Nonfarm Prospects Under Agricultural Liberalization

Maureen Kilkenny

Abstract. What does the United States stand to gain from liberalizing international trade in agriculture? This article estimates potential dollar gains and simulates the relocation of workers out of agriculture and into nonfarm activities. Different nonfarm sectors would expand under three cases of macroeconomic adjustment to the change in farm policies. The benefits of full liberalization would arise largely from the implied reduction in the Federal budget deficit. The greatest benefits would result if in addition to liberalization, macroeconomic policies that stimulate investment or net exports were pursued.

Keywords Liberalization, nonfarm employment, computable general equilibrium modeling

Budget pressures, the new farm bill, and the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) have fueled debate on how liberalizing agriculture will affect the United States. Does farm sector activity indeed raise the gross national product (GNP), particularly when subsidies add to the government budget deficit? If the United States liberalizes agriculture but reduces farm employment, could these farm workers be employed more efficiently in other sectors?

This article presents estimates of the efficiency and employment implications for the nonfarm economy of complete multilateral agricultural liberalization under three plausible macroeconomic adjustment scenarios. Relative to 1986 (the latest year for which enough detailed data were available), multilateral agricultural liberalization may allow for real GNP gains of $4.5 billion in the United States because about 200,000 full-time workers will move from farming to nonfarm sectors. Since the gains from freer trade and markets are achieved by a reallocation of economic resources, an economywide computable general equilibrium (CGE) model is appropriate for simulating reallocation and estimating possible gains. The simulation analyses indicate that benefits from multilateral liberalization have less to do with removing the policy distortions than with reducing the government deficit.

Agricultural liberalization is a catchall term meaning complete market orientation, which implies the termination of coupled farm income support, government stockpiling to support prices, restrictions on imports, all export enhancement programs, and restrictions on participants' land use. Liberalization is multilateral when all other countries also end domestic support that affects trade, import protection, and export subsidies.

Previous multilateral and CGE analyses of liberalization found different comparative-static economywide gains for the United States. The Walrasian CGE model (4) was used to estimate that real output in the United States could increase by 0.1-0.2 percent under unilateral liberalization (18). This gain is $7.4 billion relative to the 1986 real GNP of $3.7 trillion. The Static World Policy Simulation (SWOPSIM) multilateral model estimated nominal GNP gains, relative to 1986, of about $9 billion (21). Robinson, Kilkenny, and Adelman used a nonlinear Walrasian CGE model to estimate real GNP gains of about $10 billion relative to 1991 for multilateral liberalization (19). Hetzel, Thompson, and Tsitas used a log-linear CGE model to estimate that unilateral liberalization could result in a $6.6-billion nominal GDP reduction but in a real domestic income gain of $5 billion relative to 1982 (6).

Previous estimates may be biased, however, because of how factor supplies or government budgets are modeled. In most previous models, liberalization was simulated by assuming or imposing that farm program spending changes would not affect the government budget. For the WALRAS experiments, household income tax rates were allowed to fall in order to hold the government budget deficit constant. The SWOPSIM multimarket model does not model the government explicitly. Hetzel, Thompson, and Tsitas assumed that saved revenues are redistributed back to households (6). Only Robinson, Kilkenny, and Adelman allowed both the savings and the tax revenue increases to reduce the U.S. government budget deficit, 1 used the same approach for this article.

There are two possible paths of adjustment when the government budget deficit declines through saved farm program expenditures (13). In the first, more savings may be available for private domestic investment. Factors of production would be pulled into the investment goods-producing sectors. In the second, foreign capital investment may fall, which is consistent with the behavior of foreign investors who respond to a reduction in U.S. interest rates (and the value of the dollar) as government borrowing falls. Decreased foreign capital inflows would reflect a reduced trade defi-

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The reallocation of labor across sectors can change GNP simply because labor productivity and wages differ across sectors. These differences are due, in part, to variations in labor-augmenting capital across sectors (10), and because some sectors are willing to pay higher real wages to elicit higher productivity (14, 15). These two factors are interrelated because workers in capital-intensive industries are generally paid higher wages (5, p 78).

There are three ways to handle the observed variations in factor returns across sectors in CGE models. One approach, possible in all types of models, is to assume that these differentials are due entirely to immobility and to impose this assumption on the model. The other two ways allow for mobility but link the observed differences to the factor or to the sector. The former approach uses economywide data on compensation paid to the factor and quantity employed to calculate the economywide rate of return (22). Then the number of units of average return-earning factors employed by each sector is imputed as the compensation paid divided by the economywide average return, which associates the variations across sectors with the factors. The latter approach calculates sector-specific returns to each factor and then the proportional divergences paid by each sector from the economywide average return (WFDIST, see "Nominal flow parameters," app 1). The result associates the variations in factor returns with the sectors, which is consistent with the efficiency wage hypothesis and empirical evidence on the United States (16). This article relies on a version of the model in (19) which associates the variations in labor productivity with the sectors.

