatondrazaka	-174.8	1%
Mampikony	-198.5	1%
Mandritsara	-204.6	1%
Bealanana	-235.2	1%
Befandriana Avaratra	-243.7	1%
Constant	1190.6	1%

Figure 4 Regression Results: Temporal Price Variation
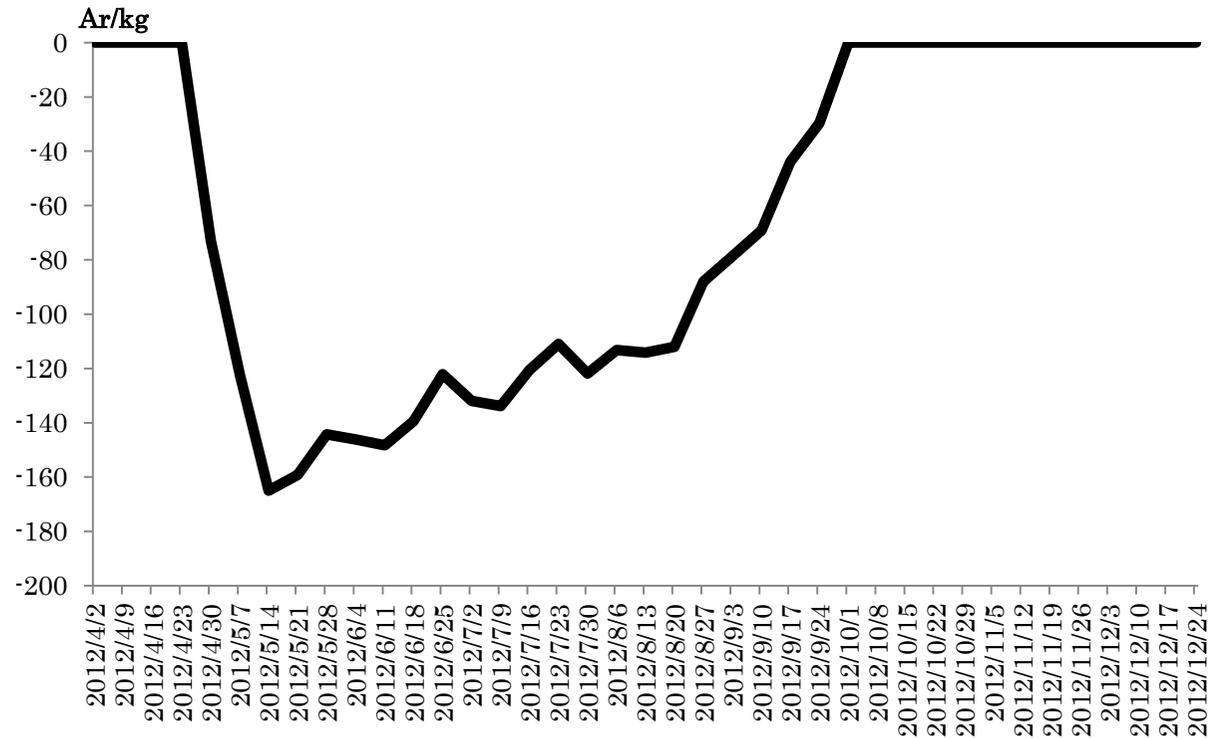
Note: If price difference is not significantly different from zero, it is assumed to be zero.

Week	Price Difference (Ar/kg)	Significance Level
2012/4/2	-16.7	Not significant
2012/4/9	-4.1	Not significant
2012/4/16	14.6	Not significant
2012/4/23	-22.2	Not significant
2012/4/30	-72.6	5%
2012/5/7	-121.9	1%
2012/5/14	-164.4	1%
2012/5/21	-158.8	1%
2012/5/28	-144.0	1%
2012/6/4	-146.2	1%
2012/6/11	-148.2	1%
2012/6/18	-139.3	1%
2012/6/25	-122.0	1%
2012/7/2	-131.9	1%
2012/7/9	-133.8	1%
2012/7/16	-120.4	1%
2012/7/23	-111.0	1%
2012/7/30	-121.8	1%
2012/8/6	-113.1	1%
2012/8/13	-114.1	1%
2012/8/20	-111.9	1%
2012/8/27	-87.8	1%
2012/9/3	-78.4	1%
2012/9/10	-68.9	1%
2012/9/17	-43.9	5%
2012/9/24	-29.7	10%
2012/10/1	-12.0	Not significant
2012/10/8	-12.0	Not significant
2012/10/15	-17.8	Not significant
2012/10/22	-22.6	Not significant
2012/10/29	-17.4	Not significant
2012/11/5	-16.3	Not significant
2012/11/12	-9.8	Not significant
2012/11/19	-13.0	Not significant
2012/11/26	-0.3	Not significant
2012/12/3	-6.3	Not significant
2012/12/10	-6.3	Not significant
2012/12/17	-5.3	Not significant
2012/12/24	0	Reference

