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An evaluation of paddy production policies in Sri Lanka: 1998 to 2018

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ABSTRACT

Sri Lanka introduced several policies related to paddy production since independence to make the country self-sufficient in rice at a cost to the economy. Hence, the main objective of the research study is to evaluate the impact of government policies on paddy production in Sri Lanka from 1988 to 2018. The specific objectives are to identify policies implemented from year 1998 to 2018, to assess the effectiveness and impacts of agricultural policies on paddy production. The study collected secondary data from all paddy-growing areas in Sri Lanka. The effectiveness of policies was estimated using indices such as via producer support estimates (PSE) and market price support estimates (MPS). Irrigation, paddy farming, and diversification, land, fertilizer subsidy, climate change adaptation, policy on research and development, paddy marketing, and trade policies are the broad categories of policies introduced. PSE and MPS are negative, which indicates that the government policy instruments prevailing in Sri Lanka induce a lower farm gate and domestic market price, thereby discouraging commodity production. Further, according to the regression analysis, improved access to information has a positive effect on yield and climate variables; especially rainfall has a significant effect on paddy yield, which highlighted the need for more climate resilience policies, markets that are better developed and improved access to information.

Keywords: *Paddy, Policies, PSE, MPS*

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INTRODUCTION

Successive post-independence governments have taken several measures to enhance paddy production in the country, as rice being the staple food of Sri Lanka. They include guaranteed price schemes, fertilizer subsidies, and policies related to irrigation and trade. The intention was to make the country self-sufficient in several food crops including rice and to stabilize prices in the open market.

Further, Sri Lanka maintains a high level of self-sufficiency in rice at a cost to the economy (Thiruchelvum, 2005) where the government spends between 1.4 and 2.4 LKR per acre to increase farm income by only one rupee per acre (World Bank, 2013). Policies such as fertilizer subsidy policy of Sri Lanka have created a great financial burden to the government budget which accounts for 4.4% of agriculture GDP and 2% of the total government expenditure as average in the year 2014. During the period 2005-2014, the total government expenditure on the fertilizer subsidy increased to LKR. 238.3 billion (Central Bank of Sri Lanka, 2014).

However, statistics on paddy reveal that the development of irrigation and agricultural infrastructure and the implementing of price and trade policies had a positive impact on increasing the total extent, yield and crop production (Henegedara, 2002).On the other hand, input costs also increased over time, gradually eroding net returns. While a comprehensive economic analysis has not been done on agricultural policies, research efforts on effect and impact of agricultural policies since 1998 have also been limited. Research in this area is clearly important; the United Nations General Assembly in 2015 noted that agricultural policies have better potential to help address food security challenges with respect to the Sustainable Development Goals (SDGs).

Therefore, country-specific studies are needed to assess the outcomes of particular government interventions since every policy reform which can have both positive and adverse impacts depending on the economy and the characteristics of the population segment (Ranathunga, 2016).

METHODOLOGY

Descriptive analysis with formulated indexes and trend analysis were done in order to identify how policy and sector performance has changed over time and to obtain the impact of these.

The period covered in this research is from 1998 to 2018. The analysis was done on an aggregate country level. An overview of the variables from external sources and the sources of secondary data obtained are provided below. All variables stipulated below are time series ranging from 1998-2018.

Data and Data Sources

Yield: Yield is used as a measure of productivity or land use efficiency. For the regression analysis, yield is measured in Kilograms per hectare (Kg/ha) as per data available at the Department of Census and Statistics, Sri Lanka.

NRA: The Nominal Rate of Assistance(NRA) was used as a measure of agricultural price distortion. NRA measures the gap between current domestic prices and free-market prices (border prices). It is defined as the percentage change in gross return to farmers compared to the gross return to farmers without government intervention (Anderson and Nelgen, 2013). The domestic market price data for the period of 1998 to 2018 was gathered from the Department of Census and Statistics, Sri Lanka, and the Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka. The border price of imported rice was collected from the FAOSTAT Database.

