Commercial Policy Uncertainty, the Expected Cost of Protection, and Market Access

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Abstract: Protection unconstrained by rules often varies substantially over time. Rules-based disciplines like OECD industrial tariff bindings negotiated under GATT since 1947 and new Uruguay Round bindings on agricultural and services trade and on developing country industrial tariffs, constrain this variability. We examine the theoretical effects of such constraints on the expected cost of protection and offer a formalization of the concept of "market access," emphasizing both the first and second moments of the distribution of protection. As an illustration, we provide a stylized examination of Uruguay Round agricultural bindings.

Keywords: expected costs of protection, commercial policy uncertainty, market access WTO, tariff bindings.

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Abstract: Protection unconstrained by rules often varies substantially over time. Rules-based disciplines like OECD industrial tariff bindings negotiated under GATT since 1947 and new Uruguay Round bindings on agricultural and services trade and on developing country industrial tariffs, constrain this variability. We examine the theoretical effects of such constraints on the expected cost of protection and offer a formalization of the concept of "market access," emphasizing both the first and second moments of the distribution of protection. As an illustration, we provide a stylized examination of Uruguay Round agricultural bindings.

I. Introduction

Historically, rates of protection have varied substantially over time. In the much-studied case of protection of industrial products in developed countries, this variability has been greatly diminished as a result of the progressive lowering of multilaterally agreed tariffs. For example, U.S. tariffs averaged 40 percent in the nineteenth century, while ranging between 20 percent and 60 percent over the period. In the first half of the twentieth century, U.S. tariffs followed a similar pattern, ranging from a low of approximately 20 percent to a high of 60 percent of dutiable value. Since the establishment of GATT in 1947, average U.S. tariffs have fallen to less than 5 percent, while the variance of individual bound tariffs has been virtually eliminated.[1] However, the stochastic nature of protection has remained strongly evident across individual sectors and instruments free from, or lightly constrained by, multilateral trade rules. Thus, protection rates have varied substantially in areas such as agriculture (in both developed and developing countries) and in industrial products in developing countries. When we look beyond bound tariffs on industrial goods, we find that a wide range of measures such as variable levies, import quotas, voluntary export restraints (VERs), import surcharges, and the various forms of contingent protection (such as balance of payments actions, safeguard actions, anti-dumping and countervailing duties) continues to be used to generate time-varying rates of protection.

During the Uruguay Round, the coverage of multilateral trade rules was increased substantially. The coverage of tariff bindings was greatly expanded, with the coverage of bindings on agricultural commodities increasing to almost 100 percent. There were also large increases in the proportions of industrial product imports into developing countries covered by bindings. In addition, completely new disciplines were introduced

[1] Caves, Frankel, and Jones (1993, Chapter 14). Changes in bound U.S. tariffs outside the scope of multilateral and bilateral liberalization exercises have become a relatively rare event. They are usually made in the context of disputes over negotiated tariff concessions. This includes the U.S. duty on light trucks, increased in a dispute with Germany in the 1960s. Tariffs on countries outside the GATT system of most-favoured nation (mfn) tariff bindings, like U.S. duties on imports from China, remain subject to movements induced by political winds, including the threatened imposition of non-mfn (Smoot-Hawley) rates.

for trade in services and trade-related investment measures. However, while the range of trade covered by bindings has expanded, many of the new tariff bindings introduced by the Uruguay Round agreements represent relatively loose constraints on policy, being set at or above the currently applied rates of protection. To analyze the effects of these measures requires techniques that have not been widely used by trade policy analysts.

Trade negotiators have long recognized the importance of tariff bindings in an otherwise uncertain world, and the introduction of constraints on countries' trade policies is at the heart of the multilateral trading system. The very structure of market access commitments under the GATT is centered on the concept of bindings. In policy discussions of market access, special emphasis is often placed on the perceived benefits of reductions in the uncertainty confronting exporters regarding commercial policy. This is manifested in trade negotiations, where negotiating credit is given even for tariff bindings at or above initial applied rates. Yet, economists have given relatively little attention to formal evaluation of the benefits of tariff bindings and other commitments in the context of time-varying underlying protection processes.[2] Our objectives in this paper are twofold: to push our notion of protection and trade liberalization further away from one based primarily on fixed policy instruments, and closer to one that involves policy regimes subject to uncertainty and variability; and to offer a relatively simple analytical framework for examination of the implications of rules-based commitments in this context.

We start with a very brief overview of the recent political economy literature on the determinants of protection. The goal of this section is not the choice of a particular political submodel, but rather the motivation of our characterization of trade policy as subject to uncertainty. In our view, this body of literature provides a rather convincing rationale for treating the rate of protection as inherently uncertain. We then examine the impact of policy rules on the first and second moments of the intertemporal distribution of rates of protection. This is followed by an evaluation of the consequences of changes in these moments for the expected cost of protection in own markets, and for the conditions of market access in export markets. A simple stylized examination of Uruguay Round agricultural bindings is then provided as illustration.

II. Characterizing the distribution of protection

A major thrust of trade policy research in recent decades has been the development of political economy models to represent the process of trade policy formulation. These models specify national trade policy

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[2] The literature on trade under uncertainty emphasizes stochastic disturbances in preferences or technology. See, for example, Helpman and Razin (1978), Pomery (1984), and Falvery and Lloyd (1991). With the notable recent exceptions of Stockman and Dellas (1986), Barari and Lapan (1993), who examine asset markets under tariff uncertainty, and Stahl and Turunen-Red (1995), who examine tariff games, the formal implications of stochastic tariff regimes remain relatively unexplored. The formal literature on trade rules and institutions focuses instead on rules in the context of tariff games between governments. (In this regard, see the excellent survey by Staiger 1996).

measures as being determined by a set of time-varying explanatory variables operating through a political process, which introduces a wide range of additional shocks to protection rates. While the emphasis of this literature has been on explaining the level of protection at any time, it seems clear to us that the models used imply that unrestrained protection will typically be subject to uncertainty. Our goal in this section is not to offer a preferred political economy model of uncertainty in the level of protection, but rather to argue that the existing body literature provides rational for expecting the reduced form representation of protection from such processes to be subject to uncertainty. [3]

One set of explanations for variations in rates of protection across industries and over time is inspired by the work of Olson (1965) and Stigler (1974), and focuses on factors such as the structure of the industry, its consequent costs of organization, and lobbying success. Another set of explanations surveyed by Dornbusch and Frankel (1987) emphasizes the role of macroeconomic shocks. A third set of models considers in more depth the nature of the political decision making system which generates protection decisions (see Magee, Brock and Young, 1989) and introduces shocks from random political outcomes. Yet another approach emphasizes the role of past and present shocks to import levels. Finally, the choice of protective instrument will reflect the preferences of decision makers regarding the volatility of protection, and this choice will introduce an additional random element into the behavior of protection.

Anderson (1978, 1980) draws on the theoretical work of Olson and Stigler to explain differences in protection levels across industries in terms of a range of predetermined variables, including the number of firms, the size of the industry, the industry's net trade position, the labor intensity of the production process, and its geographical concentration (which influences its political strength). Gardner (1987) draws on similar literature to explain differences in agricultural protection both across industries and over time. In such a conceptual framework, variations in "predetermined " variables, like the net trade position of an industry and industry size and health, can generate consequent swings in protection.

Dornbusch and Frankel (1987) offer models of protectionist pressures based on highly variable macroeconomic influences such as the real exchange rate, the real interest rate and the rate of unemployment. Ray (1987) provides other evidence linking protection to unemployment and recessions, Hanson (1990), and Bohara and Kaempfer (1991). The variables that generate changes in protection in these models are random, and are augmented by other random influences not captured in the models. Again, such linkages suggest that medium- and long-run swings in the macroeconomic environment may also generate swings in protection at the industry level. In the context of developing countries, Rodrik (1994) emphasizes the importance of tariffs as a source of government revenue. This provides a direct link between macroeconomic conditions and government incentives for applying tariffs.

[3] See Rodrik (1986, 1994), and also Nelson (1994), for discussion of this literature.

We also know that tariff levels are positively correlated with import levels (Leamer, 1988), which in turn are variable and subject to movements in exchange rates and macroeconomic conditions.[4] In terms of quotas, Bhagwati and Srinivasan (1976) offer a theoretical example where the level of imports in one period determines the probability of an import quota in the next. The threat of such protection reduces the (optimal) incentives for export from the point of view of the exporting country. One can imagine the level of import penetration, in various permutations of such a framework, as depending on exchange rate swings, the business cycle, or a number of other factors. The more recent theoretical literature (Baldwin 1989; Magee, Brock and Young, 1989; and Hillman, 1982) also links protection, in its various guises, with increased import penetration. In particular, increased penetration leads to intensified lobbying for protection. Trefler (1993) offers evidence that the application of NTBs in the United States is correlated with changes in the level of import penetration. In Trefler's results, it is changing (i.e. variable) market conditions and not the level of import penetration *per se*, that leads to increases in protection.