Table 4 Regression Results: Impact of Rice Varieties on Price

Rice Category	Rice Name	Price Difference (Ar/kg)	Significant Level
	Taya	68.4	1%
	Manga Fofotra	46.9	1%
	Sebota	28.9	5%
	Fotsy	25.4	Not significant
	Mena	23.4	10%
	Rojo	6.3	Not significant
	Mifangaro	3.6	Not significant
Vary Gasy	X	2.3	Not significant
	Sitilo	-3.7	Not significant
	Botry	-14.0	Not significant
	An-Tanety	-27.4	Not significant
	Fianatan	-53.3	5%
	V5	-59.4	Not significant
	Bealanana	-163.9	1%
	Other Vary Gasy	0	Reference
	Makalioka	38.6	1%
Makalioka	Dista	25.0	5 %
	Tsemaka	12.1	Not significant
Tsipala	All types	2.2	Not significant
Importé	All types	-25.4	Not significant

Table 5 Regression Results: Impact of Rice Characteristics

Rice Characteristics		Price Difference (Ar/kg)	Significance Level
Color	White	26.7	1%
	Red	-10.5	Not significant
	Mixture	0	Reference
Shape	Long	19.8	10%
	Short	-15.2	Not significant
	Mixture	0	Reference
Milling Methods	By hand	1.2	Not significant
	By machine	0	Reference

Figure 5 Zoning of Madagascar based on Rice Market Integration and Ethnic Culture

Zone Number	Zone Name	Region Number	Region Name
1	Central Highland North	3	ITASY
		4	ANALAMANGA
		6	BONGOLAVA
		11	ALAOTRA MANGORO
2	Central Highland South	5	VAKINANKARATRA
		14	AMORON' I MANIA
		15	HAUTE MAHATSIATRA
		16	VATOVAVY FITOVINANY
		17	ATSIMO ATSINANANA
		18	IHOROMBE
3	North West	7	SOFIA
		8	BOENY
		9	BETSIBOKA
4	North East	1	DIANA
		2	SAVA
		12	ATSINANANA
		13	ANALANJIROFO
5	South West	10	MELAKY
		19	MENABE
		20	ATSIMO ANDREFANA
		21	ANDROY
		22	ANOSY

Table 6 Mean Price Comparison between White Rice and Red Rice by Zone (Vary Gasy Only)

Zone Number	Zone Name	Mean Price of White Rice (Number of Observations)	Mean Price of Red Rice (Number of Observations)	Significance Level by T-test
1	Central Highland North	1091 (N=350)	1105 (N=462)	White < Red 10%
2	Central Highland South	1201 (N=878)	1206 (N=525)	No difference
3	North West	1014 (N=2065)	974 (N=256)	White > Red 1%
4	North East	1270 (N=751)	1364 (N=94)	White < Red 1%
5	South West	1275 (N=1599)	1189 (N=341)	White > Red 1%
Whole Country		1156 (N=5643)	1148 (N=1678)	White > Red 10%

Table 7 Mean Price Comparison between Long Rice and Short Rice by Zone (Vary Gasy Only)

Zone Number	Zone Name	Mean Price of Long Rice (Number of Observations)	Mean Price of Short Rice (Number of Observations)	Significance Level by T-test
1	Central Highland North	1117 (N=521)	1088 (N=377)	Long > Short 1%
2	Central Highland South	1186 (N=760)	1201 (N=331)	Long < Short 1%
3	North West	1024 (N=1765)	965 (N=458)	Long > Short 1%
4	North East	1324 (N=362)	1247 (N=403)	Long > Short 1%
5	South West	1277 (N=1509)	1209 (N=329)	Long > Short 1%
Whole Country		1158 (N=4917)	1133 (N=1898)	Long > Short 1%

Table 8 Mean Price Comparison between Machine-Milled Rice and Hand-Milled Rice by Zone (Vary Gasy Only)

Zone Number	Zone Name	Mean Price of Machine-Milled Rice (Number of Observations)	Mean Price of Hand-Milled Rice (Number of Observations)	Significance Level by T-test
1	Central Highland North	1097 (N=1093)	1252 (N=9)	Machine < Hand 1%
2	Central Highland South	1206 (N=1676)	1209 (N=95)	No difference
3	North West	1011 (N=2322)	957 (N=30)	Machine > Hand 5%
4	North East	1277 (N=815)	1370 (N=31)	Machine < Hand 1%
5	South West	1257 (N=2002)	1175 (N=25)	Machine > Hand 10%
Whole Country		1154 (N=7908)	1193 (N=190)	Machine < Hand 1%