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Measuring Trade Policy Intervention

A Cross-Country Index of Relative Price Dispersion

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Not only is it hazardous to characterize an inward-oriented country as interventionist and an outward-oriented country as liberal, but the characterization is simply wrong for developing countries. Whether a country intervenes does not tell the whole story about its trade policy, and misses an essential aspect of intervention: which goods are favored by subsidies and which are protected by tariffs.

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In the debate about the relationship between trade policy and growth, various measures for trade intervention have been used. Aitken presents a new measure based on a country's relative price structure and the structure of relative world prices. This measure, he argues, conforms more closely than existing measures to the concept of trade intervention.

The relationship between "openness" and trade liberalization is more complicated than is often believed. Whether a country intervenes does not tell the whole story about its trade policy, and misses an essential aspect of intervention: which goods are favored by subsidies and which are protected by tariffs. Indonesia and Peru, for example, have comparable measures of intervention, but the relative price of equipment is very high in Peru and very low in Indonesia; consumer nondurables appear to flow freely in Latin America, while prices for these goods in Japan and Korea are inexplicably high. Understanding differences in the growth experience of these countries clearly requires a more subtle view of trade policy than "outward" and "inward" orientation, and a more informed understanding of the nature of intervention.

The debate has been confused by the failure to distinguish between trade intervention and outward orientation. Trade intervention implies policies that distort the flow or pattern of trade: outward orientation implies incentives to export that are greater than incentives for import substitution. The two may be related but a heavily interventionist policy could be outwardly oriented.

And a country could impose trade policies that raise the *average* incentive to export, while increasing the *dispersion* of incentives within the export and import sectors — so that when such a country liberalizes, trade might return to its original pattern but with incentives inwardly oriented.

The index of relative price dispersion that Aitken develops has the advantage that it is objective, measures intervention in both exports and imports, is comparable across countries, and is independent of fluctuations in exchange rates caused by macroeconomic mismanagement. Unlike average tariffs and measures of nontariff barriers and price levels, the relative price dispersion index measures incentive distortions *within* categories of goods.

The Leamer index looks directly at the effects of trade policy intervention, but the theoretical assumptions required to calculate the pattern of trade in the absence of distortion are questionable. Such assumptions are unnecessary when calculating relative price dispersion, as world prices are directly observable.

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In the debate over the relationship between trade policy and growth, a variety of measures of trade intervention have been used. In this paper, I present a new measure based on differences between a country's relative price structure and the structure of world relative prices, and argue that this measure conforms more closely than existing measures to the concept of trade intervention.

Trade policy debate has been confused by the failure to distinguish outward orientation from trade intervention. Trade intervention implies policies which distort the flow or pattern of trade (Edwards, 1989), while outward orientation implies that the incentives to export are greater than the incentives to import substitute (Kreuger, 1978). Trade intervention is often associated with outward orientation because the two may in fact be correlated: a restrictively interventionist trade regime can bias production against exports through an appreciated exchange rate (see Appendix). However, a highly interventionist trade policy that balances import restrictions with export incentives may be as "outwardly oriented" as completely liberalized economy. Also, A country may impose trade policies which raise the *average* incentive to export relative to import substitute while increasing the *dispersion* of incentives within the import and export sectors. When such a country liberalizes, trade may return to its original pattern but with incentives inwardly oriented.

Since intervention and outward orientation are distinct, an empirical relationship between outward orientation and growth does not imply the same relationship exists between intervention and growth. To test the effects of trade intervention on growth separate from the effects of outward orientation, one needs a satisfactory cross-country measure of trade intervention. The four most widely used measures of trade policy have been trade intensity, average tariffs and coverage ratio of NTB's, deviations in a country's trade pattern from that predicted by its factor endowments, and distortions in the real price level.

1 Problems with Commonly Used Trade Policy Measures

1.1 trade intensity

Trade intensity, defined for country j as

$$L_j = \frac{X_j + M_j}{GDP_j} \tag{1}$$

(with X_j being exports and M_j imports) is used as an indication of trade policy. A related measure, import penetration, is defined

$$L_j = \frac{M_j}{GDP_j} \tag{2}$$

These measures are often adjusted for "structural" factors by regressing the numerator of equation 1 or 2 on country specific variables such as area, income level, and CIF/FOB ratios, and redefining the measure as

$$L_j = \frac{\hat{r}_j}{GDP_j} \tag{3}$$

with $\hat{r}_j$ being the residual from the regression.

Trade intensities and import penetration ratios, whether adjusted for "structural" factors or not, are simply not measures of trade intervention. A high trade share or import share may characterize either a liberal regime or an interventionist regime in trade balance with significant export subsidies (see the model in the appendix). Trade share is even unconvincing as a measure of outward orientation; it is notoriously unstable across time as well as across countries, more so than can believably be attributed to trade strategy[1].

1.2 adjusted price level

A second trade policy measure interprets the deviation of the aggregate price level of country j (p_j expressed in dollars) relative to the United States (p_{us}) from the level predicted by the "structural" relationship (with y_j being income per capita also in dollars)

$$\frac{p_j}{p_{us}} = 1 + \beta y_j + \epsilon_j \tag{4}$$

as a distortion reflecting trade policy (Dollar, 1990). A country's price level contains a nontraded price which differs systematically across countries with income, and a traded price, which differs from world prices only through trade policy restrictions. Increases in import restrictions can raise the price level of the economy by raising both the price of imported goods and of nontraded goods, biasing production against exports (see Appendix). But the resulting index does not measure intervention directly for the same reason as the trade share; interventions designed to keep the *average* tariff low while increasing the *variance* of traded goods prices will *lower* the price level. A low price level can be maintained even with a high average import tariff if exports are taxed. In this case the "adjusted" price level would fail as a measure of outward orientation as well; a low price level would be associated with a trade regime biased toward producing import substituting goods.

[1]Helleiner (1990) finds that Korea, for example, went from an export share of GDP of 9% to 36% over a twenty year period

1.3 administrative measures

Administrative measures of trade regime include average tariffs and the percent of traded products covered by NTB's. These measures reveal nothing about intervention in the export sector, and neither are precise measures of the *effect* policy intervention on the flow of trade. The most important trade restriction for developing countries is import licensing, a restriction which is highly discretionary; a strictly enforced licensing requirement on one good could be more restrictive yet result in a lower coverage ratio than several goods with unenforced requirements. Average tariffs for imported goods fail as intervention measures by ignoring the dispersion of tariffs within a category of goods. Also, the two measures are not complementary; replacing a NTB with a high tariff as is common in liberalizing countries increases one measure of intervention while decreasing the other.

1.4 quantity measures

One can determine the seriousness of policy intervention by measuring the degree to which trade patterns are distorted from those occurring in the absence of intervention. Such a measure has the advantage of determining the *effects* of intervention, thus avoiding many of the problems with administrative measures. But the "normal" pattern of trade which would occur in the absence of intervention is not observable, and some theoretical assumptions must be imposed to recover this pattern.

Leamer (1989) measures deviations of actual trade patterns from those predicted by the country's endowment using a Hecksher-Ohlin factor intensity model. Although the most theoretically grounded of the measures of intervention, this index suffers from its reliance on a theory which has had questionable empirical success. In practice, the three intervention measures calculated by Leamer are only mildly correlated with one other (having rank correlations between 20 and 30 percent), suggesting the index should be treated with caution.

Since all these measures are emphasizing different aspects of trade strategy, it would be surprising if they were correlated with one another. Indeed they are not. In a recent paper, Pritchet (1991) searches for correlations between the measures described above, and finds a "complete absence of correlation among them". While Harrison (1991) finds that the relationship improves when trade policy measures are observed over time, the correlation remains weak. Measures commonly used to describe trade regime cannot all be characterizing the same aspect of trade policy intervention.

If intervention is defined in terms of its effects on trade flows, one can measure intervention either by observing trade patterns deviating from non-intervention patterns, as was discussed above, or by measuring deviations of relative prices from world relative prices; in the absence of price controls, any "distortion" in the pattern of trade will also result in a deviation of relative prices from the non-intervention price structure. While measures based on relative price distortions share the advantage quantity measures have of focusing on the effects of intervention, relative price-based measures have the added advantage that prices in the absence of trade distortions are directly observed in the world economy; provided there are no other major barriers to price arbitrage across countries (such as transportation costs and monopolies in the distribution of goods), and after allowing for systematic differences across countries in the cost of distributing goods, the prices for traded goods observed in an economy in the absence of trade barriers will equal the world prices.