The political processes highlighted in models emphasizing the political lobbying process (see, for example, Magee, Brock and Young, 1989) introduce additional sources of randomness into the determination of protection policies. Voters' views of protection vary through time, as does the extent to which politicians supply the trade policies they promise. The possibility of voter retribution in cases of nonperformance introduces further variability into the trade policy process.

The form of protection chosen may have an important impact on the variability of protection. While *ad valorem* tariffs maintain a fixed relativity between domestic and world prices, this is not the case with virtually any other form of protection. Specific tariffs can lead to very large changes in relative prices. Crucini (1994) finds that the use of specific tariffs was much more important than the Hawley-Smoot Act in raising US tariff rates during the 1930s. Protective instruments such as import quotas and variable import levies can have similarly dramatic impacts on relative prices for particular commodities. As emphasized by Vousden (1990, p70), the choice of protective instrument is not arbitrary. It is likely to be influenced by its impact on the mean and variability of the incomes of various groups. In turn, this choice will influence the variability of protection rates.

Uncertainty (and hence intertemporal variability) in the rate of protection is particularly marked in import monitoring and administered protection regimes such as those imposed where dumping is alleged. Winters (1994) finds that import surveillance, in the case of the European Union, can have a significant dampening effect on trade. Tollefsen (1994) notes that, as a group, VERs and monitoring mechanisms are the

[4] For example, the round of trade activism in trade-sensitive sectors in the United States in the mid 1980s, during a period with a soaring dollar and massive capital inflows, could be characterized as one of microeconomic triage for macroeconomic imbalances. The demand for protection can be responsive to swings in conditions well beyond those related to the immediate workings of particular sectors and their respective agents.

most common form of nontariff barrier (NTB) protection applied in the industrial countries. Both are a common outcome of threatened or suspended antidumping and countervailing duty actions.

While EC antidumping cases are more frequently settled by price undertakings and associated monitoring mechanisms (Hindley, 1990), U.S. practice in this area can take a similar tack, as evidenced by the U.S. export restraint arrangements on bearings from Japan and uranium from the FSU republics. Hindley postulates that, given the administrative uncertainly inherent in the U.S. system, there is an incentive for exporters to the United States to raise their prices on products not covered by antidumping duties, simply to reduce the probability of an investigation. Similar incentives exist to accept "voluntary" restraint arrangements under the threat of AD actions. In addition to administrative uncertainty, Feinberg (1989) links findings of dumping to swings in exchange rates, while Feinberg and Hirsch (1989) link such findings in downstream industries to the imposition of protection in upstream sectors.

Under the system of administrative reviews and revision to dumping duties used in the United States, existing dumping orders themselves serve as a type of monitoring mechanism. This mechanism may have a significant effect, even when bond requirements are below one percent. Boltuck, Francois, and Kaplan (1990) offer empirical evidence related to the outcome of administrative reviews. Because dumping duties in the United States are initially levied as bonds, with the actual duty rates determined long after the actual entry of imports, the *ex ante* variance in the duty-inclusive price of imports subject to bonding requirements can be quite large, introducing yet another stochastic component to the observed rate of protection.

Whichever model, or combination of models, is chosen to characterize the *ex ante* distribution of protection, it seems clear that protection rates for individual commodities should be characterized not merely by a single deterministic value, but as the outcome of an inherently stochastic process characterized by a mean value and one or more higher moments.

III. Rules as limits on protection

Born out of the experience of escalating tariffs in the period between the two world wars, the multilateral trading system is a set of rules which restricts the damage that governments can impose through unbridled use of the range of policy instruments otherwise available to them. In most cases, multilateral trade rules do not prescribe precisely what countries must do. Rather, they tend to operate by imposing limits on the values and types of protection which are allowed, and by forcing a degree of transparency onto trade regimes. Like Ulysses tied to the mast, governments are then able to listen to the siren call of protectionist lobbies, while pleading an ability to actually respond. Tariffs are prohibited from varying across suppliers by most-favored-nation (mfn) requirements and their variation over time is limited by tariff bindings. The application of certain quotas is limited, or even prohibited, by the Uruguay Round Agreements. Contingent protection, through fair trade and safeguard actions, is in theory limited by related GATT disciplines as well. Other rules apply to balance-of-payments actions, licensing requirements, and trade-related investment measures. In the Uruguay Round, market access bindings were also introduced for the service sectors.

Countries offering tariff bindings do not generally specify the tariff rate that they will actually apply. Instead, they commit themselves to tariff rates not exceeding the bound rate. Bindings are vital to the process of securing trade agreements. If an agreed tariff reduction could be unilaterally reversed, any liberalization offer would have to be weighed against the probability of backsliding. Exporting firms, which provide much of the political support for multilateral trade liberalization, are likely to be unenthusiastic about tariff cuts they expect to be short-lived. Bindings themselves are considered to be so important that countries agreeing to bind previously unbound tariffs are given "negotiating credit" for the decision. This is true even if the tariff is bound above the currently applied level.

Mexico provides a recent example of ceiling bindings that limit future increases in protection. The overall pattern of tariffs, for the period spanning from 1982-1991, is presented in Table 1. The level of tariffs in the table reflects an episode of liberalization following Mexico's 1982 financial crisis. As part of Mexico's accession to the GATT in 1986, Mexico agreed to bind its entire tariff schedule, including both industrial and agricultural products, at a 50 percent ad valorem rate.[5] In the year prior to accession (1985), the average tariff was 18.5 percent. However, while the average tariff in 1985 was 18.5 percent, some products were dutied at rates of up to 100 percent. The average tariff on consumer goods in the year prior to GATT accession was 45 percent. Even since accession, Mexico's average tariffs have ranged between 4.0 percent and 13.1 percent. A further cap on tariffs was imposed by Mexico's entry into the North American Free Trade Agreement (NAFTA). From 1967 to 1990, the aggregate U.S. and Canadian share of Mexican imports has hovered around 65 percent. The combined effects of GATT accession and the NAFTA has been to significantly limit Mexico's scope for raising trade barriers through tariffs, and has placed caps that, though often above current rates, are well below the historically observed peak rates. (Francois 1997).

Tariffs are not the only measures that can be bound. For agricultural products, bindings include commitments on subsidies granted to exported products or to volumes exported with the aid of subsidies, and on internal support to agricultural producers. In the case of services, where obstacles to trade are not centered on border measures, countries have bound the level of market access and national treatment for sectors listed in their respective schedules, meaning that no new measures affecting entry and operation in the market may be imposed with respect to four modes of supplying a service (cross-border, consumption abroad, commercial presence, and movement of personnel).

To ensure the credibility of these commitments, it is necessary to limit the remaining set of available instruments as well. Under GATT 1994, the limitations on industrial quotas accomplish part of this. The

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[5] The exception was any imports already covered by lower bindings. Mexico also negotiated quotas were also negotiated for certain products (primarily agricultural and wood-based products) under bound rates. See GATT(1993).

Uruguay Round Agreement on Safeguards requires the abolition of VERs, orderly marketing arrangements or any similar measures on the export or the import side, and places further limits on GATT-legal contingent protection. In theory, this includes notification requirements for the introduction of new quotas under the safeguards provisions (Article XIX). The Agreement also applies a "sunset clause" to all safeguard actions and sets out requirements for safeguard investigations. The Agreement on Implementation of Article VI (antidumping) clarifies many aspects of the rules governing the application of anti-dumping measures. Whether these rules actually constrain protection outcomes remains to be seen, however (see Finger, 1996).

IV. The effect of binding rules on the observed distribution of protection

In this section, we develop a formal (and admittedly stylized) representation of rules-based bindings on trade policy. For clarity of exposition, we limit ourselves to a single instrument operating as a tariff. Though we limit ourselves to a price-based instrument, other rules-based constraints on protection can be analyzed, qualitatively, in a similar way.

We begin by representing the underlying distribution of protection in the absence of a tariff binding by a distribution such as that depicted in Figure 1. In general terms, we motivate our representation by the determinants of uncertainty in protection discussed in the previous section. In this context, there are numerous political models that can be invoked here to drive the underlying probabilities related to a particular government orientation toward trade. (See, for example, Stahl and Turinen-Red). What is important for the present discussion is not the choice of a particular political submodel, but rather the resulting characterization of trade policy as subject to uncertainty. Formally, therefore, we simply assume that the expected level of the tariff is μ_0 in the absence of a binding on the tariff rate applied, and the distribution of protection can be characterized by a relatively small number of moments.