Another problem with previous CGE analyses concerns land supply. Total land available was assumed exogenous and fully employed. Liberalization entails removing set-aside constraints on land use. This was modeled by imposing that acreage once set aside would come back into production. This would necessarily increase real output. Furthermore, because land substitutes for labor, capital, or other inputs, estimates of outmigration of the other factors of production may be overstated.

Hertel, Thompson, and Tsagas modeled overall land supply inelasticity while allowing for elastic supplies of land for any one particular use (8). They detailed the farm sectors and specified a range of alternative uses of land, such as for crop production or pasture. Set-aside restrictions are modeled as ad valorem equivalents. This modeling specification may simulate the conversion of grain acreage, for example, into grazing land (8, p 269). A simple version of this assumption, which can be applied in models where the farm sectors are aggregated, is to distinguish cropland from total land supply; then simulate the levels of cropland use to maximize producer profits. Cropland use is thus endogenous but less than or equal to total available arable land supply, which is inelastic. I applied that approach.

CGE models are good tools for estimating the economywide impacts of sector-specific policies because farm policies, interindustry linkages, market distortions in the nonfarm economy, and the government and trade budgets are all explicit. I used the CGE model to replicate the pattern of production, employment, prices, income, and other variables in the U.S. economy in 1986 with the farm policies in place to provide a benchmark, then conducted experimental simulations. I calculate the influence of a policy as the difference between the simulation of the economy given the change and the benchmark solution.

Multilateral liberalization is simulated under three plausible macroscenarios. In the first scenario, called transfer, government expenditures on farm programs are redistributed as transfers to households (equal to providing decoupled income support or reducing household income taxes), so that there is no change in the government deficit or aggregate savings.

In the second, the invest scenario, the Federal Government's farm program expenditures are saved, reducing the deficit. More funds are available for domestic private investment (1). Since this is a shift between public and private domestic use of loanable funds, rather than a change in supplies or demands for funds, the rate of interest (exogenous) remains unchanged.

In the third scenario, the balance of payments (BOP), the demand for loanable funds declines because of the government budget deficit reductions. Although no asset markets exist in the CGE model, interest rates clearly could fall. The exchange value of the dollar would fall, foreign capital inflows would decline, and the current account balance would improve. The polar case of complete capital inflow offset is modeled by reducing foreign capital by the same amount as the reduction in the government deficit. The depreciation of the dollar is endogenously determined in the model, given this change in the balance of payments.

The discussion of these scenarios focuses on employment patterns and output in the nonfarm economy. This article reports which sectors displaced farmers would move to to achieve the optimal longrun pattern of resource allocation. The three patterns reported correspond to the three possible macroscenarios. The discussion provides a point of departure for the important task of quantifying adjustment costs. Farm sup-
port policies are “inextricably intertwined with the problem of factor market adjustment” (7, p. 4) Adjustment costs will depend on how much it costs to relocate, how much of farm skills are useful in nonfarm jobs, or how much retraining costs. Factor market adjustments to farm policy changes are also intertwined with monetary and fiscal policies, because these policies determine the sectoral composition of aggregate demand.

The Model Assumptions

A version of the 10-sector USDA/ERS CGE model of the United States is used to conduct the experiments (20) (See (12) for an explanation of the farm program modeling.) The 10-sector model explicitly simulates only the five major U.S. farm policies — deficiency payments, loan and stocking programs, export enhancement, import quotas, and acreage restrictions. Since the 10-sector model generates the same overall real GNP level, pattern, and macroeconomic results as the 30-sector model (which disaggregates the food and fiber system more finely), it is just as useful and more clear as a model of the nonfarm economy. Appendix I shows the main model equations and parameter values.

The model distinguishes three agricultural sectors (dairy and meat, grains and oilseeds, and other agriculture), five industrial sectors (light consumer goods, basic intermediates, capital goods, construction, and electronics), and two service sectors (trade and finance, and other services) (app. 2).

The relevant differences among the sectors for these experiments are the character of demand facing the sector, the capital/labor ratio, and the factor returns in the sector relative to average returns (tables 1 and 2). These are the relevant differences because they indicate how policy changes influence employment. First, labor will move to sectors favored in the particular macroeconomic aggregate demand adjustment scenario. Second, and all else equal, labor will move to more labor-intensive or high-productivity sectors. And, because productivity differs across sectors, these movements will spawn variations in estimated GNP across scenarios even though primary factor supplies change little.

The horizontal rows in table 1 show the character of demand. The dairy and meat sector has little to do with trade under the existing policies. Only 0.3 percent of that sector’s output is exported, and imports constitute less than 1 percent of domestic sales. Final consumer demand equals 8.9 percent of the dairy and meat sector’s output, which consists mainly of intermediate goods processed into light consumer goods. Grains and oilseeds are also intermediate goods (66 percent relative to output), but export demand accounts for 18.4 percent of the output from the farm.
distortions in the labor market. Labor appears most productive in the basic intermediate goods, capital goods, and construction sectors. Any changes that provoke labor to move out of agriculture will bring about an improvement in economywide productivity and an increase in GNP as typically measured. The source of the measured increase in GNP is known as a "composition effect." The final column in Table 2 indicates that the first two farm sectors are relatively capital-intensive. The relatively labor-intensive sectors are agriculture, light consumer goods, capital goods, construction, electronics, and trade and finance.

