Integrating Agricultural Input Expenditure into a South African Agricultural Sector's Partial Equilibrium Model

By

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Integrating Agricultural Input Expenditure into a South African Agricultural Sector's Partial Equilibrium Model

Yemane Gebrehiwet[1], Ferdi Meyer[1] and Johann Kirsten[1]

Abstract

Agricultural inputs expenditure has not been widely incorporated in most partial equilibrium models. Moreover, input costs are treated exogenous and the recursive link between input and output side of the sector is overlooked in few of the models that attempts to incorporate input expenditures. The study has addressed both issues by integrating agricultural input expenditures into the South African sectoral partial equilibrium model by endogenising input costs and recursively linking both input and output side of the agricultural sectors to enhance the results of a standard partial equilibrium model in analysing the effect of policies on agricultural sector.

1. Introduction

In reviewing most of agricultural partial equilibrium models Conforti (2001) noted that few of these models incorporate the input components of the sector. Thus, most of the analyses of these models are limited to simulate the impact of economic policies on the output side of agricultural sector that includes area planted, commodity prices, production levels and gross income. Hence, the implication of economic policies on the net farming income and value added of the sector is mostly unaddressed. Furthermore, some of the models that estimate the net farm income model such as the FAPRI-CARD model does not recursively link the agricultural input and output side due to the treatment of the variable input costs that affect production as exogenous variable in the model (Westhoff, *et al.* 1990; Westhoff, 2008).

The general review of the USDA net farming income model that is well documented by McGath, *et al.* (2009) also indicates that input expenditure and other components are

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estimated by adjusting the previous year's value using the index derived from the output model and input price index forecasts. Hence, input and output models are not recursively linked to enable the model in generating medium term outlook of net farm income and evaluate the recursive effect of input prices on the commodity production.

Since agricultural producers' generally respond to higher input cost by reducing the area devoted for production (Mushtaq and Dawson (2002), Meyer (2006) and Gafar (1997), the total amount of production may be reduced and depending on the size of the output reduction, the output prices may be affected. Area reduction by producers in response to higher input costs could also subsequently reduces agricultural input demand, which then may affect the prices of some agricultural inputs. An increase in input costs also affects the total input expenditure. The size of the impact, however, largely depends on the price elasticity of the agricultural input demand. For price inelastic input demands, a rise in input cost results in higher input expenditure. Thus there is a recursive effect of a change in input markets on commodity production and vice versa. Hence, an attempt to investigate their impact should incorporate this recursive in to account to appropriately assess the effect of policies on the sector.

Thus, the main objective of the study is to extend the existing South African multi-market model by recursively linking input and output sides of the agricultural sector and endogenising input costs so as to improve its ability in comprehensively evaluating the net impact of economic policies on the agricultural sector.

This paper is organised as follows. Section two reviews the partial equilibrium model and it is followed by section three that describes how inputs are treated in partial equilibrium models. Section four presents the methodology of the study. Results and discussion of the study are given in section five and the conclusion of the study is presented in section six.

2. Partial equilibrium models

Partial equilibrium models are the most widely used models to assess the effect of various policy interventions on agricultural sector. They are specifically justified in cases where the sector is relatively small in the economy, inputs are mainly specific to the sector and competition for factor with other sectors is limited (Conforti, 2001). In these cases, therefore, the effect of agricultural sector on the whole economy can be safely considered negligible. The effect of the economy to the agricultural sector, however, is captured using exogenous variables.

Though there are various classifications among partial equilibrium models, they are mainly categorized according the estimation method used to obtain the parameters that measure the relationship among explanatory and dependent variables and how the dynamics of the model is specified (Van Tongeren, *et al*. 2001). There are two approaches of estimating the parameters that measures the relationship between the explanatory and dependent variables. They are the econometric and calibration approaches. In the econometric approach coefficients are estimated using various econometrics techniques (single equation, simultaneous equation, two stages least square, etc) depending on the availability of data and the appropriate techniques for a given situation. The calibration approach, which is also called synthetic approach, parameters are obtained from the benchmark data and the model's theory (Van Tongeren, *et al*. 2001). In this approach, estimated elasticity from other sources is calibrated according to the functional form and initial equilibrium data set to obtain the coefficient. One of the limitation of this approach is that the parameter estimated can not be statistically assessed (Conforti, 2001).

The first partial equilibrium multi-market commodity model for the South African agricultural sector has been developed and is maintained by the Bureau for Food and Agricultural Policy (BFAP). The system of models used by BFAP is composed of three levels, which are the international, sectoral and farm levels (see figure 2.1). These tiers are important to analyse the impact of any major policy or market changes at the international and sectoral level on the gross market of producers.