Helleiner argues "there is usually no escape from difficult and costly product-by-product comparisons of domestic and world prices in search of 'tariff equivalents'" (1990). In this paper I perform such a comparison, measuring directly the degree to which policy intervention distorts the incentives *within* the traded sector. I will not be measuring the effects of intervention on the *average* price of traded goods relative to nontraded goods, as these effects are captured in measures of deviations of the price level; an import tariff on some goods which does not change the average tariff will distort relative prices from world prices but will not raise the price *level*, while a uniform tariff on imports matched by a uniform subsidy on exports will not distort incentives within the traded sector but will raise the price level (see Dollar, 1990, and the appendix).

2 A Model of Relative Price Dispersion

Consumption in the economy is divided between one nontraded and n traded goods. Price arbitrage in traded goods assures that the domestic price of a traded good can deviate from the world price only through trade intervention. The log domestic dollar price in dollars of traded good i in country j is

$$P_{ij} = P_i^* + \epsilon_{ij} \tag{5}$$

where P_i^* is the international price of the produced good and ϵ_{ij} represents the impact of the policy intervention (an import restriction or an export subsidy).

Traded goods, whether produced at home or imported, are not consumed in their produced form, but can only be consumed after being "distributed". Goods are transformed into "distributed goods" using a Leontieff production technology, where the inputs are the produced good and a fixed service requirement (the nontraded good) per unit of the distributed good. If goods are distributed with a constant marginal product in nontraded services, and if distribution is perfectly competitive, then the log of the dollar price of distributed good i in country j will be

$$p_{ij} = P_i^* + \epsilon_{ij} + a_i log P_{Nj} \tag{6}$$

where P_{Nj} is the domestic nontraded goods price in dollars and a_i is the unit service requirement. I assume the service requirement in the distribution of goods can vary across goods, but not across countries. The last assumption is for exposition; the results of this section hold provided the service requirement in distribution moves monotonically with the service price.

To allow for the possibility of nominal stickiness in the face on a nominal exchange rate fluctuations, equation 6 can be expressed

$$p_{ij} = P_i^* + \epsilon_{ij} + a_i(log \hat{P}_{Nj} - log e_j) \tag{7}$$

where $\hat{P}_{Nj}$ is the domestic currency price of nontraded goods and e is the nominal exchange rate expressed in dollars per unit of domestic currency.

According to equation 7, differences in prices of distributed goods from world production prices (P_i^*) are caused by the nontraded service component required to distribute the good, changes in the exchange rate (to the extent of nominal price stickiness), and trade distortions ϵ_{ij}[2].

The effect of policy on prices can be isolated by subtracting the average distributed price from the distributed price p_{ij} in equation 7, and comparing this difference to the world price. Subtracting

[2]Other possible differences, such as are caused by monopolies in the distribution of goods will not be considered here. If distribution monopolies are not natural monopolies, but are caused by trade polices, the resulting price distortions can be safely attributed to intervention ϵ_{ij}

the mean distributed price gives the *relative* distributed price

$$p_{ij} - \bar{p}_j = P_i^* - \bar{P}_i^* + \epsilon_{ij} - \bar{\epsilon}_j + (a_i - \bar{a})(log\hat{P}_{Nj} - loge_j) \quad (8)$$

where $\bar{p}_j$, $\bar{P}_i^*$, $\bar{\epsilon}_j$ and $\bar{a}$ are average values across goods within a country. The relative distributed price will be influenced by the exchange rate if nontraded prices adjust slowly and the nontraded service requirement of the good differs from the average.

Since world prices for "produced" goods are not directly observable, I subtract the relative distributed price defined in equation 8 for the United States from the relative price for country j[3]

$$\rho_{ij} = p_{ij} - \bar{p}_j - (p_{iUS} - p_{\bar{U}S}) = \epsilon_{ij} - \bar{\epsilon}_j - (\epsilon_{iUS} - \epsilon_{\bar{U}S}) + (a_i - \bar{a})(log\hat{P}_{Nj} - loge_j - logP_{NUS}) \quad (9)$$

or rearranging terms

$$\rho_{ij} = A_i + (a_i - \bar{a})log\frac{\hat{P}_{Nj}}{e_j} + \epsilon_{ij} - \bar{\epsilon}_j \quad (10)$$

where A_i is defined

$$A_i = \epsilon_{iUS} - \epsilon_{\bar{U}S} - (a_i - \bar{a})logP_{NUS}$$

If A_i and $a_i - \bar{a}$ could be identified, the effects of intervention on price (the term $\epsilon_{ij} - \bar{\epsilon}_j$ in equation 10) could be isolated. This term represents the deviation of the *relative production* price of good i in country j from world *relative production* prices.

[3]In the estimation, the weighted average of relative prices in OECD countries was substituted for the price in the United States, but the results were not changed.

3 Relative Price Estimation

Although I do not observe A_i and $a_i - \bar{a}$ directly, I can estimate them with cross-country regressions performed for each good i. The data used for estimation are drawn from the last phase of the Incomes Comparison Project, which consists of goods prices relative to the United States for 151 traded and nontraded goods based on detailed price and expenditure data from a cross section of 57 countries in 1980 (Kravis, Heston and Summers, 1982; United Nations, 1986). In order to ensure the plausibility of the assumption that a_i is the same across countries, I aggregate the original 151 traded and nontraded goods to a sample of 16 traded goods and one nontraded good (see table 1)[4]. Prices were computed for these 16 traded goods and two nontraded goods (rent and services/construction) as the expenditure-weighted averages of the original 151 prices. Extensive efforts have been made in producing these data to control for cross-country differences in quality such that prices are compared for the same good across countries.

3.1 bias from the impact of intervention on nontraded prices

If the dollar price of nontraded goods in country j is influenced by the average policy distortion ϵ_j, then estimating equation 10 using nontraded prices as an explanatory variable will bias the estimates of $a_i - \bar{a}$. The relationship between nontraded prices and average tariffs and subsidies in long run equilibrium is described in a detailed model in the appendix, but will be summarized here. An increase in the average import tariff or export subsidy shifts production towards the

[4] education and health care were dropped from estimation to avoid the difficulties of cross-country quality comparisons in these goods.

Table 1: Traded Goods Categories and World Expenditure Shares

Consumer Goods: Good	Share	Capital Goods: Good	Share
Food	0.30	Transportation	0.04
Tobacco & Beverage	0.07	Machines	0.08
Clothing	0.10	Agr. Machines	0.01
Fuel	0.03	Elec. Equipment	0.04
Household	0.06		
Appliance	0.01		
Medical	0.02		
Auto	0.04		
Auto Parts	0.05		
Recreate - Durable	0.03		
Recreate - Nondur	0.02		
Government	0.09		
Other	0.01		

traded (import competing or exporting) sector while at the same time increasing the demand for and decreasing the production of nontraded goods. The excess demand for nontraded goods must be rationed with an increase in the price of nontraded goods. The increase is less than the increase in the policy measure since both supply and demand respond to an increase in nontraded prices.

This relationship introduces a potential bias into the estimation of equation 10. If the average distortion $\bar{\epsilon_j}$ increases from a uniform increase in ϵ_{ij} across goods, then $\epsilon_{ij} - \bar{\epsilon_j}$ remains orthogonal to P_{Ni}. If however distortions are concentrated on some goods, then $a_i - \bar{a}$ would be overestimated for those goods for which $\epsilon_{ij} - \bar{\epsilon_j}$ increased and underestimated for the goods for which $\epsilon_{ij} - \bar{\epsilon_j}$ decreased.

Estimation bias can be avoided by estimating in two stages; since service costs (mostly labor) are predicted to vary systematically with wages across countries, I first regress each of the two nontraded prices (in dollars) on income and income squared per worker (also in dollars) derived from Summers and Heston. The predicted values of these prices are now independent of the error term, and can be used to estimate $a_i - \bar{a}$ in equation 10.

3.2 comparing price distortion between countries with different incomes

While it is not likely that the average level of distortion $\bar{\epsilon_j}$ greatly affects income per capita, if countries with low income levels are more likely to have high average distortion levels, then using income per worker as an instrument for nontraded prices may bias estimates of $a_i - \bar{a}$. Erzan et al find that in 1985 average tariffs were between 50 and 66 percent for countries with GDP per capita less then $500 and between 3 and 5 percent for countries with GDP per capita greater than $5000. NTB's coverage ratios were found to be highest among middle income countries[5].

