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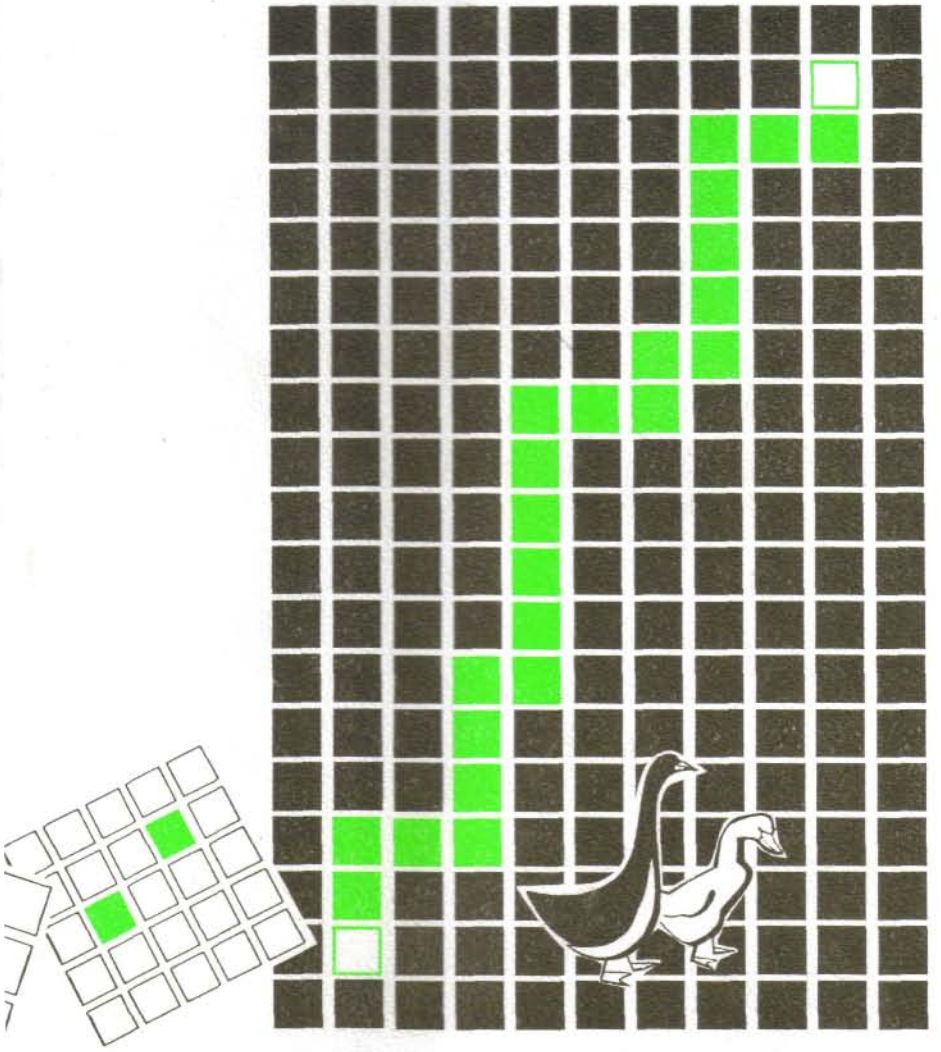

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POLICY OPTIONS FOR THE POULTRY (BROILER) INDUSTRY IN TRINIDAD AND TOBAGO UNDER A LIBERALIZED TRADE REGIME

Edward A. Evans
Graduate Research Assistant, University of Florida

Carlton G. Davis
Professor, Food and Resource Economics Department
University of Florida

Historically, agricultural policy in Trinidad and Tobago has had the expressed objectives of maximizing the degree of domestic agricultural self-sufficiency, raising agricultural incomes, and creating employment. The principal policy instruments adopted to achieve these objectives included the subsidization of agricultural activities through both input subsidy programmes and guaranteed output prices for specific commodities, and market protection through tariff mechanism and quantitative restrictions.

Recently, the Government has embraced the concept of economic liberalization in an attempt to propel the economy along a path that would enable it to compete in the global economy. In this regard, various measures have been contemplated to reform the country's international commercial policies and correct certain perceived inefficiencies. Among the measures contemplated is the dismantling of the negative list (commodities with zero import quota) and the revamping of subsidies.

