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The "30-30-30 Proposal": CGE Simulation of Unilateral Compliance by the USA to Partial Trade Liberalization

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A CGE model of the United States is applied to analyze unilateral compliance with the current partial liberalization proposal to the GATT. A key issue is voluntary participation in the programs. The main implications are that economywide real GDP could increase by $6 billion, farm income per FTE could rise by 3 percent, while returns to cropland fall by 15 percent.

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The "30-30-30 Proposal": CGE Simulation of Unilateral Compliance by the USA to Partial Trade Liberalization

Resolution of the Uruguay Round of the GATT hinges on an agreement on agriculture. The basis for continuing negotiation is the "30-30-30 Proposal" which calls for a 30 percent reduction in aggregate internal support, a 30 percent reduction of border protection, and a 30 percent reduction in export subsidies (Appendix I). These reductions are to be made relative to the current (1990) levels of support over a five-year horizon. Since the gains from trade are achieved by a reallocation of resources economywide to capitalize on comparative advantages, an economywide computable general equilibrium (CGE) model is used to estimate the possible gains from this move towards freer trade.

The United States believes it will gain from multilateral agricultural liberalization. It has an absolute advantage in agriculture that may be realized as a comparative advantage when there is free trade in farm products. When producers in other countries are no longer protected, world market prices should strengthen. American farmers should be able to recapture lost export markets, and this would reduce the trade deficit. The market price increases due to liberalization may also make farm income support programs unnecessary. This would help reduce spending and the government budget deficit. A lower government deficit would relax the strain on domestic savings or reduce the need for foreign capital, and allow for increased investment and future growth. Finally, removing distortions should allow for a more efficient economywide allocation of resources, resulting in GDP gains.

Analytical support for the above arguments comes from a variety of simulation models applied to the question of full liberalization: multimarket models: OECD, 1987; Meyers, Devadoss, and Helmar, 1987; Parikh, et al., 1986; Roningen

and Dixit, 1989; Tyers and Anderson, 1987; and computable general equilibrium models: Hertel, Thompson, and Tsigas, 1988; Burniaux, et. al., 1988; Kilkenny and Robinson, 1990; and Robinson, Kilkenny, and Adelman, 1989. No CGE analysis of *partial* liberalization, however, has been published.

It is tempting to assume that the implications of the 30-30-30 proposal can be interpolated as 30 percent of the gains from full liberalization. According to that rule, U.S. GDP gains under the 30-30-30 proposal would be 30 percent of the $10 billion dollar estimated gains from liberalization (e.g. Economic Report of the President 1990; page 258). This is a mere $3 billion, and it is probably too low. The main reasons why partial liberalization should not be inferred from full liberalization are that participation in domestic U.S. farm support programs is voluntary and conditional upon compliance with acreage use restrictions, and border measures are non-tariff barriers. Supply controls and non-tariff barriers are only locally approximated by tax or tariff equivalents, so that the impact of a change in the instruments as large as 30 percent will not be correctly approximated by equivalents. Furthermore, the endogeneity of the participation decision is critical for any analysis of partial reduction of internal support.

This paper presents an analysis of this partial liberalization scenario using an economywide model of the United States that does not rely on tax or tariff equivalents of the policy instruments and simulates participation endogenously. The thirty sector FPGE-WP Model (Farm Programs in General Equilibrium - With Participation) is used to generate estimates of the changes in economywide real GDP; trade; government expenditures to support agriculture and accumulate stocks; as well as farm sector activity, employment, and income under *unilateral* partial liberalization. Most interestingly, the model is also used to determine the *optimal changes in existing policy instruments* necessary to comply with the required reductions in the aggregate measure of support.

