Chile's Wheat Trade Environment: the Economics of Price Bands, Import Tariffs and Policy Transparency

Vincent H. Smith
*Barry K. Goodwin**

Research Discussion Paper No. 30
June 1999

*The authors are professors of agricultural economics at, respectively, Montana State University and North Carolina State University. The views presented in this paper are those of the authors and do not necessarily represent those of the academic institutions with which they are associated.

Introduction

In the 1990s, as in the 1980s, Chile has been a consistent importer of wheat. Table 1 shows that domestic production in Chile has been between 1100 and 1400 thousand metric tons of wheat each year while, over the same period, domestic consumption of wheat has remained relatively stable at about 1950 thousand metric tons. Imports of between about 500 and 800 thousand metric tons have made up the shortfall between relatively stable levels of domestic consumption and less stable levels of domestic production. Wheat production has varied from year to year both in response to fluctuations in growing conditions (in particular, weather) and expectations about wheat prices. In 1996, for example, mainly in response to relatively high world and domestic wheat prices, producers in Chile planted considerably more acres to wheat than they had in previous years.

The fact that wheat producers in Chile respond to price signals means that Chile's import policies with respect to wheat have potentially important implications for domestic wheat output and, therefore, Chile's wheat imports. If wheat import policies implemented by Chile raise domestic prices received by producers, then they also encourage domestic production and reduce imports. Chile's explicit import policy with respect to wheat has two important components. The first is an eleven percent tariff which is also levied on most imports by Chile (including agricultural commodities such as grains, oilseeds and meat, and manufacturing goods such as computers, industrial machinery and vehicles). The second is a complicated price band, variable import levy mechanism which has as its ***stated*** objective the stabilization of domestic prices. However, several aspects of its structure and operation also appear to be directed towards providing protection for Chilean domestic wheat producers by raising import costs above world market price levels. Recent free trade agreements between Chile and the MERCOSUR countries and Chile and Canada are of interest because, while their provisions will lead to reductions in the standard tariff rate on imports of wheat from those countries, under those agreements Canada and the MERCOSUR countries accepted Chile's price band variable import levy for wheat as it is currently operated.

Since 1991, as is shown in table 2, Chile has mainly sourced its wheat imports from Canada, Argentina, the United States and, more occasionally, the European Union. Those shares have varied considerably from year to year for a variety of reasons related to trade conditions. For

example, in 1996, Chilean wheat imports from the United States were zero because Chile implemented a ban on such imports based on concerns about the spread of karnal bunt. To the extent that the Chile-MERCOSUR and Chile-Canada trade agreements create uneven playing fields in Chile for other exporting countries (including the United States), they may also prevent those other countries from competing in Chile's wheat market.

This study has two major objectives. The first is to provide a clear description of each element of Chile's import tariff and price band policies as they apply to wheat and to identify issues associated with policy and price transparency. Several aspects of Chile's price band policy, including its inherently complex structure, are relevant in this context.

The second is to investigate the economic effects of those policies, and in particular their effects on imports. These turn out to depend crucially on very detailed aspects of the implementation of the price band mechanism. In particular, the mechanism by which the price bands are established involves inflating historical f.o.b. (free on board) Gulf prices for hard red winter (HRW) ordinary wheat. However, the resulting variable import levies are typically determined through the establishment of a reference price for classes of wheat that sell at lower prices than HRW ordinary wheat. Both the process of inflating historical prices to determine the price band and the use of a reference price for cheaper wheats to determine variable import levies increase the frequency and magnitude of import levies and reduce access to Chile's wheat markets for producers in major wheat exporting countries, including the United States.[1]

The study is organized as follows. Chile's import tariff policy and its price band mechanisms for wheat and wheat flour are described in section 2. Statistical issues associated with the use of general price indexes in the construction of the Chile wheat price band are examined in section 3. Alternative procedures for estimating wheat price bands are compared and

[1]Market level effects of Chile's price band variable levy policy and the standard tariff rate are also examined in Appendix A of the study. In addition, the implications for Chilean and U.S. wheat producers of the Chile-MERCOSUR and Chile-Canada Free Trade Agreements as they apply to wheat are discussed in Appendix B. These free trade agreements do not have substantial implications for U.S. milling (non-durum) wheat exporters in short run, but do have important implications for access to the Chile market by U.S. durum growers. The provisions of these agreements do indicate, however, that over time U.S. wheat growers would benefit from a free trade agreement between the United States and Chile that provides U.S. wheat producers with at least similar access guarantees to those enjoyed by Argentinian and Canadian wheat producers.

their implications for general levels of protection for Chile's wheat producers are evaluated in section 4. Conclusions are presented in section 5.

The major findings of the study are as follows. First, Chile uses historical prices for Hard Red Number 2 wheat, f.o.b. Gulf over the previous five years to establish its price band. These prices are adjusted to account for general inflation. The index selected by Chile to adjust these prices for inflation results in a higher and wider price band than would otherwise be the case. Moreover, nominal world wheat prices have increased at a much slower rate than the general level of inflation, and therefore, if Chile's objective is really to stabilize rather than to increase domestic wheat prices, there is no compelling reason to compute a price band for wheat using inflation adjusted historical prices. Second, Chile has chosen to compute variable import levies under the price band policy using estimates of pre-variable levy import costs that are based on the lowest quoted f.o.b. price for wheat relevant to Chile. As a result, import levies have frequently been computed using prices for classes of wheat that are often more than twenty dollars lower than the price of the class of wheat on which the price band is based. The consequences of these two features of Chile's price band are as follows. Chile's variable import levies for wheat are much more frequent and much higher, and, correspondingly, standard tariff rebates are less frequent and lower than would otherwise be the case. If, instead, the price band was computed using nominal prices and variable import levies were calculated using estimated import costs based on the price of the class of wheat used to compute the price band, then variable import levies would be imposed much less frequently and, on average, would also be considerably lower.

Chile's Wheat Import Policies

Chile has a complicated import policy for milling wheat (wheat other than durum) and wheat flour that involves the use of two tariff instruments. The first is a *standard* tariff of 11 percent that is imposed not only on wheat and other agricultural commodities, but also on manufactures and other imports. This tariff is applied to the sum of an estimated f.o.b. price of the milling wheat and estimated cargo, insurance and freight or c.i.f. costs of shipping the wheat to Santiago at point of importation (Quezada, 1991; U.S. Wheat Associates, Chile, 1997). The

standard tariff, described as the *Arancel Ad Valorem*, applies to both milling wheat and durum wheat. For milling wheat (but not for durum wheat), the standard tariff is augmented by a complicated price band-variable import levy mechanism. Price band-variable import levy mechanisms, which were first introduced by Chile for wheat grain in 1983, have also since been applied to edible oilseeds (beginning in 1984), sugar (beginning in 1986) and wheat flour (beginning in 1992). A previous study of Chile's mix of tariff and price band import policies estimated that the two policies resulted in average nominal tariff rates for wheat of over 30 percent in the late 1980s (Cesal).

The principle underlying Chile's price band-variable import levy mechanism is quite simple. Each year, the Chilean government identifies a *high* price and a *low* price for each commodity. These two prices then form the price band for that commodity for a fixed twelve month period from November 16 of one year to November 15 of the next. If the estimated cost per ton of a shipment of imports (including the 11 percent standard tariff) of the commodity, delivered at Santiago, Chile, is less than the low price, then a variable import levy or tariff is charged to bring the estimated import cost up to the low price in the price band. If, however, the estimated import cost for the commodity lies between the low price and the high price, the commodity is subject only to the 11 percent tariff. Finally, if the estimated import cost of the commodity is greater than the high price that defines the price band, then the standard 11 percent tariff is reduced, falling to zero if the import price becomes sufficiently greater than the high price. The trade-off is as follows. The dollar amount of the standard tariff is reduced by the difference between the estimated import cost and the high price in the price band until the tariff falls to zero.

The way in which the cost of imports at the point of delivery in Chile is estimated is crucial to both the implementation of the price band/variable import levy program and the average level of tariffs that results from the program. A reference price for f.o.b. wheat is identified for each successive one week period. This reference price is the lowest f.o.b price for wheat quoted during the previous weekly period that is relevant to Chile. Note that it is ***not*** the f.o.b. price at which each specific shipment of wheat is sold to Chilean importers. Frequently the reference price is the price of Argentinian wheat which, as shown in figure 1, is almost always

lower than the price of hard red winter ordinary wheat from the Gulf, often by as much as $20 a ton.

The use of a reference price for the calculation of the variable levy discriminates against higher quality classes of wheats which would be subject to lower variable import levies than lower quality wheats if actual transactions prices were used to compute variable import levies. In addition, selecting the lowest possible reference price clearly is intended to increase the frequency and size of variable import levies, reducing the competitiveness of U.S. and other wheat exporters in the Chilean wheat market relative to domestic producers.

In order to compute the estimated import cost on which the variable import levy is based, estimated freight and insurance costs are added to the f.o.b. reference price. The freight charge is assumed to be fixed while insurance costs are assumed to be proportional to the estimated value of the shipment. The eleven percent standard tariff is then levied on the sum of the f.o.b. reference price and estimated freight and insurance costs. Additional amounts are also then added to account for finance, custom agent and unloading charges (Quezada) to obtain the final estimated per ton cost of importation. The estimated per ton import cost is then compared to the price band to determine whether any variable levy will be charged and, if it is to be imposed, what the size of that variable levy will be.

It is useful to examine some specific numerical examples in order to appreciate how the policy actually works. Price bands implemented by Chile during the period 1991 to 1998 are presented in table 3. During the period November 16, 1996 to November 15, 1997, the price band for wheat ranged from $210 to $240 per metric ton (on a c.i.f. basis). Given this price band, we consider how the price band-variable import levy mechanism works in the following illustrative hypothetical examples.

Case 1. The pre tariff import price is less than the low price in the price band.

> Suppose that on May 15, 1997, US wheat is shipped to Chile from the Gulf of Mexico. The actual delivered price of the wheat at Santiago — including all actual cargo, insurance and freight charges — is $125 per ton f.o.b. at the Gulf. However, the reference price for the period, based perhaps on Argentinian wheat quotes, is $105. Freight charges are assumed to be $20 a ton and insurance charges to be 0.7 percent of the sum of the reference f.o.b. price and estimated freight charge. Thus the c.i.f cost of the wheat to

which the standard tariff of eleven percent is applied is $125 + 0.007*$125 or $125.87. The eleven percent standard tariff is thus equal to 0.11*$125.87 or $13.85 per ton. Additional finance, customs and unloading charges amount to about 4 percent of the sum of the estimated f.o.b. price and freight charges (Quezada) or, in this example, about $5 per ton (0.04*$125). The (pre-variable import levy) estimated import cost of the wheat is therefore the sum of the reference price ($105), the estimated freight charge ($20)and estimated insurance charge ($0.87), the standard tariff ($13.85) and the estimated additional finance, customs and unloading charges ($5). It therefore amounts to $144.72 per ton.

The *low* price in the Chile price band is $210 c.i.f. (cargo, insurance and freight) at Santiago. Thus, in addition to the eleven percent tariff of $13.85, this shipment of wheat would be subject to a variable import levy of $65.28 (the difference between the low price in the price band of $210 and the estimated import cost of the wheat of $144.72). The total dollar amount of the two tariffs levied on the imported wheat is thus $79.13, the sum of the variable import levy ($65.28) and the standard eleven percent tariff ($13.85). The nominal tariff rate relative to the actual f.o.b. price of the wheat, the ratio of the total tariff ($79.13) to the actual f.o.b. price ($125), is approximately 63.3 percent.

Note that had the variable import levy been based on the actual f.o.b. price of the U.S. wheat of $125 the variable import levy would have been substantially lower. Using the same procedures described above, an f.o.b. import price of $125 per ton yields an estimated import cost for the wheat of $167.88 per ton, including a standard eleven percent tariff $16.06 (which is higher than the standard tariff based on the reference price of $105). The variable import levy would therefore be only $42.22, more than $20 less than the variable levy that would be charged given the use of the reference price of $105 per ton of wheat. The total dollar amount of the new variable import levy ($42.22) and the new standard tariff ($16.06) would amount to $48.28, substantially less than the actual tariff based on the reference price. The nominal tariff rate would also fall substantially to 38.6 percent.

This example clearly highlights the importance of Chile's policy of basing variable import levies on a reference price that is the ***lowest*** quoted f.o.b. price relevant to Chile. This approach increases the variable import levy and the nominal tariff rate (the sum of the standard tariff and the variable import levy divided by the actual f.o.b. price) charged on wheat imports. At the very least, Chile's choice of a reference price should be consistent with its method for computing the price band which is based on the price of HRW ordinary wheat, f.o.b. Gulf which, as shown in figures 1 and 2, is generally not the quoted wheat price relevant to Chile.

The example also indicates areas of concern with respect to ***policy transparency*** – the degree to which the policy can be clearly and transparently understood and its effects measured.

The major problem is that, as noted above, Chile's choice of the reference price on which its variable import levy is based is not standardized with respect to class of wheat. Chile also utilizes its own estimates of freight rates, insurance charges, etc. which vary from year to year. While such variations are not unreasonable if they reflect changes in market conditions, there appears to be no evidence that Chile systematically ties these charges to those conditions.

Another aspect of ***policy transparency*** concerns the measurement of nominal tariff rates. Chile implements its standard tariff on a c.i.f. basis. This leads to higher tariffs and higher nominal tariff rates than those associated with f.o.b. point of origin prices. The actual standard tariffs levied by Chile would be lower if Chile were required to impose them on an f.o.b. "point of departure" basis rather than a c.i.f. "point of destination" basis. It should also be noted, however, that Chile's practice of using the lowest quoted wheat price relevant to Chile as its reference price to which the standard tariff rate is applied partially offsets the effects of its decision to impose its standard tariff for wheat on a c.i.f. basis for higher quality, higher priced classes of wheat.

Case 2. The pre tariff import price is between the low price and the high price in the price band.

> Suppose that on November 19, 1997, US wheat is shipped to Chile from the Gulf at an actual f.o.b. price of $185 per ton. However the estimated import cost of the wheat is $217.66 per metric ton, consisting of an f.o.b. reference price of $168 per ton, $28.84 in estimated cargo, insurance and freight charges, and a standard tariff of $20.82.
>
> In this case, the delivered price lies between the low price of $210 and the high price of $240; that is, it lies within the price band. The wheat is therefore subject only to the *standard* tariff of 11 percent which, as noted above, amounts to $20.82.[2] Note that this does not necessarily mean that the cost of the wheat to the importer is therefore the estimated import cost. Assuming that Chile's estimates of c.i.f. charges are relatively accurate, in most cases the import cost of the wheat is likely to be substantially higher than the estimated import cost because, as noted above and as assumed in this example, the actual f.o.b. price of the wheat is likely to be substantially higher than the reference price.

[2] In this case, the standard tariff is levied on the sum of the reference price of $168, the estimated freight charge of $20 and the estimated insurance charge of 0.7 percent of the sum of the reference price and the freight charge; that is, the standard tariff is equal to 0.11*($168 +$20 + 0.007*$188).

Case 3. The pre tariff import price is above the high price in the price band.

> Suppose that on January 19, 1997, US wheat is shipped to Chile from the Gulf at an estimated import cost of $254.70 per metric ton delivered at Santiago based on a reference price of $200 per ton, a freight charge of $20, insurance costs of $1.54 (0.007*$220), a standard tariff of $24.36, and other import charges of $8.80. This is $14.70 in excess of the high price in the price band of $240. Thus, through a "rebate", described as the *Rebaja de Arancel*, the standard tariff is reduced by this amount to $9.66 ($24.36 - $14.70). Thus when the estimated import cost exceeds the high price, the standard tariff is reduced.
>
> Note that the standard tariff does not fall to zero until the estimated import cost rises sufficiently far above the high price. If the high price is $240, it can be shown that under the assumptions used above, the reference price must rise above $209.36 and the corresponding estimated import cost to more than $265.39 before the standard tariff falls to zero.[3] This means that, given a high price in the price band of $240 per ton, because of quality differentials, frequently the actual price of U.S. wheats would have to rise to about $230 per ton before the standard tariff declined to zero.

