Cheese - marketing

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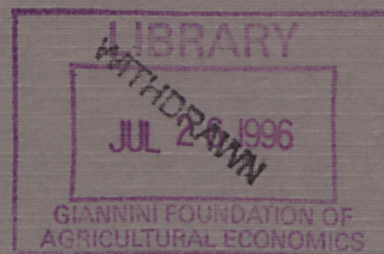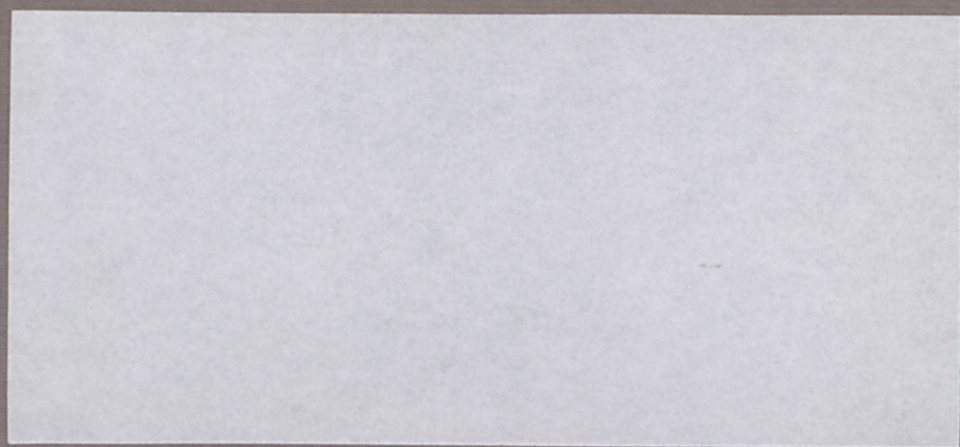
# SELLING IMPORT QUOTA LICENSES:
## THE U.S. CHEESE CASE

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## Abstract

Recent discussions on U.S. trade policies suggest that import quotas should be auctioned to ensure the U.S. Treasury acquires the quota rent. However, studies which have estimated the potential benefits have ignored important details of import quota regimes, assumed perfect competition and no retaliation from exporters. This paper aims to deal with these three criticisms with an application to the U.S. import quota regime for cheese. The results show that in oligopolistic settings, the government could maximize potential rents from import restrictions by auctioning off an optimal quota. However, preventing retaliation reduces Treasury gains. Further, license sales have distributional implications for U.S. cheese processing firms and consumers. Depending on the source of rent dissipation, selling cheese quota licenses may result in a net welfare loss.

Introduction

Recent discussions on U.S. trade policies suggest that import licenses could be sold to ensure that the U.S. Treasury captures the rent from import quota regimes (see studies by, the Congressional Budget Office, Bergsten et al., and Feenstra). Typically, in the sectors that are protected by quantitative import restraints (e.g., autos, steel, machine tools, sugar and dairy products) all or some of the quota rent is captured by the exporting country and, in some cases, also by importing firms. Rent dissipation to the exporter is clearly a loss to the U.S. economy which, it is argued, could be retrieved by auctioning import licenses. For example, Alan Blinder suggested in Business Week that "Auctioning import rights is one of those marvelous policy innovations that create winners, but no losers, or, more precisely, no American losers. The big winner is obvious: the U.S. Treasury" (March 9, 1987).

There have been some attempts to estimate how much revenue would be generated through selling import quota licenses. The Congressional Budget Office (CBO) estimates potential revenue gains of $3.5-$5 bn in 1987 while Bergsten et al. estimate gains of $5.1 bn in 1987. The sector which generates the highest revenue gain from auctioning in both studies is the textile sector with the steel sector also generating substantial gains. The sugar and dairy import quota regimes are estimated in both studies to generate relatively smaller gains of $300m and $200m, respectively.

There are three important criticisms of these estimates. First, Bergsten et al. assume that the per unit quota rent is constant across all varieties of imported cheese. However, empirical evidence suggests that this is not true which leads to a re-evaluation of the quota rents currently generated by the U.S. dairy import regime. Second, they typically assume perfect competition in deriving the estimates, hence taking the difference between internal and world prices as the estimate of the quota premium. However, the sectors for which these estimates were made are typically characterized, to varying degrees, by imperfect competition. Krishna has argued in a series of papers (e.g., Krishna 1988, 1990) that, when imperfect competition prevails, most estimates are likely to be erroneous since exporters' responses to auctioning should be taken into

account. Furthermore, where markets are oligopolistic, import license sales could also result in 'rent-shifting' effects in a strategic trade policy context (e.g., Brander and Spencer).

Third, the quota revenue estimates can be criticized on the grounds that the unilateral imposition of auctioned quotas may provoke retaliation from the U.S.'s competitors and may possibly contravene GATT rules. In dealing with this criticism, Feenstra has recalculated the potential revenue from auctioning under the constraint that exporters are not made worse off than their free trade position. Although he still assumes perfect competition, the revenue generated from auctioning under these circumstances is considerably lower (around $1.5 bn excluding autos) than that estimated by the CBO and Bergsten et al. Auctioning U.S. dairy quotas would raise $110m as opposed to $200m. However, it should be noted that Feenstra also does not account for differences in per unit rent across varieties of cheese.

This paper explores the auctioning debate in the context of the U.S. dairy quota regime taking into account the three major criticisms of the CBO and Bergsten et al. studies. Specifically, it utilizes a differentiated oligopoly model to derive equilibrium quota license prices which may also generate strategic rent-shifting effects. Further, since a proportion of the quota rents are captured by the exporter, the level of the quota license price is derived keeping the rate of rent dissipation to the exporter constant in order not to provoke retaliation.[1] The model is calibrated to several varieties of U.S. cheese imports to provide empirical estimates of the net welfare and distributional effects of license sales. The main results are two-fold: first, allowing per unit rents to vary across varieties of cheese, estimates of the U.S. Treasury benefits from import license sales are considerably lower than those suggested by previous studies. Second, selling import licenses, while generating revenue for the U.S. Treasury may, when markets are (to varying degrees) oligopolistic, generate a net welfare gain. In other circumstances (i.e., when the government wishes to prevent retaliation) a net welfare loss may result. In both cases, however, domestic cheese-processing firms benefit while U.S.

consumers lose.

The paper is organized as follows: section 1 gives a brief overview of the U.S. dairy import quota system and discusses some features of quota rent capture in this sector. The theoretical model is presented in section 2. The calibration of the theoretical model is discussed in section 3 with the results being presented in section 4. Section 5 summarizes and concludes the paper with some suggestions for future research.

1.  U.S. Dairy Import Quotas

Import quotas were first introduced in 1951 as a means of supporting the U.S. dairy market. Although quota allocations and the detailed operation of the quota system has periodically changed, the regime has remained largely intact in its original form. 95 percent of the quantitative restrictions refer to imports of cheese where the quota allocation determines the source, the variety and amount of cheese to be imported annually. Import licenses are distributed to eligible importers by the Department of Agriculture with an administrative fee being charged to importers. As Table 1 shows, the quota regime has been successful in containing the supply of foreign-produced cheese to the U.S. market, with imports - even when one accounts for non-quota cheese - accounting consistently for around 5-6 percent of the U.S. market.

Table 1.  U.S. Cheese Trade:  1980-1975.

| Year | U.S. Prod. (m lbs.) | Total Imports (m lbs.) | | | Market Share of Imports % | Quota Imports as % of Imports |
|------|---------|-------|-------|-----------|--------|--------|
| | | Total | Quota | Non-Quota | | |
| 1980 | 3968 | 231 | 195 | 36 | 5.5 | 84.4 |
| 1979 | 3715 | 248 | 118 | 130 | 6.3 | 47.6 |
| 1978 | 3520 | 242 | 111 | 131 | 6.4 | 45.9 |
| 1977 | 3358 | 209 | 106 | 103 | 5.9 | 50.7 |
| 1976 | 3320 | 207 | 97 | 110 | 5.9 | 46.8 |
| 1975 | 2811 | 179 | 92 | 88 | 6.0 | 51.4 |
| 1951 | 1161 | 52 | 28 | 24 | 4.6 | 53.8 |

Source:  Hornig.

