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## Benefit-Cost Analysis: Distributional Considerations under Producer Quota Buyouts

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# Benefit-Cost Analysis: Distributional Considerations under Producer Quota Buyouts

Andrew Schmitz and Troy G. Schmitz

## Abstract

Benefit-cost (B/C) analysis must take into account the distributional effects from a policy or program change. To highlight this, we focus on the theory of production quota buyouts within a B/C framework. As an empirical application, we provide evidence on the distributional effects of the U.S. government buyout of the peanut program in 2002, where production quotas were key ingredients. Two approaches to producer compensation under the buyout are discussed: (1) *value of quota* approach and (2) *gains from quota* approach. In the peanut quota program buyout, the U.S. government chose the *value of quota* approach. Both consumers and producers were made better off as a result of the buyout, and there was a net gain in efficiency. If the government had chosen the *gains from quota* approach instead, government expenditures and producer gains would have been lower, and consumer benefits would have remained unchanged. Under either approach, the B/C ratios calculated for the government quota buyout are almost identical.

**KEYWORDS:** benefit-cost analysis, distributional effects, production quota buyouts, U.S., peanut quota program, *value of quota* approach, *gains from quota* approach

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## Introduction

A conclusion reached at the October 2009 conference on benefit-cost (B/C) analysis held in Washington, D.C. was that more attention must be given to the distributional consequences in B/C analysis. Along this line, our paper highlights the distributional and efficiency effects associated with a B/C analysis of a production quota buyout. While production control programs are commonplace in many parts of the world, some are being phased out. In the United States, for example, the tobacco and peanut production quota programs were eliminated in the first decade of the twenty-first century. In these two cases, the owners of quota, including producers, were compensated for potential losses under the quota buyout. Generally, quota buyouts result in an improvement in net societal welfare. Often, different approaches are used in government buyouts of production quotas. The outcome for farmers depends on the payment approach taken by the government. Farmers lobby for the payment method that leads to their greatest benefit. Successful political rent-seeking behavior by farmers favors them over taxpayers (Vercammen and Schmitz 1992; Schmitz, Furtan, and Baylis 2002).

Little theoretical and empirical analysis has been done on the impact of production quotas, with a few exceptions such as Wallace (1962) and Johnson (1965). Even more problematic, there is a shortage of studies that focus on the economics of quota buyouts. This paper develops a theory of production quota buyouts and applies the theory to the longstanding U.S. peanut program that ended in 2002. Under this program, production quotas played a key role. As we show, there are several approaches to government compensation to producers under a quota buyout. The method chosen need not affect B/C ratios associated with a specific quota buyout; however it does affect the magnitude and distribution of the gains and losses among producers, consumers, and taxpayers.

## Theoretical Model

We present a theoretical discussion using welfare economics (Just, Hueth, and Schmitz 2004) of the impact of production quotas, which we use as a basis for analyzing the termination of the U.S. Peanut Marketing Quota Program. Consider Figure 1 where  $S$  is the supply schedule for good  $x$  and  $D$  is the domestic demand. The competitive price is  $p_0$  and the corresponding output is  $q_0$ .

Suppose we introduce a production quota. Price increases to  $p_1$ . In addition, consumers lose an amount  $(p_1 p_0 ba)$  while producers gain  $(p_1 p_0 da - dcb)$ . This result is often ignored in discussions of production quotas. The inefficiency loss attached to the quota is shown as  $(abc)$ . The deadweight loss triangle  $(abc)$  is attributed to Harberger (Schmitz, Furtan, and Baylis 2002).

