Distributional Effects of U.S. Farm Commodity Programs: Accounting for Farm and Non-Farm Households

Kenneth Hanson and Agapi Somwaru

Economic Research Service, U.S. Department of Agriculture
Contact: Kenneth Hanson, khanson@ers.usda.gov

Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Montreal, Canada, July 27-30, 2003.

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Introduction

The new agenda for the trade negotiations focuses on reducing agricultural support and protection in the areas of market access (tariffs and tariff-rate quotas), export competition (export subsidies), and domestic support (production subsidies and other trade-distorting support). The next round of trade negotiations launched in Doha, Qatar, in November 2001 put in place new conditions for the World Trade Organization (WTO) member countries. Agriculture in the United States enters these negotiations with commodity programs governed by the Farm Security and Rural Investment Act of 2002 (2002 Farm Act). This paper analyzes the distributional impacts of U.S. commodity programs involving price-contingent and lump-sum payments on U.S. farm and non-farm households. The analysis uses a highly disaggregated U.S. Computable General Equilibrium (CGE) model. In the model, farm household impacts occur through program effects on farm household income as well as farm sector output and commodity prices. Non-farm household impacts occur through taxes and the cost of food.

Farm households that receive commodity payments have striking differences in sales class, wealth, and dependence on off-farm income. The Economic Research Service of the U.S. Department of Agriculture (USDA-ERS) developed a typology that distinguishes farm households by these characteristics. We embodied this typology into a U.S. CGE model to capture some of the heterogeneity across farm households in responses and in outcomes generated by the commodity programs. Farm household responses have not been used as an indicator of policy effects. Typically, policy affects on commodity markets –prices, production, and trade- have been addressed with CGE models. Although traditional CGE models allow some heterogeneity in how relative price effects are felt across sectors, most models capture the effects of policy through a single representative household, and ignore how households decide to engage in labor markets, allocate income to current consumption or savings for farm and non-farm investments.

Given the detailed structure of the CGE model, with its inclusion of non-farm and farm households distinguished by the USDA-ERS farm household typology, we simulate the distributional effects from current U.S. farm policy relative to no policy under unilateral liberalization. Farm commodity programs under the 2002 Farm Act are expected to distribute to farm households an annual average $11 billion per year for the next five years to farm households. Our analysis explores the distributional impact from direct payments, counter-cyclical payments, and marketing assistance loans. A key issue

[1] Kenneth Hanson is Economist, Economic Research Service, U. S. Department of Agriculture. Agapi Somwaru is Economist, Economic Research Service, U. S. Department of Agriculture. Contact: Kenneth Hanson, khanson@ers.usda.gov. Date of paper is April, 2003

for measuring the distributional impact is whether the programs are modeled as a lump-sum transfer (decoupled) or a market distorting subsidy (coupled). Direct payments are decoupled and marketing assistance loans are coupled. Counter-cyclical payments are treated as decoupled in one scenario and coupled in another scenario. Our analysis examines the sensitivity of the distributional impacts to the alternative treatments of counter-cyclical payments.

The 2002 Farm Act is also expected to have distributional effects among farm households and non-farm households. Mid- and high-income non-farm households pay the taxes that finance the government payments. Taxes impose a burden on the taxpayer that leads to a welfare cost. To the extent that farm programs reduce farm prices and the lower commodity prices are passed onto consumers as lower food prices, non-farm households benefit. We assess the distributional impacts from program payments to farm households, from lower food costs to all households, and from tax payments and the efficiency cost of taxes to mid- and high-income households.

Background and Method of Analysis

The analysis uses a U.S. CGE model developed and maintained at USDA-ERS. The model supports comparative static analysis, and is rich in detailed specification of industry, labor, and households to allow for the distributional analysis. This section describes the model, farm commodity programs, and farm households.

U.S. CGE Model

A CGE model is an economy-wide computer simulation model that captures the economic interactions among households, producers, and government. Each of these economic entities has multiple roles and each interacts with all other entities. Households supply labor to production and consume goods and services using the income they have earned. In addition, they receive income from the ownership of capital, receive government transfer payments, save, and pay taxes. Producers make goods and services for the market, and use labor inputs as well as capital stocks and other goods. The government collects tax revenue and provides transfers and various public services to households.

Each of the economic entities in the model may be aggregated at different levels of detail, refining the model's specification and making it relevant for specific policy issues. We aggregate producers by industry groups using the Input-Output Accounts (U.S. Department of Commerce, Bureau of Economic Analysis). The industry groups are chosen to emphasize the role of agriculture and food processing in the U.S. Economy. We use a model with 59 sectors, of which 10 are farm sectors and 12 are food processing. Trade and transportation are also treated explicitly so that household consumption behavior responds to the retail price, while production decisions respond to the producer price. Even with this high level of industry detail, the farm sectors combine some commodities, such as wheat with rice in "food grains" and corn with hay in "feed grains," that would ideally be treated separately.

Households are grouped to focus on the impact of farm commodity programs on farm and non-farm households. The treatment of farm households will be discussed in more detail below. Non-farm households are distinguished by income (high and low) and low-income households are further distinguished by whether or not they participate in the Food Stamp Program. Households are segmented into these social-economic categories using data from the Current Population Survey (CPS) and the Agricultural and Resource Management Survey (ARMS).[2]

Households receive income from three main sources: earnings both from wages and salaries and from self-employment; capital income from the ownership of assets– dividends, interest, and rent; and transfer income from government programs. In addition to a number of government transfer programs for low-income and elderly households (such as food stamps and Social Security), we include three farm commodity programs (direct payments, counter-cyclical payments, and loan deficiency payments). Separate consideration is given to the farm rents paid to non-farm households (non-operator landlords). Households use their income to consume goods and services, pay taxes, and save. Household expenditure shares, tax rates and savings rates are derived from survey data and may differ among household types.[3]

Labor supply and demand is also treated in detail. The primary and secondary earner of each household type supplies labor in an earner specific mix of occupations distinguished by skill (education and training) categories. Only farm households supply "farm operator" as an occupation, but farm households also supply labor to off-farm occupations. Similarly, each industry demands labor in its own unique mix of occupations.[4] The mix of occupations supplied by households and demanded by firms can adjust in response to changes in relative wages. For households this occurs through a Constant Elasticity of Transformation (CET) function. For firms this occurs through a nested Constant Elasticity of Substitution (CES) production system.

Households are modeled as agents that maximize utility, a measure of their well-being, through the purchase of an array of goods and services and the enjoyment of leisure, as each faces a budget constraint and a constraint on the total amount of time allocated to work or leisure. A Linear Expenditure System, extended to include leisure, is used to derive household commodity demand and labor supply. Commodity price and income elasticity values are specified using estimates by Blanchiforti et al. (1986),

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[2] See U.S. Department of Commerce, Bureau of Census, CPS and USDA-ERS, ARMS Briefing Room.

[3] Expenditure shares are derived from U.S. Department of Labor, Bureau of Labor Statistics, Current Expenditure Survey. Tax rates are derived from CPS cited in the previous footnote. Savings rates are from the Federal Reserve, Survey of Consumer Finances, as used by Bosworth, Burtless, and Sabelhaus (1991).

[4] Household occupation data are from CPS and ARMS cited in the first footnote. Industry occupation data are from U.S. Department of Labor, Bureau of Labor Statistics, Occupational Employment Statistics.

Blundell et al. (1993), and Park et al. (1996) as guidance. Parameters central to the analysis are the price and income elasticities for food demand. The price elasticity ranges from –0.13 to –0.16, while the income elasticity ranges from 0.33 to 0.36 among the household types. The net wage and income elasticity values for labor supply are also important. There is a large empirical literature on labor supply elasticity values, which we discuss below in context of the social cost of taxes. For our analysis, the secondary earner or spouse is more responsive to income and wage changes, while the primary earner has very little response. We assume an income elasticity of –0.025 for the primary earner and –0.2 for the secondary earner, as well as a compensated elasticity of 0.075 for the primary earner and 0.6 for the secondary earner (Hanson et al. 2002).

Firms maximize profits from the sale of goods and services to households, given their technology of production. Intermediate goods are used in fixed proportion to production, while primary factor substitution in production is characterized with a CES value-added production function. For aggregate labor, capital, and land, the elasticity of substitution is set slightly greater than one for manufacturing and slightly less than one for services and agriculture, based on Balisteri, et al. (2001) where they find that a Cobb-Douglas specification (with an elasticity of substitution equal to one) is a reasonable starting point.[5] Aggregate labor is a CES function of labor by occupation with an elasticity of substitution of one-half.

