

Annex I

Effects of U.S. Upland Cotton Subsidies on Upland Cotton Prices and Quantities

Summary

I use a traditional log linear equilibrium displacement model to simulate the effects of removing U.S. cotton subsidy programs on U.S. production, U.S. exports and world prices of cotton. The model simulates impacts for recent crop years, 1999 through 2005, and for future years, 2006 through 2008.

I examine and report the impact of removing all or part of the complex web of U.S. subsidy programs for cotton. The results I report vary by year, by the subsidy programs considered and by choices of underlying parameters. For example, I find that the effect of marketing loan and counter-cyclical payments is to lower world prices of cotton by between 9.3 percent and 10.7 percent in marketing year 2005, depending on the procedure used to create proxies for farmers' expectations.

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I. Introduction and Executive Summary

1. This report documents the simulated effects of U.S. upland cotton (hereafter “cotton”) subsidies on U.S. production and U.S. exports and the world price of cotton (the A-Index). The model simulates the percentage effects of removing specific subsidy programs relative to actual market data. It also simulates the percentage effects of removing specific subsidy programs relative to a baseline projection prepared under the assumption that cotton subsidies other than Step-2 would remain in place. The model, including all underlying equations and data, is open to review and assessment by the Panel and the United States. A complete electronic copy of the model is attached to this submission.

2. The model is a traditional log linear equilibrium displacement model using equations that represent supply and demand for cotton in the United States and the rest of the world. The equations in the model do not require any specific allowances for factors that cause differences between cotton prices in the United States and prices in the rest of the world because they are specified in log differential form. In other words, the model solves for approximate percentage changes in U.S. cotton production and exports as well as world prices due to policy “shocks” of removing U.S. cotton subsidy programs. It does not solve for resulting new absolute quantity or price levels. After aggregating supply and demand across the United States and the rest of the world, the model solves for percentage changes in the market-clearing price, as well as U.S. production and export as a function of model parameters and policy variables. The algebraic framework for the model is explained in more detail in Section II.

3. The model’s parameters incorporate up-to-date market information on U.S. and world production and consumption of cotton. Price elasticities of supply and demand are consistent with recent economic literature as well as with the particular counterfactual circumstances of removing different cotton subsidy programs on production in the United States and the rest of the world. In particular, subsidy programs for other crops are assumed to remain in place. To test the robustness of the model’s results, simulations are conducted with a U.S. price elasticity of supply taking the value of 0.8 as well as with a more conservative U.S. supply elasticity taking the value of 0.5. A value of 0.8 means that if the revenue per unit were expected to be lower by 10 percent, quantity would be lower by 8 percent. I discuss this and other parameter values in Section III.

4. In the model, U.S. producers respond to revenue they expect to receive from market prices and expected government subsidies, where relevant expectations are those that are held around the time that planting and other key production decisions are made. U.S. producers do not know with certainty what actual prices and subsidies will turn out to be as they unfold during the marketing year. Therefore, as in reality, the model assumes that actual prices or subsidies in a marketing year do not affect cotton growers’ behavior in that marketing year. However, actual data is relevant for growers’ behavior because it affects expectations about future payments, prices or other variables.

5. In view of the extensive discussion of alternative approaches to price expectations in the original *U.S. – Subsidies on Upland Cotton* panel proceeding, I conduct simulations using three different proxies for expectations about market prices and resulting amounts of U.S. subsidies that are tied to market price. These approaches include using expectations based on (1) a one-year lag of actual data on prices and selected subsidies; (2) planting

period prices for the harvest period futures contract, and (3) projections published in the FAPRI outlook at planting time for the upcoming marketing year. A detailed explanation of the different price and policy expectation proxies used is provided in Section IV and in Appendix II.

6. In the model, I examine the effects of seven U.S. cotton subsidies, including marketing loan program benefits, counter-cyclical payments, direct payments, crop insurance subsidies and user marketing Step-2 subsidies (plus the production flexibility contract payments and market loss assistance payments, which were paid until 2002). To reflect the different degrees to which each subsidy affects farmers' decisions to produce cotton, I use a policy coefficient that reflects the degree of incentive of revenue from that government program relative to the production incentive created by market revenue. I discuss, identify and explain the degree of production incentives for each subsidy program in Section V.

7. The results that I present to the Panel show a range of effects based on different parameter and policy assumptions. Results are provided for four different policy scenarios, including (A) a removal of marketing loan subsidies and counter-cyclical payments, (B) a removal of Step-2 subsidies, (C) removal of marketing loan subsidies, counter-cyclical payments and Step-2 subsidies, and (D) a removal of all of the seven subsidies to the extent that they are relevant for the marketing year simulated. For each policy scenario, I conduct three simulations depending on how price expectations are modeled.²

8. Results are provided for marketing years 1999 through 2005 when the simulation involves an examination of the Step-2 program. For the one-year lag expectation approach, I provide results for crop years 1999 through 2008. When the futures market price is used as a basis for price expectations, I use the period of marketing years 1999 through 2006, as the last available futures prices were the February 2006 futures prices for crops planted and harvested for marketing year 2006. For the FAPRI projection approach to expectations I present results for 2001 through 2008, because data for the first two years are not available. The range and breadth of results allows the Panel to appreciate the sensitivity of the results to alternative assumptions. As the Panel can see, my results are robust to changes in assumptions.

9. Naturally, results vary from year to year because expectations about market and price-contingent subsidy levels vary from year to year. In marketing year 2005, the removal of marketing loan and counter-cyclical payments decreases U.S. cotton production by 16.9 to 19.4 percent, decreases U.S. exports by 23.5 to 26.9 percent and increases the world price of cotton by 9.3 to 10.7 percent, depending on the proxy used for deriving revenue expectations.

II. A Framework for Simulating Market Effects of U.S. Cotton Subsidies

10. This section contains the algebra underlying the simulation model that shows analytically the effects of U.S. cotton subsidies on U.S. production, U.S. exports and

² The appendix also includes the results of a sensitivity analysis where the U.S. supply elasticity takes a value that I consider to be too low.

world market prices.³ The model is used to derive equations that represent the proportional effect of removal of all or some of the U.S. cotton subsidies.

11. I begin with four simple equations specified in logarithmic differential form. These equations represent the supply and demand for cotton in the United States, shown by subscript u and in the rest of the world shown by subscript r:

$$\begin{aligned} (1) \quad & d\ln S_u = \varepsilon_u(d\ln R_u), \\ (2) \quad & d\ln D_u = \eta_u(d\ln P), \\ (3) \quad & d\ln S_r = \varepsilon_r(d\ln P), \text{ and} \\ (4) \quad & d\ln D_r = \eta_r(d\ln P). \end{aligned}$$

In these equations, the term $d\ln S$ stands for the approximate percentage (or proportional) change in the quantity supplied, $d\ln D$ stands for the approximate percentage change in the quantity demanded, and $d\ln P$ stands for the approximate percentage change in market price. The variable R_u represents the effective revenue per unit received by producers in the United States and thus includes government subsidies. The parameters ε_u and ε_r are the per-unit revenue elasticities of supply in the United States and the rest of the world. The parameters η_u and η_r are the price elasticities of demand in the United States and the rest of the world.

12. The variable R_u equals market price, P , plus effective per-unit revenue received from government subsidies, denoted G . For U.S. producers, effective revenue per unit is therefore written as $R_u = P + G$. The variable G is not simply per-unit revenue from government payments and other subsidies; it also reflects the degree to which those subsidies provide an incentive for production relative to the incentive created by market price. Some revenue from government programs may be partly “decoupled” and hence may not provide as much production incentive as revenue from the market. Alternatively, in some cases, per-unit revenue from government programs could have a stronger production effect than market revenue. This could occur, for example, if government revenue causes production of cotton to be less risky than it would otherwise be. As discussed below, marketing loan benefits vary inversely with market price and smooth overall revenue from cotton production in addition to increasing expected per-unit revenue. This suggests that the incentive effect of expected marketing loan revenue may be larger than that for expected market revenue. But here I take the conservative case in which the degree of production incentive for each program has a maximum of 1.0.

13. I introduce these ideas into the model by defining a policy parameter, denoted γ , to represent the average degree to which government revenue provides a production incentive relative to revenue from the market. This concept is introduced in the model by defining $G = \gamma g$, where g is the per-unit government support from all subsidies. Thus, the variable G measures subsidies in market price equivalent terms. Hence, we may consider R_u as the effective price-equivalent per-unit revenue available to U.S. producers.

In logarithmic differential terms, per-unit revenue may be written as:

$$(5) \quad d\ln R_u = \alpha d\ln P + (1-\alpha)d\ln G.$$

³ The model is a traditional log linear equilibrium displacement model as explained for example in Bruce Gardner *The Economics of Agricultural Policies*, McGraw Hill, 1990. This exposition draws on annex 1 in Daniel A. Sumner, “Boxed In: Conflicts between U.S. Farm Policies and WTO Obligations,” Research Report, Cato Institute, Washington DC, December 2005.

The expression $d\ln G$ is the approximate percentage change in the effective government subsidy (measured as a price-subsidy equivalent). A percentage reduction in G may be achieved by reducing the degree of production incentives inherent in the support, $d\ln \gamma$, or by reducing the level of support, $d\ln g$. That is,

$$(6) \quad d\ln G = d\ln \gamma + d\ln g.$$

In equation 5, the parameter α is the share of market price in effective producer revenue per unit. That is,

$$(7) \quad \alpha = P/R_u,$$

and

$$(8) \quad (1-\alpha) = G/R_u.$$

Clearly the parameter α is closely related to the size of the per-unit subsidy, g , and the effective incentive per unit of subsidy, represented by the parameter γ . The share

$$(9) \quad \alpha = P/(P + \gamma g) \quad \text{and} \quad (1-\alpha) = (\gamma g)/(P + \gamma g) = \gamma/(\gamma + P/g).$$

In this second expression, the share of production-enhancing government support in production-enhancing revenue, $(1-\alpha)$, depends on the degree of production incentive inherent in the government programs (relative to the production incentive in market price), γ , and on the ratio of market revenue to revenue from government subsidy, P/g .

14. Because they are specified in log differential form, the equations in the model do not require any specific allowances for product differentiation, trade barriers, transport costs, and other factors that cause differences between the price of cotton in the United States and the price of cotton in the rest of the world. These aspects are implicitly held constant in the analysis. These terms could be included in the model, but they would appear as additive terms in the specification and thus would not affect the coefficients or the model solutions determining the impact of U.S. cotton subsidy programs.⁴

15. Likewise, because our attention is on the effects of removing U.S. subsidies holding other factors constant, I need not explicitly represent cotton subsidies in other countries. Subsidies in Europe, for example, may lower the level of equilibrium prices but they do not change the magnitude of the impact of U.S. subsidies on those prices. The effects of government programs in Europe or elsewhere on the response of prices or quantities to U.S. subsidies is felt through the supply elasticity in the rest of the world, ϵ_r , and the demand elasticity in the rest of the world, η_r .

⁴ This specification is standard in the literature and similar specifications appear in T.D. Wallace, "Measures of Social Costs of Agricultural Programs," *Journal of Farm Economics*, 44 (1962): 580-599; Bruce Gardner *The Economics of Agricultural Policies*, McGraw Hill, 1990; Daniel A. Sumner and Michael Wohlgenant, "Effects of an Increase in the Federal Excise Tax on Cigarettes," *American Journal of Agricultural Economics*, (85), 2 (May 1985): 235-42. The approach is discussed in some detail in Julian M. Alston and Jennifer S. James, "The Incidence of Agricultural Policy," Chapter 33 in B.L. Gardner and G. Rausser, eds. *Handbook of Agricultural Economics, Volume 2*. Elsevier, Amsterdam, 2002: 1689-1749.

16. Some policies insulate producers from market signals. When production or consumption in a country is partially insulated from world price movements by policy, transaction costs or transport costs, supply and demand responses to world prices will be smaller and, in the model, ϵ_r and η_r will be closer to zero. In a model with a different focus, one would explicitly incorporate other variables of specific interest. For example, in modeling a global reduction in subsidies, we would want to consider the simultaneous reduction of all subsidies and trade barriers. But that is not the case in this analysis.

17. As specified, this model does not explicitly include equations that provide details about the markets for alternative crops or details about the factors underlying the demands for cotton from domestic or international buyers. On the supply side, the prices of alternative crops are treated as endogenous, meaning that they would be expected to adjust to reductions in U.S. cotton subsidies. The supply elasticities I use take these adjustments into account. The demand elasticities are also equilibrium values reflecting adjustments in related markets.

18. To proceed with the model development, we aggregate supply and demand across regions, to obtain equations for aggregate supply and demand, and then solve for the market-clearing price as a function of model parameters and policy variables. Since total output is the sum of quantities from each source, total supply in log differential form, $d\ln S_w$, is the share-weighted sum of the equations for supply from the United States and the rest of the world. Thus we simply add equations 1 and 3. We can then use equation 5 to replace R_u . The result is:

$$(10) \quad \begin{aligned} d\ln S_w &= \delta_{su} d\ln S_u + (1-\delta_{su}) d\ln S_r = \delta_{su} \epsilon_u d\ln R_u + (1-\delta_{su}) \epsilon_r d\ln P \\ &= \delta_{su} \epsilon_u \alpha d\ln P + \delta_{su} \epsilon_u (1-\alpha) d\ln G + (1-\delta_{su}) \epsilon_r d\ln P \\ &= [\delta_{su} \epsilon_u \alpha + (1-\delta_{su}) \epsilon_r] d\ln P + \delta_{su} \epsilon_u (1-\alpha) d\ln G, \end{aligned}$$

where δ_{su} is the share of U.S. production in world production.

Similarly, on the demand side world demand in log differential form, $d\ln D_w$, is

$$(11) \quad \begin{aligned} d\ln D_w &= \delta_{du} d\ln D_u + (1-\delta_{du}) d\ln D_r = \delta_{du} \eta_u d\ln P + (1-\delta_{du}) \eta_r d\ln P, \\ &= [\delta_{du} \eta_u + (1-\delta_{du}) \eta_r] d\ln P, \end{aligned}$$

where δ_{du} is the share of U.S. consumption in world consumption.

