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"Green Box" Measures for Agricultural Support: How Decoupled Can They Really Be? An Investigation within SAM and CGE Frameworks

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AJAE ABSTRACT

The Uruguay Round Agreement on Agriculture classified some subsidies as "Green Box" measures and presuming that they would not distort production/trade patterns, kept them outside the AMS reduction commitments. This study investigates the validity of this view through simulation results from SAM multiplier and CGE analyses for the US economy.

SUMMARY

The Uruguay Round Agreement on Agriculture required members of the WTO to gradually reduce the domestic levels of agricultural support and protection relative to the respective levels of Aggregate Measures of Support (AMS) estimated for the base period of 1986-1988. Some policies classified as "Green Box" measures, however, were kept outside AMS reduction commitments on account of the presumption that they would not distort production and trade patterns. The direct payments, for example, are excluded from the AMS calculations since they are presumed to have no (or at most minimal) distortionary effects on prices. Yet, given that changing levels of government expenditures are likely to create certain relative price effects, albeit indirectly, whether various transfers to producers would be consistent with the rationale behind their inclusion in the Green Box category is ultimately an empirical question. This paper investigates this issue within the context of agricultural support policies in the US, by particularly considering the case of deficiency payments eliminated by the FAIR Act of 1996 and direct payments that will be in effect at least until 2002. For this purpose, the paper compares simulation results obtained by using Social Accounting Matrix (SAM) multipliers and a Computable General Equilibrium (CGE) model of the US economy. Since SAM multipliers are known to overlook relative price effects whereas the CGE simulations take them into account, the differences between results obtained within each framework would indicate the magnitude and direction of effects resulting from the changes in relative prices. It is argued in the paper that a measurement of these effects can be used to judge whether it is appropriate to classify various direct payments that are in use in different countries into the Green Box category.

Key Words: Social Accounting Matrix (SAM) Multipliers, CGE Models, Agricultural Support Policies, USA.

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1. Introduction

The Uruguay Round (UR) Agreement on Agriculture required members of the WTO to gradually reduce the domestic levels of agricultural support and protection relative to the respective levels of Aggregate Measures of Support (AMS) estimated for the base period of 1986-1988. Some policies, however, were classified as “Green Box” measures and with the presumption that they would not distort production and trade patterns, were kept outside AMS reduction commitments. The most contentious category of Green Box measures is the direct payments to producers. Not to be included in the AMS calculations, direct payments must satisfy the requirement that they have no (or at most minimal) distortionary effects on prices. In other words, the government should not make transfers to the producers in a way that distort domestic commodity prices or agricultural terms of trade (Tangermann, 1996). Since the support policies that are tied to prices are known to distort resource allocation between agricultural and non-agricultural sectors by changing the relative price structure in the whole economy, the purpose was to eliminate these policies but, at the same time, to give the governments some leeway so as not to force them to cut support spending abruptly. As a result, the existence of Green Box has led, and continues to lead, many countries to replace policies that tie support to commodity prices with direct payments schemes. While this enables them to maintain levels of support spending without violating the UR Agreement, there are arguments in the literature that it is impossible to provide distortion-free support to agriculture and that support spending will affect relative prices even when subsidies are not tied to commodity prices (e.g., Blandford and Dewbre, 1994). Typically deficit financed support expenditures and the resulting growth in budget deficits, for example, are argued to affect relative prices by changing the composition of aggregate demand between consumption and investment goods, regardless of whether the support is provided in the form of commodity price-distorting subsidies or direct payments (Sayan, 1996a). Since this is a theoretically well-defined channel for support payments to indirectly affect relative price structure of the economy, the question is not so much whether direct payments would cause price distortions but rather, whether the magnitude of distortions would be considerable.

The purpose of this paper is to measure the extent of price distortions that arise as an unintended consequence of support to agriculture through direct (i.e., decoupled) payments by looking at the economywide effects resulting from a replacement of price-related subsidies with such payments. To address this question, the paper considers the case of deficiency payments that were eliminated through the FAIR Act in the US (Young, 1996), and illustrates the effects of a policy switch from deficiency payments to direct transfers not tied to production decisions or prices. In the US, such payments will be used until the year 2002 and may be terminated thereafter (Tweeten and Zulauf, 1997).

The economywide effects associated with the move from deficiency to decoupled payments are evaluated in the paper using comparative results from simulation exercises conducted in Social Accounting Matrix (SAM) and Computable General Equilibrium (CGE) frameworks. Since the SAM multiplier analyses are known to overlook relative price effects and factor substitution possibilities, the results from the SAM exercise would show the effects of decoupled payments that would have resulted in the absence of relative price effects. This SAM scenario would therefore correspond to the argument that such payments could help avoid the distortionary effects of agricultural subsidies, consistently with the rationale behind the Green Box measures. Theoretically, however, a more realistic evaluation of the effects of such a policy move requires taking the additional, indirect effects that it is likely to inflict upon relative prices into account, and this can be accomplished within a CGE framework. A comparison of the simulation results from the SAM and CGE exercises would then show the magnitude and direction of errors caused by the omission of relative price effects that arise from the maintenance of support spending under a direct payment scheme. The magnitude of these errors, in turn, can be used to judge the validity of the presumption behind Green Box provisions concerning the neutrality of direct payments with respect to relative prices.