Five simulations are conducted and the results of two are summarized here. Foremost is the simulation of unilateral compliance by the United States with the 30-30-30 Proposal package. Three more simulations are conducted to show the relative importance of internal support, border protection, and export assistance to the United States. The fifth is a simulation of the optimal degree of acreage reduction given unilateral compliance that internal support be reduced by 30%. This last experiment is designed to determine whether supply controls, which reduce supply and thus raise domestic market prices, might be an effective way to reduce overall support. This paper discusses the results of the 30-30-30 experiment and the choice of set-asides experiment.

The FPGE-WP model is written with the GAMS (General Algebraic Modelling System) software, and can be run and solved on a mainframe computer with 4 or more megabytes of disk space. It is a system of over 1,300 structural equations which simulate the economy according to assumed neoclassical behavioral rules in a deterministic manner, given a single set of observed initial conditions, transactions, and policy choices. It solves for the long run price and quantity results of the interaction of optimizing economic agents subject at all times to market clearing and budget constraints. The FPGE-WP model distinguishes thirty sectors. Of these, eight are agricultural sectors. There are also eight food processing sectors, two extractive industries, eight industrial sectors, construction, and three service sectors.

The unique features of the FPGE-WP model include (1) an exact account of every dollar spent on farm programs, (2) explicit modelling of each farm and agricultural trade policy, and (3) a household aggregation scheme that highlights farm households and accounts for their non-farm income, and (4) explicit modeling of the "participation" decision and thus the acreage set aside from production.

Policies that affect resource allocation affect the profit maximizing

choices of primary factor employment. In the model, the revenue distributed to the primary factor suppliers per each additional unit of output is the value-added price (PVA). It is the producer price per unit (PX_i) net of *ad valorem* indirect business taxes ($ITAX_i$), net of the cost of the intermediate good bundle ($\Sigma_j\ IO_{j,i} \cdot P_j$), and gross of subsidies (PIE_i):

(1) $PVA_i = PX_i \cdot (1-ITAX_i) - (\Sigma_j\ IO_{j,i} \cdot P_j) + PIE_i$

The value-added price per unit times output is marginal revenue net of intermediate costs. Net revenue after payments to primary factors is profit per unit. The first order conditions for the profit maximum (or the cost minimum) state that the marginal value product of a factor minus that factor's price equals zero at the optimum. Given diminishing marginal returns, the derived demand for primary factors in each sector i is a positive function of PVA_i and a negative function of the factor price.

Farm programs which raise value-added increase agriculture's derived demands for mobile capital, labor, or land. If these primary factors are not mobile, farm programs simply bid up their factor prices. All programs which affect value-added from production are reflected in PVA_i in the FPGE-WP model. Programs which restrict primary factor supply raise factor prices and reduce supply, *ceteris paribus*. All such programs are modeled directly as restrictions on the factor supplies.

The following paragraphs of this paper, given the space limitations, focus only on the specification of the endogenous components of PIE, on factor supply restrictions, and on how trade policies affect final demand and market prices.

Deficiency payments are made to participating producers if the market price falls below a policy-prescribed target price. Thus the deficiency payment policy instrument is the target price. The payment rate equals the difference between the target price and the national weighted average market price received by

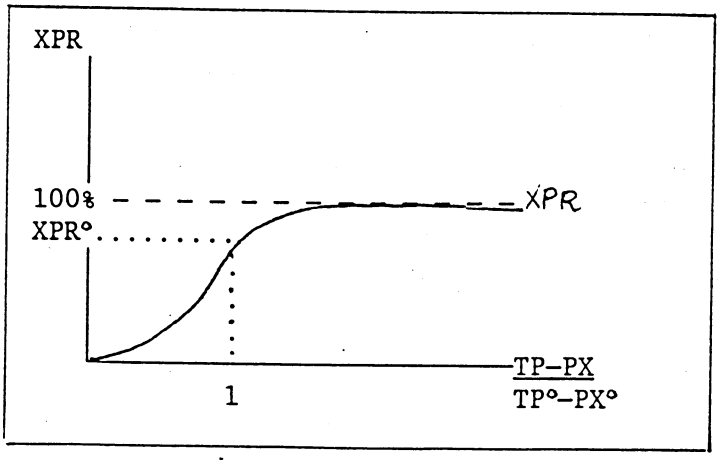
farmers or the announced loan rate, whichever is higher. When farmers growing program crops participate in programs they receive the deficiency payment rate per unit of program output. The deficiency payments received by the nation's producers of commodity i ($DEFPAY_i$) is national program output (XP_i) times the excess of the parametric target price (TP_i) over the loan repayment rate (PL_i) or the variable producer price (PX_i), whichever is higher:

$$(2) \quad \begin{aligned} DEFPAY_i &= XP_i \cdot (TP_i - PL_i) && \text{if } PL_i \geq PX_i \\ DEFPAY_i &= XP_i \cdot (TP_i - PX_i) && \text{if } PL_i < PX_i \\ DEFPAY_i &= 0 && \text{if } PX_i \geq TP_i \end{aligned}$$

A key element in determining actual deficiency payments is participation ($XPR_i = XP_i/XD_i$). The decision to participate is based on the producer's comparison of net revenue under the program to net revenue on the market. While it would be desirable to express this choice explicitly, there is no data which strictly explains why some farmers find participation profitable and other don't. One may assume that there is a variety of land quality as Whalley and Wigle (1988) do for the wheat sector. More directly, one may assume that there are a variety of farmers and farmland, and some cummulative distribution function summarizing this variety. This latter approach is taken in the FPGE-WP model.

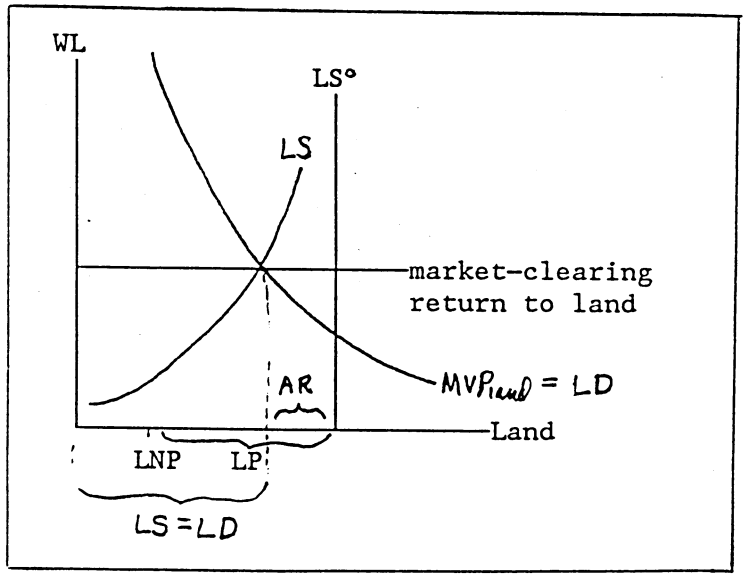
The main signal is the extent to which target prices exceed market prices, since the producer can pick up both deficiency payments and loan forfeit benefits if they participate. As this difference increases we expect program participation to rise, *ceteris*

Figure 1 The Endogenous Participation Rate



paribus. The most important in that list of "all other things" is the required rate of acreage reduction for participants. An increase in the acreage reduction requirement, ARP_i, will reduce (shift) the participation rate. The rate of participation is modelled according to a cummulative distribution function, as shown in Figure 1. The curve relates XPR_i exponentially to the change in the difference between target and market prices.

Figure 2 Acreage in Production and set aside



Producers must comply with the acreage restrictions to be eligible for deficiency payments, loan programs, and other payments. All acreage reduction programs are modeled as a unified restriction per sector on the participants' crop land in program commodities. The policy instrument is the acreage reduction percentage by crop (ARP_i). ARP_i is the proportion of participant land (LP_i) barred from production under all programs in effect for each crop. More detailed models of heterogenous agricultural land and land markets are by Whalley and Wigle (1988); Hertel (in progress), and McDonald (1990).