At the international level, the model is linked to the Food and Agricultural Policy Research Institute's (FAPRI) global model that generates projections for a range of agricultural commodities for many countries across the world. The BFAP model incorporates the FAPRI world price projections into the South African system of equations to generate medium to long-term projections for the South African market. The BFAP model also links to the computable general equilibrium (CGE) model developed by Provincial Decision-Making Enabling Project (PROVIDE) when agricultural shocks or policies are to be evaluated on the overall South African economy. Since the PROVIDE model is a static model and the BFAP sector model is a dynamic time series model, there is no direct link between these two models and the output of each models has to be adapted and interpreted before it can be incorporated in the other level.

At the sectoral level, domestic macro-economic variables such as the exchange rate and GDP growth are incorporated. In addition, the model takes into account the impacts of population dynamics, consumer trends and weather on the South African grain and livestock sector. Table 2.1 illustrates the primary commodities and other products included in the BFAP sectoral model. These commodities encompass around 70% of the primary commodities of agricultural sector.

Table 2.1: Products included in the BFAP econometric system of equations

Field crops	Animal products	Horticulture	Other
White Maize	Pork	Wine	Ethanol
Yellow Maize	Chicken	Apples	Biodiesel
Wheat	Beef	Potatoes	DDGs
Sorghum	Mutton	Table grapes	
Barley	Eggs		
Sunflowers	Diary		
Soybeans			
Canola			
Sugar cane			

Source: BFAP (2010)

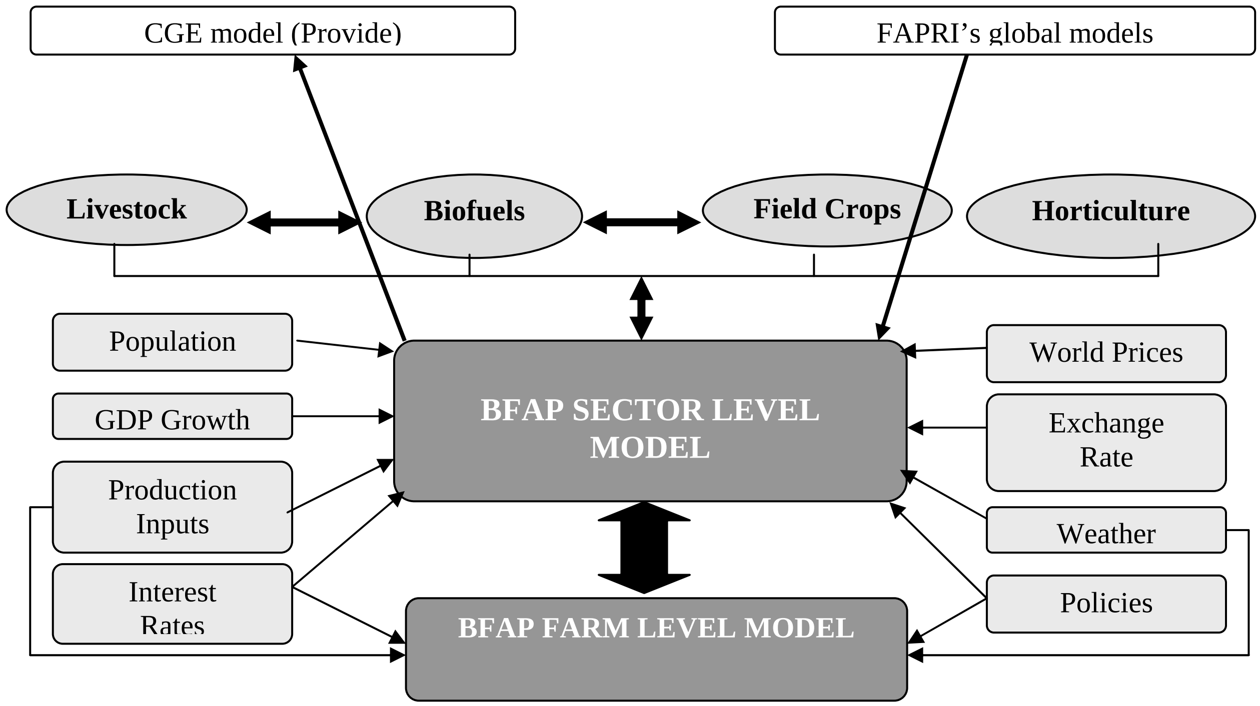

Figure 2.1: Basic structure of BFAP system of models. Source: BFAP (2010)

3 Treatment of Inputs in Partial Equilibrium Models

In general producers take various considerations into account when making production decisions. These includes expected prices of the output and competing output, costs of inputs for both the output and competing output, government policies and weather variables. Accordingly, producers choose the output and its proportion to be produced reacting to these determinant variables. Since production level is affected by factors outside the control of producers, however, area planted is often used in policy analysis to gauge the response of the crop farmers. Number of trees, on the other hand, is used for perennial fruits in the horticultural sub sector and the number of livestock (volume of animal production) is used to measure the response of producers in animal product sub sector.