Recently, Hornig et al. have undertaken a detailed study of the U.S. cheese import quota regime focussing specifically on the question of quota rent capture. They found that, for the varieties of cheese for which sufficient data were available, the U.S. Treasury received a relatively small proportion (mainly from tariff revenue) of the total quota rent available. As shown in Table 2, both importing firms and exporters received most of the quota rent with, on average, the exporter acquiring 42 percent of the quota rent and the importing firm getting 23 percent. In some cases, importing firms and exporters get around 80 percent of the quota rent. This is contrary to what Bersten et al. surmise about U.S. restrictions on cheese imports. Specifically, their calculations assume that the exporters get none of the rent; rather, the importing firms acquire all of the dissipated quota rent. Further, the data in Table 2 suggests that per unit rent can vary substantially across different varieties of cheese. Thus, calculations that assume a constant per unit rent for all cheeses are likely to be erroneous. Bergsten et al. (implicitly) assume a per unit rent of $1.03 which clearly is a mis-representation particularly for some of the larger import categories (e.g., cheddar from New Zealand and Australia).

Aggregating the figures in Table 2 over the whole of the quota regime suggests that the U.S. lost $82m in dissipated quota rent in 1980, $47m of which was lost to exporting countries. Clearly, the purpose of selling import licenses for cheese would be for the U.S. Treasury to recoup the dissipated quota rent particularly from the exporter as this represents a loss to the U.S. economy.

The remainder of the paper aims to identify the effects of selling licenses for U.S. cheese imports. Although the theoretical model is a general one, the empirical estimates of the net welfare and distributional effects of license sales are restricted to those varieties of cheese presented in Table 2 since use is made of the information on the level of rent dissipation to the exporter calculated by Hornig et al.

Table 2.  Cheese Import Quota Rents and Components
(Constant 1980 $/lb)

| Type | Total Rent | Importers Rent | Exporters Rent | Tariff Revenue |
|---|---|---|---|---|
| Blue Mold (Italy) 1980 | 1.22 | 0.33 | 0.60 | 0.29 |
| Average  1980-1974[1] | 1.27 | 0.35 | 0.65 | 0.28 |
| Blue Mold (Denmark) 1980 | 0.23 | -0.01 | 0.02 | 0.22 |
| Average  1980-1976[1] | 0.33 | 0.03 | 0.06 | 0.23 |
| Edam & Gouda (Netherlands)  1980 | 0.54 | 0.04 | 0.29 | 0.21 |
| Average  1980-1974 | 0.73 | 0.03 | 0.47 | 0.23 |
| Italian IOL (Italy) 1980 | 1.83 | 1.15 | 0.32 | 0.36 |
| Average  1980-1974 | 1.70 | 0.70 | 0.54 | 0.46 |
| Cheddar (New Zealand) 1980 | 0.65 | 0.27 | 0.27 | 0.11 |
| Average 1980-1974 | 0.67 | 0.24 | 0.30 | 0.13 |
| Cheddar (Australia) 1980 | 0.53 | 0.38 | 0.02 | 0.11 |
| Average 1980-1978[1] | 0.54 | 0.38 | 0.03 | 0.11 |

[1] Figures may not add up due to rounding.

Source:  Hornig, et al.

## 2. Theoretical Framework

The model of oligopoly used in this paper is a standard model of differentiated oligopoly taken from the industrial organization literature (see Dixit (1988), Singh and Vives, and Cheng among others). The main feature of the model is that it follows a general conjectural variations approach so that no specific form of behavior is imposed on the model. The structure of the market (for each cheese variety) is divided into two, where the domestic firms compete with the exporters in the U.S. market.[2] Domestic and foreign produced cheeses of the same variety are assumed to be imperfect substitutes. The market for each individual cheese variety is modelled separately, with no cross-effects assumed between different varieties of cheese in the U.S. market. This has the attraction of identifying different degrees of competition in each cheese sub-sector. However, it does so at the expense of ignoring cross effects between different cheese varieties which may affect the final welfare outcome.[3] While not explicitly modelled, such effects are likely to reinforce the results of this paper as Anderson has shown that product heterogeneity (between different types of cheese) is likely to exacerbate the welfare losses associated with quota regimes.

### (a) Model Outline

Home produced goods are denoted by subscript 1, imported goods by subscript 2. Focussing on the home market, consumer surplus is given by:

$$(1) \qquad \Gamma = f(Q_1, Q_2) - p_1 Q_1 - p_2 Q_2$$

where the utility function $f(Q_1, Q_2)$ is defined as:

$$(2) \qquad f(Q_1, Q_2) = a_1 Q_1 + a_2 Q_2 - \frac{1}{2}(b_1 Q_1^2 + b_2 Q_2^2 + 2k Q_1 Q_2)$$

From (1) and (2) the inverse demand functions for the home produced and imported goods can be derived:

$$(3) \qquad p_1 = a_1 - b_1 Q_1 - k Q_2$$

$$(4) \qquad p_2 = a_2 - k Q_1 - b_2 Q_2$$

where all parameters are positive, $b_1 b_2 - k^2 > 0$ since the products are imperfect substitutes, $p_1$ and $p_2$ are prices and $Q_1$ and $Q_2$ are quantities.

On the supply side, there are $n_i$ firms in the home and foreign economies. Costs are assumed to be constant. Profits for a representative firm in each country are given by:

(5)     $\pi_1 = (p_1 - c_1)q_1 - f_1$

(6)     $\pi_2 = (p_2 - c_2 - r_1)q_2 - f_2$

where $p_i$ are prices, $q_i$ are individual firm quantities, and $c_i$ and $f_i$ are marginal and fixed costs, respectively. Initially it is assumed that there is no rent dissipation so that $r$ is rent per unit of import which the home government obtains through selling quota licenses. $r_1$ is therefore the license price and enters the exporter's profit function if licenses are sold to the exporter or, by assumption there is complete pass-through of the license price to the exporting firm if the licenses are sold to the importing agents (i.e. the importer will offer the exporter $(P_2 - r_1)$).

As noted above, the model is one where firms' reactions to one another are treated as a Nash equilibrium with conjectural variations. The conjectural variations parameters are derived from the first-order conditions of the respective profits functions:

(7)     $p_1 - c_1 + q_1 dp_1/dq_1 = 0$

(8)     $p_2 - c_2 - r_1 + q_2 dp_2/dq_2 = 0$

where $dp_i/dq_i$ is the conjectural variations parameter, i.e. the firm's expectation of how market prices will vary with changes in its output. Therefore, if a representative firm plays Cournot, it believes rival firms will not change output in response to a change in $q_i$, hence $dp_i/dq_i = -b_i$, the slope of the inverse demand function. If the market were perfectly competitive, a change in one firm's output would have no effect on market price, i.e., $dp_i/dq_i = 0$.

Aggregating over the $n_i$ firms generates:

(9)     $p_1 - c_1 - Q_1 V_1 = 0$

(10)     $p_2 - c_2 - r_1 - Q_2 V_2 = 0$

where $V_i$ is the aggregate conjectural variations parameter. Thus, for Cournot

behavior, $V_i = b_i/n_i$ and as $n_i$ increases, the more competitive the Cournot outcome becomes. In the limit $V_i = 0$, i.e., perfect competition.

Finally, equilibrium prices and quantities in the model are obtained by combining (3) and (4) with (9) and (10), the explicit solutions for prices and quantities being:

$$(11) \qquad \begin{bmatrix} Q_1 \\ Q_2 \end{bmatrix} = \frac{1}{\Delta'} \begin{bmatrix} b_2 + V_2 & -k \\ -k & b_1 + V_1 \end{bmatrix} \begin{bmatrix} a_1 - c_1 \\ a_2 - c_2 - r_1 \end{bmatrix}$$

$$(12) \qquad \begin{bmatrix} p_1 \\ p_2 \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} - \frac{1}{\Delta'} \begin{bmatrix} \Delta + b_1 V_2 & kV_1 \\ kV_2 & \Delta + b_2 V_1 \end{bmatrix} \begin{bmatrix} a_1 - c_1 \\ a_2 - c_2 - r_1 \end{bmatrix}$$

where $\Delta = (b_1 b_2 - k^2)$, $\Delta' = (b_1 + V_1)(b_2 + V_2) - k^2 = (\beta_1 \beta_2 - k^2)$, $\beta_i = (b_i + V_i)$

## (b) Selling Quota Licenses

Since the model is one of imperfect competition, the sale of import licenses has the potential for generating rent-shifting effects. This is associated with the work on strategic trade policy developed by, among others, Brander and Spencer and Dixit (1988). Such rent-shifting effects will not only increase government revenue from the sale of import licenses but will also increase national welfare.