For CGE models, these data represent general equilibrium. Wages and rents are endogenously determined to clear factor markets throughout the economy. The contributions of sector-specific productivities, factor market rigidities, and risk to relative factor returns, however, are held exogenous across sectors in all experiments. The assumed Cobb-Douglas production technology rules out any factor-intensity reversals. All else equal, labor released from agriculture will move to sectors where it is paid for being most productive or used relatively intensively.

### Real GNP Under Multilateral Liberalization

The basic liberalization experiment consists of dismantling import protection policies, constraints on land use, and terminating the $26 billion spent on farm income and price supports. Liberalization in other countries is modeled by using estimates of world price and trade changes from the SWOPSIM global agricultural sector model to update import demands and export supplies to the rest of the world, variables that are exogenous to this model.

Liberalization is simulated assuming sectoral mobile labor and immobile capital and endogenous land supply. When the restrictions on land use end, a level of cropland demand is chosen to maximize profit from production, while a level of cropland supplied is chosen to maintain the rate of return to cropland. This procedure assumes a perfectly elastic longrun supply of cropland, which may be converted to pasture. Given this mix of assumptions about factor mobility, the solutions represent medium-run to longrun equilibria.

The SWOPSIM model (and all global models) estimates that multilateral liberalization enhances demand for U.S. grains and oilseeds, causing an increase in world prices which is passed on to the U.S. market price. The domestic price increase mitigates, but does not fully offset, the effects of lost income and price supports on net revenue from production. The overall impact is a downsizing of gross returns to labor, capital, and land in agriculture. The main farm sector adjustments are that land supplied for crop production diminishes and some labor moves out of the farm sector.

The magnitude of economywide efficiency gains from liberalization depends critically on the macroeconomic adjustment to the change in farm program expenditures. Figure 1 and Table 3 present the simulated changes in economywide real GNP, by aggregate sectors and overall, for each of the three macroscenarios. The fourth bar in each set of Figure 1 indicates the change in real (constant 1982 dollar) GNP for each scenario.

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### Table 2—Sector contribution to value added, real GNP, relative factor returns, and relative factor intensity

<table>
<thead>
<tr>
<th>Sector</th>
<th>Value added</th>
<th>Gross output</th>
<th>Rents</th>
<th>Wages</th>
<th>Capital/labor ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy and meat</td>
<td>0.30</td>
<td>1.20</td>
<td>121.2</td>
<td>58.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Grains and oilseeds</td>
<td>95</td>
<td>1.18</td>
<td>105.1</td>
<td>43.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Agriculture</td>
<td>77</td>
<td>7.8</td>
<td>78.0</td>
<td>56.3</td>
<td>6</td>
</tr>
<tr>
<td>Agricultural results</td>
<td>2.02</td>
<td>3.16</td>
<td>106.1</td>
<td>53.7</td>
<td></td>
</tr>
<tr>
<td>Light consumer goods</td>
<td>6.94</td>
<td>10.90</td>
<td>223.3</td>
<td>99.6</td>
<td>4</td>
</tr>
<tr>
<td>Basic intermediate goods</td>
<td>9.94</td>
<td>13.84</td>
<td>155.8</td>
<td>138.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Capital goods</td>
<td>5.07</td>
<td>8.37</td>
<td>59.7</td>
<td>145.4</td>
<td>4</td>
</tr>
<tr>
<td>Construction</td>
<td>4.94</td>
<td>7.31</td>
<td>204.1</td>
<td>142.4</td>
<td>2</td>
</tr>
<tr>
<td>Electronics</td>
<td>1.94</td>
<td>2.26</td>
<td>84.6</td>
<td>77.9</td>
<td>2</td>
</tr>
<tr>
<td>Industrial results</td>
<td>28.83</td>
<td>42.68</td>
<td>154.1</td>
<td>126.8</td>
<td></td>
</tr>
<tr>
<td>Trade and finance</td>
<td>16.85</td>
<td>14.47</td>
<td>128.6</td>
<td>96.2</td>
<td>4</td>
</tr>
<tr>
<td>Other services</td>
<td>52.30</td>
<td>39.69</td>
<td>86.1</td>
<td>91.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Services results</td>
<td>69.15</td>
<td>54.16</td>
<td>90.1</td>
<td>93.8</td>
<td></td>
</tr>
<tr>
<td>Economywide results</td>
<td>100.00</td>
<td>100.00</td>
<td>100.0</td>
<td>100.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Value added is added value by sector. Value added in constant (1982) dollar terms. Rent and labor cost shares are rates of return to productive capital by sector expressed as the percentage ratio to the economywide average. Wages are rates of return to labor by sector as a percentage ratio to the economywide average wage.

Source: Model solution for 1986 benchmark.