Now consider the introduction of a tariff binding at rate β. By definition, such a binding rules out all tariff rates above β. If the underlying probability distribution does not change, then all of the probability mass formerly associated with applied tariffs equal to or above β is mapped onto tariff rate β. The resulting distribution of tariffs is a winsorized distribution consisting of a truncated distribution of tariff rates up to the binding, and a "spike" at the bound rate, β. With the binding, the expected rate of protection will decline to a point like μ_1, and its variability will decrease. The effect of a binding at any given level above μ_0 on the mean of the protection process will be greater the larger is the variance of the protection process.

The effect of a tariff binding on the mean of the protection rate can be evaluated by calculating the expected tariff rate in the presence of a binding and comparing it with the mean of the unconstrained distribution of protection. Adapting the approach used by Martin and Urban (1984) to analyze the effects of support prices, we obtain the following expression for the mean tariff equivalent in the presence of the binding.

(1) $$\mu_1 = \int_0^{\beta} \tau . f(\tau)d\tau + \int_{\beta}^{\infty} \beta \cdot f(\tau)d\tau$$

where μ_1 is the mean of the new distribution where tariffs are constrained by the binding; τ is the tariff rate; and *f*, which may be conditional on the exogenous factors suggested in the literature, is the density function of the tariff rate.[6]

Because β is a constant, equation (1) may be simplified to:

(2) $$\mu_1 = \int_0^{\beta} \tau . f(\tau)d\tau + \beta .(1 - F(\beta))$$

where $F(\tau)$ is the distribution (cumulative density) function of the tariff rate.

If the distribution of the tariff rate can be approximated by a normal distribution, and if the distribution assumed to be invariant with respect to the imposition of a binding, the mean of the tariff can be expressed in normalized form (μ_Z) as:

(3) $$\mu_Z = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(Z^*)^2} + Z^*(1 - F(Z^*))$$

where $Z = (\tau-\mu_0)/\sigma_0$, is simply the normalized tariff rate, defined by calculating the deviation of the tariff rate from its unbound mean and dividing by σ_0, the standard deviation of the original distribution, and where $Z^* = (\beta-\mu_0)/\sigma_0$ is the value of the normalized tariff binding. Similar expressions can be derived for alternative functional distributions.

In more general terms, rearranging equation (2) gives us the following general expression for the long-run mean of the tariff following the introduction of a binding:

(4) $$\mu_1 = \mu_0 - \int_{\beta}^{\infty} (\tau - \beta) f(\tau)d\tau = \mu_0 - \int_{\beta}^{\infty} (\tau) f(\tau)d\tau + \beta \int_{\beta}^{\infty} f(\tau)d\tau$$

From the structure of the expression, it is clear that μ_1 must be less than the mean of the unbound tariff, μ_0. The relationship between the mean subject to binding (μ_1), and the unbound mean (μ_0) is a nonlinear one, implying that the expected tariff cannot change one for one with the binding, as is frequently

[6]Alternative approaches for this type of problem have been suggested by Fraser (1988) who derived the mean price by mixing the two distributions, and by Bardsley and Cashin (1990), who applied option pricing theory.

assumed in the applied literature. For β well below μ_0, $F(\beta)$ (the probability mass to the left of β) will be relatively close to zero and so μ_1 will essentially decline one for one with reductions in the tariff binding. At higher bound rates, the marginal effect of a reduction in the tariff binding will be much less than unity. Importantly, however, the marginal effect of a change in a tariff binding does not change abruptly when the binding passes through the mean tariff rate, but rather declines monotonically with increases in the distribution function. This contrasts sharply with the deterministic case where changes in the binding have a unit impact below the applied rate and a zero impact at all values above the applied rate. For very high values of β, the marginal impact of a change in the binding approaches zero, giving the common-sense conclusion that marginal changes in the binding about very high levels have essentially no effect on the expected value of the tariff. Another way of interpreting equation (4) is in terms of the amount of probability mass accumulated at the binding. A marginal reduction in β has a one for one impact on the protection rate associated with the probability mass accumulated at that point. The impact of the change on the mean rate of protection depends upon the amount of probability mass accumulated at the binding, that is on $(1-F(\beta))=\int_{\beta}^{\infty} f(\tau)\,d\tau$.

If we take the average tariff rates on industrial products prior to the first post-war GATT Round as indicative of the underlying mean rate of protection on industrial products in developed countries, then this would imply an underlying average tariff rate of 40-50 percent (Preeg 1994). With average industrial tariffs in the developed countries reduced to only six percent after the Tokyo Round, and 3.5 percent with the Uruguay Round, it seems likely that $F(Z^*)$ was effectively zero from a policy viewpoint, implying that incremental reductions in industrial tariff bindings in the OECD (which by the end of the Tokyo Round were virtually all equal to the applied rates) had essentially a unit impact on expected future tariff rates. This is consistent with the approach used in quantitative studies of the Tokyo (see, for example, Deardorff and Stern, 1986), where reductions in bindings were treated as leading to one-for-one reductions in protection. To extrapolate such an approach to Preeg's "brave new world" of the Uruguay Round agreement seems hazardous-- particularly since it involves bindings at or above previous levels of protection in many areas, and particularly in the agriculture agreement (Hathaway and Ingco, 1996).

The effect of a binding on the variance of the distribution can be evaluated using similar procedures to those adopted for the mean. We first write the general expression for the post-winsorization variance of a standardized variable (Freund and Walpole 1980):

(5) $$\sigma_z^2 = \int_{-\infty}^{Z^*} Z^2 . f(Z).dZ + \int_{Z^*}^{\infty} Z^{*2} . f(Z)dZ - \mu_Z^2$$

For the standardized normal, this has the explicit solution:

(6) $$\sigma_z^2 = F(Z^*) - Z^*.\frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}Z^{*2}} + Z^{*2}(1 - F(Z^*)) - \mu_Z^2$$

The variance of the standardized distribution of protection in the presence of a binding is then given by:

(7) $$\sigma_1^2 = \sigma_0^2 . \sigma_z^2$$

The marginal impact of a binding on the variance of protection can be derived in the same way as the impact of the binding on the mean. By differentiating equation (7) and rearranging the results, we find that:

(8) $$\frac{\partial \sigma_1^2}{\partial \beta} = 2(\beta - \mu_1)(1 - F(Z^*))$$

From equation (8), it is clear that the marginal impact of a change in a tariff binding on the variance may be considerably different from the impact on the mean. For values considerably above the underlying mean of the unfettered distribution, the impact of a change in the binding on the variance is very small for the same reason that the impact on the mean is small: because *(1-F(Z*))* approaches zero. This result reflects the intuition that small changes in bindings that are so high as to be irrelevant for practical policy purposes have very little impact on either the mean or the variability of the distribution. An important difference arises when we consider changes in bindings well below the underlying mean of the distribution. In this case, the binding approaches the mean of the winsorized distribution. Accordingly, $(\beta-\mu_1)$ approaches zero and the marginal impact of the binding on the variance of the distribution approaches zero -- even though the marginal impact on the mean is at its maximum in this situation. Here, virtually all of the probability distribution is collected at the binding and marginal reductions in the binding have very little further impact on the variance of protection.

V. The welfare implications of commercial policy uncertainty

We next turn to a general equilibrium representation of the welfare effects of protection. Our emphasis in this section is on protection in import markets (i.e. own protection). However, this will be extended to a more general representation of market access uncertainty (i.e. protection by trading partners as well) in the next section. For clarity of exposition, we continue with our focus on a single price-based instrument.

A convenient approach to evaluating the welfare impacts of protection in general equilibrium is the Balance of Trade function (Lloyd and Schweinberger 1988; Anderson and Neary 1992; Martin 1995). Under this approach, a money measure of the change in welfare resulting from a tariff is obtained by evaluating the change in the balance of trade necessary to maintain constant utility (i.e. the net transfer needed to maintain welfare), given a change in a policy. A policy distortion that reduces domestic efficiency increases the costs of achieving a given level of utility, and requires a transfer from the rest of the world to maintain that utility level. As will become evident, for individual product markets, more generally for standard 2 good models, and alternatively for the stylized representation of exports and imports by composite goods, this approach can be used to illustrate general equilibrium welfare effects through familiar geometric tools normally associated with partial equilibrium models. (See Martin 1997; Francois and Hall 1997).

