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David C. Stifel
Lafayette College

Claude Randrianarisoa
Cornell University and FOFIFA

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by

David C. Stifel (Lafayette College)
and
Jean-Claude Randrianarisoa (Cornell University and FOFIFA)[1]

Contact author:

David C. Stifel
Department of Economics and Business
Lafayette College
Easton, PA 18042-1776
USA

Tel: 1-610-330-5673
Fax: 1-610-330-5715
E-mail: stifeld@lafayette.edu

Abstract:

The purpose of this note is to illustrate how a generic multi-market model can be adapted to the circumstances of a particular developing country to assess the impact of alternative agricultural policies on the well-being of households. We describe the main features and results of a multi-market model for Madagascar that focuses on income generating activities in an agricultural sector that is characterized by seasonal variability. We find evidence that investments in rural infrastructure and commercial food storage have both direct and indirect benefits on poor households.

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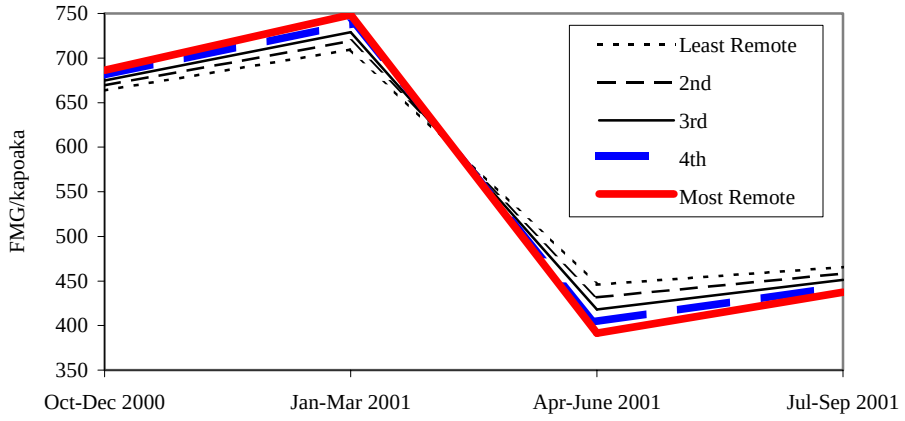
The purpose of this note is to illustrate how a generic multi-market model can be adapted to the circumstances of a particular developing country to assess the impact of alternative agricultural policies on the well-being of households. Given the competing demands for simple and transparent methods of *ex ante* policy impact analysis on the one hand, and for more sophisticated and reliable methods on the other (Gunter, et al., 2005), multi-market models provide a flexible tool that strikes a balance. Although they lack the complexity of computable general equilibrium (CGE) models, multi-market models are useful in understanding the intended and unintended consequences of proposed policies at the sectoral level. By taking an intermediate position between single-market analyses and CGEs, multi-market models permit the policy analyst to pay careful attention to cross-market interactions. Further, since they are less demanding in terms of data and modeling requirements, generic multi-market models can readily be adapted to local circumstances to produce timely analyses that are comprehensible for policy makers.

In what follows, we briefly describe the main features and results of a multi-market model for Madagascar that focuses on income generating activities in an agricultural sector that is characterized by seasonal variability. To motivate the seasonal nature of the model, we note that Madagascar is a typical developing country that experiences dramatic regional and seasonal price variability (Sahn, 1989). For example, Minten and Randrianarison (2003) find that the price of the dominant crop (rice) can vary by as much as 70 percent between the lean season (January through March) and the harvest period (April through June). As illustrated in Figure 1, this price variation also differs by region, where more remote areas experience greater seasonal price swings than the less remote areas. This follows in large part due to weak credit markets, market

concentration, and high transactions costs typical of many developing countries, which result in commercial bulk grain storage frequently being concentrated in urban areas (Barrett, 1996). In turn, inter-seasonal trade reversals can be observed as grain flows out of rural areas to urban storage facilities at low prices after the harvest, and back to rural areas at higher prices once farming households exhaust their own stocks.[2] This seasonal price variation and the inability of households to smooth their annual food consumption also manifest themselves in seasonal variation in calorie intake. Dostie et al. (2002) find

Figure 1: Seasonal Rice Price Variation by Degree of Remoteness in Madagascar



Source: Minten and Randrianarison, 2003

that in rural areas, the disparity between lean and harvest season calorie consumption can be as much as 11 percent. Thus to appropriately model the agricultural sector in Madagascar, we build a seasonal component into the model and consider the welfare effects of policy efforts to reduce the observed price variability.

The Seasonal Model

The multi-market model[3] used in this analysis extends Lundberg and Rich's (2002) generic model which was designed to facilitate analysis of agricultural policy

[2] Barrett and Dorosh (1996) find that 49 percent of Malagasy farmers are net grain buyers.
[3] The reader is referred to Stifel and Randrianarisoa (2004) for a full description of the model.

reform issues in Africa. This model interlinks agricultural markets such as those for rice, maize, roots and tubers, cash crops and other foods, providing a useful means of assessing the effects of policy changes on more than one subsector in agriculture (Lundberg, 2005).