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4The simulation results are robust with respect to various homogeneous technology specifications. This is because the substitutability between primary factors of production is moot as long as relative factor prices do not change. Since agriculture is a small employer of labor, and cropland supply is modeled as elastic at prevailing land prices in the long run, even a drastic reduction in the demand for primary factors in agriculture will not affect longrun relative factor prices or cost shares.

5For discussions on the farm sector price, quantity, and income effects of unilateral or multilateral liberalization, see (2, 8 21).
Under the *transfer* scenario, agriculture and industry contract, services expand, and overall GNP climbs slightly. If unspent farm program money is not saved, there are insignificant economywide gains of $90 million real GNP (relative to a $4,000-billion economy). The farm program money, when saved, can be either invested domestically (*invest*) or allowed to offset foreign capital investment (BOP). In both the *invest* and BOP scenarios, real GNP increases $3.3 billion and $4.5 billion (1982 dollars), respectively, demonstrating the importance of reducing the government deficit. Multilateral liberalization of agriculture alone is not the most important policy prescription for real economic growth.

Why is it that real GNP barely improves when farm program savings are withheld from reducing the deficit? There are two interrelated reasons. First, the income transfer part of the policy change simply substitutes one class of consumer demand (from farm households) for another (from taxpayers, which includes farm households). Thus, the composition of aggregate demand remains the same under the *transfer* scenario. Final consumer demand is largely for services (note the pattern in CLES, in app 1). Second, since productivity in the service sector is generally below average but higher than in agriculture (table 2), overall GNP improves only slightly as labor moves from agriculture to services.

Efficiency gains are much higher under the *invest* and BOP scenarios because of the type of final demand stimulated. The construction and capital goods sectors expand. Labor generates relatively high real output in the sectors that supply investment goods. This shift of labor to higher productivity uses has a positive composition effect on real GNP.

The most balanced pattern of nonfarm expansion is under the BOP scenario. The real depreciation associated with the change in the balance of payments stimulates U.S. exports, which are produced by a variety of sectors including grains and oilseeds, capital goods, and electronics. To meet the demand, more land is kept in grain and oilseed production, and labor moves to the capital goods sector. Labor productivity appears quite high in the capital goods sector. These two patterns of resource use account for the relatively large real GNP gains.

The BOP scenario provides the highest overall economywide gains of about $4.5 billion by terminating about $26 billion in farm program expenditures. The implication is that for every $100 of deficit-reduction savings due to ending farm programs and reducing the trade deficit, the economy gains $17.20 of additional real GNP.
Employment Patterns Under Multilateral Liberalization

The pattern of employment under liberalization is very sensitive to the macroscenario (fig. 2). Sectoral employment changes differ across the three macroscenarios. In each case, labor moves out of the agricultural and light consumer goods (food and feed processing) sectors. The longrun assumption of full employment means that all displaced farmers are reemployed elsewhere in the economy, a relocation that results in real GNP gains.

Why and where do factors relocate? Liberalization pushes labor out of agriculture because farm value added falls. Most of the program crops are in the grain and oilseed sector, and these sectors contract when subsidies are eliminated. The reduced supply raises farm-level market prices well above market prices under the programs. The higher grain and oilseed market prices ease the strain on crop sectors but hurt livestock sectors. High feed crop prices mean increases in intermediate costs in the dairy and meat sector. Since the rise in intermediate costs exceeds the increase in market price, value added declines. This reduces the sector’s return to labor, so labor moves elsewhere and dairy and meat sector output contracts.

Liberalization’s effect on employment among agricultural sectors, however, depends only slightly on the macroscenario. As noted above, the grain and oilseed sectors retain more resources under the BOP assumptions because export demand is strong. Foreign demand strengthens farm market prices so much that value added per unit of grain output after multilateral liberalization is only 4 percent lower than in the base year, according to our model. That suggests that domestic farm market prices rise almost enough under multilateral liberalization to offset the loss of large deficiency payments and price supports.

Farm price increases are costly to some nonfarm sectors. Increases in market prices for agricultural products are passed on to the food processing industries in the light consumer goods sector as higher costs for intermediate goods, squeezing value added in the light consumer goods sector. Multilateral liberalization pushes 101,000 full-time equivalent workers (under the invest scenario) out of the light consumer goods sector (fig. 2).

Figure 2

Relocated full-time equivalent workers across sectors under multilateral liberalization under three macroeconomic scenarios

<table>
<thead>
<tr>
<th>Sector</th>
<th>Transfer</th>
<th>Invest</th>
<th>BOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy and meat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grains and oilseeds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other agriculture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light consumer goods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic intermediate goods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital goods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade and finance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thousands

0 40 80 120 160 200 240

38
Labor moves to capture relative wage gains in the growing sectors, which are determined by the macroeconomic policies concomitant with liberalization. Under the transfer scenario, most displaced labor moves to services. Construction and capital goods industries are favored under the invest scenario because these sectors supply investment goods. These labor-intensive industries provide a strong pull to reemploy agricultural labor, so that there are almost 20 percent more job changes under the invest scenario than under the BOP assumptions.