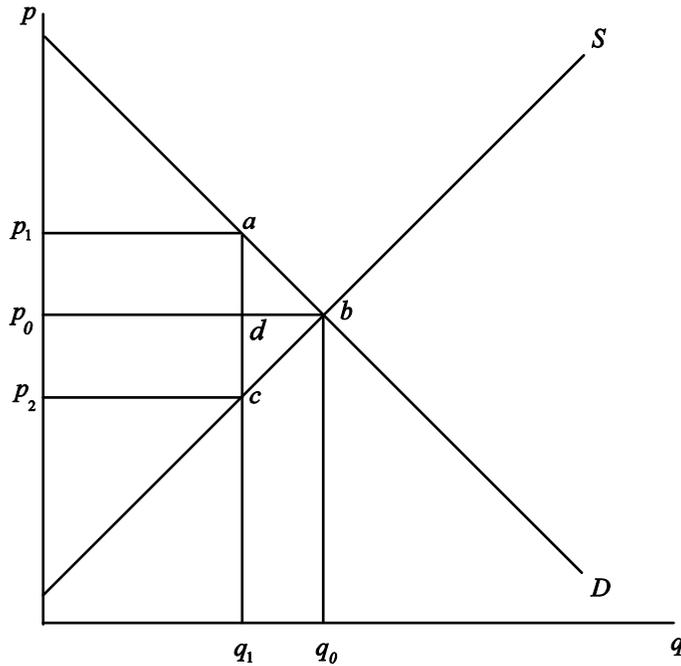


Figure 1. The Welfare Cost of Production Quotas

The inefficiency loss, often referred to as the dead weight loss (DWL), is a function of demand and supply elasticities. In the following:

$$DWL(quota) = \frac{1}{2} r^2 \eta p_0 q_0 \left( 1 + \frac{\eta}{\varepsilon} \right), \quad (1)$$

where  $\eta$  is the absolute value of the demand elasticity,  $\varepsilon$  is the supply elasticity, and  $r$  is the percentage increase in price (i.e.,  $r = (p_1 - p_0) / p_0$ ).

The above discusses the welfare cost of a production quota by comparing the competitive equilibrium price  $p_0$  and quantity  $q_0$  to the quota price  $p_1$  and quantity  $q_1$ . We now discuss the results where the government terminates the production quota program through a government-financed buyout compensation scheme. We examine two extreme alternatives that the government might use in making compensation payments: (1) The government pays the producers the *value of the quota* (Vercammen and Schmitz 1992) which is  $(p_1 p_2 ca)$  or (2) the government pays the producers the amount  $(p_1 p_0 da - dc b)$  which is the *gains from quota*. As we show later, while the distributional effects of the two payout approaches are very different, the B/C ratios do not vary a great deal. In either case, there is a net societal gain from removing the production quota.

How do the different approaches to the buyout affect consumer welfare? Note that in Figure 1, the change in consumer surplus  $p_1 p_0 ba$  is unaffected by the method of program payment. As a result, the DWL is not affected by the different approaches to compensation.

With the removal of quotas, production is expected to increase. This is seen in Figure 1, where production increases from  $q_1$  to  $q_0$ . Production increases because the producer price on which supply is based increases from  $p_2$  to  $p_0$ , even though the market price falls from  $p_1$  to  $p_2$  because quota values fall to zero. Under a quota system, production responds to the producer price net of quota values. In our model, producers respond to price  $p_2$ , not to price  $p_1$ .

## The U.S. Peanut Program

The U.S. Peanut Marketing Quota Program, established in the early 1930s, was designed to foster high and stable prices and to support the incomes of peanut growers. Because of a variety of factors, including concerns of the Free Trade Area of the Americas (FTAA), the United States eliminated the peanut program at the beginning of the 2002 crop year (Schmitz, Schmitz, and Rossi 2006). The elimination of the peanut program is referred to as a “buyout” because those who owned the right to sell peanuts were paid for the loss of their asset (i.e., the quota). According to Dohman, Foreman, and Da Pra (2009b: 21):

The idea of the marketing quota programs was to limit sales (marketings) to a certain quantity (quota) to keep prices higher and more stable than they would have been in a free market system. The USDA could adjust the quota annually based on evaluation of demand conditions to ensure that the market-clearing price matched or exceeded an established support price, known as a quota loan rate.