Although Chile has argued that the price band variable import levy mechanism is designed simply to stabilize prices for specific commodities, the clear effect of the policy is to establish a price floor for imports. In the case of wheat, this price floor helps the Chilean government-owned marketing board COTRISA to implement its farm program of providing a guaranteed minimum price to Chilean wheat producers for their output by acting as a "buyer of last resort" at the guaranteed minimum price. If imported wheat could enter Chile at prices below the guaranteed minimum level, Chile's wheat grain policy could become very costly in terms of government funding, as the government would then have to provide often substantial subsidies to domestic producers.

---

[3]A simple formula can be applied to obtain this estimate. Let the proportion of the reference price, R, and freight charges, F, estimated to be insurance costs be denoted by I, the standard eleven percent tariff rate be denoted in proportional terms by t and the proportion of R and F estimated to be additional finance, customs and unloading charges be denoted by m. In addition let HP denote the high price in the price band. Then the reference price at which the total tariff charged on wheat falls to zero, R*, is:

$$R^* = [HP/(1 + m + I)] - F.$$

The import cost associated with this reference price, IC*, can be shown to be:

$$IC^* = [(1 + I)(1 + t) + m] \bullet [R^* + F].$$

The degree of price support protection that can be provided to Chilean wheat producers depends on how the low price in the wheat price band is set as well as on the reference price that is being used to determine variable import levies. Clearly, a higher "low price" permits COTRISA to implement a higher guaranteed minimum price. The formal mechanism for establishing the price band is well defined. It is also enshrined as GATT-compatible until at least 2000 as a result of the various negotiations and side agreements over tariffication and implementation of the 1994 GATT agreement. As will become apparent, if the goal of the price band mechanism is to stabilize wheat prices in Chile by reducing variations in domestic prices around the ***current average world price*** then the mechanism by which the price band is set is not satisfactory. In fact, the mechanism is designed to generate an upward ***bias*** in the price band that ensures that domestic producers receive prices that typically are higher than world market prices. This is reinforced by the selection of a reference price, the lowest quoted f.o.b. price relevant to Chile, that then maximizes the frequency and size of variable import levies

The mechanism for establishing the price band for wheat is as follows. The price band for wheat for the twelve month period from November 16 of a given year to November 15 of the subsequent year is announced by the February immediately prior to November 16 of the first year. The price band is established by implementation of the following three steps.

1. Average monthly prices for Hard Red Number 2 wheat, f.o.b. Gulf are identified for each of 60 consecutive months, where the last month is the series is the December prior to the implementation of the new price band. Thus, for example, the monthly prices used to establish the price band for the November 16, 1996 - November 15, 1997 period were for the 60 month period January 1, 1991 to December 31, 1995.

2. These prices are ***adjusted*** upwards by an external inflation index — the *Indice de Inflacion Externa Relevante para Chile* — created and published by the *Banco Central de Chile.* The adjustment is as follows. The base month for the index, the month in which the index is set equal to 100, is the December prior to the implementation of the price band. The index is then converted to proportional terms (the base month value is redefined as 1) and the wheat price for each month is divided by the value of the index for each month. This procedure leaves the last price in the 60 month series unchanged but **increases** almost every other price in the 60 month series in periods of general inflation.

An f.o.b. price band is then established by first ranking the "inflation adjusted" 60 prices from the lowest price to the highest price and then selecting the sixteenth lowest price as the low price in the price band and the forty fifth highest price as the high price in the price band. In other words, the lowest and highest 15 prices are dropped from the series and the range is defined by the remaining lowest and highest prices. Thus, more formally, Chile selects the interquartile range of the past 60 months of inflation adjusted wheat prices as the price band for the subsequent 12 month period.

It must be emphasized that, in the case of wheat prices, which have been declining in real terms over the long run, the process of adjusting nominal wheat prices "to fully account for the effects of inflation" does not systematically link the price band to expected market conditions. Using a general price index to adjust nominal wheat prices simply provides a clear upward bias to the price band. Nominal Hard Red Number 2 wheat prices, f.o.b., Gulf of Mexico, USA for the period 1978 to 1997 are presented in figure 2. While it is true that they jumped in 1995 and 1996 because of atypical production conditions, it is equally clear that they declined in late 1996 and 1997 and that, apart from the spike that occurred in 1995 and 1996, in nominal terms wheat prices have shown no marked upward trend. In contrast, as figure 2 also illustrates, the inflation index used by Chile to adjust nominal wheat prices, the *Indice de Inflacion Externa Relevante para Chile*, demonstrates a steady upward trend.

3. Once the f.o.b. price band has been identified through the implementation of steps 1 and 2, a further adjustment is made to both the low and high prices in the price band. The price band is increased by a fixed amount to reflect cargo, freight and insurance (C.I.F.) charges associated with delivery of the grain from the Gulf of Mexico to Santiago, Chile and the standard eleven percent tariff. These amounts have been large. Data published by the Chile Ministry of Agriculture indicate that over the period 1990 to 1995 in nominal terms these estimated transportation and standard tariff charges have ranged from $52 per metric ton in 1993 to $57 per metric ton in 1990.

   The additions for freight and insurance also represent potential sources of bias. In this case, the upward bias is not to the variable import levy but to the standard 11 percent tariff levied on imports of wheat.

Clearly, the use of a general inflation index to adjust world (f.o.b. Gulf) wheat prices tends to inflate the price band. A second source of bias derives from the fact that there is only one price band for all classes of milling wheat. The direction of this bias depends on the type of wheat. Figures 1 and 2 shows annual average prices for five different wheats, all of which are exported from the US, for the period 1990-1997. These include, in addition to Hard Red Winter

(HRW) Ordinary Number 2, Dark Northern Spring (DNS) Number 2 (14 percent protein) at the Gulf, Western White (WW) Number 2 (at Pacific Ports), Soft Red Winter (SRW) Number 2 at the Gulf and Argentinian wheat. Figures 1 and 2 show that f.o.b. prices for all of these other wheats at various times are lower than for Hard Red Number 2. While some care must be taken in comparing these prices because while two are f.o.b. Gulf prices, one is an f.o.b. west coast price, and one an f.o.b. Argentina price, the point is still clear. The price band is based on only one of several wheats that are exported, and the price of this wheat is consistently ***higher*** than the prices of several other exported wheats. In contrast, the reference price on which variable import levies are based is the ***lowest*** f.o.b. price, often the quoted price for Argentinian wheat. The result of this approach is to ***increase*** the average size of the variable import levy relative to what it would be if the same variety and grade of wheat were used to establish both the price band and the reference price.

The Statistical and Price Band Policy Implications of Adjusting Nominal Wheat Prices for General Inflation

Deflating price series is standard practice in economic analysis. Deflation is typically motivated by the knowledge that many economic relationships impose a condition of homogeneity on prices. For example, the fundamental axioms of utility maximization theory imply that demand conditions should be homogeneous of degree zero in prices and income. The implication of this homogeneity condition is that proportional movements in prices and income will not influence consumer behavior. Similarly, in most profit maximization models of firm behavior, when prices received for outputs and prices paid for inputs increase proportionally, firms do not change their production decisions. In practice, a price series for a commodity is often deflated by a more general index of prices in order to compare the real or "constant dollar" prices of the commodity at different points in time. This price deflation process is intended to remove spurious movements in a nominal price series for a commodity (or several commodities) resulting from movements in aggregate prices (that is, movements in prices in general).

While deflation is often justified on theoretical grounds when the objective is to compare the real purchasing power of nominal prices observed at different points in time, a number of

statistical and econometric issues may arise when working with deflated prices. At the most fundamental level, the price index appropriate for deflating the prices of interest has to be chosen. Ideally, and typically in practice, the economic context of the problem suggests which type of price index is most likely to be the most accurate deflator. In particular, the homogeneity condition pertinent to the economic phenomena being modeled should be used to identify the most appropriate price index. In practice, however, several different deflators may be available and the analyst may have difficulty in making the proper choice. For example, analyses of US agricultural prices have used, among other price indexes, the consumer price index, the GDP deflator, and the producer price index. The problem of selecting an appropriate price index is even more difficult in the case of internationally traded products, which may face nominal price distortions from movements in domestic prices or from exchange rate movements.

Agricultural commodity price trends do not always follow the same path as movements in economy-wide aggregate prices. Thus, deflating those commodity prices by a general price index has the potential to create serious distortions in the distributional properties of a price series. Of course, what are ignored when wheat and other commodity prices are deflated using an aggregate price index are the effects other systemic factors that influence long-run trends in those prices. For example, steady improvements in production technologies and yields have systematically lowered prices for many agricultural commodities including, and perhaps especially, wheat over the last one-hundred years (Johnson). This is illustrated in figure 3 which presents annual average per bushel U.S. prices for wheat over the period 1913 to 1996 in real or inflation adjusted terms. The data show that the long term average price of wheat (measured in 1997 dollars) has declined from about $12 per bushel in 1913 to about $4 per bushel over the most recent five year period (1992-1996). In fact, if the objective is to remove systematic variations in commodity price movements over time that are predictable and therefore do not have anything to do with the expected short-run variability of commodity prices under current market conditions, the commodity prices of interest should not simply be adjusted to remove inflationary effects. Instead, they should be adjusted to account for ***all*** trend effects that make comparisons of historical prices and current prices problematic. For example, as figure 3 shows, if nominal US wheat prices for each of the past 100 years are deflated by a general price index such as the CPI,

wheat prices in the period 194-1917 exceed $15 per bushel when expressed in current (1997) dollar terms. No one, however, expects wheat prices to come close to $15 per bushel under current market conditions.

The Chilean price band policy described in section 2 defines the price band for wheat in any given year on the basis of the variability of monthly prices over the preceding five year period. This price band serves to insulate domestic markets by stabilizing and supporting domestic prices. The price band is essentially an interquartile range, defined by the sixteenth and forty fifth highest of 60 previous monthly prices, where prices in earlier months are adjusted using the *Indice de Inflacion Externa Relevante para Chile* to reflect current year prices. The width and level of the band is thus directly driven by the variability of the prices used to define the band.

To the extent that improper deflation distorts the variance of historical prices, the price bands may also be distorted. In particular, in an environment where nominal prices for the commodity have not increased at the same rate as aggregate prices (that is, as the index used for deflation), deflating nominal commodity prices will produce a price series with a downward trend. Thus, historical commodity prices tend to be inflated relative to the prices that are actually expected to prevail under current market conditions. Adjusting nominal commodity prices to account for the effects of general inflation therefore creates price bands that are both higher and wider than they should be if the intent is for the price bands to actually reflect accurately expectations about the probable distribution of those prices under current market conditions. This, in turn, makes it more likely that actual prices will lie below the lower price band and thus that the price band will be binding and the tariff will be imposed. Further, the upward bias in the level and width of the price band results in smaller standard tariff rebates in those periods where the actual price of the commodity exceeds the high price in the price band and also results in actual prices exceeding the high price in the price band less frequently. The statistical issues involved in adjusting nominal commodity prices by an index of general inflation can be illustrated more formally. Consider a single random variable, y_i with a variance of σ_i^2. If this series is deflated by a nonrandom term, d, the resulting series will have a variance of $d^{-2}\sigma_i^2$. Thus, adjusting for inflation by a monotonically increasing index is likely to raise the mean and

variance of early values of the series which are being divided by values of d_i that are progressively farther below unity as we move farther back in time. This is exactly the situation with respect to the historical wheat prices and general inflation index used to construct Chile's wheat price band over most of the past fifteen years.

In more general terms, the series used for deflation should also be considered to be a random variable possessing its own variance as well as a nonzero covariance with the nominal commodity price series that is being adjusted for inflation. In this case, the distribution of a random variable produced by deflating one random variable y_i by another random variable, x_i, will inherit properties of each of the individual series used in its construction (Judge et al.). The exact analytical solution for the variance of a ratio of random variables depends on the precise distributional properties of each of the individual series, including the parametric distributions of each of the individual variables. In general, this expression will be complex, making an exact analytical solution difficult. It is possible, however, to approximate the variance of a nonlinear function of two or more random variables by taking a first-order (linear) Taylor series expansion of the function around the means (Greene). In particular, if $g = f(y)$ represents a nonlinear function of a vector of random variables y which have a mean of μ and a covariance matrix given by Ω, then a first-order Taylor series approximation to g is given by:

$$g(y) \cong g(\mu) + j'(y - \mu) \quad .$$

Using this relationship, the variance of $g(y)$ can be approximated by:

$$Var(g(y)) = j \Omega j'$$

where j is a row vector of partial derivatives, evaluated at the means. When one random variable y is deflated by dividing through by another random variable x, an approximation to the variance of the ratio $r = (y/x)$ representing the deflated series will be given by:

$$\sigma_r^2 \cong \frac{\sigma_y^2}{\mu_x^2} + \frac{\sigma_x^2}{\mu_x^3} - 2\frac{\sigma_{xy}\mu_y}{\mu_x^4}$$

where μ_x and μ_y represent the means of x and y, respectively, σ_s^2 and σ_y^2 are variance terms for x and y, and σ_{xy} is the covariance between variables x and y. Thus, the variance of the deflated series will be influenced by the variance of the nominal series as well as by the variance of the

series used to deflate and the covariance between the nominal price series and the deflator. In particular, the variance of the deflated series will be larger, ceteris paribus, as the values of either of the two single variance terms increases or as the covariance between the two series decreases.

The motivation for deflation most often involves a desire to convert historical prices to current values so that proper comparisons can be made of real movements in those prices across time. In using deflated prices to construct a price stabilization band, however, if the objective is to establish a price band that reflects expected current market conditions, this motivation is not necessarily appropriate. Price stabilization usually involves establishing a range within which *current* prices, not historical prices, are expected to fluctuate. The use of an inappropriate price index may build an unreasonable trend or pattern into a deflated price series. The resulting price band, therefore, is likely to fail to represent the expected distribution of wheat prices over the period to which it applies.

The importance of the choice of a price index is illustrated in figure 4 which, for the period 1978-1997, shows nominal prices and real prices for US HRW ordinary wheat, where the real prices are obtained using three different price indexes – the US Consumer Price Index, the US Bureau of Labor Statistics Price Index for All International Commodities, and the *Indice de Inflacion Externa Relevante para Chile*. Figure 4 illustrates that, as we move farther back in time, deflation causes real prices, measured in terms of 1997 dollars, to become much larger than nominal prices. In the early 1980s, deflated wheat prices approached $380 per metric ton, a price that was widely believed to be unattainable at the beginning of 1997. Thus, construction of a price band that utilized prices extending back through the early 1980s would be unreasonably wide and, more importantly, would be significantly biased upward. Such an upward bias in the price band would cause the variable import levy associated with the price band to be applied more frequently and to be larger, and the standard tariff rebates associated with high prices to be less-frequently applied and to be smaller. In fact, the Chilean price band is calculated using only prices for wheat in the preceding 60 months.[4] To the extent that deflation biases expected prices

[4] The band is actually based upon prices over the preceding 72 months, excluding the last 12 month period. This is because the bands for one year are calculated in the preceding year on the basis of the 60 lagged prices.

upward, the bias becomes smaller as fewer lagged prices are used to calculate the band. However, the bias does not disappear or necessarily become trivial because the nominal price series for wheat simply does not match the strong downward trend associated with each of the deflated price series.

As has been noted above, adjusting wheat prices to account for general inflation also raises a "second-order" problem associated with the selection of the appropriate deflator. The stated objective of Chile's price band policy is to stabilize and insulate domestic markets. Presumably, deflation is undertaken to remove spurious movements in nominal prices that are associated with inflation. The benchmark price is the US dollar price of HRW number 2 ordinary protein wheat at the US Gulf. To the extent that prices should be made comparable to domestic Chilean market prices and that deflation is justified in the first place, one more credible avenue for deflation would be to adjust prices using a deflator that reflects changes in US nominal prices (such as the US consumer price index) and then to convert the real dollar prices into Chilean currency equivalent terms (that is, by using the contemporaneous exchange rate). Alternatively, another potentially more credible approach to deflation would be to convert US nominal dollar prices into Chilean currency units and then deflate by a Chilean aggregate price index (such as the Chilean consumer price index). This approach would be equivalent to the preceding deflation method if purchasing power parity holds.[5] In practice, prices are deflated using an index that reflects movements in the aggregate price of Chile's international trade.