For the crop sectors, we use a CET land allocation function to model the allocation of land among crops in response to commodity price changes. Historically, the production response of agricultural crops has been inelastic, and we calibrate the model response accordingly using a CET land elasticity of 0.7 (Lin et al. 2000).

The treatments of aggregate supplies for land, labor, and capital are important features of a CGE model, influencing how the model's outcomes respond to a policy shock. The aggregate supply of land for agriculture is fixed. Labor supply, in terms of more or less hours worked by occupation, is an endogenous outcome of household decisions. In the short-run, the aggregate stock of capital is fixed, but it can be reallocated among sectors of production. In the long-run, aggregate capital stock adjust to maintain the rate of return to capital at its original level.

The CGE model incorporates imperfect substitution between imports and domestic goods using the Armington assumption. Domestic demand is for a composite commodity of imports and domestically produced goods combined by a CES aggregation function. There is a parallel treatment of export supply, with each sector producing a composite commodity that can be transformed into an export or a commodity sold on the domestic market with a CET function. Imports and exports are generally taken to be elastic in response to price changes (McDaniel and Balistreri 2002, Gallaway et al. 2000). We use an export price elasticity of 2, and an import price elasticity of 1.5.

We complete the specification of the CGE model by adding the accounts for three other economic entities: government, Rest of World (ROW), and capital account. Model

[5] The labor demand elasticity can be derived and compared to the findings reported in Hamermesh (1993).

closure determines how the government, ROW, and capital accounts adjust to maintain an accounting identity, in response to changes in economic activity (Robinson 1989, Arora and Dua 1993). Closure for the government summarizes the outcome of a political process. For the trade balance, closure summarizes the complex process by which the balance of trade, exchange rate, and foreign capital income flows adjust. Similarly, for the savings-investment balance, closure summarizes a complex system of financial transactions whose net result is the allocation of financial savings into physical investment for equipment and structures. In none of these cases is there an explicit set of behavioral equations attempting to describe the outcome of these complex market and political processes. Instead, it has proven expedient to introduce certain closure rules for these major aggregate balances.

The government collects taxes, purchases goods and services from firms in different industries, and disburses transfers to households and producers. Taxes include personal income tax, corporate profit tax on capital income, social security tax on labor income, a business tax on sales, and tariffs on imports. Transfers from government include those to low-income and elderly households, as well as farm commodity programs. For the government account, the closure identity is that revenue less expenditure equals the surplus (deficit if negative). The closure rule used in our analysis is to fix real government expenditures and the government deficit at base levels, and let personal income tax rates adjust.

The treatment of ROW as one actor rather than many countries is a standard simplification for single country models that we maintain in our CGE model. The ROW supplies imports to the United States and purchases exports from the United States. For the ROW account, the closure identity is a balance-of-trade constraint in which the value of imports at world prices must equal the value of exports at world prices plus a number of capital income flows. These include net foreign investment, net foreign factor income payments, net foreign remittances, interest payments to foreigners on the U.S. government debt, and foreign transfers by the U.S. government. The closure rule used in our analysis is to fix the trade balance at the base level, and let the exchange rate adjust, which affects the price paid for imports and the revenue earned from exports.

The capital account describes the market for loanable funds. Sources of savings are households, businesses, government surplus or deficit, and net capital inflows from the ROW. Business savings are from depreciation of capital stocks and retained earnings. Investment is divided between changes in inventory and fixed investment, or the purchase of new capital stocks by industry and government produced through the purchase of equipment and construction services. For the capital account, the closure identity is that savings equal investment. The closure rule used in our analysis is to fix real investment at the base level, and let household savings rates adjust.

In summary, the closure rules direct the impact of a policy change to take the form of a change in household real income rather than changes in the trade balance, real investment, and the government deficit. These closure rules allow the model to produce a measure of change to household well-being.

A CGE model solves for market price relative to a fixed price index, or numeraire. There is a choice among a number of price indices to fix. For policy applications we generally fix a domestic price index. The fixed numeraire forces the weighted-average price change across commodities to balance out: if domestic prices fall for some goods they will rise for other goods. Although switching numeraire may influence how price changes are transmitted in the modeled economy, the final impact as measured by the change in household real income remains the same.

A CGE model traces the impacts from a "shock," such as a change in policy, through the economy and its inter-linked entities. Simulating the impacts of a policy change in our CGE model is an exercise in comparative static analysis, a what-if comparison of two equilibrium states of the economy. The results of comparative static analysis are changes in economic activity when the economy has completed a move from a base equilibrium associated with existing policies to a new equilibrium as a result of a policy change. In the actual economy, such changes occur over time, the economy does not adjust to a new equilibrium instantaneously. A CGE model describes and compares the old and new equilibrium but not the adjustment process. Analysis with a CGE model is "not strictly to predict the future but to facilitate a systematic exploration of … critical events" (Granger 1989: 224). The model provides a laboratory for gaining insight into the economic impacts from a policy change. It does give a quantitative result, but not a time-dependent dynamic path of adjustment.

One contribution of a CGE model is its comprehensive look at the impact of policy change on the economy, taking into account the various linkages among the economic entities. In the case of farm commodity programs, a policy change of interest is the removal of the programs and the relative impacts of removing coupled payments or alternatively decoupled payments. The initial impact is a reduction in government transfers to farm households, removal of a price distortion for program commodities, and a decrease in the personal income tax rate to maintain a budget neutral policy change. Farm households respond to a change in income and relative prices for program commodities with changes in labor supply and production. Taxpayers adjust their labor supply. Each direct effect of a policy change creates its own set of ripple effects, captured by the CGE model. An indirect effect of interest is the impact of changes in farm commodity prices on food prices and the cost of food consumption. The three distributional impacts from farm commodity programs are transfers from government to farm households, taxes paid by households, and cost of household food purchases. This paper traces out these three impacts and compares them under alternative scenarios of whether counter-cyclical payments are coupled or decoupled payments.[6]

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[6] The U.S. CGE model we use for farm policy analysis is a modified version of a model used for food policy analysis in Hanson et al. (2002), Hanson (2002). An earlier version of the model was used for farm and agricultural trade policy in Robinson, Kilkenny, and Adelman (1989), Kilkenny and Robinson (1990), and Bernat and Hanson (1995). The model follows the neoclassical-structuralist modeling tradition that is presented in Dervis, de Melo, and Robinson (1982), Robinson (1989), and Lofgren, Harris and Robinson (2001). Devarajan and Robinson (2002) review the experience using such CGE models to affect public policy. The model is programmed in the GAMS software (Brooke, Kendrick, and Meeraus 1992).

Farm Commodity Programs

The 2002 Farm Act governs agricultural programs through 2007. Title I of the Act reauthorizes and amends commodity support programs administered by the U.S. Department of Agriculture (USDA-ERS, Farm and Commodity Policy Briefing Room). For our analysis, we focus on the distributional impacts of three key programs under this title; direct payments, counter-cyclical payments, and marketing assistance loans. These three programs provide income support for wheat, feed grains, upland cotton, rice, oilseeds, and peanuts. Our analysis does not account for the sugar or dairy commodity programs, nor does it account for conservation, trade, and crop insurance programs.

Table 1 presents preliminary USDA-ERS projections for the average annual expenditures for the three farm commodity programs. The projections are made in relation to the Agricultural Baseline (USDA-ERS, Baseline Projections Briefing Room). Total annual average subsidies are $11.2 billion, with $4.9 billion as direct payments, $4.6 billion as counter-cyclical payments, and $1.7 billion as loan deficiency payments. In this paper, we investigate the distributional impacts from these projected average annual program expenditures.

The commodity programs governed by the 2002 Farm Act are comparable with those governed by the 1996 farm act. Direct payments replace the production flexibility contracts (PFC), maintaining annual average expenditures at a similar average level. These programs are decoupled in that payments do not depend on current market prices or current farm production, rather they depend on historical acreage and historical yields. For the WTO, direct payments are like PFC that meet the criteria of the green box.

The 2002 Farm Act continues the commodity loan program with marketing loan provisions. Loan deficiency payments and marketing loan gains occur when market prices are lower than commodity loan rates. During 1998-2001 market prices were exceptionally low and annual average expenditures were $6.2 billion by our calculations. Preliminary projections over 2003-06 for annual average loan deficiency payments are $1.7 billion. Higher market prices are projected to reduce program payments (USDA-ERS, Agricultural Baseline Briefing Room). Since the payment a farmer receives depends on current production and current market price, the program is coupled and directly influences farm production decisions. For the WTO, loan deficiency payments meet the criteria of the amber box.

