PRODUCTION QUOTA BUYOUTS: A THEORETICAL AND EMPIRICAL EXAMINATION

By

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To my parents, my wife, and my daughter

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This dissertation is a combination of three research papers. The first provides an overview of both the United States (US) tobacco production quota program and the US tobacco production quota buyout. Results show that as the spread between the true quota value and the inflated quota value increases, so does the net return to producers from removing the quota. Producers gain $53 million a year given a $0.30/lb. quota value buyout versus $202 million a year under a $1.00/lb. quota value buyout. Conversely, the buyout adversely affected consumers because a tobacco consumption tax was used to fund producer compensation. Given a $1.00/lb. quota value buyout, consumers lose $293 million a year; however, they realize gains $390 million when the buyout ends.

The second paper contains a theoretical and empirical comparison of the US Tobacco Quota Buyout and the US Peanut Quota Buyout. While the former was paid for by a consumer tax, the latter was based on compensation from the US Treasury. Under a consumer tax buyout (CTB), producers may lose or gain, depending on the length of the compensation period; consumers lose as they are the source of funding for the buyout, and society loses in the short run as there is a sustained deadweight loss from the buyout. Under a treasury buyout (TB), producers gain, consumers are not taxed to fund the buyout, and society does not face efficiency losses due to the buyout. For these reasons, producers, consumers, and society favor a TB over a CTB.

The third paper analyzes and compares the impact of the US Tobacco Quota Buyout within both a partial and a general-equilibrium framework. In a partial-equilibrium framework (as presented in the first paper) a tobacco quota buyout results in producer gains, consumer losses, and net losses because of higher prices and deadweight losses. Within a general-equilibrium framework, the tobacco quota buyout results in a decrease of society's smoking-related healthcare costs due to the decrease in demand for tobacco. It also leads to an increase in worker productivity as employees reduce the amount of smoking-related sick days taken.

CHAPTER 1
INTRODUCTION

The First Paper

This dissertation is a combination of three research papers. The first provides an overview of the US tobacco production quota program as well as the tobacco production quota buyout. Through the use of tobacco production quotas, the 1938 US Tobacco Program enhanced and stabilized tobacco prices. Due to many factors, including public health concerns, the program was terminated in 2004 and producers were compensated, though it was not legally required, with monies from a consumer tobacco tax. This research determines how producers, consumers, and society were affected by the buyout within a welfare economics framework.

The Second Paper

The second paper offers a theoretical and empirical comparison of two historic production quota buyouts: the 2002 US Peanut Quota Buyout and the 2004 US Tobacco Quota Buyout. The US Peanut Quota Buyout was based on compensation from the Treasury while the US Tobacco Buyout was paid for by a consumer tax. Given these two buyouts, an important question arises: How does the method of compensation affect distribution and efficiency? A treasury buyout (TB) is favored over a consumer tax buyout (CTB) for several reasons. Under a TB, producers are compensated considerably more, consumers are not burdened with the charge of funding the buyout, and society does not face additional efficiency losses due to the buyout.

The Third Paper

The third paper analyzes the impact of removing the US tobacco program in both a partial and general welfare economics framework. In a partial-equilibrium framework, a consumer tax-funded quota buyout can result in producer gains, consumer losses, and net losses because of higher prices and deadweight losses. In a general-equilibrium framework, society can

gain from the tobacco buyout due to potential savings from a reduction of healthcare costs, which are attributable to a decrease in smoking. Additionally, we present a model addressing the addictive qualities of tobacco, and at the same time, we consider the effects of the quota buyout. Also, we conclude that a possible effect of the buyout is an increase in worker productivity, when employees who are able to quit smoking reduce the amount of smoking-related sick days they accumulate.

CHAPTER 2
TOBACCO PRODUCTION QUOTA BUYOUTS—INFLATED QUOTA VALUES*

Background

The United States (US) Tobacco Program was instituted in 1938 to improve the income of tobacco producers. Its main feature was the use of production quotas, in which tobacco production was restricted below competitive levels. This benefited tobacco producers and landowners (collectively quota holders/owners) by artificially raising the price of tobacco (Schmitz, Furtan, and Baylis, 2002). Over time, public health organizations such as the American Cancer Society pressured the government to not support the tobacco industry. As a result, the US government terminated the program in 2004 and compensated tobacco quota holders when they placed a consumer tobacco tax on the purchase of tobacco products for the next 10 years (Womach, 2005).

The termination of the federal tobacco program was a controversial effort that began in 1997 (Brown, Rucker, and Thurman, 2007) and culminated in the "The Fair and Equitable Tobacco Reform Act" that was signed into law by President George W. Bush on October 22, 2004. The 2004 Act provided compensation to quota owners and effectively deregulated US tobacco production and prices (Dohlman, Foreman, and Da Pra, 2009a). E.C. Pasour, Jr. (2005) asked the question: Did the Buyout make sense—legally, economically, or ethically? No. He argued that "…the fact that tobacco-marketing quotas had economic values does not indicate that their owners had a legally protected property right in them. If tobacco quota owners had no legally protected property rights, there is no economic or legal basis for a buyout."

Generally, legislators from the tobacco states supported the termination of the tobacco program only if the tobacco quota owners were to be compensated. After much debate, the final

* Parts of this chapter are included in a working paper by Schmitz, Haynes, and Schmitz (2013).

legislation provided all quota owners $7 per pound on the 2002 basic quota; the producers were compensated an additional $3 per pound on the 2002 effective quota. These compensation payments were outlined to be paid for by a tobacco consumption tax placed on the buyers of tobacco products, to be made in 10 equal annual installments of $0.70/lb. and $0.30/lb. (Womach, 2005).

This chapter provides a theoretical and empirical analysis of the historic 2004 US Tobacco Quota Buyout. While a considerable amount of literature exists on the impact of instituting production quotas, little is known about the effect of removing them, especially when the revenue from a consumer tax is used to pay for the compensation.[1] The result of a quota buyout, in part, depends on the magnitude of the compensation to quota owners. We estimate (1) the compensation package to producers from the buyout, (2) the domestic and foreign consumer losses, and (3) the net societal losses.

In the 2004 US Tobacco Buyout, the money paid to quota owners (i.e., producers and landowners who rented land to producers) was generated from a tobacco consumption tax. The net gain from the buyout to these quota owners was far less than was the tax revenue. In addition, the producer net gain depended on several factors, including the quota value used as the basis for the buyout.

In this chapter we develop a compensation model based on a consumer tax, which is different from a TB (Schmitz, Schmitz, and Haynes, 2012). Under the latter, producers can still gain from a quota buyout even if they are compensated the true value of the production quota (Schmitz and Schmitz, 2010). We present results under various quota values and show why it was in the best interest of quota owners to have an inflated quota value used for the buyout that

[1] Kirwan, Uchida, and White (2012) examine the distortionary effects of the tobacco buyout on Kentucky, specifically focusing on farm productivity and reallocation.

exceeded the true economic quota value. Theoretically, it was in the best interest of quota owners to inflate quota values prior to the buyout because there would be nothing to gain from a CTB if it were based solely on the true quota value. From a political economy/rent-seeking perspective, the active lobbying on behalf of the tobacco quota owners had a high economic payoff to these groups (Schmitz, Moss and Schmitz, 2010).

Theoretical Framework

Johnson (1965) estimated the social cost of quotas as applied to Flue-cured tobacco. He argued that because the United States had a substantial degree of monopoly power in the international market for Flue-cured tobacco in the 1950s, the US Tobacco Program generated net societal welfare gains. In this paper, we extend the analysis to include Burley tobacco and consider the possibility of rent-seeking behavior by tobacco producers.

Quota Implementation

Consider Figure 2-1 where S is the supply schedule, D_t is total demand, and D_d is domestic demand. The competitive price and output are p_0 and q_0, respectively, and exports total to $(q_0 - q_2)$. Now consider the effect of a production quota q_1 being implemented using the basic theorems of welfare economics (Just, Hueth, and Schmitz, 2004). The price rises to p_1 and producers gain $\left[(p_1 p_0 da) - (dcb)\right]$. Quota owners now receive the true value of the quota $(p_1 p_2 ca)$ from the market while consumers lose $(p_1 p_0 ba)$.[2] Domestic consumers, however, lose only $(p_1 p_0 ir)$ while consumers in the importing country lose $(riba)$. There is a net positive

[2] Throughout this paper, the term "value of the quota" will refer to the actual dollar amount of the quota (e.g., the value of the quota, area $p_1 p_2 ca$ is \$280 million). Any terms including "quota value" (e.g., *inflated quota value* or *true quota value*) will refer to a per-unit value (e.g., \$0.70/lb. or \$0.50/lb.). The "value of the quota" depends on the "quota value"—consider the following example:
$\$2.00/lb$ (*quota value*) * 100 lb of tobacco (quota) = \$200 (value of the quota).

welfare gain to the country imposing the production quota (i.e., the exporting country) of $\left\{\left[\left(p_1p_0da\right)-\left(dcb\right)\right]-\left(p_1p_0ir\right)\right\}=\left[\left(rida\right)-\left(dcb\right)\right]$. The net welfare cost of the quota for both the exporting and importing countries (i.e., the deadweight loss) taken together is $\left(acb\right)$.

Quota Removal

As we show, if the buyout exactly equaled the true value of the quota via a tobacco tax, quota owners would have neither reason nor incentive to support the buyout. This is because their net gain would have been zero over the time period when the tax would have been in place to pay for the buyout. After that period, the net gain to producers would have fallen because prices would no longer have been supported. The net effect of the buyout on quota owners and consumers from a consumption tax would have been zero until the competitive equilibrium was restored. As discussed in the next chapter, the consumer tax model discussed here is very different from the standard model of production quota buyouts in which compensation is paid for by the US Treasury. In the TB, the quota owners would still be able to gain if they were to be compensated by an amount equal to the true value of the quota (Schmitz and Schmitz, 2010, 2011).

What happens when the dollar amount of compensation exceeds the true value of the quota? The net producer gain from the buyout depends on the perceived value of the quota on which compensation is based relative to the true value of the quota. Therefore, from a rent-seeking perspective, it was in the interest of quota owners to lobby for an *inflated quota value* that was larger than the *true quota value*. We now present two cases where the *inflated quota value* is used as the basis for the quota buyout.

Case 1: Consider Figure 2-1 where a *true value of the quota* of $\left(p_1p_2ca\right)$ and an *inflated value of the quota* used for the buyout $\left(lmno\right)$ are depicted. The buyout causes the consumer

price to rise to l while the producer price falls to m. Under the inflated quota case, domestic consumers lose (lp_1rf) and foreign consumers lose $(frao)$—the sum of which is (lp_1ao). Producers gain an amount $\left[(lp_1jo)-(jnca)\right]$.

Case 2: Instead, consider the same *true value of quota* (p_1p_2ca) relative to the even more *inflated value of the quota* used for the buyout (p_4p_5sv). The buyout causes the consumer price to rise to p_4 while the producer price falls to p_5. Under this case, domestic consumers lose (p_4p_1rt) and foreign consumers lose $(trav)$—the sum of which is (p_4p_1av). The net producer gain is $\left[(p_4p_1xv)-(xsca)\right]$. Clearly, the net producer gain from the quota buyout increases as the spread between the *true quota value* and the *inflated quota value* increases. Therefore, it is in the interest of quota owners to lobby the government for a buyout based on the *inflated quota valu*e rather than a buyout based on the *true quota value*. To increase the size of the buyout, quota owners will attempt to manipulate quota rental rates so that the quota value presented and argued for in the buyout will be above the *true quota value*. As discussed in more detail later, this is what appeared to have happened in the 2004 US Tobacco Quota Buyout.

In the above framework, what happens when the inflated quota is removed and competitive equilibrium is restored at q_0? In the theoretical model (Figure 2-1 and Case 2), the negative producer gain from removing the quota is $\left[-(p_4p_0yv)+(ysb)\right]$. Domestic consumers gain (p_4p_0it) and foreign consumers gain $(tibv)$. This totals (p_4p_0bv) which is a net positive

gain to society.[3] As a result, if quota owners are paid only the true value of the quota, they are worse off than they would have been before the buyout.

Productivity, Efficiency, and Shifting Supply

The termination of the US Tobacco Program had several implications on many facets of the tobacco industry—more specifically on farm numbers, size, allocation, productivity, structure and efficiency. Kirwan, Uchida, and White (2012) found that in Kentucky alone, there were huge impacts on farm size from the buyout. They report that the number of tobacco farms plummeted almost 75% from 2002 to 2007. However, according to their study, the average tobacco farm size more than doubled during the same period. Overall, entrants into the tobacco market, post-buyout, were significantly larger, more productive, and harvested more than double the tobacco of their pre-buyout counterparts (Kirwan, Uchida, and White, 2012). Even though this research focused mostly on pre and post-buyout Kentucky tobacco farms, the findings can be extrapolated easily to the rest of the United States when considering the impact of the tobacco buyout.

We consider several reasons (including the above, i.e., larger, more productive farms) as to why a tobacco production quota buyout could cause a supply shift. Take, for example, these three key factors: (1) efficient producers stay in the market, (2) inefficient producers exit the market, and (3) new efficient producers enter the market. Figure 2-1 depicts the shift to S' after the buyout. Output increases from q_2 to q_1 initially, as a result, producers gain $(p_6 p_7 zuhn)$.[4] When equilibrium is restored after the 10-year buyout period $(\text{point } k)$, the price lowers to p_2 and there is a higher output level q_4. Producers now gain $(mp_2 kp_7 p_6 n)$ plus the original gains

[3] This is purely an economic gain as consumers benefit from the reduction in the price of a good. This reduction translates to an increase in the consumption of tobacco which inherently increases healthcare costs to society. We discuss the health impacts and negative externalities associated with the buyout in Chapter 4.

[4] Assuming Case 1 from above.

from removing the quota of $\left[\left(lp_1 jo\right)-\left(jnca\right)\right]$ minus $\left(lp_1 rf\right)$ from domestic efficiency loss minus $\left(lp_2 * o\right)$ for the loss of the quota. The shift acts effectively as an increase in the quota value which results in a larger net producer gain, and a US net efficiency gain from removing the quota.