This discussion is not meant to imply that any one of the above deflation methods is clearly preferable to the others. The important point is that a variety of deflators could be used and that different deflators produce different deflated prices and thus different price bands. Figure 4 illustrates that differences, though not extreme, do exist in the deflated wheat prices obtained using different price indexes and that therefore the use of different price indexes may result in different price bands.

[5] Purchasing power parity requires that exchange rate equals the ratio of aggregate prices. This, in turn, requires that prices of all goods are equal when expressed in a common currency. A vast empirical literature has concluded that support for purchasing power parity is very weak (see Officer for a discussion of this issue).

A Comparison of Alternative Price Band Methodologies

Using different price indexes to deflate commodity prices is likely to result in different price bands. In addition, the price band obtained by using undeflated or nominal wheat prices is likely to be very different. In this section we examine the implications of alternative methods for computing Chile's price bands for wheat. We begin by attempting to replicate the price bands actually utilized by Chile, using the estimation method utilized by Chile, as described by Cesal, that relies on monthly price data on HRW Number 2 ordinary protein wheat at the Gulf for the period 1978 to 1997 and the *Indice de Inflacion Externa Relevante para Chile* for the period 1986 to 1997. Monthly data for the *Indice de Inflacion Externa Relevante para Chile* were not available for parts of 1992 and therefore the missing monthly data were interpolated using time series analysis of the data that were available. These data are reported in appendix table1 and appendix table 2.

Figure 5 presents the nominal price for US HRW ordinary protein wheat along with Chile's actual price band for wheat and the replicated price band constructed using the methods described above with the prices deflated by the Chilean external trade price index. We have been able to reasonably replicate the price bands in every year except 1992.[6] The significant differences for 1992 are unexplained and may reflect revisions in the methods or price indexes used in calculating the bands.

As noted above, the use of deflated prices is likely to shift the price band upward relative to the price band that would be implied by nominal prices. The extent of this shift depends upon the extent to which the deflator increased over the preceding 60 months. Figure 6 compares the price bands that would have been implemented by Chile had they been calculated using nominal prices with the actual bands that were used to illustrate this point. Between 1992 and 1996, nominal wheat prices rarely fell below the low price in the price band calculated using nominal prices. In contrast, nominal HRW number 2 wheat prices quite often fell the low price in the actual price band utilized by Chile that was based on inflation-adjusted wheat prices. On the other hand, on the upper side of the band, actual nominal prices quite often exceeded the high

[6] Slight differences in the price bands likely reflect our use of interpolated data for the 1992 external inflation index. All data used in the construction of the price bands are presented in an appendix table.

price for the band calculated using nominal prices, but much less frequently exceeded the high price for the band that was actually used by Chile; that is, between 1992 and 1996, the frequency and extent of standard tariff rebates would have been much greater for a price band based upon nominal prices.

In fact, a clear inconsistency exists in the manner in which the price band is calculated and the trigger price from which tariffs are determined. In particular, the price band is calculated annually using prices of US hard red winter (HRW) ordinary wheat at the US Gulf ports while the reference price is determined on a weekly basis (from Monday to Sunday) using the lowest quotation from any wheat exporter during the week. It is certainly possible that higher and more frequent tariffs than what would be implied by US export prices occur in response to low prices from other exporters. In light of the proximity and relatively low export prices of Argentine wheat, one might expect that larger and more frequent tariffs would be implied by Argentine export prices.[7]

Figure 7 confirms these suspicions. The figure illustrates nominal prices of Argentine trigo pan wheat along with the actual price band and a price band calculated from the nominal Argentine prices. As one would expect in light of the lower average prices of Argentine wheat, the price band constructed using Argentine prices is significantly lower than the price band constructed using US HRW number 2 prices. Furthermore, when the Argentine export price is taken as the reference price for determining tariffs, it is clear that imports were taxed throughout most of the 1990s. In comparison to a situation in which US export prices are used as the reference price (figure 4), the tariffs based upon Argentine export prices are larger and significantly more frequent.

If the actual intent of the Chile price band program were simply to stabilize domestic market prices, it would be inconsistent to calculate stabilization bands from prices in a market that tend to be higher and determine tariff trigger prices from a different market with lower prices. Such an approach clearly results in higher and more frequent tariffs and thus has a more trade-distorting effect than would be the case if the band and trigger prices came from the same

[7] The description of the process determining the reference price was provided by Pablo Maluenda of the Chilean office of the US Wheat Associates.

market. The effect may be even greater than that which is implied by figure 7 for two reasons. First, Argentine prices are not necessarily the lowest export prices. Second, the price bands are calculate from monthly prices while the reference price is calculated on a bi-weekly basis. The more frequently observed, less aggregated price will generally be more variable and thus reach lower levels more frequently. Figure 8 presents four additional alternative price bands, three of which are calculated using alternative price deflators (the US Consumer Price Index, the US Bureau of Labor Statistics Price Index for All International Commodities, and the *Indice de Inflacion Externa Relevante para Chile)* while the fourth is the price band based upon nominal prices. The highest price band is the price band calculated using existing methods (that is, the price band based on the Chilean external price index). A price band based upon deflation using the US consumer price index is lower most of the time. Again, however, in figure 8 the lowest price band is based upon nominal prices.

The width of the actual price band used by Chile is based upon the variation of the deflated prices. As discussed above, the variation of a deflated price series is likely to be affected by the variation of the nominal price and the variation of the price deflator. Figure 9 illustrates the behavior of standard deviations of the preceding 60 monthly nominal and real prices based upon alternative deflators. Three deflators are considered; the Chilean external price index, the US consumer price index, and the US Department of Labor's international price index for all goods. Nominal prices generally exhibit the lowest variation while the series deflated by the Chilean external price index has the highest variation in recent periods. While the patterns are similar across time, the variability of the deflated prices is clearly affected by the choice of deflator. This point can be illustrated by examining the actual price probability densities. Probability density functions were estimated using non-parametric kernel density estimation techniques (Silverman) for a period of low variation (June 1996) and a period of high variation (June 1989). The distribution is much wider for the high variation period and implies an interquartile range (i.e., a price band) of $50.71. In contrast, the distribution of prices in the low variability period is much narrower and implies an interquartile rate of only $23.45.

In summary, several important points emerge from this discussion. First, if the objective is to build a band around which prices are expected to lie, it is by no means clear that nominal

wheat prices should be deflated by any price index; in fact, probably they should not be deflated at all. The reason is that deflation may distort historical prices by building in movements associated with prices in general (that is, the deflator) that are not especially pertinent to movements in short-term future expected prices. Second, even if deflation were justified, the choice of an appropriate deflator is unclear. A number of candidates are potentially viable. This is not meant to imply that the current choice of the Chilean external price index is necessarily inappropriate, but rather that other deflators which may have their own particular merits are likely to produce different price bands. Third, the variability of deflated prices, the factor underlying the price bands, depends critically on the index chosen for deflation. Fourth, using nominal prices to construct the price band generally yields a narrower and lower price band. Fifth, as was pointed out in section 2 and clearly demonstrated in figure 7, using the lowest quoted price over each weekly period as the reference price results in substantial increases in both the frequency and level of variable import levies. It is also important to note that measures of the degree of nominal protection received by Chilean wheat producers through Chile's standard tariff and price band/variable import levy based on comparisons of U.S. HRW f.o.b. prices and the price band will heavily understate the actual nominal rate of protection provided by the program.

Conclusion

This study has examined both Chile's price band variable import levy stabilization policy and its standard tariff rate policy for milling wheat. Since the introduction and joint implementation of the price band variable import levy and standard tariff rate policies in 1983, despite Chile's official view that the major purpose of that policy is to stabilize domestic wheat prices, both the price band policy and the standard tariff policy have served to insulate domestic wheat producers in Chile from world market conditions and, on average, to increase the prices they have receive for their product.

Chile's standard tariff rate and price band system for wheat consists of two individual tariff mechanisms: a price band variable import levy policy and a standard 11 percent tariff on imports. If estimated import costs (including the 11 percent standard tariff) are within the

estimated price band, imported wheat is subject only to the 11 percent tariff. If, however, estimated import costs are less than the low price in the price band, variable levies are applied to bring estimated import costs up to the lower band. If import costs are above the higher band price, "rebates" to the 11 percent tariff are then issued. The net result is that free-trade conditions are achieved only if c.i.f. import costs are substantially larger than the high price in the price band. Although Chile is a relatively small importer of wheat, its variable import levies and standard tariffs for wheat inhibit trade, undoubtedly result in welfare losses for Chilean consumers and, to the extent that world prices and trade volumes are affected, also adversely affect international wheat producers, including those in the United States.

In the context of the 1994 GATT and subsequent WTO discussions, Chile has been successful in arguing that its price band variable import levy is relatively innocuous, and certainly GATT compatible, because the policy is intended simply to prevent disruptions in Chile's domestic market that may result from large short run swings in world price associated with volatile short term changes in world wheat market conditions. However, this study has demonstrated that the method used by Chile to construct its price band for wheat, which uses monthly inflation-adjusted prices for Number 2 Hard Red Dark Northern Spring wheat (f.o.b. gulf) over the previous five years to establish the band, introduces a substantial upward bias to the low price, the high price, and the range of the price band.

In addition, on a week-to-week basis, the variable import levy, which is applied to all classes of milling wheat, is computed using estimated import costs for wheat that are based on the lowest quoted price relevant to Chile for any class of wheat. Frequently, the reference price used by Chile in computing those estimated import costs has been the f.o.b. price for Trigo Pan wheat from Argentina, a price that is frequently more than twenty dollars lower than the price of the variety of wheat on which the price band is based.

This study has shown that the direct consequences of Chile's use inflation adjusted wheat prices to compute the price band and its choice of a "low ball" reference price have been much higher and much more frequent variable import levies, and fewer and smaller rebates on the standard tariff rate. At first blush, the Chilean wheat price band variable import levy policy, which is complex and neither price transparent or policy transparent, does appear to be targeted

towards price stabilization. However, when the methods used to implement the policy are examined more carefully, it becomes clear that Chile's price band variable import levy policy has insulated domestic producers from longer run changes in world market conditions by levying relatively high tariffs on most wheat imports and raising domestic wheat prices. In this context, a particularly interesting finding of the study is that the index used to adjust world market wheat prices for general inflation, Chile's external inflation index, increase the low price in the price band by more than several other credible alternative inflation indexes such as the U.S. Consumer Price Index and the U.S. Bureau of Labor Statistics Index for All International Commodities. These are both reasonable alternatives because world wheat prices are denominated in U.S. dollars.

Ideally, Chile should be encouraged to abandon its trade distorting price band variable import levy for wheat as soon as possible, but that may not be a feasible option. Chile's wheat price band policy was deemed to be GATT compatible by the WTO after the 1994 GATT agreement and has been accepted by both MERCOSUR and Canada in recent free trade agreements with Chile. However, this study has demonstrated that if the price band for wheat were to be computed using nominal wheat prices for the past five years, the low price, the high price and the range of the price band would be substantially lower. As a result, variable import levies would, on average, be smaller and also would be imposed less frequently, and rebates on the standard eleven percent tariff would be larger and occur more frequently. In fact, even if reasonable alternative general price indexes were used to compute the price band, the policy would be less trade distortionary. Moreover, and perhaps even more importantly, if variable import levies were computed using a reference price for the same class of wheat used to construct the price band, they would also be imposed less frequently and be much lower, and rebates on the standard tariff rate would occur more frequently and be larger.

Accomplishing both of these changes in the implementation of Chile's price band variable import levy would improve access to the Chilean wheat market for all wheat exporters and also provide benefits to Chile's wheat consumers. Moreover they would help Chile's price band variable import levy accomplish its stated objective of stabilizing domestic wheat prices in Chile without enhancing them through trade distortionary tariffs.

Finally, it should be noted that if Chile's goal is to simply stabilize domestic wheat prices around the expected world price, then a completely different approach to establishing the price band should be considered. There is broad agreement among economists that futures contract market prices generally represent the best forecasts of future spot commodity prices. In addition, information about the expected volatility and distribution of prices over the next year can be obtained either from historical price data or from current data on options contract prices. Well functioning futures and options markets exist for wheat in the United States at the Chicago Board of Trade, the Kansas City Board of Trade, and the Minneapolis Grain Exchange and thus this type of approach is certainly feasible. It also has the virtue of avoiding any issues associated with the question of whether historical wheat prices should be adjusted for inflation and other long run trends. However, no matter what mechanism is used to establish Chile's wheat price band, at the very least the associated variable import levies should be computed using week-to week prices for the same class of wheat on which the price band was based in the first place.

References

Amjadi, A. and L. A. Winters. "Transport Costs and Natural Integration in MERCOSUR." World Bank Working Paper No. 1742, March 1997.

Cesal, L. "Chile" in *Global Review of Agricultural Policies: Western Hemisphere* edited by Donna Roberts and David Skully, United States Department of Agriculture Economic Research Service, Statistical Bulletin 992, Washington D.C. 1996.

General Agreement on Tariffs and Trade. *Trade Policy Review: Chile*. Geneve, General Agreement on Tariffs and Trade, 1991.

Greene, W. H. *Econometric Analysis* (third edition). Upper Saddle River, New Jersey; 1997.

Johnson, D. G. "North America and the World Grain Market." Paper presented at the Symposium on the Economics of World Wheat Markets, Montana Trade Research Center; June 1997.

Judge, G. C., R. C. Hall, W. E. Griffiths, H. Lutkepohl and T. C. Lee. *Introduction to the Theory and Practice of Econometrics* (second edition). New York; John Wiley and Sons, 1988.

Officer, L. H. *Purchasing Power Parity and Exchange rates: Theory, Evidence, and Relevance*. Greenwich, CT: J.A.I. Press, 1982.

Quezada, Norberto A. "Chile. Efectos de la Banda de Percios de Importacion de Trigo." *Cuadernos de Economia*, 28 (August, 1991): 221-248.

Raney, T. and J. Ugaz. "Chile Move Ahead with Regional Trade Agreements." International Agriculture and Trade--NAFTA Situation and Outlook, September 25, 1996.

Silverman, B. W. *Density Estimation for Statistics and Data Analysis.* London; Chapman and Hall, 1996.

United States International Trade Commission. *U.S. Market Access in Latin America: Recent Liberalizing Measures and Remaining Barriers (with a Special Case Study on Chile).* United States International Trade Commission Publication 2521, Washington, D.C., June 1992.

U.S. Wheat Associates, Chile. Personal Communication from Pablo Maluenda to the Wheat Export and Trade Education Committee, October 9, 1997.

Table 1. Wheat Production, Consumption and Imports in Chile: 1990-96

Year	Harvested Acres ('000s)[a]	Domestic Production ('000s of tons)[b]	Domestic Consumption ('000s of tons)[c]	Imports[d,e] ('000s of tons)
1990		1,718		56
1991		1,588		161
1992	362	1,567	1,950	567
1993	390	1,322	1,970	516
1994	370	1,271	1,930	697
1995	404	1,372	1,950	814
1996	385	1,227	1,930	480

[a]Data on harvested acres were obtained from various USDA FAS country reports for wheat in Chile.

[b]Data on domestic production were obtained from the Chile Ministry of Agriculture home page.

[c]Data on estimated domestic consumption were obtained from various USDA FAS country reports for wheat in Chile.

[d]Data on annual imports were obtained from the Chile Ministry of Agriculture home page.

[e]The sum of domestic production and imports does not exactly equal domestic consumption because of unreported changes in stocks.

Table 2. Chile Wheat Imports from Five Major Exporting Countries: 1986/87 - 1995/96 ('000s of metric tons)[a]

Year	Argentina	Australia	Canada	Eur. Union	United States	Total Imports
1986/87	35 (14.1%)	0 (0%)	0 (0%)	56 (22.5%)	158 (63.4%)	249 (100%)
1987/88	11 (10.2%)	0 (0%)	0 (0%)	71 (55.5%)	44 (34.3%)	128 (100%)
1988/89	11 (9.5%)	0 (0%)	0 (0%)	92 (77.3%)	13 (13.4%)	116 (100%)
1989/90	0 (0%)	7 (18.4%)	0 (0%)	31 (81.6%)	0 (0%)	38 (100%)
1990/91	9 (5.0%)	0 (0%)	34 (18.8%)	52 (28.7%)	86 (47.5%)	181 (100%)
1991/92	297 (57.2%)	0 (0%)	191 (36.8%)	31 (14.0%)	0 (0%)	519 (100%)
1992/93	170 (31.7%)	0 (0%)	303 (56.5%)	32 (6.0%)	31 (5.8%)	536 (100%)
1993/94	231 (29.2%)	0 (0%)	284 (35.9%)	35 (4.4%)	240 (30.5%)	790 (100%)
1994/95	237 (37.5%)	0 (0%)	352 (55.7%)	43 (6.8%)	0 (0%)	632 (100%)
1995/96	8 (1.1%)	94 (12.6%)	351 (46.8%)	0 (0%)	296 (39.5%)	749 (100%)

[a]The data source for this table is the US Congressional Research Service. The import data are for marketing years and therefore not directly comparable with the import data in Table 1.