Capital: Gross fixed capital stock in agriculture was collected from the FAO database. The gross fixed capital stock is the value of assets held by a farmer. Assets are valued at nominal prices and are the sum of physical assets (land development, livestock, machinery and equipment, and structures for livestock). The variable is divided by the rural population to obtain a per capita measure given the assumption that the rural population is equal to the total farmer households since the majority of farmers live in rural settings. The study makes this assumption due to data limitations on farm households. The rural population was calculated by multiplying the midyear population by the percentage of the rural population in the most recent survey done by the Department of Census and Statistics (2012). The mid-year population data was gathered from Central Bank Reports of Central Bank, Sri Lanka (Rural Population = Mid-year population* percentage of rural population)

Land: The land area was calculated as arable land plus permanent crops per capita from the FAO database.

Rainfall: Yearly rainfall data (in millimeters) was used and was gathered from the Central Bank Report.

Temperature: Average temperature during the period 1998 to 2018 was used, the data was obtained from the Central Bank Report.

Roads: Data on overall infrastructure quality is not available, but the length of the road network is used instead as a proxy using data in the Central Bank Report. The length of the total road network is used as a measure for infrastructure with the assumption that if the road network is more advanced, farmers will have more access to markets which may have yield increasing effects.

Telephone: Data on information access is not available, but the number of telephone lines is used as a proxy instead, again using Central Bank data. This variable serves as a measure of access to information, which, as explained in the theoretical framework, is expected to affect yield.

Policy variability: A policy variability is captured by taking the five-year rolling relative standard deviation of NRA. This implies that the policy variability for one year is calculated by taking the relative standard deviation (or the coefficient of variation) of the previous five years.

Income: GDP per capita in the years 1998 to 2018 was taken from Central Bank Reports.

Economic growth: Annual GDP growth in percentages was also obtained from Central Bank Reports.

Population: Population is used as a proxy for food self-sufficiency, because the larger the population, the more food a country needs to produce. Countries with larger populations are less likely to be food self-sufficient. The relevant data were obtained from Central Bank reports.

Structural change: The share of the rural population of the total population was used as the proxy for structural changes.

Food self-sufficiency ratio: cereal self-sufficiency data was taken from the FAOSTAT database.

Analysis

Estimating Policy Transfers: Price Transfers

The key theoretical assumption underlying the estimation of support is that agricultural markets are competitive. In this context, a persistent price differential between the domestic and external markets is the result of government interventions. As such, this price differential becomes a key parameter for estimating transfers arising from the government's price policies. This policy-induced price difference is denoted as the Market Price Differential (MPD) (The PSE Manual, 2016).

Where:

MPD = DP-BP

MPD - Market Price Differential

DP - Domestic Market Price

BP - Border Price

In calculating the Market Price Differential, it was assumed that the absolute price gap measured at a higher level of the processing chain is the same as which occurs at the farm gate. MPD is positive when the policy induces a higher domestic market price, thereby supporting commodity production. It is negative when the policy induces a lower domestic market price, thereby discouraging commodity production. The MPD is interpreted as a static measure of the additional price received by producers resulting from agricultural policies in a given year. It is the extra cost paid by consumers and in some cases also by all taxpayers, resulting from policies that provide market price support to agricultural production.

Market Price Support (MPS)

The Market Price Support (MPS) for a commodity is estimated by adding together transfers to producers from consumers and taxpayers, alternatively found by multiplying the quantity of production by the MPD(The PSE Manual, 2016).

MPS **=** MPD * QP

Where,

MPS - Market Price Support

MPD - Market Price Differential

QP - Quantity of Production

Price Transfers from Consumers/Consumer Support Estimate (CSE)

Price Transfers from Consumers (PTC) for a commodity are estimated by adding together transfers from consumers to producers and transfers from consumers to other recipients. Alternatively, this can be found by multiplying the quantity of consumption by the MPD.