However, the U.S. government may also wish to prevent retaliation from the cheese exporting countries. The no-retaliation rule that is employed here is that the percent quota rent captured by the exporter can be retained when the U.S. government sells import licenses. It will be the case, therefore, that the level of the equilibrium license price will depend on the level of per unit quota rent the exporter is allowed to retain. However, it is also the case that the level and effects of license prices will depend on the source of rent dissipation in the exporting country i.e. whether it is the privately-owned cheese processing firm or the exporting countries' marketing board that captures the quota rent.[4]

Three cases are therefore considered. The first, the benchmark case, is the optimal license price when there is either no rent dissipation or the government

is not concerned with retaliation, it only being concerned with retrieving the dissipated quota rent. Cases 2 and 3 develop scenarios where the U.S. government is concerned with retaliation but in each case the quota rent is captured by the privately-owned exporting firm (Case 2) or the exporters' marketing boards (Case 3).

**(i) Case 1: No Quota Rent Dissipation**

The government's aim is to maximize national welfare by choosing the optimal value for the license price $r_1$.[5] Initially it is assumed that the government retains all of the quota rent or is not concerned with the possibility of retaliation. National welfare is defined as the sum of consumer surplus $\Gamma$, domestic firms' profits and government revenue as given by:

$$(13) \qquad W = \Gamma + Q_1(p_1 - c_1) + r_1 Q_2$$

Maximizing welfare with respect to $r_1$ gives the first-order condition:

$$(14) \qquad \frac{\partial W}{\partial r_1} = \frac{k}{\Delta'}(a_1 - c_1) - \frac{\beta_1}{\Delta'}(a_2 - c_2) + Q_1\left(\frac{kV_1}{\Delta'}\right) + Q_2\left(1 + \frac{V_2\beta_1}{\Delta'}\right)$$

where $\beta_1$, $\beta_2$ and $\Delta'$ are defined as above.

Substituting in for $Q_1$ and $Q_2$ from (11) gives the optimal license price as:

$$(15) \qquad r_1 = \frac{k(a_1-c_1)(V_1\beta_2-V_2\beta_1) + (a_2-c_2)(V_2\beta_1^2-k^2V_1)}{\beta_1^2(\beta_2+V_2) - k^2(\beta_1+V_1)}$$

This license price with no rent dissipation is identical to an optimal tariff and will lead to an increase in welfare in a strategic trade policy sense (Dixit, 1988). The level of imports (the optimal quota) this generates can be found by substituting (15) into (11).[6]

**(ii) Case 2: Quota Rent Dissipation/Private Firms**

As shown in Table 2, quota rent dissipation to the exporting country is a feature of the quota regime.[7] Case 2 considers the effect on the license price when the cheese exporting firm captures the quota rent and the U.S. government, allows the level of rent dissipation to remain constant. The aim of the quota

license scheme in these circumstances would, therefore, be to increase government revenue for a given level of quota rent passed to the cheese processing firms in the exporting country.

National welfare is therefore redefined as:

$$(16) \qquad W = \Gamma + Q_1(p_1 - c_1) + r_2Q_2 - r_2Q_2(1 - \alpha).$$

Where $\alpha$ is the proportion of rent retained by the government and varies between zero and one. $r_2Q_2(1 - \alpha)$ is, therefore, the level of rent dissipation to the exporter in the quota regime. The government chooses the quota license price that will maximize national welfare. The exporting country's cheese processing firms' profits function is now given by:

$$(17) \qquad \pi_2 = (p_2 - c_2 - \alpha r_2)Q_2 - f_2$$

The equilibrium license price that is consistent with this framework is given by:

$$(18) \qquad r_2 = \frac{k(a_1-c_1)(V_1\beta_2-V_2\beta_1) + (a_2-c_2)(V_2\beta_1^2-k^2V_1)}{\alpha[\beta_1^2(\beta_2+V_2) - k^2(\beta_1+V_1)]}$$

The relationship between the license price with and without quota rent capture to the exporting private firm can be seen by comparing (18) with (15). This is given as:

$$(19) \qquad \frac{r_2}{r_1} = \alpha^{-1}.$$

Thus, if the government is concerned with avoiding retaliation, the license price in this case, relative to the case where there is no rent dissipation or retaliation is not a concern of the government, is the reciprocal of the level of quota rent retained by the U.S. government.

This suggests that $r_2$ could be relatively high. For example, if the government only retained half of the quota rent, raising government revenue through selling import licenses, would lead to a license price that would be double that of a license price when it was not concerned with retaliation.

Interestingly, however, the welfare effects of selling licenses at $r_2$ are exactly the same as selling import licenses at $r_1$. This is because the cheese exporting firms' profits functions have now changed. Since equations (11) and (12) would now be re-written to account for this, substituting in $\alpha r_2$ for $r_1$, it is obvious that the change in prices and quantities following the sale of import licenses will be exactly the same in both cases. Thus, license prices may be higher in Case 2 relative to Case 1, but the welfare effects are the same and both are consistent with the strategic trade policy outcome.

(iii) Case 3:   Quota Rent Dissipation/Marketing Boards

This case considers the possibility that marketing boards in the exporting country capture the quota rent. The possibility arises since (as Hornig notes), in some cases, processed cheese exports are coordinated by marketing boards and/or cooperatives, even though the private processing firms retain autonomy over production decisions.[8] National welfare is again given by (13) and the exporting firms' profit function reverts back to (6). The equilibrium license price ($r_3$) is now given by:

$$(20) \qquad r_3 = \frac{k(a_1-c_1)(V_1\beta_2-V_2\beta_1) + (a_2-c_2)(V_2\beta_1^2-k^2V_1)}{\beta_1^2(\alpha\beta_2+V_2) - k^2(\alpha\beta_1+V_1)}$$

The relationship between $r_3$ and $r_1$ is given by comparing (20) with (15) to give:

$$(21) \qquad \frac{r_3}{r_1} = \frac{\beta_1^2(\beta_2+V_2) - k^2(\beta_1+V_1)}{\beta_1^2(\alpha\beta_2+V_2) - k^2(\alpha\beta_1+V_1)}$$

It is clear from (21) that the license price in this scenario will be greater than the optimal license price when the government does not retain all of the quota rent i.e. for any value of $\alpha$ greater than or equal to zero and less than one. The result suggests (as before) that as the exporter retains a greater proportion of the per unit quota rent, the government should charge a higher price for the import license to compensate for the rent dissipation, though the

level of $r_3$ is lower than $r_2$ for any given value for $\alpha$.

However, the license price leads to non-equivalence in the welfare outcome in Case 3 relative to Cases 1 and 2.[9] For any value of $r_3$ greater than $r_1$, the level of imports will be lower relative to the strategic trade policy outcome.[10] In other words, if the government sold quota licenses, for a given level of $\alpha$ less than one, the Stackelberg-equivalent import quota would be non-binding in Case 3. Consequently, this affects domestic prices and, taking the two effects together, is likely to lead to a lower level of welfare.[11] Thus selling import licenses when the government is to some degree "altruistic" but the private exporting firm does not retain (all of) the dissipated rent will offset the positive rent-shifting effects that exist when there is either no rent dissipation to the exporter or when it is solely the exporting processing firm that retains all of the quota rent. Whether these effects are strong enough to completely offset the strategic trade policy benefits of Cases 1 and 2 is an empirical matter.

The effects of $r_3$ relative to $r_1$, on prices and quantities can be shown explicitly. Substituting $r_3$ into (11) and (12), the effects on $p_1$ and $Q_2$ for varying levels of rent loss can be derived. It is easy to see that $\partial Q_2/\partial\alpha > 0$ and $\partial^2 Q_2/\partial\alpha^2 < 0$. Thus, for lower levels of quota rent retention by the government, the lower the value of $Q_2$ relative to the Stackelberg (strategic trade policy) outcome. Similarly, $\partial p_1/\partial\alpha < 0$ and $\partial^2 p_1/\partial\alpha^2 > 0$; as the level of rent loss to the exporter declines, $p_1$ will be lower relative to the Stackelberg outcome. These relationships between $p_1$, $Q_2$ and $\alpha$ are sketched in Figure 1 with the net welfare effects being shown in Figure 2. Clearly, it is of interest to know the exact shape of the function in Figure 2 for each variety of cheese. These effects suggest, therefore, that in the process of attempting to raise government revenue, quota license sales may lead to a net welfare loss. The empirical aspects of selling import licenses are explored in the following section.