Counter-cyclical payments to producers are meant to offset low market prices. The program is designed to avoid emergency assistance under adverse market conditions. It provides benefits to producers of grains, oilseeds, and cotton whenever the effective price for the commodity is less than its target price. The payment rate is the target price less the direct payment rate, both specified in the 2002 Farm Act, less the higher of the commodity price or loan rate. The program payment is the payment rate times payment acres and payment yield, where both acres and yield depend on historical data and not current farm production (USDA-ERS, Farm and Commodity Policy Briefing Room).

Counter-cyclical payments depend on current market prices but they do not directly depend on current production. Indirectly, current production influences market prices, and expected prices influence current production. So, the coupled-decoupled treatment of this program is not as straightforward as for the other two commodity programs (Westcott, Young, and Price 2002). Do counter-cyclical payments influence farm production decisions? The distributional impact of the farm commodity programs depends on the market-distorting influence of the programs. For our analysis, we experiment with both treatments.

With counter-cyclical payments dependent on market prices, projected annual average expenditures depend on projections of U.S. and world agricultural conditions. Under the USDA-ERS Agricultural Baseline, preliminary projections for annual average counter-cyclical payments are $4.6 billion over 2003-06. This is less than our estimate of $5.9 billion annual average expenditure on the same commodities through emergency assistance over 1998-01 period.

The farm commodity programs governed by the 2002 Farm Act are introduced into the U.S. CGE model as either production distorting subsidies by commodity or as lump-sum transfers to farm households. Direct payments are lump-sum transfers, while loan deficiency payments are production distorting subsidies. Counter-cyclical payments are treated as a lump-sum transfer in scenario-1 and as a production distorting subsidy in scenario-2. The annual average expenditure on production distorting subsidies amount to $1.7 billion in scenario-1 and $6.3 billion in scenario-2, while lump-sum transfers amount to $9.5 billion in scenario-1 and $4.9 billion in scenario-2. The relative importance of production-distorting subsidies to lump-sum transfers in the distributional impact of farm programs will be illustrated with these two scenarios.

In the CGE model, lump-sum transfers are distributed among farm household types in proportion to ARMS data on program payments. Through rents paid to non-operator landlords, some of these payments end up as income to non-farm households. Though these transfers do not directly distort production decisions by farmers, they do influence farm household behavior. Income transfers influence labor supply decisions of on- and off-farm work by both the operator and spouse.[7] Production-distorting subsidies are commodity specific and directly linked to current production of the program commodities by the different farm household types. They distort the marginal conditions for the production of program commodities and influence the level of production and labor demand to the production of these commodities. These subsidies are introduced into the CGE model as a price wedge to the production of program commodities and added to the returns to land in production. The distribution of these subsidies among farm households is in proportion to their production of the program commodities.

[7] For program impacts on investment, see USDA-ERS (2003), Westcott, Young, and Price (2002), Westcott and Young (2002), Westcott and Young (2000).

Farm households

Offutt (2002) emphasized the importance of assessing farm household impacts from farm programs in her Presidential Address to the American Agricultural Economics Association. Farm households in the U.S. CGE model are disaggregated according to the USDA-ERS farm typology. The Agricultural Resource Management Survey (ARMS) provides the data to account for the farm and non-farm activities of the different farm household types (USDA-ERS, ARMS Briefing Room). USDA-ERS (2001, 2002) provide a comprehensive description of farm households in the farm typology (USDA-ERS, Farm Income and Costs Briefing Room, farm household income).

The USDA-ERS farm typology disaggregates farm households by various characteristics. In addition to four sales classes, farm households are distinguished by whether they have limited resources (farm assets less than a given value), whether the operator is retired, and whether the operator reports a non-farming occupation as their primary occupation. From these characteristics, 7 types of farm households are distinguished in the detailed ERS farm typology. Table 2 presents the distribution of farm households among these seven types, along with data for their on- and off-farm sources of income. Whereas 43.4 percent of farm households have a residential lifestyle (primary occupation of operator is other than farming), they only account for 8.4 percent of gross cash receipts. Very large family farms (sales of $500,000 or more) receive 40.4 percent of gross cash receipts, while only accounting for 2.7 percent of farms.

Off-farm income is a significant share of farm household income, accounting for 83.3 percent of household income for all farm households (Table 2). The importance of off-farm income varies from 17.2 percent for the very large family farms to 110.5 percent for limited-resource farms that receive negative self-employed farm income on average. Earnings (wages and salaries plus off-farm business income) are the largest share of off-farm income, though income from public programs such as Social Security are not insignificant for some farm households.

Table 3 summarizes ARMS data on the distribution of government program payments received by the farm household types. The larger farms receive a larger percent of the farm commodity program payments since payments depend on current or historical levels of production. The share of farm program payments in each farm household’s gross cash receipts from farming ranges from 6 percent for the very large family farms to around 10 to 13 percent for the other types of farm households (from unreported data underlying Tables 2 and 3). So, even though government program payments go largely to larger farms, the payments are a smaller share of gross cash receipts for larger farms.

Tables 4 and 5 provide information on the distribution of farm production by product category and farm household type. Table 4 illustrates the farm household share of production for each product category. For the grains and oilseed crops, that is the program commodities, the very large family farms produce a lower percent (23 to 25 percent) of the crop than they do for most other product categories. Table 5 presents the product share for each farm household type. Feed grains and livestock are large shares for all farm household types.

Table 6 presents data from ARMS for on-farm and off-farm work by the operator and spouse for each farm household type. Farm households engage in Full- and part-time work, both on- and off-farm. ARMS data on labor supply needs to be combined with empirical estimates of how the operator and spouse adjust their on- and off-farm labor supply in response to changes in farm self-employed income, off-farm wages, and income transfers. In a survey of farm household models, Huffman (1991) reports wage elasticity values for the operator ranging from 0.06 to 0.4. We hope that future empirical analysis of ARMS data will provide new estimates for both the operator and spouse in a joint decision (Ahearn, El-Osta, and Dewbre 2002, Dewbre and Mishra 2002, Mishra and Holthausen 2002, USDA-ERS 2003). An important component of this work is imputing a wage to the operator and spouse for on- and off-farm work (Whitener and Parker 1992, El-Osta and Ahearn 1996).

Farm rent paid to non-operator landlords is an additional income flow important for our distributional analysis of farm commodity programs. Data on the rent paid to non-operator landlords by commodity are available in the Input-Output Accounts underlying the CGE. Similar data by farm household type are available in ARMS. At this time, we have not reconciled the rent paid data from these two sources, and have relied on the data in the Input-Output Accounts to specify the rent paid to non-operator landlords (non-farm household) by commodity. The rent payment amounted to $18.3 billion in 1997 (about 24 percent of non-labor income to the farm sector). Given that market distorting subsidies are treated as a return to land, the same proportion of them are distributed to non-farm households through this distribution of rents. Lump-sum transfers to farm households are also partially distributed to non-farm households in proportion to the distribution of rent paid to non-operator landlords.

Accounting for the farm and off-farm sources of income received by the different farm household types is important for the appropriate characterization of households in the CGE model. We accomplish this by combining the 1999 ARMS data on farm households with other micro survey data on non-farm households into the Social Accounting Matrix (SAM) database underlying the CGE model. In using the 1999 ARMS data, the farm commodity programs covered by the survey are those governed by the 1996 Farm Act. These are different from but similar to the programs governed by the 2002 Farm Act. Until we are able to access the newer ARMS data, the 1996 program data will be used to distribute the 2002 programs among the farm households. Future research may improve specification of the on- and off-farm labor supply and wages for both the operator and spouse, and the specification of expenditure shares (particularly food and housing), tax rates and saving rates of farm households.

Social Costs of Taxes

The social cost of funds for the farm commodity programs equals the taxes paid plus an additional amount -excess burden or cost of reduced economic efficiency- due to the distorting impact of taxes and transfers on economic decisions. Our analysis of the distributional impact of farm commodity programs includes the impact of taxes to fund the program and the excess burden from the taxes. We use balanced budget analysis when measuring the efficiency cost of funds for the farm programs, where the efficiency cost is measured for an increase in taxes to fund a transfer program. Because farm commodity programs influence farm household labor supply and saving decisions as well as the relative price of commodities, the efficiency cost of taxation is not separable from the use of the funds and the impact they have on farm households and commodity prices.

We assume the funds for the farm commodity programs are from the personal income tax, which distort the work-leisure and save-consume decisions by households.[8] Taxes introduce a wedge between the gross wage a household earns and the net wage they receive. The impact of the tax wedge on a household's labor supply depends on the labor supply elasticity values, and is the basis for the excess burden of taxation. The labor supply elasticity values we use are discussed below.

