HOW SUCCESSFUL ARE GOVERNMENT INTERVENTIONS IN FOOD MARKETS? INSIGHTS FROM THE PHILIPPINE RICE MARKET

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Abstract

We investigate the Philippine government's price stabilization policy for rice. Seemingly Unrelated Regressions are used to examine the effectiveness of the program at regional and national levels over a 21-year period (January 1983 to December 2003). Results of the regional analysis indicate some NFA-induced spatial and temporal differences in terms of producer prices. The NFA successfully increased producer prices in 5 of 13 regions through stock accumulation and paddy rice purchase at floor prices. NFA stock releases do not correlate strongly with retail prices at the national level, although results from the regional model indicate that NFA stock releases reduced retail prices in five regions, leading to perceptible spatial and temporal differences between regions. Although the NFA support price appears to have been moderately successful in increasing producer prices at a national level, on average, the support price led to an increase in consumer prices in ten regions and contributed little to price stabilization. Overall, therefore, our results indicate very limited success on the part of the NFA to achieve its major objectives at either regional or national level. We suggest the NFA should concentrate its resources in the poorest areas of the country, where it might exert greater and more useful influence in smaller and locally thin rice markets.

Keywords: Philippines, rice, price supports, markets, commodity storage, food policy
JEL codes: Q11, Q18

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Introduction

Price stabilization is considered an important objective of agricultural policy, particularly in developing countries (Ferto, 1995). Price stability could contribute to equity and poverty reduction by reducing the vulnerability of the poor to sudden shocks in food prices or availability (Timmer, 2004). Price stability could also influence long-run economic growth, by facilitating investment in human capital (Williamson, 1993; Birdsall, et al., 1995).

Numerous studies of price stabilization have documented the very large costs of intervention (Newbery and Stiglitz, 1979, 1981; Behrman, 1984; Williams and Wright, 1991; David, 1997). In this paper, we focus on the effectiveness of interventions, analyzing monthly producer and consumer rice prices in the Philippines over the 21-year period January 1983 to December 2003. We use Seemingly Unrelated Regression (SUR) models to measure the magnitude of price changes associated with changes in government stocks and price supports implemented by the Philippine National Food Authority (NFA), for both national-average and region-specific prices.[1]

In the Philippines, the NFA has had a longstanding interest in supporting farmgate prices and reducing retail prices of rice, the country's main staple. Here we measure the links between NFA stock interventions and changes in rice prices, differentiating between producer and consumer prices. Analysis at the national level controls for international trade, while analysis at the regional level takes account of domestic transportation and market integration.

Our analysis extends previous empirical work on the Philippine rice market, much of which has questioned the efficacy of NFA actions (e.g., Baulch 1997, Reeder 2000, and Shively, Martinez and Masters, 2002). That previous work uses national-average prices, however, which could mask the effectiveness of interventions at a regional or provincial level, to the extent that local markets are not fully integrated with the national market. Thus, intervention in some regions could be effective, while interventions elsewhere might not be. For this reason, we pursue our objectives by studying both national and regional data.

The Philippine National Food Authority

In the Philippines, rice is the staple food for 85 percent of the population. The price stabilization program implemented by the NFA aims to keep farmgate prices of rice at levels that provide farmers with a reasonable income and retail prices at levels that confer affordability for low-income consumers. To influence both the producer and the consumer prices, the NFA buys paddy rice from farmers during peak harvest periods, stores this rice in state-owned warehouses,

[1]Data explicitly cover 14 of the Philippines 16 regions. The National Capital Region is excluded since it is a highly industrialized with a very minimal rice production area. The provinces which comprise the Autonomous Region of Muslim Mindanao (ARMM) are reallocated over the other regions in Mindanao to facilitate construction of a time series data of rice prices in 13 regions.

processes this rice in state-owned rice mills, and then sells the milled rice to poor consumers during periods in which prices are at their seasonal highs. The NFA's regional and provincial offices manage approximately 296 warehouses with a combined storage capacity of more than one million metric tons of grains. The NFA focuses almost exclusively on rice.

During the past three decades, the Philippines was occasionally self-sufficient in rice (i.e., 1978-1983, 1987, 1991, 1992, 1994), but during import years the quantities can be very significant. In 2001, imported rice constituted about 10% of the total rice consumed in the country.[2] Historically, the NFA has controlled the importation of rice through quantitative restrictions. Prior to 1996, the NFA was the country's sole rice importer. In 1996, with the enactment of the Agricultural Tariffication Act, private enterprises gained the rights to import minimal quantities of rice. It was only in 2003 that the private sector imported substantial quantities,[3] but NFA imports still accounted for 75% of total rice importation (NFA, 2005).

Objectives

This study aims to measure the impacts of NFA activities on rice prices. Three questions are addressed:

(1) Are NFA interventions associated with price stabilization?
(2) Are NFA interventions associated with higher producer prices?
(3) Are NFA interventions associated with lower consumer prices?

We answer these questions from both regional and national perspectives. At a regional level, the analysis aims to determine if the NFA successfully achieved its objectives for each of the 13 rice producing regions. The regional analysis also aims to capture the spatial and temporal diversity of the Philippine rice market. The extent of market diversity can be attributed to the country's geographic conditions as an archipelago consisting of 7,107 islands and islets. This situation contributes to price differentials due to very different cost of shipment to and from different locations. At a national level, the analysis investigates links between NFA interventions, farmgate and retail prices, and international trade.

Model

Our empirical analysis builds on a model of competitive stock holding to predict price changes (Williams and Wright, 1991). We posit a pair of SURs for farmgate and retail rice prices in auto-regressive form:

$$\Delta P_{it} = \alpha_i T_i + \beta_{ikt} NFA_{ikt} + \sum_{ijt} \gamma_{ijt} M_{ijt} + \sum_{iht} \delta_{iht} Y_{iht} + \varepsilon_{it} \qquad (1)$$

where ΔP_{it} represents the change in the average monthly price of rice (farmgate or retail) in region i at time t. We use T to represent a unit-step time trend, NFA_{ikt} to represent the monthly change in the NFA's intervention of interest for region i at time t (where k serves as an index

[2] This is computed base from the figures reported by Phil Rice (2003), where about 7.6 million metric tons of rice was supplied by local farms while about 0.8 million metric tons of the deficit was imported from other countries (mainly from Vietnam, Thailand and USA).

[3] This is to be compared to the 2002 private importation of 100 metric tons.

over three possible interventions: stock changes and changes in purchase and sales prices) and M_j is a binary indicator for month j, which we include to account for seasonal fluctuations in prices, if any. Y_{iht} is a dummy variable for year, used to capture any inter-annual variation, while α, β, and γ are the unknown parameter vectors to be estimated. Equation 1 is used for regional analysis.

We also construct a national model that includes international trade variables:

$$\Delta P_t = \alpha T + \beta_{kt} NFA_{kt} + \sum_{jt} \gamma_{jt} M_{jt} + \sum_{ht} \delta_{ht} Y_{ht} + \lambda_t I_t + \eta_t \Delta R_t + \rho_t (I \times \Delta R)_t + \varepsilon_t \qquad (2)$$

where NFA now represents the national NFA intervention (either aggregate stock level or average price target) at time t, I_t is a binary indicator variable equal to 1 for any year in which rice importation took place, ΔR_t is the change in the international rice price (F.O.B. Bangkok), and $(I \times \Delta R)_t$ is an interaction term between importation and the international rice price at time t. The parameter vectors α, β, γ, δ, λ, η, and ρ are to be estimated.

Data and Data Sources

Data are compiled from several sources. Rice prices come from the Philippine Bureau of Agricultural Statistics and the NFA's Business Development and Promotion section. We deflated nominal prices to 1994 constant prices using national and regional CPIs collected from the Philippine National Statistics Office. NFA stockholding data come from the NFA. International trade data come from the International Rice Research Institute and NFA. World rice prices (F.O.B. Bangkok) were deflated using the currency conversion data from the U.S. Department of Agriculture. The national data set consists of a pair of time series (farmgate and retail) each with 252 observations. The regional data set consists of two balanced panels, each with 13 regional cross-sections and 252 observations (n=3276).

To illustrate the trends in real rice prices, Figure 1 presents a graph of farmgate, retail and international rice prices from 1983 to 2003. From 1983 to 1992, policy appears to have favored consumers over producers as exhibited by the comparatively higher average world price and a more stabile (and falling) average retail price. This pattern is consistent with that reported by Umali (1990) which argues that, from 1974 to 1986, the NFA favored consumers over producers. In contrast, beginning in 1994, policy appears to have shifted toward protecting producers from the decline in world prices as exhibited by the convergence of domestic farmgate prices and world prices. The spike in the retail price in 1995 marks a food price "crisis" induced by policy failure (David 1997).[4] One explanation is that the government did not have the right information when making decisions regarding the timing of rice importation.