# Figure 1. Effects of Rent Dissipation on
## $P_1$ and $Q_2$: Case 3[a]



$P_1, Q_2$

$P_1$

$r_1 = 100$

$Q_2$

$0 \quad \leftarrow \alpha \rightarrow \quad 1$
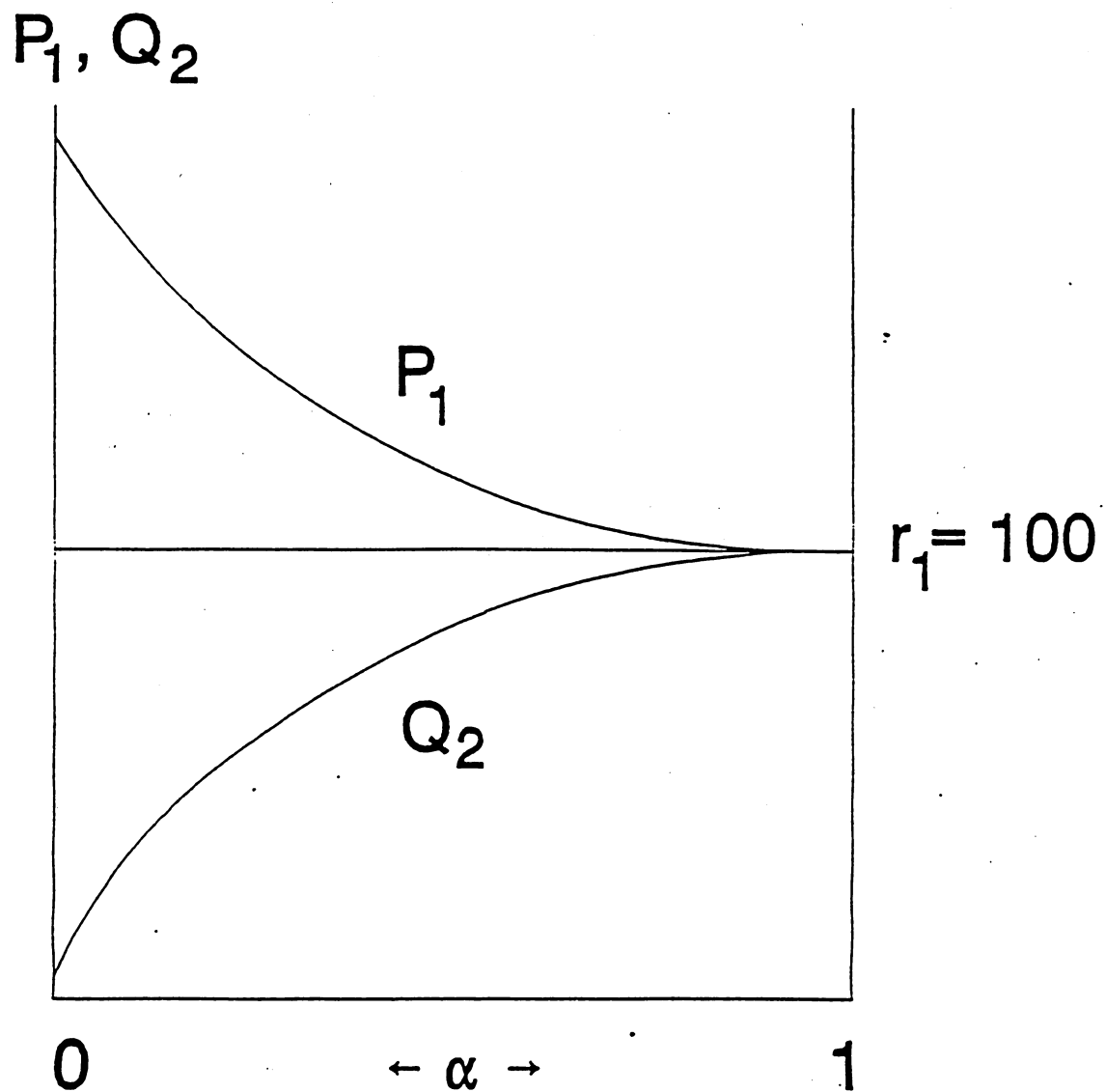
[a] Deviation of $P_1$ and $Q_2$ with $0 \leq \alpha < 1$ with $r_3$ relative to $r_1$.

# Figure 2. Anticipated Welfare Effects of Import License Sales with Rent Dissipation.



$W$

$Wr_1 = Wr_2$

$W_c$

$Wr_3$

$0 \qquad \leftarrow \alpha \rightarrow \qquad 1$
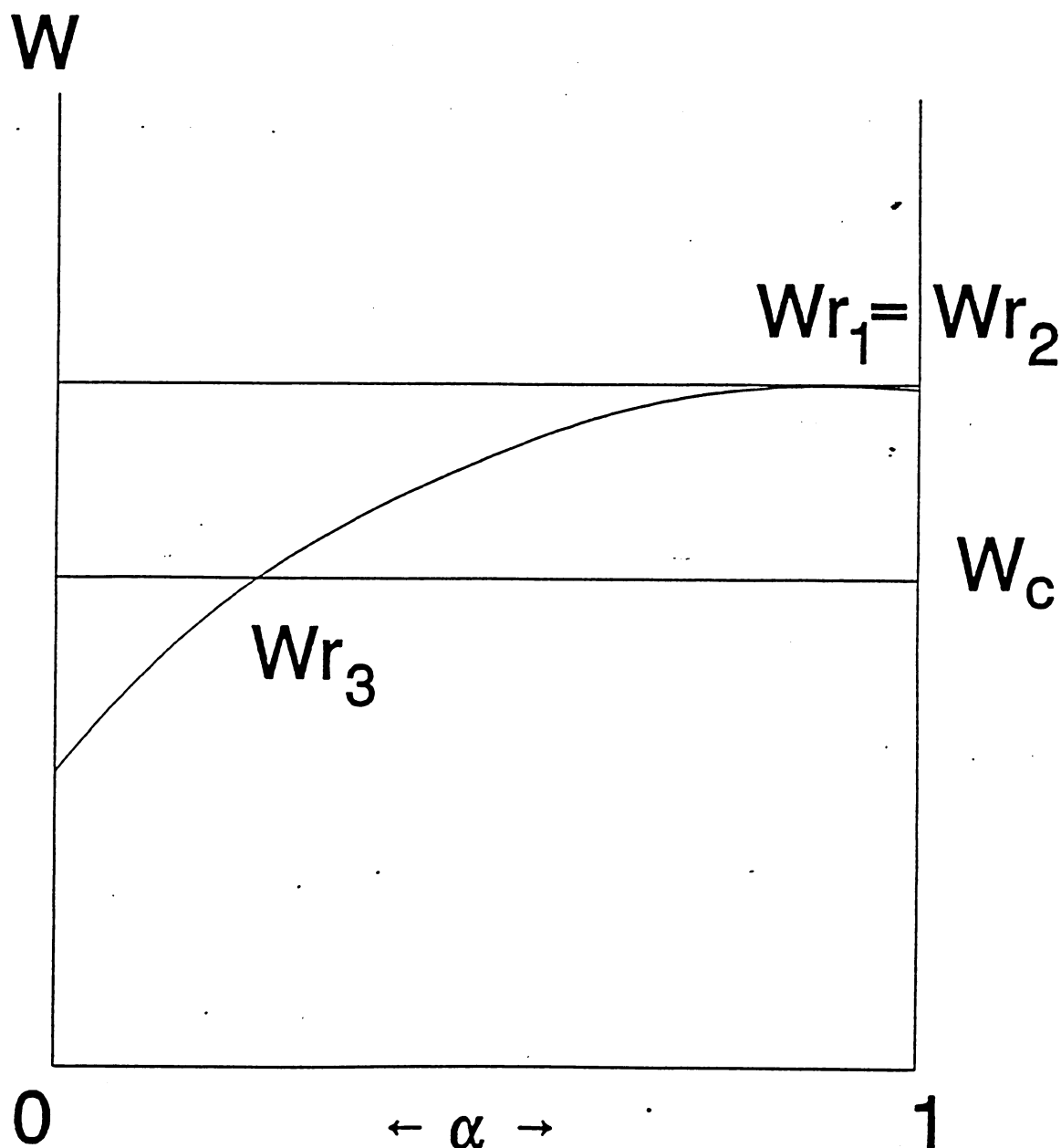
$W_c$ - Welfare before License Sales

$Wr_1$ - Welfare with License Sales (no rent dissipation) : Case 1

$Wr_2$ - Welfare with License Sales (with rent dissipation to exporting firm) : Case 2

$Wr_3$ - Welfare with License Sales (with rent dissipation to marketing board in exporting country) : Case 3

3.  Model Calibration

One advantage of the theoretical model outlined above is that it can be used to generate empirical values for the demand system and, hence, policy values and the relevant welfare consequences can be evaluated. This technique was pioneered by Dixit (1987) and involves calibrating the model in a manner similar to computable general equilibrium models. Essentially, external values of own-price elasticities and the elasticities of substitution between home produced goods and imports, combined with observations on prices, quantities and firms' costs are required to solve a system of equations in order to derive values for the parameters of the demand system.[12] The main advantage of the technique is that it requires only a limited amount of data, does not impose any explicit form of behavior on the market (behavior being endogenously determined) yet can be used to derive values for the optimal policies and their welfare outcomes in oligopolistic settings.[13]

However, one valid criticism of these calibration techniques is that since they use point estimates of the elasticities, the results will depend upon the data used in the calibration, particularly the choice of elasticity values. Consequently, simulations of the model would require extensive sensitivity analysis in order to be confident in the results.[14] To deal with this criticism, the model was calibrated in the following manner. Reasonable upper and lower values for the elasticities were chosen, assuming this range of values to be uniformly distributed. A random number generator (utilizing 40,000 random draws) was then used to draw from this distribution. Since firms' cost data may also be uncertain, the same procedure was used for these parameters. The results from the policy evaluation exercise will therefore provide mean values for the welfare outcomes with estimated upper and lower bounds of the results being calculated.