Methodology and Empirical Analysis[5]

Data

Even though the two major kinds of tobacco grown in the United States, Flue-cured and Burley, account for over 90% of US production, payments under the tobacco buyout for quota owners were the same (Serletis and Fetzer, 2008). Thus, we aggregate the production of these two types of tobacco and use average prices and quantities for the 1999 to 2003 period (ERS/USDA, 2005) of $1.88/lb. and 839.4 million pounds, respectively.[6]

Most studies estimate the price elasticities of demand for tobacco to be between –0.3 and –0.5 (Sloan, Smith, and Taylor 2003; Chan and Capehart, 2004). Brown, Snell, and Tiller (1999) estimate the total price elasticity of demand for US Burley and Flue-cured tobacco to be –0.53 and –1.75, respectively. Serletis and Fetzer (2008) estimate demand elasticities for Flue-cured ranging from -0.72 to -1.24 and demand elasticities for Burley ranging from -0.03 to -0.11. Weimer, Vining, and Thomas (2009) provide price elasticities of between –0.09 and –0.34. Goodwin and Sumner (1990) estimate the aggregate supply elasticity under the tobacco program to be around 4.0 while Fulginiti and Perrin (1993) estimate the supply price elasticity to be 7.0. In the absence of the tobacco program, the aggregate long-run supply elasticity is assumed to be

[5] We determine the distributional effect between producers and landowners who leased land to these producers in a later section but, briefly, producers gained more from the buyout relative to those landowners who were not producers.

[6] Roughly 46% of this US tobacco production was exported between 1999 and 2003 (ERS/USDA, 2005). This production value accounts for the change in stock size over the five-year period.

perfectly elastic (Brown, Snell, and Tiller, 1999). In view of the wide range of price elasticities, we present results under varying demand and supply elasticities (Appendix A).

Introduction of the Tobacco Quota

As the base of our analysis, we calculate the yearly effect of the tobacco quota based on average production and price data for the five years prior to the buyout (1999–2003).[7] Consider Figure 2-2 where we depict the implementation of the tobacco quota.[8] Given a total demand elasticity (E_{DT}) of −1.1, a domestic demand elasticity (E_{DD}) of −0.9, and a supply elasticity (E_S) of 0.5, the net producer gain and the value of the quota are roughly $88 million and $252 million, respectively (Table 2-1).[9] The total consumer loss is $95 million of which domestic consumers lose $49 million and foreign consumers lose $46 million. The net welfare gain to the exporting country is $38 million while the net welfare cost (i.e., the dead weight loss) to both countries of implementing the quota is $8 million. These results highlight the distinction between net producer gains and the value of the quota. The value of the quota is roughly three times the net producer gain.

How do varying supply and demand elasticities change the results? A more elastic supply curve widens the gap between p_1 and p_0, effectively increasing the net producer gain. For example, under an E_S of 1.4, *ceteris paribus*, the net producer gain increases from $87.5 million to $145.7 million (Table 2-1). This more elastic supply curve increases net consumer loss to

[7] The million dollar amounts presented in the text and tables are yearly estimates unless otherwise stated.

[8] In our model, we construct supply and demand curves assuming a $0.30/lb. *true quota value*.

[9] The results likely underestimate the net effect of removing the tobacco quota for three reasons: (1) the supply curves we use are relatively inelastic, compared with the above-mentioned studies (Goodwin and Sumner, 1990; Fulginiti and Perrin, 1993), because the more elastic the supply curve, the greater the net producer gain and vice versa, (2) we use a quota level of 839.4 million pounds in our model which is less than the 2002 basic quota level of 959 million pounds, and (3) we do not account for the net cost of quota nontransferability across states. In their seminal paper, Rucker, Thurman, and Sumner (1995) estimate this to be around $21 million.

$159 million, with domestic and foreign consumers losing roughly $81 million and $79 million, respectively. The net welfare gain to the exporting country rises to $65 million. On the other hand, using a more elastic demand curve has the opposite effect. For example, for an elasticity of −1.5 for both E_{DT} and E_{DD}, the net producer gain falls from $87.5 million to $61.5 million.

Removal of Tobacco Quota

It is important to note that under a tobacco quota buyout where quota holders are not compensated, the economic impact would be the negative of the results in Table 2-1. Clearly in this case, the buyout is simply the reversal of the quota implementation.

As shown theoretically, if producers are compensated only the value of the quota in the buyout, their net welfare would remain unchanged. Therefore the incentive for accepting the compensation package depends on the size of the payment that exceeds the true value of the quota ($251.8 million, Table 2-1). What are the effects of the quota buyout under an *inflated quota value*? [10] Figures 2-3, 2-4, and 2-5 depict the cases where the *inflated quota value* is $0.50/lb., $ 0.70/lb., and $1.00/lb., respectively. The economic impact for these inflated quota levels is presented in Table 2-2. When the *inflated quota value* is $0.50/lb. $(E_{DT} = -1.1,$ $E_{DD} = -0.8,\ E_S = 0.6)$, relative to the *true quota value* of $0.30/lb., the net producer gain is $53 million, the net consumer loss is $73 million (domestic and foreign consumers lose $39 million and $34 million, respectively). The net producer gain from an *inflated quota value* of $0.70/lb. $(E_{DT} = -1.0,\ E_{DD} = -0.8,\ E_S = 0.7)$ is $100 million, the net consumer loss is $143 million (domestic and foreign consumers lose $77 million and $66 million, respectively). For an *inflated quota value* of $1.00/lb. $(E_{DT} = -1.1,\ E_{DD} = -0.7,\ E_S = 0.7)$, the net producer gain increases to

[10] This was done by calculating key economic components (e.g., net producer gain, net consumer loss, and net efficiency loss) for the varying inflated quota values from $0.50/lb., $0.70/lb., and $1.00/lb. (all while keeping the true quota value constant at $0.30/lb.).

$202 million, the total net consumer loss increases to $292 million (domestic and foreign consumers lose $162 million and $130 million, respectively), and the net efficiency loss increases.

The effect of varying the supply and demand elasticities is also given in Table 2-3.[11] The more elastic the supply curve, the greater are the net producer gain and the net consumer loss. Regarding a $1.00/lb. buyout, for an E_S of 1.0 as opposed to 0.7, the net producer gain increases from $202 million to $229 million. The net consumer loss increases from $229 million to $322 million. Conversely, a more elastic demand curve has the opposite effect. For an elasticity of −1.6 for both E_{DT} and E_{DD}, the net producer gain is only $131 million while the consumer loss falls to $279 million.

The relationship between quota values and net producer gain is depicted in Figure 2-6. For a buyout quota value of $0.30/lb., there is no net producer gain as this was the same as the original quota. For a $0.50/lb., $0.70/lb., and a $1.00/lb. buyout quota value, the net producer gains are $53.1, $99.5, and $201.9 million, respectively. As the *inflated quota value* increases, so does the net producer gain. Thus from a rent-seeking position, producers will try to gain the highest buyout amount by inflating the quota values. Given a *true quota value* of $0.30/lb. as opposed to an inflated quota value of $1.00/lb., the net producer gain from quota value escalation is roughly $200 million a year. This was the net gain from the buyout given that producers had already received economic benefits from a $0.30/lb. quota.

Adjustments in the True Quota Value

We consider the possibility of a higher *true quota value* and its impact on producers. For a higher *true quota value of* $0.50/lb., as opposed to $0.30/lb., the net producer gain from

[11] These figures are available upon request.

introducing the quota is $201.3 million as opposed to $87.5 million. Correspondingly, the net gain to producers from removing the $0.50/lb. quota fell from $201.9 million to $157.1 million. Keep in mind that the total net gain to producers from both implementing and eliminating the quota is $299.2 million. For the $0.50/lb. quota, the net producer gain from the buyout was roughly 80% of the net producer gain from implementing the quota. Given the $1.00/lb. buyout, the net payout to producers from both implementing and eliminating the quota does not greatly depend on the *true quota value* (Table 2-4). However, as shown earlier, the net gain from removing the quota is heavily dependent on the *true quota value* relative to the *inflated quota value*.

The Buyout after Ten Years

After the 10 years of compensation when the buyout is over, competitive equilibrium will be restored. The competitive price and quantity are p_0 and q_0, respectively (Figures 2-3, 2-4, and 2-5). Quota owners lose the tax area $(lmno)$ and gain the much smaller area (p_0mnb). This results in a net producer loss of $\left[-(lp_0go)+(gnb)\right]$ and a consumer gain of (lp_0bo). Table 2-5 includes these eleventh year producer impacts.[12] For the *inflated quota values* of $0.50/lb., $0.70/lb., and $1.00/lb., the producer gains are −$142 million, −$190 million, and −$295 million, respectively. These values should be taken into account when calculating the net producer gains from the quota buyout. Otherwise, the net producer gains over the 10-year period of the buyout are likely overstated.

The net consumer gain is $168 million for an *inflated quota value* of $0.50/lb. (domestic consumers gain $87 million and foreign consumer gain $81 million). For an *inflated quota value*

[12] Throughout this paper, the term "eleventh year" period refers to the time period when competitive equilibrium is restored. The eleventh year calculations above are per-year estimates which are factored into the present value calculations of a later section.

of $0.70/lb., domestic consumers gain $125 million and foreign consumers gain $113 million. For an *inflated quota value* of $1.00/lb., the domestic consumers gain $219 million and the foreign consumers gain $171 million.

The efficiency gains from removing the quota are also provided in Table 2-5. The US net efficiency gain for a $1.00/lb. quota value is $27.5 million. The aggregate efficiency gain from removing the quota was $95 million for the same quota value.

Productivity Gains from Shifting Supply

The above results are predicated on the assumption that the removal of quota does not impact production efficiency. As Kirwan, Uchida, and White (2012) report, the opposite is true.[13] For this reason, our previous results likely underestimate both the producer gains from quota removal and the efficiency gains. Consider Figure 2-5 under the case where supply shifts.[14] If we take a *true quota value* of $0.30/lb. and an *inflated quota value* of $1.00/lb., and assume estimates for US production increases of 10%, 15%, and 25% due to the buyout, the resulting gains to producers from the outward shift in supply are roughly $116 million, $177 million, and $328 million, respectively (Table 2-6).

As seen in the theoretical discussion (Figure 2-1), one can actually have net benefits from quota removal, even when competitive equilibrium is restored. When returning to equilibrium after the 10th year of the buyout, producers gain (p_2kvtc), or $177 million (Figure 2-5 and Table 2-6, respectively). In this case, the gain to producers from the return to equilibrium is smaller than the loss of the quota area (lp_3*o) of $458 million. However, if we consider a 25% shift in supply, the gain to producers increases to $502 million. On net, a 10% increase in output results

[13] The report concluded that between 2002 and 2007, aggregate productivity growth in Kentucky was 44%.

[14] The depicted shift is an example of a 10% increase in output.

in a US net efficiency loss of $242 million while a 25% increase yields a net efficiency gain of $83 million.

Net Producer Gain Present Value Calculations

Two cases[15] are considered that model the impact of the buyout on producers: (1) net producer gain present value calculations are made over a 10-year period, and (2) net producer gain present value calculations are made over the same 10-year period as above and an eleventh year is added to show the effect of allowing competitive equilibrium to be restored.[16] In the first case, under a 5% discount rate, net producer gains were $410 million, $770 million, and $1.56 billion for $0.50/lb., $0.70/lb., and $1.00/lb. inflated quota values, respectively. In the second case, under a 5% discount rate, net producer gains were $327 million, $658 million, and $1.39 billion for $0.50/lb., $0.70/lb., and $1.00/lb. quota values, respectively (Table 2-7). As expected, the restoration of competitive equilibrium reduces net producer gain as producers are no longer receiving compensation from the tobacco tax.

A producer compensation present value calculation (assuming a 5% discount rate) of the $700 million consumer tax (i.e., the $1.00/lb. tax area $[lmno]$ in Table 2-2) over 10 years is $5.4 billion. This same calculation under a $0.70/lb. *inflated quota* is $4.06 billion. Under a $0.50/lb. *inflated quota*, the producer compensation drops to only $3.17 billion. Finally, under the true quota of $0.30/lb., the producer compensation is $1.9 billion. Thus, by inflating the value of the quota from $0.30/lb. to $1.00/lb., producers had the possibility of a $3.5 billion increase in compensation over 10 years.

[15] Both cases are calculated at 5% and 8% interest rates.

[16] After adding the eleventh year, the net producer gain values of the subsequent years are all zero as equilibrium has been restored.

The Missing Billions

In our analysis of the Tobacco buyout, an interesting puzzle arose: Approximately $4.2 billion in compensation was unaccounted for. More specifically, our above present value estimate of the $700 million value of the quota is $5.4 billion over 10 years while Womach (2005) and many others suggest that the cost of the Tobacco buyout was about $9.6 billion. In order to arrive at the $9.6 billion estimate, we would need a $1.78/lb. tax in our model as opposed to $1.00/lb. This results in a huge net benefit to producers from the Tobacco buyout. In this case, the net benefit is more than three times the net benefit of introducing the tobacco quota.

Distributional Effects

Landowners vs. Producers

This section focuses on the distribution of rents between producers and landowners from the tobacco buyout. The net producer gain results given in earlier tables were aggregate numbers for producers and landowners taken together. We use these results to determine the producer versus landowner gains from the buyout.

While most tobacco producers owned some quota, about 60% of quota production for each crop was from rented quota. Producers wanting to expand the scale of their operations had to rent quota rights from landowners who owned quota, which added to their cash expenses and management time. The small plot size also discouraged investment in specialized equipment; the use of which was economically justifiable only if used over a larger area. This was particularly true for tobacco farms, which typically had low tobacco acreage and relied heavily on manual labor (Dohlman, Foreman, and Da Pra, 2009b).

We show in Table 2-8 the net producer gain and landowner gain in two situations: (1) the quota was divided evenly between producers and landowners and (2) the producers had roughly 60–65% of the share of quota (Capehart [2004] estimated that at least 62% of the tobacco land

farmed was owned by producers).[17] Under a 50/50 split and $0.50/lb. *inflated quota value*, producers gain $34.5 million while landowners gain $18.6 million. Under a 60% split and $0.50/lb. *inflated quota value*, producers gain $37.2 million while landowners gain $15.9 million. Under a 50/50 split and $1.00/lb. *inflated quota value*, producers gain $131.2 million while landowners gain $70.7 million. Under a 60/40 split and $1.00/lb. *inflated quota value*, producers gain $141.3 million while landowners gain $60.6 million.