Table 3. Chile's Price Bands for Milling Wheat: 1992-1998[a]
(Dollars per Metric Ton)

Period	Low Price	High Price
Nov. 16, 1991-Nov. 15, 1992	$201	$252
Nov. 16, 1992-Nov. 15, 1993	$190	$232
Nov. 16, 1993-Nov. 15, 1994	$187	$246
Nov. 16, 1994-Nov. 15, 1995	$183	$234
Nov. 16, 1995-Nov. 15, 1996	$183	$235
Nov. 16, 1996-Nov. 15, 1997	$210	$240
Nov. 16, 1997-Nov. 15, 1998	$213	$251

[a]The data presented in this table were obtained from various Foreign Agricultural Service commodity reports and the home page of Chile's Ministry of Agriculture.

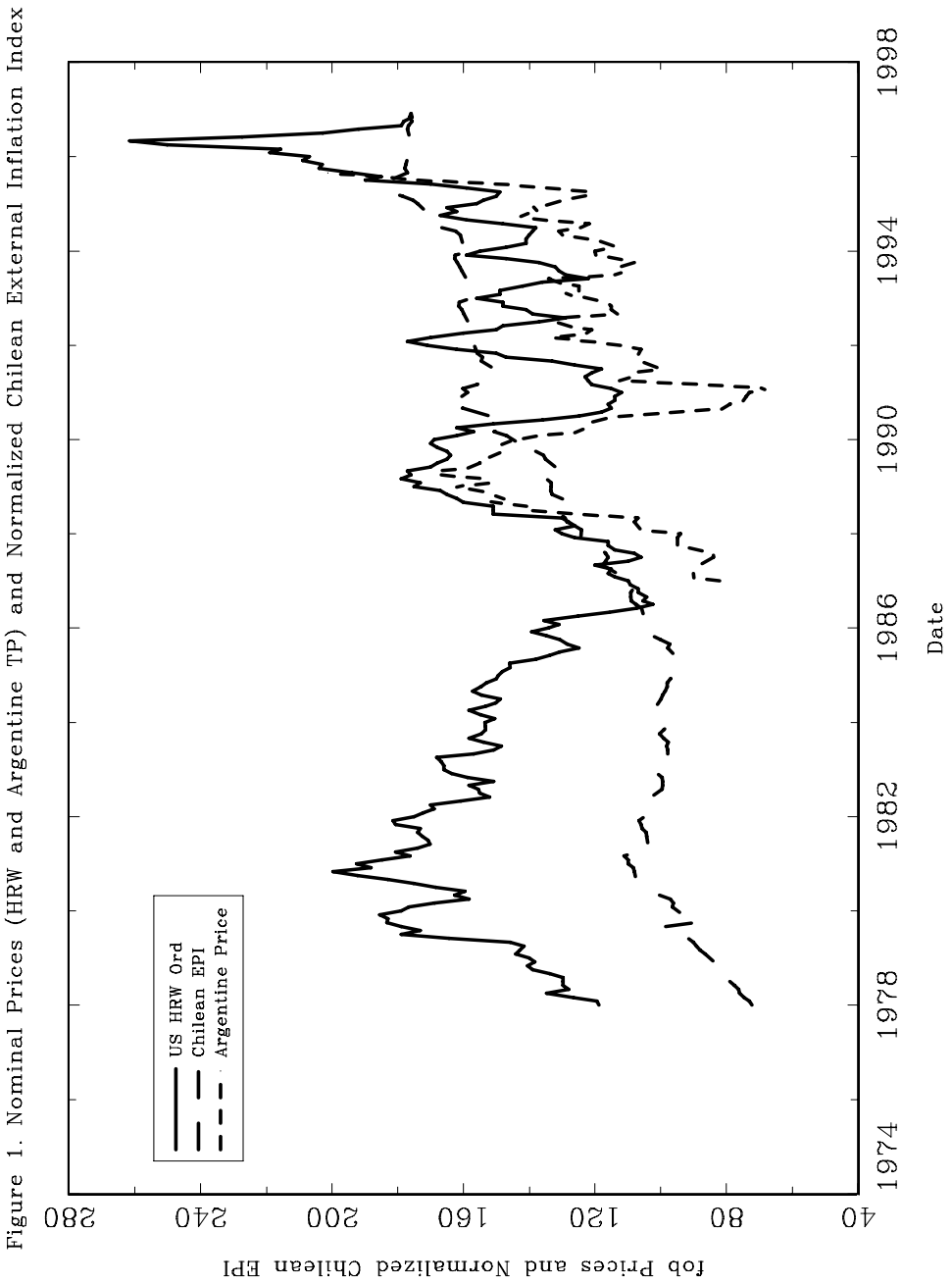


Figure 1. Nominal Prices (HRW and Argentine TP) and Normalized Chilean External Inflation Index

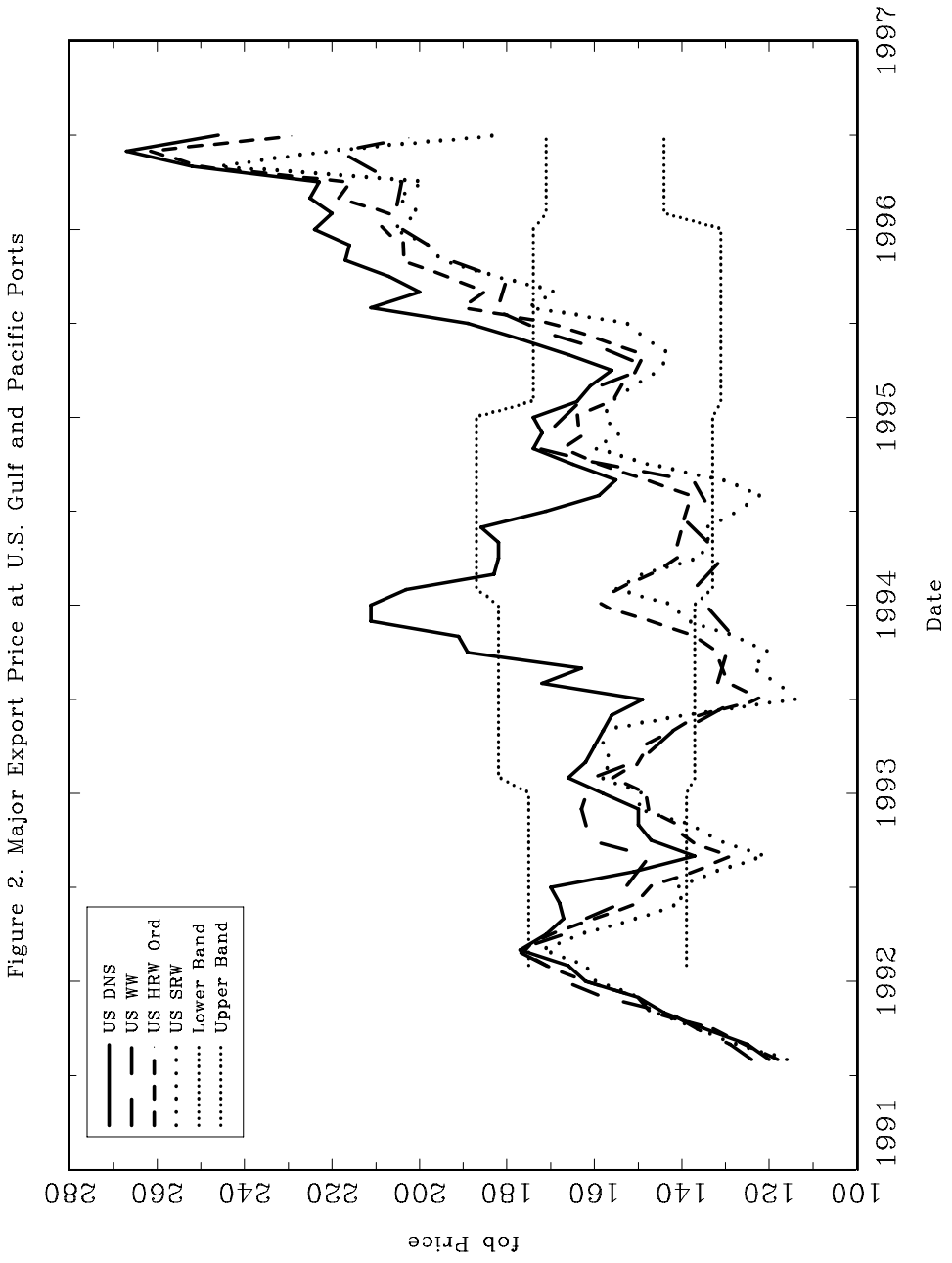


Figure 2. Major Export Price at U.S. Gulf and Pacific Ports

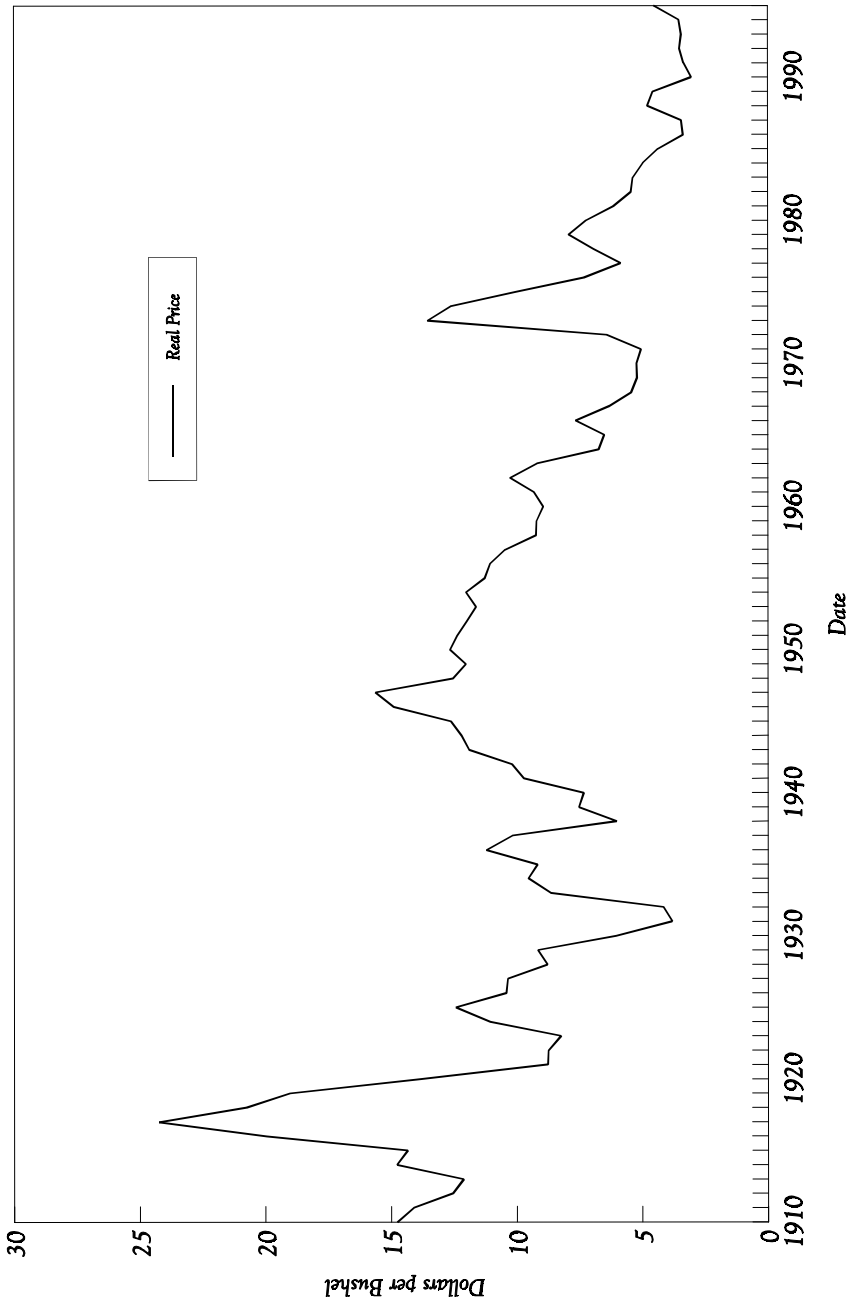
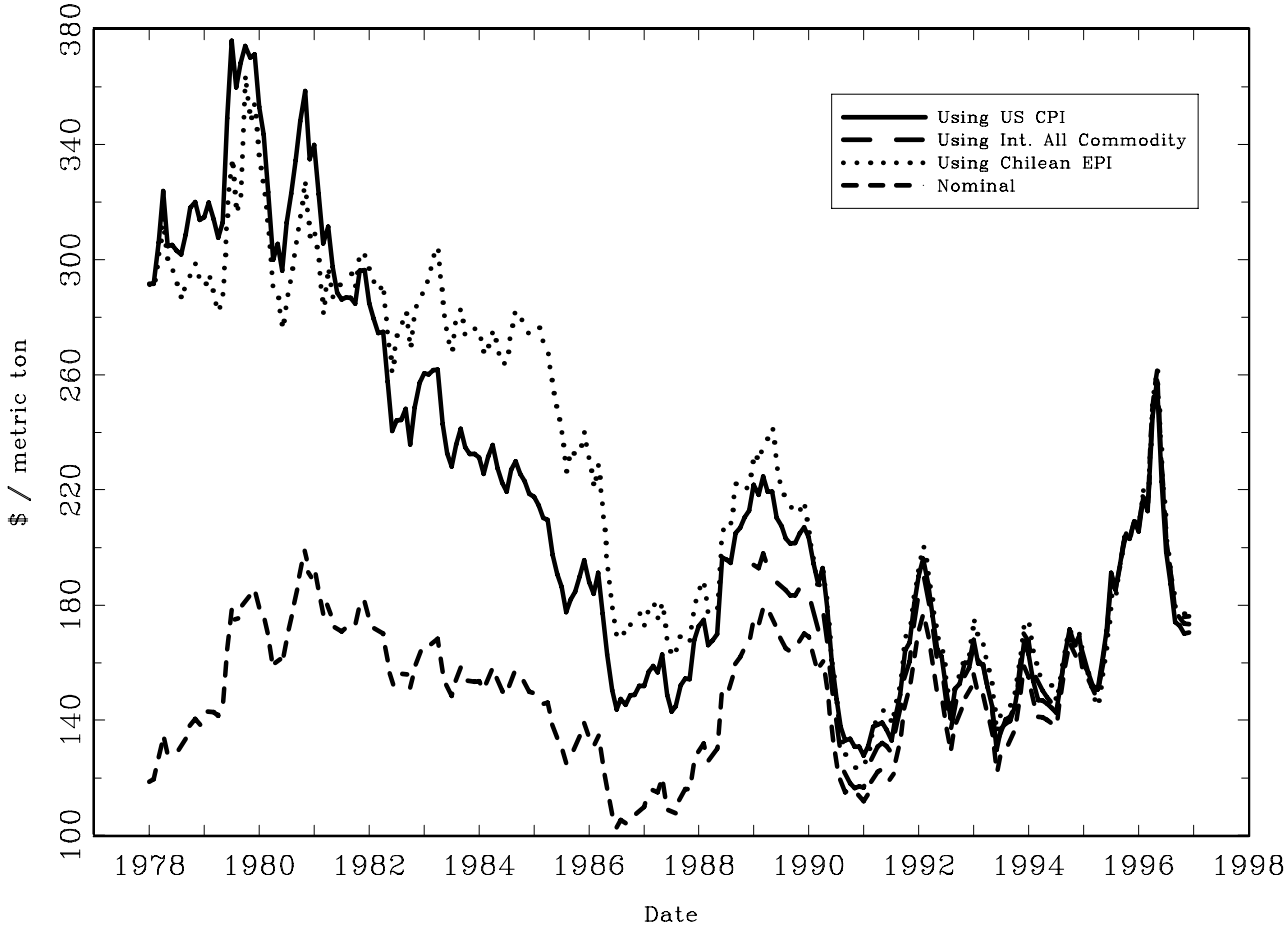