If indeed low and middle income countries have higher average distortion levels than upper income countries[6], then the measured distortions in low and middle income countries will understate the true price distortions, and estimates of $a_i - \bar{a}$ will be biased.

The importance of this bias in comparing price distortions for two countries will increase with the difference in the countries' income levels. Let $\hat{\epsilon_{ij}}$ be the estimated error $\epsilon_{ij} - \bar{\epsilon_j}$, let $\hat{\beta_i}$ be the estimated $a_i - \bar{a}$ and β_0 be the true $a_i - \bar{a}$. Comparisons of the relative distortion for good i between countries j and k can be expressed as the difference

$$\hat{\epsilon_{ij}} - \hat{\epsilon_{ik}} = [(\epsilon_{ij} - \bar{\epsilon_j}) - (\epsilon_{ik} - \bar{\epsilon_k})] - (\hat{\beta} - \beta_0)(y_j - y_k) \tag{11}$$

where y_j is the nontraded price predicted by per capita income in country j and y_k is the same in country k. According to equation 11, the estimated difference between two countries of price distortion equals the true difference plus a bias which increases with the difference in nontraded

[5] Average tariff levels understate the importance of trade barriers in developed countries: tariffs are among the least important barriers to trade within the EC, next to administrative barriers, technical regulations, and frontier delays (see Emerson et al. 1988)

[6] Unless the higher average distortion ϵ_j is caused by uniformly higher distortions ϵ_{ij} for all goods, leaving $\epsilon_{ij} - \epsilon_j$ constant (see above). Ezran et al (1987), for example, found that for developing countries average tariff levels were roughly the same for food and for manufactures.

prices predicted by income. While estimated price distortions in Paraguay may be comparable with estimated price distortions in Peru, caution should be used in comparing these estimated price distortions with those of Denmark. For this reason, comparisons are made within three broad income categories. As a further precaution, price dispersion was measured both over the entire sample of countries, and over a restricted sample which only considers countries in the high and middle income groups (eliminating India and most of Africa).

3.3 estimation

Since population density and urbanization are likely inputs in the distribution of goods and may affect relative prices, I include these variables in the price regressions. As indicated in equation 10, changes in the exchange rate can influence relative prices if nontraded prices are sticky. To control for this I include the log of the exchange rate in the year 1980 (the year of the ICP sample) minus the log of the average exchange rate over the previous ten years (defined as ex_rate_j).

Deviations from world production prices are estimated using the following equation for each good i

$$\rho_{ij} = A_i + \beta_1 rent\_\hat{p}_j + \beta_2 service\_\hat{p}_j + \beta_3 \log urban_j + \beta_4 \log density_j + \beta_5 ex\_rate_j + \eta_{ij} \qquad (12)$$

where $rent\_\hat{p}_j$ is the log rent price predicted by log income per worker, $service\_\hat{p}_j$ is the log service and construction price predicted by log income per worker, and ex_rate_j is described above. I use the residual $\hat{\eta}_{ij}$ from the estimation of equation 12 as an estimate of $\epsilon_{ij} - \bar{\epsilon}_j$, the deviation of the relative price of good i in country j from the world relative price.

3.4 relative price estimation results

The results of the estimation of equation 12 on the restricted sample (low income countries excluded) are given in table 2. Including Low income countries reduces the percentage variation of relative prices explained by the dependent variables, but does not change the magnitude of the coefficients significantly. High nontraded goods prices substantially increase the price of consumer nondurables relative to capital goods and consumer durables; a 1 percent increase in service prices increases the *relative* price of clothing by 0.7 percent while decreasing the *relative* price of electrical equipment by 0.95 percent. This suggests the distribution of consumer nondurables is much more labor intensive than the distribution of capital goods. Capital goods are also relatively cheaper in areas of high population density, a result suggesting lower distribution costs in these areas.

High rent prices have a tendency to decrease prices for capital and consumer nondurable goods relative to consumer durables, but the effects are not uniform across all goods; the effect of rent prices may reflect higher inventory requirements in the distribution of consumer durables. A temporary depreciation of the exchange rate lowers the price of consumer nondurables relative to consumer durables and capital goods. This is the predicted response if exchange rate changes pass through to prices more slowly for capital and consumer durable goods, where products are more likely to be differentiated.

4 Computing Relative Price Dispersion

As indicated above, the residual from the estimation of equation 12 for good i represents the deviation of the relative price of good i for country j from the world relative price. To derive a single measure (V_j) of the degree to which relative prices in country j differ from world prices, I

Table 2: Explaining Differences in Relative Prices Across Countries

$$\rho_{ij} = A_i + \beta_1 rent\_\hat{p}_j + \beta_2 service\_\hat{p}_j + \beta_3 \log urban_j + \beta_4 \log density_j + \beta_5 ex\_rate_j + \eta_{ij}$$

ρ_{ij} is the log price of traded good i in country j relative to the expenditure weighted sum of all traded prices in country j, minus the same relative price of good i in the United States. Independent variables are explained in the text describing equation 12.

Good	Coefficient on the Independent Variable					r-squared
	$service\_\hat{p}_j$	$rent\_\hat{p}_j$	$\log density_j$	$\log urban_j$	ex_rate_j	
Food	0.31	-0.20	0.006	0.037	0.34	0.41
	(2.1)	(1.1)	(0.4)	(0.6)	(2.0)	
Tobacco & Beverage	-0.075	0.112	0.008	-0.182	0.16	0.17
	(0.2)	(0.3)	(0.3)	(1.5)	(0.4)	
Clothing	0.72	-0.28	-0.08	-0.04	-0.07	0.43
	(3.0)	(0.9)	(3.0)	(0.3)	(0.2)	
Fuel	0.70	-0.50	0.106	0.047	0.007	0.16
	(1.0)	(0.6)	(1.4)	(0.2)	(0.0)	
Household	0.56	-0.14	0.006	-0.200	0.52	0.16
	(1.8)	(0.4)	(0.2)	(1.5)	(1.4)	
Appliance	-0.31	0.54	0.077	-0.218	-0.29	0.24
	(0.8)	(1.2)	(1.9)	(1.3)	(0.7)	
Autos	-1.04	2.08	0.034	-0.003	-0.20	0.32
	(2.1)	(3.2)	(0.7)	(0.0)	(0.4)	
Auto Parts	-0.644	0.934	0.049	0.153	-0.408	0.16
	(2.0)	(2.3)	(1.4)	(1.1)	(1.1)	
Recreate-Durable	-0.50	0.030	-0.074	0.147	-0.190	0.19
	(1.4)	(0.1)	(1.9)	(0.9)	(1.4)	
Recreate-Nondur	0.441	-0.224	-0.078	-0.087	0.62	0.14
	(1.2)	(0.5)	(1.9)	(0.5)	(1.4)	
Other	-0.517	1.08	-0.021	0.087	0.071	0.19
	(1.7)	(2.8)	(0.7)	(0.7)	(0.2)	
Government	0.271	-0.047	-0.012	0.036	-0.018	0.31
	(1.5)	(0.2)	(0.6)	(0.9)	(0.1)	
Transportation	-0.598	-0.528	-0.054	0.086	-0.85	0.40
	(1.6)	(1.2)	(1.4)	(0.6)	(2.0)	
Machines	-0.137	-0.927	-0.014	0.095	-0.216	0.48
	(0.6)	(3.3)	(0.6)	(1.0)	(0.8)	
Agricult. Mach.	-0.215	-0.350	-0.162	-0.152	-1.00	0.40
	(0.6)	(0.6)	(3.5)	(0.8)	(2.0)	
Elec. Equipment	-0.953	0.192	0.023	0.286	-0.905	0.28
	(2.7)	(0.4)	(0.6)	(1.9)	(1.8)	

t-statistics in parentheses

Coefficients from estimation on the *restricted* sample square the deviations for each good i and country j and sum the magnitudes across all goods

$$V_j = \sum_i \alpha_{ij}\hat{\eta}_{ij}^2 = \sum_i \alpha_{ij}(\epsilon_{ij} - \bar{\epsilon}_j)^2 \tag{13}$$

where α_{ij} is the expenditure share predicted by a cross country regression of expenditure on income and income squared[7]. The index V_j represents the degree to which *relative* prices in country j differ from world *relative* prices.

4.1 relative price dispersion across countries

Country rankings of intervention according to the price dispersion measure are listed in table 3 by income category. The dispersion categories in the table 3 are defined such that a country in the "low dispersion" category, for example, has a dispersion which is low *relative* to those in its income category. Among the middle income countries with high dispersion are Sri Lanka, Bolivia, and Portugal. Low dispersion economies include Pakistan, the Dominican Republic, and Costa Rica. In the high income group, Japan, Israel, and Spain have high dispersion, while Austria and Italy have relatively low dispersion. For the low income countries, Nigeria, Zambia, and India are high, while Madagascar and Kenya are low.

