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General Equilibrium Analysis of the Farm Bill: SNAP versus Farm Programs

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Introduction

The U.S. farm bill is a wide-ranging piece of legislation that proposes to meet a variety of economic objectives pertaining to food and agriculture. The most recent bill, known as the Agricultural Act of 2014, incorporates farm commodity price and income supports, provisions for domestic nutrition assistance, and a host of other activities in support of multiple objectives (Johnson and Monke 2014). The act authorized \$489 billion in spending over five years, with the largest share going to nutrition assistance programs, primarily the Supplemental Nutrition Assistance Program (SNAP) which accounts for 80% of farm bill spending (Johnson and Monke 2014). SNAP is the nation's most important and largest anti-hunger program which offers nutrition assistance to low-income individuals and families. SNAP enables low-income eligible households to buy food, freeing up money for recipients to spend what money they have on other needs, such as housing, transportation, and health care. The program therefore affects not just beneficiaries but also demand for goods and services in a variety of sectors.

The other major share of farm bill spending is for farm "safety net" programs that account for 13% of farm bill spending (Johnson and Monke 2014). Most spending subsidizes crop insurance, which provides producers with protection against risks such as lost income, due to low output prices or poor crop yields. There are also farm commodity programs which provide benefits based on price or revenue targets for producers of certain crops that are covered (Weber et al. 2014). As with SNAP, these programs may affect demand for goods and services in a wide variety of sectors.

These two major components of the farm bill – SNAP and farm programs – have many differences yet have some common features. Each has effects on multiple sectors and therefore impacts across the economy. Each may affect the supply, demand, and price of a range of products. Each involves transfers among different households or firms. Both programs influence the efficient allocation of resources and overall economic welfare. At the same time, both SNAP and farm programs may entail large opportunity costs. If the funds were left with taxpaying households they would likely spend it on goods and services somewhat distinct from what occurs with these programs in place.

For the above reasons it is of considerable interest to analyze SNAP and farm programs within a common quantitative framework. Recent high levels of spending for these programs have raised questions about their necessity and performance. There isn't a consensus on the effects of either program in isolation or in tandem. Gauging the impact of these two major components of the farm bill is of great importance in understanding how taxpayers' money is at work, and more broadly, about efficiency and equity with respect to the allocation of resources in the economy.

The goal of this study is to compare and contrast the U.S. economy-wide effects of SNAP and farm safety-net programs (henceforth referred to as “farm programs”). Distinct effects are quantified with respect to commodity prices, farm income, farm assets, the distribution of income, household welfare, employment and wages, and overall economic efficiency. To make this objective manageable, additional aspects of the farm bill, such as programs related to conservation, research and other aspects are not considered. This allows for a sharpened comparison of the two major thrusts of the farm bill: SNAP and farm programs.

To achieve these objectives, a social accounting matrix (SAM) for the year 2010 is first created using IMPLAN and other sources of data for the United States as a whole. The SAM distinguishes nine types of households that differ by income level, sources of income, consumption patterns, and transfers to and from each other, and to and from government. The SAM also distinguishes 50 economic sectors including a large number of manufactured goods and service categories, as well as those sectors directly affected by either SNAP or farm programs (e.g., food retailing, food processing, oilseed farming, grain farming, and dairy production).

The SAM embodies the effects of the 2008 farm bill that was in place at the time of the analysis in 2010. In order to gauge the impacts of the two programs, a representation of the structure of the economy in the absence of these programs is required. Since this is unobservable, it must be simulated. The SAM is therefore used to parameterize an applied general equilibrium model that is a modified version of the general approach described in Löfgren, Robinson, and Harris (2002) and recently published as part of Reimer, Weerasooriya, and West (2015). The model combines Walrasian general equilibrium with optimizing households and firms, intermediate input use, inter-household and government transfers, savings and investment, government, and trade with the rest of the world. Once parameterized through calibration, the general equilibrium model is used to compare four numerical scenarios:

- (i) the U.S. economy in 2010 with both programs in place (the SAM baseline),
- (ii) the U.S. economy simulated without SNAP in place,
- (iii) the U.S. economy simulated without farm programs in place, and
- (iv) the U.S. economy simulated with neither of the above two programs in place.

Although in some sense the results are like a benefit-cost analysis of the individual programs, the results emphasize the complex and intertwined series of effects that these program have. These scenarios are compared in terms of price and quantity effects by commodity, the welfare effects on different household types (e.g. equivalent variation), the size of different economic sectors (e.g. jobs by sector), and measures of resource allocation efficiency (e.g. GDP and asset values). Predictions are also made for standard performance measures of agricultural operations, including farm cash receipts, net profits, and farm assets.

To our knowledge, no existing study has attempted to analyze both of these programs at the same time within a common framework. The study thus complements micro-economic studies of nutrition assistance, on the one hand (e.g., Gundersen and Oliveira 2001; Jensen 2002; Wilde and Nord 2005; Ratcliffe, McKernan, and Finegold 2008; Mykerezi and Mills 2010), and related analysis of farm programs on the other (e.g., Young, Vandever, and Schnepf 2001; Whitaker 2009; Coble and Barnett 2013; Goodwin and Smith 2013; Bradley et al. 2016). It complements general equilibrium analysis of these two programs that have hitherto treated them in isolation (e.g., Hanson & Somwaru 2003; Reimer, Weerasooriya, and West 2015).

The remainder of the paper is as follows. The next two sections provide an overview of SNAP and farm programs in the United States. The fourth section provides a detailed description of the data and the SAM for United States in 2010. The fifth section describes the general equilibrium model and its unique features. The sixth section describes the design and implementation of the counterfactual scenarios. The seventh section reports the major results and the final section summarizes some tentative conclusions.

Supplemental Nutrition Assistance Program (SNAP)

During the focus year, 2010, the farm bill in effect was the Food, Conservation, and Energy Act of 2008. SNAP received upwards of 80% of spending in that year. Total SNAP expenditures for 2010 were \$68.3 billion and were allocated to 40.3 million participants in the U.S. (USDA Food and Nutrition Service 2016). Out of this expenditure, \$64.7 billion were distributed among participants as benefits and \$3.6 billion was spent as federal and state administrative expenditures. Seventy percent of SNAP recipients are in families with children and more than 25% are in households with seniors or people with disabilities.

While there are some differences in how SNAP is administered at the state level, this study is a national-level analysis and is focused on eligibility under federal guidelines. To be eligible for SNAP benefits a household must meet three requirements. First, it must have a gross income at or below 130% of the poverty line. That corresponds to an annual income of about \$24,100 for a household of three. Second, it must have a net income after relevant deductions at or below the poverty line – about \$18,500 per year. Third it must have assets of \$2,000 or less. These criteria do not strictly apply for households with elderly or disabled members, or in states with certain eligibility requirements (Hoynes and Schanzenbach 2015). Most people who receive SNAP benefits live in households with low income. In 2010 the average income of a benefit recipient household was \$8,800 per year. The average benefit was \$133 per person per month and \$287 per household per month (FitzGerald et al. 2012; USDA Food and Nutrition Service 2016).

Farm programs

This analysis considers farm commodity programs and crop insurance which collectively are referred to as “farm programs.” Title I of the act authorizes and amends farm commodity programs administered by the USDA. Under farm commodity programs, income support is provided to growers of selected commodities including wheat, feed grains, cotton, rice, oilseeds, peanuts, sugar, and dairy. Support is largely administered via direct payments, counter-cyclical payments, and marketing assistance loans. Other support mechanisms include government purchases for dairy, and marketing quotas and import barriers for sugar (Monke and Johnson 2010). Combined, these payments were approximately \$7.5 billion. On the other hand, Title XII of the act allows for subsidized crop insurance to producers to protect against risks such as lost income due to declines in prices or yields. In 2010, crop insurance payments accounted for approximately \$5.3 billion.

Table 1 show the amount spent under farm programs in 2010 for the main farming sectors. Activities with the largest benefits were corn at \$3,495 million, wheat at \$1,732 million, and soybeans at \$1,555 million. Livestock and dairy received a combined \$301 million. Along with the 2010 SNAP payments, the amounts in Table 1 will play an important role in the counterfactual simulations developed below.

Data and the Social Accounting Matrix

The major data source is IMPLAN (2012), which distinguish 440 distinct sectors of the economy along with nine household types. Relevant farm bill administrative data was obtained from the USDA Economic Research Service (2016). While all nine households are used in the SAM, the 440 sectors are aggregated to 50 economic sectors. The aggregation preserves detail about

sectors that are most likely to be affected by one or the other program, and is reported in Table 2. The IMPLAN data are based on the structure of the national income and product accounts, and were used to create a Social Accounting Matrix (SAM). The SAM is a highly detailed account of monetary flows between economic agents, commodities, factors, and institutions including government and trade.