The basic intermediate goods and electronics manufacturing sectors are favored under the BOP scenario. These are important import-competing sectors, and the depreciation improves their competitiveness by making imports appear more expensive in dollar terms. These sectors also display high labor productivity. The expansion of these high-productivity sectors explains the larger real GNP gains under the BOP scenario. The gain equals about $17,700 in additional real output per worker who changes jobs, the most optimistic estimate among the three macro scenarios.

An important determinant of adjustment costs is the number of job changes required to reach the new equilibrium. The high number of job changes (309,000) economywide required for an optimal allocation under the invest scenario may mean higher adjustment costs than for the BOP or transfer scenarios. The lowest number of job changes (253,000) economywide is required for the BOP scenario. The model predicts that 175,000-208,000 workers are expected to leave agriculture simply due to changes in policy during the 5-10-year liberalization period. The simulations do not include estimates of the changes in agricultural employment from causes other than agricultural liberalization such as technical change. For example, forces not modeled here induced 279,000 workers to leave agriculture between 1980 and 1985, even with farm programs.

Conclusions

Agricultural liberalization would likely benefit the economy, and certain nonfarm sectors may expand under multilateral termination of farm support programs. The analysis suggests that agricultural support programs have been a drag rather than a stimulus on GNP, especially given the Federal budget and trade deficits. Terminating programs multilaterally may allow the United States to benefit from real GNP gains of $4.5 billion (1982 dollars).

In 1986, the United States spent $31.4 billion on farm programs. Liberalization concomitant with government deficit reduction would not only save that amount but would also generate $3.25-$4.48 billion of additional real GNP. If we ignore the crowding out due to deficit spending, liberalization would generate $0.09 billion of real GNP. This suggests that deficit spending is much more costly in terms of GNP forgone than farm programs.

This analysis shows that the government budget deficit did more to retard general economic growth than the 1985 farm bill, even in the peak farm program spending year of 1986. Deficit spending stimulates GNP when there is unemployment, but stimulates currency appreciation and trade deficits when the economy is fully employed (as in the recent past). The corollary multilateral liberalization alone provides small overall benefits. If farm policy is liberalized, but the farm program savings are simply redistributed to households, the gains are insignificant. Only when the savings reduce the government budget deficit do significant gains occur.

The analysis relative to 1986 must be re-interpreted for the 1990’s. The government budget deficit continues high, but unemployment has also been increasing. Thus, the effects of liberalization in the 1990’s would probably be lower than the effects estimated relative to 1986. Real GNP gains due to liberalization may approach $1.25-$1.72 billion (constant 1982 dollars).

In the long run, agricultural liberalization will likely cause relocation of up to 208,000 workers from the farm sector and up to 101,000 from the food and fiber sectors to industry and/or service sectors. If liberalization occurs with real currency depreciation, the trade sectors may offer more employment opportunities. Barring depreciation, the reduced Federal budget deficit should spur private investment demand, stimulating employment in construction and other capital goods sectors.

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Appendix 1—CGE model

Indices $i = \text{sector}, f = \text{factor}, \text{hh} = \text{household}, \text{inst} = \text{institution}$

<table>
<thead>
<tr>
<th>Market quantity</th>
<th>Market price</th>
</tr>
</thead>
<tbody>
<tr>
<td>$FE_i$</td>
<td>Factor employment</td>
</tr>
<tr>
<td>$X_f$</td>
<td>Composite good supply</td>
</tr>
<tr>
<td>$XD_f$</td>
<td>Domestic output</td>
</tr>
<tr>
<td>$XXD_f$</td>
<td>Domestic sales</td>
</tr>
<tr>
<td>$E_i$</td>
<td>Exports</td>
</tr>
<tr>
<td>$M_i$</td>
<td>Imports</td>
</tr>
</tbody>
</table>

**Demand**
- $CD_f$: Final demand for private consumption
- $DK_f$: Final demand for fixed investment
- $DIST_f$: Inventory investment by sector
- $GD_f$: Final demand for government consumption
- $GDOT_f$: Aggregate real government consumption
- $ID_f$: Final demand for investment goods
- $INT_f$: Intermediate input demand

**Income/expenditures**
- $PVA_i$: Value added per unit output
- $DEPRECIA$: Total depreciation charges
- $ENTSAV$: Enterprise savings
- $ENTTAX$: Enterprise tax revenue
- $FBOR$: Net foreign borrowing
- $FXDIV$: Fixed capital investment
- $FSAV$: Foreign savings
- $GENT$: Transfers to enterprises
- $GOVSAT$: Government savings
- $GR$: Total government revenue
- $HHSAV$: Total household savings
- $HHT$: Transfers to households
- $INDTAX$: Indirect tax revenue
- $INVEST$: Total investment
- $NETSUB$: Total export subsidies
- $REMIT$: Net remittances
- $SAVINGS$: Total savings
- $SSTAX$: Social security revenue
- $TARIFF$: Tariff revenue
- $TOTHITAX$: Household tax revenue
- $YF_i$: Factor income
- $YH_i$: Household income
- $YINST_i$: Institutional income