The general model specification of the main determinants for area planted for a given crop consists of all the factors that affect the variable input costs. Separating the impact of individual variables on the supply response of the above equation becomes statistically unfeasible due to the multicollinearity and low degrees of freedom, which precludes the validity of most statistical inferences. Thus, in most partial equilibrium models gross margins and ratios are often used to address these problems (Ferris, 1998).

Real expected gross margin for the product per hectare *(REGMP)* is computed as follows.

$$REGMP = [P*Y - (aFUP + bFP + cSP + dCP)]/CPI \quad (3.1)$$

Where *P* and *Y* are respectively output price and yield. *FUP* stands for fuel price, *FP* represent fertiliser price, *SP* denotes seed price and *CP* stands for Chemical/pesticide price and *CPI* is a deflator. *a, b, c* and *d* respectively denotes the amount of inputs applied per hectare of the product. In a similar fashion, the gross margin per hectare for the competing products is computed and the area response equation is estimated using equation 3.2.

$$AREA = f\,(REGMP, REGMPc, GOV, OTHERS) \quad (3.2)$$

Where *REGMPc* denotes the real expected gross margin of the competing product, *GOV* refers to various government policies and *OTHERS* stand for technology and all the factors excluded in the model. The merits of introducing the gross margin in the above equation include incorporating priori information and reducing multicollinearity. Moreover, this approach conserves degrees of freedom and it is able to provide projections of profit indicator for various enterprises (Ferris, 1998). However, this approach demands more data, especially on the cost side and it often produces low adjusted R square. Furthermore, when the variables are collapsed as a single variable, the response to adjustment to lags of output and input prices could also not be easily differentiate (Ferris, 1998).

In computing the gross margin equation, variable costs are often used since they play a determinant role in influencing the decision making for short term horizons, which extends to five years. Moreover, compilation of data on variable costs display less inconsistency across a country than fixed costs. Thus variable costs are more preferable than the fixed or total cost in computing the gross margin (Ferris, 1998). The latest

BFAP output model uses the following equations and elasticity to estimate the area response for the summer and winter regions (BFAP, 2010). The proxies used for the variable costs in estimating the area response equation are fuel and fertiliser prices.

Table 3.1: Estimated equation in the BFAP model for summer grain area harvested

Variable	**Coefficient**	**Elasticity**
Summer grain real expected weighted gross market return (lag)	0.62	0.3
Real fuel price (lag)	-126.49	-0.05
Real fertiliser price (lag)	-733.13	-0.07
Rainfall (summer region)	1.49	0.13

Table 3.2: Estimated equation in the BFAP model for winter grain area harvested

Variable	**Coefficient**	**Elasticity**
Winter grain real expected weighted gross market return (lag)	0.075	0.29
Real Fuel price	-10.88	-0.04
Real Fertiliser price	-21.39	-0.07
Rainfall (winter region)	0.235	0.13
Real mutton auction price (lag)	-0.074	-0.17

The real expected weighted gross market return refers to the weighted sum of the expected gross market return for six grains for the summer area and three grains for the winter area. The weight for each commodity is given according to the share of its area to the total grain area. The expected gross market in the equation is obtained from the product of trend yield and prices of each commodity. Input cost prices that determine the winter area are expected to affect the current area response since the production and harvesting time occurs largely at the same year compared to the summer region. Once the total area response of the whole grain sector is estimated, the share of the area devoted for each crops will be estimated. For yellow maize, for example, the model is specified as follows (Meyer, 2006).

$$YMAH = f\,(YMRGMSA\,(-1)) \qquad (3.3)$$

Where, YMAH refers to the yellow maize percentage share of the total grain area.

YMRGMSA(-1) stands for the ratio of lagged value of the yellow maize expected gross market return to the weighted sum of the expected gross return of the remaining crops. A similar model specification is also used for the other commodities.

As shown in table 3.1 and 3.2 fuel and fertiliser price are used as a proxy to capture the effect of variable costs on area planted due to the lack of data to be used for computing the net return of each commodities. However, since these input costs are not endogenised in the model, the effects of factors that affect input costs such as crude oil price, world fertiliser price could not be assessed.

4. Methodology

Incorporating agricultural inputs in to the multi-market modelling framework basically utilises the theory of the derived demand, which states that demand for inputs exists as a result of the consumer demand for the final output. If a given product does not have a demand, then all factors of production necessary to produce the item will not be demanded. Thus a change in agricultural output markets (like gross income, commodity and animal products prices, volume of production and area planted) plays an instrumental role in determining agricultural input demand. Besides the output market, input demand is also determined by its own price and other factors.

In general three factors remain the main drivers of domestic prices, which are oil price, exchange rate and world price. Hence, these variables are used to estimate the model of input prices. The impact of increasing demand for inputs by producers on input prices is also incorporated. A feed cost index, which is computed for each animal product by applying various weights for the field crops and other relevant cost indicator variables in the sectoral output model, was used to estimate the aggregate feed price indice in estimating the feed demand.