From a review of the literature on excess burden of taxation, we find a range of 10 to 30 percent reasonable. This range is similar to a 10 to 25 percent range in Alston and James (2002), as used by Gardner (2002). Our range is lower than the 20 to 50 percent range suggested in Alston and Hurd (1990) and cited in Moschini and Sckokai (1994). More recent excess burden estimates from the 1990's use lower labor supply elasticity values than older estimates from the 1980's.

Other factors besides the labor supply elasticities influence the estimated excess burden. One factor is the tax used to fund a program and the magnitude of its marginal tax rate. Most studies use a marginal tax rate of around 40 percent on labor income (Ballard 1988). In our analysis the marginal tax rate on labor income for mid- and high-income households is 34.5 percent and equals the sum of the personal income tax rate and labor income tax rate. Browning (1987) compares the impact of different marginal tax rate under a common set of elasticity values, for two alternative uses of the funds. When the funds are used by the government to purchase goods and services such as national defense, an increase in the marginal tax rate from 43 percent to 48 percent (12 percent increase), increases the excess burden from 21.2 percent to 25.9 percent (22 percent increase). When the funds are redistributed back to households, then a 12 percent higher tax rate leads to a 30 percent larger excess burden (from 27 percent to 35 percent).

How the funds from the tax are used has a bearing on the resulting excess burden. In some studies the funds are used to purchase goods and services such as national

[8] Our analysis does not account for the impact of taxes on savings. Ballard, Shoven and Whalley (1985) find the excess burden less sensitive to a tax impact on savings than on labor supply. Also see Randolph and Rogers (1995), Engen, Gravelle, and Smetters (1997), Bernheim (1999).

defense, which are assumed to be separable in how they enter household utility. This separability assumption allows the excess burden of taxation to be determined independently of how the funds are used, because government expenditures are assumed to not affect relative prices for commodities nor affect household labor supply decisions.

Another use of funds is to redistribute them back to households. A universal transfer redistributes the funds to each household as a lump-sum transfer. Such a transfer is wasteful in that the same households that are taxed receive the transfer, which leads to larger estimates for the excess burden than for other uses of funds. Browning (1987) finds that the excess burden increases from 21.2 percent when the funds are used for a separable government purchase to 27 percent for universal redistribution, under a common set of assumptions about the marginal tax rate and labor supply elasticity values.

A notched transfer is another form of redistribution in which some households are taxed while other households receive the transfer, such as the U.S. social welfare system for low-income households. Ballard (1988) illustrates how the notched transfer reduces the excess burden to 17.7 percent compared to an excess burden of 80 percent for a universal transfer, under a common set of assumptions about the marginal tax rate and labor supply elasticity values. Ballard (1997, 1999) and Ballard and Goddeeris (1999) suggest that labor supply elasticity values lower than those used in Ballard (1988) are appropriate, which result in an excess burden of 27.5 percent for the universal transfer. Comparable revisions to the notched transfer program have not been made.

Both the universal and notched transfer programs influence household labor supply decisions, so the excess burden from taxation cannot be estimated separately from the use of the funds. Similarly, if the publicly funded project affects relative prices of commodities, then the tax and spending policy of the government are non-separable, and the project has an impact on the excess burden of taxation (Ballard and Fullerton 1992), Ahmed and Croushore 1996). In this situation, the excess burden of taxation is project dependent. An example is the financing of health care (Ballard and Goddeeris 1999).

Farm commodity programs are a mix of universal and notched transfers in that not all farm households receiving the transfers pay a personal income tax.[9] Both decoupled and coupled farm commodity programs influence farm household labor supply decisions. Coupled programs also distort commodity prices. Consequently, the excess burden of taxation used to fund these programs depends on the impact of the programs.

Household Labor Supply Elasticity

A change in the personal income tax rate affects the wage rate net of the tax rate, which influence household labor supply. The magnitude of the impact of a change in the

[9] Exploration of farm household receipt of payments from farm commodity programs and payment of personal income taxes is a project proposal under consideration at USDA-ERS. In 1998, 75 percent of all farm sole proprietors paid federal income tax, and 62 percent with business receipts greater than $100,000.

net wage on household labor supply can be summarized by the household's labor supply elasticities. A change in the net wage rate makes each hour of labor more or less remunerative, and the household's response can be divided into two components. In response to a higher net wage, households tend to supply more labor. A component that is called the compensated wage elasticity. A change in the net wage also results in higher or lower total earnings for the same amount of time worked. Households tend to respond to higher total earnings by reducing labor supply, a negative component that is called the income elasticity. The households total response to a net wage change is the sum of the compensated wage and the income elasticity, and is called the uncompensated wage elasticity. It can be positive or negative, depending on whether the compensated wage elasticity or the income elasticity is larger. The sign of the uncompensated wage elasticity is an empirical issue.

There is a large literature on labor supply elasticity estimates. The estimates apply to single adults distinguished by sex, couples, participants in government programs for low-income households, and the affluent[10]. A general finding is that labor supply is both wage and income inelastic, though exceptions exist. Furthermore, the secondary earner or spouse is more responsive to income and wage changes than the primary earner, who has very little response.

One general summary for all labor is an uncompensated labor supply elasticity of 0.05, compensated labor supply elasticity of 0.2, and income elasticity of –0.15 (Ballard 1997). Ballard (1997,1999) specifies a set of elasticity values for men, women and couples that are consistent with these overall elasticity values. The income elasticity is –0.15 for all groups, while the uncompensated labor supply elasticity is –0.05 for men (making men's labor supply negatively sloped or "backward bending"), 0.2 for women, and 0.1 for couples. These elasticity values are lower, implying less labor supply response to a tax change, than used in earlier tax policy analysis (Ballard 1985, 1988). For instance, Ballard (1988) assumes an income elasticity of -0.2 for all labor, a weighted-average uncompensated labor supply elasticity of 0.16, and a compensated labor supply elasticity of 0.36. The lower central-case elasticity values lead to lower estimates of the excess burden from taxation (Ballard 1996, 1988).

The U.S. Congressional Budget Office (1996) also summarizes labor supply elasticity estimates in context of their use for tax policy analysis. The elasticity values represent the combined response of average hours by those working and the participation decision. For all people, the total wage elasticity or uncompensated labor supply elasticity is 0 to 0.3, the income elasticity is –0.2 to –0.1, and the compensated elasticity is 0.2 to 0.4. They consider single women similar in response to men, with a total wage elasticity of –0.1 to 0.2, an income elasticity of –0.1 to 0, and a substitution elasticity of 0.1 to 0.2. For married women, they summarize the total wage elasticity at 0.3 to 0.7, the income elasticity at –0.3 to –0.2, and the substitution elasticity at 0.6 to 0.9.

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[10] See: Moffitt (2002), Blundell and MaCurdy (1999), Moffitt (1998), Kimmel and Kniesner (1998), Engen, Gravelle, Smetters (1997), U.S. Congressional Budget Office (1996), Randolph and Rogers (1995), Hum and Simpson (1994), Heckman (1993), Hammermesh and Rees (1993), Bosworth and Burtless (1992), Juhn, Murphy, and Topel (1991), Pencavel (1986), Killingsworth and Heckman (1986), Hausman (1985).

In our CGE analysis, we use labor supply elasticity values that fall in the range of the US CBO (1996) summary values and are close to the central-case values suggested by Ballard. For all households in our analysis, including farm households, we assume an income elasticity of –0.025 for the primary earner and –0.2 for the secondary earner. We assume an uncompensated elasticity of 0.05 for the primary earner and 0.4 for the secondary earner, which implies a compensated elasticity of 0.075 for the primary earner and 0.6 for the secondary earner.

Household Food Expenditures

To the extent that farm commodity programs lower farm commodity prices, and these lower prices are passed onto consumers as lower food prices after processing, there is a social benefit to domestic consumers to the farm programs. The benefit to consumers is an aspect of the distributional analysis of farm commodity programs. Our measure of household well-being is a real income measure, which accounts for the benefits from price changes to food. We calculate the benefit as the base year food consumption multiplied by the difference between the new and old price.

We do not expect a commodity price impact from farm commodity programs that are lump-sum transfers, but market-distorting subsidies will have an impact on program commodity prices. The marketing loan program will reduce the market price paid for the program commodities. To the extent that counter-cyclical payments are market distorting, they will also reduce the market price for program commodities.

Food purchased for home consumption (excluding alcohol) amounted to 7.4 percent of personal consumption expenditures in 2001 ($516 billion of $6,987 billion). Adding food consumed away from home ($350 billion), the food expenditure share rises to 12.4 percent of total expenditures. In our calculation of this benefit, we focus on food consumed at home. The food expenditure share varies by household income. According to published data from the Consumer Expenditure Survey for 2001, the food expenditure share (at home) is 11.3 percent for the lowest 20 percent of households and 5.9 percent for the highest 20 percent of households (USDL-BLS, CEX).