One industry that benefitted a great deal under the protective environment is that of poultry with the result that today the country is self sufficient in both poultry and egg production. The industry employs approximately eight thousand persons - the majority of which operate at the farm level. The implementation of the proposed policy reforms could no doubt have serious consequences for this industry, creating serious dislocation in the short run with possible social unrest. It is therefore the intention of the author to examine option for policy reform in respect to the broiler industry within the framework of trade liberalization.

In examining the likely fall out from the move towards opening up the industry, the following hypotheses will be tested:

- In light of the high degree of vertical integration which exists, the net social gains will be greater than the loss. In other words, consumers' benefits will far outweigh that of producer losses.
- The adverse effects on the returns to growers as opposed to entrepreneurs will be dis-

proportionate, with the former bearing the brunt of the effects.[1]

The paper commences by giving a brief overview of the world poultry market. Next, a brief overview of the poultry industry in Trinidad and Tobago is presented, focussing on the broiler aspect of the industry and highlighting the protection given to the industry. The analytical framework is then introduced, followed by the specifics of the model to be employed. The penultimate section presents the results and discussions of the investigation and the paper ends with a few concluding remarks.

Brief Overview of World Poultry Market and the Implications of Trade Liberalization on the Industry[2]

Poultry is the world's major and fastest growing source of meat, representing about 25 percent of all meat production in 1995. Poultry meat includes meat from broilers, turkeys, other chickens, ducks, and geese. Broilers represent almost 75 percent of these meats. Over the last 25 years, world poultry production has more than tripled.

In 1995, world production of poultry meat was estimated at about 80 billion pounds. The large increases in world poultry production since the early 1960's reflect advances in, and relatively easy transfer of, production technology, as well as the ability to construct modern, efficient poultry production complexes almost anywhere near labour and markets.

Of the main producers, the United States is the largest, accounting for nearly 30 percent (about 24 billion pounds) of global output in 1995. It is also the second (France being the first) largest exporter. While the USA Government does not play a direct major role in the poultry industry, public Programmes play a greater role in poultry trade. For instance, the Food Security Act of 1985 authorized the Secretary of Agriculture to implement several export assistance programmes to help USA agricultural producers regain the markets they lost. Under this programme, approximately 25 percent of all USA poultry meat export received an export subsidy on average of about US$0.24/lb.[3] The ultimate effect of programmes such as these is to depress world market price.

With respect to trade liberalization, the consensus is that it will increase both world poultry meat production and trade because of lower consumer prices and lower feed prices in several countries. The primary effects on poultry producers and consumers would be changed feed prices, loss of producers subsidies (where applicable),

[1] In this paper the term "entrepreneur" will be used to refer to the integrated producer while that of the "growers" will be used in reference to the contract farmers. The "producers" refers jointly to the growers and the entrepreneurs.

[2] Information presented in this section is based on Livestock and Poultry Update and The World Poultry Market - Government Intervention and Multilateral Policy Reform 1995.

[3] As cited in the *Report on the Current Status of the Poultry Industry in Trinidad and Tobago*, 1993, p. 19.

and the removal of the implicit taxes on poultry consumers.[4] The combination of the removal of the implicit taxes and the likely long-term rise in income due to freer trade is expected to cause consumption to increase further.

Overview of the Trade Regime and Broiler Industry in Trinidad and Tobago

As indicated earlier, Trinidad and Tobago is self-sufficient in the production of poultry meat, consuming approximately 78 million pounds annually, or just about 15 whole chickens per person. Chicken is therefore very much a part of the staple diet.

The growth of the industry in the mid 1970s to mid 80s was brought about by several lucrative incentives, as alluded to earlier. The Government has since reduced these incentives and at present, the only ones that remain are duty free concessions on machinery and equipment, and market protection through a zero import quota.