The schematic view of how the existing output model and input modules developed in the study are recursively linked is presented in figure 4.1. The figure also displays the common exogenous variables that influence both the output and input side of the integrated model. As shown in figure, the area planted, which affect the production hence the price and income in the output model, also determines the quantity of inputs to be applied in the production process. Together with exogenous variables such as exchange rate and oil prices, the quantity of input demand also influences some of the domestic input prices. The domestic input price subsequently determines the area planted for the next season. Thus, there is a recursive link between the output and input models where a shock introduced in one side will have a recursive effect on the other side and vice versa.

For the recursively linked integrated model, therefore, the effect of a shock introduced in the integrated model is expected to converge slowly instead of an abrupt halt. To evaluate the comparison between the recursively linked and unlinked integrated model and to test the hypothesis of a slow and cyclical convergence of the effect of a shock in a recursively linked model, the recursive link between the input and output model would be "switched off" and domestic input prices remain exogenous so that the effect of a shock on both versions of the model would be compared.

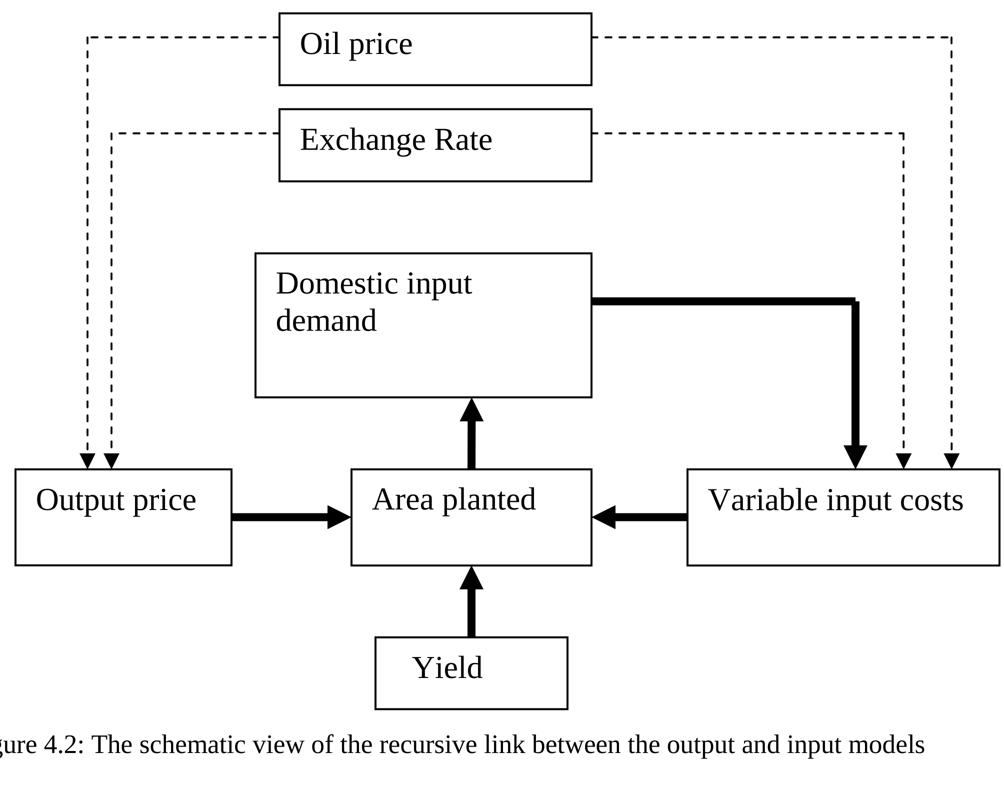

Figure 4.2: The schematic view of the recursive link between the output and input models

This recursive link between field crops and inputs introduced in this study is similar to the recursive link between animal production and field crops in the BFAP output model. Both sub-sectors in the output model are recursively linked through feed equations. Thus, a rise in commodity price augments the feed (input) cost for animal production. As the result of lower ratio of output price to input costs, animal production subsequently declines. The fall in the production consequently brings a fall in feed demand. The fall in the feed demand, therefore, results in lower feed consumption and domestic use of the commodity that may ultimately affect the domestic commodity prices.

Once the input demand and prices are estimated the total input expenditure is obtained by the product of the quantity of input and costs and the gross income of the sector is obtained from the output model by multiplying the output price, area planted and yield of the field crop. In addition, a projected variable from the sectoral model such as area planted is used to estimate the rent paid by the agricultural sector. The model for own construction is also indirectly determined by the variable from output model, which is gross income, through its effects on the gross capital formation of the sector. The depreciation value for the sectors asset value is computed using the annual depreciation rate used by Department of Agriculture, Forestry and Fisheries (DAFF). The model for interest paid is largely determined by the amount of debt and real interest rate. The wage rate and employment figure will also be used to estimate the amount of labour remuneration.