PTC = -MPD* QC

Where,

PTC - Price Transfers from Consumers

MPD - Market Price Differential

QC -Quantity of consumption

Price Transfers from Consumers (PTC) are defined as 'the annual monetary value of gross transfers from (to) consumers of agricultural products, measured at the farm gate level, arising from policy measures that support agriculture by creating a gap between domestic market prices and border prices of specific agricultural commodities.' In this case, PTC is given a negative sign because these transfers represent an implicit tax on consumers (The PSE Manual, 2016).

General Service Support Estimates

General Services Support Estimate (GSSE): The annual monetary value of gross transfers arising from policy measures that create enabling conditions for the primary agricultural sector through the development of private or public services, institutions, and infrastructure regardless of their objectives and impact on farm production and income, or consumption of farm products. It includes policies where primary agriculture is the main beneficiary, but does not include any payments to individual producers.

GSSE transfers do not directly alter producer receipts or costs, or consumption expenditures (The PSE Manual, 2016)**.** The GSSE measures the value of transfers provided through policies that support producers collectively rather than as individual producers (The PSE Manual, 2016).

Model Specification

The relationships between the different variables are modeled in a linear panel model. Policy variability, roads, and telephone are expected to have an interaction effect with NRA. It is expected that the effect of NRA on yield depends on the extent to which pricing policy varies, markets are developed, and rural areas have access to (price) information. Together with NRA, these variables are lagged by one year, as the investment decisions of farmers will be based on the previous year. Yield and per capita land are logged because of non-normality. Roads and telephones are already logged. Interaction effects are difficult to interpret, especially when there are multiple interaction effects in one equation. Hence, to get interpretable results, the models are estimated with one interaction effect at a time(Malan,2015).

The equation estimated is as follows.

$$Log\ paddy\ production\ i,_t = \beta 0 + \beta 1 NRAi,_{t-1} + \beta 2 Capi_t + \beta 3\ \log\ land1,_t + \beta 4 Raini,_t + \beta 5 Temi,_t + \beta 6 policyi,_{t-1} + \beta 7 Roadsi,_{t-1} + \beta 8 Tel\ i,_{t-1} + \varepsilon$$

Where

Paddy Production i,t : All island paddy production in t^{th} year

NRAi,t^{-1} : Lag value of Nominal Rate of Assistance (NRA)

Capi,t : Capital to rural population ratio in t^{th} year

Landi,t : Total arable land availability in t^{th} year

Raini,t : Average rainfall in t^{th} year

Policyi,t−1 : Rolling five year standard deviation of NRA

Roadsi,t^{-1} : Length of roads in Km in t^{th} year

Teli,t^{-1} : telephone penetration in t^{th} year

The second model is designed to identify the variable which may have effect

on NRA. The model is as follows:

$NRAi^{,t} = \beta o + \beta 1 \log GDP\ percapi,t-1 + \beta 2 \log structurali,t-1 + \beta 3 \log Popui,t-1 + \beta 4 Foodself i,t-1 + \varepsilon$

Where,

NRA,$^{t-1}$: Nominal Rate of Assistant

GDP percap,$^{t-1}$: GDP per capita

Structural,$^{t-1}$: Structural Changes

Population $^{,t-1}$: Midyear population

Food self$^{,t-1}$: Food self-sufficiency ratio

RESULTS AND DISCUSSION

Composition of Government Spending by PSE, MPS, CSE, and GSSE: 1998 to 2018

Policy instruments have been varied along the years reflecting changes in domestic political and economic settings and, progressively, developments in the international economic arena. Table 1 provides the statistics on the indicators developed in this study.