Figure 2 shows that the abrupt increase in the retail price coincided with a very low NFA rice stock in that year. After the record high retail price in 1995, the NFA responded by building up its stock to record levels both by buying more rice locally and increasing imports. In 1998, local rice production was very low due to El Niño. This triggered a record high importation of about

[4] In the popular press, this incident is often attributed to an "artificial rice shortage" emanating from rice middlemen. It appears that there was no true rice shortage in 1995 based on evidence regarding domestic milled rice production and expected consumption graph (see Figure 2).

2.1 million tons of rice. In 1999, the NFA had accumulated an all time high stock of about 12 million metric tons of rice. One might posit that higher NFA stock levels from 1996 to 2003 contributed to more stable rice prices. Indeed, retail prices were relatively stable in these years. But it is clear from Figure 1 that consumers were paying very high retail prices for this stability, at the same time they were protecting producers from the slide in the world price.

Domestic retail prices appear to have been less variable than the world price as exhibited in Figures 3 and 4. Figure 3 shows monthly percentage changes in local rice prices from 1983 to 2003. This measure of price variability suggests two stages: one ranging from 1983 to 1996, characterized by relatively higher price variability; and a second (1997 onwards) in which the magnitude of price fluctuations decreased. The latter pattern can be attributed to the higher amount of purchases of local paddy rice and greater volume of rice importation.

Figure 5 presents percentage changes in the volume of monthly rice stocks of the NFA from 1983 to 2003. The graph illustrates sharp increases and decreases in stock volumes, but from 1999 to 2003 there appears to have been a decrease in the variability of NFA stock levels. This can be traced to the higher rice inventory (as shown in Figure 2). The higher inventory levels were made possible by higher NFA budget allocations in those years.

As mentioned earlier, the NFA provides the low-income segment of the market with relatively cheaper milled rice while it buys paddy rice from at a relatively higher farmgate price. This scenario is exhibited in Figure 6, which presents average monthly prices over the 21-year period, along with NFA support prices. Average domestic retail prices are the highest among the five price series, with an average of P13.53 per kg of milled rice. On average, the retail price is 21% higher than the average NFA consumer support price. The average world price is 35% lower than the domestic retail price. The fourth line in Figure 6 (ordered from the top to bottom) represents the NFA producer support price. This producer support price was, on average, 7% higher than the average farmgate price.

Figure 7 shows the average monthly NFA injection and the average monthly procurement. The NFA injects the greatest volume of its rice stock into the market during the months of July, August and September when retail prices typically reach their highest annual level. The NFA sells this rice at a lower price compared to the average retail price. During the 21-year study period, the NFA injected about 9%, on average, of the total rice consumed in any given year. On the other hand, the NFA marks its largest domestic during October, November and December. Farmgate prices are lowest during October. During the study period, the NFA purchased, on average, about 4% of the total rice produced in the country.

It is important to note that the aggregate patterns displayed in Figures 1 to 7, may mask important regional differences. For example, price variability differs in access regions reflecting local conditions and relative degrees of success. Table 1 presents correlations among regional price changes. Most regions of the country display high degrees of positive correlation. Most pair-wise correlations are statistically significant.

Results

Before embarking on analysis, we tested the national and regional data sets for time trends and stationarity. Dependent variables for the regression models are farmgate and retail prices.

Independent variables include NFA producer and consumer support prices. Stationarity tests for the four sets of prices indicate that none of them display a significant quadratic or linear time trend. The dependent variables for analysis are therefore constructed in first differences (i.e., $p_t - p_{t-1}$). This approach can be justified by results from the Augmented Dickey-Fuller (ADF) test for unit root.[5] All series satisfy the stationarity test (see Table 2).

All regression models are estimated using the seemingly unrelated regression (SUR) method. This method estimates the parameters of the system, accounting for heteroskedasticity, and contemporaneous correlation in the errors across equations (Greene, 2003). Estimates of the cross-equation covariance matrix are based upon parameter estimates of the unweighted system.

The National Level Analysis

For the analysis of national level data, three regression models (Models 1, 2 and 3) are used. Results are presented in Table 3. Model 1 is the base model in which a constant, a time trend and monthly indicators capture all exogenous effects. Model 2 adds to Model 1 two NFA intervention variables: the first difference in the rice stock and the first difference in the producer support price. Model 3 adds to Model 2 the first difference in the NFA consumer support price, the first difference in the international rice price, an indicator variable for importation, and an interaction variable between importation and the international rice price. [6]

The three major groups of regressors for Model 3 are NFA intervention variables, international trade variables and the indicator variables for months and years. The indicator variables for months aim to capture seasonal variation in prices, with January serving as the month of reference. The indicator variables for the years 1983 to 2003 capture inter-annual variation in prices, with 1983 serving as the base year.

Results from Model 3 indicate that a 1% increase in the NFA producer support price is associated with a 0.2% increase in the farmgate price, ceteris paribus. One might view this pattern as benefiting the 2.5 million rice producing households that account for approximately 19% of the Philippine population. However, a 1% rise in the NFA producer price was also associated with a 0.09% increase in the retail price, an increase that was shouldered by the approximately 85% of the Philippine population whose staple food is rice (PhilRice, 2003). The negative correlations between NFA stock changes and farmgate and retail prices is consistent

[5]After constructing all the needed data sets and prior to estimating equations (2) and (3), the series were tested for stationarity using AR(1) regressions allowing for cross-section correlation. Stationarity is defined as a quality of a process in which the mean, standard deviation, and autocorrelation structure do not change with time (Challis and Kitney 1991).

[6] Model 2 includes only the independent variables that are not significantly correlated with each other. However, there may be omitted variable problems in this specification. This gives rise to Model 3 which includes all the available data on NFA intervention, importation and international rice prices as regressors. Since it was detected that significant correlations exist between the producer support prices and the consumer support prices, a series of regressions were used to test for multicollinearity problems. The results of these tests show that the signs and magnitudes of the point estimates are fairly robust to choice of specification. Thus, there appears to be no serious multicollinearity for Model 3.

with the fact that NFA does the bulk of its rice purchasing during the peak harvest months of September and October when the farmgate prices are low (see the monthly estimates in Table 3). The negative coefficient on the NFA stock change indicates that the NFA injects rice mainly during the months of July, August and September, when retail prices are highest (and the supply of rice is at its lowest).

The discussion is illustrated by way of Figure 8. Figure 8 shows the monthly patterns of prices with and without NFA intervention (derived from Models 1 and 2, respectively). The graph displays the coefficient estimates for the monthly dummy variables for each price. The solid lines represent the monthly price changes without NFA interventions while the dotted lines represent the monthly price changes with NFA intervention variables (NFA stock, producer support prices and consumer support prices).

Similar to previous findings, we see that, at the national level, the NFA interventions did achieve the intended effect on the monthly price changes. However, the magnitude of the effect of the NFA interventions is very small. Results show that farmgate prices with NFA intervention are slightly higher than those without NFA intervention. The biggest gap between the with and without NFA intervention occurs in the month of October when the farmgate price, on average, is pulled up by about 1.4 percentage points. With regard to the changes in retail prices, the biggest gap between prices with and without NFA intervention occurs in the month of October, although the magnitude of the increase is smaller at only 0.6 percentage point.

Model 3, which includes the NFA consumer support prices, reveals no significant correlation between the price ceiling and the farmgate and consumer prices. One interpretation of this is that while the government tries to sell cheaper rice into the market to target the very poor, at the national level this price ceiling does decrease the average national retail price due to the small volume of NFA rice relative to the total market. From 1983 to 2003, on average, NFA rice accounted for only about 8.9% of the total rice consumed in the Philippine market. This percentage share of NFA rice in the market fluctuates from year to year. Within the 21-year period, the lowest share occurred in 1994 (1.5%) and the highest occurred in 1998 (20.8%).