In 2002, there were 56,977 tobacco farms in the United States producing roughly 873 million pounds of tobacco.[18] Table 2-9 presents the distribution of payouts to producers and landowners under a 50/50 split. About 8% of the 56,977 tobacco farms produced 77% of the total tobacco.[19] Correspondingly, 8% of all the producers and landowners received roughly $101 million and $54 million, respectively.[20] Under the same percentage distribution, 92% of all producers and landowners received roughly $30 million and $16 million, respectively. Table 2-10 presents the distribution of payouts to producers and landowners under a 60/40 split. Similarly, 8% of all producers gain roughly $109 million while landowners gain roughly $47 million, with 92% of producers receiving roughly $33 million and landowners receiving only $14 million.

[17] In this section, we assume that the landowners are strictly landowners and do not produce tobacco. On the other hand, we also assume that all of the producers own land. It is because of these assumptions that in Table 2-8, the 50/50 split between landowners and producers is skewed in favor of producers as opposed to being exactly half. The aggregate values are taken from Table 2-1.

[18] The source of this data is the United States Census of Agriculture.

[19] The above source provided the number of tobacco farms and the poundage for these farms. These data were divided into acreage categories (e.g., 0.1–0.9, 1.0–1.9, 2.0–2.9, etc.), showing which size farms produced the most tobacco.

[20] These estimates were derived from the "Inflated Quota Value of $1.00/lb." section of Table 2-3.

Escalating Quota Rents

For producers to gain significant sums from the buyout, they prefer a quota at the time of the buyout to have a value that exceeds the true value of the quota given a fixed buyout price. In the case of tobacco, the buyout price in total was $1.00/lb. per year. Given this, the smaller the *true quota value* is relative to the perceived quota value, the greater is the net producer gain. When the manipulated quota value is higher, the compensation from the government to quota owners, via the buyout, is greater.

Tobacco quota rental rates, from which quota values are derived, have fluctuated over time and have also increased sharply (Table 2-11). Rental rates for Burley-cured tobacco increased by roughly 50% between 1998 and 2004 while rental rates for Flue-cured tobacco more than doubled during the same period. The rental rate should have decreased or remained stable between 1997 and 2003, instead, it rapidly increased. So, why the rapid increase in quota rental rates? One explanation is that there was a payoff to quota owners from bidding up the rental rate, and hence quota values, in order to receive a payment based on the overvalued quota given a fixed, smaller quota value.

Consider Table 2-12 where we show the extra cost to producers from higher land rental rates for a 50/50 split between the producers and landowners and a 60/40 split between producers and landowners. The extra cost to producers from rising quota values is between $79.5 million and $63.6 million.

Results

The US Tobacco Program instituted in 1938 became controversial for several reasons, and was terminated in 2004. The tobacco producers and landowners could not benefit from the tobacco program buyout if they were paid only the true market quota value. Through a successful bidding up of the quota rental rate and effective lobbying, the final compensation package was much

greater than it would have been under the *true quota value*. Our results show that as the spread between the *true quota value* and the *inflated quota value* increases, so does the net return to producers from removing the quota. This was the incentive for quota owners to bid up the quota value.

The initial implementation of the tobacco quota adversely affected consumers as they faced higher tobacco prices. The US Tobacco Quota Buyout made the initial impact on consumers even worse with the levying of a tobacco consumer tax (which was designed to be in place for 10 years). Consumers will, however, realize considerable gains at the end of the buyout when competitive equilibrium is restored after 2014. It is important to stress that under a consumer tax model, producers cannot gain from a production quota buyout if they are paid only the *true quota value*. As our study shows, compensation was based on far greater quota values that generated significant net producer gains. In turn these net producer gains far exceeded those generated from quota implementation.

Given these considerations, the key issues concerning this buyout were the legality of the buyout itself, the societal efficiency ramifications of the buyout, and the amount of compensation to be paid to owners of quota (this included both producers and landowners). Three points can be made from the issues above: (1) there was no real legal basis for the tobacco buyout, (2) even though there was a huge burden on consumers due to the nature of the buyout from an economic stand point, the US Tobacco Buyout eliminated the deadweight loss due to the initial quota implementation, and (3) as we have shown in our analysis, quota holders successfully exhibited rent-seeking behavior as they were compensated the inflated amount of the buyout.

Table 2-1. Economic gains and losses due to $0.30/lb. tobacco quota implementation under various elasticities[21]

Component	Area	1999–2003 Average (US million dollars)		
Value of the Quota	(p_1p_2ca)	251.8	251.8	251.8
Net Producer Gain (NPG)	$[(p_1p_0da)-(dcb)]$	87.5	145.7	61.5
Net Consumer Loss	(p_1p_0ba)	95.1	159.4	69.2
Domestic Loss	(p_1p_0ir)	49.2	80.7	35.8
Foreign Loss	$(riba)$	45.9	78.7	33.4
Net Welfare Gain to Exporting Country	$[(rida)-(dcb)]$	38.0	65.0	26.0
Net Efficiency Loss (Aggregate of both Countries)	(acb)	8	14	8

Table 2-2. Economic gains and losses under an inflated quota buyout of $0.50/lb., $0.70/lb., and $1.00/lb. (with a true quota value of $0.30/lb.)[22]

Component	Area	1999–2003 Average (US million dollars)		
Inflated Value of Quota	$(lmno)$	410.8	526.4	700
Net Producer Gain	$[(lp_1eo)-(enca)]$	53.1	99.5	201.9
Consumer Loss	(lp_1ao)	73.3	143.2	292.5
Domestic	(lp_1rf)	38.9	76.7	162.1
Foreign	$(frao)$	34.4	66.5	130.4
US Net Efficiency Gain	$\{[(lp_1eo)-(enca)]-(lp_1rf)\}$	14.2	22.8	39.7
Net Change in Efficiency	$(onca)$	18.0	41.0	87.0

[21] E_{DT}, E_{DD}, and E_S represent the total demand elasticity, the domestic demand elasticity, and the supply elasticity estimates, respectively. Values in the third column reflect the following elasticities: $E_{DT} = -1.1$, $E_{DD} = -0.9$, $E_S = 0.5$. Values in the fourth column reflect the following elasticities: $E_{DT} = -1.1$, $E_{DD} = -0.9$, $E_S = 1.4$. Values in the fifth column reflect the following elasticities: $E_{DT} = -1.5$, $E_{DD} = -1.5$, $E_S = 0.5$.

[22] Using more elastic demand curves yielded lower net producer gains and vice versa. Using more elastic supply curves resulted in higher net producer gains. Values in the third column reflect $0.50/lb. a quota value and the following elasticities: $E_{DT} = -1.1$, $E_{DD} = -0.8$, $E_S = 0.6$. Values in the fourth column reflect a $0.70/lb. and the following elasticities: $E_{DT} = -1.0$, $E_{DD} = -0.8$, $E_S = 0.7$. Values in the fifth column reflect a $1.00/lb. quota value and the following elasticities: $E_{DT} = -1.1$, $E_{DD} = -0.7$, $E_S = 0.5$.

Table 2-3. Economic gains and losses under an inflated quota buyout of $1.00/lb. (varied elasticities)[23]

Component	Area	1999–2003 Average (US million dollars)	
Inflated Value of Quota	$(lmno)$	688.1	683.4
Net Producer Gain (NPG)	$\left[(lp_1eo)-(enca)\right]$	229.1	130.9
Consumer Loss	(lp_1ao)	322.2	278.6
Domestic	(lp_1rf)	179.1	149.2
Foreign	$(frao)$	143.1	129.5
US Net Efficiency Gain	$\left\{\left[(lp_1eo)-(enca)\right]-(lp_1rf)\right\}$	50.0	-18.3
Net Change in Efficiency	$(onca)$	109.2	149.9

Table 2-4. Impact of varying true quota value on producers ($0.30/lb. versus $0.50/lb) US million dollars

Component	$0.30/lb.	$0.50/lb.
NPG from Quota Implementation	87.5	201.3
NPG from $1.00/lb. Quota Buyout	201.9	157.1
Total	289.4	358.4

Table 2-5. Eleventh year economic gains and losses under the removal of an inflated quota buyout (a comparison between $0.50/lb., $0.70/lb., and $1.00/lb. inflated quota values)[24]

Component	Area	1999–2003 Average (US million dollars)		
Net Producer Loss	$\left[(lp_0go)-(gnb)\right]$	142.0	189.8	294.55
Consumer Gain	(lp_0bo)	168.0	238.1	389.55
Domestic	(lp_0if)	86.5	125.4	218.54
Foreign	$(fibo)$	81.5	112.7	171.01
US Net Efficiency Gain[25]	$\begin{bmatrix}(lp_0if)+(lp_1eo)-(enca)\\-(lp_1rf)+(p_2p_3kvtc)\\-(lp_3*o)-(lp_0go)-(gnb)\end{bmatrix}$	N/A	N/A	27.5
Aggregate Efficiency Gain	(onb)	26.0	48.3	95.0

[23] Values in the third column reflect the following elasticities: $E_{DT} = -1.1$, $E_{DD} = -0.7$, $E_S = 1.0$. Values in the fourth column reflect the following elasticities: $E_{DT} = -1.6$, $E_{DD} = -1.6$, $E_S = 0.9$.

[24] Values in the third column reflect a $0.50/lb. quota value and the following elasticities: $E_{DT} = -1.1$, $E_{DD} = -0.8$, $E_S = 0.6$. Values in the fourth column reflect a $0.70/lb. quota value and the following elasticities: $E_{DT} = -1.0$, $E_{DD} = -0.8$, $E_S = 0.7$. Values in the fifth column reflect a $1.00/lb. quota value and the following elasticities: $E_{DT} = -1.1$, $E_{DD} = -0.7$, $E_S = 0.7$.

[25] Under a 25% supply shift (see next table).

Table 2-6. Producer gain and net efficiency gain from shifting supply

Component	Area[26]	Quantity Percent Shift 10%, 15%, and 25%, Respectively		
Producer Gain from Shifting Supply	$(tvhn)$	115.5	177.1	328.1
Producer Gain from Shifting Supply (equilibrium restored)	$(p_2 p_3 kvtc)$	176.7	271.0	502.0
Loss of Removing Quota	$(lp_3 * o)$	458.7	458.7	458.7
Original US Net Efficiency Gain	$\{[(lp_1 eo)-(enca)]-(lp_1 rf)\}$	39.7	39.7	39.7
US Net Efficiency Gain Including Supply Shift	$\{[(lp_1 eo)-(enca)]-(lp_1 rf)\} +(p_2 p_3 kvtc)-(lp_3 * o)$	−242.3	−148.0	83.0

Table 2-7. Producer impact: Present value of tobacco quota, US billion dollars

	$0.50/lb. Inflated Quota Interest Rates		$0.70/lb. Inflated Quota Interest Rates		$1.00/lb. Inflated Quota Interest Rates	
Years	5%	8%	5%	8%	5%	8%
10	0.410	0.356	0.769	0.668	1.559	1.355
15	0.327	0.295	0.658	0.586	1.387	1.228

Table 2-8. Quota rent distribution from the tobacco buyout: Landowners vs. Producers

Title	Quota Share	Net Gain (US$ million)	Quota Share	Net Gain (US$ million)
Inflated Quota Value of $0.50/lb.				
Producers	50%	34.5	60%	37.2
Landowners	50%	18.6	40%	15.9
Total	100%	53.1	100%	53.1
Inflated Quota Value of $0.70/lb.				
Producers	50%	64.7	60%	69.7
Landowners	50%	34.8	40%	29.9
Total	100%	99.6	100%	99.6
Inflated Quota Value of $1.00/lb.				
Producers	50%	131.2	60%	141.3
Landowners	50%	70.7	40%	60.6
Total	100%	201.9	100%	201.9

Table 2-9. Distribution of benefits according to farm size and structure of land ownership, 50/50 split in US million dollars

Percent of Distribution of Benefits	Landowner Gains	Producer Gains	Total
8% receive 77% of benefits	54.4	101.0	155.4
92% receive 23% of the benefits	16.3	30.2	46.5
100%	70.7	131.2	201.9

[26] In reference to Figure 2-5.

Table 2-10. Distribution of benefits according to farm size and structure of land ownership, 60/40 split in US million dollars

Percent of Distribution of Benefits	Landowner Gains	Producer Gains	Total
8% receive 77% of benefits	46.6	108.8	155.4
92% receive 23% of the benefits	13.9	32.6	46.5
100%	60.5	141.4	201.9

Table 2-11. Quota rental rates for flue-cured and burley tobacco

Year	Flue-cured Effective Quota (million lbs.)	Estimated Flue-cured quota rental rate[1] (cents/lb.)	Burley Effective Quota (million lbs.)	Estimated Burley quota rental rate[27] (cents/lb.)
1997	1,019.8	35.0	879.8	23.0
1998	819.6	43.0	867.5	24.0
1999	671.5	51.0	690.1	31.0
2000	553.0	56.0	362.0	46.0
2001	545.3	57.0	369.0	49.0
2002	545.3	57.0	349.0	49.0
2003	536.2	61.0	330.0	54.0
2004	500.0	66.0	331.0	52.0

Data source: Tobacco and Peanuts Division, Farm Service Agency (FSA); Tobacco Situation and Outlook Report TBS-246, April 2005 ERS/USDA for basic and effective quotas.

Table 2-12. Producer cost increase from possible quota rental value escalation

Year	Average Quota Rental Rate (US$)	Total Poundage (millions)	Total Cost of Quota (US$ millions)	Extra Cost to Producers 50/50 Split (US$ millions)	Extra Cost to Producers 60/40 Split (US$ millions)
2001	0.53	457.2	242.3	9.1	7.3
2002	0.53	447.2	237.0	8.9	7.2
2003	0.575	433.1	249.0	28.2	22.5
2004	0.59	415.5	245.1	33.2	26.6
Total		1753	973.4	79.5	63.6

[27] From the tobacco costs of production accounts published by ERS. Covers the states of KY, TN, VA, NC, SC, and GA.