The organization of the paper is as follows. The next section describes the CGE framework and the derivation of SAM multipliers. Section 3 describes the simulation scenarios and concludes the paper by comparing results from the elimination of deficiency payments obtained using SAM and CGE frameworks.

2. The CGE Model and the SAM Multipliers

In the mid-1980s when the US agricultural economics literature began to witness a proliferation of works investigating the links between agriculture and the rest of the economy, Social Accounting Matrix (SAM) multipliers appeared to be useful tools for empirically investigating the strength of general equilibrium linkages of agricultural sectors (e.g. Adelman and Robinson, 1986). While easier both to implement and to interpret, the SAM multiplier analysis was later replaced by Computable General Equilibrium (CGE) models of the Walrasian tradition, which, as differently from SAMs, were capable of capturing the relative price effects and (nonlinear) substitution possibilities among factors of production (Hertel, 1990). The advances in computing technologies and introduction of software capable of solving large non-linear models have significantly contributed to the increasing popularity of CGE analyses of agricultural liberalization such as OECD (1989-1990), Kilkenny and Robinson (1990), Kilkenny (1993) and Sayan (1996a) (Sayan and Tin, 1997). As a result, SAM multiplier analyses were given up on account of their failure to address relative price effects. Yet, what seems to be their weakness proves to be a strength for the purposes of this paper. They make it possible to derive economywide effects that would have resulted from the policy switch considered here, had they not caused any relative price changes just as presumed by Green Box provisions.

2.1. The CGE Model

The typical approach to model agricultural intervention is to represent price distortions through *ad valorem* equivalents of various support programs. Price distorting effects of subsidies are then measured by the deviation of subsidy-ridden prices from prices determined in the market when there is no subsidies (Hertel, 1990). Since these price wedges would change relative prices, the resource allocation corresponding to this relative price structure would be different than the case with no such wedges. With their roots in the Walrasian tradition, the CGE models take the change in relative prices as the key mechanism for adjustment to exogenous shocks, and prove especially useful for comparing resource allocations under distorted and undistorted relative price structures. This, in fact, is what explains the widespread popularity of the CGE framework in investigating the economywide effects of agricultural subsidies in developing and developed countries alike – see, for example, the papers in OECD (1989-90) and in Goldin, *et.al.* (1994).

Another advantage of CGE models over others is the availability of checks for model consistency. In addition to Walras' Law which may be used for a global consistency check, the use of Social Accounting Matrices (SAMs) enables the modelers to check if basic macro-economic identities are satisfied. Built upon SAMs, CGE models incorporate such macro balances as the savings-investment balance and the budget position of the government (Hertel, 1990). As such, CGE models consolidate formulation of macro balances and neoclassical features at the sectoral level, providing a useful framework for investigation of the joint effects of support spending (Hushak, Sayan and Tweeten, 1995).

Prior to the signing of Uruguay Round Agreement on Agriculture, formulation of subsidies through *ad valorem* equivalents effectively served to the purposes of researchers since conventional policies were either directly based on price supports or involved elements which would distort relative prices. Yet, given the difficulty in capturing the effects of all programs through price wedges alone, other CGE models incorporated more detailed and explicit formulations of individual support programs involving quantitative controls, income subsidies, support prices and the like (e.g., Kilkenny and Robinson, 1990). For the US, a detailed description of techniques to formulate each program in the context of a specific CGE model is given by Kilkenny (1991a). Sayan (1996a and b) considered the effects of subsidies under alternative schemes using an 18-sector CGE model.

2.1.1. Overview of the CGE Model[1]

The CGE model used in this study is in the tradition of neoclassical CGE models described in Dervis, de Melo and Robinson (1982) and it can only determine relative prices in the Walrasian sense. It requires simultaneous clearance of all goods, services and factor markets, all of which are assumed to be perfectly competitive. Sectoral value added is created by sector-specific capital ($\underline{K}_i$), and sectorally mobile labor (L_i) and land (T_i) whose economywide supplies are fixed at $\underline{L}$ and $\underline{T}$, respectively. Given the sectoral domestic production technologies –captured by constant returns to scale Cobb-Douglas functions, demands for these factors are determined through profit maximization conditions. The basic structure of the model is schematically represented in the following figure.

