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General Equilibrium Measures of Agricultural Policy Bias in Fifteen Developing Countries

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Abstract

A comparative analysis of 15 developing countries shows that, during the 1990s, indirect taxes, tariffs, and exchange rates significantly discriminated against agriculture in only one country (Malawi), was largely neutral in five (Argentina, Brazil, Costa Rica, Indonesia, and Zimbabwe), provided a moderate subsidy to agriculture in four (Mexico, Tanzania, Venezuela, and Zambia), and strongly favored agriculture in five (Egypt, Korea, Morocco, Mozambique, and Tunisia). In contrast to earlier partial equilibrium results, our general equilibrium analysis indicates that exchange rate changes can lead to anything between strongly increasing and strongly decreasing relative agriculture/non-agriculture incentives, depending on relative trade shares and relative tradability of agricultural and non-agricultural commodities. Country-specific circumstances greatly affect the relative impact of trade policies on agriculture and the rest of the economy in a general equilibrium setting. Earlier partial equilibrium measures of policy bias could not adequately incorporate country heterogeneity and are therefore likely to have overstated the bias. In any case, from the empirical results with our sample of countries, we conclude that any incentive bias against agriculture in the 1980s had mostly disappeared by the 1990s.

JEL classification: D58, O10, Q18

Keywords: Urban bias, food and agricultural policy, general equilibrium modelling

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1. Introduction

"Getting prices right" was a rallying call when developing countries started re-orienting their economic policies in the early 1980s. The agricultural sector, in particular, was seen as being damaged by trade and macroeconomic policies that favored urban industry. The existence of an incentive bias against agriculture was affirmed in the late 1980s by a major World Bank research project carried out under the direction of Anne O. Krueger (Krueger, Schiff, and Valdés, 1988; Krueger, 1992; Schiff and Valdés, 1992; and Bautista and Valdés, 1993).[1] The research team analyzed data from the early 1960s to the mid-1980s and concluded that reductions in trade distortions such as import tariffs and export taxes and the elimination of overvalued exchange rates would greatly improve agricultural performance and contribute to economic growth.

The above studies relied on partial equilibrium analysis, focusing on the agricultural sector, with little attention to intersectoral linkages and feedback effects from changes in incomes and relative prices. They have nevertheless continued to play a highly influential role in the thinking about the way in which economic policy affect incentives and associated resource pulls in developing countries. An illustrative example is Krueger (1998), included in the Controversy on trade and policy reform published by the *Economic Journal* in September of 1998 (with an introduction by Dixon, 1998). Reviewing Krueger's arguments, it is apparent that one of the remaining challenges in this area of economic inquiry is the need to move toward a more comprehensive understanding of the sector implications of trade and exchange rate policy and their measurement.[2]

Fortunately, new data in the form of economy-wide social accounting matrices (SAMs) have recently become available for a large number of developing countries. They allow us to shed fresh light in this paper on past perceptions, taking account of general equilibrium interactions, to help clarify both (i) the extent to which the agricultural incentive bias continues to exist and (ii) the limitations of partial equilibrium measures of the bias.

Our main purpose is to provide general equilibrium measures of agricultural policy bias in the 1990s for a sample of 15 developing countries. We develop single-country CGE models, based on data that include agricultural detail to assess how indirect taxes, including import tariffs and export taxes, and current account imbalances affected relative agricultural price incentives.[3] In addition, simulations of agricultural export taxes, non-agricultural import tariffs, and exchange rate appreciation are carried out to study the impact of trade policies, traditionally applied to protect industrial production sectors.

[1] This discussion formed part of a broader debate about development strategy and "urban bias". The term was coined by Michael Lipton (1977) to describe the general tension in developing countries between rural-urban and industry versus agriculture. A recent contribution based on an information theoretic approach is Majumdar, Mani and Mukand (2004).

[2] This observation is in tune with the Feature on trade liberalization and economic performance published by the *Economic Journal* in February of 2004. Here a variety of authors provide insights into other aspects of the trade reform process in a stimulating attempt to push the debate forward (see for example Santos-Paulino and Thirlwall, 2004; and Winters, 2004).