The model was calibrated for 1980 for the six varieties/sources of cheese presented in Table 2. Table 3 reports the data for the calibration procedure. Domestic prices ($p_1$) were taken from USDA's Dairy Market Statistics Annual Summary. Import prices ($p_2$) and quantities ($Q_2$) for each cheese variety and from individual exporters were derived from U.S. Imports for Consumption and General

Table 3. Calibration Data.

| Cheese Type | $P_1$ ($/lb) | $P_2$ ($/lb) | $Q_1$ (lbs.) | $Q_2$ (lbs.) | $C_1$ ($/lb.) | $C_2$ ($/lb.) | $\varepsilon$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|
| Blue Mold (Italy) | 1.79 | 2.52 | 32,344,000 | 117,419 | (1.65, 1.19) | (2.33, 1.68) | (0.4, 1.0) | (1.0, 2.0) |
| Blue Mold (Denmark) | 1.79 | 1.83 | 32,344,000 | 2,902,915 | (1.65, 1.19) | (1.69, 1.22) | (0.4, 1.0) | (1.0, 2.0) |
| Edam/Gouda (Netherlands) | 1.83 | 1.72 | 15.000,000 | 8,219,359 | (1.69, 1.22) | (1.59, 1.15) | (0.4, 1.0) | (1.0, 2.0) |
| Italian IOL | 2.47 | 2.60 | 977,956,000 | 1,247,976 | (2.29, 1.65) | (2.41, 1.73) | (0.4, 1.0) | (1.0, 2.0) |
| Cheddar (Australia) | 1.51 | 1.21 | 2,365,137,000 | 2,626,739 | (1.40, 1.01) | (1.12, 0.81) | (.04, 1.0) | (1.0, 2.0) |
| Cheddar (New Zealand) | 1.51 | 1.21 | 2,365,137,000 | 6,650,610 | (1.40, 1.01) | (1.12, 0,81) | (0.4, 1.0) | (1.0, 2.0) |

Source:  See text.

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Imports, these prices being adjusted for prevailing tariff rates reported in Hornig. Domestic production ($Q_1$) for each cheese variety was found in USDA Agricultural Statistics. Estimates on home and foreign costs are difficult to obtain. Hornig et al report price-cost margins for exporters ranging between 8 and 46 percent. Since the calibration used here requires no point estimate, values for costs for home and foreign producers ($c_1$ and $c_2$) were bounded between 8 and 50 percent below observed prices. No explicit data on elasticities for individual cheese varieties were available. Heien and Wessels report an aggregate elasticity of demand value ($\varepsilon$) for cheese in the U.S. of 0.52; the random number generator was therefore used to select values from a distribution bounded between 0.4 and 1.0. Similarly, a value for the elasticity of substitution ($\sigma$) was bounded between 1 and 2. This was based on an observation from Higgs for Australia of 1.6. Widening the upper and lower bounds on the calibration will of course affect the results; however, it is more likely to affect the distribution of the results and have less of an impact on the mean values.
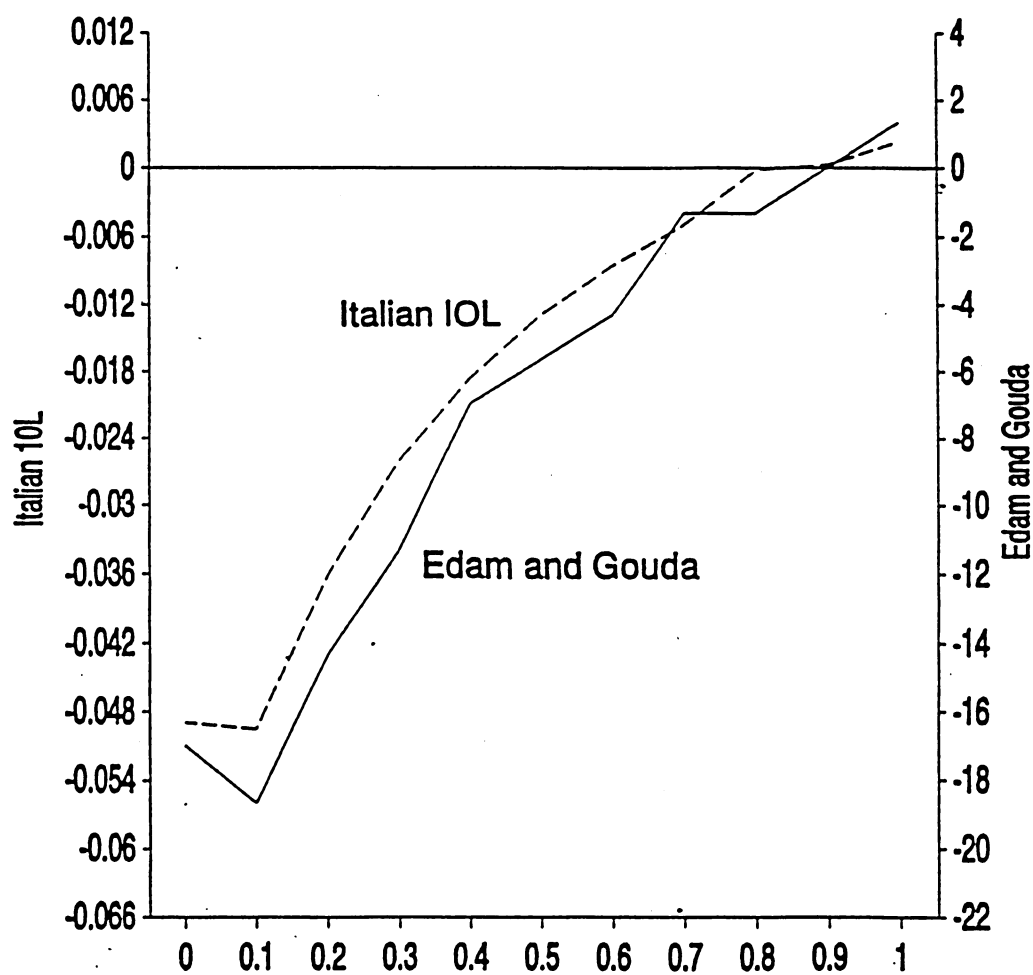
4.  Results

Having calibrated the model as above, values for $r_3$ were derived, with $\alpha$ varying between zero and one. These values were substituted into (11) and (12) and the subsequent welfare effects were derived. The welfare effects for Cases 1 and 2 are nested within these simulations since the effects from both of these cases are equivalent to Case 3 when $\alpha$ equals one. The effects of selling import licenses on two varieties of cheese are discussed here. The effect on net welfare for varying values of $\alpha$ for Italian IOL cheeses and Edam and Gouda from the Netherlands are presented in Figure 3. When $\alpha$ equals one, i.e. no rent dissipation (hence $r_1=r_2=r_3$), there is a small net welfare gain in all cases. In the Italian IOL case, welfare increases by 0.086 percent while for Edam and Gouda the gain is 0.75 percent.[15] This result holds even if there is rent dissipation, but the quota rent fully accrues to the private processing firms in the exporting country. However, when the rent accrues to the marketing board or government agency in the exporting country, welfare following the sale of quota licenses,

falls for relatively low levels of rent dissipation. In both examples, the proportion of quota rent retained by the exporter needs only to be 20 percent ($\alpha$ = 0.8) for the license sales to generate welfare losses. In the extreme, with the exporters' marketing board getting a higher proportion of the quota rent, welfare falls significantly. For example, in the Edam and Gouda case, for a level of $\alpha$ of 0.5, selling licenses would result in a welfare loss of 4.33 percent. Similar effects are found for the other varieties of cheese (not shown).