The SAM is a square data matrix, and each cell entry corresponds to an income transfer from the account of its column to the account of its row for services rendered or goods supplied. In other words, each cell entry corresponds to a payment made from the account of its column to the account of its row. The sum of a column gives total expenditure made by that particular account to all other accounts. Similarly, the sum of a row represents all income payments to that particular account by all other accounts. Obeying the double-entry accounting principle, for each account in the SAM, the total revenue/row total equals total expenditure/column total (Löfgren, Robinson, and Harris 2002).

A highly aggregated version of the actual SAM (called a macro SAM) is presented in Table 3 (This is for illustration only; the full SAM is too large to present visually). Looking at Table 3 it is seen that the SAM consists of activities, commodities, factors of production, households, institutions, and rest of the world trade. Activities are the entities that are used as inputs or intermediary goods in production. Commodities refer to the final product or the activity output. Activities and commodities are separated which allows any commodity to be produced by multiple activities and any activity to be used in producing multiple commodities. The SAM allows all 50 sectors to act as an activity as well as a commodity. In the macro-SAM presented in Table 3, these sectors are aggregated into six broad categories due to space constraints. They are numbered as 1-6 when referring to an activity and 7-12 when referring to a

commodity. Agricultural and natural resources use \$162 billion of agricultural and natural resources, \$5 billion of food and beverages, \$117 billion of manufactured goods, and so on. This activity also used \$119 billion of labor and \$280 billion of capital.

The nine representative households are aggregated into one representative household in the macro-SAM. In Table 3 it is seen that households as a whole sold \$7,041 billion of labor and \$1,942 of capital. They purchased \$117 billion of agriculture and natural resources, \$4,500 billion of services, and so on. In the actual SAM there are nine households, the characteristics of which are reported in Table 4. These households differ in terms of: level of income, share of income from labor, capital and transfers, tax rates, and how they allocate discretionary spending across the 50 consumption categories, among other differences.

Table 3 shows in some detail the factors of production (labor and capital) as well as institutions, government, business taxes, investment, and trade with the rest of the world. Since column totals are equal to the row totals, the SAM is balanced and can be used to obtain economic parameters of interest. For example, gross domestic product (GDP) for the U.S. can be calculated two ways. First is final demand GDP, which can be obtained by adding household consumption, government consumption, investment and net exports and subtracting institutional sales ($\$10,461 + \$3,448 + \$2,032 - \$673 - 746$ billion) which results in \$14,522 billion. Second is value added GDP, which is obtained by adding employer compensation, proprietor income plus other property type income and tax on production and imports ($\$7,981 + \$5,545 + \$997$ billion), also resulting in \$14,522 billion. One observation is that the value of the farm bill programs examined, at less than \$81 billion, is but a fraction of the U.S. economy in 2010.

Computable General Equilibrium model for the United States

The balanced SAM described above represents the U.S. economy in 2010 with the farm bill already in place. In order to understand how SNAP and farm programs influence the economy, a counterfactual scenario in which these programs were not in place is required. Since this is not observed, it must be simulated. For this, a computable general equilibrium (CGE) model for the U.S is employed based on the pathbreaking approach of Löfgren, Robinson, and Harris (2002). The model traces the impacts of a change, and in this study will represent a move from a base equilibrium (with the policy) to a new equilibrium (without the policy), so as to compare the two states. Since the model is static, it does not give a time-dependent dynamic path of adjustment (Hanson and Somwaru 2003).

Use of the model in this context is valuable in two particular ways. First, it allows one to observe the unobservable, that is, what the economy of 2010 would have looked like without the shock. Second, the model offers complete coverage in a consistent format of all the sectors that could be affected by each of the policies. While distinct, they have in common numerous linkages to product and factor markets, along with households, institutions, and trade.

The model is designed to be consistent with all of the payments recorded in the SAM and incorporates general equilibrium with national economic data (Reimer, Weerasooriya, and West 2015). The model is based on a set of simultaneous equations that makes use of computer simulations to define the decision making of the economic agents as well as the market equilibrium condition. A brief exposition of salient features such as the behavior of firms, households, government, trade, factor market and macroeconomic closures of the model is given below. (Readers not interested in the technical details can skip the rest of this section.)

In the model a multistage production function is adopted. At the top level, firms (represented by each activity) engage in production of commodities, combining intermediate inputs and capital and labor by way of a constant elasticity of substitution (CES) production function. The representative firm for each activity shifts how it uses capital and labor based on changes in their price, and the available technology according to a CES production function at the factor level. Intermediate inputs are combined in fixed proportions as given in the SAM.

Households receive income from labor, capital, inter-household transfers, government transfers, and investment income. Households spend money on commodities, inter-household transfers, government taxes, and investment. Household consumption demand is governed by a linear expenditure system (LES) demand function. Households maximize utility subject to their budget constraint.

The government collects taxes and receives transfers from all other institutions. All taxes are at fixed ad valorem rates. Government uses this income to purchase commodities for its consumption and for transfers to other institutions.

The supply of goods and services (i.e., commodities in the SAM) is then either sold in the U.S. or exported according to a constant elasticity of transformation (CET) function with an assumption of imperfect transformability between the two. Foreign demand for U.S. products is infinitely elastic at given world prices. Domestic demand for commodities is governed by a CES aggregation function to reflect imperfect substitutability between imports and domestic output sold domestically.

Market equilibrium is attained by agents optimizing objective functions subject to macro-economic constraints, including the external balance, savings-investment balance, government

budget balance, and an aggregate supply of primary factors constraint i.e. equilibrium in factor markets and macroeconomic balances is established through a number of closure rules.

This study aims to measure the welfare impacts using equivalent variation, which is theoretically defensible in a general equilibrium framework only under certain closure rules, i.e., the classification of variables into endogenous versus exogenous variables. External balance (the current account of the balance of payments which includes the trade balance) is achieved by adopting fixed foreign savings and variable exchange rates adjust to maintain the current account balance. Savings-investment balance is achieved by assuming investment is savings driven. In this case, saving rates are fixed and investment adjusts endogenously to the availability of loanable funds. Government balance is achieved by allowing government savings to be flexible while fixing all tax rates.

In factor markets it is assumed that both capital and labor are fully employed, fixed in supply, and mobile across sectors. The model makes use of IMPLAN employment data by sector, which allows the model to directly calculate actual numbers of jobs, which may be part- or full-time jobs. Information from the SAM is used to calibrate a factor productivity factor index by sector (*WFDIST*) that represents sectoral differences in factor productivities. For example, it allows that labor is less productive in certain sectors and more productive in others, allowing for a sector specific wage.

The SAM is used to calibrate most model parameters. During calibration, all prices in the model are set to unity and the base year factor levels and SAM flows are substituted into the model as equilibrium values of model variables. The model also contains a number of exogenous parameters that are set by the user. These are either estimated econometrically or set at values commonly employed in CGE analyses (see Waters, Holland, and Weber 1997; Löfgren,

Robinson, and Harris 2002; Holland, Stodick, and Painter 2007; Mccullough et al. 2011 for more details). A mathematical presentation of the model can be found in Löfgren, Robinson, and Harris (2002), with additional documentation in Waters, Holland, and Weber (1997) and Hosoe, Gasawa, and Hashimoto (2010).

Policy Experiments

Impact of SNAP

In the 2010 baseline data, the federal government spent a total of \$68.3 billion dollars on SNAP (USDA Food and Nutrition Service 2016). The counterfactual will indicate how the economy would be different if SNAP was not in place (i.e. no SNAP spending). This approach allows the otherwise unobservable effects of SNAP on the U.S. economy to be evaluated. This type of experiment requires an assumption regarding how funds released from SNAP would be used. It could be used to reduce the deficit, for example, or be spent on other government programs that are underfunded. Here, the funds are returned to taxpaying households at the rate they pay taxes.

To achieve this, the percentage of SNAP benefits received by each household type is required. This is estimated using Survey of Income and Program Participation (SIPP) data from United States Census Bureau (2016), which is reported in column 5 of Table 4. It can be seen that low income households receive a higher percentage of SNAP benefits (Household categories 1-4 receives 80.6% of SNAP benefits). If SNAP is taken out, each household will lose a share of the total SNAP benefits based on these percentages.

On the other hand, once SNAP is eliminated, the households no longer require paying taxes to finance the SNAP budget. To make it a revenue neutral transfer, they are given to the taxpaying households represented by the nine household categories in the IMPLAN data,

according to the percentage share that each household type has of federal income tax revenue. These statistics are given in column 4 of Table 4. These were estimated using data from United States Congressional Budget Office (2013). As expected, poorer households contribute less towards federal tax revenues (household category 1 contributes 0.20% whereas household category 9 contributes 68.94% to federal tax revenues).