Table 1: Indicators for Composition of Government Spending

Statistics	PSE[1]	MPS[2]	CSE[3]	GSSE[4]	TSE[5]
Mean (LKR Mn)	-87436.4	-88478.6	2109.437	16702.2	-157103
Variance	4.91E+09	4.86E+09	24805.36	2.59E+08	1.8E+10
Minimum (LKR Mn)	-210478	-210478	1807.19	2279.25	-414692
Maximum (LKR Mn)	-13006.4	-13006.4	2269.33	46291.41	-21654

Note: PSE[1] - Producer Support Estimates, MPS[2]- Market Price Support, CSE[3]- Consumer Support Estimates, GSSE[4]- General Service Support Estimate, TSE[5]-Total Support Estimates

Source: Authors' own calculations

According to the analysis, Producer Support Estimates (PSE) and Market Price Support (MPS) having a negative sign which indicates that the government policy instruments prevailing in Sri Lanka during the period 1998-2018 induced a lower domestic market price, thereby discouraging commodity production. Most commonly, policies affecting market prices are implemented by governments in order to increase the price received by producers of a commodity. All other things being equal, such

policies will lead to a positive *MPD*. However, Sri Lanka has maintained a domestic market price below the world market price. This is due to the government policy on ceiling prices. In Sri Lanka rice price as well as farm gate price is politically sensitive. Since successive governments had heavy government intervention in order to maintain the consumer price, has ultimately discouraged commodity production. The comparatively low open market price of rice has increased consumer utility hindering the producers' earning capacity which ultimately created a situation where rice producers are slowly migrating out from rice cultivation.

Estimates of the Effect of Government Policy (1998 to 2018)

Summary Statistics

The summary statistics are given in Table ii. Each variable was tested and adjusted for multicollinearity and heteroscedasticity before being utilizing for the regression analysis. According to Table 2, the mean value of production is 1,726,143 MT per year with a standard deviation (SD) of 569,694 MT. In considering the Nominal Rate of Assistance (NRA), the average is 0.1479 which indicates that Sri Lanka is more protectionist in nature with regard to rice. The policy variability is in fact the standard deviation of NRA, calculated as a five year rolling standard deviation (as explained in the variable descriptions) in order to identify the changes in policies over five-year time periods.

Table 2: Summary Statistics for Crop-specific Variables

Variables	Mean	Standard Deviation	Minimum	Maximum
Production/year (MT)	1,726,143	569,694	909,000	2,903,000
NRA	0.1479	569,694	-0.3100	0.6545
Temperature(Cº)	26.70	0.2730	26.12	27.21
Policy variability(5 year rolling SD of NRA)	0.1483	0.27	0.0718	10.2656
Roads(Km)	27,461	0.0567	20,761	31,398
Telephone penetration	12,762,251	2945	433,811	30,807,137
GDP per capita	0.0021	0.0021	0.0014	0.0036
Population	19,975,476	19,975,476	17,735,000	21,670,000
Structural Changes	0.7802	0.7802	17,735,000	0.8000
Food self sufficiency	0.30	0.30	0.25	040

Source: *Authors' own calculations*

The results of the estimation of the regression analysis indicate that the model specified explains 46.20 percent of the variability as per the R-square value.

Table 3: Estimates of the Regression Analysis

Description	B	t-value	Sig.	SD	95% CI
Constant	18.768	0.656	0.517	28.625	(-39.469) – 77.005
Ln Capital/rural population	-0.525	-1.132	0.266	0.464	(1.469) -0.419
ln land	1.359	0.590	0.559	2.304	(-3.327) -6.046
Rainfall	0.004**	3.412	0.002	0.001	0.001-0.006
Mean temperature	-0.261	-1.198	0.240	0.218	(-0.705) -0.183
Ln policy variability (5 year rolling SD of NRA)	-0.042	-0.256	0.801	0.164	(-0.375) -0.291
NRA	0.756*	1.778	0.085	0.085 0.425	(-0.109) -1.621
ln roads	-2.052	-1.182	0.246	1.736	(-5.584) -1.481
ln telephone	0.443*	1.978	0.056	0.224	(-0.013) -0.009

R squre: 0.462

Adjusted R^2: 0.331

Note: ** significant at 0.05 significant level, *significant at 0.100 significant level 0.1