By setting the input model as mentioned above, the net effect of some exogenous variables like exchange rate and oil prices on the sector can be unlocked as their parallel effect on output and input will be taken in to account. Moreover, using the aggregated values from the sectoral output and input models, the key indicators of agricultural sector's role in the economy, which is the gross value added are computed using the following formula.

$$GVA = GINC - INTEXP - OCONS + CLI \qquad (4.1)$$

Where GVA denotes the gross value added (agricultural GDP); *GINC* refers to the gross income of agricultural sector; *INTEXP* refers to intermediate input expenditure; *OCONS* refers to own construction, which is the erection of new buildings and works, additions to and alterations of existing buildings and works which is done by agricultural producers and *CLI* refers to change in the value of livestock inventory. In this study, change in livestock inventory is assumed to have a negligible effect on the gross value added, as evidenced by its average value over the past decades, which is close to zero. Once the gross value added is obtained in equation 4.1, the following formula is used to calculate the net farming income.

$$NFI = GVA - INTPAID - LREMU - RENPAID - DEPRE \qquad (4.2)$$

Where *NFI* stands for net farming income; *GVA* denotes the gross value added; *INTPAID*, *LREMU*, *RENPAID* and *DEPRE* are respectively expenditures on capital (interest paid), labour (labour remuneration), land (rent paid), and depreciation value of assets.

Once all system of input expenditure equations are estimated, using projections of exogenous variables from other sources such as FAPRI and Global Insights, a baseline projection is presented for all the variables including net farming income and gross value added from the period 2010-2015. Then the baseline is used as a benchmark to evaluate the effect of alternative scenarios.

Due to the flexibility it offers in modelling a policy oriented models, Hendry's methodology of general-to-specific is used to estimate the demand for each equations. This approach, which follows a single-equation framework, is suitable in constructing these models than other approaches due to the flexibility that allows accommodating many explicit policy variables and ensuring that the exogenous variables have a projected value. Furthermore, the approach is conducive when there is limited data set on detailed agricultural input expenditures (McQuinn, 2000).

Most of the data are sourced from the Department of Agriculture Forestry and Fisheries (DAFF) which includes all intermediate input expenditures and their respective price indices, own construction, change in livestock inventory and the components of net farming income, which are depreciation value, labour remuneration, rent paid and interest paid. The same source is also be used to obtain the data for the asset value, gross capital formation and total debt value of the sector. The data for interest rate, consumer price index, producer price index and exchange rate are obtained from the Reserve Bank and the quantity, domestic and world price of fertilisers demand will be sourced from GrainSA.

5. Result and Discussion

The forecasted values of the selected exogenous variables of the model used for producing the baseline are given in table 5.1. The data sources for most of these variables are mainly from Global Insight and FAPRI projections.

Table 5.1: Projected values of selected exogenous variables

Exogenous Variable	2010	2011	2012	2013	2014	2015
Exchange rate (R/USD)	7.90	8.22	8.64	8.99	9.35	9.65
Average annual prime rate (%)	11.1	12.00	12.50	13.00	13.00	13.00
Oil price (USD)	79.6	90.00	80.77	86.43	86.00	80.65
Yellow maize, US No.2, fob, Gulf ($/t)	184.7	183.86	191.04	192.50	199.09	202.34
Wheat US No2 HRW fob Gulf ($/t)	224.9	224.09	231.09	235.44	241.47	247.18
Sorghum, US No.2, fob, Gulf ($/t)	178.8	179.03	186.21	189.46	195.66	199.49
Cheese, FOB N. Europe ($/t)	2356.4	2618.8	2747.7	2802.4	2879.1	2969.4
Chicken, U.S. 12-city wholesale ($/t)	1791.1	1820.6	1846.3	1873.5	1907.7	1937.7
WMP, FOB N. Europe ($/t)	1988.4	2183.6	2225.3	2283.3	2365.2	2462.4

Using the forecasted values of the above exogenous variables, a baseline is generated for key agricultural variables. To test the hypothesis of the study that argues a recursively linked input and output side of the agricultural sector converges slowly to subdue the effect of exogenous shocks introduced in the model, two versions of the integrated model are used. The first version is the one where both sides of the sector are recursively linked and domestic input prices are endogenised and the second version ‘switches off’ the recursive linked and domestic input prices remain exogenous.

5.1 A shock of 50 Percent increase in World Fertiliser Price

The results of a single shock of a fifty percent increase in world fertiliser price introduced on both recursively linked and unlinked models in 2010 are given in table 5.2 and 5.3 respectively. As shown in the table, the impact largely increases the intermediate input expenditures due to the rise in the cost of the fertiliser input. However, there is a fall in the area planted and gross income due to impact of the current input prices on the winter area planted. As a result, both gross value added and net farming income of the sector falls in the recursively linked model in 2010.