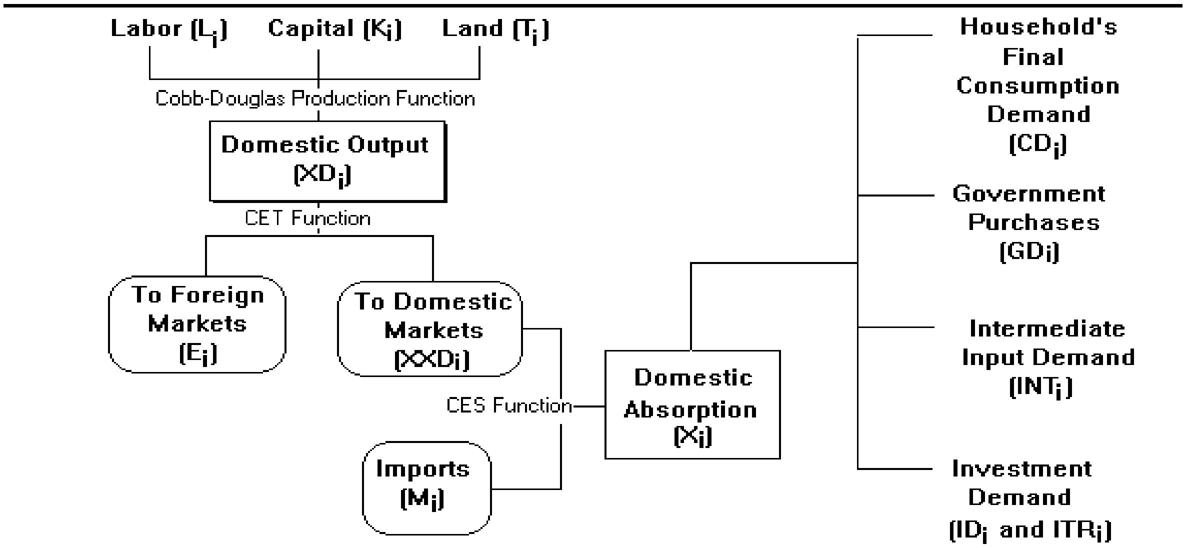

FIGURE: A SCHEMATIC REPRESENTATION OF MODEL STRUCTURE

Part of the domestic production, XD_i, is exported by each sector. Sectoral exports (E_i) and domestically consumed part of domestic production in sector *i* (XXD_i) are assumed to be imperfect substitutes for each other. Similarly, X_i, the domestic absorption in sector *i*, is composed of imports, M_i, and that part of domestic production that is not exported, i.e., XXD_i above, and the imported and domestically produced components are again assumed to be imperfect substitutes for each other.

This composite output X_i is demanded for final consumption purposes by the representative household (CD_i) and the government ($\underline{GD}_i$); and for use as intermediate inputs (INT_i), and for inventory adjustment purposes (ITR_i) by the producers. If *i* is a capital goods producing sector, then, part of its composite output is also demanded for productive investment purposes (ID_i). In other words, equilibrium in the market for the good or the service produced by sector *i* requires

[1] This section draws heavily on Sayan (1996a).

$$X_i = CD_i + \underline{GD}_i + INT_i + ITR_i + ID_i \quad \textbf{(1)}$$

Private final consumption demands by the representative household, CD_i, are formulated through Marshallian demand functions inversely relating the sectoral demand to respective prices using linear expenditure system (LES) coefficients. Sectoral government demands, $\underline{GD}_i$, are fixed in real terms. INT_i, intermediate input demand for the output of sector *i* is determined using fixed coefficients, $a_{j,i}$, as in input-output models. Sectoral inventory demand, ITR_i, is determined as a fixed proportion of X_i. ID_i in (1) denotes what is called "investment by sector of origin," i.e., that part of sector *i* 's output demanded by all sectors for investment purposes ("investment by sector of destination"). So, if *i* is not a capital goods producing sector, ID_i will be zero.

Since the model is static, investment is assumed not to add to the total capital stock of the economy: newly produced capital goods are demanded for investment purposes but they are assumed not to be installed during the period under consideration. However, as the loanable funds creating the demand for investment come from savings in the economy, investment must be linked to savings to prevent leakages from the circular flow of funds in the economy. So, on the macro side, the model includes the savings-investment balance and balance of payments (foreign exchange market) equilibrium condition with current account deficit set equal to exogenous foreign capital inflow (foreign savings) term. Total savings in the economy (total supply of loanable funds) is found by adding to dollar value of foreign savings to the sum of domestic savings by the representative household, corporate savings, depreciation expenditures and net government savings, all determined endogenously. The maintenance of investment-savings balance requires that TSV be equal to the sum of total expenditures on inventory investment and productive investment

$$PIN = \sum_i P_i.ID_i \quad \textbf{(2)}$$

where P_i is the price of composite commodity *i*. A capital composition matrix is used to transform investment by sector of origin into investment by sector of destination.

In this set-up, any rise (decline) in the level of government transfers to agriculture changes the government (dis)savings term and causes a crowding-out (crowding-in) of investment leading to a decrease (increase) in the demand for investment/capital goods. This, in turn, results in a decrease (increase) in the prices of these goods relative to those of consumption goods. This mechanism through which the spending-induced effects on relative prices will arise remains the same regardless of whether transfers to agriculture are made through programs that distort commodity prices or not. In other words, the relative prices will be affected following any change in the level of agricultural support spending regardless of whether there is any program-induced effects or not.