Until the buyout, the peanut program stood in contrast to the evolving U.S. farm policy, which had moved toward planting flexibility and reduced government support that was tied to the production of individual commodities. By law, the Peanut Marketing Quota Program was meant to operate without any direct government payments to producers. Supply limitation supported producer prices, so the Peanut Marketing Quota Program acted as an income transfer from consumers to producers. Prior to the buyout legislation, peanut producers were under a marketing quota system that gave quota owners the exclusive right to sell a set amount of their commodity at or above the support price (Dohman,

Foreman, and Da Pra 2009a). Quota was essentially an asset that could be owned and used by producers or leased from owners who no longer produced peanuts.

Marketing quota programs limit sales to a certain quantity (quota) to keep prices higher and more stable than they would be in a free market system. The U.S. Department of Agriculture adjusted the quota annually based on an evaluation of demand conditions to ensure that the market clearing price matched or exceeded an established support price, known as a quota loan rate. Prior to the removal of the peanut program, the average quota loan rate was \$610 per ton during 1996-2001 (Dohlman et. al. 2004). The national peanut quota (poundage) peaked in 1990-91 at slightly over three billion pounds (Figure 2). This decreased to two billion pounds in 2001-02. Yearly price fluctuations were less than were the fluctuations in poundage. Peanut prices peaked in 1990-91 at roughly \$0.35 per pound, and fell to a low of \$0.23 per pound in 2001-02.

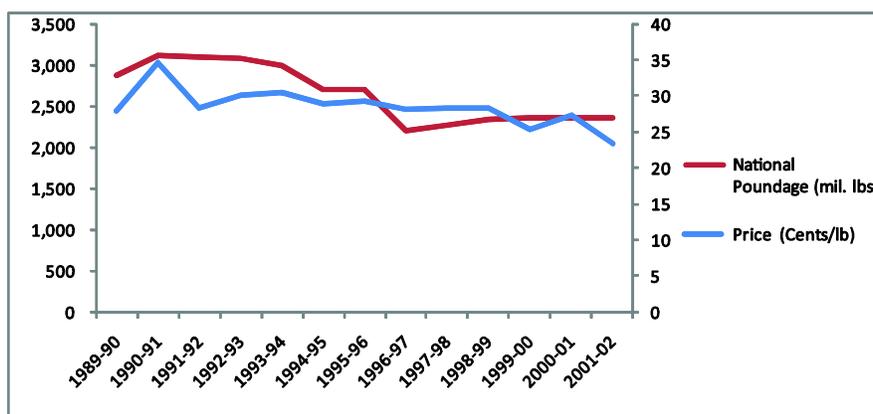


Figure 2. U.S. Peanut Poundage and Prices

The quantity and price data on which the buyout was made were derived from 2001 crop data. Under the quota buyout, holders of peanut quota (both peanut farmers and holders of quota who rented quota to farmers) in 2001 were compensated at the annual rate of \$0.11 per pound, or \$220 per ton (quota value).<sup>1</sup> The total poundage on which the payment was made totaled 2.4 billion pounds of peanuts. Authorized compensation was paid to quota holders over a five-year period where quota holders received \$0.55 per pound, or \$1,100 per ton. These payments were intended to compensate owners for the loss of an income producing asset.

<sup>1</sup> Data obtained through correspondence with Dr. E. L. Dohlman (peanut specialist, USDA/ERS). Professor Stan Fletcher (highly regarded specialist who works on the economics of U.S. peanut production and marketing at the University of Georgia) estimated the value of the quota to be in the neighborhood of \$0.10 per pound.

## Empirical Assessment (U.S. Peanut Quota Buyout)

The following provides an empirical assessment of the U.S. peanut quota buyout in 2002 in the context of the theoretical framework presented earlier. We present results for two approaches to the quota buyout: (1) the *value of the quota* approach and (2) the *gains from quota* approach.<sup>2</sup>

### Results: Value of the Quota Buyout

We provide empirical results of the effect of removing the longstanding U.S. Peanut Production Quota Policy along the lines of the *value of the quota* buyout. We do so under different supply and demand price elasticities for peanuts.<sup>3</sup> As discussed earlier, the DWL effects depend on the size of these elasticities, as does the distribution among consumers and producers from a quota buyout. With reference to Figure 1 for the quota buyout, if the government pays the producers the amount  $(p_1p_2ca)$ , then producers gain  $(p_1p_2ca + p_0p_2cb)$  and consumers gain  $(p_1p_0ba)$  (Table 1).<sup>4</sup> There is a net societal gain of  $(abc)$ . The net producer gain is  $(p_0p_2cb)$ , where  $(p_0p_2cb) > (p_1p_0da - dcb)$ .