Following the year of the shock, however, the area and gross income in the recursively linked model falls in 2011 due to the recursive impact of the rise in input costs on the summer area planted decision. Gross income falls due to the fall in the percentage of production has exceeded more than the rise in the price for most of field crops. Since, the input expenditure falls following the decline in area planted in 2011, however, the recursively linked model shows little change in the gross value added and net farming income of the sector in 2011. The rise in output prices in 2011 has also caused an increase in the area planted and gross income in 2012 and following a little change in intermediate input expenditure, the gross value added and net farming income showed a slight increase. Thereafter the effect of the shock on the gross value added and net farming income is slowly converging in a cyclical pattern until the effect eventually disappears (see figure 5.1 and 5.2).

For the recursively unlinked model, however, the effect of the shock is felt by the rise in input expenditure that induce a fall in gross value added and net farming income in 2010. The shock didn’t impact the area response as domestic input prices are exogenous in the model. Furthermore, due to the lack of the recursive effect of the shock on the output side, the subsequent impacts of the shock disappear in 2011 and thereafter. Thus the effect of the rise in world fertiliser price on the gross value added and net farming income using the recursively linked model showed a presence of a positive impact of the effect which is slowly dwindling than a once off plummeting effect implied by the recursively unlinked model.

Table 5.2: Results of the recursively linked model for the shock of 50% in world fertiliser price in 2010

Variable	2010	2011	2012	2013	2014	2015
Area planted	-0.21%	-2.03%	0.34%	0.03%	0.06%	-0.03%
Gross income	-0.06%	-0.29%	0.17%	0.00%	0.07%	-0.06%
Intermediate input expenditure	2.06%	-0.64%	-0.05%	0.09%	-0.04%	0.02%
Gross value added	-1.84%	0.03%	0.36%	-0.08%	0.17%	-0.12%
Net farming income	-3.42%	0.09%	0.82%	-0.17%	0.48%	-0.32%

Table 5.3: Results of the recursively unlinked model for the shock of 50% in world fertiliser price in 2010

Variable	2010	2011	2012	2013	2014	2015
Area planted	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross income	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Intermediate input expenditure	2.14%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross value added	-1.79%	0.00%	0.00%	0.00%	0.00%	0.00%
Net farming income	-3.32%	0.00%	0.00%	0.00%	0.00%	0.00%

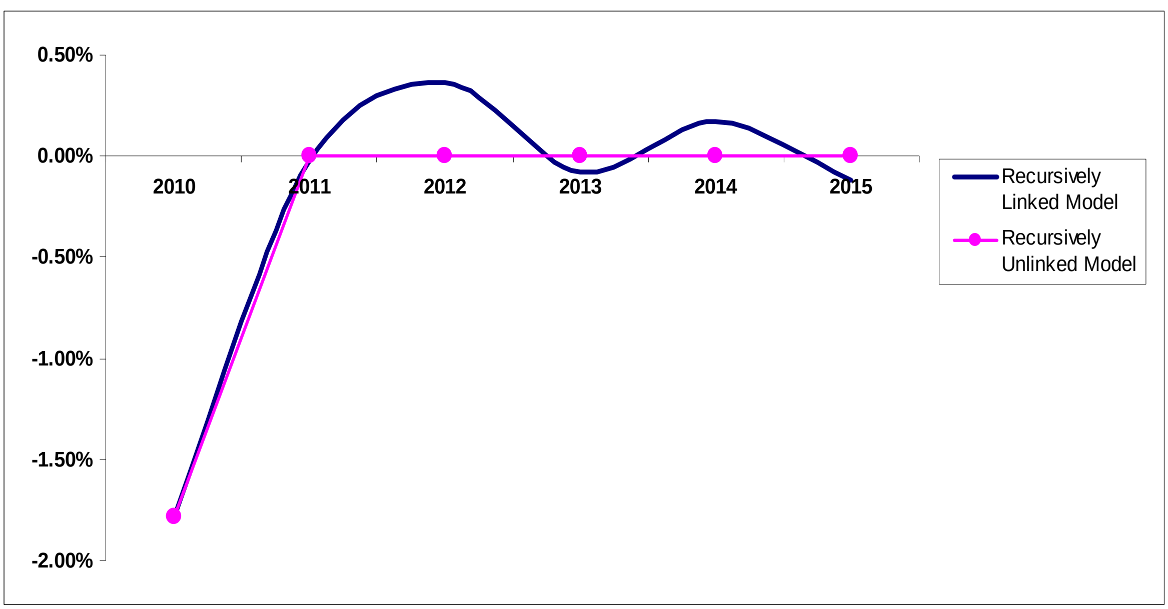

Figure 5.1: The impact of a 50 percent shock in world fertiliser price on the gross value added of agricultural sector