Seasonality is integrated into the model on the demand side for three "seasonal" consumption commodities (rice, maize and cassava) by allowing consumer prices to differ during the harvest and lean periods by the cost of storage for these products, as well as by varying the urban-rural marketing margins seasonally to capture the reversal of internal trade flows for these commodities. This approach differs from those of others such as Dostie et al (2000) who solve sequentially for each season with six seasons linked by the previous season equilibrium prices and levels. Their approach, also for Madagascar, was appropriate in the context of their objective to study the seasonality of food consumption. Given that the objective of the current analysis is to simulate the second round income effects of agricultural policies, however, we prefer a model that solves simultaneously across seasons. The rationale for this is that farmers make their major input decisions at the time of planting based on two sets of prices – their *ex ante* expectations of producer prices that they receive for their crops at the time of harvest, and current input prices. Since these prices – output and input – are realized during different seasons, we are more comfortable modeling production in a simultaneous model.[4] Further, in the rice sector, Bockel (2002) finds more stability among producer price in the 1990s than among consumer prices.

[4] Note that this multi-market model exercise assumes that household consumption and production decisions are separable; Singh, Squire and Strauss, 1986.

Once the system of equations was solved for the model, we used changes in the average real income levels of each household group to simulate the effects of the policy experiments on urban, rural and national poverty. This was done using external contemporaneous nationally representative household survey data. The household consumption aggregate levels in the 2001 *Enquete Prioritaire aupres des Menages* (*EPM*) were scaled up or down by the model-simulated percent change in the real income levels for the corresponding household groups. Poverty measures were then applied to these new distributions using the original poverty line[5] to derive the simulated effects on poverty. These were then compared to the baseline poverty levels that are consistent with the estimates of INSTAT (2002).

Impacts of Policies to Reduce Seasonal Price Variability

The welfare effects of policies to address seasonal price stability were simulated with the model. These policies – a 50 percent reduction in the cost of inter-seasonal crop storage and a 20 percent reduction in the urban-rural marketing margin – reduce the harvest-lean period price differential for food crops in a manner consistent with the literature on rural infrastructure and storage costs (Barrett, 1996, and Minten, 1998). As illustrated in Table 1, the combined effect of lower urban area commercial storage costs along with policies that address physical infrastructure deficiencies in the presence of intra-seasonal flow reversals is a reduction in the temporal price variance.

The major welfare effects of these policies are concentrated in rural areas where the decrease in the price differential is largest. As incomes of the rural poor rise by 4.6 percent, rural poverty falls by some 2.7 percent. This, in turn, leads to a 2.3 percent fall

[5] See Stifel and Thorbecke (2003) and Decaluwe et al. (1999) for a similar methodology.

in national poverty as over 80 percent of the poor live in rural areas (Paternostro et al., 2001; INSTAT, 2002). Further, a decrease in harvest-period food consumption due to rising prices during this period are more than offset by the increase in food consumption during the lean period. The result is higher overall calorie consumption for the poor.

Table 1: Effects of Policies to Reduce Seasonal Price Variability
50% Drop in Storage Costs & 20% Drop in Urban-Rural Marketing Margin

	Baseline	Percent Change		**Baseline**	Percent Change
Urban Consumer Prices			***Rural Consumer Prices***		
Harvest Period			*Harvest Period*		
Rice	**2,173.0**	0.0	Rice	**1,521.1**	8.6
Course Grains	**1,072.6**	0.1	Course Grains	**815.2**	6.4
Lean Period			*Lean Period*		
Rice	**2,499.0**	-6.5	Rice	**2,573.9**	-7.1
Course Grains	**1,179.8**	-4.4	Course Grains	**1,097.2**	-3.0
Real Incomes			***Caloric Intake***		
Urban Nonpoor	**2,259.4**	0.0	Urban Nonpoor	**2,121.0**	0.4
Urban Poor	**556.5**	-0.2	Urban Poor	**996.1**	0.2
Rural Nonpoor	**1,899.2**	0.7	Rural Nonpoor	**3,380.1**	-0.4
Rural Poor	**455.8**	4.6	Rural Poor	**1,436.9**	1.6
Poverty (Headcount Ratio)					
Urban	**44.1**	0.0			
Rural	**77.1**	-2.7			
National	**69.6**	-2.3			

These findings add to the evidence that investments in rural infrastructure and in commercial food storage have both direct (e.g. reduced price variability; see Barrett, 1996), and indirect benefits (e.g. improved consumption and real incomes; see Ahmed and Donovan, 1992) on households in developing countries. Further, they illustrate how a generic multi-market model can be adapted to the circumstances of a developing country such as Madagascar for a timely and transparent assessment of the welfare impacts of policies before they are implemented.

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