Apart from allowing the country to become self-sufficient in poultry, the lucrative incentives have resulted in drastic changes in the industry from that of 30 to 40 years ago. Notable is the significant decline in the number of producers concomitant with significant increases in the size of the remaining farms, as well as massive capitalization. Production has therefore shifted to the vertically integrated poultry - producing firm, in which production and marketing decisions are centralized and production complexes are either owned directly or controlled through contracts. The integrated producer (entrepreneur) is involved in all stages of operations, from the hatching of eggs to shipping the meat into the marketing channels. The increased size has no doubt enabled modern operations to take advantage of economies of scale in production and has encouraged the rapid adoption of biological and technological advances.

In terms of broiler production, the entrepreneurs account for about 70% of the birds marketed. They seek to have a steady supply of birds for processing and accomplish this through their own farms as well as through contract growers. In the case of the contract growers, the entrepreneurs provide all the inputs including the pens with the only exceptions being that of space and labour. The growers are paid a rate of about TT$0.40 per lb. for each bird delivered to the processor.

In spite of the high degree of concentration within the industry, the wide variety of distribution chains, and the power of the various buyer groups ensure and foster a high degree of competition in the market within the context of a closed economy. The finished bird is sold on the market at a price of TT$4.25/lb. Table 1 shows the components of the cost per lb. of chicken sold.

The Theoretical Framework

To investigate the likely effects of a change in the output price on the returns to factors of production, use will be made of Floyd's (1965) one-product, two-input model. In that model, he investigated the effects of farm price

[4] It is a fact that poultry consumers in some countries pay domestic prices that are well above the world level. With trade liberalization, those prices would actually fall, as the world price (adjusted for transportation costs) becomes reflected in domestic markets.

supports on the returns to land and labour in agriculture.[5] Variation of this basic model has been under-taken by Gardener (1975), in which he generated quantifiable predictions about how various shifts in the demand for and supply of food, will affect the retail farm price ratio and the farmers share of retail food expenditures. Holloway (1991) extended Gardener's model to a conceptual model for the analysis of imperfect competition in the food industries, while Schroeter and Azzam (1991) took it a step further by providing a conceptual and empirical framework for analyzing marketing margins in a non-competitive food-processing industry facing output price uncertainty. While these extensions and variations are undoubtedly important and serve as useful refinements, the issues which are to be addressed in this paper can be resolved within the framework of the basic Floyd's Model, without the added complications.

The model comprises the following six equations:

Industry Production function:

$X = f(a,b)$ (1)

VMP = factor price:

$f_a P_x = Pa$ (2)

$f_b P_x = P_b$ (3)

Factor Supplies:

$a = g(P_a)$ (4)

$b = h(P_b)$ (5)

Product Demand:

$X = D(P_x)$ (6)

where:

X = the level of output

a = one input used in the production process e.g. land

b = the second input used e.g. labour

P_a, P_b and P_x = the factor prices of the inputs a and b, and the retail price of the commodity, respectively.

As pointed out by Gardner (1987), in order to justify these equations the following assumptions must be made: the output market is competitive; the input markets are competitive; producers maximize profits; and all firms are identical. Gardner (1987, p 89) further points out that the last assumption may be taken as meaning that all units of *a* and *b* have the same characteristics, and only one least-cost technology is available, which is represented by a twice differentiable, concave production function that generates the usual U-shaped average cost function. These conditions imply that at competitive equilibrium, all producers will observe the minimum of their average cost function so that the industry production function of Eq. (1) above is linearly homogeneous. The slopes of supply and demand equations are assumed to have the normal signs, and a single equilibrium with positive prices and use of both inputs is assumed to exist.

The six-equation system can be solved to find the equilibrium in terms of percentage changes and parameters such as elasticities and factor share.[6]

[5] This is the same Model elaborated on by Gardner (1987) in his treatment of price supports and factor markets in his text on *The Economics of Agricultural Policies*.

[6] See Gardner (1987, 90-93) for detail on manipulation of the six equations to obtain the equilibrium quantities in terms of percentage changes.

Following Gardner (1987), the system of equations can be written as:

$$EX = K_aEa + K_bEb \quad (1')$$
$$Ep_a = K_b/\sigma Ea + K_b/\sigma Eb + Ep_x \quad (2')$$
$$Ep_b = -K_a/\sigma Eb + K_a/\sigma Ea + Ep_x \quad (3')$$
$$Ea = e_aEP_a \quad (4')$$
$$Eb = e_bEP_b \quad (5')$$
$$EX = \eta Ep_x \quad (6')$$

where:

EX, Ep_a, Ep_b, Ea, Eb and Ep_x are six mutually determined percentage change variables i.e. three quantities and three prices.