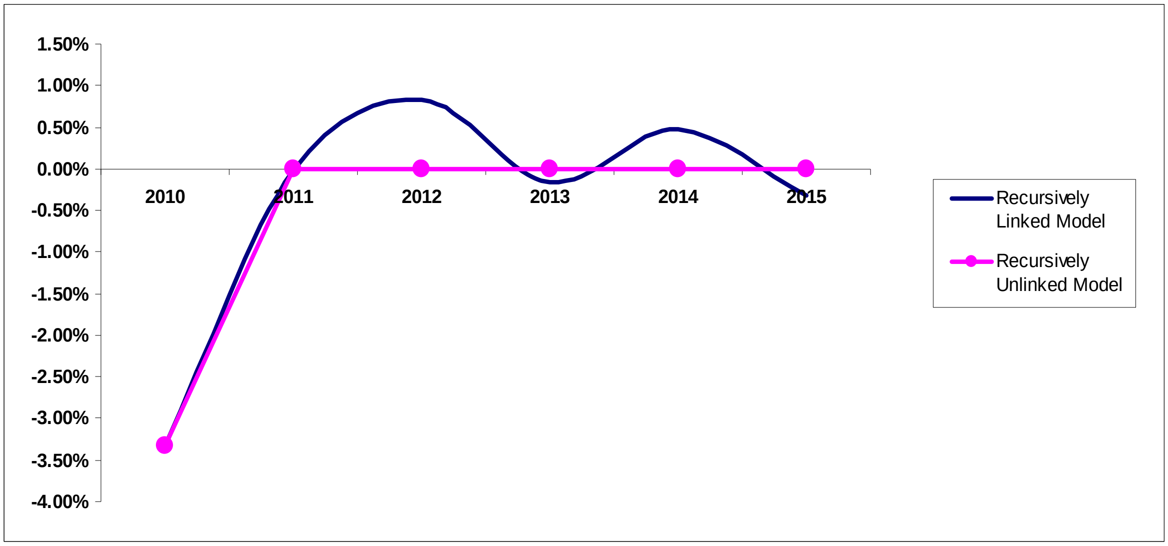

Figure 5.2: The impact of a 50 percent shock in world fertiliser price on the net farming income

5.2 A Shock of 50 percent increase in Crude Oil Price

The results of the impacts of a single 50 percent increase in crude oil price introduced in 2010 on the agricultural sector using the recursively linked and unlinked models are presented in table 5.4 and 5.5 respectively. The impact of the shock entails a fall of the gross value added and net farming income due to the rise in input expenditure. Unlike the effect of the shock in world fertiliser price, however, the crude oil price shock shows a marginal increase on the gross income of both versions of the model in 2010. This is due to the effect of the shock in raising the domestic prices of some commodities by increasing the transport cost is captured in both models.

In 2011, while the unlinked model shows a marginal increase in area and gross income due to an increase in output prices in 2010, the area planted and gross income falls in the recursively linked model since it takes in to account the full effect of the change in fuel prices during 2010 in making the summer planted area decision for 2011. Similar to the above scenario, gross income falls due to the fall in the percentage of production has exceeded the rise in the price for most of field crops. However, the reduction in input expenditure following the decline in area planted augments the gross value added and net farming income. In 2012, gross value added and net farming also grows after the effect of the change in gross income and input expenditures is taken in to account. Gross income rises in 2012 due to the rise in area planted that followed the rise in price in 2011. Thereafter, the impact of the shock on the gross value added and net farming income slowly converges in a cyclical pattern until it slowly disappears (see figure 5.3 and 5.4). Thus the effect of the rise in crude oil price on the agricultural sector may not be a once off fall in gross value added and net farming income when the recursive effect is fully taken in to account.

Table 5.4: Results of the recursively linked model for the shock of 50% in crude oil price in 2010

Variable	2010	2011	2012	2013	2014	2015
Area planted	-0.29%	-2.51%	0.74%	-0.07%	0.12%	-0.06%
Gross income	0.24%	-0.06%	0.25%	-0.03%	0.11%	-0.09%
Intermediate input expenditure	2.75%	-0.75%	-0.01%	0.07%	-0.07%	0.03%
Gross value added	-1.86%	0.56%	0.46%	-0.11%	0.26%	-0.19%
Net farming income	-3.46%	1.17%	1.02%	-0.28%	0.70%	-0.58%

Table 5.5: Results of the recursively unlinked model for the shock of 50% in crude oil Price in 2010

Variable	2010	2011	2012	2013	2014	2015
Area planted	0.00%	0.38%	0.07%	0.00%	0.00%	0.00%
Gross income	0.34%	0.18%	0.02%	0.00%	0.00%	0.00%
Intermediate input expenditure	2.83%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross value added	-1.77%	0.34%	0.04%	0.00%	0.00%	0.00%
Net farming income	-3.29%	0.70%	0.10%	0.00%	0.00%	0.00%