19. Next we can set $d\ln S_w = d\ln D_w$ and solve for $d\ln P$ caused by the removal of all U.S. cotton subsidies, or some element of U.S. cotton subsidies. Therefore,

$$(12) \quad d\ln P = -d\ln G [(1-\alpha) \epsilon_u \delta_{su}] / [\delta_{su} \alpha \epsilon_u + (1-\delta_{su}) \epsilon_r - \delta_{du} \eta_u - (1-\delta_{du}) \eta_r].$$

Equation 12 provides the basis for assessing the effect of changes in the U.S. cotton subsidy rate, G , on the market clearing world price. Elimination of the U.S. subsidy is represented by setting $d\ln G = -1.0$ (that is, a 100 percent reduction in G). For elimination of only some of the subsidy programs $d\ln G$ becomes smaller in absolute value. Equation 12 shows that in the absence of the U.S. cotton subsidy, the world price would be higher. In equation 12, the demand elasticities, η_u and η_r , are negative and the supply elasticities ϵ_u and ϵ_r are positive. Of course, the shares, α and δ , are all positive and less than 1.0, therefore $d\ln P$ is positive for any negative value of $d\ln G$.

20. Combining equations 1 and 5 we may write the expression for the proportional change in U.S. cotton supply as

$$(1') \quad d\ln S_u = \varepsilon_u[(\alpha d\ln P) + (1-\alpha)d\ln G] = \varepsilon_u \alpha d\ln P + \varepsilon_u(1-\alpha)d\ln G.$$

Introducing the expression for $d\ln P$ from equation 12 we have

$$(13) \quad d\ln S_u = d\ln G[(1-\alpha)\varepsilon_u] \{1 - [\alpha\varepsilon_u\delta_{su}]/[\delta_{su}\alpha\varepsilon_u + (1-\delta_{su})\varepsilon_r - \delta_{du}\eta_u - (1-\delta_{du})\eta_r]\}$$

Equation 13 says that U.S. production would be smaller but for the subsidy G . The direct impact of elimination of all cotton subsidy ($d\ln G = -1.0$) on quantity supplied is shown by $\varepsilon_u(1-\alpha)$, which is positive. This exceeds the indirect effect that operates through a rise in the equilibrium market price and therefore $d\ln S_u$ will be negative for any negative $d\ln G$.

21. Finally, the impact of the elimination of U.S. cotton subsidy on the proportional change in U.S. exports reflects the effects on both U.S. quantity supplied, as shown in equation 13, and on U.S. quantity demanded:

$$(14) \quad d\ln X_u = d\ln(S_u - D_u) = (S_u/X_u)d\ln S_u - (D_u/X_u)d\ln D_u.$$

The expression for the effect of subsidy removal on quantity demanded is shown by introducing equation 12 into equation 2:

$$(15) \quad d\ln D_u = -d\ln G[\eta_u(1-\alpha)\varepsilon_u\delta_{su}]/[\delta_{su}\alpha\varepsilon_u + (1 - \delta_{su})\varepsilon_r - \delta_{du}\eta_u - (1 - \delta_{du})\eta_r].$$

The percentage change in quantity of cotton demanded in the United States is positive when the cotton subsidy is removed because the market price would be lower and this would stimulate the quantity demanded.

Substituting equation 15 and equation 13 into equation 14 and consolidating terms, the proportional change in exports is equal to:

$$(16) \quad d\ln X_u = d\ln G(1-\alpha) \varepsilon_u[(S_u/X_u)\{1 - (\alpha\varepsilon_u\delta_{su})/[\delta_{su}\alpha\varepsilon_u + (1 - \delta_{su})\varepsilon_r - \delta_{du}\eta_u - (1 - \delta_{du})\eta_r]\} + (D_u/X_u)\{\eta_u \delta_{su}/[\delta_{su}\alpha\varepsilon_u + (1 - \delta_{su})\varepsilon_r - \delta_{du}\eta_u - (1 - \delta_{du})\eta_r]\}].$$

III. Model Parameter Values

22. In order to assess the effects of U.S. cotton subsidies quantitatively, I next apply market data and policy information to specify the parameters used in the simulation model. Table 1, which lists the parameters of the model, provides concise definitions of each variable and includes its value based on information and analysis described in this section and in the appendix. The remainder of this section discusses the justification and support for the chosen parameter values. The data appendix provides further details about calculations as well as detailed citations and sources.

Table 1: Model Parameters and Indicated Values and Ranges

Model symbol	Parameter definition	Indicated value
ε_u	Elasticity of supply of cotton in the United States in response	0.8

	to changes in per-unit revenue	
ϵ_r	Elasticity of supply of cotton in the rest of the world in response to changes in per-unit revenue	0.2
η_u	Elasticity of demand for cotton in the United States in response to changes in market price	-0.2
η_r	Elasticity of demand for cotton in the rest of the world in response to changes in market price	-0.2
δ_{su}	Share of U.S. production in world production (model uses average for 2003 though 2005)	0.2
δ_{du}	Share of U.S. consumption in world consumption (model uses average for 2003 though 2005)	0.05
S_u/X_u	Ratio of U.S. production to U.S. exports (model uses average for 2003 though 2005)	1.43
D_u/X_u	Ratio of U.S. consumption to U.S. exports (model uses average for 2003 though 2005)	0.42
$E(\alpha) = E(P/(P + \gamma g))$	Expected share of market revenue in effective revenue from the market and government subsidy. Three alternative procedures are used to develop proxies for the expectations about market revenue and effective government subsidy.	Varies by year

Sources: See data appendix and the discussion in sections III and IV.

United States Supply Elasticity

23. The parameter, ϵ_u , represents the elasticity of supply of U.S. cotton to total per-unit market revenue and equivalent revenue from government programs (“per-unit revenue”). It measures the percentage change in quantity supplied for a one percent change in per-unit revenue. In my model, the supply elasticity for the United States takes the value of 0.8. However, to test sensitivity, I also include model results when the supply elasticity takes a lower value of 0.5.

24. My model considers policy scenarios under which farm subsidy programs are eliminated for cotton while subsidy programs remain in place for other crops that compete with cotton for land and other resources. Under my scenario, when cotton programs are eliminated, producers may shift to other program crops and be eligible for marketing loans for these competing crops. This means that the supply response is naturally larger than if we were considering a case where subsidies for all program crops remained in place, or where subsidies were reduced for all program crops together. My model’s focus on eliminating cotton subsidies while subsidies for other crops remain compels the use of a larger supply elasticity for the United States than often found empirically based on data covering periods when cotton and other farm programs were in place or used in simulations designed for other purposes, for example, by FAPRI and USDA.

25. The U.S. supply elasticity of 0.8 used in my model is appropriate for the policy simulations in which U.S. cotton quantity supplied responds to large *reductions* in government-provided cotton revenue per unit. For many producers in major U.S. cotton producing regions, the revenue available without government payments is below the cost

of production and sometimes, even below the variable cost of production.⁵ Not surprisingly, in these cases, the supply response to a removal of major subsidies would be very large. In order to minimize losses, such producers and the resources they control would stop producing cotton. The specific question that I analyze also suggests that some producers will switch to the production of other crops for which, unlike cotton, they would continue to receive revenue from government programs. Given this particular focus of my policy scenarios, we would expect a larger supply response for cotton in percentage terms to a decline in the revenue than the typical estimates in the literature, including from USDA and FAPRI, that generally consider relatively small movements, up or down, in price or subsidy – but do not simulate for the total removal of subsidies to one program crop.

26. In contrast to my model, the FAPRI model uses an average national planted acreage elasticity for the United States of approximately 0.5 for cotton. This elasticity applies for marginal changes, up and down, in per-unit revenue assuming all government programs (including those for cotton) remain in force.⁶ As explained above, this estimate is based on analysis of data from time periods when government programs were in force, and is used for simulations of different questions, such as, for example, the effect of reducing (but not eliminating altogether) marketing loan rates for all crops by a certain amount. For this and other reasons supported by the academic literature, a U.S. elasticity in the range of 0.5 is too low for an analysis of U.S. cotton supply response to large per-unit revenue effects from the removal of only the U.S. cotton subsidies.

Rest of World Supply Elasticity

27. The value of ϵ_r , the supply elasticity in the rest of the world, is lower than the supply elasticity in the United States. For results on world price and production, I need not differentiate between regions outside the United States in the model and therefore use a single parameter to reflect the weighted average of response in all countries. The supply elasticity of 0.2 that I use is approximately the weighted average of the individual country estimates used in the Iowa State CARD international cotton model.⁷

⁵ Schnepf, Randy and Jasper Womach. “Potential Challenges to U.S. Farm Subsidies in the WTO: A Brief Overview,” CRS Report for Congress, RS22522, October 25, 2006, Figure 1 and Table 5, available at <http://farmpolicy.typepad.com/farmpolicy/files/RS22522.pdf>. See also USDA surveys of cotton costs and returns, available at <http://ers.usda.gov/Data/CostsAndReturns/testpick.htm>.

⁶ Food and Agricultural Policy Research Institute, “Documentation of the FAPRI Modeling System” FAPRI-UMC Report # 12-04, available at http://www.fapri.missouri.edu/outreach/publications/2004/FAPRI_UMC_Report_12_04.pdf. See also Lin, William, Paul C. Westcott, Robert Skinner, Scott Sanford, and Daniel G. De La Torre Ugarte. *Supply Response Under the 1996 Farm Act and Implications for the U.S. Field Crops Sector*, TB-1888, U.S. Department of Agriculture, Economic Research Service, July 2000, available at <http://www.ers.usda.gov/publications/tb1888/tb1888.pdf>. See also *Quantitative Simulation Analysis by Professor Daniel Sumner*, Annex I to Brazil’s Further Submission of 9 September 2003, Table 1, available at http://www.mre.gov.br/portugues/ministerio/sitios_secretaria/cgc/analisequantitativa.pdf.

⁷ See *Quantitative Simulation Analysis by Professor Daniel Sumner*, Annex I to Brazil’s Further Submission of 9 September 2003, Table 3, available at http://www.mre.gov.br/portugues/ministerio/sitios_secretaria/cgc/analisequantitativa.pdf. The author obtained these elasticities from CARD economists. They were applied in Bruce A. Babcock, John C. Beghin, Jacinto F. Fabiosa, Stephane De Cara, Amani El-Obeid, Cheng Fang, Chad E. Hart, Murat Isik, Holger Matthey, Alexander E. Saak, Karen Kovarik, and FAPRI Staff, *Doha Round of the World Trade Organization: Appraising Further Liberalization of Agricultural Markets*, 02-WP 317, November 2002, available at <http://www.card.iastate.edu/publications/DBS/PDFfiles/02wp317.pdf>, and Cheng Fang and

28. My analysis is consistent with the existence of a world market for cotton and the findings about price transmission made by the panel in the original proceeding. The supply elasticity in the rest of the world, which is lower than the supply elasticity in the United States, reflects a number of factors. First, there is an imperfect transmission of price changes generated by U.S. cotton policy changes to cotton producers in certain cotton producing regions. Market institutions, centralized crop marketing, government policies, limited information, and high per-unit transport costs partially insulate producers in certain regions of the world from receiving, and responding proportionally to, the full increase in external world market prices from the shock of removing U.S. cotton subsidies. This is especially so in the short or intermediate run. By contrast, the U.S. supply elasticity in my model reflects a direct reduction in revenue that provides the incentive to grow U.S. cotton. A more limited price transmission triggers a more limited response to upward movement in world market prices and hence a more limited increase in cotton area and production. In other words, limited barriers to the full transmission of the world market price increases to producers suggest that supply response to the world price in certain regions is relatively small.

29. Moreover, in the short run, it is difficult for farmers in certain regions of the world to expand cotton production by buying or renting land, purchasing seeds and fertilizer, as well as specialized equipment in more developed countries, in response to the anticipation of a higher world price. Such difficulties in drawing new resources into cotton production when price rises for example by 10 percent or so on average, suggests that potential expansion in some major cotton producing regions is more limited.

30. Nonetheless, important cotton-producing regions in Africa, China, Central Asia and elsewhere do respond to some degree to world prices and certainly would benefit from higher cotton prices. Other countries and regions, such as Brazil, are able to adapt their production more quickly to respond to the positive price shock of removing U.S. production due to the elimination of subsidies.

31. The rest of world supply elasticity I use in my model is consistent with these and other considerations supported by the economic literature and, as noted above, takes the approximate value of the weighted average of the individual country estimates used in the CARD international cotton model.

Demand Elasticities

32. The U.S. and rest of world demand elasticities, η_u and η_r , are both set at -0.2. This reflects the relatively inelastic response of demand to changes in cotton prices. Whereas synthetic fibers can substitute for cotton in some uses, the econometric evidence shows that the market has demonstrated relatively little response in the use of cotton fiber to movements in the raw cotton price. For many uses consumer preferences for cotton over synthetic fabrics appear to be very strong for textiles. Furthermore, the cost of raw cotton makes up a small cost share in the final price of textile products. Consumers respond little to relatively small changes in the price of raw cotton because the impact of such changes on the relative price of retail textile products is minimal.

33. The use of the -0.2 parameter is consistent with the econometric literature and the FAPRI parameter sets. This value is approximately equal to the elasticity for the United States implied by the FAPRI model. (FAPRI uses a linear specification so the elasticity varies with quantity and price.⁸) It is also equal to the weighted average of the demand elasticities in the Iowa State CARD international cotton model.⁹ The value I use is twice the magnitude of the demand elasticity parameter used by Goreux (-0.1) and four times the magnitude of the demand elasticity parameter used by ICAC (-0.05) in their studies of the effects of subsidies.¹⁰ When the price elasticity of demand is smaller the resulting price impact is larger (as shown in equation 12). Thus, my use of the larger demand elasticity is conservative relative to these other studies.

Other Parameters

34. The shares of U.S. production and consumption in the world, as well as U.S. exports and total world exports and production, are based on recent USDA data. The ratios of U.S. consumption to U.S. exports and production to exports are derived from this data. The data appendix provides further details on these calculations.¹¹

35. Finally, Section IV, below, discusses the parameter of expected government and market revenue.

IV. Developing Proxies to Reflect Grower Expectation about Prices and Policy Revenue

36. U.S. cotton producers respond to the expected prices and expected rates of subsidy that apply at the time planting and other key decisions are made in the production cycle. Growers use many sources of information to assess what they believe to be the prospects for market revenue and government program benefits. Those sources of information include futures market prices, past and present farm prices, and the amounts of subsidies provided, which themselves depend on prices. Various institutions, such as FAPRI, also prepare price and subsidy projections, using the same array of information that growers

⁸ Food and Agricultural Policy Research Institute. "Documentation of the FAPRI Modeling System" FAPRI-UMC Report # 12-04, available at http://www.fapri.missouri.edu/outreach/publications/2004/FAPRI_UMC_Report_12_04.pdf. See also *Quantitative Simulation Analysis by Professor Daniel Sumner*, Annex I to Brazil's Further Submission of 9 September 2003, Table 2, available at

http://www.mre.gov.br/portugues/ministerio/sitios_secretaria/cgc/analisequantitativa.pdf.