The scenario for this counterfactual is given in Table 5. For example, household category 1 (which would also be eligible for SNAP benefits) had a negative transfer to the federal government, i.e., they received \$1,489 million from the federal government. Without SNAP, they would have had to pay \$19,927 million. In contrast, household category 9 (which received only 0.54% of the total SNAP benefits) paid the federal government \$343,870 million under SNAP. Once SNAP is eliminated, they pay a net of \$297,158 million. Similar interpretations hold for other households as well. Solving for the model's endogenous variables under these new rates effectively removes SNAP from the 2010 baseline data.

Impact of farm programs

In order to estimate the impact of farm programs on the economy, both commodity program and crop insurance will be separately eliminated from the baseline SAM of 2010. A key issue for measuring the distributional impact is whether the programs are modeled as decoupled (a lump-sum transfer) or coupled (a market distorting subsidy). In their analysis of the commodity program, Hanson and Somwaru (2003) treat direct payments as decoupled and marketing assistance loans as coupled. Counter-cyclical payments are treated as decoupled in one scenario and coupled in another scenario. Their analysis examines the sensitivity of the distributional impacts to the alternative treatments of counter-cyclical payments. In the study at hand, the

support is treated as effectively lowering the tax rates of farm enterprises. This provides some consistency with studies (e.g., Young and Westcott 2000; Goodwin and Mishra 2005; Goodwin and Mishra 2006) which find evidence that suggest that so-called decoupled programs can be market distorting.

The counterfactual involves eliminating the support received under farm programs. Similar to the SNAP elimination, a revenue neutral transfer of funds back to tax-paying households is conducted i.e. the funds are returned to taxpaying households at the rate they pay taxes (as done with SNAP).

Seven activities in the 50-activity SAM had receipts under farm programs, including oilseeds, grains, cotton, other crops, tobacco, and the livestock and dairy sectors. Amounts are reported in Table 1 as compiled by the Environmental Working Group (2010). If farm programs are eliminated then the transfer to these activities are reduced by the amount in Table 1.

Following the method implemented in the counterfactual for the SNAP, the money is given back to households based on the percentages given in column 4 of Table 4. Once the transfer is done, indirect business taxes for the production sectors effectively increase (now that they receive no support from the federal government) and the income tax rate of households decreases (since they no longer have to pay taxes to fund these programs).¹

Data for this counterfactual is given in Table 6. For example, on the production side, the oilseed sector paid the government \$870 million in taxes when farm programs were in place. When farm programs are eliminated, they have to pay \$2,605 million in federal taxes. On the

¹ The counterfactual scenario is carried out by manipulating the business tax rate parameter within the model denoted tb and federal income tax parameter within the model denoted ty . Parameter tb represents the percentage of business tax a particular production sector would pay (or receive in the case of a subsidy) out of the total value for that sector. Parameter ty represents the percentage of income that households pay to (or receive from) the federal government non-defense account that includes farm bill funding. These tax rates are for the federal government non-defense spending account, and therefore do not represent taxes to other government accounts such as the federal government defense account, or the state government accounts. The federal government non-defense account was chosen because it is where farm bill expenditures are located within the IMPLAN data.

household side, household category 9 paid a total of \$343,870 million at a rate of 12.06% with farm programs in place. Once the farm program is eliminated, they pay only \$337,630 million. Similar interpretations can be made for other farming sectors and households. Solving for the model's endogenous variables under these new rates effectively removes farm programs from the 2010 baseline data.

Impact of both SNAP and farm programs

In this case, the assumptions made in the two earlier counterfactuals are used. By eliminating SNAP and farm programs simultaneously, households pay less in taxes, eligible households receive no SNAP benefits and eligible farms no longer receive farm program benefits. The nature of the counterfactual is given in Table 7. The interpretation follows Tables 5 and 6. Solving for the model's endogenous variables under the new rates of the table effectively removes SNAP and farm programs from the 2010 baseline data.

Results

The results consist of new equilibrium values of the endogenous variables under the revised tax and transfer schemes identified above. For ease of presentation, results across the nine households are aggregated into quintiles. A series of changes will be considered, including effects on household disposable income, consumption expenditure by household, additionality, production by firms, changes in relative prices, changes in the number of jobs in each sector, and labor wages. Once these are reported, changes to household welfare and GDP are reported. Standard performance measures of farm-sector well-being are also reported. Three scenarios, (i) impact of SNAP, (ii) impact of farm programs, and (iii) impact of both SNAP and farm

programs, will be compared side-by-side and discussed in this section. The first scenario represents a move from not having SNAP to having it, with farm programs intact before and after. The second scenario represents a move from not having farm programs to having them, with SNAP in place in both situations. The third scenario represents a move from not having either program, to having both of them, all else the same.

Disposable income

Changes in disposable income are reported in Table 8. A general conclusion of the table is that SNAP has a higher impact on households compared to that of farm programs. This is partly because SNAP is a larger program, but also because SNAP is effectively a transfer among households, as opposed to affecting enterprises more directly. The impact is higher for the lowest and second quintiles (1-2) which consist of 80% of SNAP receipts. Disposable income of the lowest quintile increases by 3.55% at an average increase of \$1,306 per household. The second quintile gains somewhat less, at 0.5%. Disposable income of 3-5 quintiles falls as they now have to pay more taxes, and they receive little in terms of SNAP benefits. This loss of disposable income is highest among the fifth quintile, with a \$7,650 loss per household.

Turning to the farm program scenario in Table 8, all households have a reduction in their disposable income, due to the taxes that must be paid for these programs. However, the effect on disposable income is less than 1%. Percentages are higher among higher income households.

Turning to the third scenario, which represents moving from no farm bill to the farm bill (i.e., both programs are introduced), its effects on disposable income are distinct. When the impact of both programs is considered, the pattern of effects by quintile is similar to the case of SNAP, but now the values are comparatively lower than the case when SNAP is introduced in

isolation. This is consistent with expectations; the two programs affect disposable income in opposite directions for net tax-paying households.

The overall impact on all households can also be considered, specifically, the absolute change in disposable income by combining all nine households together. When SNAP is implemented, the total absolute change in disposable income is \$107,835 million (\$918 per household) or 1.03%. When farm programs are implemented, the total absolute change in disposable income is \$17,149 million (\$146 per household) or 0.16%. If both programs are implemented, it results in the highest absolute change in disposable income which is \$120,127 million (\$1,022 per household) or 1.15%.

Consumption expenditure

Once discretionary income changes, it changes household consumption expenditures, as well as the demand for inter-industry input trade and factors of production. The changes in consumption expenditure are given in dollars per household for all three scenarios. Table 9 reports the change in consumption for major consumption categories due to the implementation of SNAP. In the lowest two quintiles (1-2), consumption has increased in all categories. This would make sense as they receive more SNAP benefits and hence have more disposable income. The largest increase in terms of percentages is for the lowest quintile. On the other hand, the middle, fourth and highest quintiles reduce their consumption expenditure now that they have to pay taxes to fund SNAP. The largest reduction in consumption expenditure is for the highest quintile. Across all households, percentage changes for food are low compared to the non-food categories. This is due to the inelastic expenditure elasticities associated with food, which is a staple (expenditure elasticities are unique to each sector but are not reported below for lack of space).

Changes in consumption expenditure across major categories due to the implementation of farm programs are given in Table 10. Under these programs, consumption expenditure falls for all household quintiles. However, it should be noted that the percentages are very low due to the small monetary size of this program. Also, these are comparatively low for lower quintiles as oppose to higher quintiles. As earlier, it can be observed that the change in non-food consumption is larger than for food related consumption.

Table 11 reports the change in consumption expenditure across major categories due to the implementation of both SNAP and farm programs. The impact of SNAP appears to dominate. For the lowest and second quintile, there is an increase in consumption expenditure, although it is less than when SNAP is considered separately. However, for the middle, fourth and highest quintiles, the decrease in consumption expenditure is higher than when SNAP is considered separately. The reason is they now pay a higher portion of taxes that are used to fund both programs.

The absolute change in consumption expenditure for all households is given in Table 12. It is evident that the change in consumption expenditure is higher for SNAP and comparatively smaller for farm programs. This result doesn't contradict the prior expectation that SNAP directly affects household income whereas farm programs do not. When both programs are implemented together, the highest change is observed. Also it is noteworthy to see how all households have changed consumption expenditure across non-food and food-related categories. When households receive SNAP benefits, they have money available for non-food related consumption since part of their food expenditures are covered by SNAP. This frees up funds to be used in other (SNAP ineligible) purchases. Conversely, when households pay taxes to fund

these programs, it takes out money from their budget, and they adjust spending based to a large extent on expenditure elasticities.