**Policy instruments**
- $DEFPAY$: Deficiency payments
- $ITAX$: Indirect business tax rate
- $PIE$: Producer incentive equivalent
- $PL$: Loan rate
- $QR$: Import quota
- $TE_i$: Ad valorem export subsidy rate
- $TM$: Ad valorem tariff rate
- $TMQ$: Quota premium (domestically received)
- $TP$: Target price
- $XP$: Program participating output
- $XS$: Commodity stocks

**Economywide variables**
- $EXR$: Exchange rate
- $PINDEX$: Price index
- $FS_i$: Factor supplies
- $RGNP$: Real gross national product

**Parameters**

**Supply**
- $\alpha_i$: Factor share in value added
- $AD_i$: Production function shift
- $AT_i$: Supply shift
- $\gamma$: Export share parameter in CET supply
- $IO_{ij}$: Input-output coefficients
- $\eta$: Export-domestic transformation in CET exponent

**Demand**
- $AC_i$: Demand shift
- $CLES_{ih}$: Expenditure share
- $GLES_i$: Government expenditure share
- $\delta_i$: Import share parameter in CES demand
Demand
\( \sigma \) Import-domestic substitution elasticity
\( \rho \) CES exponent = \( 1/1+\sigma \)
\( E_{00} \) Foreign demand shift
\( \varepsilon \) Foreign demand elasticity
\( \delta \) CCC stockpiling parameter
\( IMAT_{ij} \) Capital composition coefficients

Nominal flows
\( WFDIST_{it} \) Proportion of sector to average
\( SINTY_{hh,ms} \) Household share of net income
\( MPS_{hh} \) Household savings rate
\( HTAX_{hh} \) Household income tax rate

Selected parameter values

<table>
<thead>
<tr>
<th>Sector</th>
<th>( \eta )</th>
<th>( \gamma )</th>
<th>( \sigma )</th>
<th>( \delta )</th>
<th>( \varepsilon )</th>
<th>( CLES_i )</th>
<th>( GLES_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy and meat</td>
<td>3</td>
<td>0</td>
<td>01</td>
<td>4</td>
<td>0</td>
<td>26</td>
<td>3</td>
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<tr>
<td>Grains and oilseeds</td>
<td>1</td>
<td>3</td>
<td>43</td>
<td>4</td>
<td>0</td>
<td>18</td>
<td>3</td>
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<tr>
<td>Other agriculture</td>
<td>1</td>
<td>5</td>
<td>16</td>
<td>4</td>
<td>0</td>
<td>40</td>
<td>3</td>
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<tr>
<td>Light consumer goods</td>
<td>1</td>
<td>5</td>
<td>17</td>
<td>2</td>
<td>0</td>
<td>21</td>
<td>(-)</td>
</tr>
<tr>
<td>Basic intermediate goods</td>
<td>1</td>
<td>5</td>
<td>21</td>
<td>7</td>
<td>50</td>
<td>07</td>
<td>(-)</td>
</tr>
<tr>
<td>Capital goods</td>
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<td>5</td>
<td>30</td>
<td>7</td>
<td>50</td>
<td>07</td>
<td>(-)</td>
</tr>
<tr>
<td>Construction</td>
<td>1</td>
<td>7</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Electronics</td>
<td>1</td>
<td>5</td>
<td>28</td>
<td>1</td>
<td>1</td>
<td>25</td>
<td>(-)</td>
</tr>
<tr>
<td>Trade and finance</td>
<td>2</td>
<td>7</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Other services</td>
<td>2</td>
<td>7</td>
<td>01</td>
<td>5</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
</tbody>
</table>

\* = very close to zero \(-\) = not applicable \( CLES_i \) and \( GLES_i \) each sum to 100 percent

Equations:

**Domestic farm programs**
\[ DEFPAY = (TP-PL) \times P \]
\[ XS = XSO + XSO (PX/PL) \]
\[ PIE = (DEFPAY + (PL-PX) XSO)/XD \]
\[ PVA_i = PX_i (1-ITAX_i) - \Sigma_i IO_{i,j} + PIE_i \]

**Production, factor demand, and supply**
\[ XD_i = AD \times I_i \times FE_{it}^{\gamma f} \]
\[ WF_t, WFDIST_{it} = \alpha_{i,t} PVA_i \times XD_i \]
\[ INT_i = \Sigma_i IO_{i,j} \times XD_j \]
\[ XD = A \times [\gamma E^{\gamma} + (1-\gamma) \times XXD^{\gamma}]^{1/\gamma} \]

**Demand**
\[ ID_i = \Sigma_i IMAT_{ij} \times DK_i \]
\[ CD_i = [\Sigma_{hh} CLES_{hh} (1-MPS_{hh}) \times YH_{hh} (1- HTAX_{hh})]/P_i \]
\[ GD_i = GLES_i \times GDTOT \]
\[ X = AC \times [8 \times M \times + (1-\delta) \times XXD^{\delta}]^{1/\delta} \]