We start by defining general equilibrium for a small country in terms of dual expenditure and revenue functions. The value of output is defined by the function $g(p, v)$, and the expenditure function by $e(p, u)$:

$$(9) \qquad g(p,v) = \max_{x} \{ p \cdot x | (x,v) \text{feasible} \} = p \cdot x(p,v)$$

$$(10) \qquad e(p,u) = \min \{ p \cdot c | f(c) \geq u \}$$

In equations (9) and (10), $e(p,u)$ is the expenditure required to achieve the level of utility u at the vector of domestic, distorted prices p, and $g(p,v)$ is the gdp function indicating the maximum production revenue which can be generated with resource endowments v at domestic prices p. The vector of domestic demands for output is given by the first derivative of $e(p,u)$ with respect to p, while domestic supplies are represented by g_p. The gap between the domestic and the world price, $(p-p^*)$, is the tariff on imports, so that tariff revenues are given by $(e_p - g_p)(p - p^*)$. The balance of trade function for an economy subject only to trade distortions is then defined as:

$$(11) \qquad B = e(p,u) - g(p,v) - (e_p - g_p)(p - p^*)$$

For notational simplicity, it is convenient to rewrite (11) in terms of the net revenue function $z(p,u,v)=e(p,u)-g(p,v)$ and its derivatives. Thus:

$$(12) \qquad B = z(p,u,v) - (z_p)(p - p^*)$$

To consider the effect of discrete changes in protection on the balance of trade function, it is convenient to use a second-order Taylor Series expansion. Assuming linearity of the excess demand curve, z_p , so that third derivatives vanish, this yields the following expression for the welfare effects of any change in a tariff:

$$(13) \qquad \Delta B = -z_{pp}(p - p^*)\Delta p - \frac{1}{2} z_{pp}(\Delta p)^2$$

To evaluate the expected costs of a single tariff subject to uncertainty, we evaluate (13) about a zero-tariff initial equilibrium, and take expectations to obtain:

$$(14) \qquad E(\Delta B) = -\frac{1}{2} z_{pp} E(\tau)^2 = -\frac{1}{2} z_{pp}\left(\mu_\tau^2 + \sigma_\tau^2\right)$$

where the first term on the right hand side of (13) disappears because the tariff was initially zero; Δp can be replaced by $\tau = (p - p^*)$ following the introduction of the tariff; and where μ_τ and σ_τ^2 are the mean and variance of the tariff.

From (14), we can see that our general equilibrium measure of the cost of protection on imports, relative to a free trade benchmark where $(p\text{-}p^*)=0$, is determined by the second moment of the tariff about the origin, $E(\tau)^2$, multiplied by 1/2 times the slope of the compensated import demand curve, z_{pp}. Since the second moment about the origin is equal to the sum of the mean squared and the variance, this implies that the expected cost of protection is given by the square of the mean tariff plus the variance of the tariff, all multiplied by one half the (absolute) slope of the compensated excess demand curve. Clearly, this implies that absolute reductions in the variance of protection and in the mean-squared rate of protection have the same qualitative impact on the costs of protection.

VI. The gains from improved market access

A. import protection

We next turn to a geometric representation of the welfare implications of bindings on import protection. Equation (14) can be given a graphical interpretation using Figure 2, which depicts the compensated import demand curve, z_p. If we first consider the case of a deterministic tariff of $(p\text{-}p^*)$, then our general equilibrium welfare measure is approximated by the Harberger triangle *cab* under the excess demand curve in Figure 2. This area is equal to $-1/2.z_{pp}(p\text{-}p^*)^2$. To illustrate the nature of the higher costs associated with variable protection, consider symmetric variations around this tariff level, with a higher tariff yielding a higher domestic price of p_h in one period, and a lower tariff yielding a lower domestic price, p_l in another time period. In Figure 2, the higher tariff has a welfare cost represented by area *cfg*, while the cost of the lower tariff is represented by area *cde*. Clearly, the average cost associated with the varying protection is greater than area *cab* associated with the same average rate of protection. This asymmetry is a manifestation of the convexity of equation (14) in the tariff rate.

Traditional analysis of the welfare effects of a tariff is based on the assumption that a tariff remains fixed, such that the variance term in equation (12) is zero. Under this assumption, equation (14) collapses to:

(15) $$\Delta B = -\frac{1}{2} z_{pp} \tau^2 = -\frac{1}{2} z_{pp} \mu_{\tau}^2$$

Comparison of equations (14) and (15) makes it clear that the basic element missing under the assumption of a fixed rate of protection is the variance term, which maps directly into the welfare impact of protection.

Equation (14) provides a formal representation of the concept of market security so much emphasized in qualitative analysis of trade policy. By combining the impacts of changes in bindings on both the mean and the variance of protection into a single measure of welfare change, it allows us to provide a quantitative estimate of the extent to which protection policy restrained by GATT-type disciplines is to be preferred over protection which is free to vary in an uncontrolled manner. Early in the liberalization process, when tariff bindings are generally high relative to the underlying mean of the distribution of protection, the gains from subjecting protection to multilateral disciplines may be due more to reductions in variability than to reductions in the mean level of protection. This implies that the near-universal omission of the beneficial impacts of reductions in the variability of protection in studies of multilateral trade liberalization may have greatly understated the gains, particularly in the early stages of the process.

The formula for the cost of variable protection given in equation (14) also provides us with a simple approach to estimate the relative reduction in the cost of protection associated with the introduction of a binding. This involves estimating the mean and the standard deviation of protection before and after the new binding. Squaring these and adding them yields the second moment of the rate of protection, τ, about zero. Note that z_{pp} can be replaced by $M_0 \varepsilon$ where M_0 is the free trade level of imports, ε is the (constant) import demand elasticity, and free trade prices are normalized to 1. Taking $-1/2.z_{pp}$ to be a constant, the proportional reduction in the second moment will give the proportional reduction in the cost of protection.

If we index the base cost of protection at I_o=100, then we can define a welfare-weighted index of the expected cost of protection as follows:

(16) $$I_1 = (E(\Delta B_1) / E(\Delta B_0)) \times 100 = (z_{pp} E(\Delta p_1)^2 / (z_{pp} E(\Delta p_0)^2) \times 100$$

We will revisit the possible application of equation (14) in Section VII of this paper.

B. *improved market access*

While as trade economists we often emphasize import protection when subjecting trade liberalization to our formal analytical tricks, political emphasis during negotiations is actually placed on protection in export markets. Improved market access, which to exporters means more restrictive bindings on protection in export markets, is the price demanded by governments for own-liberalization. This follows, in part, from the willingness of individual exporters to back initiatives that involve improved access to their export markets.[7] This is not the end of the story, however. We should also expect reduced uncertainty about trading conditions in export markets to have welfare implications for the economy as a whole. In this section, we offer a simple formal representation of improved market security access in the context of bindings.[8]

We start by again assuming a small country. Its terms of trade are taken as given, and its structure is again represented by equations (9)-(11). While the country is small, its trading partners are not, and its terms-of-trade depend on shifting patterns of protection among those large trading partners. In terms of equation (12), we are therefore assuming that $p=p^*$. We again take a second order Taylor Series expansion of equation (12), obtaining:

$$(17) \qquad \Delta B = z_p \Delta p^* - \frac{1}{2} z_{pp} (\Delta p^*)^2$$

How do we represent market access in export markets in a stochastic context? We will assume that the absence of protection in export markets defines full market access. Like the case of import protection, higher degrees of protection in export markets, which mean worse conditions of market access, are assumed to be characterized by a probability density function. Basically, with increases in such protection, our small exporter will register a deterioration in the terms of trade as reflected in P. We leave it to the reader to verify that tariff bindings in this context have implications for improvements in the <u>expected</u> terms of market access similar to the implications for expected rates of home protection. In the present context, where we are concerned with economywide welfare implications, market access uncertainty will translates into terms of trade uncertainty. Taking expectation of equation (18), we have:

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7 If one believes that own-liberalization is an important source of welfare gains, then the GATT/WTO can be viewed as a very successful trick. By pressing for mutual liberalization in export markets, Member countries are actually, on net, acting as if they were jointly pursuing import liberalization (as one's imports is another's exports). Therefore, own liberalization is pressed by the harnessing of mercantilist interests.

8 Of course, one may also expect reduced uncertainty about protection in export markets to also have implications for the behavior of investors. We turn to this issue in the concluding section of the paper.

$$(18) \qquad E(\Delta B) = z_p \eta_x - \frac{1}{2} z_{pp} \left(\eta_x^2 + \sigma_x^2\right)$$

Where η_x is the mean expected deterioration in the terms of trade, and σ_x^2 is the associated variance term.