Additionality and its implication on measuring farm bill impacts

SNAP benefits are administered through electronic benefit transfer (EBT) accounts which enable a recipient to purchase eligible food items at authorized food retail outlets. By contrast, farm programs provide funds to farmers for selected sectors under commodity program and crop insurance. Both programs directly and indirectly influence household food purchase decisions. One might expect SNAP to impact food spending more directly, while farm programs might influence it indirectly, perhaps through lowering the price of food (which will be described below). Much of the food purchased through SNAP or in the presence of farm programs would have been purchased by households even in the absence of these programs. An important question is: How much more food spending do these programs create?

This concept is termed additionality (Levedahl 1995; Barrett 2002; Hanson 2002; Hanson and Oliveira 2009) and is defined as the amount by which a dollar of program spending results in additional food spending. Additionality ranges from 0 to 1. An additionality of zero implies that all food purchased with the program would have otherwise been purchased with the participants own money, i.e., the program has no effect on food expenditure. On the other hand, an additionality value of one implies that all program spending goes to food, and a program is highly influential on food expenditure.

Additionality was estimated for all three scenarios and is reported in Table 13. For SNAP the additionality measure was found to be higher than for when the farm program is implemented. Additionality for the lowest and second quintile was found to be 0.015 and

0.0032. In other words, this implied that a dollar of federal SNAP spending raised food expenditure by 1.5 cents and 0.3 cents respectively. On the other hand, a negative value was obtained for middle, fourth and highest quintiles at 0.0008, 0.0041 and 0.0156 respectively implying reduced food expenditure. Additionality measure for farm program shows that all households reported negative additionality values as they have to pay taxes to fund farm program. Further, in absolute terms, these numbers were less in 1-4 quintiles compared to SNAP. This affirms that SNAP more directly influences food expenditure compared to farm program. Additionality measures when both programs are implemented are almost similar to SNAP. Now the divergence between the increase in food expenditure for 1-2 quintiles and decrease in food expenditure for 3-5 quintiles has increased. In future versions of this study these estimates will be decomposed with regard to narrower categories of food expenditure.

Production, prices and labor market

To meet the changes in the demands represented above there are resultant changes in quantity supplied. These results are given in Table 14. As SNAP is implemented, the value of output, prices and number of jobs increase for most sectors, albeit by small percentages. Wholesale and retail trade, durables goods manufacturing, financial and insurance and other services contract in terms of the value of output, producer and commodity prices and number of jobs. Declines in these sectors are the result of reduced demand owing to changing demand as well as intermediate input demand. Food processing, food services, farming sectors expand somewhat, in line with the increase in demand due to SNAP. Overall, however, SNAP results in a small decline in jobs as a result of these changes.

Results for the second scenario, which represents a move from no farm programs to farm programs, is reported in Table 15. Implementation of farm programs causes a contraction for most of the sectors in terms of value of output and prices. It can be seen that the value of output and prices decreases in many sectors. In some cases, such as crop farming, livestock, and dairy, physical quantities are rising but value declines due to falling prices, however modest. Meanwhile, food services, wholesale and retail, transportation, financial and insurance, health and education, and other services experience a price increase. The increase in supply is coincident with rising demand for labor in these sectors. Crop farming as a whole requires 366,116 additional jobs under farm programs whereas livestock and dairy require 9,612 additional jobs. On the other hand, farm programs have enabled many commodities to be cheaper. In total, farm programs result in slightly greater numbers of jobs within that sector, lower prices for food and agricultural, and lower total value of output.

Table 16 depicts the results of scenario 3, which concerns implementing SNAP and farm programs together. The results show that the total value of output has decreased in all sectors with the exception of alcohol and tobacco. This reduction in terms of percentages is comparatively less than the case when farm programs are treated in isolation. The same holds for prices. In most cases the prices have fallen and this reduction is less in percentage terms compared to the scenario when farm programs were treated in isolation. Sectors such as food services, wholesale and retail trade, transportation, finance and insurance, health and education and other services experience an increase in prices despite lower overall sales value. Again, compared to the scenario where farm programs were introduced in isolation, the percentages are low. This implies that the impact of prices due to SNAP and farm programs moves in opposite direction and what is depicted in Table 16 is a net effect. In terms of number of jobs, a decrease

is observed in many sectors. This change in percentage terms is less than when farm programs are introduced in isolation. In contrast, for sectors such as crop farming, animal farming, the increase in the number of jobs is higher than when farm programs are considered in isolation. This is warranted given that with both SNAP and farm programs, the number of jobs rises for these sectors. Overall, both of these programs encourage production, increase the number of jobs, yet reduce prices and the total value of output, however slightly overall.

The impact on labor earnings can also be considered. Changes in per household labor earnings are reported in Table 17. Labor earnings increase due to SNAP, but fall upon the introduction of farm programs. There is also a reduction in earnings when both programs are implemented. However, this is slightly less than the case when farm programs are introduced in isolation. In some respects, farm programs have more influence on labor earnings relative to SNAP.

Gross domestic product and welfare effects

There are numerous other changes in the economy in addition to those highlighted above, such as changes in intermediate input usage, capital intensities by sector, and taxes and transfers. To understand the net effects of the above changes on households, welfare is reported in Table 18 in terms of equivalent variation and changes in utility by household. According to the equivalent variation measure, the first and second quintiles require \$15,005 and \$5,001 respectively to be as well off as without SNAP as they are with it. The third, fourth, and fifth quintiles, meanwhile, require \$2,521, \$5,066, and \$41,092 respectively to be as well off with SNAP as they are without it.

In the second scenario, all household types require a certain amount (ranging from \$145 to \$6,386) to be as well off with farm programs as they are without them. The consequences for the farms themselves are considered below.

When both programs are considered, the results are similar to the case when only SNAP is implemented. The first and second quintiles require \$14,801 and \$4,035 respectively to be as well off as without SNAP and farm programs as they are with them. These values are less than the case when only SNAP was introduced. The third, fourth, and fifth quintiles, meanwhile, require \$5,702, \$7,546 and \$47,766 respectively to be as well off with SNAP and farm programs as they are without them. These values are larger compared to the case when only SNAP was treated in isolation as these households are willing to receive funds from both programs to be as well off with SNAP and farm program as they are without them.

Changes in gross domestic product (GDP) are reported in Table 19. When SNAP is implemented there is a small expansion of the economy by 0.0024%. In contrast, farm programs cause the economy to contract by 0.1838%. This pattern is consistent with some of the results seen above. The larger response for farm programs is interesting given that SNAP spending are considerably larger than farm program spending; they are merely a transfer among households, however, with fewer opportunities for distortions. When both programs are implemented together, there is a contraction of the economy by 0.1812%. This is slightly less than the case when farm programs are introduced alone. Based on these results, it appears that neither program has outsized effects on the overall economy. This is because these programs, at approximately \$81 billion combined, are quite small within a \$14,522 billion economy.

Effects on farming operations

An important question so far neglected is how these programs influence the well-being of the farm sector in particular. In this study, an attempt was made to look at how farm wellbeing would change using model results in conjunction with various farm statistics reported by the USDA Economic Research Service (2016a). Measurements include farm cash receipts, farm related income, direct government payments, farm sector cash expenses, farm sector net cash income, farm sector assets and farm sector jobs. These results are reported in Table 20 for all three scenarios.

When SNAP is implemented (alongside already-present farm programs), total farm sector cash receipts rise by \$88.2 million (0.02%), farm sector cash expenses rise \$67 million (0.03%), and total net cash income increases slightly at \$21 million (0.02%). Total farm assets rise by \$236 million (0.01%), and there is an increase in the number of jobs in the farm sector of 1,124 (0.03%).

When farm programs are newly introduced (alongside already-present SNAP), there is a reduction in farm sector cash receipts of \$276 million (0.09%) due to the net effect of change in prices and quantity supplied. However, they now receive \$9,038 million as direct payments and their cash expenses fall by \$183 million (0.07%). As a result, net cash income rises by \$8,945 million (8.11%). The total farm sector assets also increase by \$52,343 million (2.42%). This sector absorbs 373,769 (6.91%) jobs, drawing them from other sectors such that national employment remains constant (by assumption, which may be relaxed in future work).

When SNAP and farm programs are simultaneously implemented farm sector cash receipts decrease by \$188.4 million (0.06%). This is less than the case when farm programs are introduced by themselves. Also, the farm sector receives \$9,038 million as direct payments and

their cash expenses fall by \$116 million (0.05%). Net cash income, total farm assets, and farm sector jobs increase by \$8,965 million (8.12%), \$52,573 million (2.43%) and 374,790 (6.94%), respectively. These numbers are comparatively larger than the case when farm programs were introduced in isolation, with SNAP already present.