K_a and K_b = the relative share factor shares

η, e_a and e_b = the demand elasticity for output and the respective supply elasticities for the factors.

σ = the elasticity of substitution between factors a and b (see Allen 1938, p 343).

Gardner notes that the changes of interest can be determined in two ways: firstly by selecting one of the variables and regulating it, directly making it a policy instrument and secondly by introducing additional policy variables as policy instruments. The former approach will be adopted in this paper although similar results could have been obtained using the latter approach.

Opening the industry to world influence in the current situation, implies that the domestic price of the output would fall. Since the domestic price is known and the world price can be estimated, the policy can therefore be viewed within the small country framework, as Government fixing the price of the output. In such a case, the demand equation will become perfectly elastic up to the point where it is equal to the opportunity cost. In terms of our six-equation model, this further implies that the demand equation, Eq. (6') can be dropped out of the system of equations and the effect of the change in output price on the equilibrium level of the remaining endogenous variables can be determined by dividing throughout by the percentage change in the output price variable, and solving the system simultaneously. From manipulation of the remaining five equations, the following elasticities with respect to a given percentage change in domestic price can be found: percentage change in the quantities and prices of the respective inputs (factors a and b), and the percentage change in the quantity of the product supplied.

Empirical Analysis/Data

While the qualitative effect of the price change on the variables of interest can be obtained from the above elasticity relationships through the signs of each, on the basis of a general knowledge of the agricultural sector and the implications of the assumptions made earlier, an idea of the magnitude of the effects can be obtained with a more precise knowledge of the parameters and some additional calculation. Such information as required can be obtained from existing studies.

In adoption the model to the Trinidad broiler industry, the following modifications and assumption are necessary. First, the case to be considered is that of the integrated producers since they account for about 70% of the market with the bulk of their supplies being provided by contract growers. The model can thus be

respecified in percentage terms as follows:

$$EX = K_aEa + K_bEb \quad (1')$$
$$Ep_a = K_b/\sigma Ea + K_b/\sigma Eb + Ep_x \quad (2')$$
$$Ep_b = -K_a/\sigma Eb + K_a/\sigma Ea + Ep_x \quad (3')$$
$$Ea = e_aEP_a \quad (4')$$
$$Eb = e_bEP_b \quad (5')$$
$$EX = \eta Ep_x \quad (6')$$

where:

X=the output of broiler meat

a = all the inputs supplied by the entrepreneur including processing and marketing services

b = the inputs supplied by the farmers namely space and labour

K_a and K_b = the relative factor shares as reflected in Table 1

η, e_a and e_b = the demand elasticity for broilers and the respective supply elasticities for the factors as discussed below.

σ = the elasticity of substitution between factors *a* and *b*.

Second, it will be assumed that the necessary assumptions as discussed in the preceding section are plausible in the context of the broiler industry. Consequently, Table 2 presents values of the parameters that might be considered reasonable in light of available empirical evidence. A demand elasticity value of -0.5 was chosen on the basis of studies conducted by Evans (1993) on the Poultry Industry in Trinidad and Tobago. Huang (1985, as cited by Tomek and Robinson, 1990 p 51) also estimated the value for poultry to be -0.53. Information on the supply elasticities is less readily available but given that most of the input provided by the entrepreneurs is imported and can be used elsewhere, a value of one was chosen for input a, in the model. With respect to growers' input, (b), a value of 0.2 was chosen since as pointed out before, the supply of these factors can be considered relatively inelastic, especially in the short run. The relative share of each factor of production is based on the information provided in Table 1. In light of the arrangement under which the broilers are produced, a value of 0.1 has been chosen to reflect the narrow scope for substitutability between the factors in the model. This decision, however, necessitated a slight modification of the basic Floyd's Model which assumed an elasticity of substitution of one, with consequences as pointed out by Gardner (1987, p 141) that the distributional effects were assumed away. Thus, in this case, consideration will be given to the effect of the change in the policy variable on the factor share as reflected by the following formula:[7]

$$EK_a/EP_x = K_b (e_b - e_a) (1 - \sigma) / \sigma + K_b e_a + K_a e_b \quad (7')$$