Like equation (14), equation (18) can also be given a graphical interpretation. Returning to Figure 2, the second term in equation (18) again relates to the expected value of the welfare triangle in the figure. The critical difference is the first term, which does not appear in equation (14). This term measures the expected value of the relevant rectangles in Figure 2, those that involved tariff revenue in the case of own protection, but that now represent the expected increase in the cost of imports relative to full market access. Comparison of equations (14) and (18) shows that, in the present context, the variance component of expected interventions accounts for a relatively more important share of the welfare impact of own liberalization than it does in the case of improved market access. This is because, in the case of market access, the expected deterioration in market access conditions relative to free access enters not only in terms of the dead weight loss triangle (resource allocation effects), but also in terms of the expected increase in the cost of actual imports.

C. possible generalizations

The formal analysis offered in this paper has been stylized, incorporating the simplifying assumptions of a single price-based instrument for which the underlying probability distribution is invariant to changes in bindings. Generalizing the analysis across instruments and/or sectors would obviously require relaxation of this assumption. While this is well beyond the basic thrust of the paper, it merits some discussion here.

It should be straightforward, in principle, to generalize the analysis to cases where the distribution changes in response to changes in bindings. In some cases, the mean level of protection through a particular instrument might increase when the binding on that instrument is reduced, in an attempt to offset the effect of the reduction in the binding. In other cases, a reduction in a binding might reduce the profitability of rent-seeking behavior enough to lower the mean of the underlying distribution. (One would expect that, in most cases, these impacts will be second-order relative to those that are highlighted here, such that liberalizations are not 100 percent offset.)

More significant is the possibility of the interaction of bindings with the distribution of protection across instruments and sectors. In most of this paper we treat τ as a single price instrument, applied in a single market. However, the basic point summarized by equations (13), (14), and (15) is more general: that the mean cost of protection is determined by the probability density function surrounding the protection term τ. One could also interpret τ as a vector of instruments applied over a set of markets, where the cost of protection then depends on the probability density function (including covariance terms) for the full vector of instruments. The binding term β can then be interpreted as a vector of instrument caps.

If we assume we are working with a vector of policy instruments linked across sectors, then the cost of protection becomes a multi-market measure, rather than a single market measure. This is consistent with our general equilibrium approach to modelling the issue. Equation (11) is sufficiently general to allow for any number of trade distortions, and the expected cost of protection may be measured by a multivariate extension of equation (14). In the multivariate context, the cost of protection is given (to a second-order approximation) by a quadratic form in t: Taking expectations of this quadratic form leads to the multivariate version of equation (14):

(19) $$E(\Delta B) = -\frac{1}{2}E(t'Z_{pp}t) = -\frac{1}{2}TR(Z_{pp}\Sigma)$$

where Z_{pp} is the matrix of compensated price effects contained in the behavioral model, and S is the variance-covariance matrix of second moments about the origin of the different protective instruments.

It is also theoretically possible to extend the analysis still further and incorporate endogenous responses of the distribution of protection within a multiple-market, multiple-instrument analysis. Such a fully general analysis would need to allow for the possibility of *instrument-switching* as discussed by Martin and Francois (1997), where the impact of one instrument is offset by endogenously-determined changes in another. Undertaking a completely general, multiple-market, multiple-instrument empirical evaluation of the impacts of bindings would be problematic at best, given our basic uncertainties about which general class of political-economy models is the most appropriate for explaining the choice of particular policy instruments. However, as a modest step toward assessing the possible magnitude of the effects under consideration, we turn in the next section to a relatively simple stylized assessment for three major commodities of the impact of an important area of trade reform under the Uruguay Round -- the introduction of tariff bindings on agricultural commodities.

VII. An illustration: Uruguay Round agricultural bindings

A typical operational approach to assessing the liberalizing effects of the introduction of a new binding, or a reduction in an existing binding, is to take the marginal impact of the binding to be zero if the final binding is above the initial applied rate, and to be unity if it is below the initial applied rate. It should now be clear that this approach completely ignores the effects of tariff bindings above the mean. Less obviously, it tends to overstate the marginal impact of reductions in bindings occurring at or below the initial applied rate. Our objective in this section is to illustrate the concepts we have developed here through a stylized application to agricultural bindings undertaken during the Uruguay Round.

Because of the complexities and uncertainties inherent in the full multivariate case, we elect to focus on individual commodities and countries in this application. Since we would normally expect bindings on one commodity to reduce the pressure for protection from related industries[9], we feel that the single-commodity analysis presented below will underestimate the gains associated with the extensive tariffication undertaken during the Uruguay Round. It will, at the same time, raise the lower-bound estimate above that reached by current methods. In a global analysis, terms of trade and second-best effects of changes in world prices must also be considered. These are excluded in the present exercise in order to allow us to focus on illustration of the direct effects of primary interest. (However this could be included in a large scale numerical analysis.)

Under the Uruguay Round agricultural agreement, developed countries are required to establish tariff bindings for previously unbound agricultural products with a protective effect equal to the combined effects of tariffs and nontariff barriers in a base period (1986-88), and to subsequently reduce them by an average of 36 percent in developed countries (24 percent in developing countries) and by at least 15 percent (10 percent in developing countries) for each tariff line. As detailed in Table 2, tariffication affected roughly 13 percent of agricultural trade by value, though it was concentrated in the most heavily protected sectors. Its implications for potential welfare effects are therefore greater than suggested by the trade weights. Sectors subject to tariffication include wheat, sugar, meat, and dairy products. The procedures used to estimate the protective effects of nontariff barriers allowed considerable scope for discretion.[10] As a result, many of the new tariff bindings in developed and developing countries for products subject to tariffication will be set above their levels in the reference period. This means that many of the tariff cuts in Table 2 are from elevated levels. Developing countries also had the option to set their tariff bindings even higher through the use of ceiling bindings (Hathaway and Ingco, 1996). Hence, even for sectors not subject to tariffication, developing countries often entered tariff bindings significantly above applied rates.

In this situation, simple approaches to evaluating the liberalizing effects of agricultural tariff bindings are likely to tell us very little. If the tariff bindings are simply compared with the previously applied rates of protection, it may even appear that the agreement has resulted in an increase in protection. A standard approach is to compare applied rate to bindings, and assume changes occur only if the new bindings are below old applied rates. (See, for example, Francois *et al*, 1996). Under this approach, the estimated extent of liberalization is likely to be extremely small, as is evident from Hathaway and Ingco's (1996) analysis.

The approach we take here is to estimate the mean and variance of the underlying distribution of protection, and to evaluate the impact of bindings on the mean level and cost of protection. Comparison of the mean level of protection with the mean of the data during the sample period provides an initial indication of the extent of expected liberalization. We use data calculated by the OECD for the annual *ad valorem* equivalents of

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[9] This is particularly likely to be the case where goods are related vertically or horizontally in production. More generally, increases in protection to one industry tend to provide a positive signal to protectionist lobbies, and to stimulate protectionist pressures.

[10] The tariff equivalents were generally to be calculated at the 4-digit level of the Harmonized System, while tariffs are applied at the individual national tariff line level, which may involve 10 or 12 digits.

agricultural trade barriers in OECD countries (OECD 1994) made available on diskette by the Agriculture Directorate of the OECD. These data are available over the period 1979-93, providing a sample large enough to make a rough calculation of the standard deviation of protection for each commodity under the policy regime applying during this period. For illustrative purposes, our calculations are based on the assumption that the mean and variance of protection over the 1979-93 period would continue to apply in the future in the absence of a tariff binding.[11] Where Uruguay Round tariff bindings were made in specific terms, they have been converted to *ad valorem* equivalents using World Bank commodity price projections.

We take the world price of the good as exogenous to each individual country, and the rate of protection as distributed independently of this world price. In a short run context of sticky internal prices, it is clear that the protection rate is not completely independent of the world price on a year to year basis. In fact, once the domestic price is set for a season under arrangements such as the European Union's variable levy system, the protection rate and the world price are perfectly negatively correlated. Over the longer term, however, there is evidence that domestic prices tend to follow world prices of agricultural products, except for a stochastic margin term that includes the effects of protection policy (Mundlak and Larson, 1992).[12]

We assume that the moments of the process generating the distribution of protection remain constant after the introduction of bindings. That is, we assume that the fundamental determinants of the supply of and demand for protection do not change because of the introduction of tariff bindings, and that basically the same instruments continue to be used to determine the rate of protection below the constraint imposed by the binding. In some important cases, such as EU agricultural policy, the same general instruments for border protection will continue to be employed, subject to the constraint imposed by the GATT tariff bindings (Josling and Tangermann, 1994). Even if the specific instruments utilized do change, it seems reasonable to assume, as a general rule, that protection will still vary in similar ways, since the fundamental stochastic determinants of protection remain in place.