The farm value share of retail food expenditures is on average 20 percent. If other prices remain constant and farm prices fall by 1 percent, then food prices will fall by 0.2 percent assuming that input price changes are passed through as changes in the price of final products. In perfectly competitive industry, as in our model, these cost-based price adjustments occur. So a 1 percent farm price change will result in a $1 billion change in the cost of food consumption at home, given $516 billion of total food consumption.

Scenarios and Results

We analyze the economy-wide distributional impacts from removing three major farm commodity programs governed by the 2002 Farm Act; direct payments, counter-cyclical payments, and marketing assistance loans. The distributional impacts depend on whether the programs are lump-sum transfers, or market-distorting subsidies. In scenario-1, counter-cyclical payments are combined with direct payments as a lump-sum transfer, while marketing assistance loans are treated as a market-distorting subsidy. In scenario-2, counter-cyclical payments are combined with marketing assistance loans as a market-distorting subsidy, while direct payments are treated as a lump-sum transfer. Table 7 presents the annual average expenditures for the two types of programs for the two scenarios, using projected program expenditure data from table 1.

The distributional effects from removing the farm commodity programs are among farm households, low-income non-farm households and high-income non-farm households, and among the farm household types distinguished by the USDA-ERS typology. Farm household impacts occur through program effects on household income, farm sector output, and commodity prices. Non-farm household impacts occur through taxes and the cost of food. In both scenarios, the reduction in government expenditures is budget neutral with an off-setting proportional reduction in the personal income tax rate. Furthermore, removal of U.S. farm programs are done unilaterally, in that, the farm programs of other countries remain in place.

Scenario-1: With counter-cyclical payments treated as lump-sum transfer

With scenario-1, we assess the distributional impacts of removing the farm commodity programs with counter-cyclical payments treated as a lump-sum transfer. In this scenario, Lump-sum transfers account for 85 percent of farm commodity program expenditures, while the market-distorting subsidies account for 15 percent of program expenditures (Table 7). Of total farm program payments removed, 73 percent are taken from farm households (-$8.170 million), with the remaining 27 percent are taken from non-operator landlords as a reduction in rents (Table 8).

Given the endogenous labor supply response to the tax reduction and to the reduction in lump-sum transfers and market distorting subsidies to farm households, the farm operator and spouse reduce their on-farm labor supply by 3,800 jobs (0.2 percent), but increase their off-farm labor supply by 16,100 jobs (table 8).[11] There is a small shift of on-farm labor to off-farm labor due to the removal of a small market distorting subsidy. The larger off-farm labor supply response of farm households is from a reduction in leisure in response to the loss of an income transfer and an increase in the wage net of taxes. In a sense, the farm household attempts to maintain their income after

[11] Employment impacts are in terms of full-time equivalent jobs.

the loss of the transfer by working more, but there is an implicit cost to working more in the reduction of leisure. Even though farm households work more, there is a reduction in earnings (-$354 million), which occurs for two reasons. First, the on-farm net wage falls as the sector loses market-distorting subsidies and as tax rates are reduced. Second, the off-farm wage that farm households earn is assumed to be lower than the on-farm wage. We assume that the on-farm wage is the economy-wide average wage and that the off-farm wage is that of the low-skilled occupation, which is lower than the average wage. The specification of the on- and off-farm wages for farm households needs more empirical investigation.

The high-income households increase their labor supply response by the equivalent of 54,000 jobs (Table 8). Labor supply responds primarily to a reduction in tax rates, but also to a reduction in rents (including farm program payments) paid to non-operator landlords. This raises a question of whether the rents will fall by the amount of loss in farm program payments that were formally paid to non-operator landlords. In our analysis, they do.

The change to the cost of food consumption is in the last column to table 8. The magnitude is small for all households because the commodity price changes are small. The price changes are small because most of the farm program payments are treated as lump-sum transfers in this scenario, which do not distort commodity prices. Only the $1,700 million of marketing loan gains distort farm commodity prices. Removing the programs increases an aggregate crop price index by 0.38 percent, processed food price index by 0.18 percent and the CPI for food by 0.03 percent (Table 9).

Net income, our measure of household well-being, includes all sources of income net of taxes and is adjusted for price changes. Net income equals personal consumption plus savings adjusted for price changes. Net income falls by $6,881 million for farm households, which is 84 percent of the farm program payments received by farm households (Table 8). Due to adjustments in other sources of income, personal income tax, and consumer prices the fall in net income is less than the reduction in farm program payments.

The net income for high-income households increases by $9,579 million (Table 8). The increase in well-being is primarily due to a reduction the personal income tax, but also due to an increase in labor income. The figure is positive despite a loss in farm program payments that were received as a part of rents paid to non-operator landlords. This policy scenario has little impact on low-income non-farm households. The small reduction in labor income is due to a small fall in wages as the labor market adjusts to an increase in labor supply by farm households and high-income households, and due to a small reduction in labor supply in response to the fall in wage.

For all households net income increases by $2,676 (Table 8). The economy-wide outcome reflects both an increase in net income to high-income households, who pay less taxes and increase labor supply in response to a reduction in tax rates, and a reduction in net income to farm households as they lose transfer payments. The change in the cost of food consumption turns out to be a small contribution to the overall outcome, since the commodity price distortions from the farm programs were small under this scenario. The efficiency cost of taxes used for farm commodity programs is 24 percent, measured as the change in net income relative to the reduction in farm program payments. This figure means that for every $1 billion of farm program payments transferred to the agricultural sector, net income economy-wide is reduced by $240 million due to economic inefficiency.

Among farm households, the direct loss of income from removal of farm commodity programs is 3.4, 6.5, and 9.6 times larger per farm for the three largest farm household types than the average loss per farm among all farm households. Those ratios correspond to the distribution of farm program payments. The reduction in net income follows the same pattern among farm households. The labor supply response does not follow the same distributions. The three largest farm household types slightly increase their on-farm labor, whereas the other farm household types decrease their on-farm labor. The largest reduction in labor supply is by residential farm households, which have the largest number of farm households. All farm household types increase their off-farm labor supply. The off-farm labor supply response reflects the loss of transfer income from both coupled and decoupled programs.

Producer impacts are presented in table 9. There are two sets of outcomes in these results. One set involves the agricultural sectors' response to the removal of the farm program payments. The other set involves the non-farm sectors' response to the increased income to high-income households and their expansion of labor supply. For this paper, we discuss a few of the agricultural sector outcomes. Farm prices rise for the major crops for which the marketing loan gains are important, such as food grains (6.1 percent from the base), cotton (1.85 percent), and oilseeds (1.28 percent). Associated with the price increases for these crops are a reduction in production, jobs, and exports, such that total crop production falls by $955 million and total crop exports fall by $842 million. The loss of 11,400 jobs in the farm sector is a combination of job equivalents for farm operators and hired farm workers. Value added, which does not include program payments, falls in proportion to production as a share of the cost to production. By definition, sector income equals value added plus both market distorting subsidies and lump-sum payments to the sector, less indirect tax. Consequently, it falls due to the reductions in both value added and program payments.

Even though feed crops received marketing loan gains, when they are removed prices fall slightly and production rises slightly, contrary to a price increase and reduction in production for other crops that received marketing loan gains (Table 9). A reason for this contrary result is related to the use of feed crops (which includes hay). Exports are a smaller share of total crop production for feed crops than for the other program crops. They are primarily used as feed for domestic livestock production. Domestic demand for meat products is less elastic than foreign demand for feed crops. All these demand factors lead to a smaller response by feed crops than the other program crops. With cropland from other program crops available for alternative uses, some land moves into feed crop production increasing supply and lowering price.

Scenario-2: With counter-cyclical payments treated as market-distorting subsidy

Under scenario-2, we assess the distributional impacts of removing the farm commodity programs with counter-cyclical payments treated as a market-distorting subsidy. Lump-sum transfers now account for 44 percent of farm commodity program expenditures, while the market-distorting subsidies account for 56 percent of program expenditures (Table 7). Distorting subsidies are 3.7 times greater in scenario-2 than in scenario-1. As with scenario-1, only 73 percent of the farm program payments are received by the farm households and the other 27 percent are received by non-operator landlords as a portion of the rents paid to non-operator landlords (Table 10).

Given the endogenous labor supply response to the tax reduction and to the reduction in lump-sum transfers and market distorting subsidies to farm households, farm operators and their spouses reduce their on-farm labor supply by 18,000 jobs (0.8 percent), but increase their off-farm labor supply by 21,500 jobs (table 10).[12] Because the market distorting subsidies are greater in this scenario than in the previous one, there is a greater reduction of on-farm operator and spouse labor supply. The operator and spouse shift their labor supply to off-farm jobs. Still, the increase in off-farm labor supply is greater than the decrease in on-farm labor supply due to a reduction in leisure in response to the loss of the income transfer. Relative to scenario-1, the reduction in on-farm labor supply is greater and more evenly matched with the increase in off-farm labor supply in scenario-2 due to the greater use of distorting subsidies.