Distributional effects are the source of the net welfare losses in Case 3. As the theoretical section suggests, quota license sales for varying levels of $\alpha$ in Case 3 will raise $P_1$ and lower $Q_2$ more than in Cases 1 and 2. Hence, while in all three cases the sale of import licenses will have distributional consequences for consumers and domestic firms, these are exacerbated in Case 3 when $\alpha$ is less than 1. These distributional consequences for the two types of cheese are summarized in Figures 4 and 5. Cases 1 and 2 are consistent with Case 3 with $\alpha$ equal to one. At this extreme, selling licenses generates government revenue, raises U.S. cheese processing firms' profits and lowers consumer surplus. At the other extreme, Case 3 with $\alpha$ equal to zero, i.e. the exporter is allowed to retain all of the quota rent license sales do not generate any revenue for the U.S. Treasury. Selling import licenses, however, increases both the gains to domestic cheese processing firms and the losses to consumers, the extent of these distributional effects being exacerbated as $\alpha$ falls. The extent of these changes varies between the Italian IOL and Edam Gouda cases, which reflects the structure of the market for each of these cheese varieties.

While the above discussion confirms the consequences from selling import quota licenses in a general manner, it would be of interest to determine the welfare effects of license sales for reported levels of rent dissipation for the six varieties of cheese. The values for $\alpha$ were therefore derived from Table 2, the effects on consumers and producers of each variety of cheese as well as U.S. Treasury benefits being shown in Table 4. The results show that if the U.S. government sold import licenses for cheese in 1980, if it were not concerned with

# Figure 3. Changes in Net Welfare from Import License Sales: Italian IOL and Edam and Gouda [a] (Original Welfare = 0)
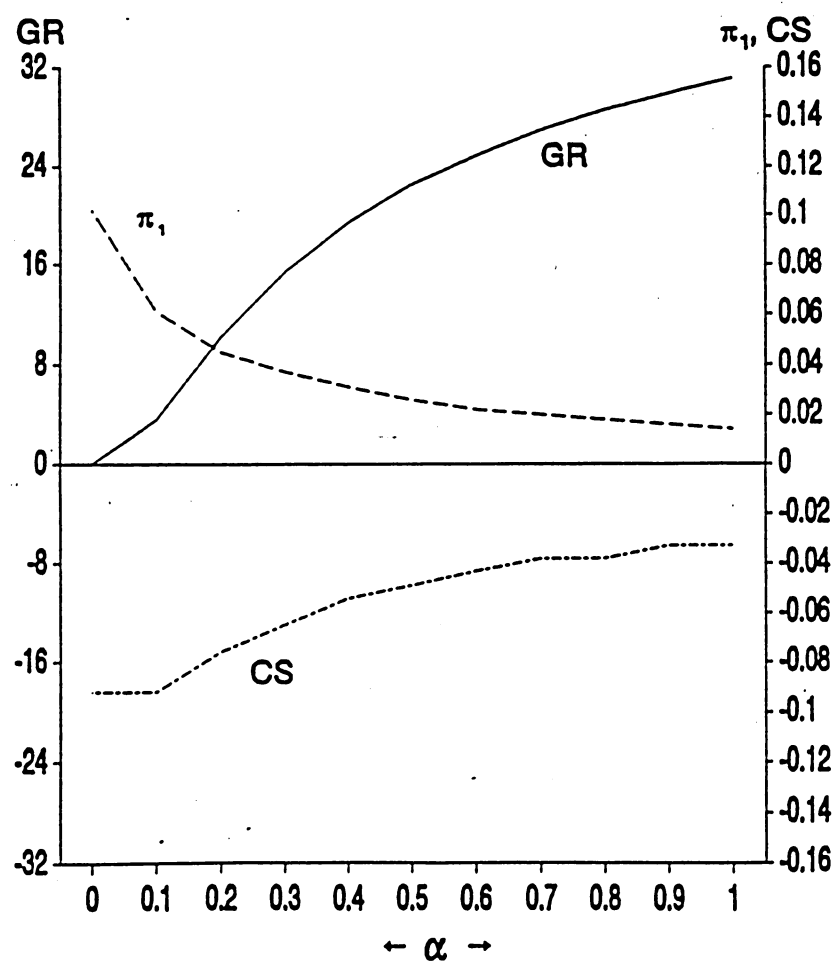


a
  Results are mean values.

# Figure 4. Distributional Effects of Import License Sales: Italian IOL Import Quotas [a] (Original Welfare = 0)
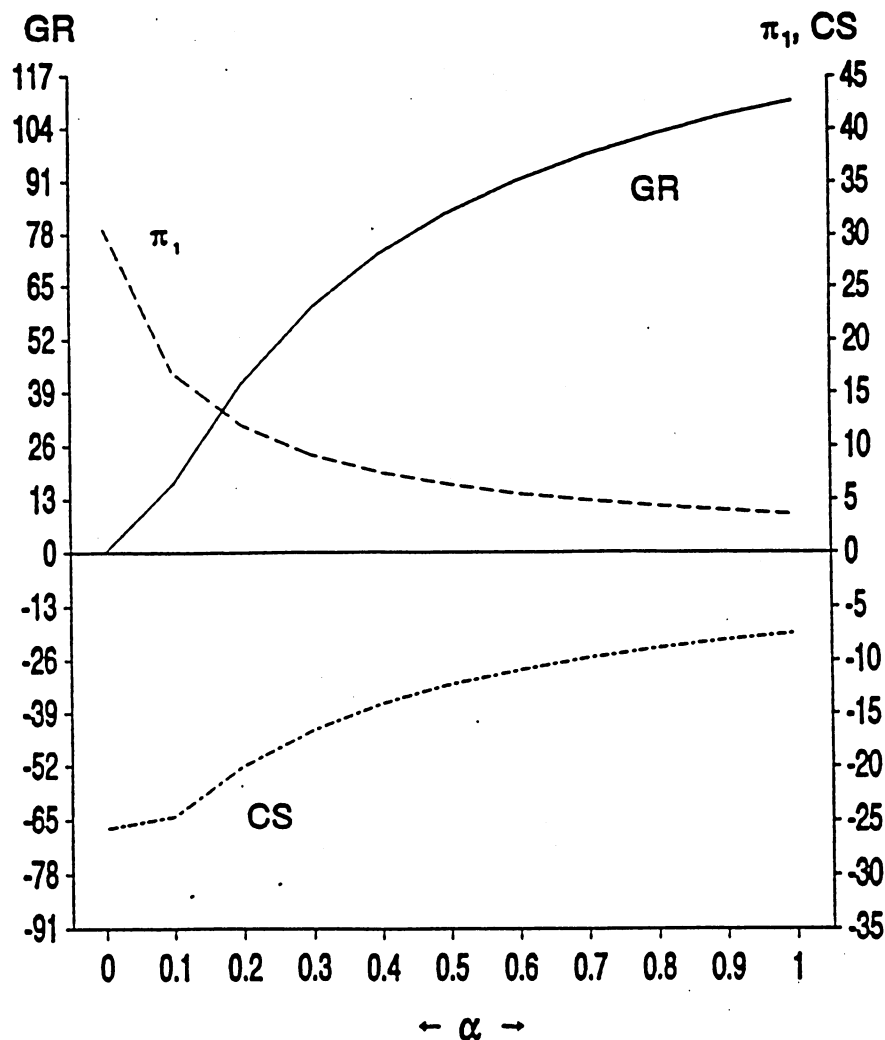


$\pi_1$ = Domestic Firms' Profits

CS = Consumer Surplus

GR = Government Revenue

[a] Results are mean values.

# Figure 5.  Distributional Effects of Selling Import Licenses:  Edam and Gouda Cheese Imports[a] (Original Welfare = 0)



$\pi_1$ = Domestic Firms' Profits

CS = Consumer Surplus

GR = Government Revenue

[a] Results are mean values.

retaliation (Case 1) or if it were but all the dissipated quota rent accrued to cheese processing firms in the exporting country, the result could have led to a net welfare gain. However, when the dissipated quota rent accrues to the marketing board or government in the exporting country, the sale of import licenses would have led to a welfare loss.