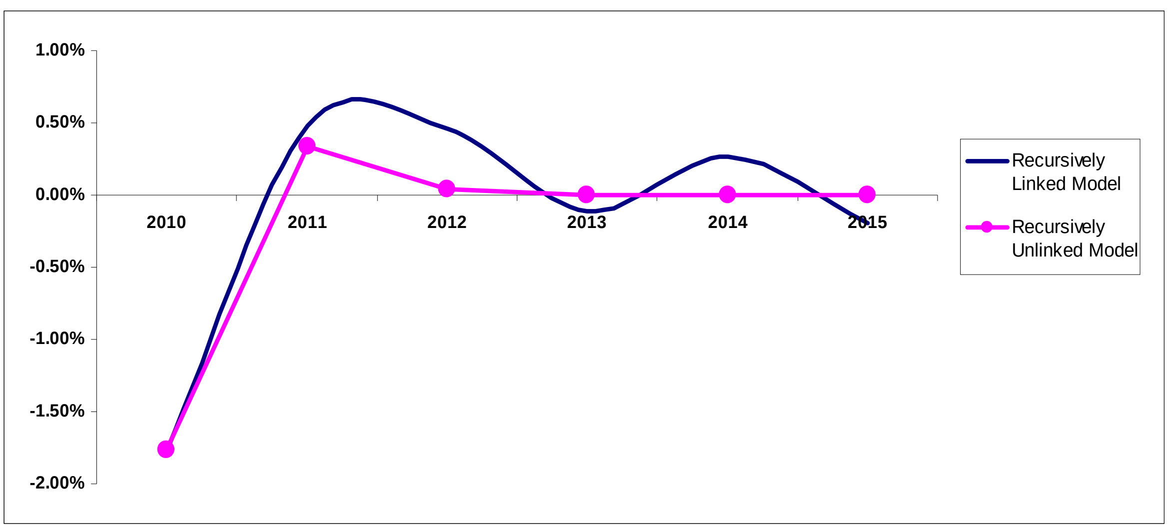

Figure 5.3: The impact of a fifty percent increase in crude oil price on gross value added of agricultural sector

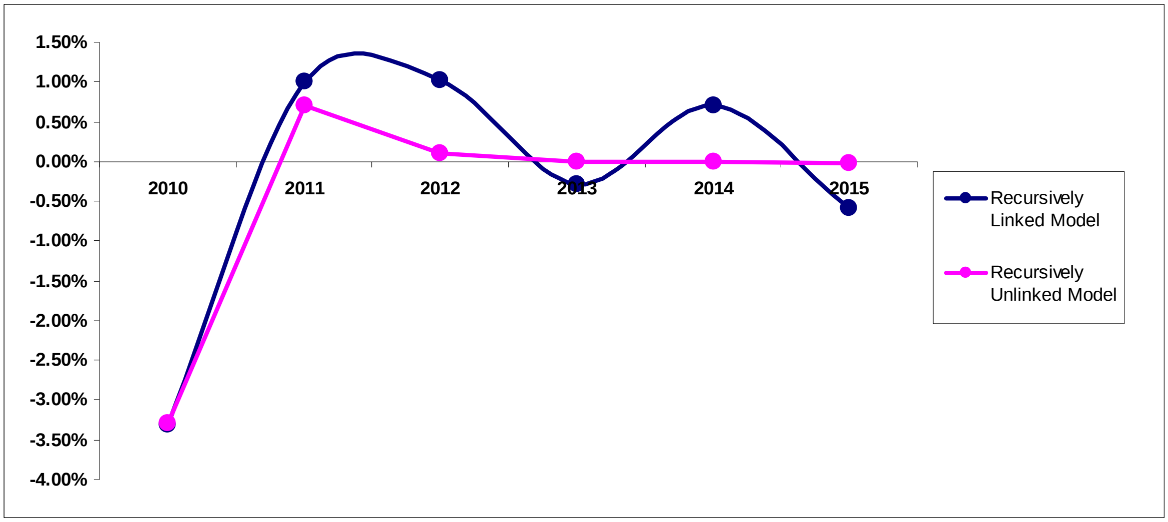

Figure 5.4: The impact of a fifty percent shock in crude oil price on net farming income

6. Conclusion

The study integrated the agricultural input expenditure model into the existing South African multi-market partial equilibrium model and tests the hypothesis that embracing the recursive effect of agricultural inputs side to the output side and vice versa and endogenised input costs in a partial equilibrium models helps to evaluate the impact of exogenous variables on the agricultural sector and replicates the dynamics of the agricultural sector by converges the effect of exogenous shocks on the sector. To test the hypothesis a shock on increasing world fertiliser and crude oil prices was introduced in the model.

Comparing the results of the recursively linked and unlinked versions of the integrated model shows that the effect of exogenous shocks on the recursively unlinked model quickly die after the year of the shock due to the lack of the recursive effect between the output and the input side and treatment of domestic input prices as exogenous in the model. For the recursively linked model, however, the effect slowly converges in a cyclical manner until it disappears due to the account for the recursive effect between the input and output side. Thus the impact of increasing input cost may not be only a fall in gross value added and net farming income as shown by the recursively unlinked model but also a growth in a subsequent years when the recursive effect of the impact is fully accounted for.

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