With respect to international trade, the indicator variable for rice importation in Model 3 shows that, at the national level, rice importation is correlated with neither the farmgate nor the retail price. The change in world price as well as the interaction between importation and world price also display no significant correlation with national prices. These results indicate that international trade has no significant direct influence on local prices. Again, this can be attributed to the limited volume of imported rice relative to the total volume of rice consumed in the country. Over the 21-year period, on average, imported rice accounted for only 6.2% of national consumption. During the 21-year period, there was no rice importation at all in 10 of the years. The proportion of imported rice to total consumption was highest in 1998 when imports accounted for about 27.2% (see Figure 2).[7]

Turning to the question of variability, Figure 9 illustrates the degree to which the domestic retail price fluctuates less than the international price. From 1983 to 2003, the domestic retail price had only one major spike (an increase of 20% in 1995), while the international price had roughly

[7] As mentioned earlier, there was an occurrence of the El Niño phenomenon in 1998 which significantly reduced the local rice production in that year.

four major spikes in prices (all of them more than 18%); two occurred in 1984 and one each occurred in 1994 and 1998. Figure 10 is a boxplot of these two price series and shows that the international price had greater variance and more outliers than did the retail price. The greater variance in the international price is indicated by a higher average coefficient of variation (13% compared to 3% for the domestic retail price). Results of a paired t-test show that these annual CVs are significantly different at a 1% test level. Despite the lower variability of the domestic retail price, international prices were 46% lower, on average, than domestic prices.[8]

Although some of the independent variables in Model 3 are undoubtedly correlated, estimates from Model 3 are similar to those of Model 2. In Model 3, inter-annual variation is captured by the inclusion of year indicator variables. In the regression for Model 3, all indicator variables for 1984 to 2003 were included. However, only the point estimates for the years 1991 and 1995 are significant and included in Table 3. In 1991, farmgate prices were significantly lower by 2.8 percent as compared to the reference year (1983) while retail prices did not show a significant change in fluctuation. In 1995, due to the occurrence of a rice shortage, farmgate and retail prices were significantly higher by 2.2 and 1.6 percent, respectively. There were no significant annual differences in retail and farmgate prices in other years.

To examine the relationship between the variables in the regression, correlation coefficients are presented in Table 4. Changes in farmgate prices are positively correlated with changes in the NFA stock. This indicates that increases in the NFA stock may have contributed to higher farmgate prices. The positive correlation between NFA changes stock and the indicator variable on importation arises because increases in NFA stocks result from rice importation. The negative correlation between the international price change and the NFA stock change indicates that the NFA is less likely to import when international prices are high.

The Regional Level Analysis

The regional analysis covers the 13 rice producing regions in the country. The NFA maintains storage facilities in key rice producing areas which are responsible for the implementation of the NFA's market intervention activities. The regional level analysis includes only the NFA's intervention measures and not international trade since initial regression results did not show significant correlation between the international trade variables and the regional rice prices. In addition, we defected what we believed to be spurious correlation between the international rice price and the domestic retail price in some regions.

Results for each regional cross sectional data set show that NFA activities are correlated with price changes, although the associations were in nearly all instances. Of the 13 regions, Region 4 exhibits the features of the "typical" region. For this reason, coefficients for the monthly dummy variables from this regression are presented in Figure 11 to illustrate seasonal changes in prices for all the 13 regions. The graphs with solid lines represent the price patterns controlling for NFA intervention while the graphs in broken lines take into account the price changes with

[8] To better compare the variability of the two price series, future work should analyze the national level data set using a *seasonal Generalized AutoRegressive Conditional Heteroskedasticity (GARCH)* model (Ghysels and Osborn, 2001) and (Hamilton, 1994). The seasonal GARCH model would help determine whether the seasonal variability in international prices is significantly greater than that of the local retail prices.

NFA interventions. The effect of NFA intervention on price stabilization at the regional level is also similar to that observed at the national level (as presented in Figure 8).

The model specified in Equation 3 was run for each regional data set. A condensed summary of the regional results is presented in Table 5. A detailed summary is presented in Table 6. Only in Region 4 are farmgate prices negatively correlated with the change in the NFA stock. This indicates that the NFA regional office in Region 4 buys most of the NFA's locally purchased rice during the times when farmgate prices are low. On average, over the study period, the NFA purchased about 26% of its total rice procurement from Region 4, ranging from a low of 10% in 1983 to a high of 59% in 1998.

In terms of retail prices in five regions (Regions 1, 4, 5, 9 and 12), the retail price change is negatively correlated with the change in the NFA stock. This indicates that a decrease in the NFA stock results in a release of lower-priced milled rice into the market in the specific region. Five regions therefore had significantly lower retail prices resulting from the NFA release, particularly during the months of July, August and September (when the supply of rice is relatively lower and the retail price is relatively higher). On average, the NFA has the highest accumulation of stock during the months of June and July and then rapidly releases these stock into the market during the months of August, September and October (see Figure 12). The NFA starts to accumulate its rice stock in November by purchasing rice during the peak of the harvest season. The NFA usually has two major procurement periods in a given year: the first occurs during the months of November and December, the peak harvest period for the main (wet) cropping; the second occurs happens during the months of April and May, when harvested rice for the second (dry) cropping is usually sold.

With regard to the NFA producer support price, rice producers in five regions (Regions 4, 6, 10, 12 and 13) benefited from NFA actions as exhibited by the positive correlation between the farmgate price and the producer support price. However, the producers' price variable is also positively correlated with the retail price in 10 regions. One interpretation of this pattern is that while rice producers in 5 regions may be getting a higher income from rice farming, rice consumers in 10 regions are buying significantly more expensive rice. For the regions in which the NFA support price is correlated with both farmgate and retail prices, the percentage increase in the farmgate price is usually twice as much as the percentage increase in the retail price. This is consistent with the results in the national level analysis.

While the NFA injects cheaper rice into the market to cater to the poorer segment of the market, the results show that the volume of cheaper rice injected is not sufficient to significantly bring down the overall average retail prices in any of the thirteen regions. However, the NFA consumer support price is positively correlated with the farmgate prices in Regions 3 and 9. This may indicate that the consumer support price contributes to higher producer prices in these regions.

Farmgate and retail prices rise and fall from month to month. Using January as the base month, the SUR results at the regional level in Table 5 show that farmgate prices are at their lowest level during the months of September and October in 11 of 13 regions, during the peak harvest season. This is consistent with the pattern displayed in the national level analysis where September and October have a seven percent lower farmgate price compared with January. Retail prices reach their peak in 12 of 13 regions during the month of August when the supply of rice in the market

falls to its lowest level. This is exhibited by the positive correlation between the domestic retail price and the dummy variable for August in the regional regressions. These results are also consistent with national analysis.

Although one might hypothesize that consumer support prices play an important role in poorer regions of the country, we find no significant correlation between the consumer support price and the regional retail price in any of the 13 regions (Table 5).

The annual indicator variables are used to capture inter-annual variation in prices from 1983 to 2003, where 1983 serves as the reference year. Results show that, in most years and in most regions, prices at the regional level have no significant inter-annual variation. In 1991, 1993, 1995 and 1996, one to four regions had price variations that are significantly different from zero. The indicator variable for 1991 reveals that there are two regions with significantly lower farmgate prices in 1991 relative to their respective 1983 prices. For retail prices, only Region 7 had a significantly lower retail price in 1991. The highest spike of the graph in Figure 3, which indicates an abrupt increase in the national retail rice prices in 1995, was found in only four regions (Regions 1, 4, 5 12). In 1996, Regions 2 and 3 experienced a significantly lower farmgate price compared to the 1983 price.

Conclusions, Policy Implications and Directions for Future Work

In studying the price stabilization objective of the NFA, results suggest that NFA interventions could have had, to a limited extent, the desired correlations with rice prices. But the association with price stabilization at the national level appears to be very small, and at the regional level it appears only in some regions. It appears that the size and diversity of the rice market, relative to the modest scale of NFA activity, limits the program's influence on prices.

In terms of the NFA's goal of increasing the income of rice farmers, NFA interventions are, to their limited extent, associated with increased farmgate prices though stock accumulation and producer support prices. Thus, interventions may have contributed to significantly higher average farmgate prices, although the magnitude of the effect is small as the NFA buys only about 3.4% of the total rice produced in the country. Disaggregating by region, the correlation holds in five regions, which account for about 35% of the rice harvested area in the country.

At the retail level, NFA sales of rice show no significant correlation with consumer prices at the national level, but they are associated with significantly lower average retail prices in five regions. Changes in the consumer support price level were not significantly correlated with the average retail price at either the national or regional level.

Although the NFA could have achieved its objective in increasing farmgate prices at the national level and decreasing retail prices in five regions, its interventions did not clearly help to stabilize prices, and on balance are associated with a higher retail rice price in most regions of the country.

It is important to point out that this study is limited in important ways. First, some regions in the country have very diversified markets. This is particularly true of Region 4 which is the country's largest region. It might be preferable, therefore, to conduct this analysis using provincially disaggregated data, perhaps focusing on the poorest provinces where the rural

communities have a stronger need for price stabilization.[9] Second, it also seems advisable to conduct statistical and economic analyses comparing price variability between domestic and international prices. One might, for example, use a seasonal GARCH approach to test for differences in price variability. Third, the use of panel data opens several avenues for inquiry to study the impacts of government interventions. So, for example, the regional level data used here could be used to address regional heterogeneity in more depth, perhaps using Feasible Generalized Least Squares (FGLS) or spatial econometric methods.