2.1.2. Factor Market Equilibrium Conditions and the Formulation of Subsidies

The producers seek to determine optimal levels of demand for factors which would maximize sectoral profits, $\prod_i$, subject to the state of the technology. In the presence of subsidies distorting signal prices, $\prod_i$ should be defined in such a way to capture the effects of these subsidies. Letting W_i^f stand for the gross sectoral rental for factor *f* –f $\in$ {L,K,T}– in sector *i*, and Greek letters for technological parameters, the problem can formally be expressed as

$$\begin{aligned} &\textit{Maximize} && \prod_i = PVA_i^S . XD_i - W_i^L . L_i - W_i^T . T_i - W_i^K . \underline{K}_i \\ &\textit{subject to} && XD_i = \Lambda_i . L_i^{\alpha(i,L)} . T_i^{\alpha(i,T)} . \underline{K}_i^{\alpha(i,K)} \end{aligned} \quad \textbf{(3)}$$

where $\sum_f \alpha(i,f) = 1$ for all *i*, and PVA_i^S is the subsidy inclusive value-added price net of indirect taxes and payments for intermediate inputs. Since PVA_i^S acts as the signal price for each sector, any change in the level of subsidies will affect the relative price structure causing a reallocation of resources. Following Kilkenny (1991a), the price distorting effects of subsidies can be captured through the following equation where PX_i shows sectoral sales price and itr_i stands for the rate of indirect taxes applicable to sector *i*:

$$PVA_i^S = PX_i.(1-itr_i) + \underline{PIE}_i - \sum_i a_{j,i}.P_j . \quad \textbf{(4)}$$

The $\underline{PIE}_i$ term denoting the producer incentive equivalents exogenously captures the distortionary effects of subsidies on relative prices.[2]

Under such a setup, the profit maximizing levels of demand for factors are determined through the first order necessary conditions (FONC) for (3). These conditions would require that sectoral gross receipts for factor *f* be equal to $\alpha(i,f).PVA^S.XD_i$ for all *i*. A change in relative prices resulting from a change in, say, subsidies would then require an adjustment in sectoral demands and gross rentals for factors, W_i^f. When price-distorting programs such as the deficiency payment program in the U.S. is terminated, on the other hand, $\underline{PIE}_i$ would equal 0 and cause the distortionary effects to disappear. Even after the elimination of these programs, however, there will be indirect, spending-induced relative price effects since this would represent a reduction in the level of government spending lowering the budget deficit, causing a crowding-in of investment and hence, an increased demand for investment/capital goods.

2.2. Derivation of SAM Multipliers

The level of aggregation used in the analysis of economywide flows of goods and services varies depending upon the nature of the problem at hand. Different problems require

[2] PVA_i^S could alternatively be expressed as $PVA_i^S = PX_i.(1- itr_i + \underline{PIE}_i) - \sum_i a_{j,i}.P_j$ so as to let $\underline{PIE}$'s represent *ad valorem* wedges.

different analytical frameworks and different databases that contain records on economywide transactions. These records are kept by following certain conventions that vary across accounting frameworks. Two of the mostly widely used frameworks are the input-output (IO) and national income (NI) accounting frameworks. Due to the differing levels of aggregation chosen to address different issues, IO and NI accounts can not immediately be reconciled: NI accounts net out intermediate input transactions between sectors as well as the sectoral composition of demand, whereas IO accounts, with their relatively heavier micro focus, overlook certain relations among components of national income that are fundamental to macroeconomic analysis. The SAM framework combining elements of both IO and NI accounting stands out as a viable alternative for a reconciliation of microeconomic IO data with the macroeconomic data on various NI aggregates (Robinson and Roland-Holst, 1988).

In addition to its role as a pure accounting framework serving as a bridge between IO and NI accounting, the SAM setting may serve as a background for SAM-based linear multiplier models as well as CGE models (Hertel, 1990). As modeling tools for linear multiplier analyses, SAMs are similar to traditional IO models as developed by Leontief (1936) and Keynesian models of macroeconomic literature in that they, too, may be used for an investigation of the effects of various exogenous shocks on key economic variables. In fact, the linear multipliers calculated from SAMs can be used to measure the effects of such shocks on a wider range of economic variables than each of IO and Keynesian models. The following section describes the basics of SAMs and the derivation of SAM multipliers.

2.2.1. Computation of SAM Multipliers

In a SAM, the rows show receipts and columns show expenditures by various accounts that represent different types of transactions. For each account, total receipts must equal total expenditures. Hence, the SAM must be a square matrix whose row and column sums are in balance. Table 1 below shows the basic structure of a sample SAM with five accounts.

Table 1. A Macroeconomic Social Accounting Matrix[3]

	Expenditures →					
Receipts ↓	Activity (1)	Household (2)	Capital Account (3)	Rest of the World (4)	Government (5)	Total
1) Activity	T_{11}	T_{12}	T_{13}	T_{14}	T_{15}	y_1
2) Household	T_{21}					y_2
3) Capital Account		T_{32}		T_{34}	T_{35}	y_3
4) Rest of the World	T_{41}					y_4
5) Government		T_{52}				y_5
Total	y_1	y_2	y_3	y_4	y_5	

[3] For a more detailed discussion, see Robinson and Roland-Holst (1988).

In the aggregated macro SAM in Table 1, the first row elements show the receipts by the activity account which receives i) the payments by producers who buy intermediate inputs, hire factor services to produce commodities, and generate value added in the process (T_{11}); ii) the (representative) household's consumption spending (T_{12}); iii) the investment spending by investors (T_{13}); iv) the payments by the Rest of the World (ROW) for home country's exports (T_{14}), and v) the government spending (T_{15}). T_{21} in the second row is household income. In the third row, T_{32} is household savings, T_{34} is the balance of trade (current account), and T_{35} is government savings. T_{41} in the fourth row stands for imports and finally, T_{52} in the fifth row represents taxes paid by the households to the government.