Figure 3. The Real Price of Wheat in the United States: 1910-1995

Figure 4. Nominal and Deflated Prices(US HRW Ord.): Effect of Alternative Deflators



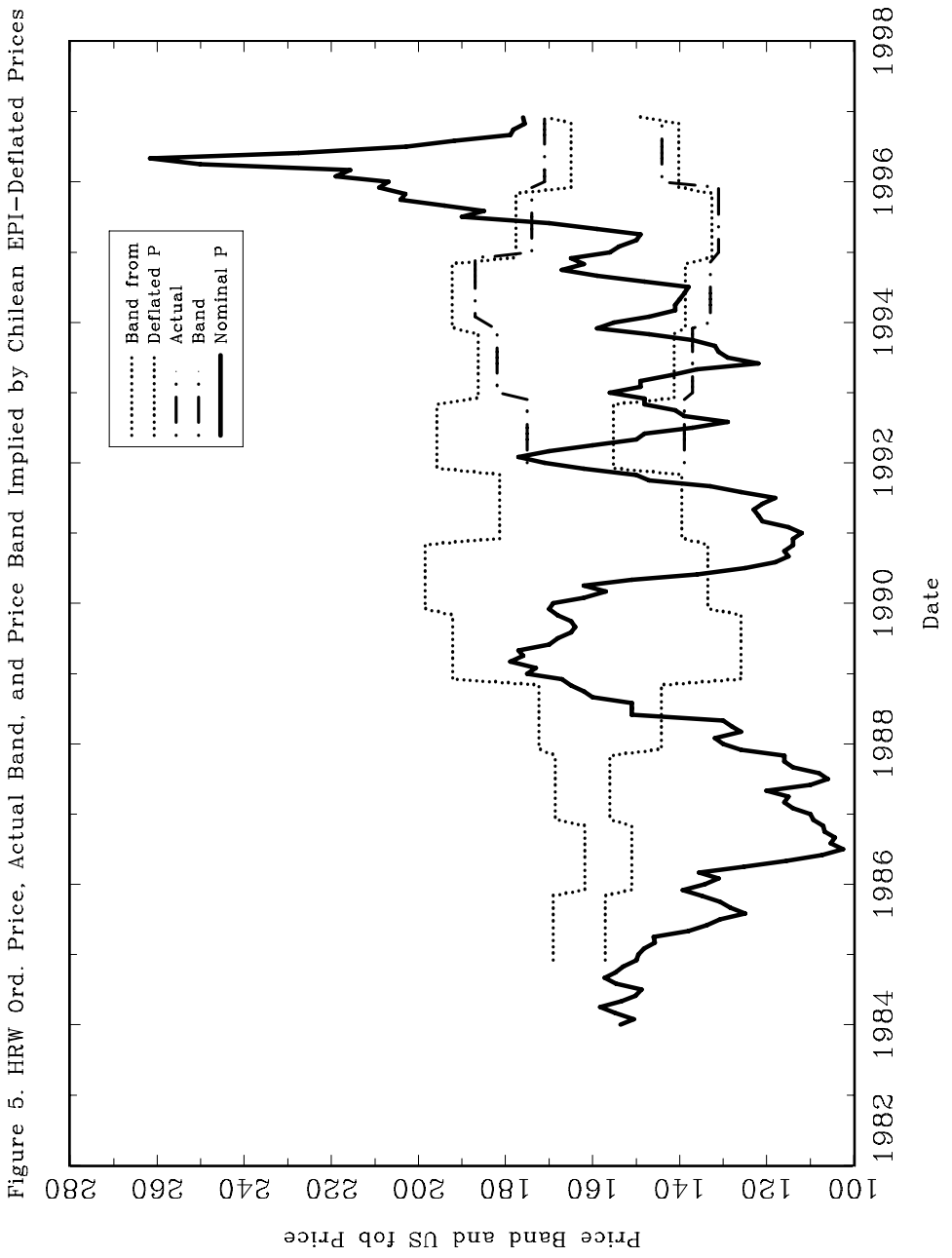
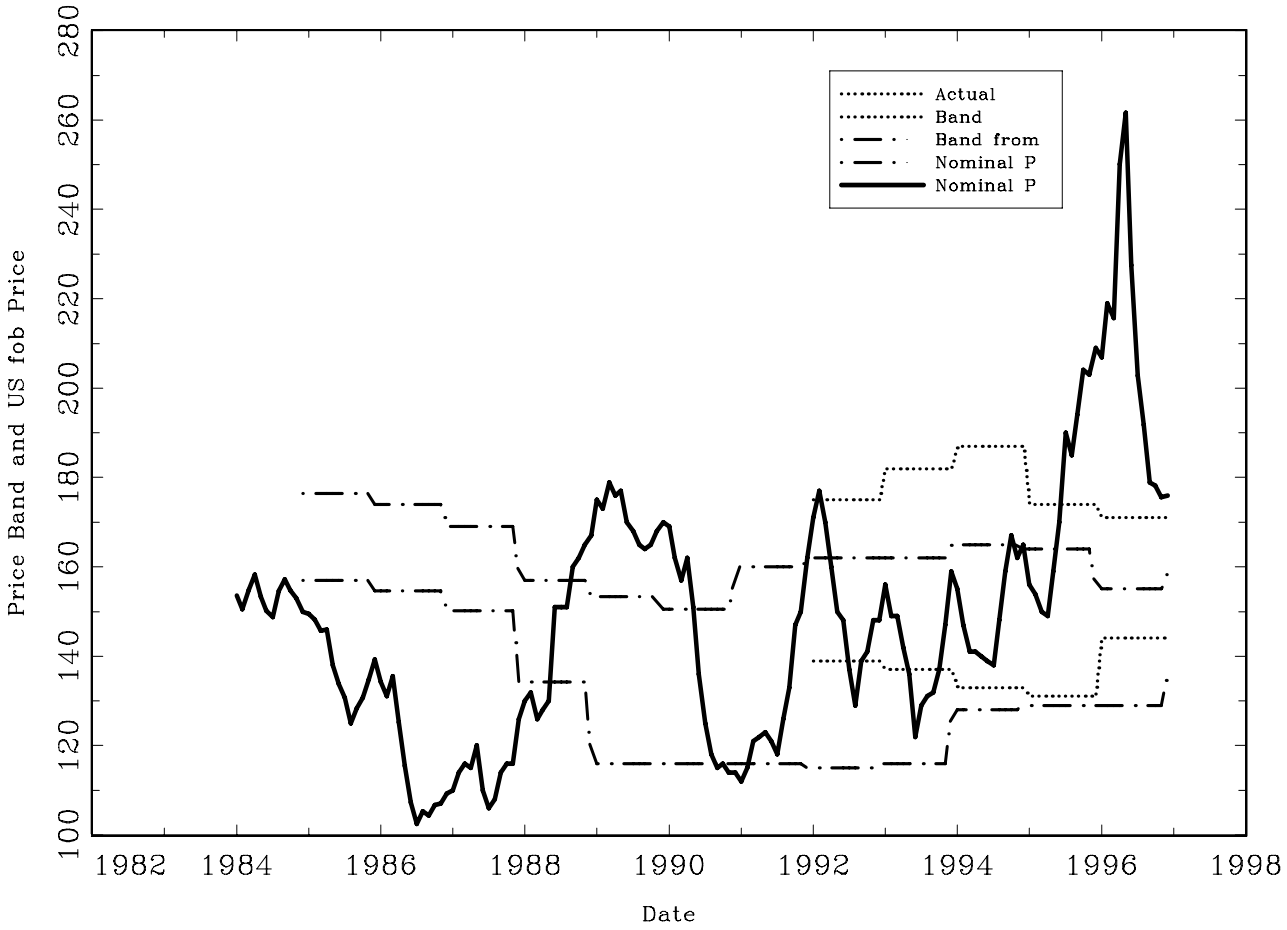


Figure 5. HRW Ord. Price, Actual Band, and Price Band Implied by Chilean EPI-Deflated Prices

Figure 6. Actual Price Band, Band Implied by Nominal Prices, and Nominal Prices



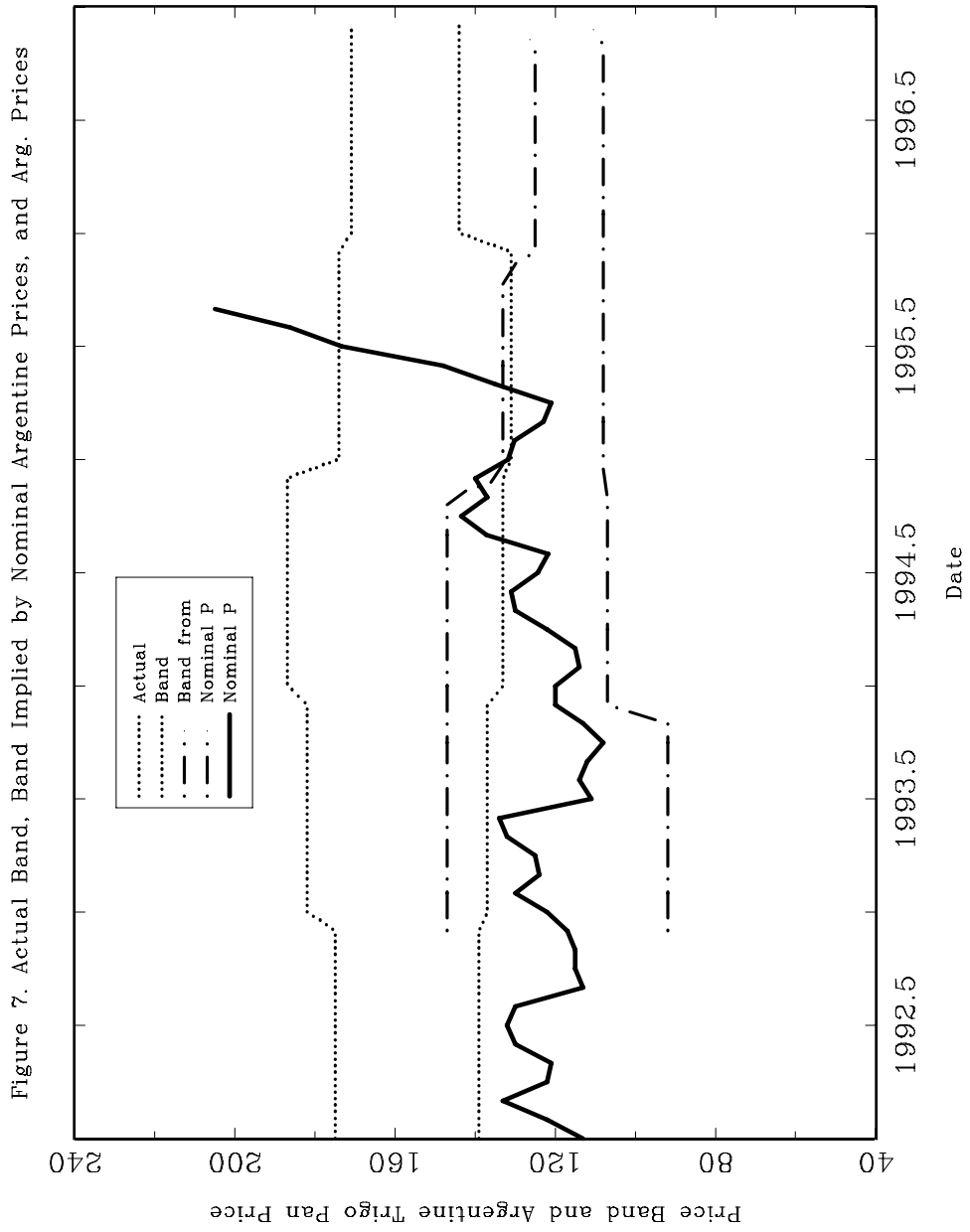


Figure 7. Actual Band, Band Implied by Nominal Argentine Prices, and Arg. Prices

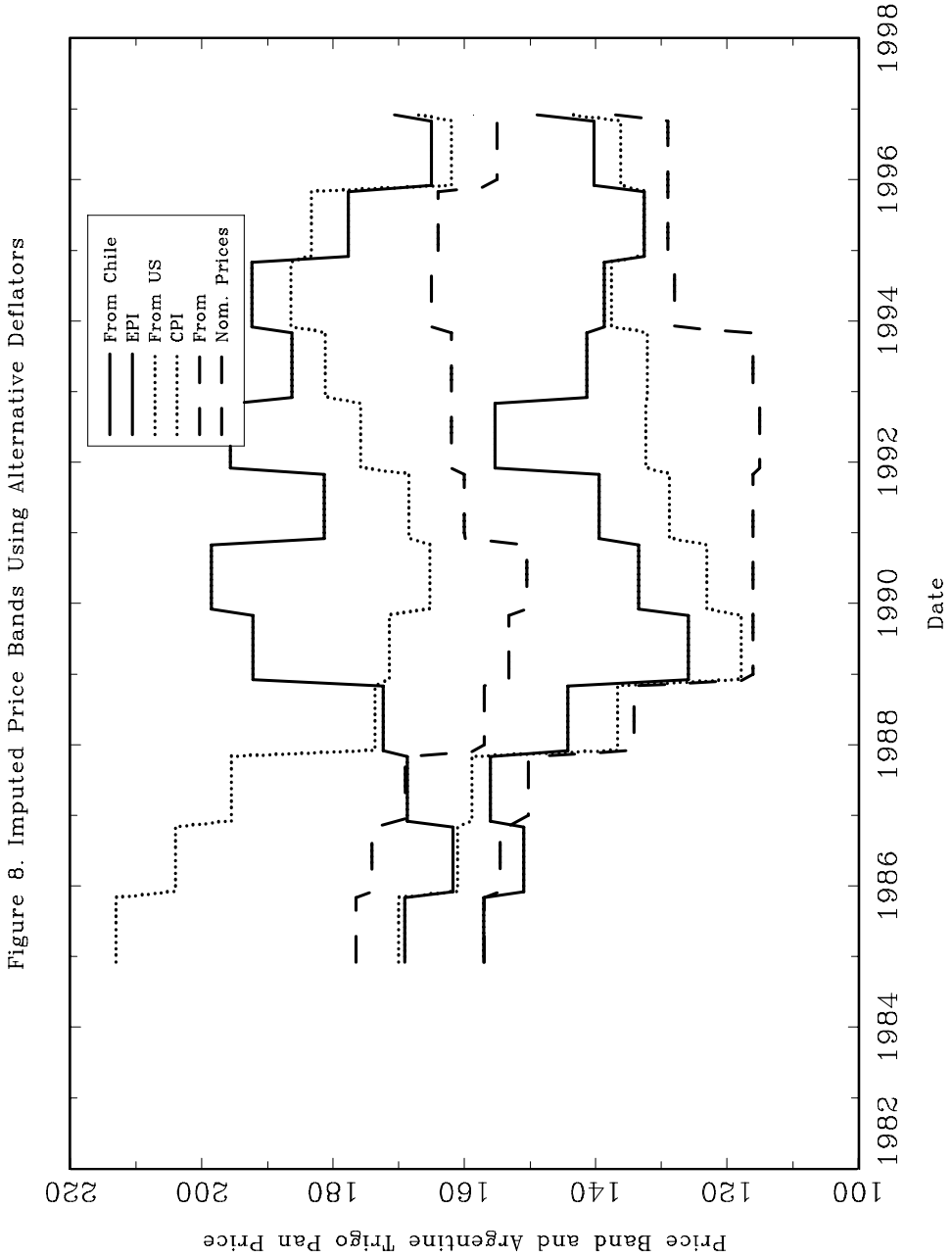
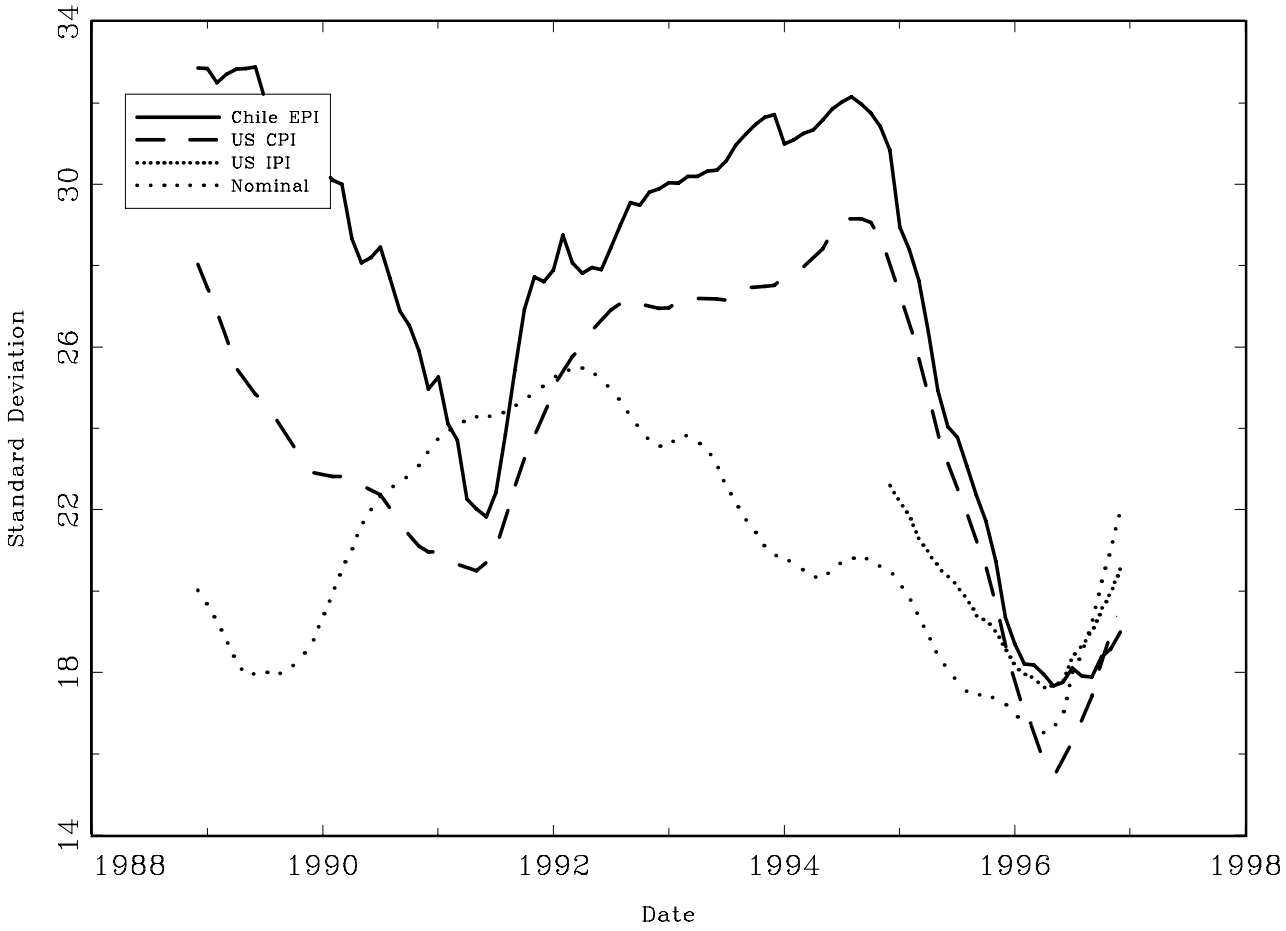