The results listed in table 3 are separated by income categories for reasons given in section 3.2: the bias in comparing dispersion in different countries increases with the difference in the countries' income per capita (see equation 11). The numbers given are the calculated index values V_j, and represent the variance across goods of differences in relative prices from world relative prices; for

[7] Actual expenditure shares were also used. Peru and Portugal show somewhat less price dispersion if their actual expenditure shares are used. An index was also calculated using the sum of the ***absolute values*** of the residuals. The resulting index was highly correlated (96% raw, 94% rank) with the sum of the squares of the residuals.

Table 3: Relative Price Dispersion Within Income Categories

$$V_j = \sum_i \alpha_{ij}\hat{\eta}_{ij}^2$$

Low		Medium Low		Medium High		High	
Middle Income Countries							
Panama	0.0372	Korea	0.0496	Guatemala	0.0606	Sri Lanka	0.102
Argentina	0.0358	Greece	0.0460	Peru	0.0600	Bolivia	0.0863
Paraguay	0.0325	Columbia	0.0418	Chile	0.0555	Portugal	0.0828
Dominican Rep.	0.0323	El Salvador	0.0416	Brazil	0.0546	Indonesia	0.0797
Costa Rica	0.0296	Ireland	0.0386	Ecuador	0.0530	Honduras	0.0749
Pakistan	0.0251	Venezuela	0.0374	Philippines	0.0522	Uruguay	0.0608
		Morocco*	0.0164	Tunisia*	0.0704	Botswana*	0.1246
Upper Income Countries							
Belgium	0.0164	Norway	0.0218	Finland	0.0439	Japan	0.1368
France	0.0134	Luxembourg	0.0197	Canada	0.0358	Israel	0.1119
Italy	0.0119	Germany	0.0189	United Kingdom	0.0319	Spain	0.0554
Austria	0.0050	Netherlands	0.0168	Denmark	0.0271		
Lower Income Countries*							
Mali	0.0250	Senegal	0.0317	Cameroon	0.0541	Nigeria	0.0947
Kenya	0.0211	Zimbabwe	0.0288	Ethiopia	0.0503	Zambia	0.0785
Madagascar	0.0184	Ivory Coast	0.0286	Malawi	0.0378	India	0.0670
						Tanzania	0.0658

Intensities of price dispersion are defined *within* each income category

* Based on index estimated over unrestricted sample

examnle Brazil, showing "medium high" dispersion in the middle income sample, has a variance of relative prices equal to 5.5 percent of the mean relative price.

The results for the middle and upper income groups were estimated using the restricted sample, in which the low income countries were not included[8]. Including low income countries does not change the hierarchy much for the upper income countries, but changes the hierarchy considerably for the middle income countries. Capital goods prices are relatively low for low and high income groups, and relatively high for middle income groups. The predicted relative price of capital declines with income in the restricted sample. Including low income groups in the estimation flattens the price-income relationship. Since almost all middle income countries have high capital prices, relatively poor countries within the middle income group show more price dispersion in the unrestricted sample; particularly Honduras, Indonesia, Pakistan, and Bolivia (the estimation results for the unrestricted sample are also given in the appendix).

Within middle income countries, Asia is slightly more interventionist than Latin America; Asia has a median dispersion index of 0.051 versus Latin America with a median of 0.047. Perhaps more significant is the high variance of dispersion measures across Asia (Japan and Sri Lanka with very high dispersion, Pakistan with very low dispersion), while the variance in Latin America is relatively low.

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[8] The rankings in table 3 for Botswana, Morocco, and Tunisia are based on estimation over the unrestricted sample. The countries' rankings are preserved if grouped with their African peers in the low income category. Botswana and Tunisia show high dispersion, and Morocco shows low dispersion

Canada is considerably more distorted when estimated using the unrestricted sample. This is primarily caused by a stronger estimated effect of exchange rate appreciation in the unrestricted estimation, combined with Canada having a significantly more depreciated exchange rate in 1980 than in previous years

4.2 equipment price distortions

Whether a country intervenes may not be as important to growth as *how* the country intervenes. Delong and Summers (1991) have emphasized the relationship between equipment investment and growth, arguing that a one percent increase in equipment investment increases growth by one third of one percent. Intervention which subsidizes prices of capital goods in general or equipment in particular would encourage this type of investment. Subsidies of capital inputs may also encourage production and export growth of manufactures which use these inputs.

The relative price regressions estimating equation 12 allow cross-country comparisons of equipment price distortions from the world relative equipment price. Equipment price distortions are defined

$$D_j = \sum_k \alpha_{jk} \hat{\eta}_{jk} \tag{14}$$

where k indexes equipment goods (machines, agricultural machines, and electrical equipment), α_{jk} is the expenditure share for each good, and $\hat{\eta}_{jk}$ is the residual from regression in equation 12. Equipment price distortions can be used as measures of the relative incentives to engage in equipment investment: unusually high relative prices would discourage investment in equipment. Categorizations by relative price dispersion and equipment price distortion are listed in table 4, and equipment price distortion measures are given in the appendix. Relative equipment price distortions vary substantially across countries within each income category; Korea, for example shows high intervention and relative equipment prices 5.3 percent below the predicted level, while Peru, having comparable levels of intervention, shows relative equipment prices 2.2 percent above the predicted level.

Within middle income countries, Asia has significantly lower median equipment prices than Latin America, although the variance of relative equipment prices is much higher in Asia mostly

Table 4: Relative Equipment Prices and Relative Price Dispersion Within Income Categories

$$D_j = \sum_k \alpha_{jk} \hat{\eta}_{jk}$$

Relative Equipment Price	Relative Price Dispersion: Low		Medium		High	
Middle Income Countries						
Low	Pakistan	-0.0057	Greece	-0.0214	Bolivia	-0.0070
	Ireland	-0.0094	Korea	-0.0526	Honduras	-0.0187
	Botswana*	-0.1177			Portugal	-0.0223
					Indonesia	-0.0251
Medium	Costa Rica	0.0072	Brazil	0.0102	Uruguay	-0.0053
	Panama	-0.0022	El Salvador	0.0019		
	Paraguay	-0.0032	Philippines	-0.0044		
	Venezuela	-0.0037	Tunisia*	-0.0010		
			Morocco*	0.0050		
High	Argentina	0.0249	Columbia	0.0320	Sri Lanka	0.0530
	Dominican Rep.	0.0228	Chile	0.0295	Peru	0.0223
			Ecuador	0.0162	Guatemala	0.0197
Upper Income Countries						
Low			Norway	-0.0238	Finland	-0.0238
			Denmark	-0.0296	Israel	-0.0352
					Japan	-0.0483
Medium	Italy	0.0090	Luxembourg	0.0140	United Kingdom	0.0075
	Austria	0.0083			Canada	-0.0214
High	France	0.0211	Netherlands	0.0275	Spain	0.0150
	Belgium	0.0172	Germany	0.0144		
Lower Income Countries*						
Low	Zimbabwe	-0.0218			Tanzania	-0.0289
					Nigeria	-0.0334
					Zambia	-0.0603
Medium	Kenya	-0.0089	Cameroon	0.0075		
			Ivory Coast	0.0065		
			Ethiopia	-0.0007		
			Malawi	-0.0053		
High	Mali	0.0401	Senegal	0.0117	India	0.0106
	Madagascar	0.0320				

equipment price distortions defined *within* income categories
* Based on estimation over the unrestricted sample

because of high prices in Sri Lanka and Philippines and low prices in Korea, Japan, Pakistan, and Indonesia[9].

5 Comparing Relative Price Dispersion and Measures of Outward Orientation

Combining intervention (the distortion of trade patterns) and outward orientation (the incentives to produce for export relative to import substitution) into a single measure of trade policy is often justified on the grounds that intervention in the form of import restrictions taxes exports, biasing incentives toward the production of import substitutes; import restrictions shift resources towards the import production, raising the prices of nontraded goods relative to the prices of exports, which are generally determined by world supply and demand (see appendix). Export producers now face higher input and labor costs. If there are no export subsidies to offset the anti-export bias of the import restrictions, then intervention will produce an inwardly oriented trade regime.