⁹ See *Quantitative Simulation Analysis by Professor Daniel Sumner*, Annex I to Brazil's Further Submission of 9 September 2003, Table 3, available at

http://www.mre.gov.br/portugues/ministerio/sitios_secretaria/cgc/analisequantitativa.pdf. The author obtained these elasticities from CARD economists. They were applied in Bruce A. Babcock, John C. Beghin, Jacinto F. Fabiosa, Stephane De Cara, Amani El-Obeid, Cheng Fang, Chad E. Hart, Murat Isik, Holger Matthey, Alexander E. Saak, Karen Kovarik, and FAPRI Staff, *Doha Round of the World Trade Organization: Appraising Further Liberalization of Agricultural Markets*, 02-WP 317, November 2002, available at <http://www.card.iastate.edu/publications/DBS/PDFFiles/02wp317.pdf>, and Cheng Fang and Bruce A. Babcock, *China's Cotton Policy and the Impact of China's WTO Accession and Bt Cotton Adoption on the Chinese and U.S. Cotton Sectors*, January 2003, 03-WP 322, available at <http://www.card.iastate.edu/publications/DBS/PDFFiles/03wp322.pdf>.

¹⁰ Goreux, Louis, *Prejudice Caused by Industrialized Countries Subsidies to Cotton Sectors in Western and Central Africa*, June 2003. ICAC, *Production and Trade Policies Affecting the Cotton Industry*, July 2002.

¹¹ These average figures for consumption and exports do not sum exactly to production, reflecting changes in year-to-year carryovers in the base data. This has no implications for the estimates of price and quantity impacts.

would use in forming their expectations. Set out below is a discussion of the expectations of how much market and government revenue farmers expect. In the model, the expectations are reflected in the model parameter $E(\alpha) = E(P/(P + \gamma g))$.

37. To specify the policy parameter, $E(\alpha)$, we first need to specify expected market revenue and subsidy revenue. Because it is impossible to observe individual or collective grower expectations, some proxy information is required. Economists have developed many different proxies for price expectations. Some of these approaches, such as the use of futures markets, rational expectations and various models using lagged variables have been used in econometric models and some in simulation models.¹²

38. FAPRI uses one-year lagged values to reflect grower expectations about revenue per acre in their simulation models.¹³ In general, economists often use futures markets, a one-year lagged value or some proxy that combines information from several sources to represent expectations. For example, to project final CCP payments for the crop year in progress a USDA study proposed using futures market prices for several dates as well as the USDA's own forecast of season average prices.¹⁴

39. Because no approach can capture expectations perfectly, I provide results using three expectation proxies, including (i) a one-year lag of actual prices and subsidy amounts, (ii) harvest period futures prices at the time of planting, and (iii) the FAPRI commodity outlook that is developed at the same time that growers are forming their expectations and projections. The rest of this section explains the procedures for specifying the proxies for market price. The following section explains each of the subsidy variables that comprise g and determine the weights used in defining parameter γ . The appendix provides more details on the data sources and computations that enter these proxies for grower expectations.

40. The three proxies discussed below are used to generate farmers' expected revenue from the market and from subsidies that depend on prices. The price-based subsidies are marketing loan and counter-cyclical payments, and through MY 2005, Step-2 subsidies. To generate expected revenue from non price-based direct payments and crop insurance subsidies (and from now expired PFC and MLA payments), I use uniform procedures for all simulations. These procedures are discussed at the end of this section.

One Year Lag of Actual Prices

41. The first price expectation proxy I use is a one-year lag of actual prices. This approach uses actual prices and government subsidies each marketing year as proxy for what farmers expect in the following marketing year. In particular, I use the data from marketing year t minus 1 to represent expectations for the following marketing year t . That is, for data for season average market price, CCP payments, marketing loan benefits

¹² David Bessler and Marc Nerlove. "Expectations, information and dynamics," Chapter 33 in B.L. Gardner and G. Rausser, eds. *Handbook of Agricultural Economics, Volume 1*. Elsevier, Amsterdam, 2002.

¹³ Food and Agricultural Policy Research Institute. "Documentation of the FAPRI Modeling System" FAPRI-UMC Report # 12-04, available at http://www.fapri.missouri.edu/outreach/publications/2004/FAPRI_UMC_Report_12_04.pdf.

¹⁴ Linwood A. Hoffman. *Forecasting the Counter-Cyclical Payment Rate for U.S. Corn* An Application of the Futures Price Forecasting Model. USDA, Economic Research Service, FDS-05a-01, January 2005, available at <http://www.ers.usda.gov/publications/FDS/JAN05/fds05a01/fds05a01.pdf>.

and Step-2 payments that go into the expression $E(P/(P+\gamma g))$, I use the values from marketing year $t-1$. For example for the P variable I use $E(P)_t = P_{t-1}$.

42. An analogous one-year lagged value is used for CCP payments, marketing loan benefits and Step-2 payments. These values are used, along with the values discussed below for PFC payments, direct payments, MLA payments and crop insurance subsidies in computing g and in the subsidy weights used in computing γ .

43. The use of one-year lag in dealing with price expectations is a standard procedure in the econometric modeling literature.¹⁵ As noted, FAPRI uses a one-year lag of actual prices in its simulations.

Futures Prices

44. The second set of simulations uses the February futures price of cotton for the December contract. Cotton futures are traded on the New York Futures and Options Exchange daily. The futures prices contain information about what market participants anticipate, at the time of their trade, about prices in the actual commodity market on the date of specified delivery of the contract. February is roughly the period when some key decisions about cotton planting are made and December represents a period when the cotton harvest is nearing completion. I, therefore, use the average of the closing prices for the trading days in February for the December contract to represent the relevant information contained in the futures markets.¹⁶ This is an approximation because, of course, many relevant decisions are not made in February and much cotton is not marketed in December.

45. The futures market provides only indirect information about the season average market price and even more indirect information about the marketing loan grains, CCP payments and Step-2 payments. Also, of course, since no futures market prices are available for marketing years 2007 and 2008, we cannot use the futures market approach for these years.

46. To create a proxy value for expectation of relevant season average market price and each policy variable, I use a simple linear regression of the variable of interest on the futures price. I use the estimated coefficients to project the expected values that are used

¹⁵ Morzuch, B.J., R.D. Weaver, and P.G. Helmlinger. "Wheat Acreage Supply Response Under Changing Farm Programs." *American Journal of Agricultural Economics*. 62(1980): 29-37; Bailey, K. and A. Womack. "Wheat Acreage Response: A Regional Econometric Investigation." *Southern Journal of Agricultural Economics*. 17(1985): 171-180; Colman, David. "A Review of the Arts of Supply Response Analysis." *Review of Marketing and Agricultural Economics*. 51(1993): 201-230. Duffy, Patricia A., James W. Richardson, and Michael K. Wohlgenant. "Regional Cotton Acreage Response." *Southern Journal of Agricultural Economics*. 19(1987): 99-109.

¹⁶ The United States proposed using the average of February average for the December contract in their discussion of futures market prices before the original panel. See U.S. Opening Statement at the Second Session of the First Panel Meeting, October 7, 2003, paras. 33-35, available at http://www.ustr.gov/assets/Trade_Agreements/Monitoring_Enforcement/Dispute_Settlement/WTO/Dispute_Settlement_Listings/asset_upload_file74_5598.pdf; U.S. Further Rebuttal Submission, November 18, 2003, paras. 152-167, available at http://www.ustr.gov/assets/Trade_Agreements/Monitoring_Enforcement/Dispute_Settlement/WTO/Dispute_Settlement_Listings/asset_upload_file972_5598.pdf; and U.S. Appellant's Submission, October 28, 2004, paras. 190-192, available at http://www.ustr.gov/assets/Trade_Agreements/Monitoring_Enforcement/Dispute_Settlement/WTO/Dispute_Settlement_Listings/asset_upload_file938_5598.pdf.

with the expectations of the other policy variable to enter our calculations of $E(\alpha)$. The regression analysis allows me to use the data-based historical relationship between the futures market price and season average market price and each policy variable. This relationship is less restrictive than simply specifying an additive or multiplicative basis as is sometimes used to link futures market price to the spot price at the closing data of the futures market price or to link the spot price on a particular day to the season average price or the world price.

47. I use the futures contract price to create the proxy for the expected price of cotton and the three relevant price-based subsidy program rates for each year. These values are then used, along with the values discussed below for PFC payments, direct payments, MLA payments and crop insurance subsidies to calculate $(P/(P + \gamma g))$ as used in the simulation model.

48. Appendix II details the methodology and information used in these calculations.

FAPRI Price and Subsidy Outlook

49. As a part of their annual process of projecting commodity prices and policy variables, the FAPRI organization convenes a panel of experts that reviews all currently available data including futures market prices to arrive at projections of the likely season average farm price for cotton and the likely values for CCP payments and marketing loan benefits.¹⁷ These projections have been available for each year since 2001. The FAPRI group did not project Step-2 payments but they did project the average AWP and the average world price along with the U.S. season average price. I use the FAPRI forecasts of these three prices in a regression analysis to project the Step-2 payment for each year. Because there is no one-year ahead projection available for the 2007 and 2008 marketing years, I use the FAPRI July 2006 midterm review for the expectations for these years.¹⁸

Uniform Procedures for Calculating Expected Revenue from Direct Payments and Crop Insurance Payments

50. All of the simulations use common calculations for expectations about non-price based direct payments, crop insurance subsidies, and the now-expired PFC and MLA payments. Direct payments are based on well-known formulas that are publicized well in advance of the crop year. I therefore use actual direct payments each year to represent what farmers expected to receive. For the marketing years for which actual historical data is not available (2006, 2007 and 2008), I use USDA projections of direct payments contained in the July 2006 mid-term review of the President's budget. These payments are not projected to change over this period. Similarly, the expired PFC payments were based on well-known formulas and from 1999 to 2001 it was generally understood that the MLA payments would be made.¹⁹ Therefore, for both PFC and MLA payments I also use actual payments each year.

¹⁷ FAPRI. *Agricultural Outlook, 2006*, January 2006, accessed at <http://www.fapri.iastate.edu/pubs/outlook.html>.

¹⁸ FAPRI. *Baseline Update for U.S. Agricultural Markets*, July 2006, accessed at http://www.fapri.missouri.edu/outreach/publications/2006/FAPRI_UMC_Report_12_06.pdf.

¹⁹ USDA, *Decoupled Payments in a Changing Policy Setting*, October 2004, p. 10-11, accessed at <http://www.ers.usda.gov/Publications/aer838/aer838b.pdf>.

51. For the crop insurance subsidy, I use the average of the three prior years as the proxy for expected crops insurance subsidy. For 2008, since we do not have 2007 data available, I use the same value as 2007, namely the three-year average of data for 2004, 2005 and 2006. The idea of this approach is to use a long enough period to reflect typical subsidy rates (given that yields vary substantially) but still use recent enough data to reflect the current situation.

V. Degree of Production Incentive

52. As discussed in paragraphs 7-8, each subsidy program is assigned a degree of production incentive relative to revenue from the market. In this section, I discuss and identify the degree of production incentive for each of the following five U.S. cotton subsidy programs:

- User marketing Step-2 payments
- Marketing loan program benefits
- Counter-cyclical payments (and Market Loss Assistance payments)
- Direct payments (and Production Flexibility Contract payments)
- Crop insurance subsidies.

53. Where such work is available, I use relevant empirical literature to guide the estimates of production incentives. I note that there are only a few empirical studies examining the production effects of various programs and none specifically for cotton.²⁰

User Marketing Step-2 Payments

54. Step-2 payments were removed on August 1, 2006. Before elimination, Step-2 payments had a domestic and an export component. The domestic Step-2 program provided a direct government payment to domestic buyers of U.S. cotton when the U.S. market price of cotton was below the average of the five lowest prices used to compile the Cotlook A (NE) Index of world cotton prices. The payments assured that the net cost to domestic buyers was lower for U.S. cotton than for import alternatives.²¹ The domestic Step-2 payments stimulated the demand for U.S. cotton by U.S. mills to the same degree that a lower price of U.S. cotton would stimulate demand. Without the domestic Step-2 program, the demand for U.S. cotton in domestic mills would have been lower. The effect of this reduction in domestic demand would have been to lower the market price received by U.S. producers, lower the amount of cotton produced in the United States, lower U.S. exports and raise the world price of cotton (the A-Index in our model). The Step-2 program lowered the net effective price that a domestic mill paid for U.S. cotton. This

²⁰ For recent evidence on the production effects of direct payments see Barry K. Goodwin and Mishra. "Another Look at Decoupling: Additional Evidence on the Production Effects of Direct Payments." *American Journal of Agricultural Economics* 87(5), December 2005; and Nigel Key, Ruben N. Lubowski, and Michael J. Roberts. "Farm-Level Production Effects from Participation in Government Commodity Programs: Did the 1996 Federal Agricultural Improvement and Reform Act Make a Difference?" *American Journal of Agricultural Economics* 87(5), December 2005. See also, Daniel A. Sumner, "Production and Trade Effects of Farm Subsidies: Discussion." *American Journal of Agricultural Economics*, (87), 5 (November 2005): 1229-1230. Goodwin, Barry K. and Ashok K. Mishra. (2006) "Are Decoupled Farm Payments Really Decoupled? An Empirical Evaluation." *American Journal of Agricultural Economics* 88(1), February 2006 pp. 73-88.

²¹ <http://www.ers.usda.gov/briefing/cotton/specialprovisions.htm#upland>.

subsidy to buyers meant that for a given market price, the effective cost per pound for a domestic buyer of U.S. cotton was less by the amount of the subsidy. Thus, the quantity purchased increased exactly as if the price of U.S. cotton were lower by the amount of the Step-2 payment. The increase in quantity demanded caused an increase in the price received and net revenue per acre for growers. As this is traced through the supply-demand system, the subsidy caused more U.S. output and exports and a lower world price.

55. The export Step-2 program operated like the domestic Step-2 program except that the payments were distributed to export shippers of U.S. cotton.²² They had an impact on export demand identical to a lower export price faced by buyers (while allowing the net revenue to growers to remain high). Removing the export Step-2 payments would have reduced the demand for exports of cotton from the United States, lowered the price received by growers and lowered U.S. cotton production and exports. The net effect would have been to raise the price of cotton in international markets.

56. In the model development and simulations, I make use of the basic result from economic theory that demand side subsidies may be modeled equivalently as a shift in effective demand or as a shift in effective supply.²³ That is, a subsidy to buyers of U.S. cotton has equivalent impact on prices and quantities as if the subsidy was applied to sellers of U.S. cotton. Furthermore, a demand side subsidy available solely for U.S. cotton must raise the effective price to suppliers by the full amount of the subsidy above the market price, which will naturally be depressed. Under such a subsidy scheme, buyers pay the same net price for U.S. cotton as they pay for other cotton because a single price must prevail in the market for a homogeneous good. Given this principle, for convenience, in the model, I include the Step-2 buyer subsidies as a part of the pure price subsidy for producers. Thus, I set domestic and export Step-2 user payments to have a relative subsidy effect of 1.0.