The net B/C ratios in Table 1 for the U.S. buyout of the longstanding peanut program are calculated within the framework of Figure 3 (illustrated only for  $e_s = 1.3$  and  $e_d = -0.58$ ). The values in Table 1 are based on the 2001 quota poundage of 2.4 billion. During 1999-2001, total peanut production averaged 3.79 billion pounds annually, roughly 37 percent greater than the 2001 quota level. The quota value used in the analysis was \$0.11 per pound. The calculations are for a given supply elasticity ( $e_s$ ) of 1.3 and two different demand elasticities ( $e_d$ ) of  $-0.58$  and  $-1.19$ . The B/C ratio for an  $e_d$  of  $-0.58$  equals  $(p_0p_2cb) + (p_1p_0ba) / (p_1p_2ca) = 1.1$ . The B/C ratio under an  $e_d$  of  $-1.19$  is 1.2. Therefore the B/C ratio results do not depend critically on the chosen demand elasticities.

<sup>2</sup> Our calculations are for year 2001 only, recognizing that to arrive at the \$1.3 billion government buyout, the government had to use a present value calculation derived from the \$264 million quota value. This figure is an annual quota value. At a discount rate of eight percent applied over a seven-year period, the government buyout cost roughly \$1.3 billion. While one could carry out a present value analysis for the producer payout and the consumer gains from removal of the peanut quota, the B/C ratios would be unaffected if the same interest rate were applied to all sectors.

<sup>3</sup> The estimated peanut demand price elasticity is  $-0.62$  (Bergtold, Akobundu, and Peterson 2004). We estimate the long-run supply price elasticity for U.S. peanuts to be roughly 2.0 given our empirical estimate of the short-run price elasticity of 0.72 (Haynes and Schmitz 2010).

<sup>4</sup> In our empirical work on peanuts, after the production buyout, peanut production increased by roughly 20 percent between 2001 and 2008.

Table 1. Value of Quota Approach (Government Quota Buyout):  $e_s = 1.3$

| Components                        | Area   | Total                  |               |
|-----------------------------------|--|------------------------|---------------|
|                                   |  | $e_d = -0.58$          | $e_d = -1.19$ |
|                                   |  | (U.S. million dollars) |               |
| Government Cost                   | $(p_1 p_2 ca)$                                   | \$264                  | \$264         |
| Net Producer Gain (Quota Removal) | $(p_0 p_2 cb)$                                   | \$53                   | \$111         |
| Net Consumer Gain                 | $(p_1 p_0 ba)$                                   | \$236                  | \$194         |
| Net Benefit (DWL)                 | $(abc)$  | \$25                   | \$41          |
| B/C Ratio                         | $\frac{(p_0 p_2 cb) + (p_1 p_0 ba)}{p_1 p_2 ca}$ | 1.1                    | 1.2           |