5.1 trade intensity and relative price dispersion

Outward orientation is usually measured as the ratio of trade to GDP (see equations 1 and 2); a higher share is thought to indicate an outwardly oriented regime. Often trade share is adjusted by using the portion of trade not predicted by "structural" factors such as income levels, area, and population (equation 3). A third measure is Leamer's measure of openness, which equates openness with the share of trade not predicted by differences in factor endowments. Negative correlations of

[9] The rankings in table 4 for Botswana, Morocco, and Tunisia are based on estimation over the unrestricted sample. Again, the countries' rankings are preserved if grouped with their African peers in the low income category: Botswana shows low equipment prices, while Tunisia and Morocco show medium equipment prices.

Table 5: Rank Correlations between Relative Price Dispersion and Common Measures of Trade Regime

	Measure	Income Category Middle	High	Low
Openness Measures*	Trade Share	18	-7	-20
	Adjusted Trade Share	37	-28	-9
	Leamer Openness	-24	-14	-
Intervention Measures	Average Tariff	-43	-	-3
	NTB Coverage	13	-	4
	Dollar (1990) Measure	-17	56	39
	Price Level	-24	-10	13
	Leamer (GDP)	-1	6	-
	Leamer (Trade Share)	-60	-33	-
	Leamer (R-squared)	-40	12	-

* A negative relationship indicates high price dispersion is associated with low trade share

price dispersion with these measures would suggest that in general outward oriented economies are more liberal.

The rank correlations listed in Table 5 reveal the relationship to be more complex. While the three measures of openness correspond to low levels of price dispersion for high and low income countries, the relationship is rather weak. With the exception of the Leamer measure, the relationship is reversed in the case of middle income countries; economies with more relative price dispersion show higher trade shares than liberal economies. The difference between the Leamer index and the other trade shares is to be expected, given that the Leamer index is more highly correlated with the raw trade share than with the "adjusted" trade share.

5.2 distortions in the price level and relative price dispersion

Comparisons with other measures of outward orientation confirm these results. As mentioned above, increases in import restrictions can raise the price of import substituting goods and of nontraded goods, biasing production against exports (see appendix). These price increases will be reflected in the price level, converted into dollars at the nominal exchange rate. Comparisons of the price level, adjusted for "structural" differences in nontraded goods prices, can be used to construct indices of outward orientation, with a lower price level indicating a more outward economy[10].

Comparisons of price dispersion with price-based openness measures also suggest that for middle income countries, economies with more relative price dispersion have *lower* price levels. Two price-based measures of orientation were used: David Dollar's (1991) measure based on a sample of 95 developing countries over the period 1976-1985, and a measure drawn from a broader sample including developed economies from 1965-1985. Both measures, listed in Table 5, confirm the earlier result that interventionist middle income countries are also relatively more outward oriented. Again, low and high income countries show the opposite result; high intervention implies relative inward orientation.

Table 6 plots relative price dispersion against the ten year average of price overvaluation[11]. No clear pattern emerges, as expected given the correlations described above. The table does help to clear up some anomalies; Both Sri Lanka and Peru have very low price levels, for example, causing them to be considered outward oriented. But they are definitely not liberal; they have the highest measures of price dispersion among the middle income countries.

5.3 World Bank Measure of Outward Orientation

If outward orientation is not correlated for middle income countries with trade intervention as measured by relative price dispersion, then what is to be made of taxonomies of trade regime

[10]Such measures are subject to move with fluctuations in the nominal exchange rate caused by macroeconomic policies. Some attempt is made to dispel the measure of nominal exchange rate changes by averaging the measure over a period of several years (see Dollar, 1990)

[11]The average of the previous ten years is highly correlated with the value for 1980. Some countries had 1980 prices significantly higher or lower than their ten year averages (see Table 6)

Table 6: Price Level (Adjusted Ten Year Average) and Relative Price Dispersion Within Income Categories
see equation 4 and Dollar (1990) for a description of adjustment

	Relative Price Dispersion		
Middle Income Countries			
Price Level	Low	Medium	High
Low	Pakistan	Philippians Ecuador Chile Columbia	Uruguay^{21} Peru^{-17} Sri Lanka^{-19}
Medium	Costa Rica Paraguay Argentina^{49}	Brazil^{-14} El Salvador	Indonesia Guatemala Bolivia
High	Ireland^{12} Venezuela Dominican Rep.$^{-10}$ Panama	Greece Korea	Honduras^{-11} Portugal
Upper Income Countries			
Low			United Kingdom^{17} Israel Canada $^{-18}$ Spain
Medium	Austria France Italy	Norway Luxembourg	
High	Belgium	Denmark Germany Netherlands	Japan Finland
Lower Income Countries			
Low	Mali^{22} Madagascar	Malawi Ethiopia^{-26}	India
Medium	Kenya Zimbabwe	Zambia Senegal	Tanzania
High	Ivory Coast	Cameroon	Nigeria^{18}

The percent deviation of 1980 price level from the ten year average is given in the superscript which combine these aspects into a single indicator? The 1987 World Development Report (pp. 82-83) argues for the removal of all trade barriers based on links between growth and their own measure of trade policy which have been questioned by other studies (Helleiner, 1990, Singer, 1988). This measure combines orientation with the degree of intervention categorizing countries by "trade orientation". Categories range from "strongly outward oriented", characterized by very low trade controls, to "strongly inward oriented", in which the incentive structure favors production for the domestic market.

Table 7 reveals no systematic relationship between what the Report calls outward orientation and relative price dispersion; inward oriented countries show *lower* median dispersion than outward oriented countries. Korea, one of the only countries to earn the Bank's label "strongly outward oriented", has a higher level of dispersion than Argentina and the Dominican Republic, both "strongly inward oriented" countries. Perhaps unusually high price levels reflecting overvalued exchange rates in these two countries qualify them as inward oriented despite their relative lack of intervention; but Columbia, El Salvador and Pakistan, which are also classified as inward oriented, all have lower price dispersion than Korea and moderate price levels. Overall, "inward oriented" countries also have lower median price levels than "outward oriented" countries. Based on the WDR's orientation index alone, it seems that liberalization is not necessary to achieve outward orientation.

6 Comparisons of Relative Price Dispersion with other Intervention Measures

Since it is now clear that outward orientation is not systematically correlated with intervention as measured by relative price dispersion, it is worth evaluating other measures of trade regime which

Table 7: World Bank (1987) Measure of Trade Orientation and Relative Price Dispersion Within Income Categories

	Relative Price Dispersion		
World Bank Measure	Low	Medium	High
Outward Oriented		Korea*	
Moderately Outward Oriented		Brazil Chile△ Uruguay	Israel
Moderately Inward Oriented	Columbia△ Costa Rica* El Salvador Pakistan	Guatemala Philippians	Honduras* Indonesia Sri Lanka△
Inward Oriented	Argentina*△ Dominican*△	Peru△	Bolivia

* indicates high average price level
△ indicates high relative equipment prices

might approximate trade intervention more closely.

6.1 administrative measures and relative price dispersion

If average tariff measures and NTB coverage ratios characterized the effects of intervention, we might expect to see them correlated with relative price dispersion in the traded sector. They're not[12]. The rank correlation between NTB coverage ratios and price dispersion is low (13% for middle income countries and 4% for low income countries; see Table 5), but at least it is positive. The same is not true for tariffs; high average tariffs are seen in countries having relatively low levels of price dispersion. This suggests that average tariff levels are a poor indicator of the effects of intervention. As Helleiner points out "moving towards neutrality (by reducing tariff)...is not evidently "liberal" if it is accompanied by increasing overall dispersion of incentives." (p.884)

[12] Although these measures are collected by UNCTAD for the year 1985 some consistency in trade policy regime over time is expected for a majority of countries

6.2 revealed quantity measures and relative price dispersion

Leamer (1990) measures the absolute value of cross-country deviations in trade patterns from those predicted by factor endowments in a Heckscher-Ohlin model. Trade policy intervention is expected to result in large deviations. In the absence of price controls, large distortions in trade patterns will be accompanied by deviations in relative prices from world relative prices. The price dispersion measure was compared with three of Leamer's measures of intervention: deviations relative to GDP, deviations relative to predicted trade, and the percentage of trade unexplained by differences in factor endowments (the r-squared measure).

None of the Leamer measures appear to be correlated with relative price dispersion (see Table 5). The second measure in particular is highly negatively correlated with measures of price dispersion within all income groups. The first measure, deviations relative to GDP, is only slightly positively correlated for low income countries. The r-squared measure is slightly positively correlated within the high income group, but significantly negatively correlated with intervention for the middle income group. The poor performance of these indices is not surprising; by Leamer's own admission, "the first criticism of the model is that it does not explain the trade of many countries very well."