Marketing Loan Program Subsidies

57. It is well-established and thoroughly discussed by USDA analysts and others that the U.S. marketing loan program in general provides benefits and incentives to produce specific commodities. For cotton in particular, the marketing loan provides a benefit to cotton farms equal to the (non-negative) difference between the loan rate established by the U.S. cotton program and the cotton loan repayment rate, which is equal to the adjusted world price (AWP) of cotton.²⁴ This benefit takes the form of either the gain on the marketing loan (including certificate exchange gains) or the loan deficiency payment.²⁵

58. The effect on grower planting incentives is to increase the expected net returns per acre for growing cotton and to lower the variability and risk of revenue from cotton production. The magnitude of the impact on incentives to produce cotton is equal to the

²² <http://www.ers.usda.gov/briefing/cotton/specialprovisions.htm#upland>.

²³ See for example the textbook treatment in Robert Pindyck and Daniel Rubinfeld, *Microeconomics*, 6th Edition, Prentice Hall, 2005.

²⁴ Paul C. Westcott, C.E. Young, and M. Price, USDA, ERS, *The 2002 Farm Act, Provisions and Implications for Commodity Markets*, Economic Research Service, November 2002.

²⁵ Claassen, Roger. "Farm Bill Side by Side: Conservation Programs, Details and Analysis," U.S. Department of Agriculture, Economic Research Service, Web Product, <http://www.ers.usda.gov/features/farmbill/analysis/conservationoverview.htm>, May 2002 and Joe L. Outlaw, "A Discussion on the 2002 Farm Bill: The Facts We Really Need to Know," Texas A&M University Agriculture and Food Policy Center, AFPC ID: PR-2002-4. <http://www.afpc.tamu.edu/pubs/8/382/victoriaagpolicy.ppt>.

expected difference between the loan rate, which is known at planting time, and the growers' expectations at the time of planting about the AWP for cotton that will apply when the grower makes that marketing loan transaction.²⁶ The expectation of this difference operates on grower incentives to directly offset lower expected U.S. market prices on a dollar for dollar basis. Thus, the impact of a reduction in expected marketing loan benefit on production is at least as large as a decrease in the expected price. In addition to the direct incentive effect, the marketing loan acts as a hedge against a fall in the market price. Farmers are typically expected to respond to reduced risk by growing more of the less risky crop.²⁷ In that way, the marketing loan has an additional impact on production over and above the market price. Nonetheless, to be conservative, I set the production incentive at a value equal to 1.0.

Counter-Cyclical Payments

59. Counter-cyclical payments for cotton are tied directly to the U.S price of cotton, providing payment whenever the U.S average market price falls below \$0.6573 cents per pound, up to a maximum of \$0.1373 cents per pound.²⁸ Unlike marketing loan payments, which are based on current production, counter-cyclical payments are paid on the basis of a farm's historical base area and a historical program yield. The production of cotton on base acres is not required to receive payment. The payments can be viewed as a hybrid between marketing loans (discussed above) and direct payments (discussed below). Below, I discuss five reasons why counter-cyclical payments have a significant impact on U.S. cotton production.²⁹

60. The counter-cyclical payments provide growers with significant additional income stabilization beyond what is already provided by marketing loans. Counter-cyclical payments are explicitly used to offset the impact of low market prices. In years when the maximum counter-cyclical payment is made, a typical commercial cotton farm with 3000 acres of cotton base acres would receive a payment in the range of \$225,000. The primary production impact of additional income stabilization of this magnitude is to reduce the amount of land that would have been removed from cotton production because of low farm incomes in years of low cotton prices.

61. Second, counter-cyclical payments can be used by farmers to invest in production-increasing farm improvements and otherwise enhance the productivity of the farm. Another way to look at this effect is to note that these payments are a substantial source of

²⁶ See, for example, P. Westcott, C.E. Young, and M. Price, USDA, ERS, *The 2002 Farm Act, Provisions and Implications for Commodity Markets*, Economic Research Service, November 2002 and Paul C. Westcott and J. Michael Price, pages 08-10. *Analysis of the U.S. Commodity Loan Program with Marketing Loan Provisions*, AER-801, U.S. Department of Agriculture, Economic Research Service, April 2001. Also see, for example, "Analysis of the grain, oilseed and cotton provision of the, 'Agriculture, Conservation, and Rural Enhancement Act of 2001 – S.1731'". FAPRI-UMC Report #18-01 November 2001. http://www.fapri.missouri.edu/outreach/publications/2001/FAPRI_UMC_Report_18_01.pdf.

²⁷ Rulon D. Pope, Richard E. Just "On Testing the Structure of Risk Preferences in Agricultural Supply Analysis," *American Journal of Agricultural Economics*, Vol. 73, No. 3 (August 1991), pp. 743-748. Jean-Paul Chavas, Matthew T. Holt. "Acreage Decisions under Risk: The Case of Corn and Soybeans," *American Journal of Agricultural Economics*, Vol. 72, No. 3 (Aug. 1990), pp. 529-538.

²⁸ All told, the counter-cyclical payment rate is less than \$0.1373 per pound for two reasons. First, payments are provided for 85 percent of a farm's base acreage. Second, payment yields are generally significantly less than actual yields.

²⁹ Paul C. Westcott, C.E. Young, and M. Price, USDA, ERS, *The 2002 Farm Act, Provisions and Implications for Commodity Markets*, Economic Research Service, November 2002.

farm income that would make the operation a more attractive customer for lenders. This secure income source would have improved access to working capital at more favorable rates. While the payments could have been used for other purposes, the fact that most payments are made to those actively engaged in cotton production naturally means that they provided encouragement to increase cotton output.³⁰

62. Third, counter-cyclical payments significantly reduce the risk for cotton farmers planting on cotton base acres because higher payments are designed to offset lower prices. As noted above there is considerable literature to support the finding that risk reduction increases crop supply.³¹ The security of counter-cyclical payments affords cotton farmers flexibility to take on more risk in their operations. With the income guarantee, farmers can extend cotton area, attempt new and potentially higher yielding technologies and generally expand their operations. Again the result is more cotton production because of counter-cyclical payments.

63. Fourth, although counter-cyclical payments do not require the production of cotton, restrictions on land use undermine the planting flexibility provided. To be eligible for the payments, the program base land is required to remain in agricultural uses (including conservation uses) and cannot be developed for urban, commercial or other non-agricultural activities. Also, the crops grown on the cotton base land are restricted. In particular, no fruits, tree nuts, vegetables, melons or wild rice can be planted (subject to some minor and restrictive exceptions). These banned alternatives include some of the most relevant alternative in some major cotton areas, especially in the Western United States where more than 15 percent of the cotton crop is produced. For example, in the San Joaquin Valley of California crops such as tomatoes, garlic, almonds, and grapes are all viable and important alternative crops to planting cotton. Thus, the restrictions that payments would be zero if any of these crops are produced on cotton base is an important limit that keeps land in cotton that might otherwise move to one of these alternatives. Fruit and vegetable crops are also important in the Southeast which also has large cotton acreage. Most analysts of general farm programs in the United States undervalue the significance of these restrictions, presumably because they have focused the discussion of the impact of direct payments on feed grains and wheat, for which restricted crops are less important.

64. Fifth, considering that the FSRI Act of 2002 allowed farmers to update their payment acres, farmers quite naturally maintain some expectation that payment acres will be updated in MY 2007, the likely start of a new farm bill. When there is a significant probability that the area base or yield used for payments will be updated in the future, a farm operation would reasonably hesitate to shift land with cotton base out of cotton. A farmer who assigns a significant chance that payment bases will be updated will attempt to stimulate higher yields and add cotton acreage in anticipation of higher payments later.

³⁰ Paul C. Westcott and C.E. Young, "Influences of Decoupled Farm Programs on Agricultural Production." Paper presented at the conference Free Trade of the Americas, the WTO, and New Farm Legislation: Responding to Opportunities and Challenges, San Antonio, Texas May 23 - 24, 2002 <http://cnas.tamu.edu/publications/powerpoint/Papers/Westcott.pdf>.

³¹ Rulon D. Pope, Richard E. Just "On Testing the Structure of Risk Preferences in Agricultural Supply Analysis," *American Journal of Agricultural Economics*, Vol. 73, No. 3 (Aug. 1991), pp. 743-748. Jean-Paul Chavas, Matthew T. Holt. "Acreage Decisions under Risk: The Case of Corn and Soybeans," *American Journal of Agricultural Economics*, Vol. 72, No. 3 (Aug. 1990), pp. 529-538.

The potential for updating the payment base can have a powerful impact on grower incentives.³²

65. Counter-cyclical payments' effect on smoothing revenue coupled with farmers' anticipation of base acre updates suggests that counter-cyclical payments are almost fully tied to production. In terms of magnitude of effect, they are closer to the amount of impact caused by marketing loan payments rather than direct payments. In addition, recent new studies of direct payments also suggest that counter-cyclical payments are far more tied to production than earlier studies suggested. Thus, there would be considerable support for the use of a figure in the range of 0.60 - 0.75 in a simulation model.

66. I note that my analysis and work presented in 2003-2004 to the original panel used a 0.40 figure. At that time, I indicated my belief that this was a conservative figure. I continue to believe this even more strongly today. The use of a lower 0.40 figure nevertheless reveals significant production, export, and price effect from the counter-cyclical payments. Use of a higher 0.60 - 0.75 figure implies that these effects would be even greater. However, for the purposes of my simulations, I use a conservative figure of 0.40 in the simulation model. (Most of these arguments apply to MLA payments that applied before 2002. I use a conservative value of 0.25 for MLA payments.³³).

Direct Payments

67. Like counter-cyclical payments, direct payments for cotton are made on the basis of a farm's historical base area and an established historical program yield rather than on current production. But unlike counter-cyclical payments, direct payments are not dependent on current market prices. Instead, they are fixed. Many of the same mechanisms through which counter-cyclical payments affect production are applicable to direct payments. Specifically, farmers' expectations of likely base and yield updating in the future as well as increased credit access, risk reduction and the effect of restricted planting flexibility all imply that direct payments have a significant production impact.³⁴

68. Serra et al. use farm-level data collected in Kansas, where grain and soybeans are dominant crops, to estimate a model examining the effect of risk aversion on the supply effects of Production Flexibility Contract Payments.³⁵ They find that the PFC payments were not "decoupled," but characterize the effects as "small." Although they focus on risk effects and on a region where fruit and vegetable production is relatively unimportant,

³² C. Edwin Young, David W. Skully, Paul C. Westcott, and Linwood Hoffman. *Economic Analysis of Base Acre and Payment Yield Designations Under the 2002 U.S. Farm Act / ERR-12*. Economic Research Service, USDA, September 2005.

³³ See *Quantitative Simulation Analysis by Professor Daniel Sumner*, Annex I to Brazil's Further Submission of 9 September 2003, Table 3, available at http://www.mre.gov.br/portugues/ministerio/sitios_secretaria/cgc/analisequantitativa.pdf.

³⁴ Also see the discussion in Roberts, Ivan and Fran Jotzo. *2002 U.S. Farm Bill: Support and Agricultural Trade*. ABARE research Report 1.13, Canberra, 2001, David Hennessy, "The Production Effects of Agricultural Income Support Policies Under Uncertainty," *American Journal of Agricultural Economics*. 80 (February 1998): 46-57 and C. E. Young, and Paul C. Westcott "How Decoupled is U.S. Agricultural Support for Major Crops?" *American Journal of Agricultural Economics* 82 (August 2000). This study also does not disaggregate the subsidies by commodity and simulates impacts of removing all programs together rather than the impact of removing the upland cotton subsidies specifically.

³⁵ Teresa Serra, David Zilberman, Barry K. Goodwin, and Allen M. Featherstone. "Decoupling Farm Policies: How Does this Affect Production?" Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Providence, Rhode Island, July 24-27, 2005.

they find nevertheless that, “the elimination of PFC payments would likely trigger the abandonment of almost 6% of the farms.”³⁶

69. Direct payments provide substantial added income directly to farms that have a history of growing cotton and mostly continue to grow cotton. For a typical commercial cotton farm with 3000 acres of cotton, direct payments are in the range of \$100,000.

70. Based on the factors cited above, I use a degree of production incentive of 0.25 for direct payments. I believe that for the case of cotton, particularly cotton that is grown in areas of strong fruits and vegetable production such as California, and the South East, that the incentive is even higher. Stronger effects beyond 0.25 are also consistent with empirical literature that is now showing stronger production effects than had previously been expected. (Most of these arguments applied to the PFC payments that applied before 2002. I use a conservative value of 0.15 for PFC payments.)

Crop Insurance Payments

71. The cotton crop insurance subsidy comes in two forms. First, the cotton crop insurance program provides a direct subsidy on the premium required to purchase the insurance. The Agricultural Risk Protection Act (ARPA) passed by the U.S. Congress in 2000 increased crop insurance subsidies substantially. The second source of subsidy is that the cotton crop insurance program provides subsidies to cover the losses in excess of the total premium receipts. The loss ratio for a region equals the sum of all insurance indemnities paid divided by the sum of all premiums charged.

72. Cotton crop insurance subsidies are among the largest available for any crop and as a result almost all cotton growers participate in the crop insurance program. The subsidies decrease the net cost of the crop insurance input and increase net returns to cotton growers. The expected difference between the premiums paid by producers and the insurance indemnities paid out by the program inflate the expected net returns from cotton production. This increase in expected returns induces more cotton acreage to be planted than if the crop insurance subsidies were not available. Under the alternative with the subsidies for crop insurance for cotton eliminated net returns per acre of cotton planted would decline.³⁷

73. Crop insurance subsidies directly reduce a common cost of production and reduce risk of yield or revenue shortfalls. I use an incentive value of 1.0 to reflect the input subsidy element.

VI. Explanation of Model Results

74. I provide results for four policy scenarios, including (A) removal of marketing loan subsidies and counter-cyclical payments, (B) removal of Step-2 subsidies, (C) removal of

³⁶ Teresa Serra, David Zilberman, Barry K. Goodwin, and Allen M. Featherstone. “Decoupling Farm Policies: How Does this Affect Production?” Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Providence, Rhode Island, July 24-27, 2005, p.15.