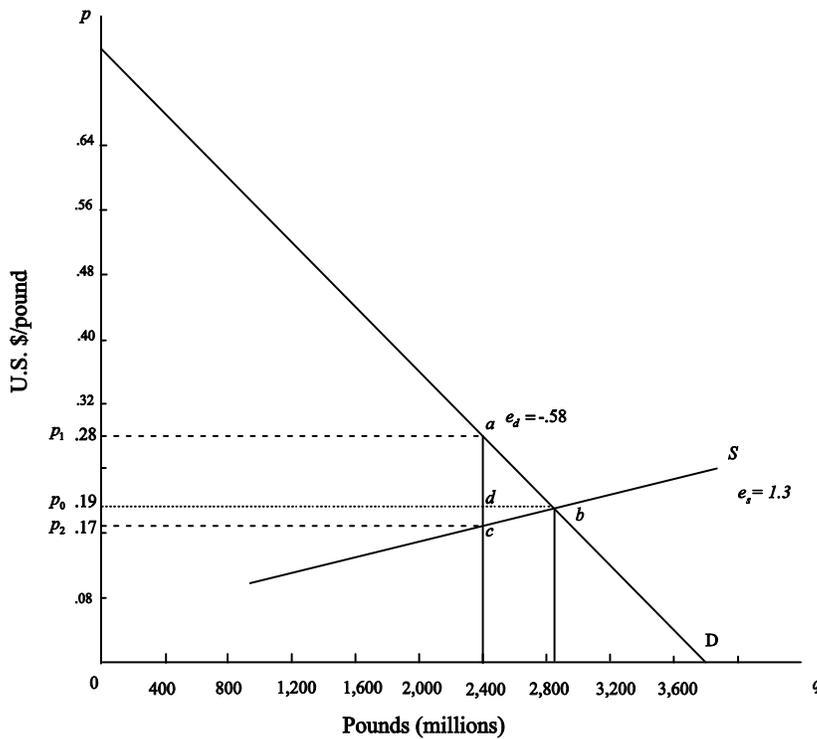


Figure 3. Termination of the U.S. Peanut Program ( $e_d = -0.58$ ,  $e_s = 1.3$ )

However, the net producer gains from the quota buyout are roughly double those under an  $e_d$  of  $-1.19$  as opposed to one of  $-0.58$ . Correspondingly, the consumer gains are smaller. The DWL is greater under the higher demand elasticity, as one might expect in view of the earlier discussion. The B/C ratio is

slightly greater under a more elastic demand curve since in the presence of the quota, the welfare costs are larger.

Table 2 gives results for the *value of quota* approach when  $e_s = 2.9$  versus  $e_s = 1.3$ . The net producer gains from the quota buyout are roughly one-half of what they are under an  $e_s = 1.3$ . The net consumer gains are larger, but the DWL remains roughly the same, as do the B/C ratios.

Table 2. Value of Quota Approach (Government Buyout):  $e_s = 2.9$

| Components                        | Area   | Total                  |               |
|-----------------------------------|--|------------------------|---------------|
|                                   |  | $e_d = -0.58$          | $e_d = -1.19$ |
|                                   |  | (U.S. million dollars) |               |
| Government Cost                   | $(p_1 p_2 ca)$                                   | \$264                  | \$264         |
| Net Producer Gain (Quota Removal) | $(p_0 p_2 cb)$                                   | \$27                   | \$57          |
| Net Consumer Gain                 | $(p_1 p_0 ba)$                                   | \$265                  | \$257         |
| Net Benefit (DWL)                 | $(abc)$  | \$28                   | \$50          |
| B/C Ratio                         | $\frac{(p_0 p_2 cb) + (p_1 p_0 ba)}{p_1 p_2 ca}$ | 1.1                    | 1.2           |

### **Results: Gains from the Quota Buyout**

In this section, we provide empirical results of the effect of removing the Peanut Production Quota along the lines of the *gains from quota* buyout. Under this scenario, the government pays the producers the amount  $(p_1 p_0 da - dcb)$ , consumers still gain  $(p_1 p_0 ba)$ , while the net gain to producers is zero since  $[(p_1 p_0 da - dcb) + (-p_1 p_0 da + dcb)] = 0$ . The net welfare gain is  $(abc)$ , which is identical to the *value of quota* approach.

The *gains from quota* results are given in Table 3 (illustrated in Figure 4 for  $e_d = -0.58$  and  $e_s = 2.9$ ). Under different demand elasticities, the B/C ratio,  $\frac{(p_1 p_0 da - dcb) + (-p_1 p_0 da + dcb) + p_1 p_0 ba}{(p_1 p_0 da - dcb)}$ , lies between 1.1 and 1.3, so the B/C ratios do not significantly depend on the chosen elasticities. In terms of Table 3, consumers are by far the largest gainers.