**Trade and trade policies**
\[ M/XXD = [PD/PM \times 8/((1-\delta))^{\delta}]^{1/(1+\rho)} \]
\[ E/XXD = [PE/PD \times (1-\gamma)/\gamma]^{1/\gamma-1} \]
\[ E = E00 \times (PE/EXR (1+TE))/PWE \]
\[ PM = EXR \times PWM (1+TM+TMQ) \]
Nominal flows
\[ Y_{F,t} = \sum WF_t, WFDIST_t, FE_{t,t} \]
\[ YINST_{labor} = YF_{labor} - STAX \]
\[ YINST_{proprietor} = YF_{land} - FRETAX \]
\[ YINST_{capital} = YF_{capital} + GENT - ENTSAV - ENTTAX - DEPRECIA \]
\[ YH = \sum (SINTYH_{labor} + \text{YINST}_{proprietor}) \]
\[ GR = \text{TARIFF} + \text{FRETAX} + \text{INDTAX} + \text{TOTHHTAX} + \text{SSTAX} + \text{ENTTAX} + \text{FBOR EXR} \]
\[ GOVSAV = GR - [\sum (\text{PD}_t, \text{GENT} + \text{HHT} + \sum \text{PIE}_t, \text{XD}_t)] \]
\[ SAVINGS = \text{HHSAV} + \text{GOVSAV} + \text{DEPRECIA} + \text{FSAV EXR} + \text{ENTSAV} \]

Market clearing
\[ FS_t = \sum \text{FE}_{t,t} \]
\[ PX = PD XXD + \text{PM}_M \]
\[ PX XD = PD XXD + \text{PE}_E \]
\[ X = \text{INT} + \text{CD} + \text{GD} + \text{ID} + \text{DST} \]
\[ \sum \text{PWM}_M, = \sum \text{PWE}_E, + \text{FSAV} + \text{REMIT} + \text{FBOR} \]
\[ \text{SAVINGS} = \text{INVEST} \]

Appendix 2—Sector aggregation

<table>
<thead>
<tr>
<th>Sector</th>
<th>Major industries</th>
<th>BEA industry classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy and meat</td>
<td>Milk, eggs, meat animals, poultry</td>
<td>1-1 03</td>
</tr>
<tr>
<td>Grains and oilseeds</td>
<td>Wheat, corn, rice, soy, cotton, peanuts, flax</td>
<td>2 01, 2 0201-2 0203, 2 06</td>
</tr>
<tr>
<td>Other agriculture</td>
<td>Sugar, tobacco, fruits, vegetables, nuts, other</td>
<td>2 03, 2 04-2 0503, 2 07, 3 0, 4 0</td>
</tr>
<tr>
<td>Light consumer goods</td>
<td>Food and kindred products, leather, footwear, feed, textiles, apparel, furniture, containers, printing</td>
<td>14-26, 33-34</td>
</tr>
<tr>
<td>Basic intermediate goods</td>
<td>Mining, petroleum, chemicals, plastic, rubber, glass &amp; stone, iron &amp; steel, fabricated metals</td>
<td>5-10, 27-32, 35-42</td>
</tr>
<tr>
<td>Capital goods</td>
<td>Munitions, engines, machinery, communications, trucks, motor vehicles, some electrical</td>
<td>13, 43-50, 52-54, 56 03</td>
</tr>
<tr>
<td>Construction</td>
<td>Private &amp; government construction</td>
<td>56 04, 57 03, 59-61</td>
</tr>
<tr>
<td>Electronics</td>
<td>Office equipment, household appliances, semiconductors, equipment, miscellaneous electronics, TV, radio, other</td>
<td>11-12</td>
</tr>
<tr>
<td>Trade</td>
<td>Wholesale and retail trade, banking and insurance</td>
<td>51, 55, 56 01-56 02, 57-57 02, 58, 62-64, 81, 84-85</td>
</tr>
<tr>
<td>Services</td>
<td>Real estate, services, noncomparable imports, transportation, and government</td>
<td>69-70</td>
</tr>
</tbody>
</table>

Poking Around Rural America with an Expert Guide


Reviewed by Sonya Salamon

Let's face it. Demographers write useful papers, but the prose involved in reporting numbers is typically not very engaging. A singular exception has been Calvin L. Beale who, during a career spanning almost 40 years as a demographer with the U.S. Department of Agriculture, has, with style and grace, produced oft-cited papers and books that track rural peoples and places. It is no accident that newspaper reporters, in particular, seek Beale out. He always rewards them with a pithy and quotable aphorism that succinctly captures the human story of changes within the populations, the small towns, and the economy of rural America. Seldom can a highly respected professional in a field also speak to the general public in words easy to understand. Beale, however, reads the census like a novel and translates the plot into well-turned phrases that are highly informative and jargon-free. His ability to do this derives from his uncanny encyclopedic knowledge of rural geography, history, and demography and a gift for synthesizing these data, enabling him to place new numerical facts in the appropriate spatial, economic, and social context.

Due to his position as a government demographer, Beale's work has more often appeared as congressional testimony, talks, or Economic Research Service reports than in the more easily accessible form of academic journal articles.