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[11]This assumption is clearly important. If protection rates are increasing, then this assumption may understate the degree of liberalization which has been achieved. Importantly, we also assume that the balance between those seeking and resisting protection will be unchanged by the presence of a binding. If, however, both parties are fully rational in their understanding of the system, it is possible that the suppliers and demanders of protection would understand that a higher level of protection during unbound periods is required to achieve any given level of average protection. In this super-rational case, our results may overstate the degree of liberalization actually achieved.

[12] As a check on the robustness of our results, we calculated the correlation between the world price and the protection rate using our sample. In general, these correlations were very small, suggesting that the lack of independence between the world price and the protection rate would not significantly affect the estimate of the variance. Had the correlations been significant, we could very simply have adjusted our procedures to obtain an estimate of the variance of the protection rate conditional on our projection of the world price. Given a predicted value for the world price, the conditional variance of the protection rate is: $\sigma_{t|p}^2 = \sigma_t^2(1-\rho^2)$, where ρ is the correlation between the world price and the protection rate (Freund and Walpole 1980). If the mean over the forecast period were expected to deviate from its underlying mean, then and adjustment to the conditional mean of the distribution of protection would also be required before the impact of the binding on protection could be evaluated.

Importantly, we assume that the mean of the distribution of protection rates will not merely be increased to fully compensate for the introduction of a binding. While possible, such a reaction would seem to require more knowledge of the system, and a greater degree of co-ordination between suppliers and demanders of protection than would seem generally likely. If individual industries were able to counter GATT rules so easily, then presumably they could block the entire GATT process of protection reduction, an assumption contradicted by the success experienced by the GATT in lowering protection rates on the goods which it has systematically covered -- manufactured goods imported by industrial countries.

We provide an illustrative application for three important agricultural commodities (wheat, sugar, and beef) in seven OECD countries for which *ad valorem measures* of the final tariff bindings resulting from the Uruguay Round are available from analysis undertaken by Ingco (1996). In most cases, the tariff commitments have been made in specific terms, and these *ad valorem* equivalents have been calculated using 1989-93 average prices as an indicator of likely future prices. An exception is the protection estimates for wheat and sugar in the EU and Japan, where the *ad valorem* bindings are based on World Bank commodity price projections for the year 2000. We discuss all of the protection measures in terms of import protection, even for exporting countries, since import restrictions are an essential backstop for export subsidy programs.

In Table 3, we provide estimates of the mean and the standard deviation of protection prior to the Round in the first and second columns. In the third column, we show the estimated *ad valorem* equivalent of the tariff binding. Then, in the fourth and fifth columns, we provide estimates of the mean and standard deviation of (bound) protection applying after the Round. The final column shows the relative reduction in the expected cost of protection resulting from the introduction of the binding, calculated using equation (12).

The results for wheat presented in the first section of Table 3 highlight the very substantial variation across regions and across time in the rates of border protection applying to wheat. Further, it is clear that the final bindings are above the average rates of protection applying in the pre-Round era, despite the commitment in the Round to lower protection relative to previous average levels. Does this imply that the Uruguay Round "liberalization " actually resulted in increases in protection rates? Clearly not. When we look at the mean protection rates in the final column of the table, it is clear that even these generally high bindings can be expected to lead to some liberalization in some major markets. This liberalization is particularly important in Japan, where the expected cost of protection declines by 287 percentage points from the 1979-93 average.

Another important feature of the results for wheat is the decline in the standard deviation of protection resulting from the introduction of tariff bindings. In the EU, the reduction in the variability of protection is greater than in the mean, implying that most of the gains are derived from the reduction in variability, rather than from the reduction in the average rate of protection. In the case of the United States, the mean falls by much more than the standard deviation of protection falls, implying that the reduction in average protection is more important than the reduction in the variability of protection. In other cases, such as Japan, the reduction in the standard deviation is much larger than that in the mean, implying that the reduction in the variability of protection is the dominant influence in reducing the welfare costs of protection. In this case, so much of the probability mass is concentrated at the binding that it effectively becomes a deterministic rate of protection.

A striking feature of the results is just how large are the reductions in the costs of protection resulting from the introduction of bindings on wheat, despite the frequently substantial slippage in the settings of the bindings relative to the objectives of the Round. The size of these reductions highlights the very large gains associated with initial reductions in rates of protection, and the importance of measuring the effects on both the mean and the variability of protection. To illustrate this point, Figure 3 presents a decomposition of the source of estimated reductions in the cost of protection, into the share attributable to mean reduction, and the share attributable to variance reduction. As suggested by Table 3, the relative importance of mean and variance reduction varies by country. Measures of protection which are based on methods like equation (13), and which therefore focus only on the reduction in observed protection, will only capture reductions related to the mean rate. As is evident from Figure 3 (particularly Canada, Australia and the United States), such an approach can miss important liberalizing aspects of rules limiting the rate of protection.

The estimates of the impact of sugar market liberalization in the central section of Table 3 present a somewhat more diverse pattern than the results for wheat. In Japan, the binding itself virtually determines the expected rate of protection after the Round. The final binding is so far to the left of the underlying mean rate of protection that virtually all of the probability mass is collected at the bound rate. The cost of protecting sugar in Japan is reduced by 94 percent because of the sharp reduction in both the mean and the variability of protection. The reduction in the standard deviation of protection is almost twenty-fold and contributes much more than the reduction in average protection to the overall reduction in costs. The binding offered by the USA, at 91 percent, reduces the average rate of protection and the standard deviation by broadly similar amounts. Even though the tariff binding is only seven percentage points below the underlying average tariff rate, the mean tariff is reduced by 32 percentage points, and the standard deviation of protection is almost halved, with the costs of protection falling by 60 percent. In the EU, the cost of protection is reduced by an estimated 43 percent even though the binding is above the previous mean level of protection.

The case of beef is quite different from that of sugar and wheat, primarily because the standard deviation of protection is much lower for this commodity than for wheat or sugar. In part because of this, and in part because of the setting of the protection rates, bindings above the average tariff rate do not have a substantial liberalizing effect in any country other than Japan. In Japan, the binding is below the average rate of protection and reduces both the mean and the standard deviation of protection substantially. Since the proportional reduction in the variability of protection is larger, this reduction contributes most of the 60 percent reduction in the costs of protection estimated in this case.

VIII. Summary and conclusions

A key feature of multilateral liberalizations has been the introduction of tariff bindings which constrain the range and variability of protection rates. While tariff bindings allow tariff rates to vary below the level of the binding, they reduce both the average applied tariff and the variability of the applied rate of protection. Drawing on the extensive literature on the political economy of protection for support, we have argued that protection rates can vary in response to a wide range of pressures for protection, and that these pressures are likely to continue to generate varying rates of protection even after the introduction of new tariff bindings. Accordingly, we characterize trade policy in the presence of a tariff binding as generating uncertain rates of protection subject to the limit imposed by the binding. Under this assumption, we assess the effect of a tariff binding on the mean and the standard deviation of protection.

As a basis for evaluating the liberalization of stochastically varying protection, we develop a conceptual framework based on the expected cost of protection. In our basic set of examples, involving a single price-based instrument, this cost can be shown to depend on the second moment of protection about the origin (or, equivalently, the sum of the squared mean and the variance of protection) and the slope of the import demand function. This approach highlights the fact that the cost of protection rises with the square of the rate and the standard deviation of the rate of protection. Within this conceptual framework, we discuss the possibility of assessing the relative impact of tariff bindings on the total costs of protection for individual commodities, through calculation of welfare-weighted cost of protection indexes.

Finally, as illustration we have provided examples, based on such indexes, for the effect of tariff bindings on imports of three important commodities: wheat, sugar and beef. Even though tariff bindings on these commodities were typically set at levels substantially higher than the average rates of protection previously applied, it seems likely that the introduction of tariff bindings will yield substantial reductions in the costs of protection on a broad range of these commodities.

The analytical approach followed here has also allowed us to provide a formal representation of the concept of "improved market access" following from tariff bindings. This is the basic objective of trade negotiations (with zero tariffs being a subset of bound tariffs), and so in our view it merits formal analysis. We have shown that improved market access, in terms of reduced terms of trade uncertainty related to export market protection, has welfare implications that follow not only from the expected level of market access, but also to the stability of those conditions of access.

A basic objective of this paper has been to push the notion of protection away from one based primarily on fixed policy instruments, closer to one that involves policy regimes subject to uncertainty and variability. While the importance of the security and certainty of market access has long been recognized in the policy process, little attention has been devoted to these issues in the formal economics literature. As has been demonstrated, the stochastic aspect of policy variables can have important implications for the effects of negotiated bindings and rules-based policy constraints, beyond those suggested in frameworks built around fixed policy regimes. This implies that the near-universal omission of the beneficial impacts of the improved stability of market access in studies of multilateral liberalization may have greatly understated the gains from the process. Further research is needed not only on rules-based liberalization and the distribution of protection for particular sectors and regions, but also on the impact of bindings given linkages in the distribution of protection across instruments and sectors. In addition, it should also be evident that reductions in the uncertainty that characterizes the commercial policy landscape could have significant effects related to the size and allocation of the capital stock, suggesting a second line of potentially useful research.