Tentative Conclusions

This study applies a detailed, static general equilibrium model for the U.S. economy in 2010 to quantitatively assess the impact of two distinct components of the 2008 farm bill: SNAP and farm safety net programs. Few if any existing studies have attempted to simultaneously analyze both programs within a common framework. SNAP and the farm programs examined here account for more than 90% of the farm bill and have a wide range of impacts on the U.S. economy as a whole. Due to these programs, a sequence of changes take place that reverberate throughout in the economy, tying together a wide range of households, business enterprises, and labor and capital markets. Using a general equilibrium model ensures that the numerous linkages of the economy are captured. This analysis is the first major attempt to make a comparison among these programs and can serve as a basis for further research in this area.

Although the study remains preliminary as of the writing, a few tentative results can be drawn at this stage. SNAP increases the disposable income of poorer households, but richer households have less disposable income as they now have to pay taxes to fund SNAP. Due to Engel effects, SNAP eligible and ineligible household expenditures change differently when SNAP is introduced. Agricultural and food sectors are positively affected by implanting SNAP. They have higher value of output, higher prices, and absorb a small amount of jobs from other sectors. Nonfood sectors that are ineligible for purchase with SNAP also expand in some

instances, as SNAP beneficiaries have more money at their disposal now that their food expenditures are, on average, partly covered through SNAP.

On the other hand, some sectors such as wholesale and retail trade and services more generally, contract somewhat under the introduction of SNAP. Overall, SNAP expands food and agricultural sectors slightly, increases labor earnings a small amount, and also expands the economy by increasing U.S. GDP by a small percentage.

Farm programs act more directly on the agricultural sector and have only modest impacts on households. They cause very little change in disposable income and consumption expenditure for most households; the main effect is a slight decrease in disposable income reflecting the fact that financial support for farm programs comes through household taxation. Although subsidies have a dampening effect on agricultural prices, causing cash receipts to fall slightly, net farm income rises due to the farm program benefits. Furthermore, the farming sector absorbs a small amount of labor from other sectors due to increased production, although labor earnings in the economy fall slightly. Farm programs have a slightly negative effect on GDP, while SNAP has a slightly positive effect on GDP.

The study also considers the impact of SNAP and farm programs when they are simultaneously introduced into the 2010 economy. The two programs reinforce one other in some ways and offset each other in other ways. Both programs increase the tax burden on higher income households, and together slightly raise overall GDP and labor use within agriculture. In contrast to SNAP, farm programs slightly reduce the well-being of low-income households, even as the price of agricultural and food items fall slightly.

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Table 1. Amounts spend under for different farming sectors

Farming sector	Amount spend (\$ million)
Oil Seed	
Soybean	1,555
Peanut	87
Sunflower	62
Canola	31
Grains	
Corn	3,495
Wheat	1,732
Rice	402
Sorghum	246
Barley	87
Oats	7
Cotton	828
Other crops	11
Diary	74
Livestock	227
Tobacco	194

Source: Environmental Working Group (2010)

Table 2. Activities/commodities used in the model

Code	Description
OILSEED	Oilseed farming
GRAIN	Grain farming
FRUITVEG	Fruits and vegetables farming
COTTON	Cotton farming
TREENUT	Tree nut farming
OTHCROP	Other crop farming
DAIRYFRM	Dairy farms
POULTFRM	Poultry farms
LVSTOCK	Miscellaneous livestock farms
RESOURCE	Forestry and mining except coal and crude oil
CRUDEOIL	Crude oil and natural gas
WHSAIL	Wholesale trade
FDSAIL	Retail trade for food and beverages
RETAIL	Retail trade other than food and beverage
DAIRY	Milk and milk based processed food
REDMEAT	Processed red meat
POULTRY	Processed poultry
SEAFOOD	Processed sea food
PROCGRN	Processed food grain based
PROCOIL	Processed oil
PROCFROZ	Processed frozen food
PROCSUGR	Processed sugar products
PROCFTVG	Processed fruit and vegetable
PROCOTHR	Processed food of plant origin other
PROCOTHER	Processed food other
AWAYFD	Food purchased away
ALCOHOL	Alcohol
TOBACC	Tobacco
APARL	Apparel and textiles
REFPETRO	Refined petroleum products
CHEMRUB	Chemical rubber and plastic products
IRON	Iron and other metal related manufacturing
COMP	Computer and electronic related manufacturing
ELECTRIC	Electric goods manufacturing
MACHINE	Machinery and equipment manufacturing
AUTOIND	Motor vehicles manufacturing
HHMNFS	Household related manufacturing
OTHNDURA	Other non-durable goods manufacturing
OTHDURA	Other durable goods manufacturing
CONSTRUC	Construction
REALEST	Real estate and owner occupied dwellings
TRANS	Transportation
FININS	Finance and insurance
EDUCHEALTH	Education and health
ELECUTIL	Electric utilities private and public
GASUTIL	Gas utilities private and public
OTHERUTIL	Other utilities water and sanitary radio tv and telephone
BUSSERV	Business related services
PERSERV	Personal services
OTHERSERV	Other services

Table 3. Macro-SAM of USA in 2010 (\$ billion)

Category	Activities					Commodities						Factors		Households	Institutions			ROW	Total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19
Activities																				
1. Agricultural & natural resources	0	0	0	0	0	0	861	0	30	0	0	2	0	0	0	0	0	0	0	894
2. Food & beverages	0	0	0	0	0	0	0	1,375	9	0	0	0	0	0	0	0	0	0	0	1,384
3. Manufactured goods	0	0	0	0	0	0	4	1	5,513	0	0	22	0	0	0	0	0	0	0	5,540
4. Wholesale-retail trade & transportation	0	0	0	0	0	0	0	0	0	2,717	0	0	0	0	0	0	0	0	0	2,717
5. Housing, construction & utilities	0	0	0	0	0	0	0	0	1	0	3,553	97	0	0	0	0	0	0	0	3,650
6. Services	0	0	0	0	0	0	0	8	0	18	135	10,723	0	0	0	0	0	0	0	10,885
Commodities																				
7. Agricultural & natural resources	162	198	458	4	86	19	0	0	0	0	0	0	0	0	117	7	110	0	86	1,246
8. Food & beverages	5	236	36	12	7	116	0	0	0	0	0	0	0	0	952	37	5	0	44	1,450
9. Manufactured goods	117	136	2,092	164	185	465	0	0	0	0	0	0	0	0	1,343	740	1,198	0	751	7,190
10. Wholesale-retail trade & transportation	30	85	294	94	72	131	0	0	0	0	0	0	0	0	1,584	79	149	0	267	2,785
11. Housing, construction & utilities	48	80	150	140	233	612	0	0	0	0	0	0	0	0	1,958	152	326	0	11	3,710
12. Services	84	164	688	456	395	2,295	0	0	0	0	0	0	0	0	4,506	2,433	245	0	431	11,696
Factors																				
13. Labor	119	271	1,032	1,079	371	5,109	0	0	0	0	0	0	0	0	0	0	0	0	0	7,981
14. Capital	280	159	749	407	1,992	1,959	0	0	0	0	0	0	0	0	0	0	0	0	0	5,545
Households																				
15. Households	0	0	0	0	0	0	0	0	5	0	0	137	7,041	1,942	173	2,528	820	0	0	12,648
Institutions																				
16. Government	0	0	0	0	0	0	5	0	5	0	18	361	940	130	1,271	2,499	2,307	997	0	8,532
17. Investment	0	0	0	0	0	0	17	8	189	0	0	0	0	3,477	743	57	618	0	668	5,777
18. Business taxes	48	56	41	361	311	180	0	0	0	0	0	0	0	0	0	0	0	0	0	997
Rest of the world (ROW)																				
19. Net exports	0	0	0	0	0	0	359	58	1,437	50	3	354	0	-5	0	0	0	0	0	2,257
Total	894	1,384	5,540	2,717	3,650	10,885	1,246	1,450	7,190	2,785	3,710	11,696	7,981	5,545	12,648	8,532	5,777	997	2,257	

Note: Income is the sum of employee compensation, proprietor income and other property income. Source: IMPLAN (2012)

Table 4. Characteristics of the representative nine households

#	Income category	Number of households in each category	Contribution to federal revenue by each household ¹	Percentage of SNAP benefits received by each household ²
HH1	< \$10,000	11,208,871	0.20%	31.56%
HH2	\$10,000 – 15,000	7,412,319	0.13%	14.90%
HH3	\$15,000 – 25,000	15,072,384	0.27%	22.38%
HH4	\$25,000 – 35,000	15,052,651	1.68%	11.77%
HH5	\$35,000 – 50,000	19,425,102	2.16%	9.36%
HH6	\$50,000 – 75,000	22,870,406	8.87%	5.89%
HH7	\$75,000 – 100,000	12,024,141	10.11%	2.18%
HH8	\$100,000 – 150,000	9,071,987	7.63%	1.43%
HH9	>150,000	5,371,952	68.94%	0.54%