In their labor supply response to the policy change, farm households attempt to maintain their net income after the loss of the transfer income by working more, but there is an implicit cost to working more in the reduction of leisure. Even though farm households work more, there is a reduction in earnings (-$1,300 million), which occurs for the same reasons as in scenario-1. The farmer wage falls more in scenario-2 due to removal of larger market distorting subsidies, leading to a larger reduction in earnings.

The high-income households increase their labor supply response by the equivalent of 48,000 jobs (Table 10). The labor supply response is slightly lower but comparable to the response in scenario-1, a result that is expected given that the policy change for them is similar. Taxes paid are lower with a reduction in tax rates, but as non-operator landlords, the rents (including farm program payments) received from the farm sector are also lower. Relative to scenario-1, the reduction in tax payments in scenario-2 is small (by $350 million) due to larger economy-wide adjustments in other tax revenues and cost of government expenditures. The removal of larger market-distorting subsidies leads to larger price adjustments and changes in the tax base for other sources of government revenue.

Food consumption costs increase by $747 million (table 10). Removal of larger market distorting subsidies in scenario-2 compared to scenario-1 leads to larger commodity price increases. Removing farm programs increases an aggregate crop price

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[12] Employment impacts are in terms of full-time equivalent jobs.

index by 1.85 percent and a processed food price index by 0.67 percent (Table 11). A food CPI increases by 0.17 percent (not reported). The increase in prices from removal of market-distorting programs implies that these programs lower commodity prices and food costs, which benefit consumers. Most of the food cost adjustment falls on high-income households who consume a greater share of food in our household aggregation.

Net income to farm households falls by $6,344 million, which is 77 percent of the farm program payments received by farm households (Table 10). The loss in net income is smaller by $540 million in scenario-2 than in scenario-1. The net income for high-income households increases by $9,343 million (Table 10). The gain in net income is smaller by $240 million in scenario-2 than in scenario-1. Overall, household net income increases by $2,954 (Table 10), which is $278 million larger than the overall increase in net income in scenario-1. The efficiency cost of taxes is 26 percent, measured as the change in net income relative to the reduction in farm program payments, slightly higher than in scenario-1. Larger market-distorting program payments in scenario-2 leads to larger efficiency costs and larger economy-wide welfare gains from their reduction.

Among farm households, the direct loss of income from removal of farm commodity programs is the same as in scenario-1, which is equivalent to the distribution of farm program payments. The distribution of the impact on net income also follows the distribution of the program payments that were removed, as in scenario-1. The distribution of on-farm labor supply response is different than scenario-1, while the distribution of off-farm labor supply is the same. The reason for the same distribution of off-farm labor supply response is that in both scenarios off-farm labor supply is responding to a loss of income from removal of all program payments, which is the same in both scenarios. It does not matter if the program payments are coupled or decoupled for the off-farm labor supply response. The difference occurs in the on-farm labor supply response. The reduction in total on-farm labor supply is larger in scenario-2, in which more payments are coupled, than in scenario-1. Coupled program payments distort the on-farm labor supply decisions of farmers. A reduction in on-farm labor supply by all farm household types in scenario-2 is more evenly matched by an increase in off-farm labor supply by all farm household types. With larger decoupled payments in scenario-1, the on-farm labor supply for the three largest farm household types increase as they also increase off-farm labor supply and decrease leisure, whereas the other farm household types decrease their on-farm labor supply as they increase their off-farm labor supply leaving leisure less effected. The larger farm household types have a greater opportunity to shift on-farm labor out of program crops and into other production activities.

Producer impacts are presented in table 11. We discuss a few of the agricultural sector outcomes. Farm prices rise for the major crops for which the marketing loan gains are important, such as food grains (13 percent), cotton (12.6 percent), and oilseeds (3 percent). Associated with the price increases for these crops is a reduction in demand that leads to a reduction total crop production by $2,733 million. The fall in production is almost completely absorbed by a $2,382 million reduction in exports, illustrating the importance of exports to these program crops. The loss of 40,500 jobs in the farm sector is a combination of job equivalents for farm operators and hired farm workers. Some farm operators shift their work from crops to livestock increasing employment (details on jobs by occupation are not reported), still, there is a reduction in livestock production as hired labor and capital stocks decrease in the livestock sectors. As in scenario-1, feed crops respond differently than other program crops. Prices rise, but only by 2 percent, and production falls but by less than other program crops (Table 11).

Given the importance of exports to program crops, we experimented with reducing the trade elasticity values by half in scenario-2, from 2 to 1. Farm commodity price increased more (16 percent compared to 13 percent for food grains), while crop exports fell only two-thirds as much. Farm households reduced their on-farm labor supply by 12,000 compared to 18,000 and increased their off-farm labor supply by 16,300. For all households, the change in food costs was doubled, and the efficiency cost of taxation was reduced from 26 percent to 19 percent. This experiment illustrates that the efficiency cost of taxation for government programs that affect the price of exported commodities depends on the responsiveness of exports to price changes.

Summary and future research developments

Integrating farm and non-farm households into the U.S. CGE model and its underlying database has been a major undertaking. The results from our analysis suggest how farm and non-farm households might respond to removal of farm commodity programs in a unilateral setting and how this response depends on whether the programs are coupled or decoupled.

Summary of Results by Comparison of Scenarios

A comparison of the distributional results between the two scenarios illustrates the relative impact of coupled versus decoupled farm commodity programs on household well-being and on their labor market participation. In both scenarios the same total amount of program payments are removed ($11,200 million). In scenario-1, counter-cyclical payments are treated as decoupled, while in scenario-2 they are treated as a coupled payment. Net income is our measure of household well-being. The loss in net income for farm households is larger by $540 million under scenario-1. For the non-farm households the gains in net income from removing the programs are larger by $260 million under scenario-1. For all households, the increase in net income from removal of the programs is smaller by $280 million in scenario-1. Conducting the scenarios in reverse, that is, adding farm commodity programs to a model that initially excludes them, the results from our analysis suggest that decoupled payments are of greater benefit to farm households than coupled payments, but that decoupled payments cost the non-farm households more than coupled payments. The net result for all households is that the use of farm commodity programs as a means of redistribution has a social cost, which is $280 million less with greater use of decoupled payments (scenario-1).

A reason for the difference between the two scenarios in the change in household net income is the impact on commodity prices and how this affects food costs. Market-distorting coupled programs lower commodity prices. The removal of program payments increases food costs more under scenario-2 than scenario-1, because the market-distorting programs are larger under scenario-2. The implication is that larger coupled payments, as in scenario-2, lower food costs, which is a benefit to non-farm households.

Another reason for the difference in the change in net income is the impact of coupled and decoupled payments on labor supply. The change in off-farm labor supply by all households is essentially the same for the two scenarios, at 69,000 jobs. The reason for this similarity is that the off-farm labor supply response is driven by the change in transfer income to farmers and the change in net wage to the taxpayers, which are the same in each scenario. A difference in labor supply response between these two scenarios involves on-farm labor supply. Coupled payments affect on-farm labor supply more than the decoupled payments because they increase agricultural production. When farm households receive coupled payments (instead of no payments), they shift labor from off-farm to on-farm jobs. When they receive decoupled payments (instead of no payments), farm households maintain farm jobs and shift from off-farm jobs to leisure.

Among farm households, the distribution of the impact on net income follows the distribution of program payments that were removed in both scenarios. The distribution of off-farm labor supply response is also similar under the two scenarios. The driving force for these similar results is the identical loss of transfer income. A difference in the distributional impacts among farm households occurs with their on-farm labor supply response. All farm household types reduce their on-farm labor supply in response to the removal of the larger coupled payments in scenario-2. When counter-cyclical payments are treated as decouled (scenario-1), the three largest farm household types increase their on-farm labor supply, while the other farm household types decrease their on-farm labor supply. Under scenario-1 there is less reduction in total on-farm labor supply compared to scenario-2, and there is some shifting of on-farm labor supply into alternative farm production activities such as livestock, which allows for the small increase in on-farm labor supply by the three largest farm household types.

Future Research Developments

We plan to update the SAM database underlying the model and analysis. The U.S. Benchmark Input-Output Accounts for 1997 will be updated to a more recent year and combined with micro-survey data on household income, labor force characteristics, and expenditures into a SAM database. Current Population Survey data will be used for non-farm households and ARMS data will be used for farm households. We will consider using a technique to reconcile household survey data with National Accounts Data that adjust population weights for data consistency (Robilliard and Robinson 1999).