To reflect the world market price, the imported price of chicken parts from the US into St. Lucia, a neighbouring island, was used as proxy. To this value was added a 20% mark up to reflect wholesale and retail markups, giving an estimated retail price of $3.25 in the free trade and $3.90 when a 20% tariff is first applied to the estimated c.i.f. price of $2.71. It should be noted that the price used is that of the imports of chicken parts - which exclude the white

[7] See Gardner (1987, p 139-141) for derivation and discussion of the formula. As discussed elsewhere the case being considered here is similar to that discussed by Gardner where the policy moves the industry off the original demand curve and along the supply curve.

meat (breast and thigh) - since this posed a greater threat than that of the price for import of whole chicken. This is so since the US places a premium on the white meat but not on the dark meat.

Results and Discussion

Utilizing the information in Table 2, and substituting in relevant percentage changes into equation 7', the effects on the relative factor shares are computed for two cases, namely free trade, and the restricted free trade where a 20% tariff is applied in lieu of the zero import restriction. In terms of the policy variables in our model, these two changes were represented as an 18.8 and an 8.2 percent reduction in the domestic price, *Px*, respectively. Table 3 below shows the results of the computations on relative factor shares. The results indicate that, opening of the industry to international competition would cause the domestic price of broilers to decrease, but more importantly that while the relative share to the entrepreneurs increased slightly, that of the growers decrease appreciably. In the case of the unrestricted free trade, the percentage changes were 3.6 and -32.4% for entrepreneurs' and growers' shares, respectively. Where the market is open, but domestic price is supported by a 20 percent tariff i.e. allowing current domestic price to fall only by 8.2 percent (restricted free trade), the result would be the same, except for the relative magnitude of the changes and the fact that the government benefits from revenue generated by the tariff. In this case, the changes are estimated at 1.5 and -13.6 percent, for the entrepreneurs' and growers' shares, respectively.

Further computations of the percentage changes in quantities and prices (not shown) assist in explaining the above results. With the reduction in price as a result of opening the industry, the producers cut back on their supply of broilers. This implies a reduction in usage of both inputs (*a* and *b*) as the producers move leftward along their supply curve. The fact, however, that the inputs supplied by the entrepreneurs are relatively more elastic than those supplied by the growers result in factor *a* experiencing a smaller reduction in price but a larger reduction in quantity employed, the quantity reduced would be smaller but the reduction in price for inputs *a* and *b* were -15.1 and -55.1 percent respectively. Moreover, given that the elasticity of substitution is so close to zero, not much of the relatively less expensive inputs of the growers can be substituted for those of the processors. Thus, the observed results that the relative share to the processors increased slightly while that of the growers reduced by a considerable percentage. The analysis is the same in the case of the restrictive free trade as pointed out before.

Table 4 shows a crude calculation of the producers' and consumers' surplus, government revenue, net social gain/loss arising from the two policy changes considered, assuming linear demand and supply functions. In calculating the effects, the supply elasticity was estimated as 0.92 and the total supply before policy intervention was assumed to be the 1993 consumption level of broilers of 78 million pounds.[8]

[8] The elasticity of supply was computed using the information contained in Table 2 and the following formula representing the total supply elasticity (see Gardner 1987, p 140): $Ex/EPx=e_a e_b+\sigma(K_b e_b)/\sigma+K_b e_a+K_a e_b$.

The computation shows that in both cases, the contribution to welfare was positive i.e. there was a net social gain of $10.52 m and $6.4 m for the unrestricted free trade, respectively. Whereas producers' surplus would decline by $74.3 m under each of the respective programmes, consumers on the other hand are likely to gain $84.82 and $28.30, respectively. Moreover, under both programmes the per capita consumption of chicken would increase from current base level. The Nominal Protection Coefficient (the ratio of the domestic price to the adjusted border price) was calculated to give a crude indication of the level of protection the industry enjoyed in the absence of free trade and in the case of the application of the 20% tariff. As indicated in the table, the values were 1.31 and 1.20 respectively, suggesting that the industry was only moderately protected.