¹Calculated based on the numbers from United States Congressional Budget Office (2013)

²Calculated based on the numbers from United States Census Bureau (2016)

Table 5. Counterfactual for the impact of SNAP

Household type	Net transfers to the federal government (\$ millions)		Total receipts (\$ millions)	Income tax rate without SNAP	Income tax rate with SNAP
	Without SNAP	With SNAP			
HH1	19,927	-1,489	378,392	5.27%	-0.39%
HH2	3,278	-6,807	275,372	1.19%	-2.47%
HH3	10,252	-4,843	745,831	1.37%	-0.65%
HH4	21,806	14,915	916,646	2.38%	1.63%
HH5	63,201	58,282	1,484,986	4.26%	3.92%
HH6	159,522	161,561	2,460,850	6.48%	6.57%
HH7	137,224	142,646	1,690,885	8.12%	8.44%
HH8	186,742	190,977	1,844,040	10.13%	10.36%
HH9	297,158	343,870	2,850,626	10.42%	12.06%

Table 6. Counterfactual for the impact of farm programs

Eliminating farm programs from the eligible farming sectors					
Farming Sector	Net transfers to the federal government (\$ millions)		Total receipts (\$ millions)	Business tax rate without farm programs	Business tax rate with farm programs
	Without farm programs	With farm programs			
Oil seed farming	2,605	870	34,224	7.61%	2.54%
Grain farming	5,964	-4	60,974	9.78%	-0.01%
Cotton farming	828	-1	6,267	13.22%	-0.01%
Other crop farming	1,283	1,272	44,408	2.89%	2.86%
Dairy	439	365	31,361	1.40%	1.16%
Livestock	1,921	1,694	74,618	2.57%	2.27%
Tobacco farming	9,575	9,380	49,236	19.45%	19.05%
Transferring the funds to the taxpaying households					
Household type	Net transfers to the federal government (\$ millions)		Total receipts (\$ millions)	Income tax rate without farm programs	Income tax rate with farm programs
	Without farm programs	With farm programs			
HH1	-1,507	-1,489	378,392	-0.40%	-0.39%
HH2	-6,818	-6,807	275,372	-2.48%	-2.47%
HH3	-4,867	-4,843	745,831	-0.65%	-0.65%
HH4	14,763	14,915	916,646	1.61%	1.63%
HH5	58,087	58,282	1,484,986	3.91%	3.92%
HH6	160,759	161,561	2,460,850	6.53%	6.57%
HH7	141,731	142,646	1,690,885	8.38%	8.44%
HH8	190,287	190,977	1,844,040	10.32%	10.36%
HH9	337,639	343,870	2,850,626	11.84%	12.06%

Table 7. Counterfactual for the impact of SNAP and farm program

Eliminating farm programs from the eligible farming sectors					
Production Sector	Net transfers to the federal government (\$ millions)		Total receipts (\$ millions)	Business tax rate without SNAP & farm programs	Business tax rate with SNAP & farm programs
	Without SNAP & farm programs	With SNAP & farm programs			
Oil seed farming	2,605	870	34,224	7.61%	2.54%
Grain farming	5,964	-4	60,974	9.78%	-0.01%
Cotton farming	828	-1	6,267	13.22%	-0.01%
Other crop farming	1,283	1,272	44,408	2.89%	2.86%
Dairy	439	365	31,361	1.40%	1.16%
Livestock	1,921	1,694	74,618	2.57%	2.27%
Tobacco farming	9,575	9,380	49,236	19.45%	19.05%

Eliminating SNAP and FP and transferring the funds to taxpaying households					
Household type	Net transfers to the federal government (\$ millions)		Total receipts (\$ millions)	Income tax rate without SNAP & farm programs	Income tax rate with SNAP & farm programs
	Without SNAP & farm programs	With SNAP & farm programs			
HH1	19,891	-1,489	378,392	5.26%	-0.39%
HH2	3,254	-6,807	275,372	1.18%	-2.47%
HH3	10,204	-4,843	745,831	1.37%	-0.65%
HH4	21,503	14,915	916,646	2.35%	1.63%
HH5	62,810	58,282	1,484,986	4.23%	3.92%
HH6	157,918	161,561	2,460,850	6.42%	6.57%
HH7	135,396	142,646	1,690,885	8.01%	8.44%
HH8	185,363	190,977	1,844,040	10.05%	10.36%
HH9	284,696	343,870	2,850,626	9.99%	12.06%

Table 8. Changes in disposable income

Household type	Change in disposable income (\$ millions)					
	SNAP		Farm programs		SNAP & farm programs	
	Value	%	Value	%	Value	%
Lowest quintile	44,008	3.55	-396	-0.03	43,409	3.50
Second quintile	10,197	0.50	-2,098	-0.10	8,375	0.42
Middle quintile	-2,521	-0.12	-3,290	-0.15	-5,704	-0.27
Fourth quintile	-10,014	-0.35	-4,990	-0.17	-14,880	-0.52
Highest quintile	-41,095	-2.07	-6,376	-0.32	-47,759	-2.40

Household type	Change in disposable income (\$ per household)					
	SNAP		Farm programs		SNAP & farm programs	
	Value	%	Value	%	Value	%
Lowest quintile	1,306	3.55	-12	-0.03	1,288	3.50
Second quintile	296	0.50	-61	-0.10	243	0.42
Middle quintile	-110	-0.12	-144	-0.15	-249	-0.27
Fourth quintile	-475	-0.35	-237	-0.17	-705	-0.52
Highest quintile	-7,650	-2.07	-1,187	-0.32	-8,890	-2.40

Table 9. Changes in consumption expenditure due to SNAP

Consumption category	Change in consumption/expenditure (\$ per household)									
	Lowest quintile		Second quintile		Middle quintile		Fourth quintile		Highest quintile	
	Value	%	Value	%	Value	%	Value	%	Value	%
Food at home	5.12	0.29	1.01	0.03	-0.31	-0.01	-1.26	-0.02	-14.97	-0.14
Dairy, meat, fish	1.98	0.33	0.41	0.04	-0.13	-0.01	-0.51	-0.03	-6.01	-0.16
Fruit, vegetables	1.04	0.16	0.18	0.02	-0.06	0.00	-0.23	-0.01	-2.69	-0.07
Miscellaneous food	2.09	0.39	0.42	0.05	-0.13	-0.01	-0.53	-0.03	-6.27	-0.19
Food away from home	4.92	0.33	0.91	0.04	-0.40	-0.01	-1.77	-0.03	-25.83	-0.16
Non-food consumption	1,294.24	3.66	293.44	0.51	-109.40	-0.12	-471.02	-0.36	-7,599.66	-2.08
Alcohol and tobacco	1.94	0.42	0.35	0.05	-0.11	-0.01	-0.44	-0.04	-4.45	-0.20
Clothing	14.75	3.20	3.48	0.46	-1.33	-0.11	-5.96	-0.32	-101.69	-1.86
Non-durables	72.08	4.00	17.60	0.56	-4.73	-0.14	-18.39	-0.39	-222.82	-2.26
Durables	71.09	4.06	16.64	0.57	-6.63	-0.13	-31.39	-0.40	-491.85	-2.29
Petroleum	41.26	4.26	8.93	0.60	-3.37	-0.15	-13.20	-0.42	-160.70	-2.44
Utilities	67.08	3.93	14.30	0.56	-4.64	-0.13	-17.45	-0.39	-220.16	-2.26
Finance and Insurance	98.09	4.07	30.86	0.57	-12.03	-0.13	-56.18	-0.39	-779.70	-2.28
Housing	213.26	3.76	44.48	0.53	-18.90	-0.13	-77.99	-0.38	-1,306.20	-2.17
Health and education	330.75	3.66	65.87	0.52	-22.55	-0.12	-84.93	-0.36	-1,571.24	-2.08
Transportation	40.29	4.27	7.36	0.60	-2.61	-0.14	-11.38	-0.42	-244.22	-2.43
Wholesale and retail	151.65	4.07	35.83	0.57	-16.18	-0.13	-86.77	-0.39	-1,161.06	-2.27
Other services	192.03	4.28	47.74	0.60	-16.32	-0.14	-66.95	-0.41	-1,335.59	-2.39
Total consumption	1,304.28	1.43	295.35	0.20	-110.11	-0.05	-474.05	-0.14	-7,640.46	-0.79

Note: This is scenario 1 and represents a move from a 2010 equilibrium without SNAP, all else the same, to the actual 2010 equilibrium that did incorporate SNAP.