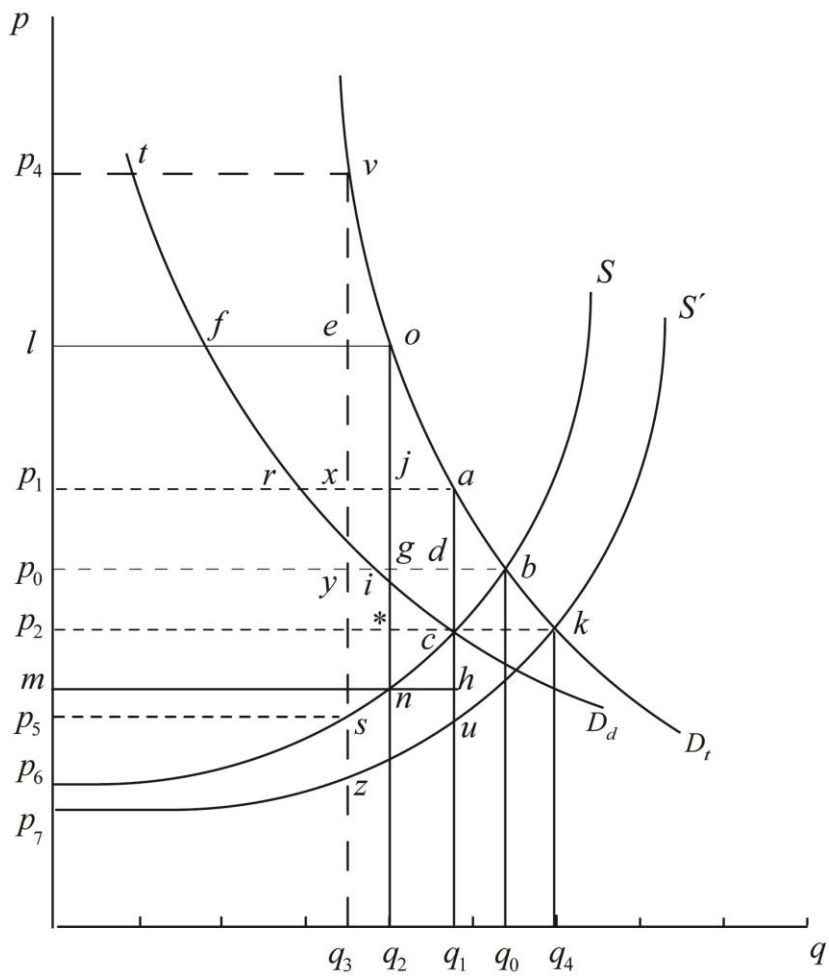

Figure 2-1. Production quota theoretical model

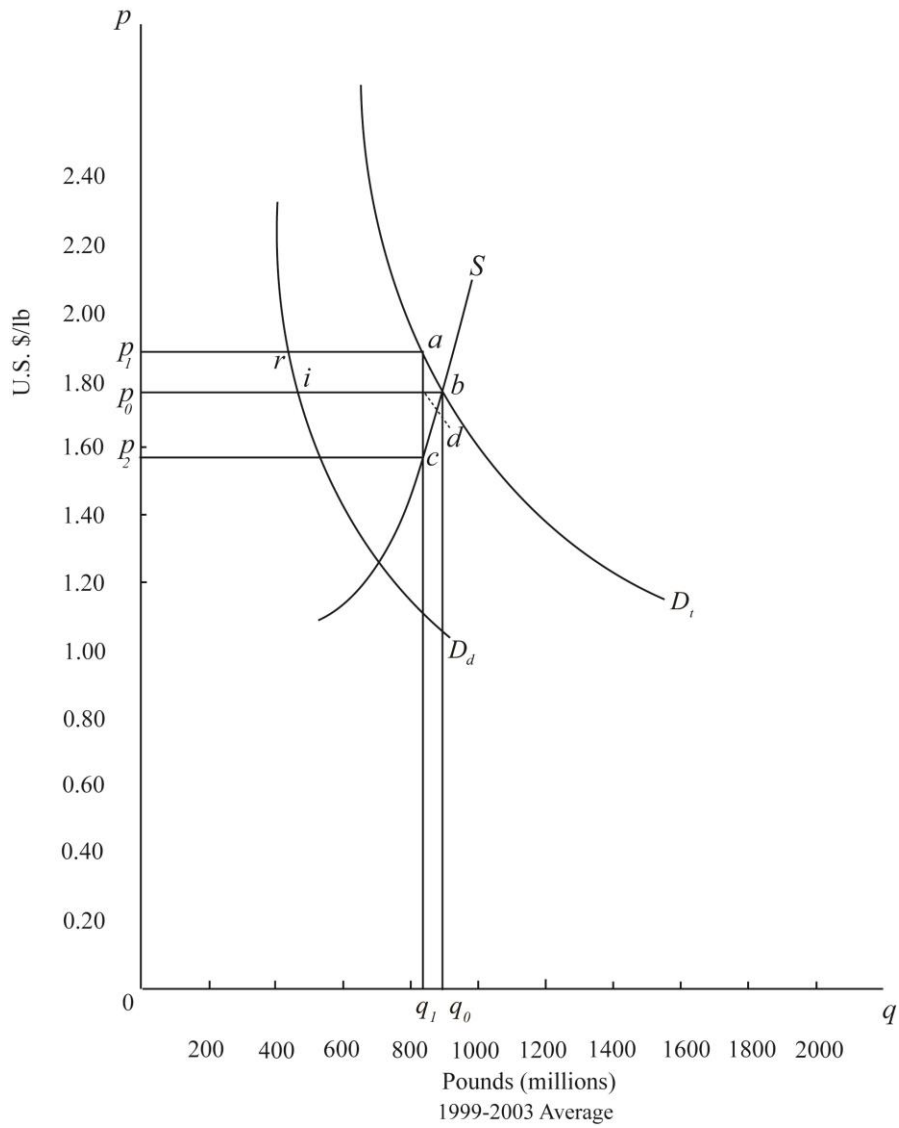

Figure 2-2. $0.30/lb. production quota implementation with $E_{DT} = -1.1$, $E_{DD} = -0.9$, $E_S = 0.5$

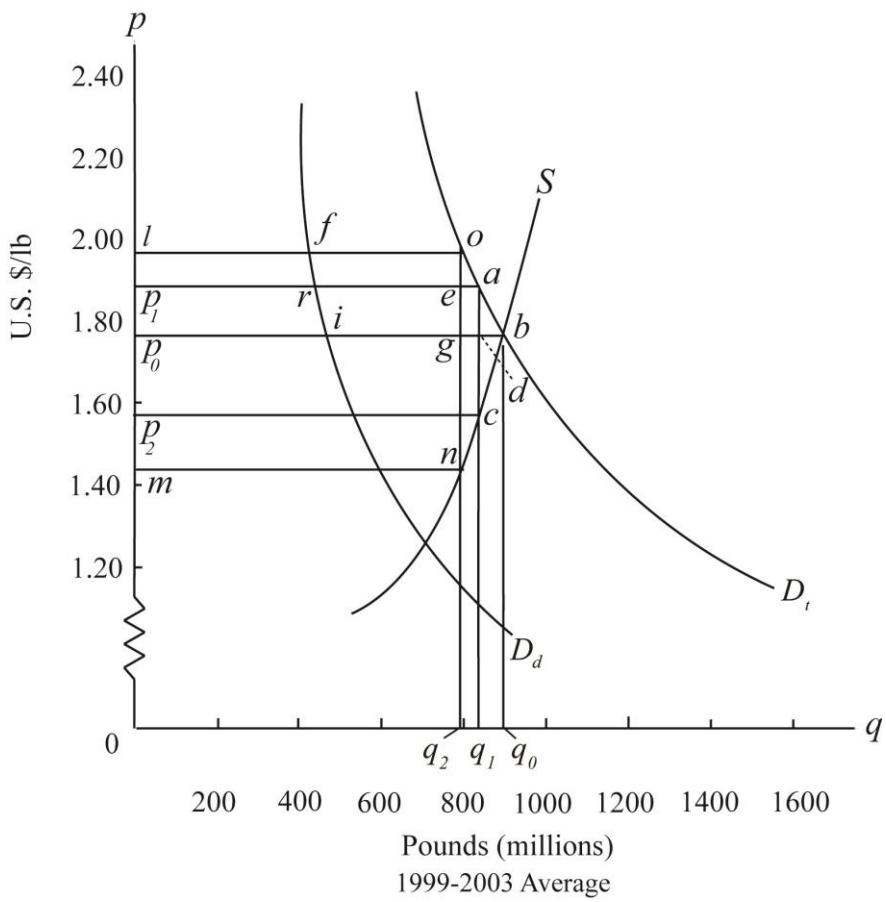

Figure 2-3. Tobacco buyout ($0.50/lb. inflated quota) with $E_{DT} = -1.1$, $E_{DD} = -0.8$, $E_S = 0.6$

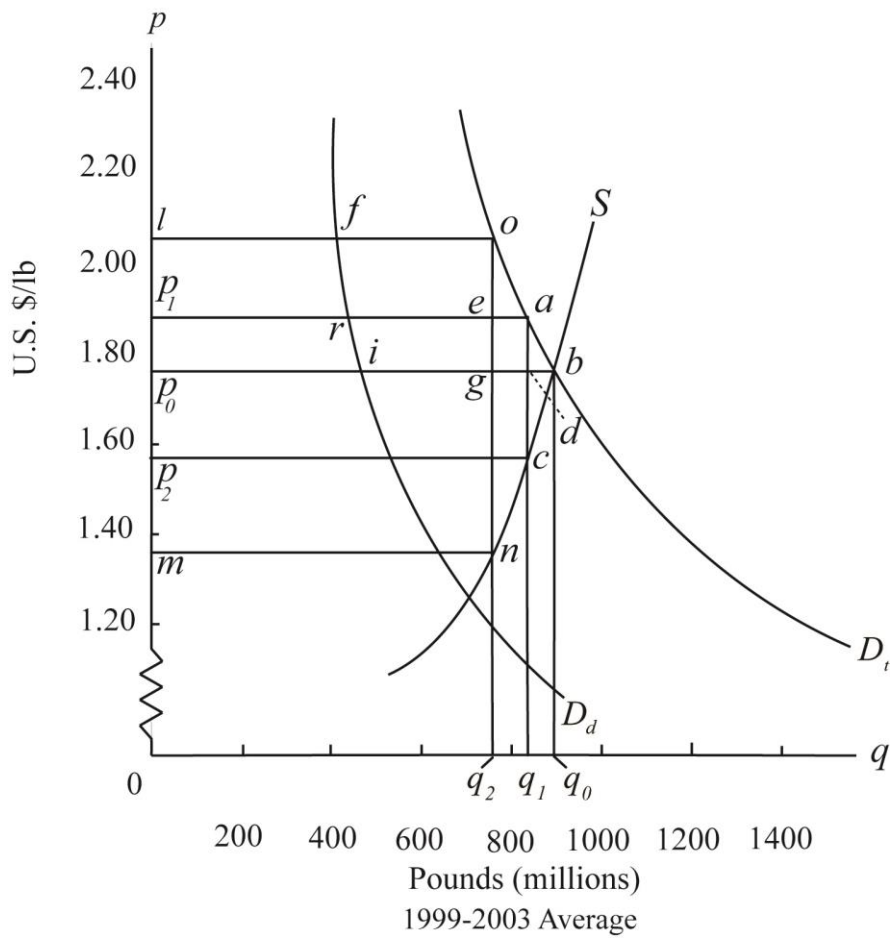

Figure 2-4. Tobacco buyout ($0.70/lb. inflated quota) with $E_{DT} = -1.0$, $E_{DD} = -0.8$, $E_S = 0.7$

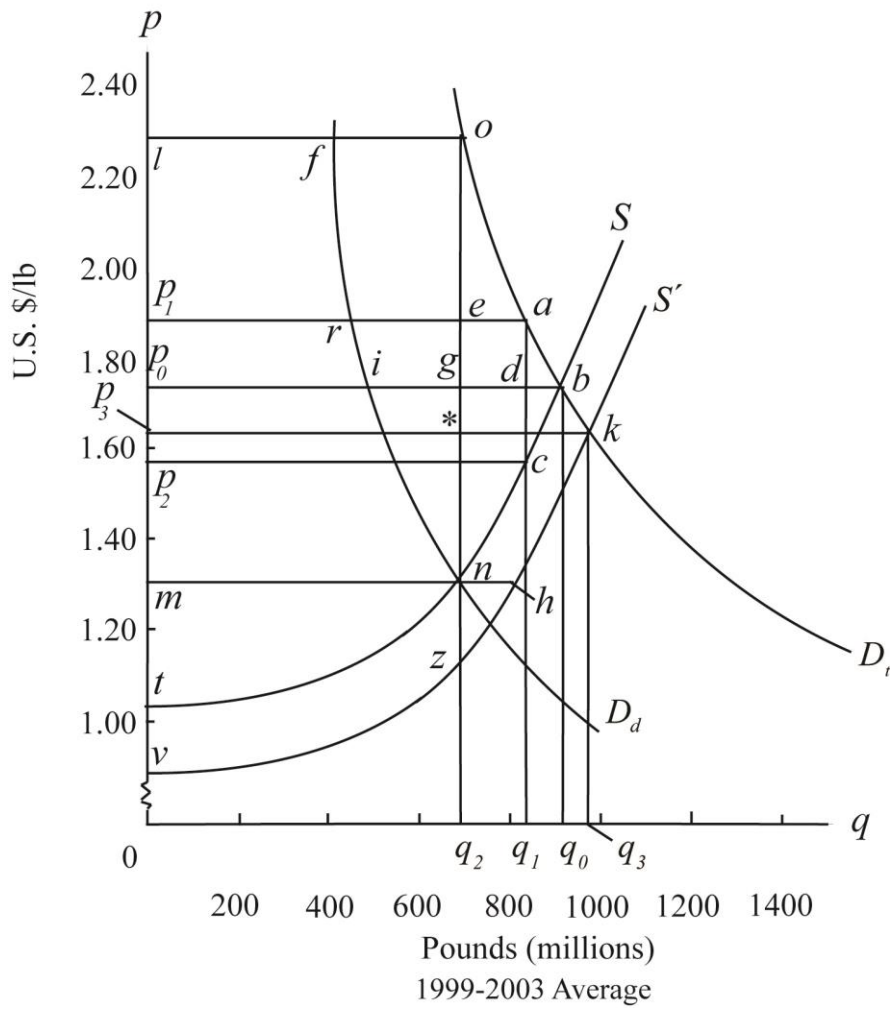

Figure 2-5. Tobacco buyout ($1.00/lb. inflated quota) with $E_{DT} = -1.1$, $E_{DD} = -0.7$, $E_S = 0.7$