Figure 8. Imputed Price Bands Using Alternative Deflators

Figure 9. Standard Deviation for Nominal and Deflated Prices Over Preceding 60 Months



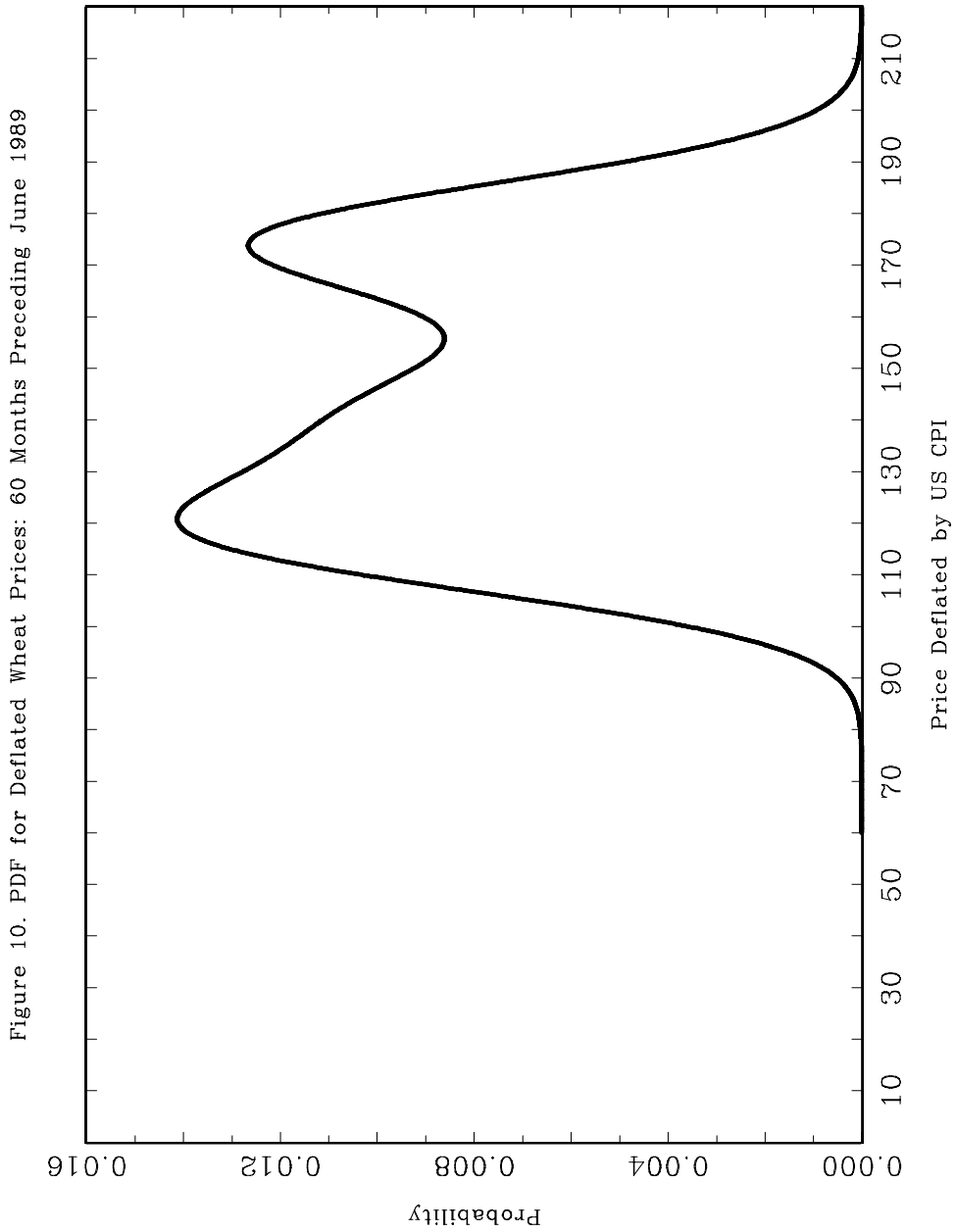


Figure 10. PDF for Deflated Wheat Prices: 60 Months Preceding June 1989

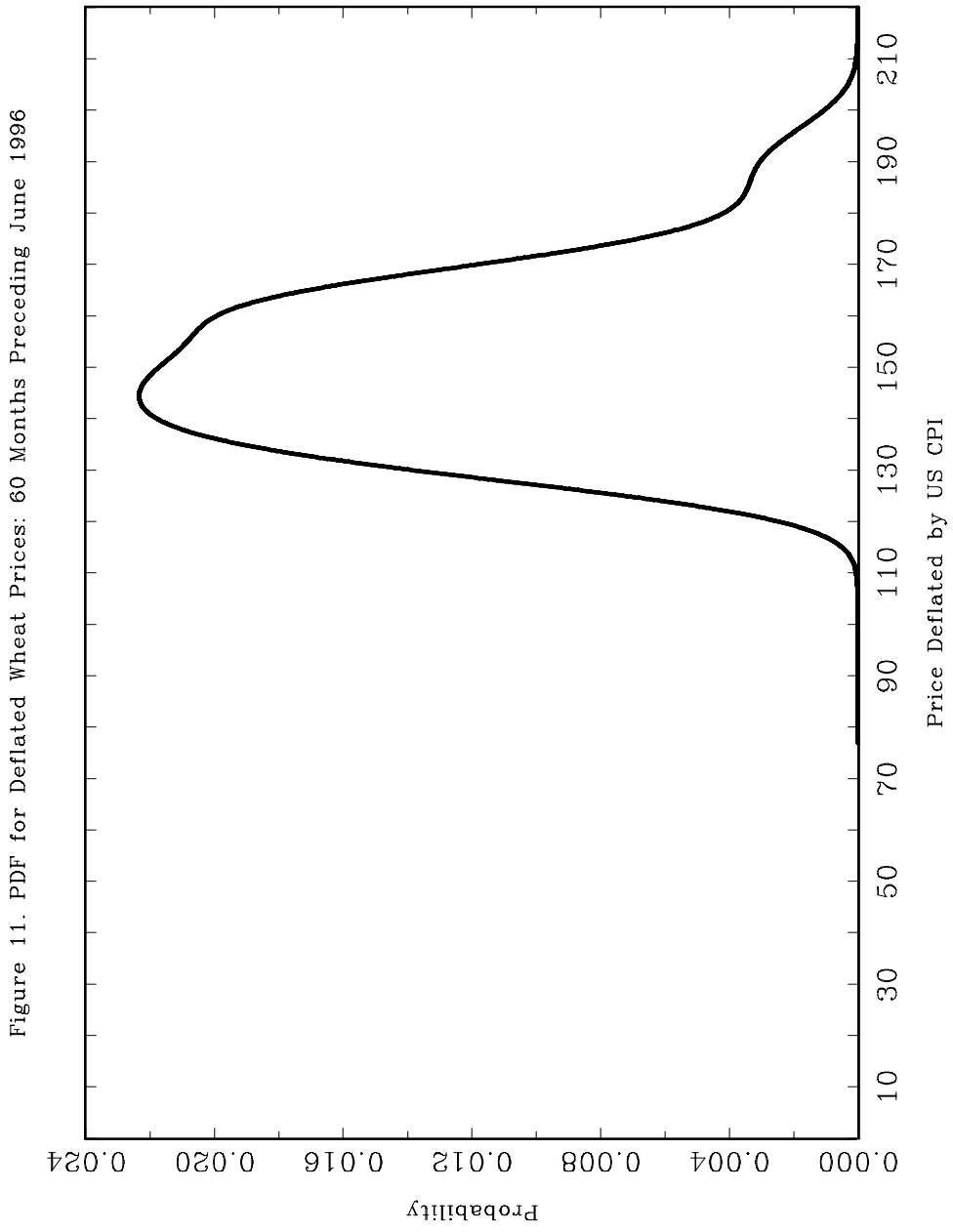


Figure 11. PDF for Deflated Wheat Prices: 60 Months Preceding June 1996

APPENDIX A

The Economic Effects of Chile's Price Band Policy

The economic effects of Chile's price band-variable import levy and standard tariff policies for wheat depend crucially on the world price of wheat. Given that world prices vary from week to week and month to month, and therefore that variable import levies and import prices also adjust, impacts on domestic producer decisions in Chile depend on the expected average effects of the policies over the course of a marketing year. The economic effects of three potential situations, each of which corresponds to the three example situations described in section 2, are graphically presented in figure Al -A3. In case 1, presented in figure Al, the world price, WP, is lower than the low price in the price band, LP; that is, WP < LP. In case 2, presented in figure A2, WP lies between the low price, LP, and the high price, HP; that is LP < WP< HP. In case 3, presented in figure A3, the world price exceeds the high price; that is, WP > HP. However, in contrast to the discussion in section 2, in Figures Al -A3, each of the three general situations is assumed to persist for the course of the entire marketing year. In each of the figures the lines labeled SS and DD represent domestic demand and supply curves for wheat in Chile.

In situation 1, presented in figure Al, over the course of the year, the import cost IC—which is equal to the sum of the world price c.i.f. Chile, WP, and the eleven percent standard tariff, ST—is assumed to be lower than the lower bound of the price band, LP. Thus, on average, a variable import levy, VL, is charged on imports equal to LP - IC. As a result, imports can only be brought into the country at a domestic price of LP, equal to the sum of the world price, the variable import levy and the standard tariff; that is, LP = WP + VL + ST.

Assuming that world supplies of wheat to Chile are perfectly elastic in supply—a reasonable assumption as Chile imports less than 1 percent of total world wheat exports to all countries—in the absence any tariff policies, the world supply of imports would be represented by the line WP-WP. At that price, domestic output in Chile would be QP_0 and domestic consumption would be QD_0. The difference between domestic consumption and domestic production, $QD_0 - QP_0$ represented by the distance AF along the world price line, would be made of imports. Imposing the variable levy and the standard tariff raises the cost of imported wheat from WP to LP and shifts the import supply curve to the line LP-LP. The result is that the domestic price increases to LP, the low price in the price band. The consequence is that domestic production in Chile increases to QP_1, domestic consumption falls to QD_1, and, as a joint result of the increase in domestic production and the decrease in domestic consumption, imports fall from AF to BG. When the low price in the price band is set above the average world price, the effect is to reduce the size of the market for wheat imports. In the case of Chile, most of the reduction in imports is likely to be the result of increased domestic production (the movement along the supply curve from point A to point B which results from the implementation of the trade policies).

In situation 2, represented in figure A2, on average c.i.f. world wheat prices are assumed to lie within Chile's price band between the low price and the high price; that is, WP lies between LP and HP. In this case, imports are not subject to a variable import levy. However, they are still subject to the standard 11 percent tariff. The effect of the standard tariff is to raise the cost of imports from WP to WP + ST, where the standard tariff ST is equal to 11 percent of WP. Given that Chile is still willing to purchase imports when the standard tariff is imposed, the post tariff

domestic price DP becomes equal to WP + ST. In the absence of the tariff, the domestic price would simply be equal to the world price, WP. In this case, as is illustrated in figure A2, again the effect of the tariff is to raise the domestic price above the world price (from WP to DP), to expand domestic production (from QP_0 to QP_1), to reduce domestic consumption (from QD_0 to QD_1) and to reduce imports (from AF to BG). The effects of the trade policy are likely to be smaller in situation 2 because imports are only subject to the standard 11 percent tariff and not the variable import levy.

In situation 3, represented in figure A3, on average c.i.f. world wheat prices are assumed to lie above the price band; that is, WP lies above the high price HP. In figure A3, it is assumed that the world price is large enough to preclude the use of any tariff. If that is the case, then, as illustrated in figure A3, Chile's trade policy has no effect on domestic production, domestic consumption or imports. However, as case 3 presented in section 2 illustrates, even when the world price exceeds the high price, if the difference between the two prices is not sufficiently large then a reduced standard tariff will be applied. The effects of the reduced standard tariff will again be to expand domestic production, reduce domestic consumption and, as a result, reduce imports.

As section 2 illustrated, Chile's price band-variable import levy mechanism and standard tariff vary every 15 days as world wheat prices and, therefore, Chile's reference price change. Chile has argued that the price band mechanism therefore operates simply to stabilize prices. Thus, in general, Chile has suggested that situation 2 is the average situation; that is, on average, wheat imports are subject only to a modest 11 percent standard tariff. However, the actual average effects of the price-band variable import levy and standard tariff policies depend

crucially on whether the mechanism by which the price band is established ensures that average world market prices will lie well within the band or below the low price in the band.