Specifically, for Cases 1 and 2, welfare would have increased (albeit marginally) following the sale of import licenses for five varieties: Blue-Mold from Italy (0.014 percent), Blue-Mold from Denmark (0.217 percent), cheddar from New Zealand (0.029 percent) and Italian IOL (0.086 percent). For cheddar from Australia, welfare would be unchanged. However, these welfare changes are either lower or, more commonly, negative in the Case 3 scenario. In this case, selling licenses for Blue-Mold cheese from Denmark would have generated a small net welfare gain (0.051 percent) due to the low reported level of rent dissipation (the increase being due to the rent-shifting effect) while all other varieties record either no welfare gains (Italian IOL) or welfare losses (Blue Mold from Italy (-0.06 percent), Edam and Gouda from the Netherlands (-4.327 percent), Cheddar from Australia and New Zealand (-0.009 percent and -0.023 percent, respectively)). Overall, taking all six of the cheese varieties together, Cases 1 and 2 would have led to a net welfare gain of 0.032 percent while Case 3 would have led to a welfare loss of 0.006 percent. U.S. Treasury revenue would rise by 68 percent (60 percent) in Cases 1 and 2 (Case 3), while domestic firms profits would rise by 0.017 percent (0.024 percent) while consumer surplus would fall by -0.036 percent (-0.048 percent).

It could be argued that these numbers are small and hence inconsequential. There are two responses to this. First, the varieties of cheese studied here represent only 11 percent of the total cheese quota, the study being limited by available data particularly on levels of rent dissipation to the exporters. However, if one were to take a crude estimate and average the estimated Treasury benefit over the whole of the cheese quota system, the results here suggest that the U.S. Treasury could generate between $114m and $128m from selling cheese import licenses depending on whether Cases 1, 2 or 3 capture the relevant

Table 4. Effects of Auctioning Cheese Import Quotas, 1980.

| Cheese Type | Domestically Retained Rent $(\alpha)$[1] | | Consumer Surplus[2] | Domestic Firms Profits[2] | Govt. Revenue[2] | Welfare[2] |
|---|---|---|---|---|---|---|
| Blue Mold (Italy) | 0.5 | OV | 44.327 | 12.008 | 0.072 | 56.407 |
| | | AQ | 44.244 | 12.020 | 0.110 | 56.373 |
| | | %Δ | -0.187 | 0.100 | 52.778 | -0.060 |
| Blue-Mold (Denmark) | .09 | OV | 48.148 | 12.008 | 0.601 | 60.757 |
| | | AQ | 47.157 | 12.129 | 1.502 | 60.788 |
| | | %Δ | -2.058 | 1.008 | 149.917 | 0.051 |
| Edam and Gouda (Netherlands) | .05 | OV | 31.679 | 5.644 | 2.219 | 39.542 |
| | | AQ | 27.7674 | 6.004 | 4.064 | 37.831 |
| | | %Δ | -12.358 | 6.378 | 83.146 | -4.327 |
| Italian (IOL) | 0.8 | OV | $1.8425^{09}$ | $4.9069^{08}$ | 1.827 | $2.335^{09}$ |
| | | AQ | $1.8418^{09}$ | $4.9078^{08}$ | 2.348 | $2.335^{09}$ |
| | | %Δ | -0.038 | 0.018 | 28.517 | 0 |
| Cheddar (Australia) | 0.6 | OV | $2.7229^{09}$ | $7.2389^{08}$ | 2.594 | $3.4494^{09}$ |
| | | AQ | $2.7221^{09}$ | $7.2400^{08}$ | 3.038 | $3.4491^{09}$ |
| | | %Δ | -0.029 | 0.015 | 17.116 | -0.009 |
| Cheddar (New Zealand) | 0.6 | OV | $2.7266^{09}$ | $7.2389^{08}$ | 0.835 | $3.451^{09}$ |
| | | AQ | $2.7246^{09}$ | $7.2416^{08}$ | 1.959 | $3.4507^{09}$ |
| | | %Δ | -0.073 | 0.037 | 134.611 | -0.023 |

OW - Original Value ($m)

AQ - Value with Quota Auctioning ($m)

%Δ - Percentage Change from Original Value.

[1] $\alpha$ - From Table 2.

[2] Mean Values.

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scenario. Further, the revenue benefits depend on the source of rent dissipation when the U.S. government wishes to avoid retaliation or contravene GATT rules. Second, the model utilized here suggests that selling import licenses has distributional consequences and could lead to an overall net welfare loss. The distributional effects exist whether or not the U.S. wants to avoid either retaliation or contravening GATT rules, though they can be exacerbated again depending on the source of rent dissipation and when the level of rent dissipation increases.

5. Summary and Conclusions

The idea of selling import licenses has been a topic of much debate in U.S. trade policy circles. However, estimates of potential license revenue ignore market structure issues and also the fact that license sales may provoke retaliation from the exporter or contravene GATT rules without some compensation to the exporter. This paper has attempted to deal with these issues both theoretically and empirically. The theoretical model shows that, for given levels of quota rent loss to the exporter, the resulting license price will be relatively high compared to the case where the government retained all of the quota revenue. The extent of these distributional effects will also depend on who retains the quota rents in the exporting countries. In some cases it is possible that, depending on the source of rent dissipation, the 'rent-shifting' effects are outweighed by losses to consumers thus reducing national welfare.

The theoretical results were applied to U.S. import quotas on cheese utilizing recent estimates of quota rent distribution in the U.S. cheese quota system. Three important conclusions arise: first, taking market structure into account increases the potential level of revenue that the U.S. Treasury could generate from selling import quota licenses; second, consumers will lose more from a licensing system while domestic cheese processing firms gain if the Treasury sets the license prices optimally, thus contradicting Blinder's comment (see Introduction) that there would be no U.S. losers; third, for given levels of rent dissipation, there could be a net welfare loss.

There is considerable scope for further research in this area. One obvious

extension would be to the other sectors considered by Bergsten et al. and the CBO since these too are typically oligopolistic.  Extending the analysis would give an overall view of this policy issue although this would require extensive detail of the structure of production and distribution in exporting and importing countries.  Further, the value of $\alpha$, the proportion of rent retained by the government, was assumed to be exogenous.  It may be interesting to broaden the analysis to endogenize levels of rent capture in quota regimes since, as is clear from the U.S. cheese quota system, exporters, importers and the U.S. government all get a share of the quota rent available.

Notes

1  In a different context, Krishna (1991) has referred to 'altruism' in auction quotas where some or all of import licenses are given to the exporter.

2  There is some information on the structure of the cheese-processing sectors in the U.S. and in many exporting countries. Hornig et al. suggests that the U.S. cheese processing sector is concentrated with the 5-firm concentration ratio for imports being above 75 percent. Connor provides an estimate of the concentration ratio for the domestic processing section in the U.S. of 44 percent.

3  While Bulow et al. have explored multi-market effects in a theoretical context, there has been little research on dealing empirically with this phenomenon, the only advances in modeling policy in oligopolistic situations being contained to single markets.

4  'Marketing boards' are used here as a catch-all for government intervention or intermediaries in the exporting country. While marketing boards are a relevant feature of the cheese sectors in exporting countries the same results hold if (for any reason) the processing firms do not retain (all of) the dissipated quota rent.

5  Although quotas are the trade instrument used, it is convenient analytically for the government to select the optimal value for the license price and find the level of $Q_2$ that is consistent with it. This follows the traditional literature on tariff and quota (non)equivalence; the optimal quota (and hence the rent generated from it) results in the same level of imports from the optimal license price. See Helpman and Krugman for a review of the non-equivalence issue.

6  In a general conjectural variations framework, one important difference between quotas and tariffs is that quotas will affect the conjectural variations parameter while tariffs will not. However, since the empirical section deals with an already quota-constrained environment, this issue does not arise in the present context.

7  It can be shown that rent dissipation to the importing firm does not affect the welfare function as given by (16) and hence the optimal license price. Therefore, in the remainder of the paper, the concern is only with the rent lost to the exporter.

8  Examples include the New Zealand Dairy Board, Holland Cheese Exporters' Association, Danish Cheese Export Board, Norwegian Dairies Sales Association and Valio Finnish Cooperative Dairies Association.

9  Intuitively, in quantity space, $r_1$ shifts the foreign firms' reaction function that is consistent with Stackelberg equilibrium i.e., the strategic trade policy effect. $r_3$, however, shifts the reaction function beyond the Stackelberg-equivalent point. Given usual assumptions about the stability of reaction functions, $Q_2$ will be lower and, hence, $p_1$ higher with $r_2$.

10  For sufficiently low values of $\alpha$, it is possible to attain corner solutions.

11  Although her theoretical model is different from the one presented here, this is exactly the point Krishna (1988, 1990) has made.