There is a matching between SAM and NI accounts. A SAM is called either GNP-based or GDP-based depending upon its structure. The macro aggregated SAM in Table 1 is GNP-based because the net factor income from abroad is not presented as a separate entry (Hanson and Robinson, 1990). Given a GNP-based SAM, the value of current GNP (at market prices) can be calculated from the information contained within the accounts of a SAM and would be equal to total value added at factor cost plus indirect taxes and tariffs paid to the government by the producers and importers. In the macro aggregated SAM above, however, indirect taxes and tariff payments do not show up as separate entries as they are included elsewhere. Likewise, there is no separate account for the value added showing the payments of the producers to the factor services they hire to produce commodities. So, this payment is directly transmitted to the households who own the factors of production, as total factor income. Therefore, the payments from the activity account to the households (T_{21}) gives the GNP at factor cost in this SAM structure.

Table 2. The Column Normalized SAM

	Activity	Household	Capital Account	Rest of the World	Government
Activity	T_{11}/ y_1	T_{12}/ y_2	T_{13}/ y_3	T_{14}/ y_4	T_{15}/ y_5
Household	T_{21}/ y_1				
Capital Account		T_{32}/ y_2		T_{34}/ y_4	T_{35}/ y_5
Rest of the World	T_{41}/ y_1				
Government		T_{52}/y_2			
Total	1	1	1	1	1

In addition to the information it gives about NI aggregates, the SAM in Table 1 can be used for a multiplier analysis much like the Keynesian models. For this purpose, the square SAM of payments and receipts must be converted into a coefficient matrix by dividing each column entry by the corresponding column sum. For such a coefficient matrix, the column sums will be unity as shown in Table 2.

Since the resulting coefficient matrix will be singular, multipliers can not be calculated without identifying exogenous accounts. So, forming a SAM-based multiplier model requires designating accounts either as exogenous or endogenous depending on the policy issues to be addressed. In most cases, the capital account, along with the government and the ROW accounts are taken as exogenous whereas sectoral production, factor returns and household incomes are taken as endogenous. Another common practice is to take capital account as endogenous so as to capture the role of the savings-investment balance in the determination of national income, and to retain the exogeneity of the government and the ROW accounts. Consequently, designating only one of the government, capital account, ROW accounts as exogenous is sufficient for the calculation of the multipliers (Adelman and Robinson, 1986). If the activity, household, ROW and capital accounts in Table 1 are treated as endogenous accounts and the government account is kept exogenous, the resulting relation between accounts can be presented through the accounting balance equations in Table 3.

Table 3. Accounting Balance Equations[4]

	Endogenous Accounts[a]	**Exogenous Accounts**[b]	**Row Totals**
Endogenous Accounts	$N = A_N \, y_N$	X	$y_N = A_N \, y_N + X$
Exogenous Accounts	$L = A_L \, y_N$	R	$y_X = A_L \, y_N + R$
Column Totals	$y_N' = I'A_N \, y_N + I'A_L \, y_N$ $\forall I \quad i' A_N + i'A_L$	$y_X' = I' X + i' R$	

[a] Activity, Household and Capital Accounts, [b] Government and ROW Accounts

In Table 3, the transactions between endogenous accounts are represented by a matrix N which corresponds to the northwestern block of SAM multiplier matrix in Table 2. $N = A_N \, y_N$ where y_N is a column vector of endogenous incomes, and A_N is the matrix of average propensities to consume which is computed from a column normalized SAM. The leakages from exogenous into endogenous accounts are represented by a rectangular matrix L which is equal to the product of the matrix of average propensities to leak, A_L, and the column vector of endogenous incomes, y_N. As such, L corresponds to the southwestern block of the matrix in Table 2. Here, the only leakage is the government's tax revenue for which no linkage is directly modeled. This is excluded from the SAM multiplier analysis. The matrix X represents the column account of the government and is composed of government expenditure, T_{15}, and government savings, T_{35}. An exogenous injection into the system can be given from either component of X. Finally, R is the matrix of SAM transactions between exogenous accounts which, in the case of SAM in Table 1, is a null matrix.

It follows from the accounting balance equations in Table 3 that the expenditure total of the endogenous accounts in Table 1 is equal to column sums of N and L matrices (Equation 5) as the column sum of each column in A_N and A_L is equal to one (Equation 6):

$$y_N' = i\,'A_N\, y_N + i\,'A_L\, y_N \qquad \textbf{(5)}$$

$$\forall\, i \quad i'\, A_N + i\,'A_L = 1 \qquad \textbf{(6)}$$

where i′ represents the row vectors of the identity matrix.

The column and row sums of exogenous accounts are also equal as shown by the following equalities:

$$y_X' = i'\, X + i'\, R \;\equiv\; y_X = A_L\, y_N + Ri \qquad \textbf{(7)}$$

$$A_L\, y_N - X'i = (R-R')\, I \qquad \textbf{(8)}$$

which states mathematically that, in aggregate, the injections into the system must be equal to leakages. From the relation between matrices N and X ($y_N = N + X$), we can write:

$$y_N = A_N y_N + X \qquad \textbf{(9)}$$

or, $y_N = (I-A_N)^{-1}\, X$ provided that $(I-A_N)^{-1}$ exists. This inverse represents the accounting multiplier matrix, M[5], and it is the channel which relates an injection in X to the endogenous incomes vector, y_N. These multipliers times the shock given to each column entry (activity, households, capital account and the ROW) from the exogenous account (government) gives the changes in the receipts of each endogenous accounts in the SAM.