³⁷ USDA economists have also written on this topic with conceptual analyses consistent with those reported here. See C. Edwin Young, Monte Vandevener, and Randall D. Schnepf. “Production and Price Impacts of U.S. Crop Insurance Programs,” *American Journal of Agricultural Economics*, Volume 83, 2001, pp. 1196-1203. Their analysis is not applied specifically to cotton and they do not produce quantitative estimates comparable to those presented below.

marketing loan subsidies, counter-cyclical payments and Step-2 subsidies, and (D) removal of all applicable subsidies. Under each of the policy scenarios, I use the relevant P/g and γ for the relevant subsidy programs examined.

75. For each policy scenario, I executed the model using three different price expectation proxies, including (1) a one-year lag, (2) futures prices and (3) FAPRI projected prices and subsidies. In all, I executed the model 12 times (three expectation schemes times four policy experiments) for each marketing year. For each scenario, I report the percentage impact on the market price, the quantity supplied by the United States and the quantity exported by the United States each year. The variations across the results allow the Panel to compare results across years, policy set and expectations proxy.

76. Numerical results of the simulations are provided below in the 12 sections of Table 2. The table numbering corresponds to policy scenario and revenue expectation proxy as labeled above. For example, section 2.A.1 examines policy scenario “A”, the elimination of marketing loan and counter-cyclical payments, using price expectation proxy “1”, a one-year lag. The first three sections, labeled 2.A.1 through 2.A.3, examine the effects of removing marketing loan and counter-cyclical payments under each price expectation proxy. The following three sections, labeled 2.B.1 through 2.B.3, examine the effect of removing Step-2 payments. Sections 2.C.1 through 2.C.3 present the results of removing marketing loan, counter-cyclical and Step-2 payments. Finally, sections 2.D.1 through 2.D.3 present results of removing all relevant subsidies.

77. The years for which results are specified in the columns and the relevant output values are shown in rows. In the top two rows of each panel, I provide the values for P/g and γ , which vary by year. Since the simulations hold other parameters constant over time, differences in P/g and γ by year determine the differences in the impacts across years.

78. Where possible, results are reported from marketing year 1999 through marketing year 2008. Because Step-2 payments were eliminated in marketing year 2005, the simulation results for policy scenario B, an elimination of Step-2 payments, are only possible through marketing year 2005. Similarly, simulation results for policy scenario C, a removal of marketing loan, counter-cyclical and Step-2 subsidies, are only reported through marketing year 2005. In marketing years 2006 to 2008, results for policy scenario C would be identical to results for policy scenario A, where only marketing loan and counter-cyclical payments are eliminated.

79. The different revenue expectation proxies also limit the years for which results are reported. Results using the second price expectation proxy, futures prices, are only provided through marketing year 2006 because futures price data for marketing years 2007 and 2008 do not exist. Simulations using the third price expectation proxy, FAPRI price and subsidy forecasts, are only available for marketing years 2001 through 2008.

80. Finally, as discussed above, I execute all 12 simulations using a conservative supply elasticity of 0.5. The results under this assumption are found in Appendix Table A3.

VII. The Quantitative Impacts of U.S. Cotton Subsidies

81. In **Table 2.A.1**, I consider the removal of marketing loan and counter-cyclical payments using a one-year lag to represent producers' expectations of prices and subsidies. If subsidies would have been removed, in marketing year ("MY") 2005 the world price would have been 10.66 percent higher, U.S. production would have been 19.40 percent lower and exports would have been 26.91 percent lower. Tables 2.A.2 and 2.A.3 show that MY 2005 effects are similar when using different revenue expectation proxies. When futures prices are used to model expectations, as reported in **Table 2.A.2**, the world price of cotton would have been 9.30 percent higher, U.S. production would have been 16.93 percent lower and exports would have been 23.48 percent lower. **Table 2.A.3** shows that when FAPRI projected prices and subsidies are used, the world price would have been 9.74 percent higher, while U.S. production would have been 17.73 lower and exports would have been 24.59 percent lower.

82. The average price and U.S. quantity effects over the four-year period, MY 2002-2005, are slightly smaller than the effects observed in MY 2005. In these years, the world price would have been an average of 8.23 to 8.91 percent higher, depending on the expectation proxy used. U.S. production would have been an average of 14.99 to 16.23 percent lower and U.S. exports would have been an average of 20.79 to 22.51 percent lower, again, depending on the expectation proxy used.

83. In future years, the removal of marketing loan and counter-cyclical payments also has significant effects. In MY 2006, a removal of marketing loan and counter-cyclical payments increases the world price of cotton by 6.52 to 8.11 percent, depending on the price expectation proxy used. U.S. production declines by 11.86 to 14.77 percent and U.S. exports decline by 16.45 to 20.48 percent. In MY 2007 and MY 2008, the effects of removing marketing loan and counter-cyclical payments are smaller than in MY 1999-2006, largely because USDA projects smaller subsidies in these years.

84. **Table 2.B.1** considers the removal of Step-2 payments using a one-year lag to model producers' expectations about revenue from market prices and subsidies. Over the four-year period, MY 2002-2005, the world price of cotton would have been 1.97 percent higher, U.S. production would have been 3.58 percent lower and U.S. exports would have been 4.97 percent lower. Average results when futures prices or FAPRI forecasted prices and subsidies are used to model expectations are the same, and slightly smaller than when a one-year lag is used. **Tables 2.B.2** and **2.B.3** show that the world price of cotton would have been an average of 1.85 percent higher, U.S. production would have been 3.36 percent lower and U.S. exports would have been 4.66 percent lower.

85. **Table 2.C.1** examines the removal of marketing loan, counter-cyclical and Step-2 payments using a one-year lag to model expectations. The results confirm that the combined effects of marketing loan and counter-cyclical payments on prices and U.S. quantities are larger than the effects of either marketing loan and counter-cyclical payments, or Step-2 payments alone and the impact of the two are roughly additive in proportional terms. In MY 2002-2005, but for marketing loan, counter-cyclical and Step-2 payments, the world price would have been an average of 10.88 percent higher and U.S. production would have been an average of 19.81 lower and exports would have been 27.47 percent lower. In **Table 2.C.2**, when futures prices are used to model producers' revenue expectations, the world price would have been an average of 10.08 percent higher and U.S. production and exports would have been an average of 18.35 and 25.45 percent

lower, over the MY 2002 through MY 2005 period. Finally, in **Table 2.C.3**, when FAPRI forecasted prices are used to model expectations, the world price would have been an average of 10.12 percent higher, U.S. production would have been an average of 18.43 percent lower and U.S. exports would have been an average of 25.56 percent lower, over the MY 2002 through MY 2005 period.

86. The final set of tables, 2.D.1 to 2.D.3, considers the removal of all cotton subsidies. **Table 2.D.1** shows that when a one-year lag is used to model producers' revenue expectations, the world price of cotton would have been 15.13 percent higher in 2005 and an average of 13.65 higher in MY 2002-2005. U.S. production would have been 27.54 percent lower in MY 2005 and an average of 24.84 percent lower in MY 2002-2005. Finally, U.S. exports would have been 38.19 percent lower in MY 2005 and an average of 34.45 percent lower in MY 2002-2005. The results in **Tables 2.D.2** and **2.D.3**, when futures prices and FAPRI forecasted prices are used as a proxy for revenue expectations, are again similar. In these policy scenarios, the world price of cotton would have been 13.24 to 13.59 percent higher, U.S. production would have been 24.11 to 24.74 percent lower and U.S. exports would have been 33.44 to 34.31 percent lower in MY 2005. Over the four-year period, MY 2002-2005, the world price would have been an average of 12.60 to 12.78 percent higher, U.S. production would have been an average of 22.93 to 23.26 percent lower, and U.S. exports would have been an average of 31.81 to 32.26 percent lower.

87. The simulation results in Appendix Table A3, under which the U.S. supply elasticity takes the value of 0.5, confirm that the effects of removing U.S. cotton subsidies are still significant under more conservative parameters. Table A3.A.1 considers the removal of marketing loan and counter-cyclical payments when a one-year lag is used to model expectations. In MY 2005, the world market price would have been 7.20 percent higher, U.S. production would have been 13.11 percent lower and U.S. exports would have been 14.06 percent lower.

88. Overall, these results indicate that removing U.S. subsidies would reduce U.S. production and exports from the United States substantially and thereby allow the world price to rise by a large and economically significant amount. Most of these effects on prices and quantities are due to the influence of the marketing loan program and the counter-cyclical payment program. For example, in the one-year lag case in MY 2005, these two programs account for 70 percent of the total price effect. These programs have been the dominant programs subsidizing cotton throughout the period of the simulations. Again in the one-year lag case, the marketing loan program and the counter-cyclical program account for about 65 percent of the impact on world price during the four year period MY 2002-2005.

VIII. Concluding Remarks

89. This report has documented that U.S. cotton programs suppress the world price of cotton and sustain large amounts of U.S. production and exports. I show that prices are driven down most by the marketing loan program, followed by the counter-cyclical payment program. I use standard methods and document fully the parameter choices for the simulation model that I have developed. These results are substantial despite that fact that I choose conservative values for supply and demand elasticities and in the policy impact parameters. I use the model to conduct a number of different policy scenarios. The results of each one of these scenarios supports the same conclusion – that U.S. cotton

programs have a serious and significant impact on U.S. production, exports and the world market price of cotton.

Table 2.A.1

Price Expectations: One Year Lag

Policy Scenario: Removal of Marketing Loan and Counter-Cyclical Payments

Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2002-2005 Average
E(P/g)	1.98	1.09	1.96	0.72	0.98	2.82	0.94	1.54	2.05	2.67	1.37
E(y)	0.609	0.748	0.650	0.849	0.652	0.623	0.709	0.613	0.543	0.535	0.71
Effect on											
World Price	4.22%	9.84%	4.01%	15.11%	8.26%	1.63%	10.66%	8.11%	5.74%	4.29%	8.91%
U.S. Quantity Supplied	-7.69%	-17.92%	-7.30%	-27.51%	-15.03%	-2.96%	-19.40%	-14.77%	-10.45%	-7.80%	-16.23%
U.S. Quantity Exported	-10.66%	-24.86%	-10.13%	-38.16%	-20.85%	-4.11%	-26.91%	-20.48%	-14.49%	-10.82%	-22.51%

Table 2.A.2

Price Expectations: Futures Prices

Policy Scenario: Removal of Marketing Loan and Counter-Cyclical Payments

Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2006	2002-2005 Average
E(P/g)	1.66	1.77	1.67	0.73	1.37	1.86	1.07	1.83	1.26
E(y)	0.633	0.661	0.717	0.669	0.675	0.674	0.667	0.620	0.67
Effect on									
World Price	5.81%	5.53%	5.88%	11.84%	6.77%	5.02%	9.30%	7.09%	8.23%
U.S. Quantity Supplied	-10.58%	-10.06%	-10.71%	-21.56%	-12.33%	-9.15%	-16.93%	-12.91%	-14.99%
U.S. Quantity Exported	-14.67%	-13.96%	-14.85%	-29.90%	-17.10%	-12.69%	-23.48%	-17.90%	-20.79%

Table 2.A.3

Price Expectations: FAPRI Price Forecast

Policy Scenario: Removal of Marketing Loan and Counter-Cyclical Payments

Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	2001	2002	2003	2004	2005	2006	2007	2008	2002-2005 Average
E(P/g)	2.92	0.67	1.07	2.08	0.98	1.62	2.30	2.70	1.20
E(γ)	0.532	0.702	0.597	0.544	0.632	0.518	0.426	0.388	0.62
Effect on									
World Price	1.11%	13.40%	7.48%	2.48%	9.74%	6.52%	3.92%	2.89%	8.28%
U.S. Quantity Supplied	-2.03%	-24.39%	-13.62%	-4.52%	-17.73%	-11.86%	-7.13%	-5.27%	-15.07%
U.S. Quantity Exported	-2.81%	-33.83%	-18.89%	-6.27%	-24.59%	-16.45%	-9.89%	-7.30%	-20.90%

Table 2.B.1

Price Expectations: One Year Lag

Policy Scenario: Removal of Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	1.98	1.09	1.96	0.72	0.98	2.82	0.94	1.37
E(γ)	0.609	0.748	0.650	0.849	0.652	0.623	0.709	0.71
Effect on								
World Price	1.99%	2.48%	1.46%	1.16%	2.54%	1.75%	2.42%	1.97%
U.S. Quantity Supplied	-3.62%	-4.51%	-2.66%	-2.11%	-4.62%	-3.19%	-4.41%	-3.58%
U.S. Quantity Exported	-5.02%	-6.25%	-3.68%	-2.92%	-6.41%	-4.42%	-6.12%	-4.97%

Table 2.B.2

Price Expectations: Futures Prices
 Policy Scenario: Removal of Step-2 Payments
 Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	1.66	1.77	1.67	0.73	1.37	1.86	1.07	1.26
E(y)	0.633	0.661	0.717	0.669	0.675	0.674	0.667	0.67
Effect on								
World Price	1.73%	1.69%	1.76%	2.28%	1.66%	1.45%	1.99%	1.85%
U.S. Quantity Supplied	-3.15%	-3.07%	-3.21%	-4.16%	-3.02%	-2.64%	-3.62%	-3.36%
U.S. Quantity Exported	-4.36%	-4.26%	-4.45%	-5.76%	-4.19%	-3.67%	-5.02%	-4.66%

Table 2.B.3

Price Expectations: FAPRI Price Forecast
 Policy Scenario: Removal of Step-2 Payments
 Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	2.92	0.67	1.07	2.08	0.98	1.20
E(y)	0.532	0.702	0.597	0.544	0.632	0.62
Effect on						
World Price	1.14%	2.31%	1.60%	1.68%	1.79%	1.85%
U.S. Quantity Supplied	-2.08%	-4.21%	-2.92%	-3.06%	-3.26%	-3.36%
U.S. Quantity Exported	-2.88%	-5.84%	-4.05%	-4.24%	-4.52%	-4.66%

Table 2.C.1

Price Expectations: One Year Lag

Policy Scenario: Removal of Marketing Loan, Counter-Cyclical and Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	1.98	1.09	1.96	0.72	0.98	2.82	0.94	1.37
E(y)	0.609	0.748	0.650	0.849	0.652	0.623	0.709	0.71
Effect on								
World Price	6.21%	12.32%	5.47%	16.27%	10.80%	3.38%	13.08%	10.88%
U.S. Quantity Supplied	-11.31%	-22.43%	-9.96%	-29.62%	-19.65%	-6.15%	-23.81%	-19.81%
U.S. Quantity Exported	-15.69%	-31.11%	-13.81%	-41.08%	-27.26%	-8.53%	-33.03%	-27.47%