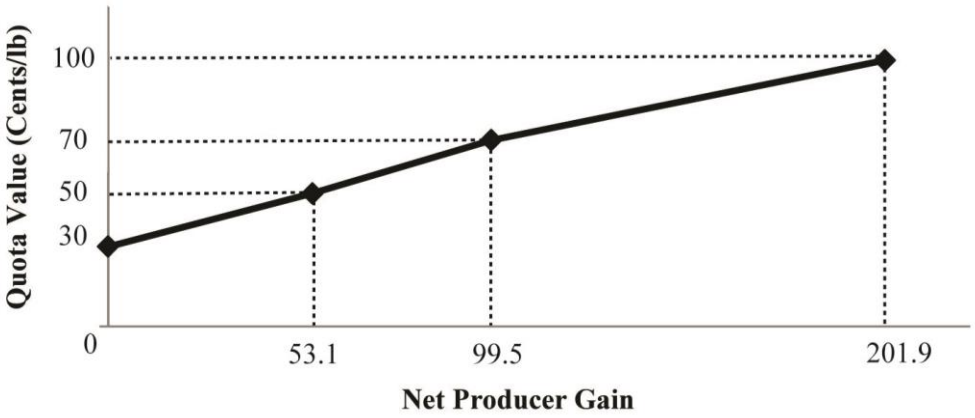

Figure 2-6. Relationship between tobacco quota value and net producer gain

CHAPTER 3
BENEFIT-COST ANALYSIS: GOVERNMENT COMPENSATION VS CONSUMER TAX MODELS*

In benefit-cost analysis, a considerable literature exists on the impact of introducing production quotas, but little is written on the distributional and efficiency effects of removing production quotas, whereby producers are compensated from the US Treasury. Likewise, this also applies to a production quota buyout in which compensation to producers is paid for through a consumer tax (Just, Hueth, and Schmitz, 2008; Schmitz and Zerbe, 2008).

This article provides a theoretical and empirical analysis of two historic production quota buyouts: the 2002 US Peanut Quota Buyout and the 2004 US Tobacco Quota Buyout. The US Tobacco Buyout was paid for by a consumer tax while the US Peanut Quota Buyout was based on compensation from the Treasury. An important question arises: Does the method of compensation affect distribution and societal efficiency? The following analysis (1) examines each of the quota buyouts under varying compensation methods and (2) determines the economic impact each buyout has on the government, producers, consumers, and society when the method of compensation is varied.

Background

The US Peanut Quota Buyout

The Peanut Marketing Quota Program was established in the early 1930s. Like other production quota programs, it was designed to foster high and stable prices, thereby supporting the incomes of peanut growers. The 2002 US Farm Program eliminated the peanut program at the beginning of the 2002 crop year (Schmitz, Schmitz, and Rossi, 2006), in part, due to growing World Trade Organization (WTO) concerns. In this article, the dissolution of this peanut

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program is discussed in terms of a "buyout" because those owning the right to sell peanuts were compensated for the loss of their quota. Under the quota buyout, holders of the peanut quota were compensated at the annual quota value rate of \$0.11 per pound (\$220 per ton).[1] The total peanut poundage upon which the payment was made totaled 2.4 billion pounds. Authorized compensation was paid to quota holders over a five-year period, whereby quota holders received \$0.55 per pound (\$1100 per ton). These payments were intended to compensate owners for the loss of an income-producing asset.

Treasury Buyout

True quota value

In the TB case, there are several results from removing the quota that differently affects the government, producers, consumers, and society. Consider Figure 3-1 where the government cost of removing the quota is $(p_1 p_2 ca)$, provided the *true quota value* was used as the basis of compensation. Producers lose $(p_1 p_0 da)$ and gain (dcb). Since they are compensated the *value of the quota*, they also gain $(p_1 p_2 ca)$.[2] This results in a net producer gain of $(p_0 p_2 cb)$. Consumers gain $(p_1 p_0 ba)$ and there is also a gain to society of (acb) when competitive equilibrium is restored.

Inflated quota value

When an inflated quota value (not considered in Schmitz and Schmitz, [2010]) is used as opposed to a true quota value as the basis for compensation, $(p_3 p_2 cf)$ is the new government

[1] Data obtained through correspondence with Dr. E. L. Dohlman (peanut specialist, ERS/USDA). Professor Stan Fletcher (University of Georgia, highly regarded specialist who works on the economics of US peanut production and marketing) estimated the value of the quota to be approximately \$0.10 per pound.

[2] Schmitz and Schmitz (2011) show that the true value of the quota equals exactly the gain to producers when the quota is implemented, plus the gain to producers when the quota is removed. However, this is not the case under a consumer tax buyout (Schmitz, Schmitz, and Haynes, 2012).

cost (Figure 3-1). In this case, producers gain $\left[\left(p_0 p_2 cb\right)+\left(p_3 p_1 af\right)\right]$.[3] Consumers gain $\left(p_1 p_0 ba\right)$ due to quota removal and the gain to society remains the same at $\left(acb\right)$ when competitive equilibrium is restored.

Consumer Tax Buyout

True quota value

In the CTB case, $\left(p_1 p_2 ca\right)$ is no longer the government cost; it is now the actual consumption tax value (Figure 3-1). Unlike the TB case, removing the quota using the *true quota value* does not result in a net producer gain in Period I.[4] In Period II, producers lose $\left[-\left(p_1 p_0 da\right)+\left(dcb\right)\right]$ which is exactly equal to the producer gain from implementing the quota. There is also no difference to consumers in Period I, as they continue to lose $\left(p_1 p_0 ba\right)$ as they would have if the quota remained in place. In Period II, however, consumers gain the area $\left(p_1 p_0 ba\right)$. Similarly to the consumer tax effect, society does not gain or lose during Period I. There is, however, a gain of $\left(acb\right)$ in Period II.

Inflated quota value

When the *inflated quota value* $\left(lmno\right)$ is used as the basis for compensation, there is a net producer gain of $\left(lp_1 jo - jnca\right)$ in Period I (Figure 3-1). In Period II, at the end of the compensation period, producers lose $\left[-\left(lp_0 go\right)+gnb\right]$ when equilibrium is restored. Consumers

[3] Given that the value of the quota is the basis of compensation to producers in the event of a buyout, the term "inflated quota value" refers to the case where producers bid up the value of the quota through lobbying and other forms of rent-seeking behavior, and thereby increase the amount of compensation they would receive from a buyout.

[4] Period I refers to the period of compensation before competitive equilibrium is restored and Period II refers to the period when competitive equilibrium is restored (Schmitz, Schmitz, and Haynes, 2012). It is important to note that Period I may be one or more years, depending on the length of the buyout. Additionally, the results we present in the empirical section are yearly estimates.

are worse off under this compensation method as they lose (lp_1ao) in Period I. On net, consumers gain $\left[(lp_0bo)-(lp_1ao)\right]=(p_1p_0ba)$ when competitive equilibrium is restored in Period II, just as they did given the *true quota value*. Therefore, the consumer gains do not depend on the nature of the buyout. Additionally, there is an increasing loss to efficiency $(onca)$ during Period I. However, there is an efficiency gain (onb) in Period II which results in an overall societal net gain (acb).

The following applies the theoretical framework above to both the 2002 US Peanut Quota Buyout and the 2004 US Tobacco Quota Buyout in order to determine how producers and consumers are affected by varying methods of compensation. In the empirical analysis, two scenarios are considered regarding the buyout: (1) the *true quota value* is used for the basis of the buyout or (2) an *inflated quota value* is used as the basis for the buyout.

Empirical Analysis

US Peanut Quota Buyout

Treasury buyout

The empirical assessment of Schmitz and Schmitz (2010) on the peanut buyout concluded that the annual government cost was roughly $264 million for a period of five years (Table 3-1).[5] Producers gained $53 million per year of compensation from the buyout on net. Additionally, Schmitz and Schmitz (2010) estimate a $236 million consumer gain due to the removal of the quota (Table 3-1).

[5] As Schmitz and Schmitz (2010) did not account for the possibility of inflated quotas in their analysis of the US Peanut Quota Buyout, the assumption of the analysis in this paper is that the true quota value was used as the basis for the buyout.

Consumer tax buyout

Consider the case in which compensation to producers is in the form of a consumer tax. Under a consumer tax compensation scheme there is no government cost. The producer gain in Period I is zero, given that a true quota value would have been used as the basis for the buyout. There is a producer loss of $211 million in Period II. Additionally, in Period I, consumers are neither better nor worse off financially due to, and during, the buyout. In Period II, consumers gain $236 million. In both the TB and CTB scenarios, the removal of the quota would have resulted in a $25 million gain in efficiency because the deadweight loss would have been removed (Table 3-1).

A significant difference between a TB and a CTB is the timing of the restoration of competitive equilibrium. Given a TB of five years, as was the case with US peanuts, competitive equilibrium was restored in the first year of the buyout when the quota was removed. This is because, along with the quota being removed, the deadweight loss is also removed as the government assumes the cost of the buyout. Given a CTB, equilibrium would have been restored in the last year of the buyout because, even though the quota were removed immediately, competitive equilibrium would not have been restored because the consumer tax used to compensate producers would have kept the inefficiency wedge in place.

US Tobacco Buyout

The following empirical analysis pertains to the 2004 US Tobacco Buyout. Even though there are two major kinds of tobacco grown in the United States, Flue-cured and Burley (accounting for over 90% of US production [Serletis and Fetzer, 2008]), payments were equal under the tobacco buyout for quota owners. The production of these two types of tobacco were aggregated

and average prices and quantities were used for the 1999–2003 period of $1.88/lb. and 839.4 million pounds, respectively (ERS/USDA, 2005)[6] as the basis for the buyout.

The above-mentioned data was used to build a model similar to Figure 3-1. Consider Figure 3-2 where the *true quota value* is $0.30/lb. and the inflated quota value is $1.00/lb.[7] The competitive price is p_0 ($1.77/lb.) and the corresponding output is q_0 (890 lbs.).

By introducing a production quota q_1 (839 lbs.), the price increases to p_1 ($1.88/lb.) and, as a result, consumers lose $95 million $(p_1 p_0 ba)$. Producers gain $88 million $\left[(p_1 p_0 da)-(dcb)\right]$ and now receive the true value of the quota from the market, equaling $252 million $(p_1 p_2 ca)$. The deadweight loss created by the quota is $8 million (acb). These results are shown in Table 3-2.

Consumer tax buyout: True quota value vs. inflated quota value

As previously stated, the US Tobacco Buyout was in the form of a consumer tax. In this case, on net, removing the quota using the *true quota value* results in producers gaining nothing in Period I. However, using the *inflated quota value* yields a $202 million per year net producer gain over the 10-year compensation period (Period I). At the end of the compensation period, immediately when equilibrium is restored, producers face a net loss of either $88 million under the *true quota value* or $295 million under the *inflated quota value* (Period II). Consumers continue to lose $95 million per year in Period I, so there is no net change to their welfare under the *true quota value* buyout. However, this value escalates to $292 million per year, given an *inflated quota value* buyout. Consumers immediately regain $95 million when competitive

[6] This production value accounts for the change in stock size over the five-year period.

[7] We present a *true quota value* of $0.30/lb. as an extreme case to show the possible effects of bidding up quota values through lobbying and other forms of rent-seeking behavior.

equilibrium is restored (CER) under the *true quota value* buyout or they regain $390 million under the *inflated quota value* buyout (Table 3-3).

Treasury buyout: True quota value vs. inflated quota value

Instead of using a consumer tax for the buyout, what if the government paid producers compensation for their loss of tobacco quota? In this case, the government cost of removing the quota using the *true quota value* ($0.30/lb.) would have been roughly $252 million per year over Period I. If an *inflated quota value* ($1.00/lb.) were used instead, this amount would increase to $839.4 million per year over Period I.

Given a *true quota value,* producers gain $164 million per year of compensation from removing the quota. Given an *inflated quota value,* producers gain $752 million per year of compensation from the removal of the quota (Table 3-4). Consumers gain $95 million in both the *true quota value* and *inflated quota value* cases from the removal of the quota. Additionally, in either case, there is an efficiency gain of $8 million due to the removal of the quota (Table 3-4).

Results

There are sharp differences but also similarities between the two different types of buyouts discussed in this paper, especially when the buyouts are based on *true quota values*. Under a TB, producers always gain from the removal of the quota. Under a CTB, producers may lose or gain, depending on the length of the compensation period. As our theoretical section highlights, in the simplest case, the consumer impacts and efficiency gains from the removal of the quota are identical between a TB and a CTB.

Under an *inflated quota value,* producers gain the most given a TB. Once again, it is possible for producers to gain from a CTB buyout, but these gains are considerably less than under a TB. In the simplest scenario, similar to the *true quota value* case, consumers are unaffected by a CTB, as are the net efficiency gains. In the case when multiple years of

compensation within Period I are included, consumer losses and net efficiency losses can be significant under a CTB.

Producers, consumers, and society favor a Treasury Buyout for several reasons. Producers are compensated considerably more under a TB, consumers are not burdened with the charge of funding the buyout, and society does not face additional efficiency losses due to the buyout. Importantly, this study shows that different policy instruments can have markedly different distributional consequences. However efficient policy instruments need not affect the size of economic efficiency gains.

Table 3-1. US peanut quota buyout yearly estimates: Treasury buyout vs. consumer tax buyout (true quota value)

Components	Treasury Buyout*	Consumer Tax Buyout
Government Cost	264	N/A
Tax Amount	N/A	264
Producer Net Gain Period I	53	0
Producer Gain Period II	0	-211
Consumer Gain/Loss Period I	236	0
Consumer Gain/Loss Period II	0	236
Efficiency Gain/Loss Period I	25	0
Efficiency Gain/Loss Period II	0	25

*The elasticities used are given in Schmitz and Schmitz, 2010.