2.2.2. Computation of SAM Multipliers for the US Economy

In this section, the SAM multipliers are calculated for the US economy using a SAM for 1986, the first year of the base period chosen for the implementation of Uruguay Round Agreement decisions. The SAM data behind the model used for the computation of SAM multipliers here have been obtained from the GAMS program files for a 30 sector version of the USDA/ERS CGE Model by Robinson, Kilkenny and Hanson (1990), and are compatible with the data used in the 18-sector, SAM-based CGE model used in this study.

The aggregated 1986 SAM for the US economy is composed of eight major accounts: activity, value added, institutions, households, capital account, government, commodity credit corporation (CCC), and the rest of the world (ROW). In analyzing the

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[4] In Table 2, ‘ i′ ’ represents the row vectors of the identity matrix (i= 1, 2,…).

[5] For more on the decomposition of SAM multipliers, see Tin (1997).

effects of a policy change, it is more convenient to use a disaggregated SAM including many activities. This will increase the information content and facilitate the interpretation of the results from a policy change by helping identify the groups of actors who are affected the most, and the gainers/losers in the economy. The disaggregated SAM for the US has 31 accounts. The first 18 of these correspond to the activity account in the aggregated SAM in Table 4. They represent 18-sectors which can be grouped as agricultural, non-agricultural and others. Next comes the value added, institutions, households accounts each with three subaccounts, and then, the capital account, government, commodity credit corporation (CCC) and the rest of the world accounts (see the Tables in the next section). Here, the CCC account pays the deficiency payments transferred to them by the government to three agricultural sectors; Cotton, Food grains and Feed crops. Due to the nature of the policy issue to be addressed, the ROW and the capital account along with the activity, value added, institution, and household accounts are treated as endogenous, whereas the government, and the CCC accounts are kept exogenous. The computation of SAM multipliers for use in this study is done as described in the previous section.

3. Simulation Results and Conclusions

Two experiments are conducted within both the SAM and CGE frameworks. In the first experiment, deficiency payments to the Cotton (\$1.021 billion), Food grains (\$4.012 billion), and Feed crops (\$7.023 billion) sectors by the CCC are eliminated. In both the CGE and SAM experiments, this requires a reduction in value-addeds by capital, labor and land. Within the SAM framework, the sectoral value-addeds by each of capital, labor and land change by the relevant sectoral multiplier times the reduction in the value-added by the respective factor of production. Within the CGE framework, on the other hand, the initial effect is through the reduction in the value-added price terms (i.e., PVA_i^S in equation 4) resulting from the elimination of price wedges, PIE_i's. This, all by itself, changes the ratios of PVA_i^S acting as signal prices, and initiates an adjustment process which will continue until the resulting relative price structure is compatible with the resource allocation decisions once again. However, since support spending is assumed to be deficit financed, the termination of deficiency payments program will also imply a 12.056 billion dollar reduction in the budget deficit which stood at -144.5 billion dollars in 1986. This causes a crowding-in of investment and requires additional changes in the capital account. So, in the SAM analysis, the changes in capital account should be separately introduced by taking into account the relevant multipliers whereas the adjustment is automatic in the CGE model.

In the second experiment, \$12.056 billion spent on deficiency payments are eliminated first but the amount saved is transferred back to the capital income receiving household (assumed to include farm households) in the form of a direct support payment. Since total support spending remains the same, the budget deficit does not change under this scenario. The results of these experiments are reported in the following tables showing the changes in row/column totals of endogenous accounts in the SAM multiplier analysis.

The results from the first experiment indicate that the direction of effects are the same across CGE and SAM frameworks for overwhelming majority of accounts considered. Two exceptions where CGE and SAM experiments indicate different directions are observed in the cases of activities 6 ("Oil crops"), 17 ("Trade and finance") and the ROW. In terms of magnitudes, the differences are relatively small (less than %1 of the respective account total in the base period) for all non-sectoral aggregates except for land/property income, and other sectors than primary agriculture. For primary agricultural sectors, on the other hand, the magnitude of differences is generally significant –varying between 2.172% ("Other crops") and %22.542 ("Food grains") of the respective 1986 account totals of the sectors subjected to the shock.

When the results of the second experiment are considered, the similarity of the effects in terms of directions disappears for several accounts. The general conclusion about the magnitudes of effects, however, remains valid as the differences between account totals obtained from SAM and CGE experiments are relatively small (less than %1 of the respective account total in the base period) for all non-sectoral aggregates except for land/property income, and other sectors than primary agriculture. The results differ significantly, however, as far as primary agricultural sectors are concerned.