12  Since the calibration technique has been discussed elsewhere, it is not covered here. Applications and details of the technique can be found in Dixit (1987) (the U.S. car market), Laussel et al., (the European car market) and McCorriston and Sheldon (the U.K. fertilizer market).

[13] The full set of equations for the model solution and detailed derivation of the results are available from the authors upon request.

[14] This point has been made by Harrison and Vinod in the context of computable general equilibrium models. They note that while many elasticities are taken from econometric work, others are obtained from "coffee table conversations"! The approach followed here is similar, in principle, to that of Harrison and Vinod.

[15] These small gains from 'rent-shifting' effects are not surprising. See studies referenced in footnote 12.

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## References

Anderson, J.E. "The Inefficiency of Quotas: The Cheese Case," _American Economic Review_, 75, (1985):178-191.

Bergsten, C.F., K.A. Elliot, J.J. Schott, and W.E. Takacs. "Auction Quotas and United States Trade Policy," _Policy Analyses in International Economics_, 19, Institute for International Economics, Washington, DC, 1987.

Brander, J.A. and B.J. Spencer. "Export Subsidies and International Market Share Rivalry," _Journal of International Economics_, 18, (1985):83-100.

Bulow, J.I., J.D. Geanakoplos and P.D. Klemperer. "Multimarket Oligopoly: Strategic Substitutes and Complements," _Journal of Political Economy_, 93, (1985):488-512.

Cheng, L. "Assisting Domestic Industries under International Oligopoly: The Relevance of the Nature of Competition to Optimal Policies," _American Economic Review_, 78, (1988):743-758.

Congressional Budget Office. "Revenue Estimate for Auctioning Existing Import Quotas," House Budget Committee, Washington, DC, 1987.

Connor, J.M. _Food Processing: An International Powerhouse in Transition_, Lexington, MA, Lexington Books, 1988.

Dixit, A. "Optimal Trade and Industrial Policy for the U.S. Automobile Industry," in _Empirical Methods in International Trade_, edited by R.C. Feenstra, MIT Press, Cambridge, MA, 1987.

Dixit, A. "Anti-Dumping and Countervailing Duties under Oligopoly," _European Economic Review_, 32, (1988):55-68.

Feenstra, R.C. "Auctioning vs. Import Quotas, Foreign Response, and Alternative Policies." _NBER Working Paper_, 2839, 1989.

Harrison, G.W. and H.D. Vinod. "The Sensitivity Analysis of Applied General Equilibrium Models: Completely Randomized Factional Sampling Designs," _Review of Economics and Statistics_, 74, (1992):357-362.

Heien, D. and C.R. Wessels. "The Demand for Dairy Products: Structure, Prediction and Decomposition," _American Journal of Agricultural Economics_, 70, (1988):219-228.

Helpman, E. and P.R. Krugman. _Trade Policy and Market Structure_, Cambridge, MA, MIT Press, (1989).

Higgs, P.J. _Adaptation and Survival in Australian Agriculture_, Oxford, Oxford University Press, 1986.

Hornig, E. _The Political Economy of U.S. Cheese Import Quotas: The Creation and Capture of Quota Rents and Subsidies_, unpublished Ph.D. Thesis, Cornell University, 1987.

Hornig, E., R.N. Boisvert and D. Blandford. "Quota Rents and Subsidies: The Case of U.S. Cheese Import Quotas," _European Review of Agricultural Economics_, 17, (1990):421-434.

Krishna, K. "The Case of the Vanishing Revenues: Auction Quotas with Oligopoly," _NBER Working Paper_, 2723, 1988.

Krishna, K. "The Case of the Vanishing Revenues: Auction Quotas with Monopoly," _American Economic Review_, 80, (1990):828-836.

Krishna, K. "Making Altruism Pay in Auction Quotas," in E. Helpman and A. Razin (eds.) _International Trade and Trade Policy_. Cambridge, MA, MIT Press, 1991.

Laussel, D., C. Montet and A. Peguin-Feisolle. "Optimal Trade Policy under Oligopoly: A Calibrated Model of the Europe-Japan Rivalry in the EEC Car Market," _European Economic Review_, 32, (1988):1547-1565.

McCorriston, S. and I.M. Sheldon. "Government Intervention in Imperfectly Competitive Agricultural Input Markets," _American Journal of Agricultural Economics_, 73, (1991):621-632.

USDA. _Dairy Market Statistics Annual Survey_, Washington, DC, 1980.

USDA. _Agricultural Statistics_, Washington, DC, (various).

U.S. Dept. of Commerce, Bureau of the Census. _U.S. Imports for Consumption and General Imports: TSUSA Commodity by Country of Origin_, Washington, DC, 1981.

Singh, N. and X. Vives. "Price and Quantity Competition in a Differentiated Duopoly." _Rand Journal of Economics_, 15, (1984):546-554.
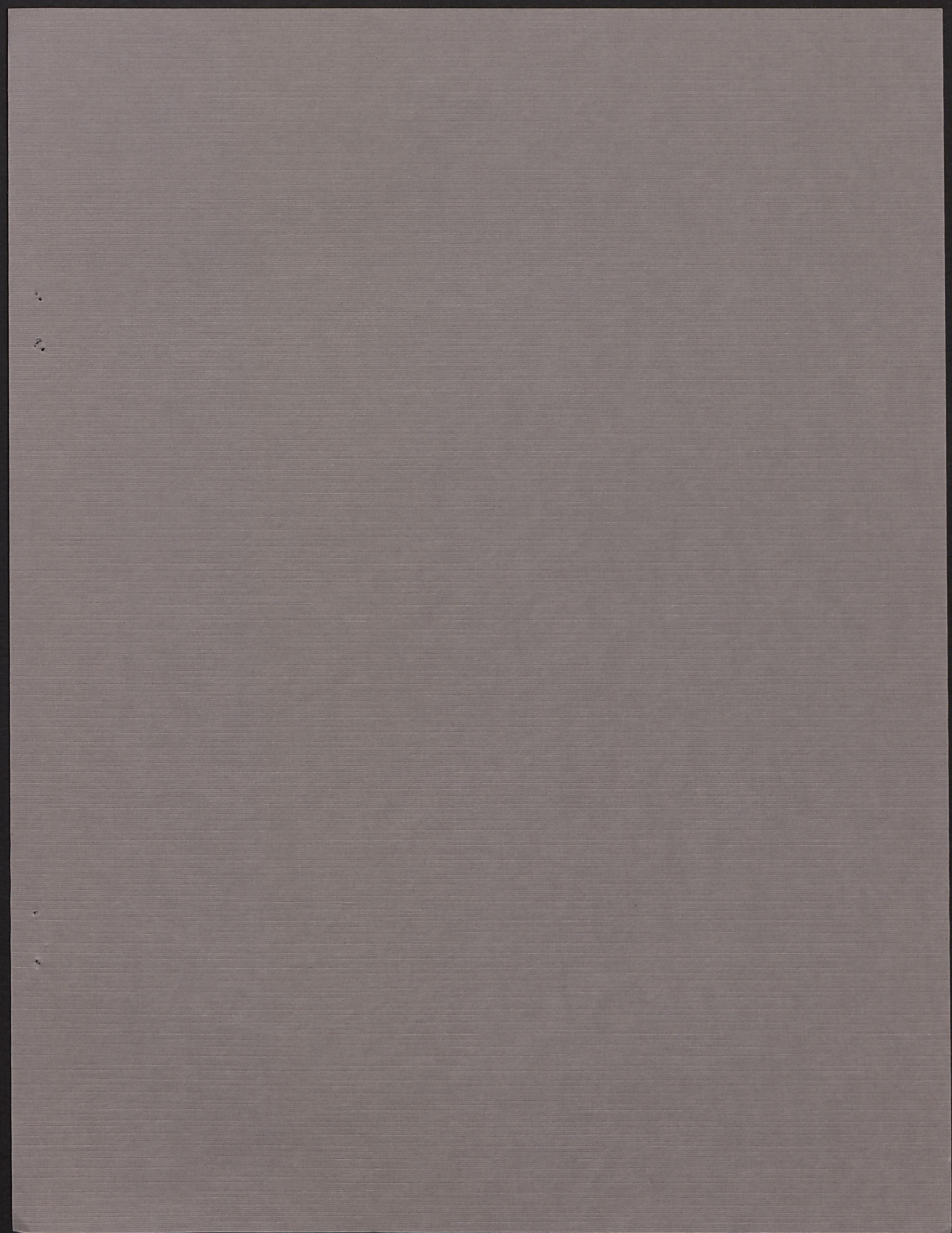
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