Concluding Remarks

From the foregoing, a number of interesting and important conclusions emerge. First, the study supports the assertions made by Cochrane and Ryan (1976, as cited in Gardner 1987 p 148) that government intervention into an industry can sometimes change the structure of that industry. Second, it supports the general hypothesis presented in the introduction that the opening up of the industry to free trade would provide benefits that far outweigh the consequences when viewed from the standpoint of net social gains. In addition, it supports the main hypothesis that the social and economic fall out, viewed from a perspective of the return to factors of production (relative shares), would be disproportionately borne by the entrepreneur, as opposed to the growers, with the latter being the less fortunate.

While the analysis presented in Table 4 suggests that strictly on the basis of overall gains to society, the unrestricted free trade policy option should be favoured over that of the restricted, there may be some justification in considering the latter on the following basis: Firstly, the unrestricted free trade policy would force a considerable amount of growers out of the industry whose services cannot be readily employed elsewhere in the society. Secondly, and related to the first point, is the fact that the so called 'free trade' is not in its entirety free trade since it is known for example that the USA provides a level of subsidy to the exporters of broilers. Thus, some of what might be perceived as being inefficiency in the industry when judged on the basis of the adjusted border price might in fact not be so. Thirdly, this policy approach enables the Government to collect revenue in the form of import tax. Such revenue could be used to provide direct support to the growers who are the ones most likely to bear the brunt of the social ills of implementation of the policy. Ideally, such support programme should not be tied to the production level, but rather, should assist in cushioning the adverse effects of the policy. The authors are well aware of the commonly held view that attempts to address one issue by itself, via transfers, often leading to the opening up of other issues, but maintain the view that such interventions are sometimes essential, especially when implemented from the perspective of persons involved, and not from any preconceived decision to favour one sector over another.

As indicated elsewhere, the results must be interpreted cautiously in

light of the simplification of the model. Moreover, the analysis focussed strictly on the effects with respect to the broiler industry, but it is known that any policy which changes the prices of one commodity will have spill over effects on other related commodity markets. For instance, it is known that pork and to a lesser extent beef and mutton are close substitutes for broilers and as such, the markets for these commodities would be affected by any decision taken in respect of the poultry industry. Consequently, considerations of these and other non-economic issues would have to be taken into account in designing the final policy proposal.

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Table 1: Production Costs Per lb. of Chicken Sold in 1993

Component	TT$	%
Cost of Chick	0.50	11.8
Feed	1.50	35.3
Medication	0.05	01.2
Servicing Cost to Farmer	0.40	09.4
Processing Costs	1.80	42.3
Average Retail Price	4.25	100.0

Source: Report of the Current Status of the Poultry Industry in Trinidad and Tobago, 1993

Table 2: Plausible Values of the Parameters

Symbol	Parameter	Value
η	Elasticity of broiler demand	-0.5
e_a	Supply elasticity of factor a	1
e_b	Supply elasticity of factor b	0.2
K_a	Relative share of factor a	0.9
K_b	Relative share of factor b	0.1
σ	Elasticity of substitution	0.1
P_w	Adjusted Border Price per lb.	$3.25
P_d	Domestic Price per lb. before liberation	$4.25

Table 3: Relative Percentage Changes in Factor Shares

Percentage Change in Variable				
Policy Variable (P_x)	Price of Input (a)	Price of Input (b)	Factor Share (K_a)	Factor Share (K_b)
-18.8	-15.1	-55.1	3.6	-32.4
-08.2	-6.3	-23.1	1.5	-13.6

Table 4: Social Implications of Proposed Policy Change

Item	Free Trade	Tariff (20%)
Domestic Production	70.59 m lbs	74.88 m lbs
Domestic Demand	91.63 m lbs	83.74 m lbs
Imports	21.04 m lbs	8.86 m lbs
Government Revenue	0	TT$ 04.80 m
Producer Loss	TT$ 74.30 m	TT$ 26.75 m
Consumer Gains	TT$ 84.82 m	TT$ 28.30 m
Net Social Gains	TT$ 10.52 m	TT$ 06.40 m
Nominal Protection Coeff.	1.31*	1.20

*Absence of Free Trade