Table 3. Gains from Quota Approach (Government Buyout):  $e_s = 1.3$

| Components        | Area                                       | Total                  |               |
|-------------------|--|------------------------|---------------|
|                   |  | $e_d = -0.58$          | $e_d = -1.19$ |
|                   |  | (U.S. million dollars) |               |
| Government Cost   | $(p_1 p_0 da - dcb)$                       | \$212                  | \$153         |
| Net Producer Gain | $(p_1 p_0 da - dcb) + (-p_1 p_0 da + dcb)$ | \$0                    | \$0           |
| Net Consumer Gain | $(p_1 p_0 ba)$                             | \$236                  | \$194         |
| Net Benefit (DWL) | $(abc)$                                    | \$25                   | \$41          |
| B/C Ratio*        | $\frac{p_1 p_0 ba}{p_1 p_0 da - dcb}$      | 1.1                    | 1.3           |

\* The complete expression is  $\frac{(p_1 p_0 da - dcb) + (-p_1 p_0 da + dcb) + p_1 p_0 ba}{p_1 p_0 da - dcb}$

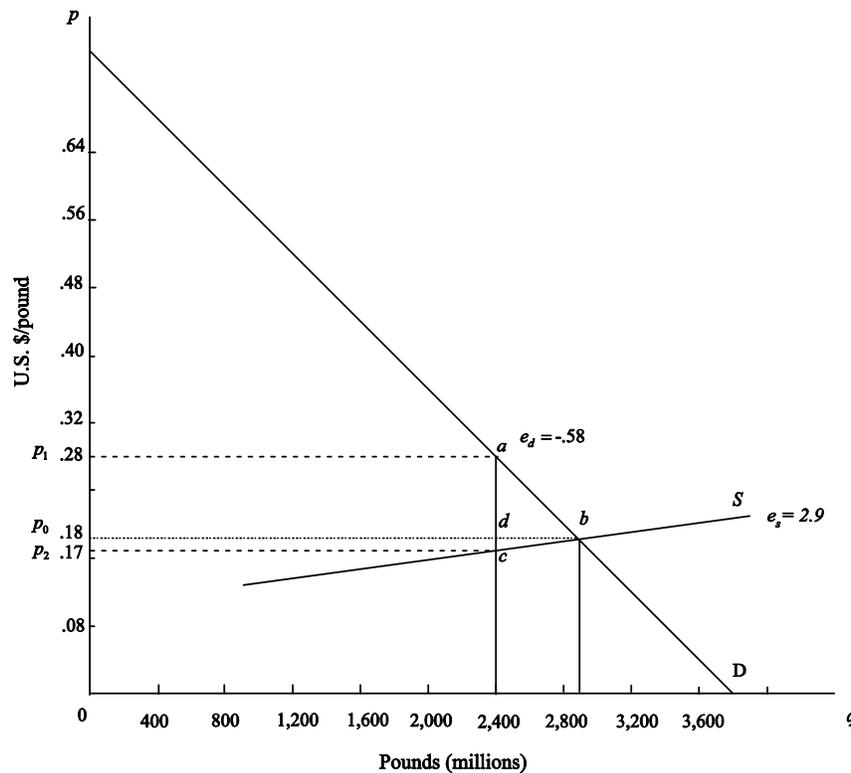


Figure 4. Termination of the U.S. Peanut Program ( $e_d = -0.58$ ,  $e_s = 2.9$ )

Unlike the *value of quota* approach, there are no producer gains from the *gains from quota* buyout approach. Also, the government cost is less than under the *value of quota* approach. The net consumer gain is unaffected.

The results in Table 4 are based on different demand elasticities and an  $e_s = 2.9$ . The net consumer gains and government costs from the buyout increase significantly when the supply elasticity is higher.