[9] For example, Region 4 can be subdivided into two major groups of provinces: Calabarzon and Mimaropa. The Calabarzon group is composed of relatively more industrialized, and smaller provinces near Metro Manila. Mimaropa consists of relatively larger and rural island provinces.

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Table 1. Correlation matrix of the first difference in rice retail prices (natural logs).

Region	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00												
2	0.61	1.00											
3	0.62	0.56	1.00										
4	0.30	0.35	0.66	1.00									
4	0.54	0.54	0.52	0.24	1.00								
6	0.44	0.42	0.36	0.27	0.50	1.00							
7	0.42	0.35	0.39	0.17	0.38	0.39	1.00						
8	0.39	0.35	0.39	0.25	0.38	0.35	0.38	1.00					
9	0.41	0.37	0.36	0.17	0.38	0.32	0.33	0.30	1.00				
10	0.04	0.09	0.05	-0.05	0.10	0.09	0.07	0.13	0.12	1.00			
11	0.45	0.42	0.40	0.20	0.45	0.45	0.38	0.37	0.40	0.12	1.00		
12	0.37	0.35	0.32	0.22	0.36	0.48	0.32	0.31	0.37	0.17	0.42	1.00	
13	0.61	0.52	0.56	0.30	0.54	0.38	0.35	0.34	0.38	-0.06	0.37	0.45	1.00

Note: Correlation coefficients (ρ) in bold are statistically different from zero at a 95% confidence level (2-tails). The ρ's in italics are significant at a 90% level.

Table 2. ADF unit root tests results for the four prices of the nationally aggregated data.[10]

Price Data	$t_{\hat{\theta}}$	1% critical value
Farmgate	-10.191	-3.990
Retail	-10.446	-3.990
NFA producer support	-11.498	-3.990
NFA consumer support	-12.179	-3.990

[10] Regional tests of stationarity are not reported here but can be obtained upon request.

Table 3. SUR estimates of farmgate and retail price changes for the Philippine aggregate data.

Item	Model 1		Model 2		Model 3	
	Farmgate	Retail	Farmgate	Retail	Farmgate	Retail
Constant	0.0236***	-0.0030	0.0273***	-0.0014	0.0251***	-0.0027
	(0.0079)	(0.0052)	(0.0076)	(0.0051)	(0.0116)	(0.0078)
Time	-2.02E-05	-1.88E-05	-1.4E-05	-1.6E-05	1.69E-06	-3.55E-05
	(2.75E-05)	(1.81E-05)	(2.64E-05)	(1.79E-05)	(5.28E-05)	(3.53E-05)
February	0.0047	0.0058	-0.0022	0.0031	0.0043	0.0024
	(0.0098)	(0.0065)	(0.0096)	(0.0065)	(0.0098)	(0.0066)
March	-0.0165*	0.0052	-0.0236**	0.0022	-0.0163*	0.0026
	(0.0098)	(0.0065)	(0.0096)	(0.0065)	(0.0099)	(0.0066)
April	-0.0114	0.0057	-0.0144	0.0044	-0.0073	0.0049
	(0.0098)	(0.0065)	(0.0095)	(0.0064)	(0.0099)	(0.0066)
May	-0.0076	0.0116*	-0.0102	0.0104	-0.0040	0.0096
	(0.0098)	(0.0065)	(0.0095)	(0.0064)	(0.0098)	(0.0066)
June	-0.0031	0.0086	-0.0071	0.0069	-0.0016	0.0047
	(0.0098)	(0.0065)	(0.0095)	(0.0064)	(0.0100)	(0.0067)
July	-0.0119	0.0195***	-0.0143	0.0182***	-0.0085	0.0169**
	(0.0098)	(0.0065)	(0.0095)	(0.0064)	(0.0101)	(0.0067)
August	-0.0267***	0.0298***	-0.0320***	0.0272***	-0.0247***	0.0276***
	(0.0098)	(0.0065)	(0.0096)	(0.0065)	(0.0101)	(0.0067)
September	-0.0819***	0.0090	-0.0825***	0.0081	-0.0744***	0.0098
	(0.0098)	(0.0065)	(0.0097)	(0.0065)	(0.0101)	(0.0068)
October	-0.0708***	-0.0178***	-0.0845***	-0.0239***	-0.0761***	-0.0240***
	(0.0098)	(0.0065)	(0.0101)	(0.0068)	(0.0102)	(0.0069)
November	-0.0309***	-0.0165***	-0.0335***	-0.0175***	-0.0277***	-0.0182***
	(0.0098)	(0.0065)	(0.0095)	(0.0064)	(0.0100)	(0.0067)
December	-0.0017	-0.0009	-0.0035	-0.0016	0.0020	-0.0030
	(0.0098)	(0.0065)	(0.0095)	(0.0064)	(0.0100)	(0.0067)
NFA Stock (Δ)			-0.0291***	-0.0144*	-0.0208*	-0.0108
			(0.0111)	(0.0075)	(0.0119)	(0.0080)
NFA Prod. Price (Δ)			0.1950***	0.0729***	0.1957***	0.0931***
			(0.0481)	(0.0325)	(0.0463)	(0.0310)
NFA Cons. Price					0.0806	-0.0191

(Δ)						
					(0.0657)	(0.0440)
World price (Δ)					-0.0290	-0.0400
					(0.0630)	(0.0422)
Imports (0/1)					-0.0075	0.0057
					(0.0126)	(0.0084)
Imports and World price (Δ)					0.0471	0.0785
					(0.0769)	(0.0515)
Indicator for 1991					-0.0285**	-0.0100
					(0.0133)	(0.0089)
Indicator for 1995					0.0219**	0.0155**
					(0.0104)	(0.0070)
Number of Obs	251	251	251	251	251	251
R^2	0.4173	0.2764	0.4628	0.2984	0.5052	0.3654
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: (1) *** significant at 99% confidence level; ** significant at the 95% level; * significant at the 90% confidence level
(2) Standard errors are enclosed in parentheses. (3) Dependent variables are first difference of retail and wholesale prices.

Table 4. Correlation matrix of the major regression variables.

Independent Variable	Farmgate	Retail	NFA stock	NFA producer support prices	NFA consumer support prices	Importation (IM)	International prices (IP)	IM and IP interaction
Farmgate	1.0000							
Retail	0.3667	1.0000						
NFA stock	0.1141	-0.0868	1.0000					
NFA producer prices	-0.0610	-0.0822	0.0872	1.0000				
NFA consumer prices	-0.0507	-0.0709	0.0958	0.9670	1.0000			
Importation (IM)	0.0041	0.0282	0.1770	0.3236	0.3982	1.0000		
International prices (IP)	0.0013	0.0449	-0.1284	-0.0456	-0.0155	0.0145	1.0000	
IM and IP interaction	0.0462	0.0805	-0.1190	-0.0002	-0.0278	-0.0133	0.8213	1.0000

Note: Correlation coefficients (ρ) in bold are statistically different from zero at a 90% confidence level (2-tails).

Table 5. Condensed summary of the SUR regional analysis results.

Variable	Farmgate		Retail	
	No. of regions	Percentage	No. of regions	Percentage
NFA Stock (–)	1	8	5	38
NFA Prod. Price (+)	5	38	10	77
NFA Cons. Price (+)	2	15	0	0
February (+)	2	15	2	15
March	1 (+), 1 (–)	15	2 (+)	15
April	2 (+), 2 (–)	31	2 (+), 1 (–)	23
May	1 (+), 1 (–)	15	4 (+)	31
June	2 (+), 1 (–)	23	3 (+)	23
July (+)	1	8	8	62
August	2 (+), 4 (–)	46	12 (+)	92
September	11 (–)	85	3 (+), 1 (–)	31
October (–)	11	85	6	46
November	1 (+), 5 (–)	46	6 (–)	46
December	3 (+), 1 (–)	31	2 (–)	15
Indicator for 1991 (–)	2	15	1	8
Indicator for 1993 (+)	0	0	1	8
Indicator for 1995 (+)	1	8	4	31
Indicator for 1996 (–)	2	15	0	0

Note: (1) “No. of regions” refers to the number of regions significantly correlated at the 90% confidence level. (2) This table only includes the indicator variables for the years when the inter-annual variation in prices are significantly different from zero at the 90% confidence level. (3) The above summary is detailed in Table 6 where ‘R1’ represents Region 1.

Table 6. Detailed summary of the SUR results by region.