The most reasonable conclusion that can be derived from the study appears to be the following: A switch from price distorting subsidies to direct payments will have considerably different consequences for the receipts of agricultural sectors when the relative price adjustment that will follow the policy switch is taken into account, but the consequences for other sectors as well as non-sectoral, economywide aggregates will be pretty similar with or without relative price effects. It should be remembered, however, the point about the latter group of sectors and aggregates holds only in relative terms. When it comes to a comparison of absolute magnitudes, the differences may be viewed as considerably important. In terms of the effects on total value-added (and hence, the GDP), for example, the second SAM experiment indicates about a $14.3 billion loss which would follow the policy switch. The CGE experiment, on the other hand, points to a total value-added loss of only $3.7 billion. Given that the CGE exercise allows for a reallocation of resources following the relative price adjustment, it is natural that the resulting efficiency gains will partly cover the cost of policy switch as compared to the case where no resource reallocation is allowed.

Experiment 1: Deficiency Payments are Terminated
(in Billions of Current 1986 Dollars unless Indicated to be %)

	Original SAM **A**	CGE Exp. Total **B**	CGE Difference **C** (B-A)	% Diff. in CGE **D** (100*C/A)	SAM Exp. Total **E**	SAM Difference **F** (E-A)	% Diff. in SAM **G** (100*F/A)	CGE-SAM **H** (B-E)	% Error **I** (100*H/A)
Primary Agriculture									
(1) Dairy	19.6487	20.3334	0.6846	3.484	19.6488	0.0001	0.000	0.6846	3.484
(2) Livestock	65.7488	67.7367	1.9879	3.023	65.7503	0.0015	0.002	1.9864	3.021
(3) Cotton	4.1825	3.7583	-0.4242	-10.142	4.1807	-0.0018	-0.043	-0.4224	-10.098
(4) Food grains	11.5680	8.9472	-2.6208	-22.656	11.5548	-0.0132	-0.114	-2.6076	-22.542
(5) Feed crops	43.4276	40.9531	-2.4745	-5.698	43.4141	-0.0135	-0.031	-2.4610	-5.667
(6) Oil crops	12.3019	12.5465	0.2446	1.988	12.2578	-0.0441	-0.358	0.2886	2.346
(7) Sugar	2.0001	1.9320	-0.0681	-3.406	1.9999	-0.0002	-0.011	-0.0679	-3.395
(8) Other crops	29.0354	28.4045	-0.6309	-2.173	29.0351	-0.0003	-0.001	-0.6306	-2.172
Other Sectors									
(9) Food processing	326.4400	326.6615	0.2215	0.068	326.4746	0.0346	0.011	0.1868	0.057
(10) Resource	84.7749	85.0745	0.2996	0.353	85.1372	0.3623	0.427	-0.0627	-0.074
(11) Petrol	249.4628	249.6569	0.1941	0.078	249.8889	0.4261	0.171	-0.2320	-0.093
(12) Construction	525.2160	530.8731	5.6571	1.077	534.0109	8.7949	1.675	-3.1378	-0.597
(13) Consumer electronics	137.8700	138.7081	0.8381	0.608	138.5275	0.6575	0.477	0.1806	0.131
(14) Transport. Equipment	394.8625	397.6277	2.7652	0.700	396.6610	1.7985	0.455	0.9667	0.245
(15) Non-durables manuf.	732.9211	733.5179	0.5968	0.081	734.1892	1.2681	0.173	-0.6713	-0.092
(16) Durables manuf.	904.6243	911.9498	7.3255	0.810	912.8721	8.2478	0.912	-0.9223	-0.102
(17) Trade and finance	2297.9895	2297.7422	-0.2473	-0.011	2301.7544	3.7649	0.164	-4.0122	-0.175
(18) Other services	2151.1131	2151.6855	0.5724	0.027	2152.6184	1.5053	0.070	-0.9329	-0.043
Non-sectoral Aggregates									
(19) VA	3860.3541	3857.4124	-2.9417	-0.076	3858.9434	-1.4107	-0.037	-1.5310	-0.040
19.1) Labor	2688.7935	2689.1377	0.3442	0.013	2692.1201	3.3266	0.124	-2.9824	-0.111
19.2) Capital	1155.2300	1153.6138	-1.6162	-0.140	1154.4108	-0.8192	-0.071	-0.7970	-0.069
19.3) Land	16.3306	14.6610	-1.6696	-10.224	12.4125	-3.9181	-23.992	2.2485	13.768
(20) INSTITUTIONS	3589.4980	3586.6168	-2.8812	-0.080	3587.5050	-1.9930	-0.056	-0.8882	-0.025
20.1) Labor	2309.5939	2309.8891	0.2952	0.013	2312.4522	2.8583	0.124	-2.5631	-0.111
20.2) Property	16.3306	14.6610	-1.6696	-10.224	12.4125	-3.9181	-23.992	2.2485	13.768
20.3) Enterprise	1263.5730	1262.0668	-1.5062	-0.119	1262.6398	-0.9332	-0.074	-0.5730	-0.045
(21) HOUSEHOLDS	3437.0579	3434.8947	-2.1632	-0.063	3435.5443	-1.5136	-0.044	-0.6497	-0.019
21.1) Transfer Recipients	496.8000	496.8000	0.0000	0.000	496.8000	0.0000	0.000	0.0000	0.000
21.2) Labor Income Earners	2309.5939	2309.8891	0.2952	0.013	2312.4522	2.8583	0.124	-2.5631	-0.111
21.3) Capital Inc. Earners	630.6640	628.2056	-2.4584	-0.390	626.2921	-4.3719	-0.693	1.9135	0.303
(23) ROW	343.8000	345.4188	1.6188	0.471	342.6669	-1.1331	-0.330	2.7519	0.800
(22) CAPITAL ACCOUNT	523.3219	532.5383	9.2164	1.761	535.0920	11.7701	2.249	-2.5537	-0.488