7 Conclusion

The index of relative price dispersion developed here has the advantage that it is objective, that it measures intervention not just in imports but in exports as well, that it is comparable across countries, and is independent of exchange rate fluctuations caused by macroeconomic mismanagement. Unlike average tariffs, NTB measures, and price level measures, the relative price dispersion index measures incentive distortions *within* categories of goods. While the Leamer index looks directly at the effects of trade policy intervention, the theoretical assumptions required to calculate the pattern of trade in the absence of distortion are questionable. Such assumptions are unnecessary when calculating relative price dispersion, since world prices are directly observable.

Comparisons of relative price dispersion with commonly used outward orientation measures reveal that the relationship between "openness" and trade liberalization is more complicated than is often believed. Not only is it hazardous to characterize a inward oriented countries as interventionist and outward oriented countries as liberal, but the characterization is simply wrong for developing countries.

Whether a country intervenes does not tell the whole story about a country's trade policy, and misses an essential aspect of intervention: which goods are favored by subsidies and which are protected by tariffs. Indonesia and Peru, for example, have comparable measures of intervention, but the relative price of equipment is very high in Peru and very low in Indonesia; consumer nondurables appear to flow freely in Latin America, while prices for these goods in Japan and Korea are inexplicably high. Understanding differences in the growth experience of these countries clearly requires a more subtle view of trade policy than "outward" and "inward oriented", as well as a more informed understanding of the nature of intervention.

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Appendix

8 Equilibrium Trade Policy Model

Common measures of outward orientation include the share of trade in GDP and the price level[13]; if a country has a low price level or a high trade share, it is considered outward oriented. These measures of outward orientation are often used to assess a country's degree of trade policy intervention, with low measures of outward orientation indicating an interventionist regime and high measures indicating a liberal regime.

I will illustrate the relationship between outward orientation and trade intervention more carefully with an Australian general equilibrium model with three goods: imports, exports, and non-traded goods[14]. I will be concerned with intervention which raises the *average level* of the import tariff, export subsidy, or export tax. A high trade share and a low price level are consistent with trade policy intervention in long run equilibrium (i.e. domestic full employment and balanced trade) if intervention takes the form of import tariffs. The relationship breaks down if intervention in the export sector is allowed: with a tax on exports, a low price level is consistent with *high* intervention; if exports are subsidized, high intervention can result in a *low* trade share. If export intervention is allowed, price level measures also fail as measures of outward orientation; export subsidies can lead to a *high* price level while biasing trade toward exports.

[13] Chenery, among others, uses trade share adjusted for structural cross-country differences; Dollar (1990) constructs an index of outward orientation based on the price level, also adjusted for cross-country structural differences.

[14] see Dornbusch (1981) for a complete discussion of the Australian model

8.1 Production

All three goods are produced by the domestic economy with fixed capital together with labor which is mobile across sectors but in fixed supply L^* for the economy. Import goods are both produced at home and imported from the world market. Export goods are both consumed domestically and exported abroad. Labor is allocated over the three sectors such that the value of its marginal product is equal in each sector

$$(1+s)\cdot MP_X(L_X) = (1+\epsilon)\cdot MP_M(L_M) = P_N \cdot MP_N(L_N) \tag{15}$$

where $MP_i(L_i)$ is the (diminishing) marginal product in sector i as a function of labor L_i (the subscript X denotes exportables, M importables, and N nontraded goods). Since I will not be considering terms of trade effects, the world price of importables is assumed to equal the world price of exportables, which is normalized to equal one. The domestic price of imports differs from the world price by the amount of the import tariff ϵ, and the domestic price of exportables differs from the world price by the amount of the export subsidy s. Production in each sector is determined from equation 15 given the total labor supply L^*:

$$Q_i\left(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}\right) \qquad i = (N, X, M) \tag{16}$$

such that

$$Q_{N1}\left(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}\right) < 0 \qquad Q_{N2}\left(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}\right) < 0$$

$$Q_{X1}\left(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}\right) < 0 \qquad Q_{X2}\left(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}\right) > 0 \tag{17}$$

$$Q_{M1}(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}) > 0 \qquad Q_{M2}(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}) < 0$$

where all goods are denominated in international currency.

8.2 Demand

Consumers value nontraded goods, importables, and exportables according to the Cobb-Douglas utility function

$$U = C_N^{\beta} C_X^{\gamma(1-\beta)} C_M^{(1-\gamma)(1-\beta)} \tag{18}$$

where C_i is consumption of good i. Consumer maximization gives the following demand functions:

$$P_N \cdot D_N = \beta E$$

$$(1+s) \cdot D_X = \gamma(1-\beta)E \tag{19}$$

$$(1+\epsilon) \cdot D_M = (1-\gamma)(1-\beta)E$$

where E is expenditure in dollars. From the demand functions given in equation 19 consumers choose their purchases such that expenditures remain constant for each good.

8.3 Domestic Market Equilibrium

The market for nontraded goods is always assumed to be in equilibrium (full employment is always obtained). The price of nontraded goods is determined by the interaction of supply (equation 16) and demand (equation 19) in the nontraded sector; the nontraded price is that which equilibrates demand at a given level of expenditure with supply, determined by the incentives to produce in the nontraded sector relative to the traded sectors. The domestic market equilibrium condition is given by

$$D_N = Q_N(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}) \tag{20}$$

Substituting nontraded demand (equation 19) into equation 20 gives

$$P_N \cdot Q_N(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}) = \beta E \tag{21}$$

Equation 21 implicitly defines the expenditure and nontraded price combinations for a given level of trade intervention (ϵ and s). The characteristics of this schedule are derived using the implicit function theorem

$$\frac{\delta P_N}{\delta E} = \frac{\beta}{Q_N - (\frac{1+\epsilon}{P_N})Q_{N1} - (\frac{1+s}{P_N})Q_{N2}} \qquad > 0 \tag{22}$$

$$\frac{\delta P_N}{\delta(1+\epsilon)} \cdot (\frac{1+\epsilon}{P_N}) = \frac{(\frac{1+\epsilon}{P_N})Q_{N1}}{(\frac{1+\epsilon}{P_N})Q_{N1} + (\frac{1+s}{P_N})Q_{N2} - Q_N} \qquad > 0 \qquad < 1 \tag{23}$$

$$\frac{\delta P_N}{\delta(1+s)} \cdot (\frac{1+s}{P_N}) = \frac{(\frac{1+s}{P_N})Q_{N2}}{(\frac{1+s}{P_N})Q_{N2} + (\frac{1+\epsilon}{P_N})Q_{N1} - Q_N} \qquad > 0 \qquad < 1 \tag{24}$$

Figure 1 shows the schedule relating expenditures to nontraded goods to slope upwards, as in equation 22. An increase in expenditure causes excess demand for nontraded goods. Nontraded price rises to ration the excess demand, decreasing the quantity demanded and increasing the quantity produced.

An increase in the import tariff or an increase in export subsidy shifts the schedule upwards but by less than the amount of the change in the policy measure (equations 23 and 24). An increase in the tariff or subsidy results in excess demand for nontraded goods, as production is diverted towards the traded sector. The nontraded price increases to ration the excess demand, but the necessary price increase is less than the increase in the tariff; since the increase in the nontraded price lowers the quantity of nontraded goods demanded, less of a supply response is required to equilibrate the domestic market.