Table 2.C.2

Price Expectations: Futures Prices

Policy Scenario: Removal of Marketing Loan, Counter-Cyclical and Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	1.66	1.77	1.67	0.73	1.37	1.86	1.07	1.26
E(y)	0.633	0.661	0.717	0.669	0.675	0.674	0.667	0.67
Effect on								
World Price	7.54%	7.21%	7.64%	14.12%	8.43%	6.48%	11.29%	10.08%
U.S. Quantity Supplied	-13.73%	-13.13%	-13.92%	-25.71%	-15.35%	-11.79%	-20.55%	-18.35%
U.S. Quantity Exported	-19.04%	-18.21%	-19.30%	-35.66%	-21.29%	-16.35%	-28.50%	-25.45%

Table 2.C.3

Price Expectations: FAPRI Price Forecast

Policy Scenario: Removal of Marketing Loan, Counter-Cyclical and Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	2.92	0.67	1.07	2.08	0.98	1.20
E(y)	0.532	0.702	0.597	0.544	0.632	0.62
Effect on						
World Price	2.25%	15.71%	9.09%	4.16%	11.53%	10.12%
U.S. Quantity Supplied	-4.10%	-28.60%	-16.54%	-7.58%	-20.99%	-18.43%
U.S. Quantity Exported	-5.69%	-39.67%	-22.94%	-10.51%	-29.11%	-25.56%

Table 2.D.1

Price Expectations: One Year Lag

Policy Scenario: Removal of All Subsidies

Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2002-2005 Average
E(P/g)	1.98	1.09	1.96	0.72	0.98	2.82	0.94	1.54	2.05	2.67	1.37
E(y)	0.609	0.748	0.650	0.849	0.652	0.623	0.709	0.613	0.543	0.535	0.71
Effect on											
World Price	7.74%	14.22%	8.21%	19.74%	13.87%	5.85%	15.13%	9.54%	6.83%	5.36%	13.65%
U.S. Quantity Supplied	-14.09%	-25.89%	-14.94%	-35.93%	-25.25%	-10.64%	-27.54%	-17.36%	-12.43%	-9.77%	-24.84%
U.S. Quantity Exported	-19.54%	-35.91%	-20.73%	-49.84%	-35.02%	-14.76%	-38.19%	-24.08%	-17.24%	-13.54%	-34.45%

Table 2.D.2

Price Expectations: Futures Prices
 Policy Scenario: Removal of All Subsidies
 Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2006	2002-2005 Average
E(P/g)	1.66	1.77	1.67	0.73	1.37	1.86	1.07	1.83	1.26
E(γ)	0.633	0.661	0.717	0.669	0.675	0.674	0.667	0.620	0.67
Effect on									
World Price	9.18%	9.05%	10.11%	17.07%	11.23%	8.85%	13.24%	8.39%	12.60%
U.S. Quantity Supplied	-16.71%	-16.48%	-18.40%	-31.07%	-20.44%	-16.12%	-24.11%	-15.28%	-22.93%
U.S. Quantity Exported	-23.18%	-22.86%	-25.52%	-43.09%	-28.35%	-22.35%	-33.44%	-21.19%	-31.81%

Table 2.D.3

Price Expectations: FAPRI Price Forecast
 Policy Scenario: Removal of All Subsidies
 Supply Elasticities: $\epsilon_u = 0.8$, $\epsilon_r = 0.2$

	2001	2002	2003	2004	2005	2006	2007	2008	2002-2005 Average
E(P/g)	2.92	0.67	1.07	2.08	0.98	1.62	2.30	2.70	1.20
E(γ)	0.532	0.702	0.597	0.544	0.632	0.518	0.426	0.388	0.62
Effect on									
World Price	4.94%	18.53%	12.23%	6.76%	13.59%	7.99%	5.01%	3.99%	12.78%
U.S. Quantity Supplied	-9.00%	-33.73%	-22.27%	-12.30%	-24.74%	-14.54%	-9.12%	-7.27%	-23.26%
U.S. Quantity Exported	-12.48%	-46.79%	-30.88%	-17.06%	-34.31%	-20.16%	-12.64%	-10.08%	-32.26%

Appendix I. Sources and Methods for Crop Year Data for Cotton used in the Simulation Model

Links to the specific USDA webpage on the President's Budget data are being updated (as of October 24, 2006) and are not yet accessible. USDA tells us they should be available soon.

Production Flexibility Contract Payment

Data for crop years 1996-2001 are from the USDA's Farm Service Agency's Budget Division, available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>. (spreadsheet link labeled "FY 2003 CCC Actuals"). For crop year 2002, we use data from the Commodity Estimates Book for the President's 2006 Budget, available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>.

Direct Payment

Information for crop years 2002-2008 are historical data and estimates from the Commodity Estimates Book for the President's 2007 Budget, Output 50, spreadsheet Out50C, rows 116-122 available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>.

Market Loss Assistance

Data for crop years 1998-2001 are available from the USDA's Farm Service Agency's Budget Division, available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc> (spreadsheet link labeled "FY 2003 CCC Actuals").

Counter Cyclical Payment

Data for crop years 2002-2003 are from the Commodity Estimates Book for the President's 2007 Budget, Output 50, spreadsheet Out50D, rows 116-118 available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>. For crop years 2004-2008, data and projections for counter cyclical payments are from the 2006 mid-term review for the 2007 President's Budget, available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>.

User Marketing (Step-2) Program

Data for crop years 1996-2000 are available from the USDA Farm Service Agency's Fact Sheet on Upland cotton, available at <http://www.fsa.usda.gov/pas/publications/facts/upcot03.pdf>.

For crop years 2001-2005, data was obtained from USDA. Weekly payments under the program, which we then added for each crop year (August 1st – July 31th). The data for crop year 2005 is preliminary.

Loan Program Benefits

Benefits are comprised of three types of benefits:
a. Loan Deficiency Program (LDP) payments

- b. Marketing Loan Gains
- c. Certificate Exchange Gains

a. *LDP* data for crop years 1996-2002 are available from the USDA's Farm Service Agency's Budget Division, available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc> (spreadsheet link labeled "FY 2003 CCC Actuals").

b. *Marketing Loan Gain* data for crop years 1996-2001 are available at the USDA's Farm Service Agency's Budget Division, available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc> (spreadsheet link labeled "FY 2003 CCC Actuals").

For crop year 2002, we use the Commodity Estimates Book for the President's 2006 Budget, Output 16, page 3 available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>

c. *Certificate Exchange Gains* data for crop year 2002 is available from the Commodity Estimates Book for the President's 2006 Budget, Output 18, page 19, available at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>
For 2003-2008 data, we use the update in the mid term review of the Commodity Estimates Books of the President's 2007 Budget.

Crop year data for Certificate Exchange Gains are not available for crop years 1996-2001. Fiscal year data on Certificated Exchange Gains approximate the crop year data. When comparing the fiscal year and crop year data for the years, for which we have both sets of data, the figures are very similar. For example, we use FY2001 (Oct 1 2000 through Sep 30, 2001) data as an approximation for CY2000 (Aug 1 2000 – Jul 31, 2001). Fiscal year data on Certificate exchange gains are available at the USDA Farm Service Agency's Budget Division website (CCC History of Net Budgetary Expenditures -Book 3 (1990-2000) and Book 4 (2001-2003)) at <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>

The sum of the three individual programs equals the total loan program benefits. For crop years 2003-2008, the total historical data and projected payments are presented in the mid term review for the 2007 President's Budget, available at: <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc>

Crop Insurance Net Transfer to Farmers

For crop years 1996-2005, we use the Summary of Business Application from the USDA's Risk Management Agency, available at <http://www3.rma.usda.gov/apps/sob/>.

Net transfer to the farmer from the program is equal to the indemnity minus the farmer-paid premium, where the farmer paid premium is the total premium minus the sum of the premium subsidy/cost share and premium discount payments (only in 1999 and 2000).

Value of Production and Quantity of Production

For crop years 1996-2005, data are from the USDA National Agricultural Statistics Service's Agricultural Statistics Database, available at <http://www.nass.usda.gov/>.

Value of production for crop years 2006-2008 use projections of price and production from FAPRI at

http://www.fapri.missouri.edu/outreach/publications/2006/FAPRI_UMC_Report_12_06.pdf

Data for all the variables listed above are contained in Table A1.

I also use data from the FAPRI outlook documents. The information for 1999 -2001 and 2003 -2006 are at <http://www.fapri.iastate.edu/publications/outlook.aspx>.

For 2002 the projections are found at

http://www.fapri.missouri.edu/outreach/publications/2002/FAPRI_UMC_TDR_02_02.pdf

These projections were made after the 2002 Farm Act was passed and reflects the new legislation. This is appropriate for the analysis here because the main features of the 2002 Act, which became law in April 2002, was known by the winter planting time for cotton growers. These projections include also information about market conditions that evolved after planting. However, given that it was developed well before the marketing year had begun, this projection is the best available information to reflect grower expectations about the 2002 marketing year.

**Appendix Table A1: U.S. Upland Cotton Subsidy, and Value of Production, Marketing Years 1996-2008,
(Smillion and million lbs)**

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Production Flexibility Contract payments	699	597	637	616	575	474	436	0	0	0	0	0	0
Direct payments ¹	0	0	0	0	0	0	182	616	615	611	611	611	611
Counter Cyclical payments ¹	0	0	0	0	0	0	1,312	392	1,375	1,376	1,077	777	676
Market Loss Assistance payments	0	0	316	613	612	524	0	0	0	0	0	0	0
User Marketing (Step-2) payments	3	390	308	422	236	193	429	350	544	350	0	0	0
Marketing Loan Program benefits ¹	0	29	534	1,546	531	2,520	871	168	1,842	1,257	650	541	433
Net transfer from Crop Insurance subsidy ²	185	67	308	317	426	473	277	279	79	-11	119	n/a	n/a
Total support, g ³	887	1,083	2,102	3,513	2,380	4,184	3,508	1,805	4,455	3,582	2,424	n/a	n/a
Value of production, P ⁴	6,137	5,709	3,924	3,534	4,073	2,834	3,497	5,266	4,540	5,204	4,857	5,337	5,435
Quantity produced, (million lbs) ⁵	8,838	8,758	6,468	7,821	8,064	9,409	7,935	8,555	10,802	11,165	9,504	9,994	9,936

Source: See discussion of data sources and methods in this data appendix. n/a means not available and not applicable

Note: Unless specified below, data for 1996 through 2005 are based on actual payment data from USDA (see Appendix for detailed sources) ¹ The 2003-2008 data on direct payments, counter-cyclical payments and marketing loan program benefits are based on actual and projected data published in the 2006 mid-term review for the 2007 President's Budget.

² Data on net transfers from the crop insurance program to the producer are realized for the period 1996 through 2006 (2006 is a preliminary figure as of October 9, 2006, which was \$99 million multiplied by 1.2).

³ Total support, g, is the sum of all seven individual payments or transfers. For 2007 and 2008 total g is not available.

⁴ Value of production for 1996 through 2005 is based on actual data from USDA. Data for 2006 through 2008 value of production are based on the July 2006 FAPRI projections.

⁵ Production data for 1996-2005 are based on actual figures from USDA, including the most recent estimate for 2005. Data for 2006 through 2008 are based on the 2006 July FAPRI projections.

Appendix Table A2. U.S. and World Cotton Production and Consumption, and U.S. Exports, Crop year 2003-05 average, in 1000 metric tons

	2003	2004	2005	Average 2003-05
Production				
United States	3,975	5,062	5,201	
World Total	20,741	26,200	24,853	
Share U.S. in World, in %	19.16	19.32	20.93	19.80
Consumption				
United States	1,364	1,457	1,285	
World Total	21,344	23,693	25,555	
Share U.S. in World, in %	6.39	6.15	5.03	5.86
Exports				
United States	2,995	3,143	3,821	
Ratio U.S. Production/U.S. Exports	1.33	1.61	1.36	1.43
Ratio U.S. Consumption/U.S. Exports	0.46	0.46	0.34	0.42

Source: USDA Foreign Agricultural Service. Production Supply and Distribution Database, Available at: <http://www.fas.usda.gov/psdonline/psdhome.aspx>, accessed September 25, 2006.

Note: The totals given here includes Pima cotton, which is about 3 percent of U.S. production and a smaller share of world production. United States Department of Agriculture, National Agricultural Statistics Service. Quick Stats (Agricultural Statistics Database). Available directly on homepage of NASS under <http://www.nass.usda.gov/>

Appendix Table A3.A.1

Price Expectations: One Year Lag

Policy Scenario: Removal of Marketing Loan and Counter-Cyclical Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2002-2005 Average
E(P/g)	1.98	1.09	1.96	0.72	0.98	2.82	0.94	1.54	2.05	2.67	1.37
E(γ)	0.609	0.748	0.650	0.849	0.652	0.623	0.709	0.613	0.543	0.535	0.71
Effect on											
World Price	2.91%	6.67%	2.76%	10.08%	5.60%	1.13%	7.20%	5.57%	3.97%	2.98%	6.00%
U.S. Quantity Supplied	-5.30%	-12.14%	-5.03%	-18.35%	-10.20%	-2.05%	-13.11%	-10.14%	-7.23%	-5.42%	-10.93%
U.S. Quantity Exported	-7.36%	-16.84%	-6.98%	-25.45%	-14.14%	-2.85%	-18.18%	-14.06%	-10.03%	-7.52%	-15.16%

Appendix Table A3.A.2

Price Expectations: Futures Prices

Policy Scenario: Removal of Marketing Loan and Counter-Cyclical Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2006	2002-2005 Average
E(P/g)	1.66	1.77	1.67	0.73	1.37	1.86	1.07	1.83	1.26
E(γ)	0.633	0.661	0.717	0.669	0.675	0.674	0.667	0.620	0.67
Effect on									
World Price	3.99%	3.80%	4.03%	7.96%	4.63%	3.46%	6.32%	4.88%	5.59%
U.S. Quantity Supplied	-7.27%	-6.92%	-7.34%	-14.49%	-8.42%	-6.29%	-11.50%	-8.89%	-10.18%
U.S. Quantity Exported	-10.08%	-9.59%	-10.18%	-20.09%	-11.68%	-8.73%	-15.95%	-12.33%	-14.11%

Appendix Table A3.A.3

Price Expectations: FAPRI Price Forecast

Policy Scenario: Removal of Marketing Loan and Counter-Cyclical Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	2001	2002	2003	2004	2005	2006	2007	2008	2002-2005 Average
E(P/g)	2.92	0.67	1.07	2.08	0.98	1.62	2.30	2.70	1.20
E(y)	0.532	0.702	0.597	0.544	0.632	0.518	0.426	0.388	0.62
Effect on									
World Price	0.78%	8.97%	5.10%	1.72%	6.61%	4.49%	2.72%	2.02%	5.60%
U.S. Quantity Supplied	-1.41%	-16.33%	-9.28%	-3.13%	-12.03%	-8.18%	-4.96%	-3.67%	-10.19%
U.S. Quantity Exported	-1.96%	-22.64%	-12.87%	-4.34%	-16.69%	-11.35%	-6.88%	-5.10%	-14.14%