The issue is illustrated in figure A4. In figure A4, the curve AA represents the actual probability density of world wheat prices (c.i.f. Santiago) in a given year. The vertical axis represents the height of the probability density function and wheat prices are measured on the horizontal axis. If the actual price band were represented by the low price LP_1 and the high price HP_1 then world prices almost always lie within the price band and Chile's argument would be reasonably accurate. However, if the actual price band were represented by the low price LP_2 and the high price HP_2 then world prices would often lie well below the low price in the price band and, on average, total tariff rates would be much higher than the standard rate, wheat imports would be subject to variable import levies. Thus, the effects of Chile's wheat import policy would be more accurately represented by situation 1 and Figure A1.

As was pointed out in section 2, how Chile establishes its price band for wheat and the reference prices it uses are therefore crucial in determining the effects of its trade policies on wheat imports. In section 2, two potential sources of upward bias in Chile's wheat price band were identified: the use of an inflation index and the use of an f.o.b. price for one class of wheat to establish a price band for all classes of milling wheat. In section 3 and 4, we examined the effects of using inflation indexes to adjust nominal wheat prices on the relationship of the price band to actual wheat prices and showed that this procedure increases both the low price in the price band and the high price in the price band. The result is that Chile implements more frequent and higher variable import levies and less frequent and lower rebates on the standard tariff. A third important problem is the use of a reference price—the lowest quoted f.o.b. price relevant to

Chile – which rarely, if ever, corresponds to the prices used to establish the price band and which also clearly results in much higher and more frequent variable import levies.

Figure A1. Chile's Price Band Policy

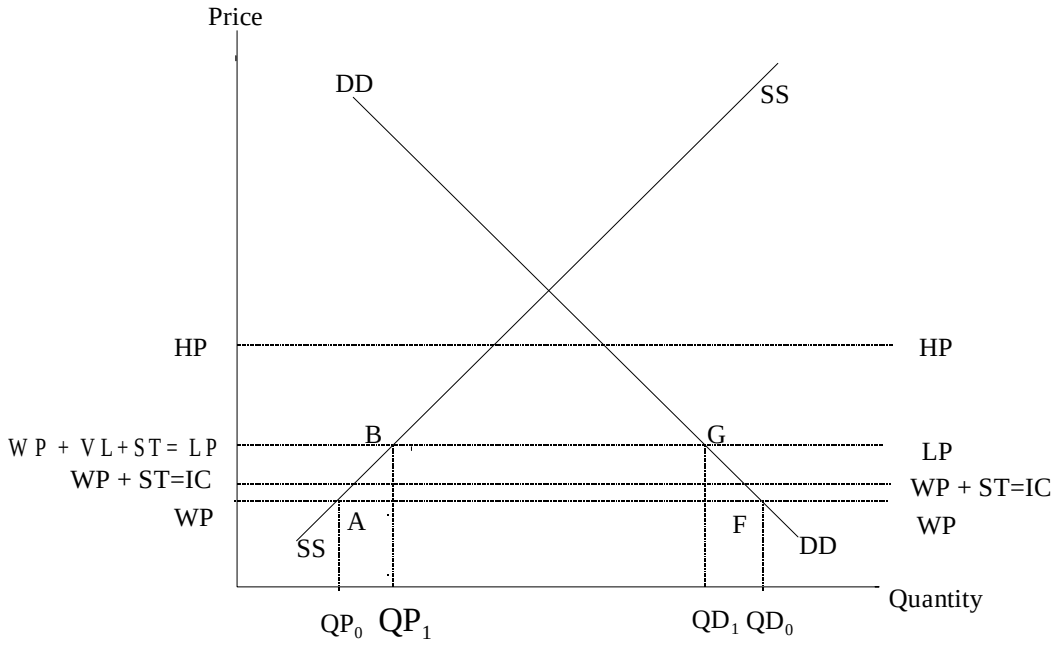


Figure A2. Chile's Price Band Policy: World Price Lies in the Price Band

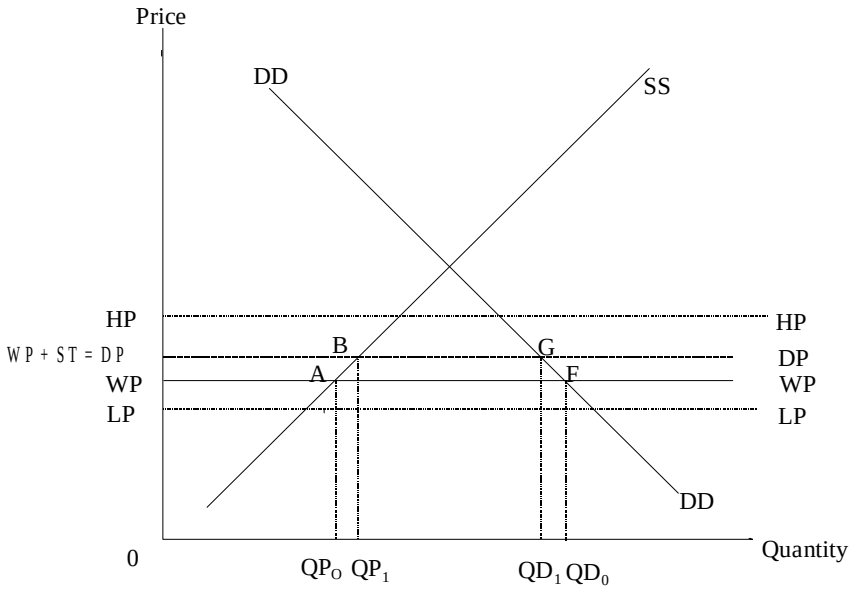


Figure A3. Chile's Price Band Policy: World Price Lies Above the Price Band

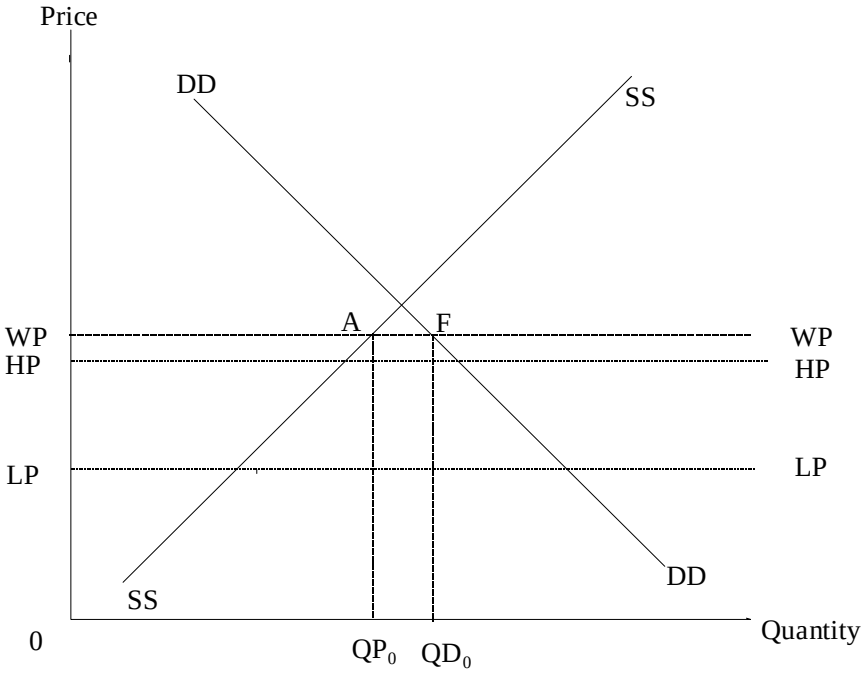
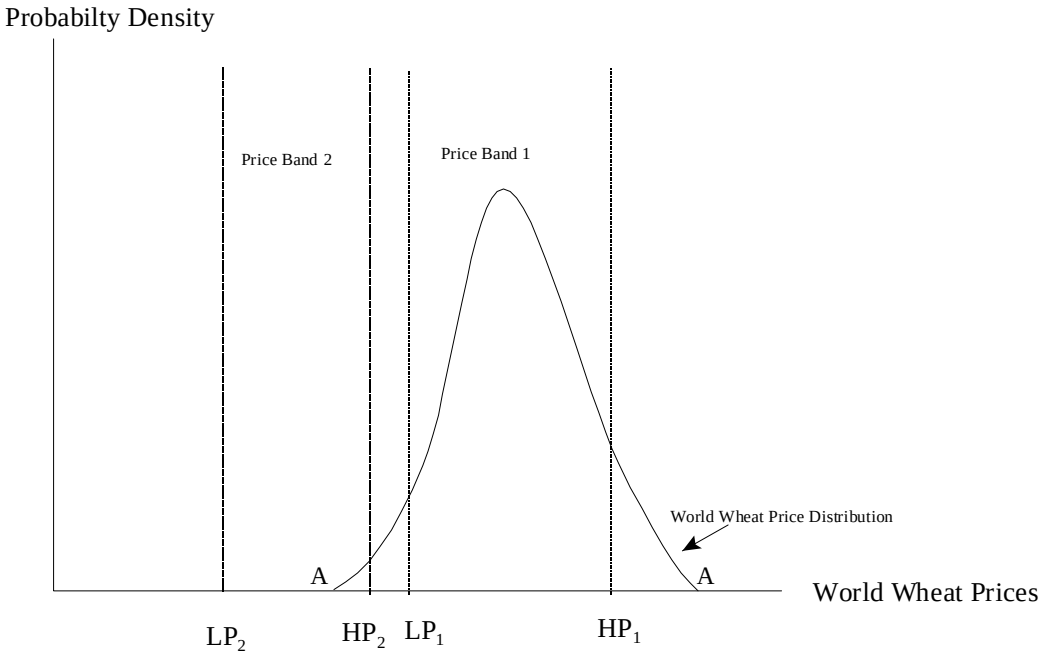


Figure A4. Price Bands and the Probability Density Function for World Wheat Prices



APPENDIX B

Recent Free Trade Agreements:
Implications for Chilean Wheat Imports

Despite the presence of trade-distorting policies such as price bands and import tariffs, Chile has a long history of relatively low trade barriers. The Chilean economy has also been one of the strongest in Latin America. Until recently, Chile appeared to be on track for accession into the North American Free Trade Agreement (NAFTA). The lack of US fast-track negotiating authority has inhibited Chile's entry into NAFTA. Chile has, however, pursued a number of other regional trade agreements on a bilateral basis. On June 25, 1995, Chile signed a regional trade agreement known as the Economic Complementary Agreement (ECA) and became an associate member of MERCOSUR. The MERCOSUR group of countries includes Argentina, Brazil, Paraguay, and Uruguay, and now Chile as an associate member. More recently, on July 2, 1997, Chile's Congress also ratified the recently signed free-trade agreement with Canada which came into effect in that month. Chile is also currently pursuing an economic cooperation agreement with the European Union. Earlier, Chile had established a free-trade agreement with Mexico in 1991 (under the provisions of the Montevideo Treaty of 1980) and Chile's trade with Mexico has expanded significantly under this agreement. Raney and Ugaz (1996) note that, with the stalling of Chile's movement toward becoming a member of NAFTA, it is likely that the deepening of the regional ties between Chile and its trading partners in the Western Hemisphere under these and other bilateral agreements will have a greater impact on US agricultural markets than Chile's eventual accession to NAFTA.

Chile's agreement to become an associate member of MERCOSUR, which came into effect on October 1, 1996, will result in gradual tariff reductions for different product groups for trade between Chile and other MERCOSUR countries. The ultimate goal of the MERCOSUR trade agreement is to establish a Latin American free-trade area, at least among member countries, within the next ten years. The trade agreement will eventually eliminate all tariffs on trade between Chile and the MERCOSUR countries. The agreement, however, does not require that Chile adopt MERCOSUR's common external tariff with nonmember countries; that is, the MERCOSUR agreement is not intended to create a customs union. Commodities subject to tariff reductions under the ECA are divided into four categories: general products, sensitive products, especially sensitive products, and products with major sensitivity. For general products, tariffs were reduced by 40 percent with the start of the agreement in October, 1996 and will be gradually reduced to zero by 2004. For commodities in the sensitive areas, tariff reductions will be delayed for several years.

Wheat and wheat flour are considered to be commodities of major sensitivity. Tariffs for these products will not begin to be reduced until 2006 and will not reach zero until 2014, eighteen years after the initial implementation of the agreement. Moreover, Chile's agreement with the MERCOSUR countries allows Chile's price band policy for wheat to remain in place. Thus, while MERCOSUR countries will eventually receive preferential treatment with Chile with respect to Chile's standard tariff, they will continue to face price band variable import levies. As part of the agreement, however, Chile has agreed to not include any new products in the system of price bands and to not change the mechanisms or apply them in a manner which would threaten market access for MERCOSUR countries.

In light of the long delay in reductions of import tariffs on wheat for MERCOSUR countries, it is unlikely that Chile's accession to MERCOSUR will have significant impacts on grain markets in the short-run. In the longer-run, however, the agreement may give important advantages to the major wheat exporter of the region: Argentina. Aside from tariff preferences, there may be some reason to suspect that the increased trade and integration brought about in other sectors may increase trade in grain products among Chile and its MERCOSUR partners. However, Amjadi and Winters (1997) report that MERCOSUR countries have had trade and transportation costs that, on average, have been 2 to 4 percent higher than for the United States. This evidence indicates that significant shifts in trade patterns purely on the basis of geographic advantages seems unlikely. Nevertheless, if over the medium to long term, the MERCOSUR agreement provides Argentina with tariff reduction advantages that more than offset higher transportation costs, then the United States and other exporting countries are likely to be squeezed out of the Chilean market for wheats that compete with Trigo pan wheat.

The Chile-Canada free trade agreement which came into force in July, 1997 also contains provisions that liberalize access for Canadian agricultural producers to Chile's agricultural markets. Correspondingly, Chile's producers of agricultural exports such as fresh horticultural products will be provided with liberalized access to Canadian markets. Generally, standard tariffs on Canadian imports will be phased out of adjustment periods of varying lengths. Barley and barley products, for example, will receive duty free treatment immediately while the phase out period for corn will be ten years. In addition, Chile's standard tariff for canola and other oilseeds will immediately be reduced to 6 percent and phased out over seven years.

Wheat is treated differently in the Chile-Canada free trade agreement. Moreover, the provisions for durum wheat are very different than the provisions for milling wheat and wheat flour. Durum wheat will immediately receive seasonal duty free treatment for six months of the year, from April 15 to November 15. Tariffs on durum wheat during the remainder of the year will be phased out over a five year adjustment period. Almost all Canadian durum wheat is already exported to Chile during this period. Thus, in effect, the agreement provides Canadian durum exporters with a tariff free trade environment in Chile. The immediate implications of these provisions for United States durum producers do not appear to be significant as Canada has been the sole supplier of durum wheat imports by Chile over the past five years. However, these provisions of the Chile-Canada free trade agreement do make it much more difficult, perhaps infeasible, for US durum wheat producers to enter the Chile market without a free trade agreement between Chile and the United States that is similar to the current free trade agreement between Chile and Canada.

The treatment of milling wheat and wheat flour is much less liberal. First, as in the MERCOSUR agreement, Canada has agreed to accept Chile's price band-variable import levy mechanism. Thus, Canadian milling wheat imports will continue to be subject to variable import levies. Second, as in the Chile-MERCOSUR agreement, the adjustment period for wheat in the Chile-Canada agreement is 18 years. However, there is to be no reduction in the 11 percent standard import tariff for wheat until year 17 of the adjustment period; that is, until 2012. In effect, the categorization of wheat as a commodity of major sensitivity was carried over to the Chile-Canada agreement. Thus, until 2012, the Canadian Wheat Board will have no trade policy advantage over other major exporters with respect to milling wheat and wheat flour. Thereafter,

absent any agreement between Chile and the United States, United States wheat exporters would be at a substantial disadvantage relative to both Canadian and Argentinian wheat exports in Chiles's wheat import market.

The Chile-Canada agreement contains one additional important clause concerning milling wheat and wheat flour. Canada will automatically be granted any improved access that Chile provides in the future to either Argentina or the United States. Thus, for example, if further tariff reductions for wheat were negotiated with Argentina or the United States, they would not necessarily be granted to the United States. In contrast, any reductions in Chile's wheat tariffs negotiated by the United States would automatically be granted to Canada. Under the current set of agreements, therefore it is possible for Canada to improve its competitive position in Chile's wheat markets relative to the United States, but not for the United States to improve its competitive position vis a vis Canada. Given the comparability of different United States and Canadian wheats, even relatively small changes in the standard tariff rate could give the Canadian Wheat Board a sufficiently large competitive edge in pricing its wheat in Chile to drive exporters of hard and soft wheats (other than Argentina) out of Chile's market. Thus, in the absence of a Chile-United States free trade agreement, the Chile-Canada free trade agreement seems to have created a more tenuous policy environment for United States wheat exporters in Chile.