Table 3-2. US tobacco: Economic gains and losses from quota implementation ($E_D = -1.1$ and $E_S = 0.7$)[8]

Component	Area	1999–2003 Average (US million dollars)
True Value of Quota	p_1p_2ca	251.8
Net Producer Gain	$\left[(p_1p_0da)-(dcb)\right]$	87.5
Consumer Loss	(p_1p_0ba)	95.1
Deadweight Loss	(acb)	8.0

Table 3-3. US tobacco buyout results (consumer tax): True quota value vs. inflated quota value, yearly estimates ($E_D = -1.1$ and $E_S = 0.7$)

True Quota Value			Inflated Quota Value		
Component	*Area*	*US million dollars*	*Component*	*Area*	*US million dollars*
Tax Value	(p_1p_2ca)	251.8	Tax Value	$(lmno)$	700.0
Producer Gain Period I	N/A	0	Producer Gain Period I	$\left[(lp_1jo)-(jnca)\right]$	201.9
Producer Loss Period II[9]	$\left[(p_1p_0da)-(dcb)\right]$	-87.5	Producer Loss Period II	$\left[(-lp_0go)+(gnb)\right]$	-294.6
Consumer Loss: Period I	(p_1p_0ba)	0	Consumer Loss: Period I	(lp_1ao)	-292.5
Consumer Gain: Period II	(p_1p_0ba)	95.1	Consumer Gain: Period II	(lp_0bo)	389.5
Efficiency Loss Period I	(acb)	0	Efficiency Loss Period I	$(onca)$	-87.0
Efficiency Gain Period II	(acb)	8.0	Efficiency Gain Period II	(onb)	95.0

[8] See Appendix A for results under varying elasticities.

[9] This refers to net producer loss during the period immediately after the buyout (competitive equilibrium restored).

Table 3-4. US tobacco results (treasury buyout): True quota value vs. inflated quota value, yearly estimates ($E_D = -1.1$ and $E_S = 0.7$)

True Quota Value			*Inflated Quota Value*		
Component	*Area*	*US million dollars*	*Component*	*Area*	*US million dollars*
Government Cost	$(p_1 p_2 ca)$	251.8	Government Cost	$(p_3 p_2 cf)$	839.4
Net Producer Gain	$(p_0 p_2 cb)$	164.3	Net Producer Gain	$[(p_0 p_2 cb)+(p_3 p_1 af)]$	751.9
Net Consumer Gain	$(p_1 p_0 ba)$	95.1	Net Consumer Gain	$(p_1 p_0 ba)$	95.1
Efficiency Gain	(acb)	8	Efficiency Gain	(acb)	8

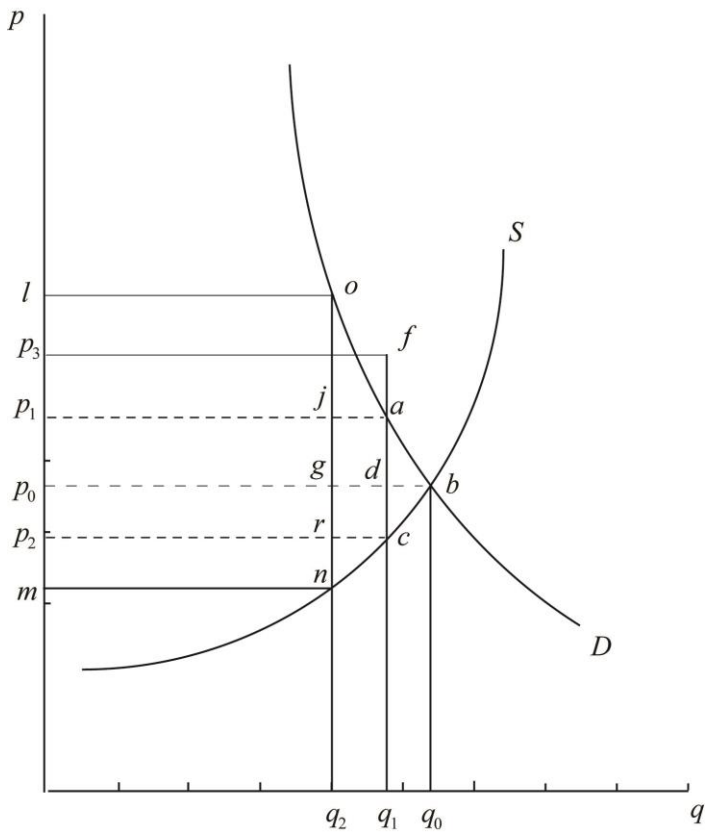

Figure 3-1. Theoretical quota buyout

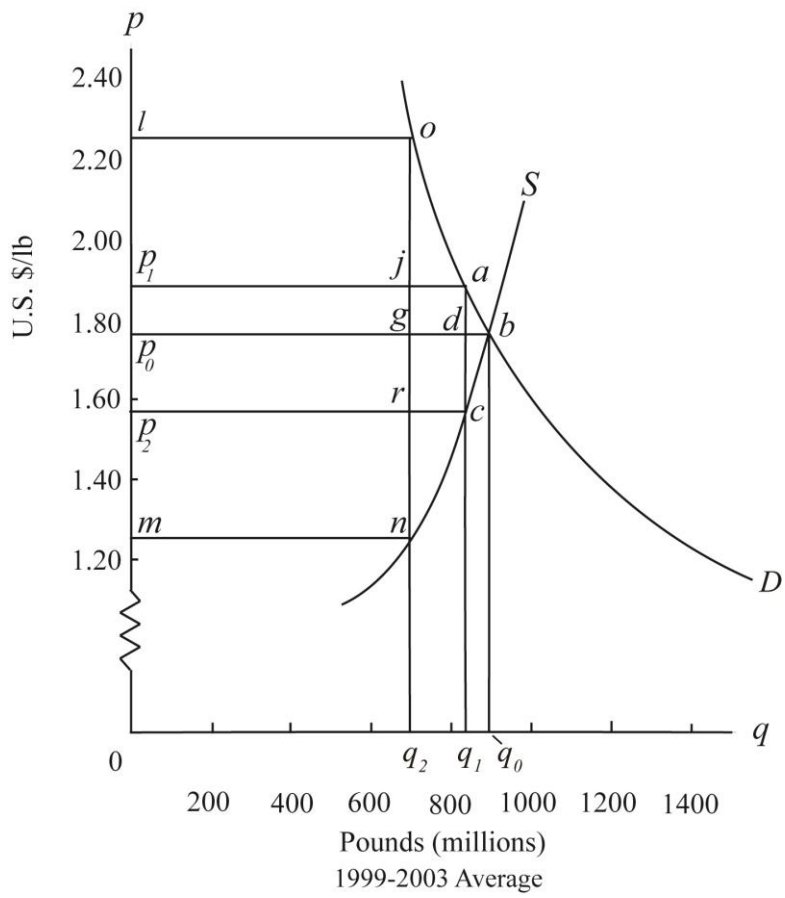

Figure 3-2. Empirical implementation and removal of quota ($0.30/lb. vs. $1.00/lb. quota)

CHAPTER 4
THE US TOBACCO BUYOUT: A GENERAL EQUILIBRIUM ANALYSIS INCLUDING NEGATIVE EXTERNALITIES FROM SMOKING*

The Consumer Tax Buyout Effect

Partial Equilibrium

Within the above framework, we can determine empirically the effect of the tobacco buyout on consumers and producers. Consider Figure 4-1 where a $1.00/lb. quota buyout is depicted. The net producer gain from the removal of the quota is $202 million per year (Table 4-1). The total net consumer loss from removing the quota is $292 million per year (Table 4-1). Therefore, given a present value calculation of the above estimates (with a 5% discount rate), over the 10-year compensation period, producers gain $1.3 billion and consumers lose $2.3 billion from the removal of the quota. Given these gains and losses, the benefit-cost ratio for this period is 0.70. Upon the culmination of the 10-year buyout, when competitive equilibrium is restored, producers immediately lose $295 million, because the consumer tax is no longer in place. Meanwhile, consumers gain $390 million in the absence of the tax (Table 4-2). In this case, the benefit-cost ratio at this point in time is 1.32.

Declining Demand Conditions and General Equilibrium

While the above model assumes a demand schedule for tobacco at the time of the buyout, the actual demand for tobacco products has fallen sharply since that time. According to Brown and Snell (2012:1):

> With large increases in both federal and state excise taxes late last decade, US cigarette consumption had declined from 4 to 8 percent per year from 2007 to 2010…. According to the Centers for Disease Control cigarette consumption in 2011 was 292.7 billion cigarettes, down from 435.6 billion in 2000.

* Portions of this chapter have been submitted to the Journal of Agricultural and Applied Economics (2013) for review. The submitted paper was co-authored by Andrew Schmitz, Ph.D., D.Litt., and Troy G. Schmitz, Ph.D.

Consider the US tobacco production quota buyout under falling demand conditions. As time moves forward, the demand for tobacco shifts left as less tobacco is consumed. Importantly, this results in a loss of consumer surplus from the decreasing demand when measured only in the tobacco market.

In a general equilibrium framework, however, at least part of the consumer surplus losses that occur during a buyout can be attributed to both a change in preferences away from tobacco and a change in relative prices favoring non-tobacco product consumption. As we show below, the losses previously measured in the tobacco market are most likely overstated. Under this scenario there could be subsequent impacts in additional markets (e.g., healthcare costs decrease because fewer people are smoking for reasons including higher prices for tobacco products).

In Figure 4-2, at price p_1 the quantity demanded of tobacco is q_1 and consumer surplus is (ap_1d). If demand shifts to D', quantity demanded falls to q_2 for price p_1. The loss in consumer welfare is $(abcd)$. Note that the expenditure on tobacco has been reduced by $(cefd)$. Given a general equilibrium framework, as an example, consider a potential change in tastes and preferences wherein consumers transfer the would-be expenditure on tobacco $(cefd)$ to another market (organic food). In Figure 4-3 the price and quantity of organic food are p_1 and q_1, respectively, with the tobacco demand of D. Now, if $(cefd)$ from Figure 4-2 is spent on organic food, we set $(cefd)$ equal to $(p_2p_1hq_1q_2i)$ in Figure 4-3, price rises to p_2 and consumption rises to q_2. There is a gain in consumer welfare of $[(kp_2i)-(jp_1h)]$ which is positive, plus a producer gain of (p_2p_1hi). Thus, the impact of reducing smoking is:

$$[(kp_2i)-(jp_1h)]+(p_2p_1hi)-(abcd)+(\text{savings in health costs from reduced tobacco consumption}).$$

Demand for Tobacco and Addiction

An important consideration regarding the demand for tobacco over time is the fact that it is an addictive good. This addictive property somewhat complicates the analysis of the quota buyout; in fact, Weimer, Vining, and Thomas (2008) acknowledge this and state that "the valuation of changes in consumption of addictive goods resulting from policy interventions presents a challenge for cost-benefit analysts." Even though the demand for tobacco has been falling since the tobacco buyout (mostly due to rising federal and state taxes which subsequently raise prices), there are a certain number of consumers whose demand is not likely to be affected by higher prices because of their addiction.

According to the Centers for Disease Control and Prevention (CDC), over 50% of smokers have tried to quit at least once and failed (Bloomberg.com 2012). Understandably, it is important to try to include addiction into the demand for cigarettes. Figure 4-4 depicts a theoretical model where D_A is the addicted demand schedule, D_N is the non-addicted demand schedule, and D_T is the total demand schedule (summed horizontally). In the case of a CTB, because of consumer price increases, the non-addicted smokers eventually leave the market thereby reducing societal healthcare costs. If the remaining smokers are truly addicted, facing demand $D_A D_N$, their consumption of cigarettes is not affected by the high taxes and/or price of cigarettes. These trends continue until there are only addicted smokers left in the market and healthcare costs can no longer be reduced.

An issue with the demand for a harmful and addictive good is that of utility. More specifically, Bruber (2002) states:

> With respect to smoking, people may recognize that smoking provides them with utility (benefits) in the current time period, but that they will experience some disutility (such as impaired health) in some future time periods.

Taken a step further, future impaired health is not only a disutility to the individual, it is also a disutility to society, especially regarding healthcare costs. This ties right into the next section on healthcare costs associated with smoking.

Negative Externalities from Smoking: Review of Articles

In Appendix B, we discuss the effect of smoking on worker productivity. Annual costs due to smoking-related absences total $97 billion (CDC, 2008). We also examine healthcare expenditures in relation to cigarette consumption in Appendix B. Annual healthcare costs attributable to smoking total $96 billion (CDC, 2008).

Cigarette smoking is the primary risk factor for the development of chronic obstructive pulmonary disease (COPD) in the United States. COPD is the third leading cause of death in the United States, which claimed the lives of 124,477 people in 2007 (CDC, 2010). Approximately 85% to 90% of COPD deaths are caused by smoking (CDC, 2004). Cigarette smoking and exposure to tobacco smoke are associated with premature death from chronic disease and account for at least 30% of all cancer deaths and early cardiovascular disease and deaths (CDC, 2004). Between 2000 and 2004, an estimated 443,000 persons in the United States died prematurely each year as a result of smoking or exposure to secondhand smoke (CDC, 2005).

Secondhand smoke exposure predicted COPD and other tobacco-related mortality in a 17 year cohort study in China. The study followed 910 subjects who were exposed to secondhand smoke at home or at work, of which, 249 died due to coronary heart disease, lung cancer, COPD, or ischemic stroke. The general conclusion was that there is evidence supporting that secondhand smoke causes COPD and ischemic stroke (NCBI, 2012b).

According to the CDC, in 2009, the incidence of lung cancer in the United States was 205,974 and the number of deaths was 158,081 (US Cancer Statistics Working Group, 2013). Lung cancer deaths surpass colon, breast, and prostate cancer combined (American Cancer

Society, 2012). The lung cancer five-year survival rate is 16.3%, compared to colon, breast, and prostate cancer at 65.2%, 90%, and 99.9%, respectively (Howlader et al., 2012). Active smoking is responsible for about 90% of lung cancer cases (Alberg and Samet, 2003).