Table 4. Gains from Quota Approach (Government Buyout):  $e_s = 2.9$

| Components        | Area                                       | Total                  |               |
|-------------------|--|------------------------|---------------|
|                   |  | $e_d = -0.58$          | $e_d = -1.19$ |
|                   |  | (U.S. million dollars) |               |
| Government Cost   | $(p_1 p_0 da - dcb)$                       | \$238                  | \$207         |
| Net Producer Gain | $(p_1 p_0 da - dcb) + (-p_1 p_0 da + dcb)$ | \$0                    | \$0           |
| Net Consumer Gain | $(p_1 p_0 ba)$                             | \$236                  | \$194         |
| Net Benefit (DWL) | $(abc)$                                    | \$25                   | \$41          |
| B/C Ratio*        | $\frac{p_1 p_0 ba}{p_1 p_0 da - dcb}$      | 1.1                    | 1.3           |

\* The complete expression is  $\frac{(p_1 p_0 da - dcb) + (-p_1 p_0 da + dcb) + p_1 p_0 ba}{p_1 p_0 da - dcb}$

The benefit-cost ratios for quota buyouts do not change under a different supply specification. However, with the *value of the quota* approach, the net producer gains are smaller under a more elastic supply curve case, but the consumer gains are larger.

### Comparisons: Quota Buyout Alternatives

Under an  $e_s = 1.3$  and an  $e_d = -0.58$ , the government cost for the *value of the quota* approach is significantly greater than under the *gains from quota* approach. The net producer gains from removing the quota are greater under the *value of the quota* approach, while the net consumer gain is identical, as is the DWL. In this case, the B/C ratios are also identical. For an  $e_s = 1.3$  and an  $e_d = -1.19$ , the government cost under the *gains from quota* approach is roughly 60 percent of

that under the *value of the quota* approach. The value of the net producer gain increases from \$53 million to \$111 million, and the net consumer gain is unaffected. The B/C ratio is slightly higher in this case.

Given an  $e_s = 2.9$  and an  $e_d = -0.58$ , the government costs are higher under the *value of the quota* approach, as are the net producer gains. The net consumer gains are the same, as are the DWL amounts. For an  $e_s = 2.9$  and an  $e_d = -1.19$ , the government cost under the *value of the quota* approach is roughly \$55 million greater, and the net producer gain is \$57 million greater. The net consumer gain is identical, as is the DWL amount.

### Monopoly Considerations

It is often alleged that producers lobby for production quotas that allow them to behave as a pure monopolist. As we show, the production quota for peanuts allowed for production that far exceeded the monopoly quota amount. The results for a monopoly quota are given in Table 5 and these also correspond to Figure 5 (the demand elasticity for the monopoly solution is  $-1.5$ ). We show only the results for a monopoly quota buyout based on the *value of the quota* approach. Under the monopoly solution, the production quota is roughly 1.5 billion tons, rather than 2.4 billion tons. The government cost for the buyout under the monopoly is \$465 million, and the net producer gain varies between \$66 million and \$131 million. Also, the B/C ratio increases to 1.5 from the quota buyout. This is in sharp contrast to the effect of removing the peanut quota that was actually in place. For the latter, the government cost was \$264 million, and the net producer gain varied between \$53 million and \$111 million (Table 2). Equally as important, the efficiency gain from removing the quota under a monopoly is much greater than for the quota that actually existed.

Table 5. Value of Quota Approach (Government Buyout):  $e_d = -1.5$

| Components                        | Area   | Total       |             |
|-----------------------------------|--|-------------|-------------|
|                                   |  | $e_s = 2.9$ | $e_s = 1.3$ |
| (U.S. million dollars)            |  |             |             |
| Government Cost                   | $(p_1 p_2 ca)$                                   | \$465       | \$465       |
| Net Producer Gain (Quota Removal) | $(p_0 p_2 cb)$                                   | \$66        | \$131       |
| Net Consumer Gain                 | $(p_1 p_0 ba)$                                   | \$616       | \$544       |
| Net Benefit (DWL)                 | $(abc)$  | \$217       | \$209       |
| B/C Ratio                         | $\frac{(p_0 p_2 cb) + (p_1 p_0 ba)}{p_1 p_2 ca}$ | 1.5         | 1.5         |