Source: Authors ’own calculation

Paddy production is significantly affected by the NRA. The NRA had a positive relationship with paddy yield, indicating that if the nominal rate of assistance to the crop increases in one year (more subsidization or less taxation), production will increase in the following year, keeping the other

variables in the model constant. According to the analysis when NRA goes up by one unit the paddy production increases by 0.756**.** The other variables in this model which are significant are rainfall and telephone penetration. The total telephone penetration is having a significant effect on production. This implies that greater access to information has a positive effect on production. However, the magnitude of the effect is small, as a 1% increase in telephone penetration or access to information leads to a 0.44% increase in production, keeping other variables constant. Rainfall is significant according to the analysis. This highlighted the need for more climate resilience policies to increase paddy production**.**

The model looks at the variability of the NRA on policy and whether high variability can decrease the effect of NRA. When the interaction effect of NRA and the policy variability of the NRA is added to the model, this gives significant effects. It is expected that the effect of NRA on production depends on how much the NRA has varied during the previous years. The higher the variability of policy, the less impact NRA will have on farming decisions, as farmers cannot count on stable policy, and thus it is less likely that farm plans would be altered on account of policy changes. However, for paddy policy, the variability of NRA is insignificant, which indicates that the farmer decision on cultivation or production is not significantly influenced by policy decisions being changed, particularly in relation to the previous year's policies. This may be since in Sri Lanka paddy is mainly cultivated in lowlands where none of the other crops could be cultivated.

Hence, the cultivation decisions of farmers are not significantly affected by the changing policies. Road length and telephone penetration are included in the regression model. The aim of this is to see how infrastructure and information access affect yield and how these variables affect the impact of NRA on yield. The results show significant effects from telephone penetration which was used as a proxy for information access.

For paddy, the direct and interaction effects are all significant and the signs are as expected. The direct effects are positive, indicating that when NRA is zero, production is positively affected when markets are better developed and there is access to information. The analysis indicates that there is no interaction effect or direct effect for roads, indicating that a more developed infrastructure does not increase the effect of NRA.

Table 4: Estimates of Regression Analysis on NRA

Description	B	t-value	Sig.	SD	95% CI
Constant	-14.103	-5.63	0.000	2.505	(-19.179) -(-9.027)
ln_GDP per capita	-0.02	-0.459	0.649		(-0.110) -0.069
ln_Structural change	-5.038	-5.529	0.000	0.911	(-3.192) - (-0.442)
Population	2.41E-07	4.162	0.000	0.000	0.000
ln_food self sufficiency	2.323	8.062	0.000	0.288	1.739 -2.906

R squre: 0.785

Adjusted R2: 0.762

Note: *** significant at 0.000 significant level, ** significant at 0.05 significant level,

*significant at 0.100 significant level 0.1

Source: Authors' own calculation

In this analysis, the population is used as a proxy for the protectionist policies of the country as we expect the anti-trade bias to be larger for countries with a larger population to feed. The anti-trade bias is large when import competing commodities are subsidized, and export commodities are taxed. Drawing from the theory on price distortions, we expect the rural share of the population to have a negative effect, as traditionally countries with a smaller rural population will subsidize agriculture more. According to the analysis, rural population, which is proxy for protectionist policies and the level of food self-sufficiency have significant effects on NRA.

CONCLUSIONS

Policies related to paddy production could be categorized under irrigation, fertilizer subsidies, irrigation development, climate change adaptation, research and development, paddy marketing, and trade. Producer Support Estimates (PSE) and Market Price Support (MPS) Estimates have a negative sign which indicates that the government policy instruments prevailing in Sri Lanka induce a lower farm gate and domestic market price, thereby discouraging commodity production. The Nominal Rate of Assistance (NRA) has a positive relationship with paddy production, meaning that if the NRA increases

in a single year (more subsidization or less taxation) production increases in the following year, keeping the other variables constant.

In addition, greater access to information has a positive effect on production, and climate variables, especially rainfall, have a significant effect on paddy yield which highlights the need for more climate resilience policies to increase paddy production. Paddy production is positively affected when markets are better developed and there is greater access to information.

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