Land supplied for production of crop i (LS_i) is constrained by the total initial crop land available in that period ($LS°_i$) less land set aside:

(3) $LS_i = LS°_i - ARP_i \cdot LP_i$

The participating land in production is determined by the participation rate times actual planted acreage (assuming similar average yields) :

(4) $(1-ARP_i) \cdot LP_i = XPR_i \cdot LS_i$

If ARP rate increases, the supply of land in production decreases. The supply of program crops shifts in, market prices rise relative to target prices, and thus the rate of participation falls. This lowers the participating land, so supply can shift out a bit, and so forth until a new equilibrium can be reached. Ultimately, participation rates will be lower, but land in production may be higher or lower if ARP is increased. This is illustrated in Figure 2.

This next section considers import quotas. This model invokes an Armington assumption to distinguish domestic from foreign goods in demand. Consumers purchase a constant elasticity of substitution [CES] aggregation of the imported and domestically produced versions of the good. This implies that given total demand if imports are bound from above via quantitative restrictions, domestic demand must rise to satisfy total demand. The quota policy is explicitly modeled as a constraint (upper bound) on imports. By creating an artificial scarcity, quotas raise the price of the import so that the prices of domestically-produced import-competing goods can also rise. This is how quotas support domestic market prices above world prices. Furthermore, the difference between the high domestic price and the low world price is captured as premia by the traders.

Given the constraints on imports, a premia rate (TMQ_i) is determined endogenously to reconcile the price domestic consumers are willing to pay for the restricted amount with the border price. TMQ_i can only function as a fixed *ad valorem equivalent* of the quota if the bound on imports is relaxed. This is how tariffication is simulated: TMQ_i is fixed at the premia rate, and imports are endogenously determined.

Under the export promotion programs, the government compensates exporters in kind or otherwise for the difference between the reference world price and the contracted sale price to a specific country. The extent to which the concessional exports augment rather than simply displace regular commercial sales is

called additionality, which is an increasing function of the importer's elasticity of demand (Houck, 1986). In this model we assume high elasticities of foreign demand for our exports (ϵ_i) and high additionality. The impact of the export enhancement program is to lower "world" prices for U.S. exports (PWE_i) relative to other country export prices ($PWSE_i$) which are assumed exogenous. On net, the price of U.S. exports to world customers is lower under the program.

The export enhancement subsidy is expressed in the FPGE-WP model as an ad valorem mark-up (TEE) over the U.S. export price (PWE).

(5) $PE_i = EXR \cdot PWE_i \cdot (1+TEE_i)$

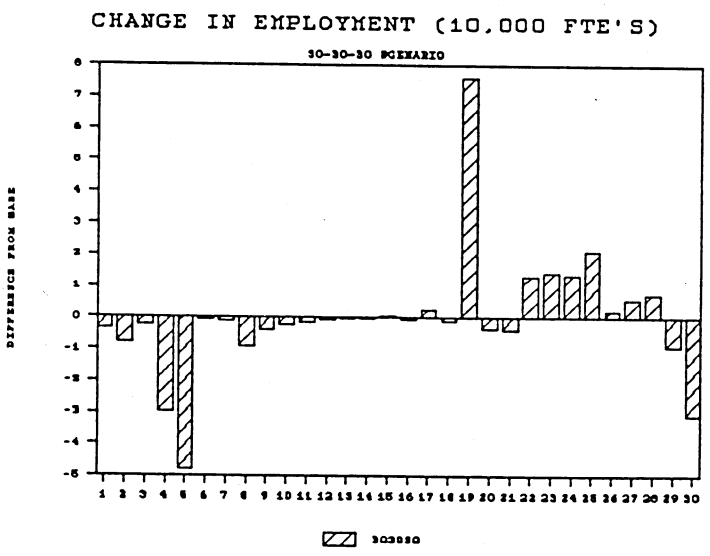
where EXR is the (direct quote) exchange rate of dollars to foreign currency. An decrease in the average rates of targeted export assistance or Export PIK payments raises the customers cost for U.S. exported products (PWE_i) relative to any other export supply price ($PWSE_i$). Export volume in markets where the U.S. is "large" is inversely related to the U.S. export price (PWE_i). Total export volume may thus fall as TEE_i falls:

(6) $E_i = EBAR_i \cdot (PWSE_i/PWE_i)^{\epsilon_i}$

The 30-30-30 proposal calls for a 30 percent reduction in internal support, (represented by the PIE in our model); tariffication and a 30 percent reduction in border protection (represented by TMQ); and a 30 percent reduction in export assistance (represented by TEE). The simulation of unilateral adherence to these three provisions is conducted by fixing PIE_i exogenously to 70 percent of the base rates, and letting the target prices, TP_i, be determined endogenously, given ARP_i rates. The constraints on allowable imports under the quota schemes are relaxed, but the tariff equivalents of the premia are fixed at 70 percent of the base levels. The rates of export subsidy are also reduced to 70 percent of the base levels. The trade balance is determined endogenously, while exchange rates are assumed to be determined by asset market (exogenous) forces.

The aggregate implications of unilateral adherence to the 30-30-30 Proposal are good. Real GDP rises by $6.47 billion; farm program expenditures are reduced by more than 33 percent, 31 percent less is spent on stocking, and the government deficit is reduced by $10 billion. The trade deficit, however, widens by 1.4 percent; which is to be expected under a *unilateral* liberalization.

Figure 3 The Economywide Reallocation of Labor under 30-30-30 Proposal



The implications for farmers are mixed. Real consumption per FTE (full time equivalent) employed in agriculture rises by 3 percent. This improvement, however, occurs largely because of the induced outmigration of labor from agriculture. When the deficiency payments decline there are fewer program participants. Land is brought back into production in some sectors and substituted for labor. The food grain sector uses 28 percent fewer FTE's. Feed crops activities use 14 percent less labor, and expands acreage slightly (1 percent). The oil crop activity expands acreage, while labor employment falls insignificantly (0.4 percent). Acreage employed in non-program crops expands by 16 percent. Overall, since land is the relatively fixed factor of production, productive returns to land fall by almost 15 percent.

Since the FPGE-WP model simulates relatively long-run full-employment equilibria, the labor that is displaced from agricultural activities is re-

employed in other sectors. The more efficient reallocation is illustrated in Figure 3. The most movement of labor is out of food grain production and into construction. This pattern emerges because the saved farm program expenditures have lowered the government's drain on loanable funds and allowed for increased domestic investment. Construction is the most important investment-goods producing sector.

Table 1 compares the aggregate results of the five scenarios. The "TP" simulation shows the implications of simply reducing internal support by 30%, by lowering Target Prices so that the PIE fall by 30 percent. The "TMQ" experiment simulates only tariffication: a 30% reduction in the value of border protection by converting the quotas to tariffs and reducing them to 70 percent of the base run values. The "EEP" simulates a 30% reduction in export enhancement program subsidies. The "ARP" scenario simulates internal support reduced by 30% by choosing acreage reduction rates, given voluntary participation. The results show that the deficiency payment program is the most critical, and accounts for most of the adjustments that occur under the 30-30-30 Proposal.

An interesting result of the "ARP" experiment is that the optimal rate of acreage reduction consistent with the reduced internal support is *no set asides at all*. The optimal allocation of land is 25 million acres more in oil crops, about 18 million more acres of feed crops, and even a few million more acres in food grains. Productive returns to land fall the most significantly, as could be expected. Under the 30-30-30 scenario, they fall about 15 percent, while under the ARP scenario they fall by 34 percent. This also spurs a strong outmigration of labor, which allows for a 5.5 percent increase in real income per FTE on farms. The ARP scenario also suggests that a removal of acreage restrictions (along with the loan program and a 30 percent reduction in income support) could provide for the most farm program expenditure savings, the best reduction

of the government deficit, and relatively good economywide real GDP gains. These aggregate results are compared for all experiments in Table 1.