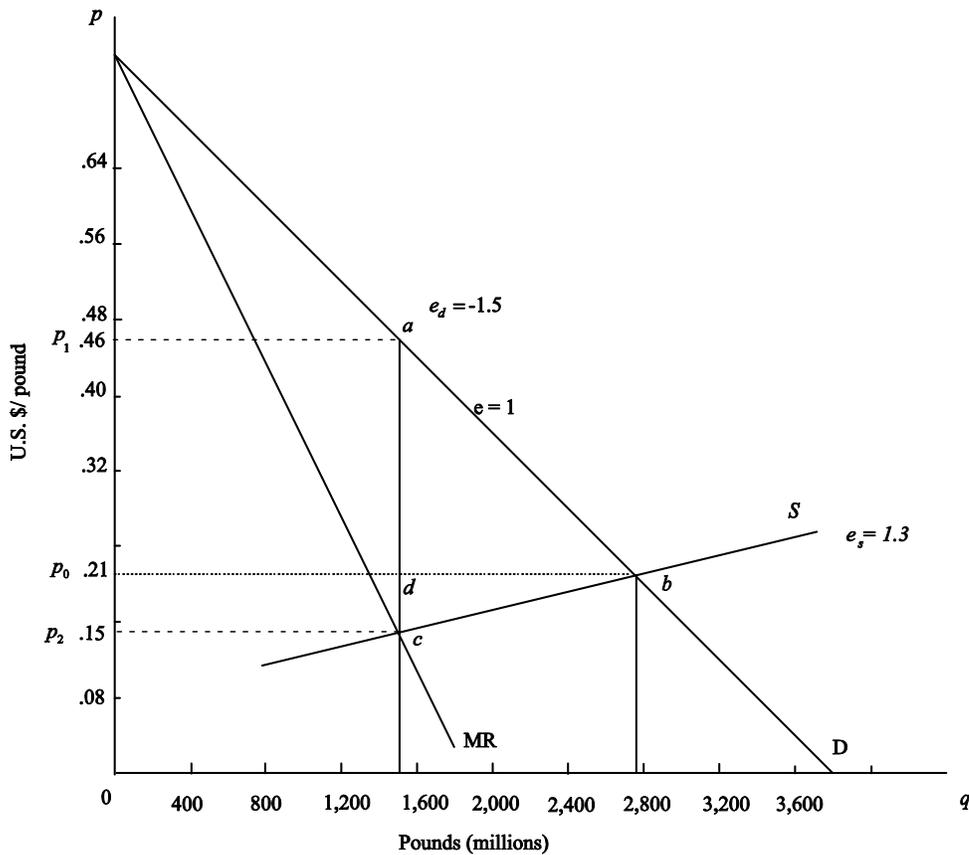


Figure 5. Benefit Cost Analysis and Monopolistic Considerations

### Concluding Comments

We have shown how the size of the gains accruing to producers and consumers from a quota buyout using government funds depends in part on the design of the compensation package. The U.S. government buyout of the Peanut Production Quota Program was based on the *value of the quota* approach. In this case, both producers and consumers gained at the expense of taxpayers. Consumers gained much more than producers, and therefore supported the peanut quota buyout of 2002. The buyout also led to significant net welfare gains with an associated positive B/C ratio. However, a different approach to the buyout could have been used that would have yielded at least as high a B/C ratio. Government costs and producer gains would have been less, but consumer gains would have been unaffected.

From a policy perspective, politicians introduce policies that maximize their chances for re-election, consistent with the theory of public choice.

Generally, politicians favor farm programs that make producers better off. This was also the case for the peanut quota buyout since the government based the quota buyout on the basis of the *value of the quota* approach where producers gain from the buyout. (It is not surprising that producers would lobby for a buyout in which they would gain; these results are consistent with the findings of the papers on B/C analyses surveyed by Schmitz and Zerbe (2008).) Even so, this resulted in a B/C ratio greater than one. In the buyout, politicians had considerable flexibility in the method of payout, since either approach to compensation yielded a B/C ratio greater than one. But, again, the income distributional effects and not the B/C ratios depend on the type and form of compensation paid producers.

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