In a major ruling (November 27, 2012), Federal Judge Gladys Kessler ordered that major tobacco companies must: (1) say that they have deliberately deceived smokers; (2) tell the public the truth regarding the dangers of smoking; and (3) inform the public that smoking kills more people than murder, car crashes, drug abuse, and AIDS, combined (AP, 2012). In 1999, a large class action lawsuit was launched against the tobacco companies and a settlement occurred. The Master Settlement Agreement awarded: (1) $206 billion to the states spread out over 25 years; (2) $1.5 billion over 10 years to support state antismoking measures; and (3) $250 million to fund research into reducing youth smoking, banning on the use of cartoon characters, sporting-event sponsorships, and the dissolution of tobacco trade organizations (Jones, 2010).

Healthday.com (2012a) reported that "a frank and graphic nationwide media campaign to motivate smokers to quit seems to be working." A key component of the campaign called "Tips from Former Smokers" began airing in March 2012. The ads are broadcast on virtually every form of media, from newspapers to the internet. The most extreme part of the campaign are TV commercials wherein "a dozen or so ex-smokers offer very personal and often harrowing testimonials on the devastating health consequences that can result from years of tobacco use."

Healthday.com (2012b) reports on new estimates from the US Congressional Budget Office (CBO) that "a 50-cent increase in the US tax on cigarettes could have a big impact on public health, though the benefits for the national wallet are less clear." The CBO reports that the tax increase to $1.51, from the current Federal tax of $1.01, "could result in more than 3 million

more nonsmokers by 2085—by either spurring people to quit or keeping would-be smokers from ever lighting up."

Investigators analyzed data on more than 47,000 patients who had undergone colorectal resection due to cancer, inflammatory bowel disease, or diverticular disease. The researchers found that smokers faced a 30% higher likelihood of experiencing some type of major complication in the first 30 days after surgery, compared to those who had never smoked. The investigators also found that smokers were more likely to die within that 30-day period than patients who had never smoked (Reuters Health, 2012). Additionally, individuals who smoke may face a higher risk of complications and mortality after colorectal surgery (Reuters Health, 2012).

Results

The end of the US tobacco production quota program paid for by a consumer tax had a significant negative impact on the consumers of tobacco products even though, perhaps, some consumers became better off because the higher prices persuaded them to give up smoking and find healthier substitutes. Within this context, addiction played a role in the outcome of the buyout, as those who truly could not quit smoking paid even more to continue smoking. Importantly, the tobacco buyout led to a decrease in society's smoking-related healthcare costs due to the decrease in demand for tobacco. It also led to an increase in worker productivity as employees reduced the amount of smoking-related sick days taken. Of course, these two outcomes depended on what percentage of the smoking population was or was not truly addicted. Additional research in the future will be necessary to determine the true impact that non-addicted smokers had on reducing demand.

Further work on this subject might want to entertain the notion of "healthcare-cost equivalents" borrowed from Schmitz, Kennedy, and Hill-Gabriel (2012) on environmental equivalents. If we compare our estimates on the $2.3 billion consumer loss over 10 years due to the US Tobacco Buyout with the CDC's annual estimates of $193 billion in economic loss attributable to smoking, it is clear that the money saved in healthcare costs by even a slight reduction of smoking would outweigh heavily the consumer loss incurred due to higher tobacco prices. The benefit-cost ratios attached to programs aimed at reducing smoking can greatly exceed one when healthcare costs are taken into account.

Another extension of the present work will be on the effect of the US Tobacco Buyout on the environment. More specifically, the main research question would be as follows: What are the potential implications of the U.S. Tobacco Buyout on the amount of litter produced from smoking? Given that the most frequently littered items are cigarette butts—approximately 38% of all U.S. roadway litter (Schultz et al., 2009), it would be interesting to examine how much of the tobacco product litter (TPL) could have been reduced by the US Tobacco Buyout.

Table 4-1. Economic gains and losses under an inflated quota buyout of 1.00/lb. (with a true quota value of $0.30/lb.)*

Component	Area	1999–2003 Average (US million dollars)
Inflated Value of Quota	$lmno$	700
Net Producer Gain	$(lp_1eo - enca)$	201.9
Consumer Loss	lp_1ao	292.5
Deadweight Loss	onb	95.0

* $E_{DT} = -1.1$, $E_S = 0.7$

Table 4-2. Economic gains and losses upon culmination of the inflated quota buyout ($1.00/lb. quota buyout value)*

Component	Area	1999–2003 Average (US million dollars)
Net Producer Loss	$\left[(lp_0go) - (gnb)\right]$	294.55
Consumer Gain	lp_0bo	389.55

* $E_{DT} = -1.1$, $E_S = 0.7$

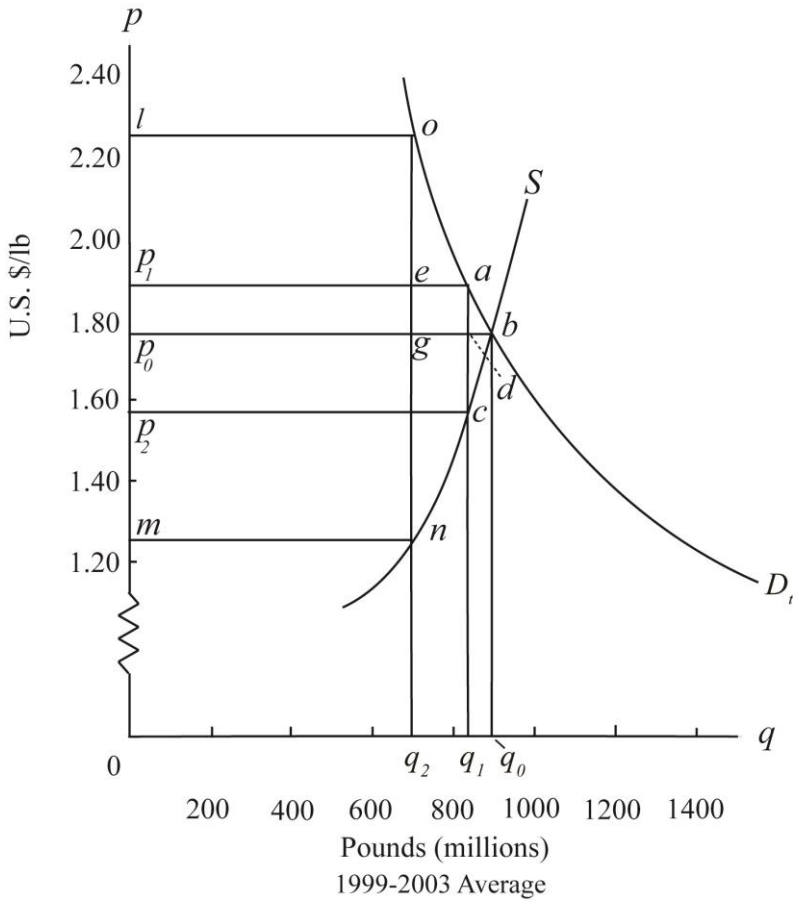

Figure 4-1. $1.00/lb. quota buyout

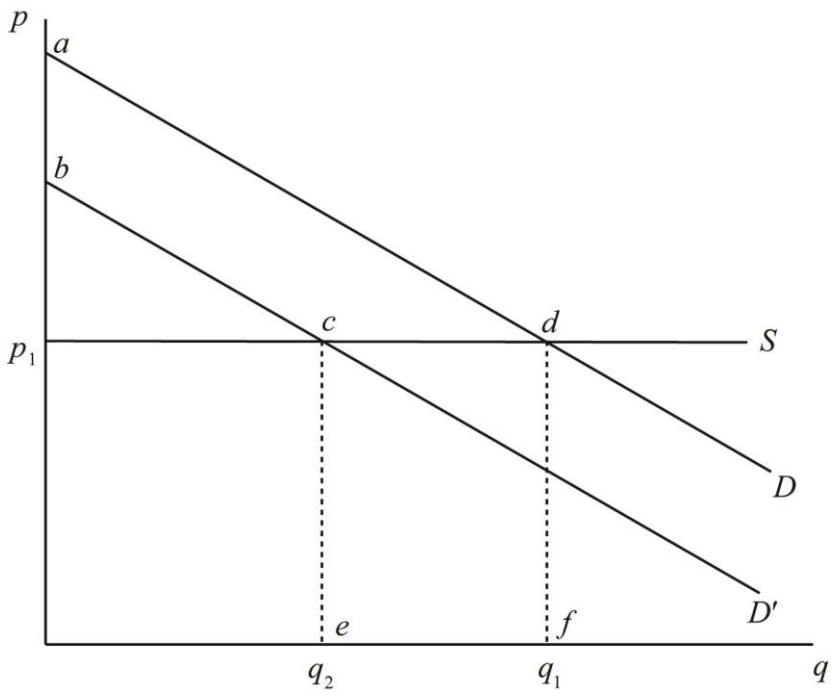

Figure 4-2. Demand for tobacco

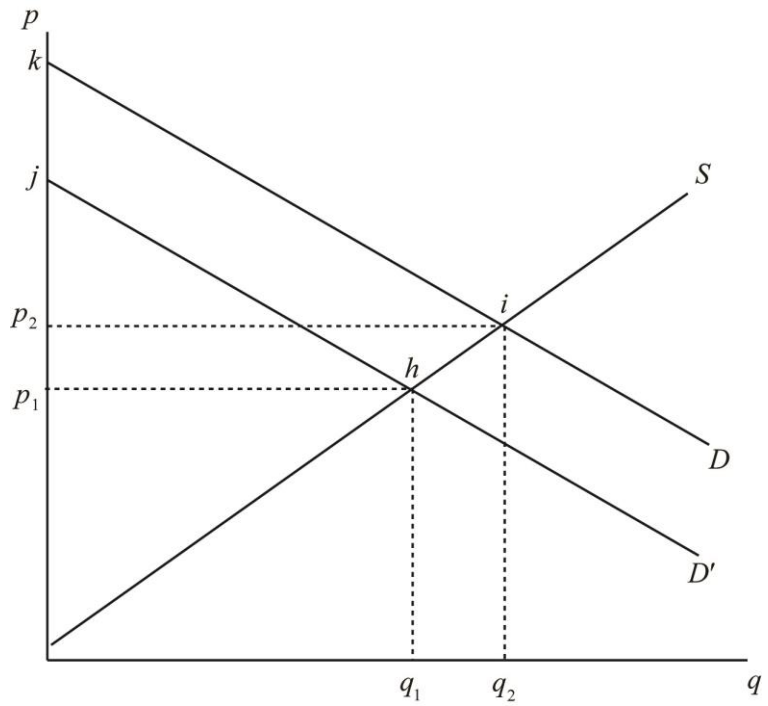

Figure 4-3. Demand for organic food

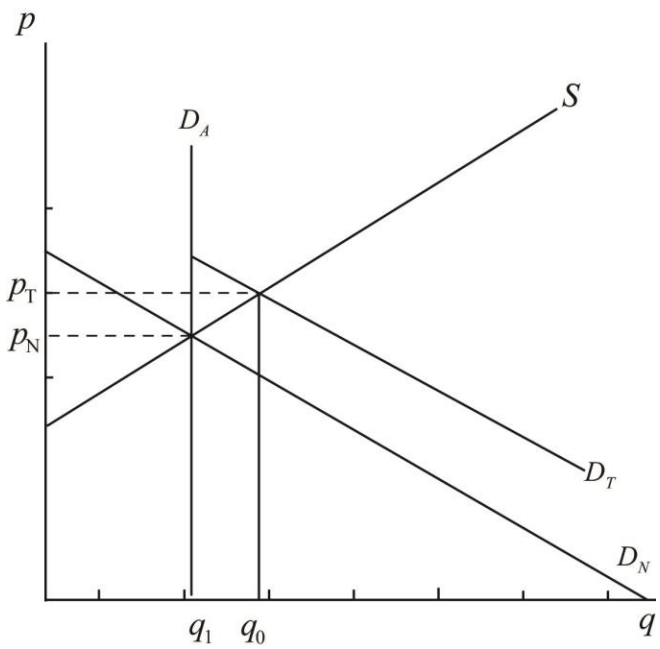

Figure 4-4. Theoretical model for demand of addictive good

CHAPTER 5
CONCLUSIONS

US Tobacco Quota Buyout

The US Tobacco Program instituted in 1938 became controversial for several reasons, and was terminated in 2004. The tobacco producers and landowners could not benefit from the tobacco program buyout if they were paid only the true market quota value. Through a successful bidding up of the quota rental rate and effective lobbying, the final compensation package was much greater than it would have been under the *true quota value*. Our results show that, as the spread between the *true quota value* and the *inflated quota value* increases, so does the net return to producers from removing the quota. This was the incentive for quota owners to bid up the quota value.

The initial implementation of the tobacco quota adversely affected consumers as they faced higher tobacco prices. The tobacco quota buyout could have made the initial impact on consumers even worse with the levying of a tobacco consumer tax (which was designed to be in place for 10 years), given the use of an inflated quota for the basis of compensation. Consumers will, however, realize considerable gains at the end of the buyout when competitive equilibrium is restored after 2014. It is important to stress that under a consumer tax model, producers cannot gain from a production quota buyout if they are paid only the *true quota value*. As our study shows, compensation was based on far greater quota values that generated significant net producer gains. In turn, these net producer gains far exceeded those generated from quota implementation.

Given these considerations, the key issues concerning this buyout were the legality of the buyout itself, the societal efficiency ramifications of the buyout, and the amount of compensation to be paid to owners of quota (this included both producers and landowners). Three points can be

made from the issues above: (1) there was no real legal basis for the tobacco buyout; (2) even though there was a huge burden on consumers due to the nature of the buyout from an economic stand point, the US Tobacco Buyout eliminated the deadweight loss because of the initial quota implementation; and (3) as we have shown in our analysis, quota holders successfully exhibited rent-seeking behavior as they were compensated the inflated amount of the buyout.