Table 1 Aggregate Implications of the Five Scenarios

	30-30-30	TP	ARP	EEP	TMQ
	- - - - PERCENT CHANGES FROM BASE - - - - -				
RGDP	0.18	0.18	0.16	0.02	0.003
FPE	-33.54	-33.37	-58.47	-3.01	-0.43
CCCE	-31.24	-31.84		-4.47	-0.67
BOT	-1.44	-1.25	0.65	-0.21	-0.13
RFYPW	3.08	3.00	5.50	0.21	0.05
GOVDEF	-7.03	-7.00	-11.81	-0.67	-0.11
LANDRENT	-14.82	-14.56	-34.38	-0.55	-0.09
	30-30-30	TP	ARP	EEP	TMQ
	- - - BILLION $ DIFFERENCE FROM BASE - - -				
RGDP	6.47	6.5	5.99	0.59	0.11
FPE	-9.04	-8.99	-15.76	-0.81	-0.12
CCCE	-2.98	-3.04	-9.54	-0.43	-0.06
BOT	-1.88	-1.63	0.85	-0.27	-0.17
GOVDEF	-10.16	-10.11	-17.06	-0.98	-0.16

Comparing real GDP change across experiments shows that reducing internal support is key to acheiving the most efficient pattern of resource allocation and the largest economywide gains. When internal support is reduced by 30 percent, either as part of the 30-30-30 package, by solely choosing the target prices ("TP"), or by finding the optimal ARP rates ("ARP"), real GDP increases by $6 billion or more. The export support and import protection appear to be insignificant distortions, in that reducing either leads to very small changes in real GDP, farm program expenditure, deficits, or the overall balance of trade. The only case in which the unilateral U.S. adherence to the 30-30-30 proposal allows the U.S. to improve it's balance of trade (BOT) is when ARP rates are determined endogenously. The acreage reduction program is clearly shown to reduce U.S. exports, since terminating it by dropping ARP's to zero gives rise to increased U.S. export activity.

Conclusions

Resolution of the Uruguay Round of the GATT hinges on an agreement on

agriculture. The FPGE-WP computable general equilibrium (CGE) model of the United States has been applied to analyze unilateral compliance with the "30-30-30 Proposal" which calls for a 30 percent reduction in aggregate internal support, tariffication and a 30 percent reduction of border protection, and a 30 percent reduction in export subsidies. A key feature of this proposal and the model is that participation in the programs may vary.

The main implications are that economywide real GDP could increase by $6 billion, real farm income per FTE could rise by 3 percent, while returns to cropland fall by 15 percent. This pattern arises because labor, capital and land can be more efficiently reallocated out of some agricultural activities and into non-farm sectors. It is notable that although the 30-30-30 Proposal falls 70 percent short of complete liberalization, the estimated economywide gains are only 36 percent lower than previously estimated gains of complete unilateral liberalization.

Other scenarios are run to identify the most potent features of the 30-30-30 Proposal for the United States. The implications are that internal support in the United States is the most costly and distortionary, while the border measures and export subsidies are relatively insignificant. The acreage control contingencies are clearly shown to interfere with rather than promote U.S. export activity. Finally, although the unilateral U.S. results show gains, multilateral liberalization would probably allow for more significant gains due to the probable competitiveness of U.S. farm product exports.

Even under partial liberalization, the sectors expected to draw the most labor are investment-good producing sectors such as construction, as long as the program savings reduce the government deficit and allow increased investment. These results correspond *qualitatively* with all other CGE analyses of liberalization under the GATT.

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