Experiment 2: Deficiency Payments are Terminated and the Amount Saved is Transferred Back to Households

(in Billions of Current 1986 Dollars unless Indicated to be %)

	Original SAM **A**	CGE Exp. Total **B**	CGE Difference **C** (B-A)	% Diff. in CGE **D** (100*C/A)	SAM Exp. Total **E**	SAM Difference **F** (E-A)	% Diff. in SAM **G** (100*F/A)	CGE-SAM **H** (B-E)	% Error **I** (100*H/A)
Primary Agriculture									
(1) Dairy	19.6487	20.3942	0.7455	3.794	19.6404	-0.0083	-0.042	0.7538	3.837
(2) Livestock	65.7488	67.9286	2.1798	3.315	65.7214	-0.0274	-0.042	2.2072	3.357
(3) Cotton	4.1825	4.7831	0.6006	14.361	4.1819	-0.0006	-0.014	0.6012	14.375
(4) Food grains	11.5680	12.9797	1.4117	12.203	11.5680	0.0000	0.000	1.4116	12.203
(5) Feed crops	43.4276	48.0768	4.6492	10.706	43.4177	-0.0099	-0.023	4.6591	10.728
(6) Oil crops	12.3019	12.1303	-0.1716	-1.395	12.3048	0.0029	0.024	-0.1746	-1.419
(7) Sugar	2.0001	1.9377	-0.0624	-3.122	1.9987	-0.0014	-0.071	-0.0610	-3.051
(8) Other crops	29.0354	28.9027	-0.1327	-0.457	29.0267	-0.0087	-0.030	-0.1239	-0.427
Other Sectors									
(9) Food processing	326.4400	327.5977	1.1577	0.355	326.2939	-0.1461	-0.045	1.3039	0.399
(10) Resource	84.7749	84.8703	0.0953	0.112	84.7034	-0.0715	-0.084	0.1669	0.197
(11) Petrol	249.4628	249.8050	0.3422	0.137	249.3406	-0.1222	-0.049	0.4643	0.186
(12) Construction	525.2160	525.0717	-0.1443	-0.027	523.7347	-1.4813	-0.282	1.3370	0.255
(13) Consumer electronics	137.8700	138.3745	0.5044	0.366	137.7406	-0.1294	-0.094	0.6338	0.460
(14) Transport. Equipment	394.8625	396.5031	1.6405	0.415	394.5402	-0.3223	-0.082	1.9629	0.497
(15) Non-durables manuf.	732.9211	733.9773	1.0562	0.144	732.5890	-0.3321	-0.045	1.3883	0.189
(16) Durables manuf.	904.6243	905.9402	1.3159	0.145	903.1778	-1.4465	-0.160	2.7624	0.305
(17) Trade and finance	2297.9895	2300.4824	2.4929	0.108	2297.0826	-0.9069	-0.039	3.3998	0.148
(18) Other services	2151.1131	2154.6656	3.5525	0.165	2150.5651	-0.5480	-0.025	4.1005	0.191
Non-sectoral Aggregates									
(19) VA	3860.3541	3856.6228	-3.7313	-0.097	3846.0258	-14.3283	-0.371	10.5970	0.275
19.1) Labor	2688.7935	2687.8860	-0.9075	-0.034	2682.3837	-6.4098	-0.238	5.5023	0.205
19.2) Capital	1155.2300	1154.0411	-1.1889	-0.103	1151.2163	-4.0137	-0.347	2.8248	0.245
19.3) Land	16.3306	14.6958	-1.6348	-10.011	12.4258	-3.9048	-23.911	2.2700	13.901
(20) INSTITUTIONS	3589.4980	3585.9966	-3.5014	-0.098	3576.0852	-13.4128	-0.374	9.9114	0.276
20.1) Labor	2309.5939	2308.8139	-0.7800	-0.034	2304.0871	-5.5068	-0.238	4.7268	0.205
20.2) Property	16.3306	14.6958	-1.6348	-10.011	12.4258	-3.9048	-23.911	2.2700	13.901
20.3) Enterprise	1263.5730	1262.4869	-1.0861	-0.086	1259.5719	-4.0011	-0.317	2.9151	0.231
(21) HOUSEHOLDS	3437.0579	3446.3935	9.3356	0.272	3437.7507	0.6928	0.020	8.6428	0.251
21.1) Transfer Recipients	496.8000	496.8000	0.0000	0.000	496.8000	0.0000	0.000	0.0000	0.000
21.2) Labor Income Earners	2309.5939	2308.8139	-0.7800	-0.034	2304.0871	-5.5068	-0.238	4.7268	0.205
21.3) Capital Inc. Earners	630.6640	640.7796	10.1156	1.604	636.8636	6.1996	0.983	3.9160	0.621
(23) ROW	343.8000	344.5919	0.7919	0.230	343.9273	0.1273	0.037	0.6646	0.193
(22) CAPITAL ACCOUNT	523.3219	522.5820	-0.7399	-0.141	521.3562	-1.9657	-0.376	1.2258	0.234

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