Varying the Method of Compensation

There are sharp differences but also similarities between the two different types of buyouts discussed in this article, especially when the buyouts are based on *true quota values*. Under a TB, producers always gain from the removal of the quota. Under a CTB, producers may lose or gain, depending on the length of the compensation period. As our theoretical section highlights, in the simplest case, the consumer impacts and efficiency gains from removing the quota are identical between a TB and a CTB.

Under an *inflated quota value*, producers gain the most given a TB. Once again, it is possible for producers to gain from a CTB, but these gains are considerably less than under a TB. Similar to the *true quota value* case, in the simplest scenario, on net, consumers are unaffected by a CTB, as are the net efficiency gains. In the case where there are multiple years of compensation within Period I, consumer losses and net efficiency losses can be significant under a CTB.

Producers, consumers, and society favor a TB for several reasons. Producers are compensated considerably more under a TB, consumers are not burdened with the charge of funding the buyout, and society does not face additional efficiency losses due to the buyout. Importantly, this study shows that different policy instruments can have markedly different distributional consequences but need not affect the size of economic efficiency gains from a policy change.

Partial-equilibrium Framework versus General-equilibrium Framework

The end of the US Tobacco Quota Program paid for by a consumer tax had a significant negative impact on the consumers of tobacco products even though, perhaps, some consumers became better off because the higher prices persuaded them to give up smoking and find healthier substitutes. Within this context, addiction plays a role in the outcome of the buyout, as those who truly could not quit smoking paid even more to continue smoking. Importantly, the tobacco buyout led to a decrease in society's smoking-related healthcare costs due to the decrease in demand for tobacco. It also led to an increase in worker productivity as employees reduced the amount of smoking-related sick days taken. Of course, these two outcomes depend on what percentage of the smoking population was or was not truly addicted. Additional research would be necessary to determine the true impact that non-addicted smokers had on reducing demand.

Further work on this subject might want to entertain the notion of "healthcare-cost equivalents" borrowed from Schmitz, Kennedy, and Hill-Gabriel (2012) on environmental equivalents. If we compare our estimates on the annual consumer loss due to the US tobacco buyout ($2.3 billion over 10 years) with the CDC's annual estimates of $193 billion in economic loss attributable to smoking, it is clear that the money saved in healthcare costs by even a slight reduction of smoking would outweigh heavily the consumer loss incurred due to higher tobacco prices. The benefit-cost ratios attached to programs aimed at reducing smoking can greatly exceed one (in some cases higher than 50) when healthcare costs are taken into account.

Another extension of the present work will be on measuring the effect of the U.S. Tobacco Buyout on the amount of litter produced from smoking. It would be interesting to examine how much of the tobacco product litter (TPL) could have been reduced by the US Tobacco Buyout.

APPENDIX A

SENSITIVITY ANALYSIS: VARYING ELASTICITIES

This section shows the economic effect of varying the supply and demand elasticities of the above models. The first case uses a slightly more elastic demand curve ($E_D = -1.6$ as opposed to $E_D = -1.1$). This seemingly minor change has several implications on the economic results of both implementing and removing the tobacco quota. While the value of the quota does not change, producers, consumers, and society are affected differently by its implementation. More specifically, this increase in demand elasticity translates into a 41% lower net producer gain, 36% lower consumer loss, and 25% higher deadweight loss (Table A-1).

Table A-1. Economic gains and losses under quota implementation
($E_D = -1.6$ and $E_S = 0.87$)

Component	*Area*	*1999–2003 Average (US million dollars)*
True Value of Quota	p_1p_2ca	251.8
Net Producer Gain	$\left[(p_1p_0da)-(dcb)\right]$	51.2
Consumer Loss	(p_1p_0ba)	61.1
Deadweight Loss	(acb)	10.0

Given a TB, the more elastic the demand, the higher are the net producer gains and the lower are the consumer gains from the removal of the quota (in both the *true quota value* and *inflated quota value cases* [Table A-2]). However, given a CTB, the more elastic the demand, the lower is the Period I producer gain and the lower is the Period I consumer loss from the removal of the quota (in the inflated case, as there is no net producer gain in the *true quota value* case). After competitive equilibrium is restored (Period II), the producer loss and the consumer gain are both lower under the more elastic demand (Table A-3).

Table A-2. Tobacco buyout (treasury funds) results: True quota value vs. inflated quota value ($E_D = -1.6$ and $E_S = 0.87$)

True Quota Value			*Inflated Quota Value*		
Component	*Area*	*US $ million*	*Component*	*Area*	*US $ million*
Government Cost	(p_1p_2ca)	251.8	Government Cost	(p_3p_2cf)	839.4
Net Producer Gain	(p_0p_2cb)	200.6	Net Producer Gain	$[(p_0p_2cb)+(p_3p_1af)]$	788.2
Consumer Gain	(p_1p_0ba)	61.1	Consumer Gain	(p_1p_0ba)	61.1
Efficiency Gain	(acb)	9.8	Efficiency Gain	(acb)	9.8

Table A-3. Tobacco buyout (consumer funds) results: True quota value vs. inflated quota value ($E_D = -1.6$ and $E_S = 0.87$)

True Quota Value			*Inflated Quota Value*		
Component	*Area*	*US $ million*	Component	*Area*	*US $ million*
Tax Value	(p_1p_2ca)	251.8	Tax Value	$(lmno)$	683.4
Producer Gain Period I	N/A	0	Producer Gain Period I	$[(lp_1jo)-(jnca)]$	131.0
Producer Loss Period II	$[-(p_1p_0da)+(dcb)]$	-51.2	Producer Loss Period II	$[-(lp_0go)+(gnb)]$	-193.2
Consumer Loss Period I	(p_1p_0ba)	-61.1	Consumer Loss Period I	(lp_1ao)	-278.6
Consumer Gain Period II	(p_1p_0ba)	61.1	Consumer Gain Period II	(lp_0bo)	344.7

The second case uses a slightly more elastic supply curve ($E_S = 0.98$ as opposed to $E_S = 0.7$). Once again, the value of the quota does not change but the impact on producers, consumers, and society does. In fact, the more elastic the supply curve, the higher are the net producer gain, consumer loss, and deadweight loss from the implementation of the quota. The results we see in Table A-4 were higher than those in both the original case and the increased demand-elasticity case.

Table A-4. Economic gains and losses under a tobacco quota implementation ($E_D = -1.1$ and $E_S = 0.98$)

Component	*Area*	*1999–2003 Average (US million dollars)*
True Value of Quota	p_1p_2ca	251.8
Net Producer Gain	$\left[(p_1p_0da)-(dcb)\right]$	111.3
Consumer Loss	(p_1p_0ba)	122.9
Deadweight Loss	(acb)	12.0

Given a TB, the net producer gain was lower under this scenario of a more elastic supply curve while the consumer gains were higher (Table A-5). Given a CTB, the more elastic the supply curve, the higher is the net producer gain and the higher is the consumer loss from the removal of the quota. After competitive equilibrium is restored, both the net producer loss and consumer gains were significantly higher than they were using the original elasticities (Table A-6).

Table A-5. Treasury buyout results: True quota value vs. inflated quota value

True Quota Value			*Inflated Quota Value*		
Component	*Area*	*US million dollars*	*Component*	*Area*	*US million dollars*
Government Cost	(p_1p_2ca)	251.8	Government Cost	(p_3p_2cf)	839.4
Net Producer Gain	(p_0p_2cb)	140.5	Net Producer Gain	$\left[(p_0p_2cb)+(p_3p_1af)\right]$	728.1
Consumer Gain	(p_1p_0ba)	122.9	Consumer Gain	(p_1p_0ba)	122.9
Efficiency Gain	(acb)	12.0	Efficiency Gain	(acb)	12.0

Table A-6. Consumer tax buyout results: True quota value vs. inflated quota value

True Quota Value			*Inflated Quota Value*		
Component	*Area*	*US million dollars*	*Component*	*Area*	*US million dollars*
Tax Value	(p_1p_2ca)	251.8	Tax Value	$(lmno)$	700.0
Producer Gain Period I	N/A	0	Producer Gain Period I	$[(lp_1jo)-(jnca)]$	229.1
Producer Loss Period II	$[-(p_1p_0da)+(dcb)]$	-111.3	Producer Loss Period II	$[-(lp_0go)+(gnb)]$	-341.5
Consumer Loss Period I	(p_1p_0ba)	-122.9	Consumer Loss Period I	(lp_1ao)	-322.2
Consumer Gain Period II	(p_1p_0ba)	122.9	Consumer Gain Period II	(lp_0bo)	451.4

APPENDIX B
NEGATIVE EXTERNALITIES

Smoking and Worker Productivity

Each year there are at least $97 billion worth of productivity losses caused by smoking; unbelievably, this estimate does not even include the costs from smoking-caused disability during work lives, smoking-caused sick days, or smoking-caused productivity declines while on the job (CDC, 2008). The only costs included were those estimated from productive work lives that were shortened by smoking-caused death. Additionally, a study done by Weng, Ali, and Leonardi-Bee (NCBI, 2012a) concluded that quitting smoking seemed to reduce absenteeism in the workplace and, as a result, there were substantial cost-savings for employers.

Consider Figure B-1 where we examine the effect of quitting smoking on the productivity of laborers. The supply of labor is denoted by S and the demand is denoted by D. Hourly wage is represented by W and quantity of hours worked is represented by Q. Once again, given a consumer tax funded buyout, we can assume that the demand for cigarettes decreases. The effect on productivity is captured in a supply shift outward from S to S', where quitting smoking has reduced health problems associated with smoking, and thereby has increased the amount of hours laborers can work from Q_1 to Q_2.

Healthcare Costs

The following is a discussion in healthcare costs, recognizing that to some, they are likely to be controversial. While the estimated costs from consuming tobacco are estimated as being large, one should keep in mind that there may be several major drawbacks from the various studies that have been done. The CDC (2008) report that during the 2000–2004 period, cigarette smoking was responsible for $96 billion in direct medical costs (or roughly 4% of the healthcare costs in 2010). Consider Figure B-2 where we examine healthcare expenditures in relation to

cigarette consumption. Healthcare expenditures are denoted by E and quantity of cigarettes consumed is denoted by Q. The supply of cigarettes is represented by S while the initial demand for cigarettes is represented by D_0. In the event of a CTB, as the price rises, a reduction in the demand for cigarettes is captured in a shift from D_0 to D_1. The quantity demanded shifts from Q_1 to Q_2, and healthcare expenditures decrease from E_1 to E_2.

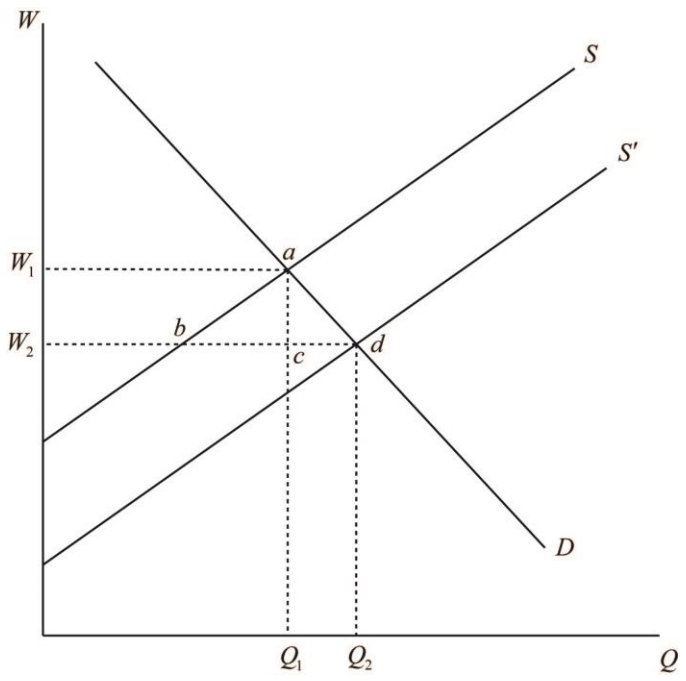

Figure B-1. Labor market effect

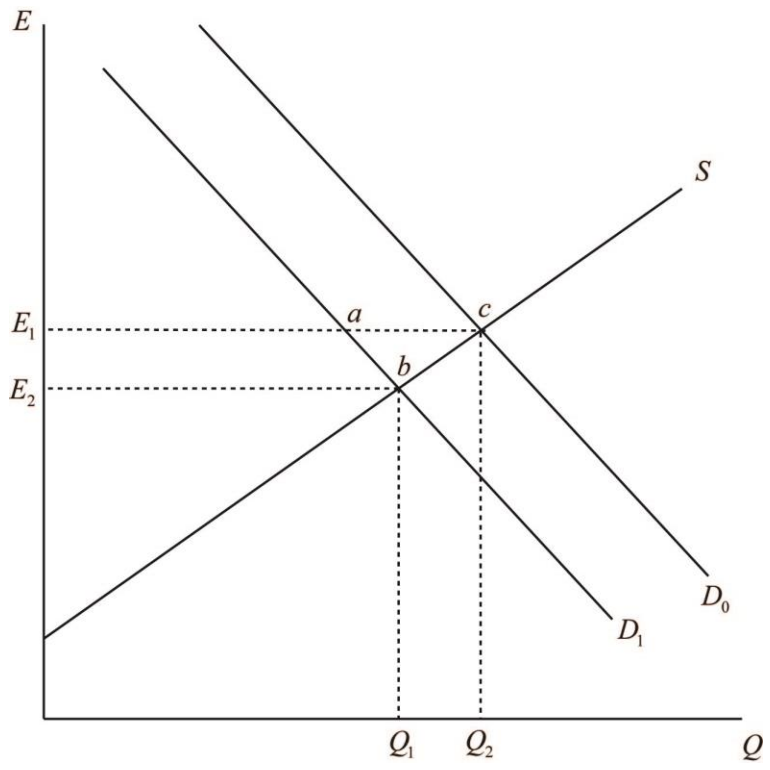

Figure B-2. Healthcare costs

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Dwayne J. Haynes completed both his undergraduate and master's degrees at the University of Florida in Gainesville. In addition to his coursework and dissertation research, Dwayne has served as both a teacher's assistant and research assistant in the Food and Resource Economics Department. Portions of his dissertation have been presented in the Southern Agricultural Economics Association meetings (2013) and the Fifth Annual Conference of the Society for Benefit-Cost Analysis (2013).

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