8.4 Trade Balance

Trade is assumed to balance in the long run. Trade balance is achieved when the world value of exports equals the world value of excess demand for imports

$$Q_X(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}) - D_X = D_M - Q_M(\frac{1+\epsilon}{P_N}, \frac{1+s}{P_N}) \tag{25}$$

Substituting the demand functions from equation 19 into

equation 25 gives

$$Q_X - \frac{\gamma(1-\beta)}{1+s}E = \frac{(1-\gamma)(1-\beta)}{1+\epsilon}E - Q_M \tag{26}$$

Equation 26 gives the schedule of nontraded price-expenditure combinations which achieve trade balance comparable to equation 21 for the domestic market. The properties of this schedule are derived using the implicit function theorem

$$\frac{\delta P_N}{\delta E} = -\frac{\frac{\gamma(1-\beta)}{1+s} + \frac{(1-\gamma)(1-\beta)}{1+\epsilon}}{(\frac{1+\epsilon}{P_N^2})(Q_{X1}+Q_{M1}) + (\frac{1+s}{P_N^2})(Q_{X2}+Q_{M2})} \qquad < 0 \tag{27}$$

$$\frac{\delta P_N}{\delta(1+\epsilon)} \cdot (\frac{1+\epsilon}{P_N}) = \frac{(\frac{1+\epsilon}{P_N^2})(Q_{X1}+Q_{M1})}{(\frac{1+\epsilon}{P_N^2})(Q_{X1}+Q_{M1}) + (\frac{1+s}{P_N^2})(Q_{X2}+Q_{M2})} \qquad > 0 \qquad < 1 \tag{28}$$

$$\frac{\delta P_N}{\delta(1+s)} \cdot (\frac{1+s}{P_N}) = \frac{(\frac{1+s}{P_N^2})(Q_{X2}+Q_{M2})}{(\frac{1+\epsilon}{P_N^2})(Q_{X1}+Q_{M1}) + (\frac{1+s}{P_N^2})(Q_{X2}+Q_{M2})} \qquad > 0 \qquad < 1 \tag{29}$$

By equation 27 the trade balance schedule slopes downward; an increase in expenditures reduces the trade balance by raising the demand for imports while lowering the supply of exports. The nontraded price must fall to shift demand away from tradables and supply toward tradables.

An increase in ϵ or s shifts the trade balance schedule up (equations 28 and 29); a tariff induced increase in the price of importables increases production of importables while decreasing demand, causing a trade surplus. Trade is balanced with an increase in the nontraded price, shifting production toward nontraded goods. The price increase simultaneously shifts demand away from nontraded goods towards imports, so the increase in the nontraded price required for trade balance is less than the increase in the tariff.

Equations 21 and 26 determine the unique nontraded price and expenditure level consistent with both domestic equilibrium and trade balance, shown in figure 2. An increase in ϵ or s leads to an increase in the price of nontraded goods consistent with long run equilibrium. If the real exchange rate is defined to be the world price of tradables (the expenditure weighted average of the price of importables and exportables) over the domestic price of nontradables, an increase in intervention in the form of an increase in ϵ or s leads to a *sustainable appreciation* of the exchange rate[15].

An increase in the import tariff or export subsidy also increases the equilibrium expenditure; the upward shift in the trade balance curve exceeds the shift in the domestic equilibrium curve. Demonstrating this requires deriving the relationship between price responses of output of the three

[15] An alternate definition of the real exchange rate is the *domestic* price of tradables over the nontraded price. The two definitions are identical if there are no trade barriers.

goods from the following labor demand conditions

$$\frac{dL_X}{d\epsilon} = -(\frac{dL_N}{d\epsilon} + \frac{dL_M}{d\epsilon}) \tag{30}$$

$$\frac{dL_X}{ds} = -(\frac{dL_N}{ds} + \frac{dL_M}{ds})$$

Combine equations 30 and 15 with the condition that the derivative of the supply of good i with respect to policy measure j is given by $Q_{ij} = MP_i \cdot \frac{dL_i}{dp_j}$, to get the following relationships between output responses to changes in policy measures (let s and ϵ be zero initially)

$$Q_{X1} = -(P_N Q_{N1} + Q_{M1}) \tag{31}$$

$$Q_{X2} = -(P_N Q_{N2} + Q_{M2})$$

Substituting equation 31 into the trade balance conditions (equations 28 and 29) gives

$$\frac{\delta P_N}{\delta(1+\epsilon)} \cdot (\frac{1+\epsilon}{P_N}) = \frac{(\frac{1+\epsilon}{P_N})Q_{N1}}{(\frac{1+\epsilon}{P_N})Q_{N1} + (\frac{1+s}{P_N})Q_{N2}} \tag{32}$$

$$\frac{\delta P_N}{\delta(1+s)} \cdot (\frac{1+s}{P_N}) = \frac{(\frac{1+s}{P_N})Q_{N2}}{(\frac{1+s}{P_N})Q_{N2} + (\frac{1+\epsilon}{P_N})Q_{N1}} \tag{33}$$

The shift in the trade balance schedule with a shift in trade policy in equations 32 and 33 are larger than the shift in the domestic equilibrium schedule (equations 23 and 24). In fact, the change in expenditure with respect to policy measure p_i can be shown to be

$$\frac{dE}{dp_i} = Q_N \frac{dP_N}{dp_i} \tag{34}$$

The larger shift implies expenditure must increase in equilibrium in response to an increase in the import tariff or export subsidy.

9 Trade Policy Intervention and Outward Orientation

The model can be used to predict the impact of various forms of trade policy intervention on two standard measures of outward orientation: the trade as a share of total output, and the price level. A low trade share or a high price level are interpreted as indications of inward orientation.

9.1 Share of Trade in GDP

Equation 25 gives the trade balance condition for the economy. since exports equal imports in trade balance and output equals expenditures, the share of trade in output will move identically with the ratio of exports (or imports) to expenditures, defined below

$$T = \frac{Q_X - D_X}{E} \tag{35}$$

Combining equation 35 with demand in equation 19 gives

$$T = \frac{Q_X}{E} - \frac{\gamma(1-\beta)}{1+s} \tag{36}$$

Trade policy intervention will be correlated with outward orientation if (in the absence of export measures) increasing the import tariff ϵ lowers the trade share. The change in T with a change in the import tariff is found by differentiating equation 36 with respect to ϵ

$$\frac{dT}{d\epsilon} = \frac{dQ_X}{d\epsilon}\frac{1}{E} - \frac{dE}{d\epsilon}\frac{Q_X}{E^2} \tag{37}$$

Changes in ϵ affect Q_X in two ways: the direct effect of increases in ϵ on output in the export sector, and the indirect effect of changes in ϵ on the equilibrium price of nontraded goods. The net effect is given in equation 38

$$\frac{dQ_X}{d\epsilon} = \frac{1}{P_N}((1 - \eta_\epsilon)Q_{X1} - \eta_\epsilon \frac{s}{\epsilon} Q_{X2}) \qquad < 0 \tag{38}$$

where η_ϵ is derived from equations 23 and 28

$$\eta_\epsilon = \frac{dP_N}{d\epsilon} \cdot (\frac{\epsilon}{P_N}) \qquad > 0 \qquad < 1 \tag{39}$$

Since $\frac{dE}{d\epsilon}$ is positive by the argument in section 8.4, the derivative $\frac{dT}{d\epsilon}$ is negative, and trade intervention results in a lower trade share and inward orientation.

By changing relative prices between the three goods, import restrictions bias production away from exportables and towards importables; the bias hurts exports, which sell at the same world price, by increasing the price export producers pay for their factor of production. Export production declines while import production increases. With a steady demand for exportables and importables, the result is a decline in trade.

The link between policy intervention and low trade share does not hold when intervention is allowed to take the form of an export subsidy. Differentiating the export share of expenditures with respect to the subsidy s gives

$$\frac{dT}{ds} = \frac{dQ_X}{ds}(\frac{1}{E}) - \frac{dE}{ds}(\frac{Q_X}{E^2}) \tag{40}$$

The first term in equation 40 expands to

$$\frac{dQ_X}{ds}\left(\frac{1}{E}\right) = \left(\frac{1}{E}\right)\left((1-\eta_s)\frac{Q_{X2}}{P_N} - \frac{\epsilon}{s}\eta_s\frac{Q_{X1}}{P_N}\right) \qquad > 0 \tag{41}$$

where η_s, comparable to η_ϵ given in equation 39, is greater than zero and less than one.

Since $\frac{dE}{ds} = \frac{P_N}{s}\eta_s Q_N$ from equation 34, the second term in equation 40 can be expressed

$$\frac{dE}{ds}\left(\frac{Q_X}{E^2}\right) = \frac{1}{E}\left(\frac{\beta\eta_s}{s}Q_X\right) \tag{42}$$

Restating the first and second terms, equation 40 simplifies to

$$\frac{dT}{ds} = \left(\frac{Q_X}{sE}\right)\left(\frac{dQ_X}{ds}\cdot\frac{s}{Q_X} - \beta\eta_s\right) \tag{43}$$

Equation 43 shows that the trade share can *increase* with trade intervention in the export sector, provided the net elasticity of the export supply in response to the subsidy exceeds $\beta\eta_s$, a number between zero and one.

9.2 Price Level

Price level is often used as a measure of outward orientation, where a high price level indicates an inward oriented economy (Dollar, 1990). The model clarifies the link between trade policy intervention and outward orientation in an economy in long run equilibrium. The price level increases with intervention and outward orientation if intervention takes place in the import sector. If intervention in exports are allowed, the price level fails both as a measure of intervention and as a measure of outward orientation; the price level can decline, for example, in response to an export tax which biases trade against exports.