Table 10. Changes in consumption expenditure due to farm programs

Consumption category	Change in consumption/expenditure (\$ per household)									
	Lowest quintile		Second quintile		Middle quintile		Fourth quintile		Highest quintile	
	Value	%	Value	%	Value	%	Value	%	Value	%
Food at home	-0.04	0.00	-0.19	-0.01	-0.39	-0.01	-0.61	-0.01	-2.29	-0.02
Dairy, meat, fish	-0.02	0.00	-0.08	-0.01	-0.16	-0.01	-0.25	-0.01	-0.92	-0.02
Fruit, vegetables	-0.01	0.00	-0.03	0.00	-0.07	0.00	-0.11	-0.01	-0.41	-0.01
Miscellaneous food	-0.02	0.00	-0.08	-0.01	-0.16	-0.01	-0.25	-0.02	-0.96	-0.03
Food away from home	-0.05	0.00	-0.20	-0.01	-0.54	-0.01	-0.91	-0.01	-4.07	-0.03
Non-food consumption	-11.47	-0.03	-60.35	-0.09	-142.69	-0.15	-234.70	-0.17	-1,181.01	-0.32
Alcohol and tobacco	-0.01	0.00	-0.06	-0.01	-0.13	-0.01	-0.20	-0.02	-0.67	-0.03
Clothing	-0.04	-0.01	-0.58	-0.07	-1.49	-0.12	-2.62	-0.14	-14.83	-0.27
Non-durables	-0.51	-0.02	-3.08	-0.10	-5.63	-0.16	-8.60	-0.19	-33.58	-0.34
Durables	-0.47	-0.02	-3.21	-0.10	-8.07	-0.17	-14.73	-0.19	-73.91	-0.35
Petroleum	-0.13	-0.01	-1.46	-0.09	-3.72	-0.16	-5.79	-0.19	-23.43	-0.36
Utilities	-0.46	-0.02	-2.62	-0.10	-5.68	-0.16	-8.30	-0.18	-33.40	-0.34
Finance and Insurance	-1.00	-0.04	-6.63	-0.11	-16.11	-0.18	-28.53	-0.20	-122.11	-0.36
Housing	-0.55	-0.01	-7.09	-0.08	-20.40	-0.14	-33.57	-0.16	-188.85	-0.31
Health and education	-4.18	-0.04	-14.53	-0.11	-32.37	-0.17	-45.59	-0.19	-253.34	-0.33
Transportation	-0.36	-0.04	-1.57	-0.12	-3.47	-0.19	-5.75	-0.21	-38.15	-0.38
Wholesale and retail	-1.79	-0.05	-8.97	-0.12	-23.01	-0.19	-46.19	-0.21	-186.49	-0.37
Other services	-1.96	-0.05	-10.55	-0.13	-22.60	-0.19	-34.84	-0.22	-212.26	-0.38
Total consumption	-11.55	-0.01	-60.74	-0.04	-143.61	-0.06	-236.22	-0.07	-1,187.37	-0.12

Note: This is scenario 2 and represents a move from a 2010 equilibrium without farm programs, all else the same, to the actual 2010 equilibrium that did incorporate farm programs.

Table 11. Changes in consumption expenditure due to SNAP and farm programs

Consumption category	Change in consumption/expenditure (\$ per household)									
	Lowest quintile		Second quintile		Middle quintile		Fourth quintile		Highest quintile	
	Value	%	Value	%	Value	%	Value	%	Value	%
Food at home	5.06	0.29	0.84	0.03	-0.69	-0.02	-1.86	-0.04	-17.36	-0.16
Dairy, meat, fish	1.96	0.32	0.34	0.03	-0.28	-0.02	-0.75	-0.04	-6.97	-0.19
Fruit, vegetables	1.03	0.15	0.15	0.01	-0.12	-0.01	-0.33	-0.02	-3.12	-0.08
Miscellaneous food	2.07	0.39	0.35	0.04	-0.29	-0.02	-0.78	-0.05	-7.27	-0.22
Food away from home	4.85	0.33	0.73	0.03	-0.91	-0.02	-2.66	-0.04	-30.09	-0.19
Non-food consumption	1,276.81	3.62	241.02	0.43	-247.42	-0.27	-699.93	-0.53	-8,833.97	-2.41
Alcohol and tobacco	1.92	0.41	0.30	0.04	-0.24	-0.03	-0.63	-0.05	-5.15	-0.23
Clothing	14.62	3.17	3.00	0.40	-2.77	-0.23	-8.50	-0.46	-117.21	-2.15
Non-durables	71.34	3.95	15.00	0.47	-10.17	-0.29	-26.78	-0.58	-257.95	-2.62
Durables	70.33	4.01	13.87	0.48	-14.42	-0.29	-45.75	-0.58	-569.14	-2.65
Petroleum	40.91	4.22	7.71	0.52	-6.95	-0.31	-18.83	-0.61	-185.22	-2.81
Utilities	66.32	3.89	12.07	0.47	-10.12	-0.29	-25.54	-0.57	-255.09	-2.61
Finance and Insurance	96.73	4.01	25.06	0.47	-27.62	-0.30	-84.06	-0.59	-907.30	-2.65
Housing	211.64	3.73	38.59	0.47	-38.53	-0.27	-110.59	-0.54	-1,503.89	-2.50
Health and education	325.16	3.60	53.15	0.42	-53.93	-0.29	-129.46	-0.54	-1,835.79	-2.42
Transportation	39.71	4.21	5.99	0.50	-5.97	-0.32	-16.98	-0.63	-284.08	-2.83
Wholesale and retail	149.10	4.00	27.81	0.46	-38.49	-0.31	-131.86	-0.59	-1,355.83	-2.66
Other services	189.04	4.21	38.48	0.49	-38.21	-0.33	-100.95	-0.62	-1,557.32	-2.79
Total consumption	1,286.71	1.41	242.60	0.17	-249.03	-0.10	-704.44	-0.20	-8,881.42	-0.92

Note: This is scenario 3 and represents a move from a 2010 equilibrium without SNAP or farm programs, all else the same, to the actual 2010 equilibrium that did incorporate SNAP as well as farm programs

Table 12. Absolute change in consumption (\$ millions), all households combined

Consumption category	SNAP		Farm programs		SNAP & farm programs	
	Value	%	Value	%	Value	%
Food at home	321	0.11	42	0.01	348	0.11
Dairy, meat, fish	127	0.12	17	0.01	137	0.12
Fruit, vegetables	62	0.06	8	0.00	67	0.06
Miscellaneous food	133	0.14	17	0.01	144	0.15
Food away from home	382	0.12	62	0.01	427	0.12
Non-food consumption	106,988	1.38	17,026	0.11	119,210	1.42
Alcohol and tobacco	113	0.15	13	0.01	121	0.16
Clothing	1,319	1.22	190	0.09	1,468	1.25
Non-durables	4,729	1.51	614	0.12	5,104	1.55
Durables	6,425	1.53	1,019	0.12	7,200	1.57
Petroleum	2,917	1.61	388	0.11	3,195	1.66
Utilities	4,410	1.49	590	0.12	4,791	1.53
Finance and Insurance	10,018	1.53	1,888	0.13	11,402	1.57
Housing	17,813	1.43	2,452	0.10	19,755	1.47
Health and education	24,163	1.38	3,705	0.13	26,614	1.42
Transportation	3,223	1.61	472	0.14	3,565	1.66
Wholesale and retail	14,782	1.53	2,872	0.14	16,928	1.57
Other services	17,077	1.61	2,822	0.14	19,065	1.65
Total consumption	107,692	0.54	17,130	0.04	119,985	0.55

Table 13. Additionality measures for all three scenarios

Household type	Additionality		
	SNAP	Farm programs	SNAP and farm programs
Lowest quintile	0.0151	-0.0013	0.0132
Second quintile	0.0032	-0.0056	0.0022
Middle quintile	-0.0008	-0.0087	-0.0017
Fourth quintile	-0.0041	-0.0163	-0.0055
Highest quintile	-0.0156	-0.0189	-0.0161