Variable	Farmgate													Retail											
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13
Time trend																										
NFA stock				--										--			--	--				--			--	
NFA producer price				+		+				+		+	+	+	+	+	+	+	+			+		+	+	+
NFA consumer price			+		+																					
February			+						+								+			+						
March					--			+						+			+									
April						+				+		--	--	+			+				--					
May								+					--				+		+	+				+		
June			+					+					--				+	+		+						
July									+						+		+			+	+	+	+	+	+	
August		--				--		+	+			--	--	+	+	+	+	+	+	+	+	+		+	+	+
September	--	--	--	--	--	--	--		--	--		--	--			+	+		--	+						
October	--	--	--	--	--	--	--			--	--	--	--	--	--				--			--		--	--	
November	--	--		--		+						--	--	--	--	--	--							--		--
December					+				+	+			--	--			--									
Indicator for 1990																										
Indicator for 1991			--	--																--						
Indicator for 1992																										
Indicator for 1993																+										
Indicator for 1994																										
Indicator for				+										+			+	+							+	

1995		
Indicator for 1996	-- --	

Note: '--' indicates a coefficient with a negative sign significant at the 90% confidence level.
'+' indicates a coefficient with a positive sign significant at the 90% confidence level.
In the original regression, the indicator variables are complete from 1984 to 2003 with 1983 serving as the year of reference.
Only the years from 1990 to 1996 are presented here due to the constraint in space.

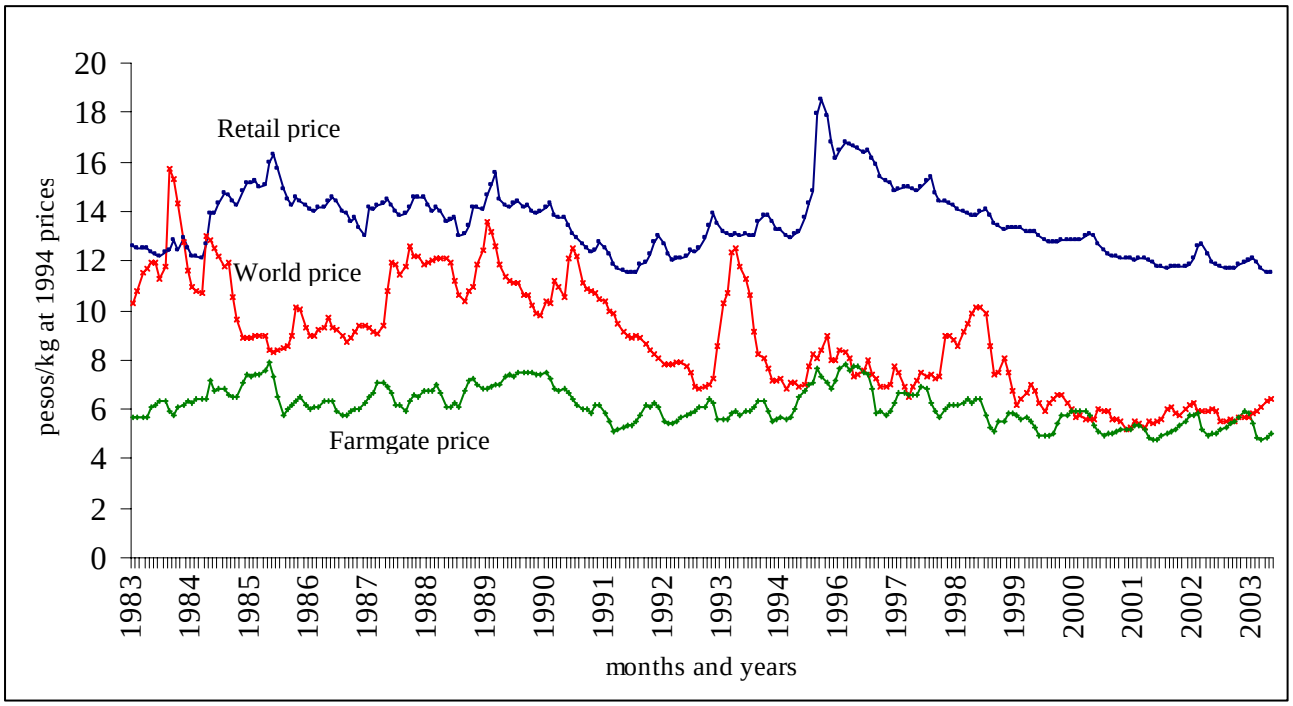

Figure 1. Retail, farmgate and the world prices (January 1983 to December 2003).

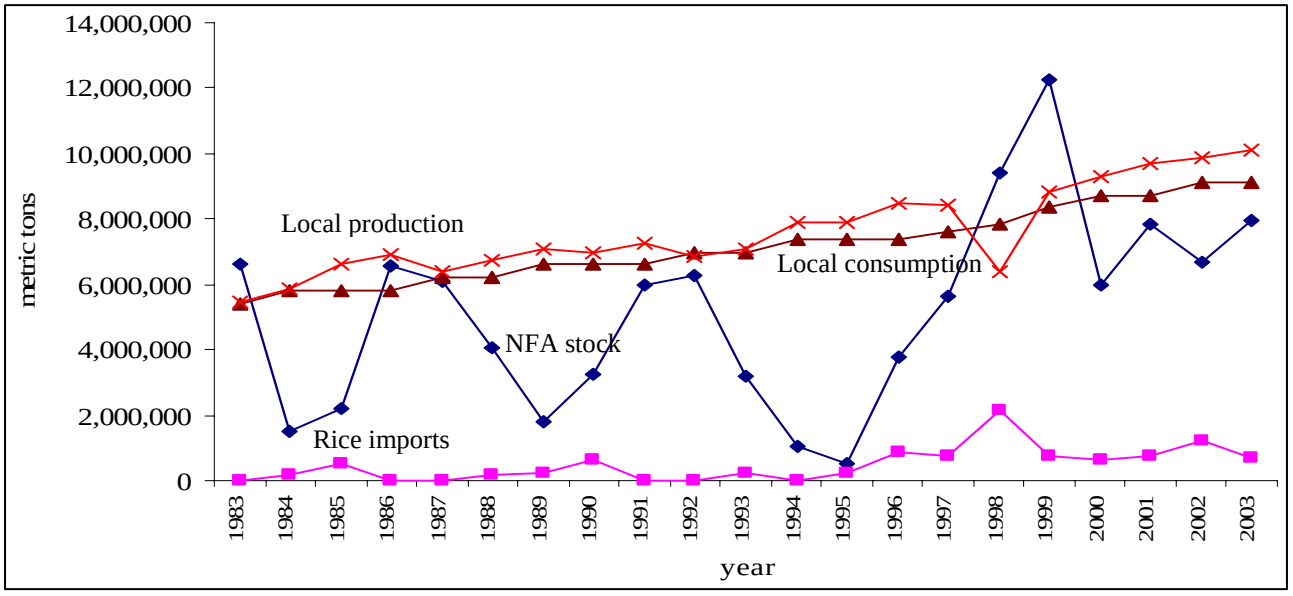

Figure 2. Local rice production, consumption, stocks, and imports (1983-2003).

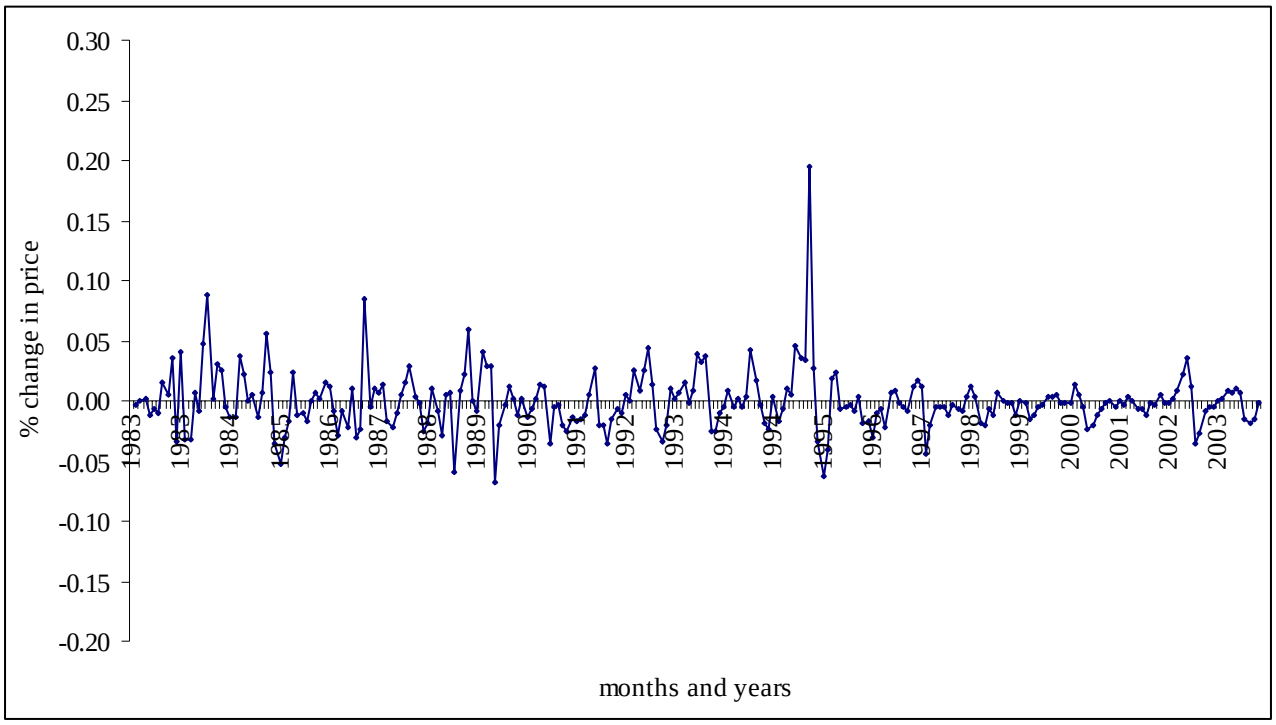

Figure 3. First difference in monthly retail prices (January 1983 to December 2003).