Appendix Table 1. Price Data and Price Indices Used in Empirical Analysis

Date	US HRW Ordinary at Gulf ($/ton)	Chile External Price Index	US Consumer Price Index	US BLS International Price Index
78.01	119	67.60	62.50	–
78.02	120	68.40	62.90	–
78.03	127	69.70	63.40	–
73.04	135	71.00	63.90	–
78.05	128	71.30	64.50	–
78.06	130	72.50	65.20	–
78.07	130	73.90	65.70	–
78.08	129	75.20	66.00	–
73.09	134	76.00	66.50	–
78.10	139	78.20	67.10	–
78.11	141	78.00	67.40	–
78.12	139	78.40	67.70	–
79.01	140	79.90	68.30	–
79.02	144	81.00	69.10	–
79.03	143	82.40	69.80	–
79.04	141	83.30	70.60	–
79.05	146	84.20	71.50	–
79.06	164	85.80	72.30	–
79.07	179	88.60	73.10	–
79.08	173	90.80	73.80	–
79.09	179	92.50	74.60	–
79.10	183	83.50	75.20	–
79.11	183	87.20	75.90	–
79.12	185	86.90	76.70	–
80.01	179	88.90	77.80	–
80.02	176	90.20	78.90	–
80.03	169	90.00	80.10	–
80.04	158	90.80	81.00	–
80.05	163	93.80	81.80	–
80.06	159	95.90	82.70	–
80.07	169	97.90	82.70	–
80.08	175	98.60	83.30	–
80.09	183	99.80	84.00	–
80.10	192	101.20	84.80	–
80.11	200	101.10	85.50	–
80.12	188	101.40	86.30	–
81.01	193	102.80	87.00	–
81.02	185	102.70	87.90	–
81.03	176	104.00	88.50	–
81.04	181	100.90	89.10	–
81.05	174	100.60	89.80	–
81.06	170	97.10	90.60	–
81.07	171	97.20	91.60	–
81.08	173	97.60	92.30	–

Appendix Table 1. (continued)

Date	US HRW Ordinary at Gulf ($/ton)	Chile External Price Index	US Consumer Price Index	US BLS International Price Index
81.09	174	97.80	93.20	–
81.10	173	98.80	93.40	–
81.11	180	99.10	93.70	–
81.12	182	99.70	94.00	–
82.01	175	98.10	94.30	–
82.02	172	97.70	94.60	–
82.03	159	97.00	94.50	–
82.04	170	96.70	94.90	–
82.05	160	97.40	95.80	–
82.06	152	96.70	97.00	–
82.07	155	93.50	97.50	–
82.08	155	93.20	97.70	–
82.09	158	93.10	97.90	–
82.10	151	93.00	98,20	–
82.11	157	93.20	98.00	–
82.12	164	94.40	97.60	–
83.01	166	95.40	97.80	–
83.02	166	93.60	97.90	–
83.03	167	91.80	97.90	–
83.04	168	91.60	98.60	–
83.05	157	91.50	99.20	–
83.06	151	91.60	99.50	–
83.07	148	91.90	99.90	–
83.08	154	91.40	100.20	–
83.09	159	92.80	100.70	–
83.10	154	93.80	101.00	–
83.11	153	92.80	101.20	–
83.12	154	92.20	101.30	–
84.01	154	92.40	101.90	–
84.02	151	93.60	102.40	–
84.03	154	95.00	102.60	–
84.04	158	95.30	103.10	–
84.05	153	94.60	103.40	–
84.06	150	94.50	103.70	–
84.07	149	93.40	104.10	–
84.08	155	93.00	104.50	–
84.09	157	92.30	105.00	–
84.10	155	91.70	105.30	–
84.11	153	91.70	105.30	–
84.12	150	90.90	105.30	–
85.01	149	90.30	105.50	–
85.02	149	88.90	106.00	–
85.03	146	89.10	106.40	–
				–

Appendix Table 1. (continued)

Date	US HRW Ordinary at Gulf ($/ton)	Chile External Price Index	US Consumer Price Index	US BLS International Price Index
85.04	146	90.20	106.90	–
85.05	138	89.60	107.30	–
85.06	134	89.70	107.60	–
85.07	131	90.30	107.80	–
85.08	125	91.60	108.00	–
85.09	128	91.00	108.30	–
85.10	131	93.60	108.70	–
85.11	135	95.70	109.00	–
85.12	139	96.20	109.30	–
86.01	134	96.60	109.60	–
86.02	131	98.40	109.30	–
86.03	136	98.30	108.80	–
86.04	125	97.90	108.60	–
86.05	115	99.10	108.90	–
86.06	107	99.00	109.50	–
86.07	103	100.60	109.50	–
86.08	105	101.90	109.70	–
86.09	104	102.10	110.20	–
86.10	108	102.10	110.30	–
86.11	107	101.50	110.40	–
86.12	109	102.30	110.50	–
87.01	110	105.60	111.20	–
87.02	114	105.90	111.60	–
87.03	116	106.20	112.10	–
87.04	115	108.80	112.70	–
87.05	120	110.10	113.10	–
87.06	110	109.30	113.50	–
87.07	l06	108.60	113.80	–
87.08	108	109.20	114.40	–
87.09	114	111.00	115.00	–
87.10	116	113.80	115.30	–
87.11	116	114.70	115.40	–
87.12	126	116.10	115.40	–
88.01	130	116.40	115.70	–
88.02	132	116.10	116.00	–
88.03	126	118.00	116.50	–
88.04	128	120.10	117.10	–
88.05	130	120.30	117.50	–
88.06	151	122.00	118.00	–
88.07	151	119.80	118.50	
88.08	151	120.30	119.00	
88.09	160	119.40	119.80	
88.10	162	122.00	120.20	

Appendix Table 1. (continued)

Date	US HRW Ordinary at Gulf ($/ton)	Chile External Price Index	US Consumer Price Index	US BLS International Price Index
88.11	165	124.40	120.30	-
88.12	167	124.90	120.50	-
89.01	175	124.70	121.10	90.60
89.02	173	124.80	121.60	90.10
89.03	179	126.10	122.30	90.80
89.04	176	122.50	123.10	91.40
89.05	177	121.50	123.80	92.10
89.06	170	123.70	124.10	91.00
89.07	168	126.70	124.40	90.00
89.08	165	126.40	124.60	89.50
89.09	164	126.90	125.00	89.80
89.10	165	129.50	125.60	90.40
89.11.	168	130.90	125.90	90.60
89.12	170	130.50	126.10	91.10
90.01	169	137.40	127.40	92.00
90.02	162	137.40	128.00	92.20
90.03	157	140.90	128.70	91.90
90.04	162	138.70	128.90	91.10
90.05	151	141.00	129.20	90.60
90.06	136	140.70	129.90	90.30
90.07	125	142.40	130.40	90.00
90.08	118	145.80	131.60	92.80
90.09	115	149.90	132.70	95.90
90.10	116	153.30	133.50	98.70
90.11	114	153.20	133.80	98.20
90.12	114	150.20	133.80	97.80
91.01	112	148.60	134.60	96.40
91.02	115	150.00	134.30	94.50
91.03	121	145.90	135.00	94.50
91.04	122	143.30	135.20	93.70
91.05	123	142.30	135.50	93.50
91.06	121	140.30	136.00	92.80
91.07	118	141.20	136.20	92.30
91.08	126	142.70	136.60	92.60
91.09	133	144.70	137.20	92.80
91.10	147	144.30	137.40	93.50
91.11	150	145.80	137.80	93.90
91.12	162	146.20	137.90	93.70
92.01	171	146.80	138.10	93.40
92.02	177	146.40	138.60	93.50
92.03	170	147.10	139.30	93.40
92.04	160	147.12	139.50	93.00
92.05	150	147.53	139.70	93.50

**Note:* The Chilean external inflation index was missing from 92.03 through 93.12 and was proxied by predicted values from a regression on annual average values, a quartic time trend, and monthly dummies.

Appendix Table 1. (continued)

Date	US HRW Ordinary at Gulf ($/ton)	Chile External Price Index	US Consumer Price Index	US BLS International Price Index
92.06	148	147.67	140.20	94.30
92.07	137	148.36	140.50	94.70
92.08	129	149.00	140.90	95.10
92.09	139	149.62	141.30	95.40
92.10	141	150.27	141.80	96.00
92.11	148	150.97	142.00	95.50
92.12	148	150.92	141.90	93.90
93.01	156	147.53	142.60	93.70
93.02	149	147.37	143.10	93.70
93.03	149	148.44	143.60	94.20
93.04	142	148.44	144.00	94.60
92.05	136	148.83	144.20	94.90
93.06	122	148.95	144.40	94.40
93.07	129	149.61	144.40	93.90
93.08	131	150.24	144.80	93.90
93.09	132	150.84	145.10	93.90
93.10	137	151.47	145.70	94.40
93.11	147	152.14	145.80	93.90
93.12	159	152.08	145.80	93.00
94.01	155	147.00	146.20	93.00
94.02	147	148.53	146.70	93.30
94.03	141	150.12	147.20	93.50
94.04	141	150.17	147.40	94.20
94.05	140	150.51	147.50	95.00
94.06	139	152.01	148.00	95.30
94.07	138	156'1 9	148.40	96.60
94.08	148	157.80	149.00	97.10
94.09	159	159.42	149.40	96.70
94.10	167	161.29	149.50	97.30
94.11	162	161.81	149.70	98.00
94.12	165	160.83	149.70	97.90
95.01	156	162.77	150.30	98.20
95.02	154	164.16	150.90	98.80
95.03	150	167.02	151.40	99.40
95.04	149	170.74	151.90	100.30
95.05	159	170.34	152.20	101.30
95.06	170	170.95	152.50	100.80
95.07	190	170.75	152.50	100.50
95.08	185	167.94	152.90	100.30
95.09	194	165.76	153.20	100.30
95.10	204	166.36	153.70	99.80
95.11	203	186.24	153.60	100.00
95.12	209	165.86	153.50	100.40

**Note:* The Chilean external inflation index was missing from 92.03 through 93.12 and was proxied by predicted values from a regression on annual average values, a quartic time trend, and monthly dummies.

Appendix Table 1. (continued)

Date	US HRW Ordinary at Gulf ($/ton)	Chile External Price Index	US Consumer Price Index	US BLS International Price Index
96.01	207	165.09	154.40	100.60
96.02	219	165.24	154.90	100.40
96.03	216	165.20	155.70	101.00
96.04	250	165.24	156.30	101.90
96.05	262	165.54	156.60	101.20
96.06	227	164.91	156.70	100.10
96.07	203	165.38	157.00	100.00
96.08	192	165.80	157.30	100.10
96.09	179	165.32	157.80	101.30
96.10	178	164.41	158.30	101.80
96.11	175	165.10	158.60	101.60
96.12	176	164.70	158.60	101.90

Appendix Table 2. US Export Prices for Wheat and Chile's Price Band

Date	US DNS at Gulf	US WW at Pacific	#2 HRW at Gulf	#2 SRW at Gulf	Chile Lower Price Band	Chile Upper Price Band
91.07	120	124	118	116	–	–
91.08	125	129	126	128	–	–
91.09	135	137	133	137	–	–
91.10	144	143	147	146	–	–
91.11	150	158	150	150	–	–
91.12	162	167	162	I60	–	–
92.01	166	171	171	162	139	175
92.02	177	178	177	172	139	175
92.03	171	167	170	163	139	175
92.04	167	162	160	150	139	175
92.05	168	154	150	140	139	175
92.06	170	153	148	141	139	175
92.07	151	149	137	132	139	175
92.08	137	148	129	121	139	175
92.09	147	161	139	132	139	175
92.10	150	162	141	138	139	175
92.11	150	163	148	150	139	175
92.12	158*	162	148	149	139	175
93.01	166	160	156	159	137	182
93.02	162	151	149	156	137	182
93.03	160	145	149	158	137	182
93.04	158	142	142	158	137	182
93.05	156	132	136	139	137	182
93.06	149	129	122	114	137	182
93.07	172	132	129	118	137	182
93.08	163	130	131	124	137	182
93.09	189	130	132	120	137	182
93.10	191	129	137	128	137	182
93.11	211	130	147	139	137	182
93.12	211	135	159	142	137	182
94.01	203	137	155	155	133	187
94.02	183	135	147	149	133	187
94.03	182	130	141	136	133.	187
94.04	182	134	141	134	133	187
94.05	186	139	140	134	133	187
94.06	171	138	139	127	133	187
94.07	159	133	138	122	133	187
94.08	155	138	148	131	133	187
94.09	165	158	159	148	133	187
94.10	174	173	167	160	133	187
94.11	172	170	162	154	133	187
94.12	174	163	165	158	133	187
95.01	164	163	156	156	131	174

*An asterisk indicates a missing price that was replaced by a proxy measure.

Appendix Table 2. (continued) US Export Prices for Wheat and Chile's Price Band

Date	US DNS at Gulf	US WW at Pacific	#2 HRW at Gulf	#2 SRW at Gulf	Chile Lower Price Band	Chile Upper Price Band
95.02	161	159	154	151	131	174
95.03	156	149	150	145	131	174
95.04	166	153	149	143	131	174
95.05	177	167	159	148	131	174
95.06	189	176	170	153	131	174
95.07	211	184	190	175	131	174
95.08	200	178	185	169	131	174
95.09	207	183	194	183	131	174
95.10	217	193	204	195	131	174
95.11	216	198	203	198	131	174
95.12	224	204	209	206	131	174
96.01	220	203	207	200	144	171
96.02	225	207	219	205	144	171
96.03	223	204	216	199	144	171
96.04	252	213	250	246	144	171
96.05	267	218	261	220	144	171
96.06	246	199	227	181	144	171

Appendix Table 3. Argentine Trigo Pan Wheat Prices

Date	Price	Date	Price	Date	Price
87.01	82.00	90.01	143.00	93.01	122.00
87.02	92.00	90.02	137.00	93.02	130.00
87.03	90.00	90.03	123.00	93.03	124.00
87.04	88.00	90.04	124.00	93.04	125.00
87.05	88.00	90.05	122.00	93.05	132.00
87.06	86.00	90.06	119.00	93.06	134.00
87.07	84.00	90.07	112.00	93.07	111.00
87.08	84.00	90.08	95.00	93.08	114.00
87.09	89.00	90.09	79.00	93.09	112.00
87.10	95.00	90.10	79.00	93.10	108.00
87.11	95.00	90.11	74.00	93.11	113.00
87.12	95.00	90.12	74.00	93.12	120.00
88.01	94.00	91.01	73.00	94.01	120.00
88.02	106.00	91.02	67.00	94.02	114.00
88.03	107.00	91.03	87.00	94.03	115.00
88.04	108.00	91.04	113.00	94.04	122.00
88.05	107.00	91.05	108.00	94.05	130.00
88.06	125.00	91.06	108.00	94.06	131.00
88.07	141.00	91.07	100.00	94.07	124.40
88.08	140.00	91.08	103.00	94.08	121.75
88.09	152.00	91.09	107.00	94.09	137.20
88.10	147.00	91.10	106.00	94.10	143.50
88.11	152.00	91.11	107.00	94.11	137.00
88.12	154.75	91.12	106.00	94.12	140.00
89.01	163.00	92.01	113.00	95.01	131.75
89.02	151.75	92.02	122.00	95.02	130.25
89.03	153.00	92.03	133.00	95.03	123.00
89.04	168.59	92.04	122.00	95.04	121.00
89.05	166.88	92.05	121.00	95.05	135.00
89.06	156.00	92.06	130.00	95.06	173.38
89.07	155.00	92.07	132.00	95.07	186.25
89.08	155.00	92.08	130.00	95.08	204.90
89.09	149.00	92.09	113.00	95.09	
89.10	149.00	92.10	115.00		
89.11	147.00	92.11	115.00		
89.12	149.00	92.12	117.00		