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Figure 1.

The implications of a tariff binding for the applied rate of protection

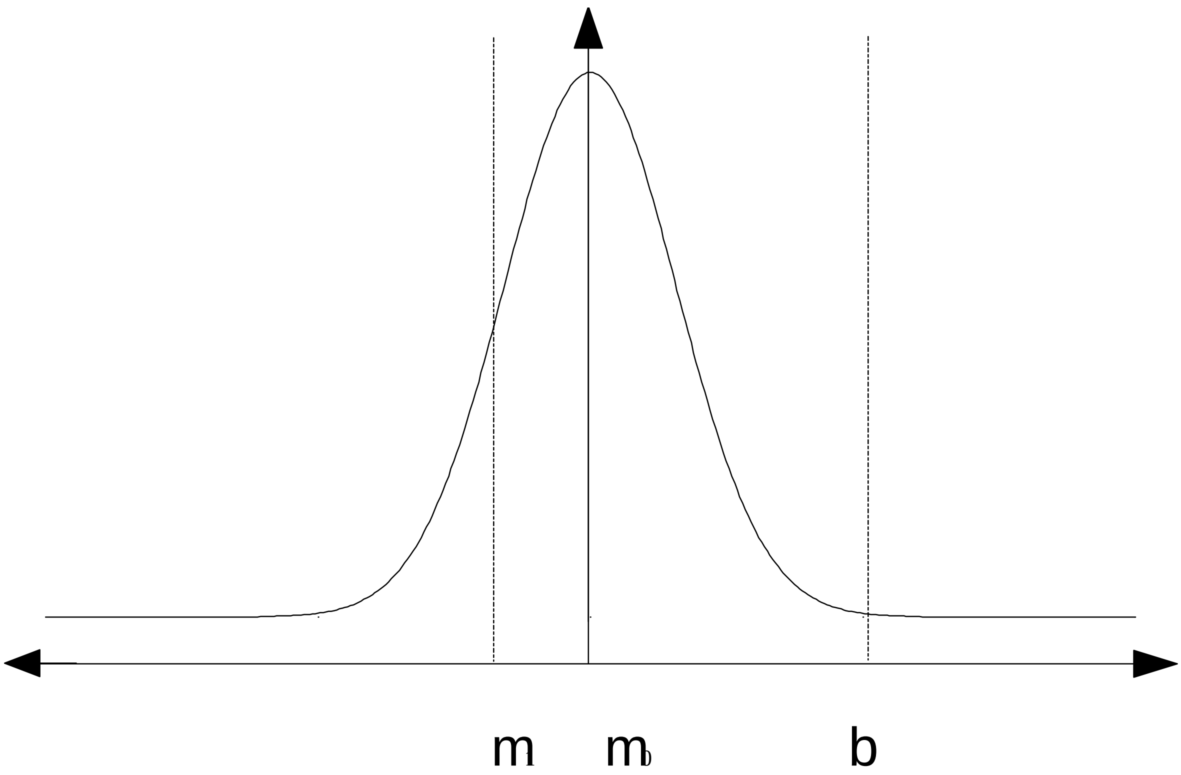

Figure 2.

The welfare impact of commercial policy uncertainty

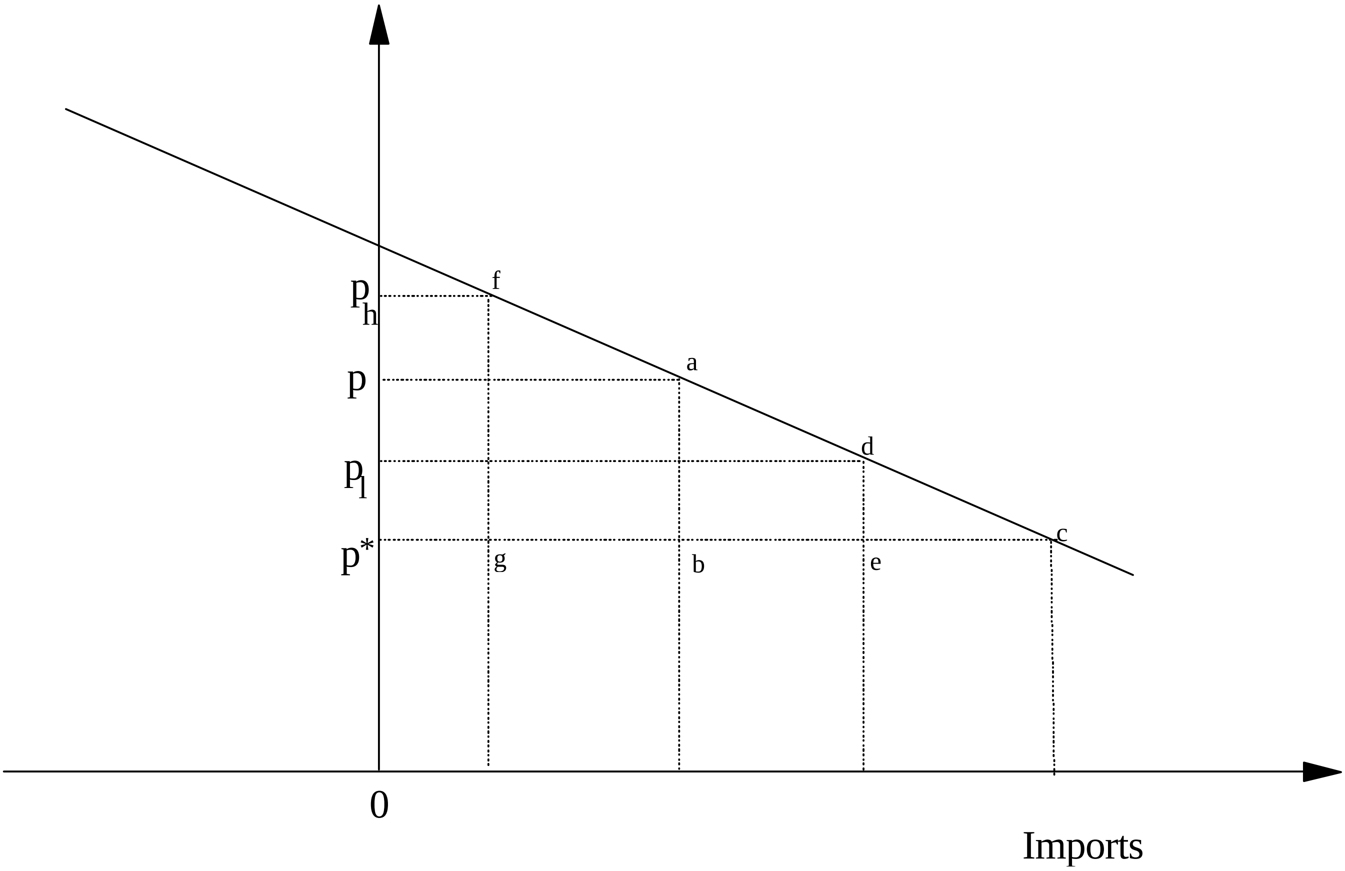

Figure 3
The Expected Cost of Protection for Wheat
(percentage reductions)