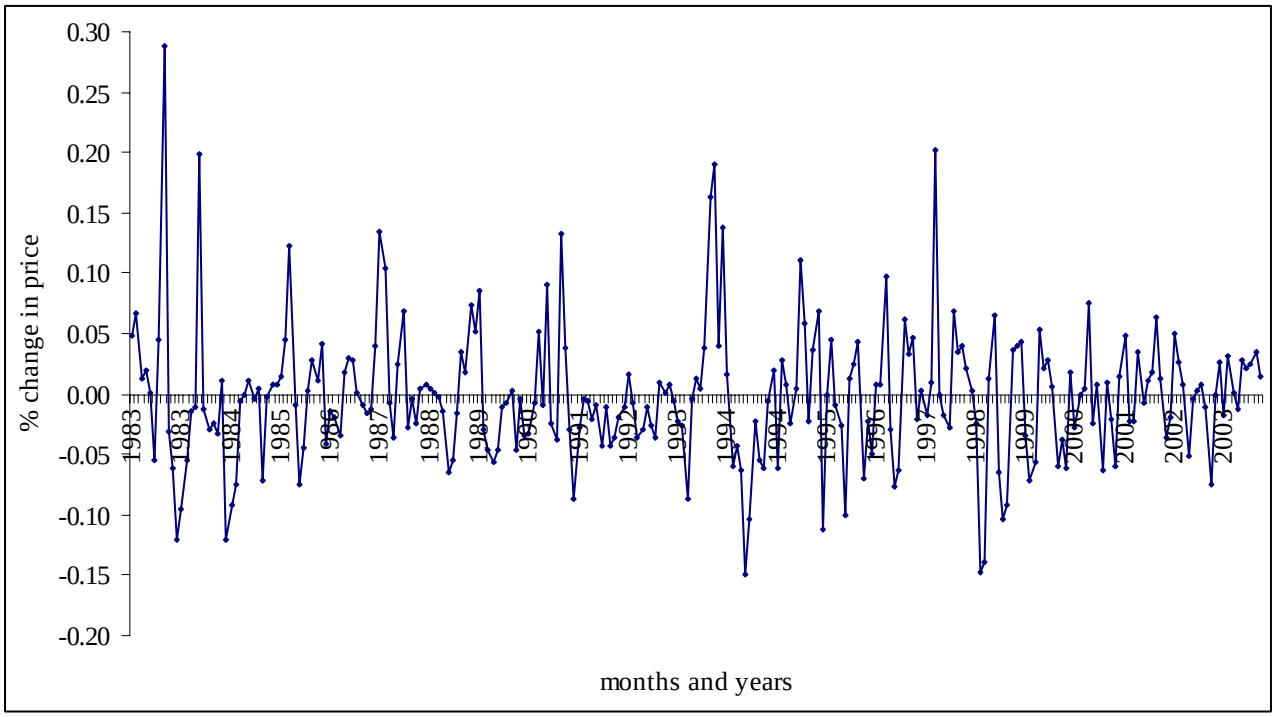

Figure 4. First difference in monthly price, FOB Bangkok (January 1983 to December 2003).

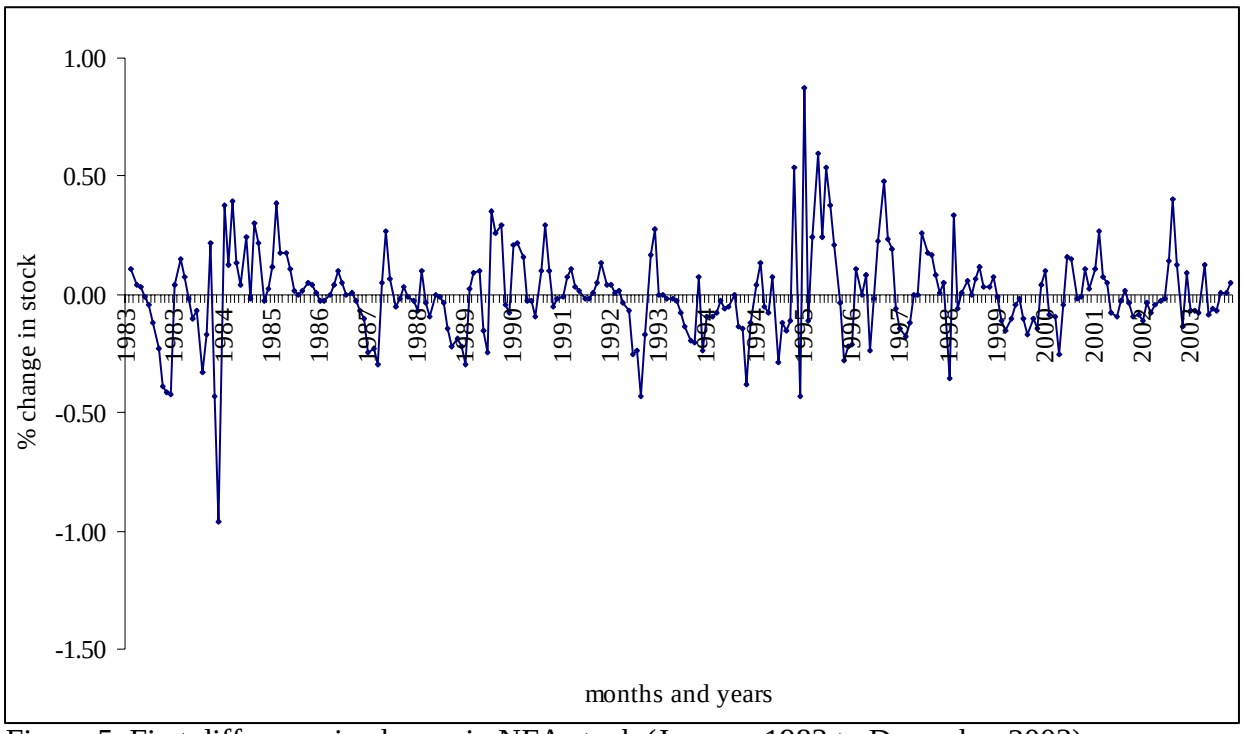

Figure 5. First difference in change in NFA stock (January 1983 to December 2003).

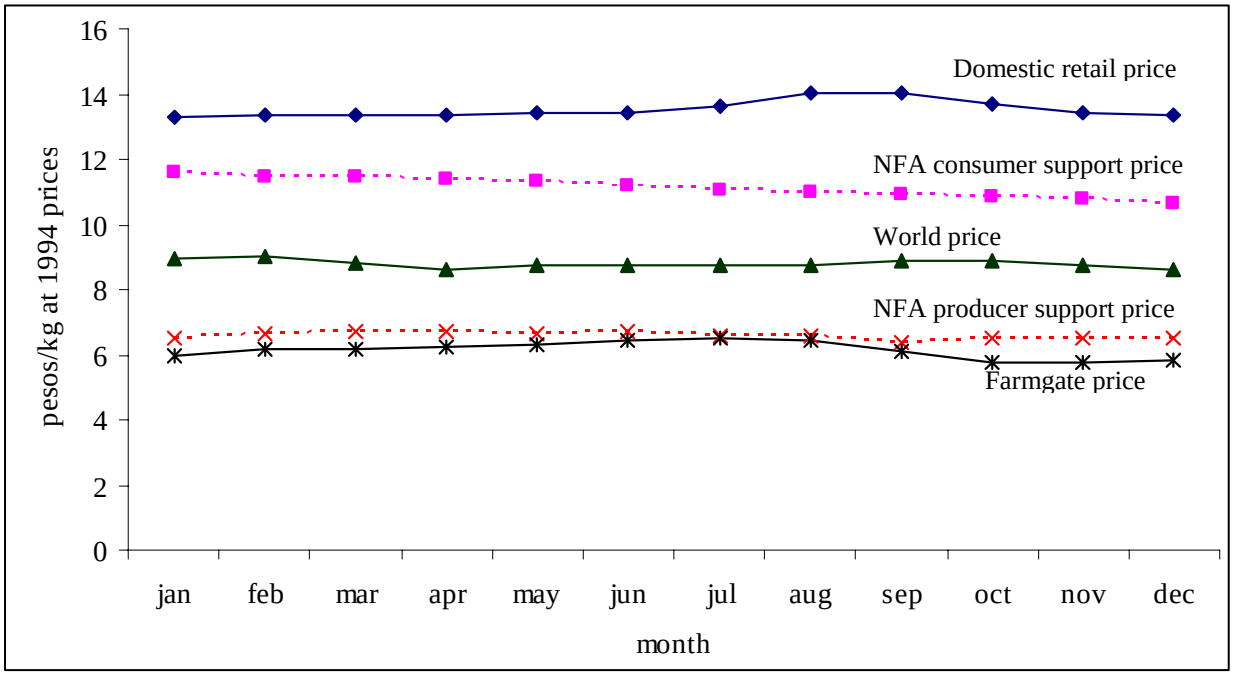

Figure 6. Average monthly rice prices (January 1983 to December 2003).