Thus, Morrison, the editor, performs a commendable service by gathering together gems by Beale that, while published, would require real detective work to uncover. Such papers might have remained fugitive documents had Morrison not included them in this volume. Of particular interest is a sprinkling of Beale's field notes, written in conjunction with his "busman's holidays" throughout the nation's countryside. Beale devotes these travels, during which he has visited half of the 2,400 nonmetropolitan counties in the country, to poking about in cafes, cemeteries, churches, and towns. He interviews people or makes observations about the remnants of the past, such as abandoned buildings or the transition from German to English on tombstones, or such changes as community newcomers that tell the human story behind the census record of population fluctuations, persistence, or anomalies. Because of the relative obscurity and remoteness of rural populations in this vast country, emerging patterns and trends tend to escape the notice of all but the most astute observer. The field notes, while somewhat amusing, also reveal the deep respect Beale has for the uniqueness of local peoples. The book lacks, unfortunately, any examples of Beale's trademark courthouse photographs taken in each county seat he visits.

The book is divided into three parts and gathers a wide range of demographic issues. Two perspectives emerge in Beale's work. Policy issues tend to thread through the fabric that charts overviews of rural diversity, whether regional or topical. Beale keeps in mind the policymakers inside the Washington, DC Beltway as he describes important differences in issues, such as the growth of rural populations or poverty, differences that might escape the notice of those who do not travel the countryside and talk to people. The other focus is on a sequence of topics that has intrigued Beale by being odd or counterintuitive. Such issues have occupied him in his travels over the years and connected him with researchers in other disciplines. It was, for example, an interest in the variation of rural midwesterners' fertility that caused our paths to cross in the late 1970s, when Beale attended a presentation of mine on ethnic differences in Illinois farm-family land transfers.

Included in the book's first section are two of the regional issues that motivated Beale's investigative activities. Beale had noted and mapped a correspondence of high fertility, ethnicity, and religious affiliation among midwestern farmers. Verifying the origins of pockets of ethnic farmers required much digging. After immigration from Europe declined around the turn of the century, census reports, until 1980, did not provide accurate information about ethnicity. Beale observed that, after 1970, high rural fertility had shifted out of the South to the North-Central region, and he sought an explanation. Using county atlases of township plat maps, Beale demonstrated the close connection between the persistence of Catholic ethnic groups among farmers, for example, and high fertility in local enclaves. Most of the data are published here for the first time. This paper illuminates Beale's unique ability to combine historical and local sources to explain patterns no one else would have thought to consider important. Also included in the section is a little known paper, reprinted from a 1972 American Anthropologist article, that deals with obscure mixed-racial populations found primarily in the U.S. South who, in the terminology of the period, Beale described as "white-Indian-Negro." (p. 33) Beale locates a number of the groups, explains their origins, lists their many names, and comments on the chances of their
It is this paper that contains a prime example of the wit in Beale's work. After citing in his introduction the highly negative observations about the character of the Melungeon people, made by a woman who had lived among them, as "thieving," "untruthful," and "exceedingly immoral," Beale pens the comment "Miss Drumgoole was essentially a sympathetic observer."

The second section is devoted to Beale's work in characterizing the economic and demographic transformations of the 20th century. These selections are particularly illustrative of how Beale used his geographic knowledge to combat what he terms "Procrustean policy beds, of the one-size-fits-all variety— all too common in public affairs." The pieces gleaned from various book chapters, congressional testimony, and reports focus on the scheme Beale developed for characterizing the country by 26 subcultural regions, distinguished by variation in their settlement patterns, economic activities, environmental resources and constraints, and ethnic makeup. A second chapter is concerned with a continuing Beale interest—rural communities in the North-Central region. With the Federal Government's rural policy in mind, Beale shows that misconceptions abound about all rural communities "dying," and the effect of decline or stability where each occurs. Another selection of the amusing and interesting results of field trips closes out the section, illustrating Beale's essentially anthropological interest in a variety of southern minority groups.

In the third section, Morrison includes Beale's seminal 1975 article on the rural population revival of the 1970's that challenged many previously held assumptions about the country's migration and growth patterns. Because Beale personally knew the explanation for the growth in a particular area, he was able to show that no one cause explained this shift and that growth had not occurred evenly in all regions or even within regions. Another chapter elegantly sketches the sweeping changes in the farm population, with transformations in age patterns, family size, succession and migration, and why these changes have come about. Beale's more recent concern with the social geography of rural poverty is illustrated in two chapters that examine the relationship among natural resources, the rural economy, and particularly, persistent minority poverty. Showing the spatial relations of rural employment and natural resources in a series of county maps makes a striking impact not possible in a table. It illustrates Beale's ability to translate numbers into a short and pungent message.

The record of Beale's career provides evidence to those who rely only on macrodata for the value of on-site investigation. What is behind numbers is the reality of people who make the choices that generate trends. Beale's encapsulated record of rural America is well worth a read by anyone who is fascinated by the diversity and shared features of its past and present.