Table 14. Changes in production, jobs, and prices due to SNAP

Industry	Change in					
	Labor Activity		Value of output		Commodity prices (% change)	Producer prices (% change)
	Number of jobs	%	Value (\$ millions)	%		
Food processing	477	0.034	198	0.028	0.0017	0.0013
Animal origin	213	0.034	81	0.031	0.0009	0.0006
Plant origin	162	0.030	63	0.023	0.0022	0.0016
Other	103	0.039	55	0.029	0.0018	0.0017
Food services (restaurants etc.)	919	0.009	12	0.002	0.0011	0.0011
Alcohol and tobacco	63	0.059	53	0.047	0.0038	0.0032
Total Farm	1,124	0.030	116	0.025	0.0028	0.0023
Crop farming	427	0.024	45	0.020	0.0039	0.0033
Livestock & dairy	359	0.033	43	0.030	0.0029	0.0029
Agri-services	338	0.034	28	0.025	0.0016	0.0008
Manufacturing	3,399	0.048	2,384	0.040	0.0030	0.0013
Clothing	-162	-0.034	-35	-0.036	0.0027	0.0003
Petroleum products	150	0.115	750	0.104	0.0053	0.0042
Durables	295	-0.005	-196	-0.011	0.0006	-0.0005
Non-durables	3,116	0.116	1,865	0.103	0.0035	0.0014
Wholesale and retail	-27,244	-0.108	-2,060	-0.114	-0.0033	-0.0027
Transportation	1,469	0.034	104	0.014	-0.0011	-0.0012
Financial and Insurance	-7,343	-0.068	-1,708	-0.076	-0.0012	-0.0010
Housing	186	0.003	-172	-0.008	0.0061	0.0061
Health and Education	28,080	0.149	2,640	0.121	-0.0030	-0.0030
Utilities	3,380	0.145	1,320	0.126	0.0024	0.0023
Other services	-6,386	-0.011	-699	-0.018	-0.0026	-0.0027
Total	-1,877	0.027	2,188	0.016	0.0006	0.0004

Table 15. Changes in production, jobs and prices due to farm programs

Industrial sector	Change in					
	Labor Activity		Value of output		Commodity prices (% change)	Producer prices (% change)
	Number of jobs	%	Value (\$ millions)	%		
Food processing	-1,222	-0.087	-427	-0.057	-0.0062	-0.0045
Animal origin	-498	-0.087	-181	-0.071	-0.0033	-0.0020
Plant origin	-511	-0.095	-172	-0.062	-0.0085	-0.0056
Other	-213	-0.080	-74	-0.039	-0.0067	-0.0060
Food services (restaurants etc.)	-8,831	-0.083	-326	-0.055	0.0057	0.0057
Alcohol and tobacco	246	0.333	-48	-0.042	-0.0164	-0.0137
Total Farm	373,769	6.908	-444	-0.104	-0.0119	-0.0088
Crop farming	366,116	20.369	-172	-0.096	-0.0162	-0.0124
Livestock & dairy	9,612	0.554	-105	-0.068	-0.0117	-0.0113
Agri-services	-1,958	-0.198	-167	-0.149	-0.0077	-0.0027
Manufacturing	-20,109	-0.211	-8,078	-0.175	-0.0159	-0.0067
Clothing	-990	-0.209	-185	-0.189	-0.0227	-0.0034
Petroleum	-291	-0.223	-1,282	-0.178	-0.0222	-0.0198
Durables	-13,134	-0.194	-4,014	-0.154	-0.0101	0.0001
Non-durables	-5,694	-0.218	-2,597	-0.181	-0.0087	-0.0037
Wholesale and retail	-48,156	-0.207	-3,674	-0.176	0.0130	0.0125
Transportation	-9,109	-0.210	-1,298	-0.181	0.0025	0.0052
Financial and Insurance	-24,803	-0.228	-4,292	-0.191	0.0035	0.0046
Housing	-15,871	-0.238	-4,212	-0.190	-0.0252	-0.0252
Health and Education	-41,402	-0.219	-3,548	-0.162	0.0146	0.0146
Utilities	-6,275	-0.233	-2,231	-0.190	-0.0102	-0.0100
Other services	-180,458	-0.257	-13,960	-0.218	0.0117	0.0126
Total	17,779	0.439	-42,537	-0.145	-0.0029	-0.0011

Table 16. Changes in production, jobs and prices due to SNAP and farm programs

Industrial sector	Change in					
	Labor Activity		Value of output		Commodity prices (% change)	Producer prices (% change)
	Number of jobs	%	Value (\$ millions)	%		
Food processing	-742	-0.053	-228	-0.030	-0.0045	-0.0033
Animal origin	-284	-0.052	-100	-0.040	-0.0024	-0.0015
Plant origin	-348	-0.065	-108	-0.039	-0.0063	-0.0040
Other	-110	-0.041	-20	-0.010	-0.0049	-0.0043
Food services (restaurants etc.)	-7,906	-0.075	-314	-0.053	0.0046	0.0046
Alcohol and tobacco	309	0.393	5	0.005	-0.0126	-0.0104
Total Farm	374,790	6.938	-327	-0.079	-0.0090	-0.0064
Crop farming	366,438	20.389	-127	-0.076	-0.0123	-0.0091
Animal farming	9,968	0.587	-61	-0.039	-0.0087	-0.0084
Agri-services	-1,617	-0.164	-139	-0.124	-0.0061	-0.0019
Manufacturing	-16,665	-0.163	-5,672	-0.135	-0.0129	-0.0054
Clothing	-1,152	-0.243	-220	-0.225	-0.0199	-0.0031
Petroleum	-140	-0.108	-529	-0.074	-0.0168	-0.0156
Durables	-12,821	-0.199	-4,205	-0.164	-0.0094	-0.0004
Non-durables	-2,552	-0.102	-719	-0.077	-0.0052	-0.0023
Wholesale and retail	-75,415	-0.315	-5,729	-0.290	0.0097	0.0098
Transportation	-7,665	-0.177	-1,198	-0.167	0.0014	0.0040
Financial and Insurance	-32,056	-0.295	-5,984	-0.267	0.0022	0.0036
Housing	-15,683	-0.235	-4,386	-0.198	-0.0190	-0.0190
Health and Education	-13,324	-0.070	-911	-0.042	0.0115	0.0115
Utilities	-2,877	-0.087	-904	-0.064	-0.0077	-0.0077
Other services	-186,885	-0.268	-14,660	-0.237	0.0091	0.0099
Total	15,882	0.466	-40,309	-0.130	-0.0023	-0.0007

Table 17. Changes in labor earnings

	Change in labor earnings (\$ per household)		
	SNAP	Farm programs	SNAP & farm programs
Lowest quintile	0.07	-15.77	-15.70
Second quintile	0.28	-62.58	-62.27
Middle quintile	0.59	-130.57	-129.91
Fourth quintile	0.92	-205.17	-204.13
Highest quintile	2.02	-448.97	-446.70
All households	0.48	-105.66	-105.12

Table 18. Equivalent variation and percentage change in utility

	Equivalent variation (\$ per household)			% change in utility		
	SNAP	Farm programs	SNAP & farm programs	SNAP	Farm programs	SNAP & farm programs
Lowest quintile	15,005	-145	14,801	0.431	-0.003	0.425
Second quintile	5,001	-1,099	4,035	0.055	-0.010	0.046
Middle quintile	-2,521	-3,288	-5,702	-0.012	-0.016	-0.027
Fourth quintile	-5,066	-2,529	-7,546	-0.037	-0.018	-0.055
Highest quintile	-41,092	-6,386	-47,766	-0.209	-0.033	-0.242
All households	2,491	-1,750	780	0.121	-0.012	0.109

Table 19. Changes in gross domestic product

	Change in GDP	
	Value (\$ millions)	%
SNAP	356	0.0024
Farm programs	-26,690	-0.1838
SNAP & farm programs	-26,318	-0.1812

Table 20. Changes in the determinants of farm well-being

Variable	Base value for 2010	Level change for 2010	Percent change
SNAP			
Total farm sector cash receipts (\$ millions)	335,698	88.2	0.02
Total farm related income (\$ millions)	20,009	0	0.00
Total direct government payments (\$ millions)	9,038	0	0.00
Total farm sector cash expenses (\$ millions)	254,399	67	0.03
Total farm sector net cash income (\$ millions)	110,345	21	0.02
Total farm sector assets (\$ millions)	2,161,361	236	0.01
Total farm sector jobs (# jobs)	3,559,974	1,124	0.03
Farm programs			
Total farm sector cash receipts (\$ millions)	335,698	-276.8	-0.09
Total farm related income (\$ millions)	20,009	0	0.00
Total direct government payments (\$ millions)	9,038	9,038	100
Total farm sector cash expenses (\$ millions)	254,399	-183	-0.07
Total farm sector net cash income (\$ millions)	110,345	8,945	8.11
Total farm sector assets (\$ millions)	2,161,361	52,343	2.42
Total farm sector jobs (# jobs)	3,559,974	373,769	6.91
SNAP & farm programs			
Total farm sector cash receipts (\$ millions)	335,698	-188.4	-0.06
Total farm related income (\$ millions)	20,009	0	0.00
Total direct government payments (\$ millions)	9,038	9,038	100
Total farm sector cash expenses (\$ millions)	254,399	-116	-0.05
Total farm sector net cash income (\$ millions)	110,345	8,965	8.12
Total farm sector assets (\$ millions)	2,161,361	52,573	2.43
Total farm sector jobs (# jobs)	3,559,974	374,790	6.94