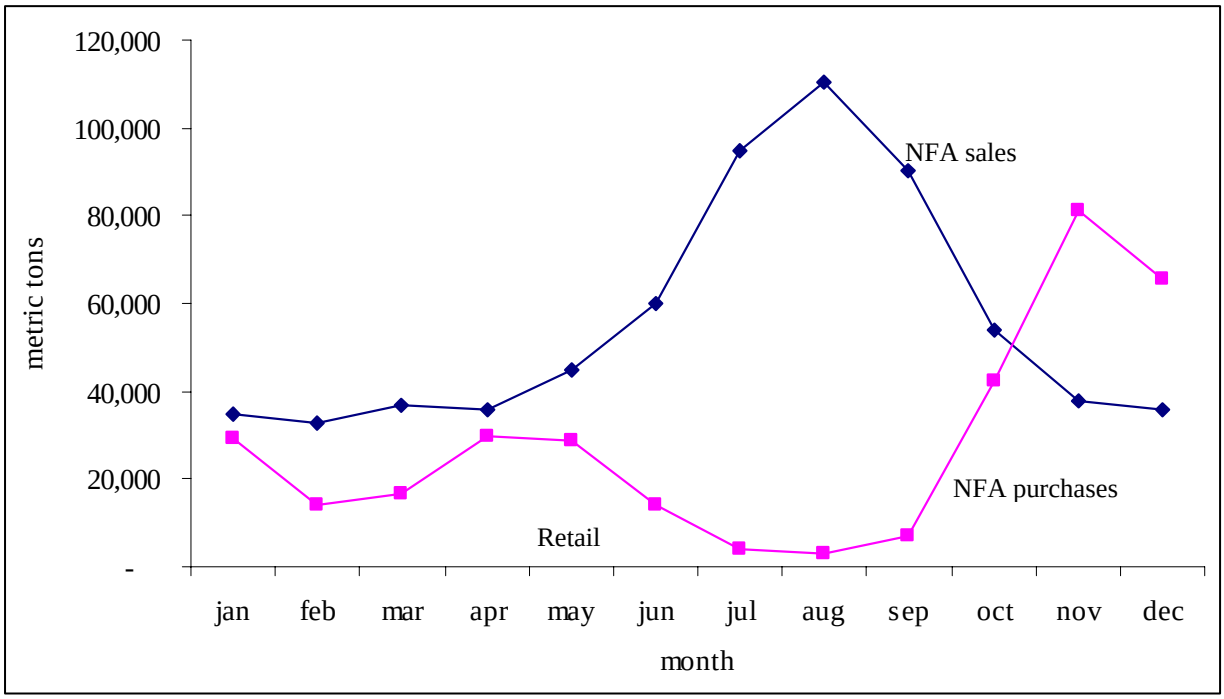

Figure 7. Average NFA rice sales and purchases (January 1983 to December 2003).

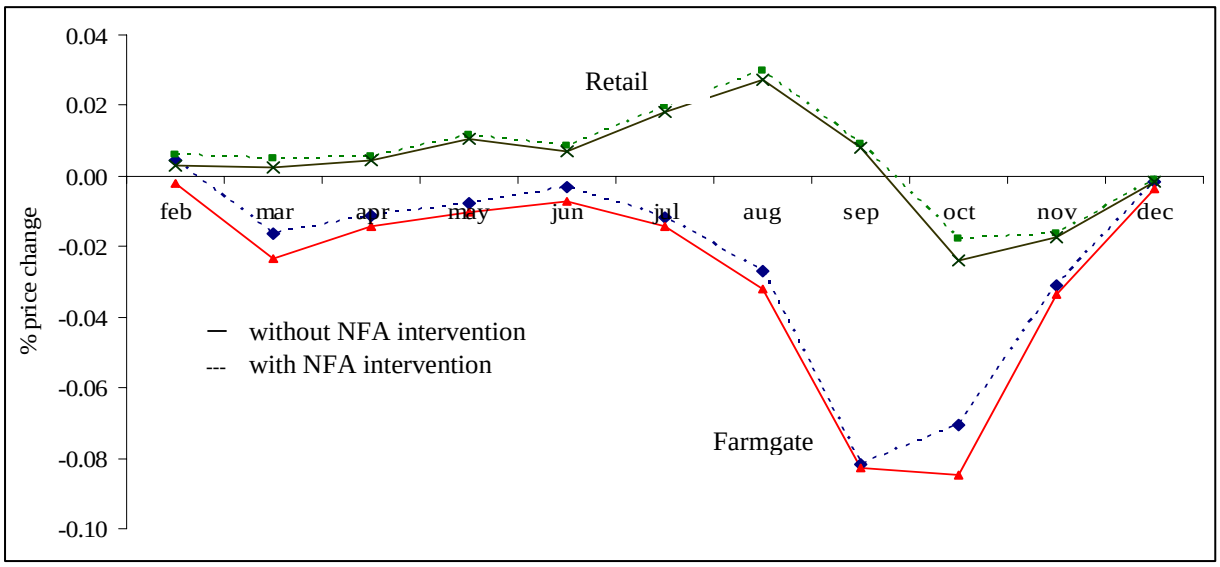

Figure 8. Monthly pattern of national price changes (January 1983 to December 2003).

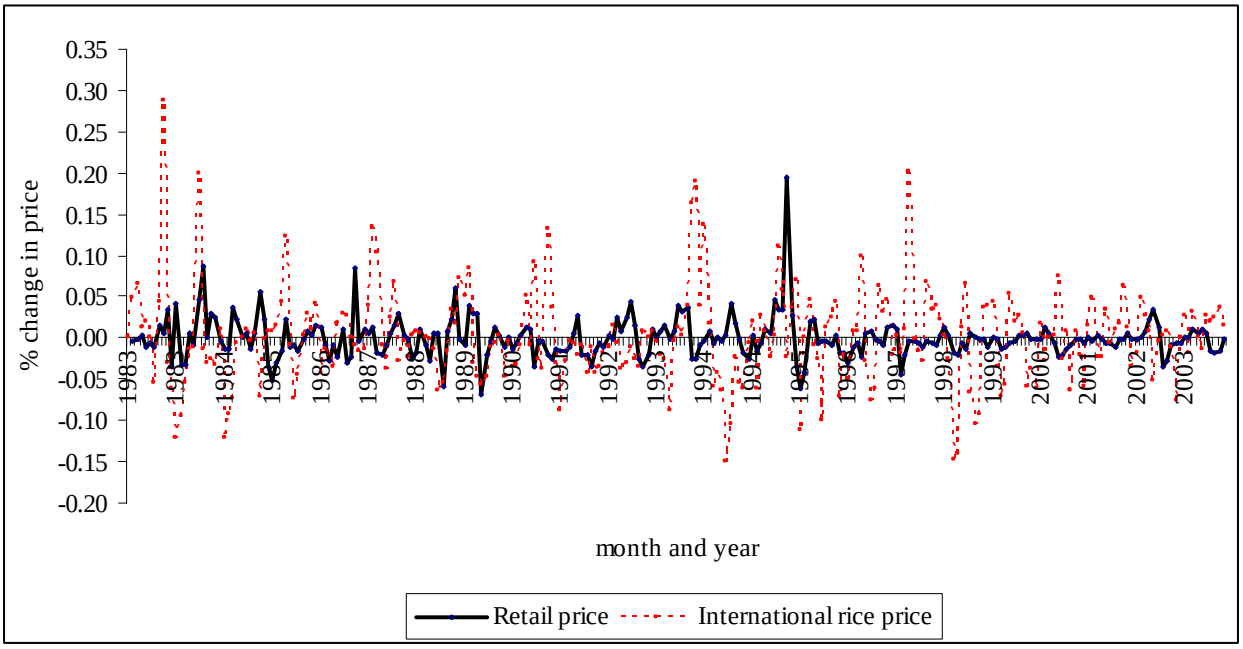

Figure 9. Variability of domestic retail and world prices (January 1983 to December 2003).