We plan to improve specification of the farm households' on- and off-farm labor supply responses to off-farm wages, farm earnings, and other income changes. Special attention can be given to the on- and off-farm wage for the farm operator and spouse, and their joint labor supply decisions. We hope to use future econometric analysis of ARMS data for this issue (Ahearn, El-Osta, Dewbre 2002, Dewbre and Mishra 2002). We will also consider integrating a microsimulation model of farm household labor supply with the CGE model as in Cogneau and Robilliard (2000).

We plan to introduce additional farm programs into the model. A likely direction for futrue work is to model import policies by the United States and by foreign countries on agricultural and textile commodities. We plan to use the database developed by Gibson, Wainio, Whitley, and Bohman (2001) to specify world export and import price wedges by commodity. We also plan to model the impact of dairy programs on the price and supply of dairy products.

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Table 1: Commodity Program Average Annual Expenditures, 2003-06 Projections, $ Million[a]

	Cotton	Wheat	Rice	Corn	Soybeans	Peanuts	Sum
Sum	1,631	2,348	1,303	3,967	1,654	292	11,195
Direct payments	582	1,147	400	1,984	728	65	4,906
Counter-cyclical payments	890	940	306	1,725	567	172	4,600
Loan deficiency payments	159	261	597	258	359	55	1,689

a. Source: preliminary USDA-ERS projections, March 3, 2003

Table 2: Farm Income Statement by Farm Household Type[a]

	limited resource	retirement	residential lifestyle	lower sales	higher sales	large family farms	very large family farms	far
Farm households, number	126,920	297,566	931,561	480,441	175,370	77,314	58,403	2,147,5
Farm households, percent distribution	5.9	13.9	43.4	22.4	8.2	3.6	2.7	10
Farm households below poverty, percent	55.0	10.7	3.0	21.6	18.4	17.0	14.9	1
Farm hh. elderly operator (+65), percent	47.2	70.5	5.0	39.4	13.0	7.9	9.1	2
Gross cash income, dollars per farm[b]	7,838	9,456	12,969	34,252	160,621	321,084	989,377	66,6
Gross cash income, percent distribution	0.7	2.0	8.4	11.5	19.7	17.3	40.4	10
Less: Expenses	11,447	10,876	17,310	35,624	136,204	274,261	829,955	61,2
Equals farm self-employment income	-3,609	-1,420	-4,341	-1,372	24,417	46,823	159,422	5,4
Plus other farm-related earnimgs[c]	29	72	334	1,244	2,284	4,264	6,212	9
Equals farm self-employment income adj.	-3,580	-1,348	-4,007	-128	26,701	51,087	165,634	6,3
Plus off-farm sources of income	13,114	41,991	87,796	39,892	26,621	34,598	35,572	57,9
Wages and salaries	4,791	8,700	59,495	17,036	16,248	18,156	16,661	33,5
Off-farm business income	1,067	2,554	20,448	5,349	2,945	5,864	6,699	11,1
Interest and dividends	899	6,956	4,088	3,787	3,242	4,640	7,349	4,2
Public programs, inc. Social Security	5,692	16,961	1,638	8,282	2,379	1,724	1,410	5,5
Other passive sources of income[d]	0	6,819	2,126	5,438	1,807	4,214	3,452	3,5
Equals average farm household income	9,534	40,643	83,788	39,764	53,322	85,685	201,206	64,3
Plus non-money income[e]	2,337	5,767	5,611	5,142	4,952	5,395	5,158	5,2
Equals average farm household income adj.	11,871	46,410	89,399	44,906	58,274	91,080	206,364	69,6
Farm self-emp, percent share of farm hh inc.	-30.2	-2.9	-4.5	-0.3	45.8	56.1	80.3	
Off-farm inc, percent share of farm hh inc.	110.5	90.5	98.2	88.8	45.7	38.0	17.2	8
Off-farm earnings, percent share of farm hh inc.	49.3	24.2	89.4	49.8	32.9	26.4	11.3	6

a. Source: USDA-ERS, 1999 Agricultural Resource Management Study (ARMS).
b. Cash receipts, government payments, income from machine hire, custom work, livestock grazing, land rental, contract production fees, outdoor recreation.
c. Net income from another farm, wages paid to other operator household memebers, and commodities paid to household members.
d. An undefined residual category of income.
e. Includes value of home consumption plus imputed rental value of farm dwellings.

Table 3. Government program payment shares by farm household type, percent distribution[a]

	limited resource	retirement	residential lifestyle	lower sales	higher sales	large family farms	very large family farms	all farms
all govt. programs, $ per farm	1,127	1,666	1,407	4,604	21,993	41,033	58,650	
Percent distribution by farm type:								
all govt. programs	0.98	3.39	8.97	15.13	26.39	21.70	23.43	100
Agricultural disaster payments	0.77	2.35	7.57	18.99	27.96	20.89	21.50	100
Loan deficiency payments	0.82	1.03	7.25	12.04	27.11	24.84	26.91	100
Production flexibility payments	0.66	1.31	6.80	14.09	28.07	23.28	25.81	100
Conservation program	3.78	23.53	26.86	21.91	12.39	6.51	5.04	100

a. Source: USDA-ERS, 1999 Agricultural Resource Management Study (ARMS).

Table 4: Farm Value of Production, Household Share of Each Product Category, Percent[a]

	limited resource	retirement	residential lifestyle	lower sales	higher sales	large family farms	very large family farms	all farms
Dairy	0.32	0.23	0.76	5.72	25.65	16.64	50.70	100
Poultry	0.00	0.00	1.51	0.44	9.76	13.34	74.83	100
Livestock	1.09	2.73	11.36	12.99	13.81	13.39	44.64	100
Cotton	0.59	0.00	1.83	3.34	18.30	23.36	52.47	100
Food grains	0.71	0.93	4.21	14.04	29.23	24.92	25.23	99
Feed grains	0.68	2.35	11.11	14.19	26.06	22.43	23.14	100
Oilseeds	0.71	0.95	8.72	13.24	27.49	26.01	22.89	100
Fruit & vege	0.32	1.19	5.66	7.33	10.02	10.58	64.86	100
Tobacco	2.25	3.13	15.12	24.23	25.62	14.41	15.22	100
Other crops	0.00	0.00	0.00	0.48	9.27	25.41	60.28	95
All crops	0.64	1.47	7.88	11.58	21.39	19.88	36.96	100
All livestock	0.59	1.31	5.79	7.66	16.10	14.30	54.24	100
All production	0.61	1.38	6.72	9.41	18.47	16.79	46.52	100

a. Source: USDA-ERS, 1999 Agricultural Resource Management Study (ARMS). The percent by farm household types does not always sum to 100 percent due to disclosure limitations and rounding.

Table 5. Farm Value of Production, Product Shares for Each Household Type, Percent[a]

	limited resource	retirement	residential lifestyle	lower sales	higher sales	large family farms	very large family farms	all farms
Dairy	8.11	2.60	1.77	9.51	21.74	15.51	17.06	15.66
Poultry	0.00	0.00	3.25	0.68	7.63	11.47	23.23	14.44
Livestock	44.86	49.75	42.60	34.81	18.86	20.11	24.20	25.22
Cotton	2.98	0.00	0.84	1.10	3.06	4.30	3.49	3.09
Food grains	4.73	2.75	2.56	6.10	6.47	6.07	2.22	4.09
Feed grains	15.91	24.21	23.52	21.47	20.09	19.01	7.08	14.23
Oilseeds	9.63	5.67	10.73	11.64	12.31	12.81	4.07	8.27
Fruit & vege	6.28	10.40	10.15	9.39	6.54	7.59	16.80	12.05
Tobacco	7.51	4.62	4.59	5.25	2.83	1.75	0.67	2.04
Other crops	0.00	0.00	0.00	0.05	0.46	1.38	1.18	0.91
All crops	47.03	47.65	52.38	54.99	51.76	52.91	35.51	44.69
All livestock	52.97	52.35	47.62	45.01	48.24	47.09	64.49	55.31
All production	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

a. Source: USDA-ERS, 1999 Agricultural Resource Management Study (ARMS).