Appendix Table A3.B.1

Price Expectations: One Year Lag

Policy Scenario: Removal of Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	1.98	1.09	1.96	0.72	0.98	2.82	0.94	1.37
E(y)	0.609	0.748	0.650	0.849	0.652	0.623	0.709	0.71
Effect on								
World Price	1.37%	1.68%	1.01%	0.77%	1.72%	1.22%	1.64%	1.34%
U.S. Quantity Supplied	-2.50%	-3.05%	-1.83%	-1.41%	-3.13%	-2.21%	-2.98%	-2.43%
U.S. Quantity Exported	-3.47%	-4.23%	-2.54%	-1.95%	-4.35%	-3.07%	-4.14%	-3.38%

Appendix Table A3.B.2

Price Expectations: Futures Prices

Policy Scenario: Removal of Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	1.66	1.77	1.67	0.73	1.37	1.86	1.07	1.26
E(γ)	0.633	0.661	0.717	0.669	0.675	0.674	0.667	0.67
Effect on								
World Price	1.19%	1.16%	1.21%	1.53%	1.13%	1.00%	1.35%	1.25%
U.S. Quantity Supplied	-2.16%	-2.11%	-2.20%	-2.79%	-2.06%	-1.82%	-2.46%	-2.28%
U.S. Quantity Exported	-3.00%	-2.93%	-3.05%	-3.87%	-2.86%	-2.52%	-3.41%	-3.17%

Appendix Table A3.B.3

Price Expectations: FAPRI Price Forecast

Policy Scenario: Removal of Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	2.92	0.67	1.07	2.08	0.98	1.20
E(γ)	0.532	0.702	0.597	0.544	0.632	0.62
Effect on						
World Price	0.79%	1.55%	1.09%	1.16%	1.21%	1.25%
U.S. Quantity Supplied	-1.44%	-2.82%	-1.99%	-2.11%	-2.21%	-2.28%
U.S. Quantity Exported	-2.00%	-3.91%	-2.76%	-2.93%	-3.06%	-3.17%

Appendix Table A3.C.1

Price Expectations: One Year Lag

Policy Scenario: Removal of Marketing Loan, Counter-Cyclical and Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	1.98	1.09	1.96	0.72	0.98	2.82	0.94	1.37
E(γ)	0.609	0.748	0.650	0.849	0.652	0.623	0.709	0.71
Effect on								
World Price	4.29%	8.35%	3.77%	10.85%	7.32%	2.34%	8.84%	7.34%
U.S. Quantity Supplied	-7.80%	-15.20%	-6.86%	-19.76%	-13.33%	-4.27%	-16.09%	-13.36%
U.S. Quantity Exported	-10.82%	-21.07%	-9.52%	-27.40%	-18.49%	-5.92%	-22.32%	-18.53%

Appendix Table A3.C.2

Price Expectations: Futures Prices

Policy Scenario: Removal of Marketing Loan, Counter-Cyclical and Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	1.66	1.77	1.67	0.73	1.37	1.86	1.07	1.26
E(γ)	0.633	0.661	0.717	0.669	0.675	0.674	0.667	0.67
Effect on								
World Price	5.18%	4.96%	5.24%	9.49%	5.76%	4.46%	7.67%	6.84%
U.S. Quantity Supplied	-9.43%	-9.03%	-9.54%	-17.28%	-10.49%	-8.11%	-13.96%	-12.46%
U.S. Quantity Exported	-13.08%	-12.52%	-13.23%	-23.97%	-14.55%	-11.25%	-19.36%	-17.28%

Appendix Table A3.C.3

Price Expectations: FAPRI Price Forecast

Policy Scenario: Removal of Marketing Loan, Counter-Cyclical and Step-2 Payments

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	2001	2002	2003	2004	2005	2002-2005 Average
E(P/g)	2.92	0.67	1.07	2.08	0.98	1.20
E(y)	0.532	0.702	0.597	0.544	0.632	0.62
Effect on						
World Price	1.57%	10.52%	6.19%	2.88%	7.82%	6.85%
U.S. Quantity Supplied	-2.86%	-19.15%	-11.27%	-5.24%	-14.24%	-12.48%
U.S. Quantity Exported	-3.96%	-26.55%	-15.63%	-7.27%	-19.76%	-17.30%

Appendix Table A3.D.1

Price Expectations: One Year Lag

Policy Scenario: Removal of All Subsidies

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2002-2005 Average
E(P/g)	1.98	1.09	1.96	0.72	0.98	2.82	0.94	1.54	2.05	2.67	1.37
E(y)	0.609	0.748	0.650	0.849	0.652	0.623	0.709	0.613	0.543	0.535	0.71
Effect on											
World Price	5.34%	9.63%	5.66%	13.17%	9.41%	4.06%	10.22%	6.55%	4.72%	3.73%	9.21%
U.S. Quantity Supplied	-9.72%	-17.54%	-10.30%	-23.97%	-17.13%	-7.38%	-18.61%	-11.92%	-8.60%	-6.79%	-16.77%
U.S. Quantity Exported	-13.49%	-24.33%	-14.28%	-33.24%	-23.75%	-10.24%	-25.81%	-16.53%	-11.93%	-9.41%	-23.26%

Appendix Table A3.D.2

Price Expectations: Futures Prices

Policy Scenario: Removal of All Subsidies

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	1999	2000	2001	2002	2003	2004	2005	2006	2002-2005 Average
E(P/g)	1.66	1.77	1.67	0.73	1.37	1.86	1.07	1.83	1.26
E(γ)	0.633	0.661	0.717	0.669	0.675	0.674	0.667	0.620	0.67
Effect on									
World Price	6.31%	6.22%	6.93%	11.47%	7.67%	6.09%	9.00%	5.78%	8.56%
U.S. Quantity Supplied	-11.48%	-11.33%	-12.61%	-20.88%	-13.97%	-11.09%	-16.38%	-10.52%	-15.58%
U.S. Quantity Exported	-15.93%	-15.71%	-17.49%	-28.96%	-19.37%	-15.38%	-22.72%	-14.60%	-21.60%

Appendix Table A3.D.3

Price Expectations: FAPRI Price Forecast

Policy Scenario: Removal of All Subsidies

Supply Elasticities: $\epsilon_u = 0.5$, $\epsilon_r = 0.2$

	2001	2002	2003	2004	2005	2006	2007	2008	2002-2005 Average
E(P/g)	2.92	0.67	1.07	2.08	0.98	1.62	2.30	2.70	1.20
E(γ)	0.532	0.702	0.597	0.544	0.632	0.518	0.426	0.388	0.62
Effect on									
World Price	3.44%	12.40%	8.33%	4.68%	9.22%	5.51%	3.48%	2.78%	8.66%
U.S. Quantity Supplied	-6.26%	-22.58%	-15.17%	-8.51%	-16.79%	-10.03%	-6.34%	-5.07%	-15.76%
U.S. Quantity Exported	-8.68%	-31.32%	-21.04%	-11.80%	-23.29%	-13.90%	-8.79%	-7.03%	-21.86%

Appendix II. Methods for calculating proxies for expected prices and expected government subsidies

As noted in the text, there are no data on what growers expect to receive from market revenue and government sources for the upcoming crop year. This appendix provides computational details for the three procedures I use to generate the proxies for these expectations that go into computing the parameter $\alpha = (P/(P + \gamma g))$ that enters the model. The alternative procedures use common calculations for proxies for expectations about the PFC payments, direct payments, MLA payments and crop insurance subsidies. The procedures for dealing with expectations differ only in how they generate proxies for the market revenue or price, CCP payments, Step-2 payments and marketing loan benefits.

I first provide information and computational details concerning the three methods for creating proxies for expectations about the market price, marketing loan benefits, counter-cyclical payments and Step-2 payments. Then I turn to the computation of proxies for expectations about direct payments, PFC, MLA payments and crop insurance subsidy.

Method 1. One-year lag

This subsection explains the calculations for expected prices, and expected per unit payment rates for the counter-cyclical payments, loan program payments and Step-2 payments.

Price

The expected per unit season average price in year t is simply the realized season average price in year $t-1$. Note that since expectations are formed before the $t-1$ marketing year is completed, this approach uses some data that is available and some accurate expectations about data that is not yet available to producers at the time the expectations are formed. The realized price for 1998-2005 is obtained from USDA NASS Agricultural Statistics Database.³⁸ The 2005 season average price is the estimate from the October 12 USDA NASS press release, where the estimated 2005 price is given as \$0.477 per pound for cotton.³⁹ For 2007, and 2008 I used FAPRI projected prices because no USDA price projections are available. For the lagged price in the 2007 expectations, I use the projected 2006 price in the FAPRI July 2006 update of the Agricultural Outlook and for the 2008 expectations, I use the projected 2007 price published in the FAPRI July 2006 update.⁴⁰

CCP, Loan Benefits and Step-2 Payments

For each payment program, the expected per-unit payment for year t is equal to the actual payment total in $t-1$ divided by the actual quantity produced in year $t-1$ for the marketing years 1999-2006. For marketing year 2007, I divide the projected total payment (according the 2007 President's Budget)⁴¹ for marketing year 2006 by total production projected by FAPRI for 2006 in its July 2006 Update of the Agricultural Outlook. For marketing year

³⁸ <http://www.nass.usda.gov/> (access via Quick Stats – U.S. and State Data).

³⁹ http://www.nass.usda.gov/Newsroom/Notices/10_12_2006.

⁴⁰ http://www.fapri.missouri.edu/outreach/publications/2006/FAPRI_UMC_Report_12_06.pdf.

⁴¹ <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-wa>.

2008, I divide the projected payment total for marketing year 2007 by total production projected by FAPRI for 2007 in its July 2006 Update of the Agricultural Outlook.⁴²

Method 2. Futures Markets

Cotton futures are traded on the New York Futures and Options Exchange daily. The futures prices contain information about what market participants anticipate, at the time of their trade, about prices in the physical commodity market on the date of specified delivery of the contract. I use the average of the closing prices for all trading days in February for the December contract to represent the relevant information contained in the futures markets about season average prices and policy variables. February is roughly the period when many key decisions are made about cotton planting and production so the February trading dates represent a reasonable proxy for the time of decision about cotton production. The cotton harvest is nearing completion by December and much of the crop is marketed in the period on either side of the December futures contract, so it is a reasonable proxy for the season average market price. These proxies are approximations because, of course, many relevant decisions are not made in February and much cotton is not marketed in December.

Because the price in the futures contract is for only the price in a single month, the futures market provides only indirect information about expectations about the season average market price and even more indirect information about the counter-cyclical payments, Step-2 payments and marketing loan benefits. For each of the three price-based subsidy programs (counter cyclical payments, Step-2 payments and marketing loan benefits) and for the expected price received by the farmer, I use a simple linear regression of the price or policy variable on the futures price and then use the estimated coefficients to project the dependent variable.

Projected Market Price

I estimated a linear regression of the marketing-year-average farm price on the average February price of the December futures contract. I use the estimated slope and intercept parameters from the regression to project the season average market prices for the period 1999-2005. The use of the regression for the whole data period is based on the assumption that there is a stable linear relationship between the futures price and the season average market price. This formulation is more general than simply calculating an average basis differential or a basis ratio.

Specifically, the regression has the following form:

$$P_{mt} = a_m + b_m * (P_{feb})_t + e_t,$$

where P_m is the marketing year average farm price in cents per pound, a_m is the intercept, b_m the slope and P_{feb} the average February Price of the December contract also in cents per pound. The estimated intercept is 0.046 with a standard error of 0.051. The estimated slope is 0.82 with a standard error of 0.086. The R^2 is 0.92. Table A3 contains the data used in the regression and the forecasted market price for the years 1999 to 2005.

⁴² http://www.fapri.missouri.edu/outreach/publications/2006/FAPRI_UMC_Report_12_06.pdf.

Table A3. Futures Price and Market Price Data and Forecasted Market Price

	Average February Price of December Contract, \$/lb	Marketing Year Average Farm Price, \$/lb	Forecasted Marketing Year Average Farm Price, \$/lb
1996	0.786	0.693	
1997	0.768	0.652	
1998	0.721	0.602	
1999	0.603	0.450	0.538
2000	0.613	0.498	0.546
2001	0.586	0.298	0.525
2002	0.422	0.445	0.390
2003	0.596	0.618	0.533
2004	0.668	0.416	0.591
2005	0.511	0.477	0.463
2006	0.604		0.539

Source: The Average February Price of December Futures Contract represents the average daily closing price in the month of February of the December contract for Cotton #2 on the New York Cotton Exchange (NYCE). The data were obtained from Norman's Historical Data, available at <http://www.normanshistoricaldata.com>. Except that the 2006 futures price was accessed from the New York Board of Trade (at <http://www.nybot.com/reports/monthlyData/cotton.XLS>). Marketing year average price is from United States Department of Agriculture, National Agricultural Statistics Service. Quick Stats (Agricultural Statistics Database). Available directly on homepage of NASS under <http://www.nass.usda.gov/>. The 2005 farm price is based on the October 12, 2006 NASS Press Release on the latest average marketing price for cotton in the United States, available at: http://www.nass.usda.gov/Newsroom/Notices/10_12_2006.

Projected Counter Cyclical Program (CCP) Payments

I estimated a linear regression of the CCP payments rate per unit of production on the average February price of the December futures contract. I use the estimated slope and intercept parameters from the regression to project the CCP payments rate per unit of production for the period 2002-2006. The use of the regression for the whole data period is based on the assumption that there is a stable linear relationship between the futures price and the CCP payments. This formulation is more general than simply calculating an average basis differential or a basis ratio.

Specifically, the regression has the following form:

$$\text{CCP Payment}_t = a_{\text{ccp}} + b_{\text{ccp}} * (P_{\text{feb}})_t + e_t$$

where CCP Payment_t is the marketing year CCP payment average farm price in cents per pound in year t, a_{ccp} is the intercept, b_{ccp} the slope, (P_{feb})_t the average February Price in year t of the December contract also in cents per pound and e_t is the error term.

The CCP payment rate per unit of production is total CCP payments divided by the quantity produced. Of course no CCP payments were made prior to 2002. However, the CCP formula allows us to calculate what payments would have been if the program was operative during those years. The following formulas are available from the Economic Research Service website on the 2002 Farm Bill and available at <http://www.ers.usda.gov/Features/farmland/analysis/countercyclicalpayments2002act.htm>.