A price index for the economy is derived from the utility function in equation 18 to be

$$P = P_N^{\beta}(1+s)^{\gamma(1-\beta)}(1+\epsilon)^{(1-\gamma)(1-\beta)} \tag{44}$$

The change in the price level with a change in the import tariff is

$$\frac{dP}{d(1+\epsilon)} \cdot (\frac{P_N}{1+\epsilon}) = \beta\eta_\epsilon + (1-\gamma)(1-\beta) \qquad > 0 \tag{45}$$

Equation 45 indicates that trade policy intervention in the form of import tariffs causes the price level to increase in long run equilibrium. The tariff increases import prices both directly and indirectly by increasing nontraded goods prices, the indirect effect in response to the supply shortage in the nontraded goods sector caused by increased production of importables. With import tariffs alone, a high price level indicates intervention and inward orientation.

The link between intervention and a high price level is broken if intervention takes the form of an export tax; a decline in the export subsidy will lead to a decrease in the nontraded goods price as well as a decrease in the price of exports. This low price level is sustainable in long run equilibrium with balanced trade and domestic equilibrium. The change in the price level with a change in the export tax is

$$\frac{dP}{d(1+s)} \cdot (\frac{P_N}{1+s}) = \beta\eta_s + \gamma(1-\beta) \qquad > 0 \tag{46}$$

A positive derivative indicates an increase in the export tax (a decrease in s) will cause a decline in the price level which is consistent with long run equilibrium.

Not only does the fall in the price level fail to capture intervention, but the fall coexists with a decline in the incentives to export relative to import substitute; the import price is stationary relative to a fall in the export price which exceeds the fall in the price of nontraded goods (η_s is less then one). Both the import price The price level in this case fails to reliably measure either trade policy intervention or outward orientation

In the absence of export subsides or taxes, the model justifies the use of trade share and price level as measures of both outward orientation (the incentive to produce for export relative to producing import substitutes) as well as measures of trade policy intervention. Intervention taking the form of import restrictions will bias production against exports, reduce trade as a share of income, and increase the price level.

The model's predictions of the impact of import restrictions differ if intervention causes export prices to deviate from world prices. An export subsidy can raise the share of trade to GDP, even in long run equilibrium; the subsidy could be large enough to offset the impact of a tariff on the trade share, causing a country to be considered outward oriented while maintaining a high level of intervention. An export tax can be used to offset the impact of an import tariff on the price level, both by decreasing the price of exportables directly, and by lowering the nontraded goods price by increasing the excess supply of goods in the nontraded sector. If price level were used to measure trade policy, a country with an export tax having a low price level would be wrongly considered liberal and outward oriented.

Table 8: Relative Price Dispersion Estimates for the Restricted Sample

$$V_j = \sum_i \alpha_{ij} \hat{\eta}_{ij}^2$$

The variable $\hat{\eta}_{ij}$is the residual from the estimation of equation 10.
All variables are explained in the text describing equation 13.

Rank	Country	Dispersion
1	Austria	0.00495
2	Italy	0.0118
3	France	0.01340
4	Belgium	0.01640
5	Netherlands	0.01684
6	Germany	0.01893
7	Luxembourg	0.01971
8	Norway	0.02178
9	Pakistan	0.02507
10	Denmark	0.0271
11	Costa Rica	0.0296
12	United Kingdom	0.0319
13	Dominican Republic	0.0323
14	Paraguay	0.03247
15	Argentina	0.03582
16	Canada	0.03584
17	Panama	0.03724
18	Venezuela	0.03735
19	Ireland	0.03857
20	El Salvador	0.04157
21	Colombia	0.04182
22	Finland	0.04390
23	Greece	0.0460
24	Korea	0.04961
25	Philippines	0.0521
26	Ecuador	0.05301
27	Brazil	0.05458
28	Spain	0.05538
29	Chile	0.05552
30	Peru	0.06002
31	Guatemala	0.06058
32	Uruguay	0.06078
33	Honduras	0.07488
34	Indonesia	0.07968
35	Portugal	0.08282
36	Bolivia	0.08637
37	Sri Lanka	0.1021
38	Israel	0.1118
39	Japan	0.1368

Table 9: Relative Price Dispersion Estimates for the Unrestricted Sample

$$V_j = \sum_i \alpha_{ij}\hat{\eta}_{ij}^2$$

The variable $\hat{\eta}_{ij}$is the residual from the estimation of equation 10.
All variables are explained in the text describing equation 13.

Rank	Country	Dispersion
1	Austria	0.00587
2	Belgium	0.01027
3	Italy	0.01035
4	France	0.01073
5	Netherlands	0.01530
6	Morocco	0.01637
7	Germany	0.01667
8	Luxembourg	0.01686
9	Madagascar	0.01843
10	Kenya	0.02111
11	Norway	0.02163
12	Pakistan	0.02200
13	Mali	0.02504
14	Ivory Coast	0.02863
15	Canada	0.02871
16	Zimbabwe	0.02882
17	United Kingdom	0.03006
18	Senegal	0.03169
19	Dominican Rep	0.03210
20	Denmark	0.03287
21	Uruguay	0.03465
22	Panama	0.03631
23	Costa Rica	0.03746
24	Malawi	0.03784
25	Finland	0.03891
26	El Salvador	0.04023
27	Paraguay	0.04184
28	Argentina	0.04244
29	Spain	0.04320
30	Ireland	0.04324
31	Greece	0.04757
32	Ethiopia	0.05030
33	Ecuador	0.05194
34	Brazil	0.05389
35	Cameroon	0.05406
36	Colombia	0.06131
37	Korea	0.06195
38	Honduras	0.06266

Table 10: Relative Price Dispersion Estimates for the Unrestricted Sample (Continued)

Rank	Country	Dispersion
39	Philippines	0.06380
40	Portugal	0.06544
41	Tanzania	0.06579
42	Chile	0.06652
43	India	0.06701
44	Tunisia	0.07040
45	Peru	0.07475
46	Zambia	0.07854
47	Guatemala	0.08147
48	Indonesia	0.08371
49	Nigeria	0.09466
50	Israel	0.09659
51	Venezuela	0.1050
52	Japan	0.11737
53	Bolivia	0.12348
54	Botswana	0.12463
55	Sri Lanka	0.17082

Table 11: Equipment Price Distortion Estimates

$$V_j = \sum_i \alpha_{ij} \hat{\eta}_{ij}^2$$

The variable $\hat{\eta}_{ij}$is the residual from the estimation of equation 10.
All variables are explained in the text describing equation 13.

Rank	Country	Dispersion
1	Botswana	-0.11770
2	Zambia	-0.06031
3	Korea	-0.05260
4	Japan	-0.04826
5	Israel	-0.03521
6	Nigeria	-0.03335
7	Denmark	-0.0296
8	Tanzania	-0.02890
9	Indonesia	-0.02511
10	Finland	-0.02382
11	Norway	-0.02382
12	Portugal	-0.02227
13	Zimbabwe	-0.02178
14	Canada	-0.02144
15	Greece	-0.02139
16	Honduras	-0.01867
17	Ireland	-0.00937
18	Kenya	-0.00888
19	Bolivia	-0.0069
20	Pakistan	-0.0057
21	Malawi	-0.00529
22	Uruguay	-0.00525
23	Philippines	-0.00440
24	Venezuela	-0.00368
25	Paraguay	-0.00321
26	Panama	-0.00219
27	Tunisia	-0.00102
28	Ethiopia	-0.00074
29	El Salvador	0.00185
30	Morocco	0.00499
31	Ivory Coast	0.00650
32	Costa Rica	0.00715
33	United Kingdom	0.00752
34	Cameroon	0.00763
35	Austria	0.00832
36	Italy	0.00904
37	Brazil	0.01019
38	India	0.01064
39	Senegal	0.01171

Table 12: Equipment Price Distortion Estimates (Continued)

Rank	Country	Dispersion
40	Luxembourg	0.01400
41	Germany	0.01435
42	Spain	0.01503
43	Ecuador	0.01621
44	Belgium	0.01723
45	Guatemala	0.01972
46	France	0.02109
47	Peru	0.02234
48	Dominican Rep	0.02275
49	Argentina	0.02492
50	Netherlands	0.02754
51	Chile	0.02951
52	Colombia	0.0320
53	Madagascar	0.03203
54	Mali	0.04006
55	Sri Lanka	00.05301

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