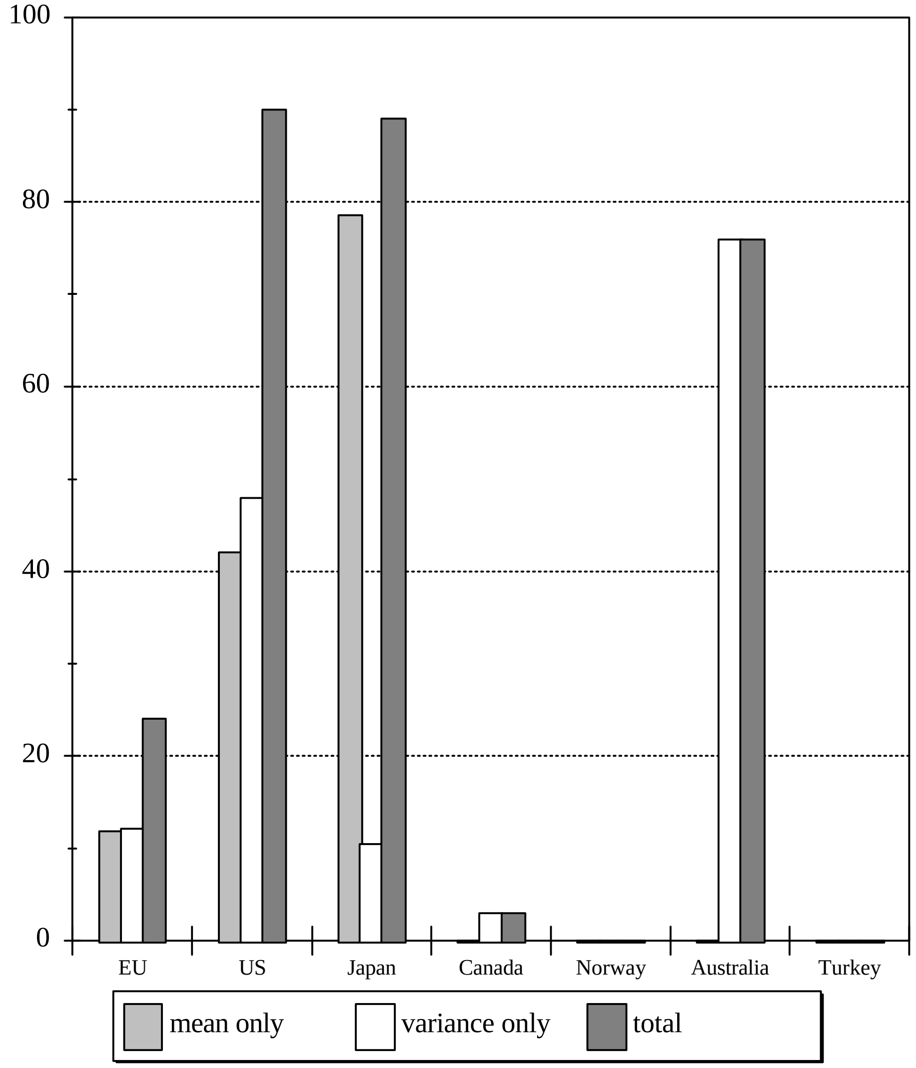

Table 1. Trade-weighted structure of Mexican tariffs, 1982-1991

Imports (US $ million)										
tariff rates	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
duty-free	3075.1	3174.2	3586.7	368.2	3004.5	4836.9	7664.4	4893.4	5172.2	5771.9
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 .0	0.0
5	1458.1	793.6	1135.3	1487.2	0.0	823.6	1537.8	247.1	290.3	388.8
10	5312.8	2853.7	4229.7	3269.7	3556.6	1452.2	1415.0	6979.0	7630.1	11531.5
15	216.6	0.0	0.0	0.0	0.0	0.0	2102.2	3085.4	4205.7	6954.1
17.5	0.0	0.0	0.0	0.0	18.5	742.8	0.0	0.0	0 .0	0.0
20	1761.3	206	231.1	129.8	6.6	0.0	1861.2	2999.2	4266.0	6078.6
22.5	0.0	0.0	0.0	0.0	1347.2	0.0	0.0	0.0	0 .0	0.0
25	375.4	290	492.3	1522.7	120.8	0.0	0.0	0.0	0 .0	0.0
27.5	0.0	0.0	0.0	0.0	25.5	0.0	0.0	0.0	0 .0	0.0
30	433.1	7.6	10.0	118	22.2	0.0	0.0	0.0	0 .0	0.0
35	28.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 .0	0.0
37	0.0	0.0	0.0	0.0	954.8	0.0	0.0	0.0	0 .0	0.0
40	462.0	190.8	211.0	1133.1	4.6	0.0	0.0	0.0	0 .0	0.0
45	0.0	0.0	0.0	0.0	394.9	0.0	0.0	0.0	0 .0	0.0
50	534.2	22.9	70.3	365.9	0.0	0.0	0.0	0.0	0 .0	0.0
60	115.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 .0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 .0	0.0
75	173.2	30.5	10.1	0.0	0.0	0.0	0.0	0.0	0 .0	0.0
80	14.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 .0	0.0
100	476.4	61.0	70.3	94.4	0.0	0.0	0.0	0.0	0 .0	0.0
total imports	14437.0	7630.3	10046.8	8489.0	9456.2	7855.5	14580.6	18204.1	21564.3	30724.9
imports dutied over 50%	1313.7	114.4	150.7	460.3	0.0	0.0	0.0	0.0	0.0	0.0
weight average duty	16.4	8.0	8.5	18.5	13.1	4.0	6.2	9.7	10.5	11.2

source: GATT(1993), Table IV.3.

Trade levels exclude imports subject to variable specific duties, which are only relevant for 1991, and covered less than 1 percent of imports.

Table 2. Bindings, tariff reductions, and tariffications in the Uruguay Round agriculture agreement (imports in millions of dollars)

Reporter country	Total imports	Scope of bindings		Profile of Tariff Reductions						Scope of Tariffication
		Pre-Round	Post-Round	0.0%	0.1-9.9%	10.0 - 14.9%	15.0 - 24%	24.1 - 36%	> 36%	
Australia	1,009	474	1,009	0	0	0	213	59	599	83
Austria	864	648	864	0	0	0	146	240	304	108
Brazil	888	320	888	327	17	271	50	62	109	0
Canada	2,065	2,024	2,065	0	0	0	298	439	295	239
Czech Republic	1,278	1,266	1,278	15	0	24	224	32	342	92
European Union	32,728	29,455	32,728	0	0	0	4,759	6,874	5,697	6,100
Finland	588	494	588	0	0	9	128	67	235	105
Hong Kong	8,419	253	8,419	0	0	0	0	0	0	0
Hungary	751	308	751	0	0	0	211	250	108	377
India	1,630	326	1,630	1,221	0	0	0	101	38	0
Indonesia	1,313	906	1,313	0	0	996	195	45	77	68
Jamaica	192	0	192	105	0	0	0	0	0	0
Japan	25,970	15,582	25,970	8	6	1,420	6,736	485	5,973	1,868
Korea Rep.	4,598	1,103	4,598	1	2	1,450	260	272	2,604	850
Macao	232	0	232	0	0	0	0	0	0	0
Malaysia	932	37	932	53	0	123	207	240	128	34
Mexico	2,740	2,740	2,740	0	137	1,911	22	532	88	743
New Zealand	293	225	293	0	0	0	16	43	97	0
Norway	512	476	512	0	0	0	68	187	43	252
Philippines	1,079	313	1,079	7	0	130	64	290	588	251
Poland	1,490	0	1,490	0	0	0	86	502	706	694
Romania	871	200	871	0	2	200	368	52	249	59
Singapore	2,103	21	2,103	0	0	0	449	23	1,612	0
Slovak Rep.	1,278	1,266	1,278	15	0	24	224	32	342	92
Sri Lanka	522	78	522	80	0	0	442	0	0	0
Sweden	1,194	1,015	1,194	0	0	0	185	114	117	299
Switzerland	1,351	972	1,351	0	12	27	298	420	304	484
Thailand	1,048	189	1,048	0	0	825	15	58	119	189
Tunisia	616	0	616	0	0	1	296	255	64	290
Turkey	1,093	109	1,093	0	0	497	360	18	218	0
United States	17,555	16,501	17,555	410	212	1,628	3,119	2,265	4,426	1,052
Venezuela	646	646	646	0	21	446	127	0	52	507
Total	117,848	77,948	117,848	2,241	410	9,982	19,568	13,956	25,531	14,835
Shares	1.00	0.66	1.00	0.02	0.00	0.08	0.17	0.12	0.22	0.13

Source: GATT/WTO secretariat. Data are for Harmonized System (HS6) participants.

Table 3. Implications of Uruguay Round agricultural bindings

	Mean 79-93 %	Std Deviation %	Final Binding %	New Mean %	New Std Dev. %	Cost Reduction %
<u>Wheat</u>						
EU	56	37	82	51	30	24
US	12	14	4	1	6	90
Japan	438	153	152	151	14	89
Canada	22	18	58	22	18	3
Norway	170	126	495	170	126	0
Australia	0	1	0	0	1	76
Turkey	13	29	200	13	29	0
<u>Sugar</u>						
EU	149	80	152	118	48	43
US	98	70	91	66	39	60
Japan	227	74	58	58	4	94
Canada	8	3	35	8	3	2
Norway	0	0	211	0	0	0
Australia	7	7	52	7	7	0
Turkey	17	30	150	17	30	0
<u>Beef</u>						
EU	84	16	125	84	16	0
US	2	2	31	2	2	0
Japan	54	21	39	36	7	61
Canada	2	2	38	2	2	0
Norway	146	25	405	146	25	0
Australia	0	0	0	0	0	0
Turkey	28	29	250	28	29	0

Note: numbers have been rounded to the nearest percent.

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