The CCP payment rate per unit of base production is given by:
 CCP Payment rate per unit of base production = (72.4) – (0.0667) – Higher or the (Season average market price, 0.52), and the total CCP payment is given by:

$$(CCP = ((\text{Base acres})(0.85))(\text{payment yield})(CCP \text{ payment rate}).$$

Using these equations from the law, we calculate the implied CCP payment for the year 1996 to 2001. We then regress the CCP payment rate per unit of production on the futures price.

In the regression, the estimated intercept is 0.379, with a standard error of 0.088 and the estimated slope is -0.447, with a standard error of 0.138. The R² is 0.57. Using the intercept and slope parameter I calculate the projected per unit payment rate under the CCP program. Table A4 presents the resulting per unit rates.

Table A4. Futures Price and CCP Data and Forecasted CCP Payments

	Average February price of December contract, \$/lb	Payment totals under CCP ¹ , million \$	Upland cotton production million lbs	Per unit CCP payment rate per unit of output \$/lb	Projected CCP payment rate per unit of output, \$/lb
1996	0.786	0	8,838	0.000	
1997	0.768	0	8,758	0.000	
1998	0.721	385	6,468	0.060	
1999	0.603	1,312	7,821	0.168	
2000	0.613	1,312	8,064	0.163	
2001	0.586	1,312	9,409	0.139	
2002	0.422	1,312	7,935	0.165	0.191
2003	0.596	392	8,555	0.046	0.113
2004	0.668	1,375	10,802	0.127	0.081
2005	0.511	1,376	11,165	0.123	0.151
2006	0.604				0.110

¹Payments for 1996-2001 period were calculated using definitions of the CCP payment.

Marketing Loan Benefits

I estimated a linear regression of the marketing loan benefit rate per unit of production on the average February price of the December futures contract. I use the estimated slope and intercept parameters from the regression to project the marketing loan benefit rate per unit of production for the period 1999-2006. The use of the regression for the whole data period is based on the assumption that there is a stable linear relationship between the futures price and the benefits from the marketing loan program. This formulation is more general than simply calculating an average basis differential or a basis ratio.

I regress the per unit loan benefit rate under the marketing loan program on the average February price of the December contract according to the following formula:

$$ML_t = a_1 + b_1 * (P_{feb})_t + e_t,$$

where ML is the per unit payment under the program, a_1 , and b_1 are the intercept and slope parameters and P_{feb} is the average February price of the December contract and e is the error term. The estimated intercept is 0.311 with a standard error of 0.159 and the slope is -0.331 with a standard error of 0.250. The R^2 is 0.179. The forecasted per unit benefit rate from the marketing loan program is calculated using the estimated intercept and slope. Table A5 presents the projected per unit rates.

Table A5. Regression Data and Forecasted Marketing Loan Benefits

	Average February price of December contract, in \$/lb	Payment totals under ML program, million \$	U.S. upland cotton production, in million lbs	Per unit payment rate under ML program \$/lb	Projected per unit benefit rate under ML program, \$/lb
1996	0.786	0	8,838	0.000	
1997	0.768	29	8,758	0.003	
1998	0.721	534	6,468	0.083	
1999	0.603	1,546	7,821	0.198	0.111
2000	0.613	531	8,064	0.066	0.108
2001	0.586	2,520	9,409	0.268	0.117
2002	0.422	871	7,935	0.110	0.171
2003	0.596	168	8,555	0.020	0.113
2004	0.668	1,842	10,802	0.170	0.090
2005	0.511	1,257	11,165	0.113	0.142
2006	0.604				0.111

Step-2 (User) Payments

I estimated a linear regression of the Step-2 payment rate per unit of production on the average February price of the December futures contract. I use the estimated slope and intercept parameters from the regression to project the Step-2 payment rate per unit of production for the period 1999-2005. The use of the regression for the whole data period is based on the assumption that there is a stable linear relationship between the futures price

and the Step-2 payments. This formulation is more general than simply calculating an average basis differential or a basis ratio.

In order to calculate the projected per unit payment rate from the Step-2 program, I regress the actual per unit payment rate under that program on the average February price of the December contract,

$$\text{Step2}_t = a_u + b_u * (P_{\text{feb}})_t + e_t,$$

where Step2 is the per unit payment under the Step-2 program, a_u , and b_u are the intercept and slope and P_{feb} is the average February price of the December contract.

The estimated intercept is 0.069 with a standard error of 0.032 and the slope is -0.051 with a standard error of 0.051. The R^2 is 0.111. The forecasted per unit payment rate from the Step-2 User program uses the estimated intercept and slope. Table A6 presents the projected per unit rates. Step-2 payments were discontinued after the 2005 marketing year.

Table A6. Regression Data and Forecasted Step-2 Payments

	Average February price of December contract, \$/lb	Payment totals, User program, million \$	Upland cotton production million lbs	Per unit User payment rate, \$/lb	Projected per unit payment rate, under User program, \$/lb
1996	0.786	3	8,838	0.000	
1997	0.768	390	8,758	0.045	
1998	0.721	308	6,468	0.048	
1999	0.603	422	7,821	0.054	0.039
2000	0.613	236	8,064	0.029	0.038
2001	0.586	193	9,409	0.021	0.039
2002	0.422	429	7,935	0.054	0.048
2003	0.596	350	8,555	0.041	0.039
2004	0.668	544	10,802	0.050	0.035
2005	0.511	350	11,165	0.031	0.043

Method 3. FAPRI Projections

The “Agricultural Outlook” that FAPRI publishes each winter includes projections of U.S. crop prices, production and various policy variables.⁴³ These projections are based on projection models and a panel of commodity experts who have access to all the available information at the time of their projections. For this expectations approach, I use the FAPRI projections for the upcoming crop year to represent grower expectations. The information for policy projections is not available before 2001. These projections are directly available for prices, quantities, marketing loan benefits and counter cyclical payments for the years

⁴³ These were available for 2001 through 2006, except that the release of the 2002 projections was delayed until the 2002 farm bill was finalized. We assume, under this method that farmers had good information about the 2002 farm bill, which was finally passed in April 2002. <http://www.fapri.iastate.edu/publications/outlook.aspx> and http://www.fapri.missouri.edu/outreach/publications/2002/FAPRI_UMC_TDR_02_02.pdf.

2001 to 2006, and with some extension of the approach for 2007 and 2008. To create expectations about the Step-2 payments, I use FAPRI projections of various prices to project the implied Step-2 payment for each year in which that program applied.

Price

For the expected price I use the FAPRI projection for the upcoming marketing year. For example, to represent the expected season-average price for 2003, I use the price projection for marketing year 2003 published in the FAPRI Agricultural Outlook, 2003, which is released early in 2003 about the same time cotton growers are making major production decisions. For marketing years 2007 and 2008, I use the price projections for those years released in the July 2006 Update of the FAPRI Agricultural Outlook.⁴⁴

Loan Program

Projected per unit loan benefits (labeled LDP in the Outlook release) were directly available for all years except 2001. In 2001, FAPRI released projections of the loan benefits per acre. Dividing these projected benefits per acre by the projected yield per acre results in the per unit expected loan program benefit for marketing year 2001. For years 2007 and 2008, I use the projected per unit rate loan benefit from the July 2006 Update.

Counter-cyclical payments

For the CCP program, FAPRI projects the CCP payment rate per unit of CCP base production. Expected CCP payment rate per pound of expected production equals the expected CCP payment rate per pound of base production times CCP program yield per acre times base acreage all divided by projected production (in pounds).

All elements of this formula are based on FAPRI projections that are available for each year for which the CCP program exists or is expected to exist, 2002 through 2008. For marketing years 2007 and 2008 the same formula applies using the projections for 2007 and 2008 from the July 2006 update of the FAPRI Agricultural Outlook.

Step-2 program payments

FAPRI did not project Step-2 payment rates. In order to use FAPRI projections to create a proxy for expected Step-2 payments, I fit the linear regression

$$\text{Per unit Step-2 Payment}_t = a + b_1 * \text{SAP}_t + b_2 * \text{Cot}_t + b_3 * \text{AWP}_t + \text{error}_t,$$

where the per unit Step-2 payment is the actual payment in each year divided by actual production in that year, SAP is the U.S. season average price, Cot is the Cotlook world price and AWP is the adjusted world price, and the error term represents unobservable variables. Note that this equation is for prediction only and we have no interest in interpreting the individual coefficients.

⁴⁴ http://www.fapri.missouri.edu/outreach/publications/2006/FAPRI_UMC_Report_12_06.pdf.

Table A7. Data for Regression of Step-2 Payment on Prices

	Step-2 Payment	U.S. Season Average Farm Price	Cotlook Price \$/lb	Adjusted World Price
1996	0.000	0.693	0.787	0.641
1997	0.045	0.652	0.721	0.582
1998	0.048	0.602	0.590	0.446
1999	0.054	0.450	0.529	0.389
2000	0.029	0.498	0.573	0.436
2001	0.021	0.298	0.419	0.286
2002	0.054	0.445	0.558	0.433
2003	0.041	0.618	0.692	0.551
2004	0.050	0.416	0.535	0.389
2005	0.031	0.477	0.571	0.421

The resulting estimated parameters are denoted $\hat{\alpha}$, \hat{c}_1 , \hat{c}_2 , and \hat{c}_3 . For projections of the Step-2 payment for the years 2001 to 2005 I use estimated parameters and the FAPRI projections as follows: Expected per unit Step-2 payment_t = $\hat{\alpha} + \hat{c}_1$ *projected SAP_t + \hat{c}_2 *projected Cot_t + \hat{c}_3 *projected AWP_t.

The estimated parameters for this regression are as follows with standard errors in parentheses: Intercept, 0.149 (0.126); Season Average Price, 0.153 (0.169); Cotlook World Price, -0.688 (0.935) and Adjusted World Price, 0.482 (0.905). The goodness of fit, R², is 0.221.

Table 8. Projected Prices from FAPRI and Step-2 Projections

	Expected Step-2 Payment	U.S. Season Average Farm Price	FAPRI Projections	
			Cotlook World Price	Adjusted World Price
2001	0.023	0.554	0.685	0.541
2002	0.050	0.385	0.451	0.317
2003	0.033	0.459	0.584	0.448
2004	0.037	0.574	0.653	0.518
2005	0.037	0.435	0.540	0.400

Next, let us turn to the methods of developing expectation proxies for the non-price based subsidies.

Crop Insurance

Net transfer to cotton producers from the cotton crop insurance program is equal to the total indemnity minus the total of farmer-paid premiums. The farmer-paid premiums are equal to the total of all premiums minus the sum of the premium subsidies/cost shares and premium discount payments (These premium discount payments were only made in 1999 and 2000). The expected crop insurance subsidy rate per unit of production for the years 1999-2006 is

defined as the three year lagged moving average of the ratio of total observed net transfer from the crop insurance program to cotton producers over the quantity of cotton produced. The calculation used the following equation:

$$E(\text{Subsidy_Rate}_{\text{CIS}})_t = 1/3 * (\text{CIS}_{t-3}/Q_{t-3}) + 1/3 * (\text{CIS}_{t-2}/Q_{t-2}) + 1/3 * (\text{CIS}_{t-1}/Q_{t-1}),$$

where $E(\text{Subsidy_Rate}_{\text{CIS}})_t$ stands for the expected subsidy rate per unit from the crop insurance program in year t , CIS_{t-i} stands for the actual observed net transfer from the crop insurance program to cotton producers in year $t-i$ and Q_{t-i} stands for the total quantity of cotton produced in year $t-i$.

For both marketing years 2007 and 2008, when we do not have complete historical data, the expected subsidy rate per unit is calculated using as follows:

$$E(\text{Subsidy_Rate}_{\text{CIS}})_{2007} = E(\text{Subsidy_Rate}_{\text{CIS}})_{2008} = 1/3 * (\text{CIS}_{2004}/Q_{2004}) + 1/3 * (\text{CIS}_{2005}/Q_{2005}) + 1/3 * (\text{ECIS}_{2006}/E(Q_{2006})).$$

As of October 15, 2006, the date when I finalized the calculations, only partial year estimates are available for the crop insurance indemnities. To estimate the final crop insurance subsidy, I use the subsidy made by October 9, 2006 (the last available update in crop insurance records).⁴⁵ I then conservatively multiply the October 9 subsidy by 1.2 to get an estimate of \$119 million. This is a very conservative estimate for two reasons. First premiums are complete records and only the indemnity is yet to be determined for the year and second it is likely that much less than 80 percent of total subsidy has been realized this early in the season. An indication of how conservative this estimate is, by October 23, the calculated subsidy was already \$112 million and the cotton harvest is still far from complete and full yield records are not yet known. The total quantity produced in marketing year 2006 is also a projection. I use the latest (October 12th 2006) USDA World Agricultural Supply and Demand Estimates to get the most recent USDA projection of quantity of cotton produced for the marketing year 2006.⁴⁶

Direct Payment, PFC, MLA

The expected per unit subsidy rates for production flexibility contract payment, direct payments and market loss assistance payments are simply the actual observed total payments under each program for each crop year 1999 through 2005 divided by the expected total quantity of cotton produced in each year. For 2006, 2007 and 2008, the total direct payment is the projection from the 2007 President's Budget for each year (the other two payments do not apply after 2002).⁴⁷ For expected quantity produced, I use FAPRI production projections for each of the marketing years 1999 through 2006.⁴⁸ (The FAPRI projections apply to all

⁴⁵ USDA, Risk Management Agency Federal Crop Insurance Corporation, "Crop Year Statistics for 2006, As of: October 9, 2006 Nationwide Summary - By Crop" page 3 cotton. http://www3.rma.usda.gov/apps/sob/current_week/crop2006.pdf.

⁴⁶ USDA, WASDE-439, October 12, 2006. <http://www.usda.gov/oce/commodity/wasde/latest.pdf>.

⁴⁷ <http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-wa>.

⁴⁸ FAPRI, "Agricultural Outlook: US Crops." <http://www.fapri.iastate.edu/publications/outlook.aspx>.

cotton, not just cotton, but cotton comprises more than 97 percent of the cotton grown in the United States. Using larger denominator in the per unit subsidy calculation implied that the subsidy estimates are conservative.) Specifically, for marketing year 2003, for example, I use production projected by FAPRI in early 2003 for the 2003 marketing year that is published the FAPRI Agricultural Outlook tables for that year. For expected production for marketing years 2007 and 2008, I use the most recent FAPRI projections (the 2006 July Agricultural Outlook update).⁴⁹

⁴⁹ FAPRI “Agricultural Outlook: July Update, US Crops.”
<http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-wa>.