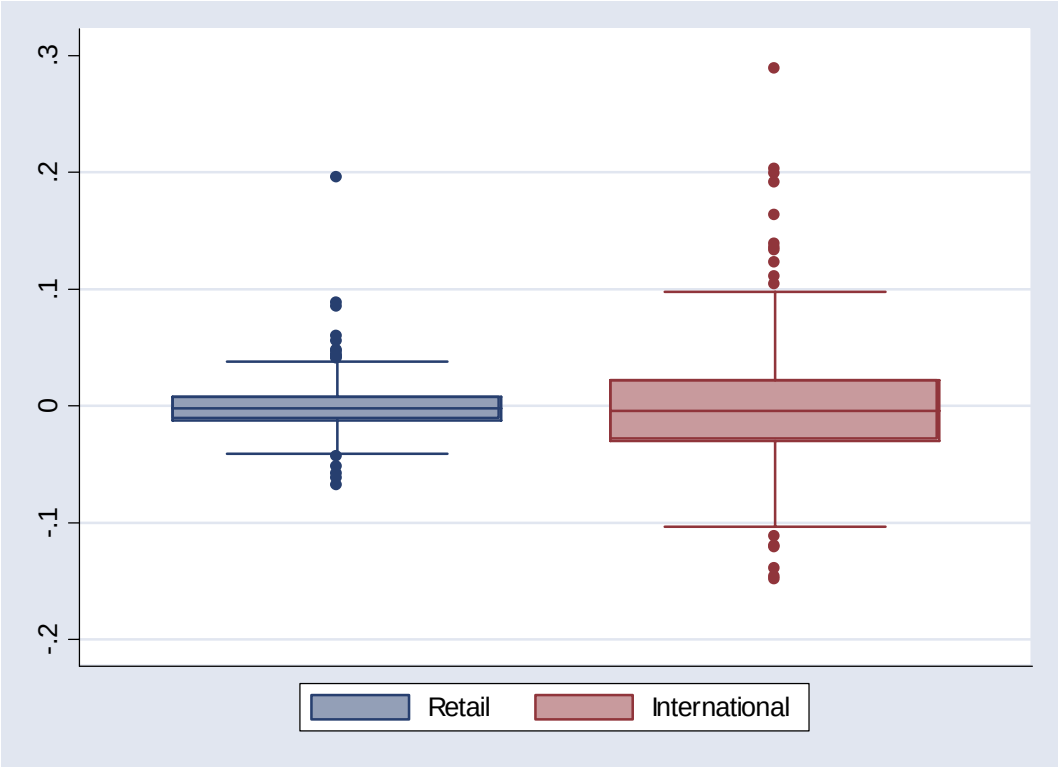

Figure 10. Boxplot of the local retail and international rice prices.

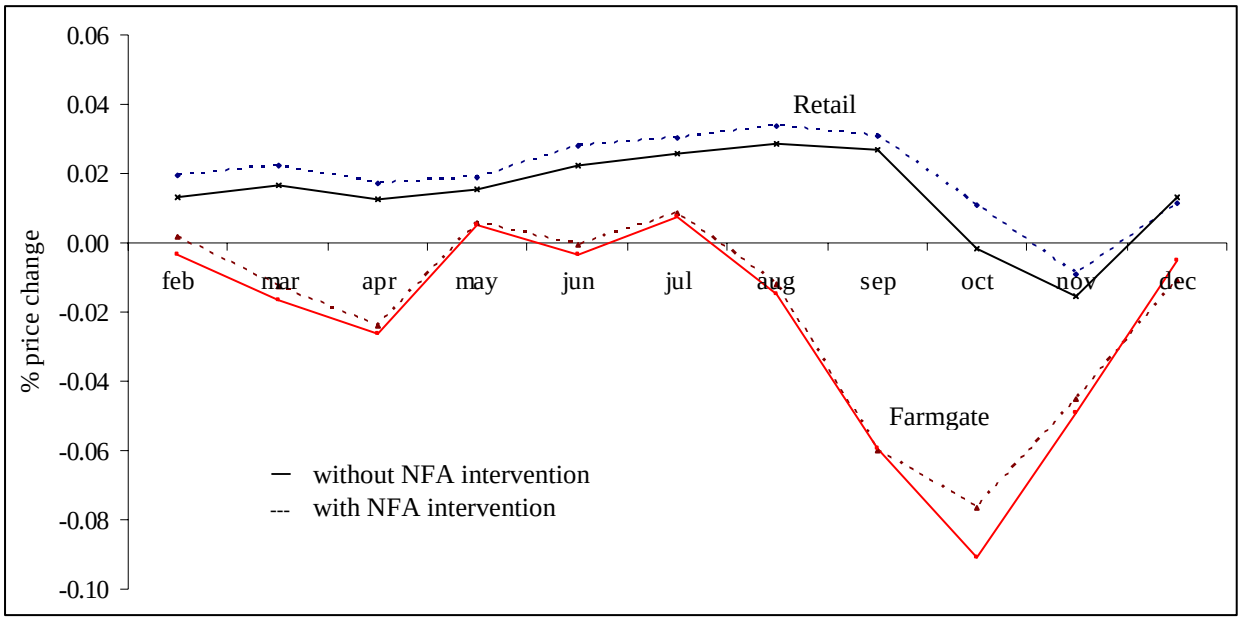

Figure 11. Monthly pattern of price changes for Region 4 (January 1983 to December 2003)

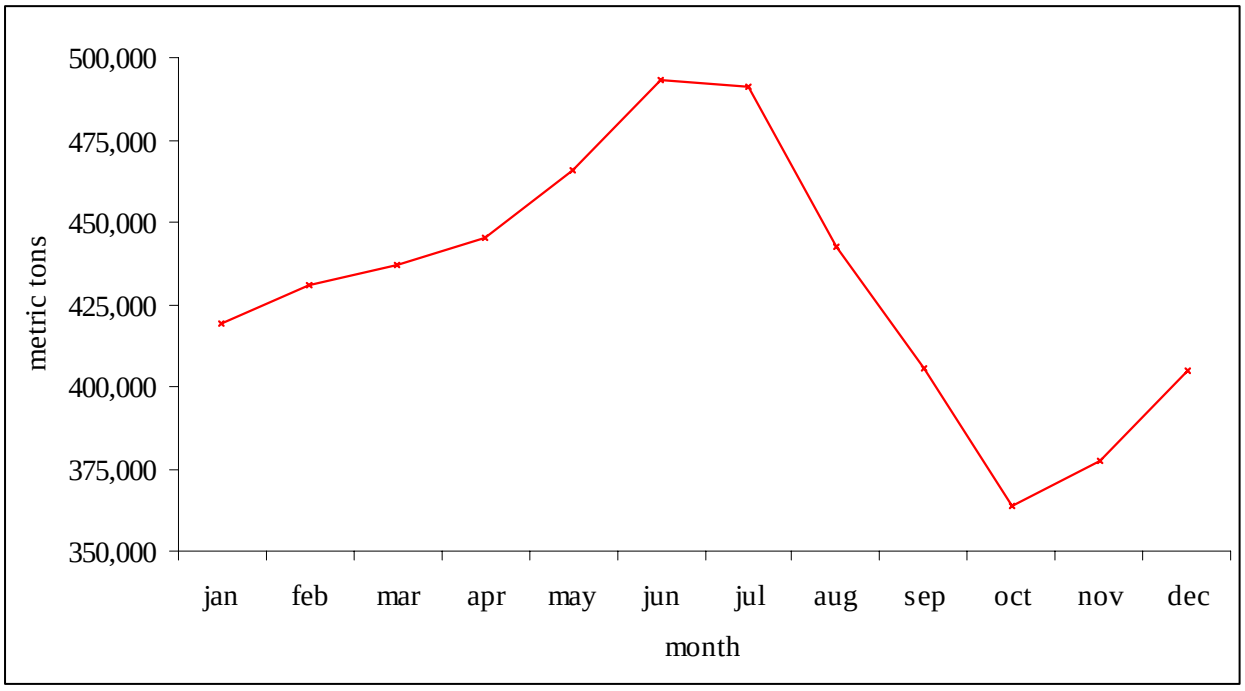

Figure 12. Average monthly NFA rice stock (January 1983 to December 2003).