Table 6: Operator Farm and Off-Farm Labor Supply, Number[a]

	limited resource	retirement	residential lifestyle	lower sales	higher sales	large family farms	very large family farms	all farms
Operator								
On-farm work	126,920	297,566	931,561	480,441	175,370	77,314	58,403	2,147,576
full-time	22,084	25,293	49,373	246,466	154,150	67,882	49,759	637,830
part-time	104,836	272,273	882,188	233,975	21,220	9,432	8,644	1,509,746
Off-farm work	36,680	33,030	877,530	152,780	45,947	17,705	9,987	1,163,986
full-time	24,686	15,326	778,370	78,071	25,455	10,180	4,624	930,025
part-time	11,994	17,704	99,161	74,710	20,492	7,525	5,363	233,961
No off-farm work	90,240	264,536	54,031	327,661	129,423	59,609	48,416	983,590
Spouse								
On-farm work								
full-time[b]	0	0	0	0	0	0	0	0
part-time	75,302	243,320	821,637	413,948	150,976	71,423	51,412	1,828,017
Off-farm work	10,166	45,987	492,160	159,370	72,167	33,712	20,256	809,811
full-time	6,770	29,846	360,754	110,762	43,805	20,092	13,146	567,678
part-time	3,395	16,142	131,407	48,608	28,361	13,619	7,110	242,134
no work	65,136	197,332	329,476	254,578	78,809	37,711	31,156	1,018,205

a. Source: USDA-ERS, Agricultural Resource Management Study (ARMS), various years.

b. Data not in the 1999 ARMS, but in subsequent surveys. Future analysis will include this data.

Table 7: Scenario Treatment of Farm Commodity Programs Expenditures[a]

	Scenario-1	Scenario-2
	billion $	
Lump-sum transfer	9.5	4.9
Distorting subsidy	1.7	6.3
Total program exp.	11.2	11.2
	percent	
Lump-sum transfer	84.8	43.8
Distorting subsidy	15.2	56.3

a. Source: preliminary USDA-ERS projections, March 3, 2003

Table 8: Household Impacts for Scenario-1 Counter-Cyclical as Lump-Sum Transfer
with results reported as differences from the base

	households (base value) thous.	farm prog payments mil $ (real)	income tax mil $ (real)	labor income mil $ (real)	net income mil $ (real)	farm labor supply thous. jobs	non-farm labor supply thous. jobs	cost of foo consumptio mil $ (nom
Total households	110,976	-11,224	-11,670	404	2,676	-3.8	69.7	12
Farm households	2,148	-8,170	-1,097	-354	-6,881	-3.8	16.1	
Low-income households	23,321	-9	-23	-36	-21		-0.1	1
High-income households	85,508	-3,045	-10,551	793	9,579		53.7	11
Farm households	2,148	-8,170	-1,097	-354	-6,881	-3.8	16.1	
Limited resource	127	-54	-10	-6	-47	-0.1	0.1	
Retirement	298	-109	-41	-62	-123	-0.7	0.5	
Residential lifestyle	932	-553	-279	-155	-397	-3.1	5.8	
Farm occup., Low sales	480	-1,137	-186	-74	-954	-0.8	2.6	
Farm occup., high sales	175	-2,280	-216	-6	-1,915	0.4	2.7	
Large family	77	-1,916	-160	-1	-1,616	0.4	2.0	
Very large family	58	-2,122	-204	-49	-1,830	0.1	2.4	

Table 9: Producer Impacts for Scenario-1 Counter-Cyclical as Lump-Sum Transfer
with results reported as differences from the base

	Jobs thous.	Production mil $ (real)	Exports mil $ (real)	Imports mil $ (real)	Value added mil $ (nom.)	Sector income mil $ (nom.)	Prod. Price % change
Total	63.9	5,268	-28	-65	2,038	-9,367	0.00
Farm	-11.4	-915	-839	0	-304	-11,508	0.16
Food processing	0.2	-169	-115	32	-35	-40	0.18
Energy	1.6	424	15	-23	206	183	0.01
Construction	1.4	91	0	0	-70	-70	-0.02
Trade and transportation	12.8	747	-186	3	152	123	-0.02
Tobacco and alcohol	0.1	26	19	-4	16	14	-0.03
Apparel	0.8	52	1	29	8	7	0.06
Non-durable MFG	2.7	479	133	-32	184	179	0.00
Durable MFG	13.1	1,923	788	-68	646	633	-0.01
Housing and finance	6.3	858	53	-1	696	595	0.00
Restaurant	3.1	78	14	0	-17	-20	-0.01
Health services	9.6	611	2	0	330	327	-0.01
Education	1.9	86	18	0	37	37	-0.02
Other services	21.8	975	67	-1	190	173	-0.02
Total farm	-11.4	-915	-839	0	-304	-11,508	0.16
Livestock aggregate	2.0	39	2	-2	-150	-148	-0.11
Dairy	0.1	4	0	0	-38	-37	-0.18
Poultry	0.2	-4	0	0	-26	-26	0.16
Livestock	1.7	39	3	-2	-86	-84	-0.16
Crop aggregate	-13.4	-955	-842	1	-155	-11,360	0.38
Cotton	-1.5	-120	-109	3	36	-1,597	1.85
Food grains	-7.1	-592	-542	26	200	-3,463	6.10
Feed crops	0.1	58	46	-2	-65	-4,031	-0.24
Oilseeds	-4.8	-389	-273	5	-52	-2,000	1.28
Other crops	0.0	88	37	-30	-273	-269	-0.67

Table 10: Household Impacts for Scenario-2 Counter-Cyclical as Distorting Subsidy
with results reported as differences from the base

	households (base value) thous.	farm prog payments mil $ (real)	income tax mil $ (real)	labor income mil $ (real)	net income mil $ (real)	farm labor supply thous. jobs	non-farm labor supply thous. jobs	cost of food consumption mil $ (nom.)
Total households	110,976	-11,268	-11,268	-1,144	2,954	-17.9	69.2	747
Farm households	2,148	-8,203	-1,049	-1,307	-6,344	-17.9	21.5	29
Low-income households	23,321	-9	-23	-69	-45		-0.3	107
High-income households	85,508	-3,057	-10,197	232	9,343		48.0	610
Farm households	2,148	-8,203	-1,049	-1,307	-6,344	-17.9	21.5	
Limited resource	127	-55	-10	-18	-48	-0.2	0.2	
Retirement	298	-107	-51	-151	-177	-1.9	1.0	
Residential lifestyle	932	-554	-301	-444	-553	-7.9	8.6	
Farm occup., Low sales	480	-1,063	-174	-249	-880	-3.4	3.5	
Farm occup., high sales	175	-2,208	-183	-135	-1,594	-1.4	3.0	
Large family	77	-1,946	-138	-92	-1,377	-0.9	2.2	
Very large family	58	-2,270	-191	-218	-1,715	-2.2	3.0	

Table 11: Producer Impacts for Scenario-2 Counter-Cyclical as Distorting Subsidy
with results reported as differences from the base

	Jobs thous.	Production mil $ (real)	Exports mil $ (real)	Imports mil $ (real)	Value added mil $ (nom.)	Sector income mil $ (nom.)	Prod. Price % change
Total	47.3	6,494	-533	-564	414	-10,884	0.00
Farm	-40.5	-2,853	-2,390	17	194	-11,076	1.32
Food processing	-1.6	-770	-451	125	-201	-216	0.67
Energy	1.8	631	39	-169	163	141	-0.03
Construction	1.4	110	0	0	-235	-233	-0.05
Trade and transportation	13.1	830	-444	-2	-473	-395	-0.07
Tobacco and alcohol	0.2	81	60	-11	23	20	-0.09
Apparel	-4.2	-436	-178	156	-192	-194	0.40
Non-durable MFG	0.3	755	349	-179	94	91	-0.04
Durable MFG	28.2	4,588	2,125	-491	1,380	1,352	-0.04
Housing and finance	7.2	1,376	149	-3	113	94	-0.05
Restaurant	3.4	87	23	0	-94	-102	0.02
Health services	10.8	706	4	0	188	186	-0.05
Education	2.3	112	35	-1	31	31	-0.06
Other services	24.9	1,276	144	-7	-577	-583	-0.07
Total farm	-40.5	-2,853	-2,390	17	194	-11,076	1.32
Livestock aggregate	2.3	-119	-8	4	-378	-385	0.68
Dairy	0.1	-10	0	0	-89	-89	0.82
Poultry	0.3	-20	-2	0	-63	-63	0.71
Livestock	1.9	-89	-6	4	-227	-233	0.63
Crop aggregate	-42.8	-2,733	-2,382	13	572	-10,691	1.85
Cotton	-8.1	-611	-579	17	293	-1,350	12.59
Food grains	-14.1	-1,061	-988	54	495	-3,186	12.98
Feed crops	-7.5	-352	-277	10	635	-3,362	1.93
Oilseeds	-12.5	-928	-634	11	-134	-2,086	3.09
Other crops	-0.6	219	96	-79	-717	-707	-1.74