[3] Jensen, Robinson and Tarp (2002), which is an earlier version of this paper, contains full details on the modeling methodology.

Further background for the study is presented in Section 2; country models and data sets are summarized in Section 3; results of the various simulations are reviewed in Section 4; and conclusions are offered in Section 5.

2. Measuring the Incentive Bias

To quantify the impact of policy regimes on relative agricultural price incentives, Krueger and her colleagues studied a representative group of 18 developing countries.[4] They distinguished between direct and indirect policy measures affecting agricultural price incentives. Direct policy measures were defined to include all measures, which affected the wedge between agricultural producer and border prices directly. These measures typically included domestic agricultural taxes and subsidies, export taxes on cash crops, and import tariffs on food crops. In contrast, indirect policy measures were defined as economy-wide measures, affecting the difference between relative agricultural producer and border prices. Indirect measures came under two main headings: (i) industrial protection policies, and (ii) overvaluation of the exchange rate. The former group of industrial protection measures included industrial import tariffs and quotas, as well as domestic industrial taxes and subsidies. The overvaluation of the exchange rate was measured by the depreciation required to eliminate the non-sustainable part of the current account deficit in addition to the exchange rate impact of other trade policy interventions.

The quantification of direct and indirect effects of domestic tax and trade policies on agricultural price incentives was primarily based on the computation of nominal protection rates (NPRs). The total NPR for a given traded agricultural product was defined as the proportional difference between (i) the ratio of the agricultural producer price and a non-agricultural producer price index, and (ii) the ratio between the agricultural border price and a non-agricultural border price index, both measured at the equilibrium exchange rate. Subsequently, the total NPR was additively decomposed into (i) a direct NPR measuring the impact on relative prices of differences between agricultural producer and border prices measured at the current exchange rate, and (ii) an indirect NPR measuring the impact on relative prices of differences between non-agricultural producer and border prices, and between the current and equilibrium exchange rates.

The study by KSV, which covered the period 1975-84, presented NPRs for one agricultural tradable good from each of the 18 countries in their sample. The results indicated that exported agricultural products suffered from both direct and indirect nominal protection. Using simple averages, KSV found that agricultural export goods suffered from a negative direct NPR of –11 percent, while import-competing agricultural goods benefited from a positive direct NPR of around 20 percent. KSV also found that the direct NPRs were swamped by the economy-wide indirect NPRs, averaging –27 percent. Accordingly, the KSV study concluded that indirect effects dominated direct effects and that total nominal protection was negative for all types of (traded) agricultural goods. While KSV used nominal protection as their measure of relative price distortion, they acknowledged that a more appropriate measure would be the Effective Rate of Protection (ERP), which also

[4] Krueger, Schiff and Valdés (1988), and Schiff and Valdés (1992) will henceforth be referred to as KSV and SV.

takes distortions in input prices into account. However, "Due mainly to data inadequacy…" the study by KSV contains no results on ERPs.

The SV study included the same sample of 18 countries, but extended the period of coverage to 1960-84 and generalized the results by extending the number of agricultural goods. Accordingly, SV reported average agricultural NPRs, which were based on "…four to six agricultural commodities, and that coverage typically represented between 40 and 80 percent of net agricultural product". Their results were qualitatively similar to those of KSV. They confirmed that agricultural exports and imports faced NPRs of respectively –13 percent and 14 percent, on average; and that these direct effects were dominated by indirect NPRs, averaging –22 percent. Moreover, SV reasserted the conclusion arrived at by KSV that total nominal protection was on average negative for all types of traded agricultural goods. The SV study also found that the nominal disprotection of traded agricultural goods increased over time, and that "…industrial protection has penalized agriculture more than overvaluation of the exchange rate in two-thirds of the countries examined".[5]

Based on the assumption that all agricultural goods are traded, KSV and SV argued that their results (for the chosen set of goods) were representative for the overall agricultural sector. The SV study did recognize that "…traded products have non-tradable components, including some distribution and marketing costs." Yet, no attempt was made to take account of these non-tradable components of domestic agricultural production, and the same goes for their underlying causes in the form of marketing costs and qualitative differences from world market goods. Perfect substitution between domestic and world market goods was assumed, and general equilibrium effects were ignored.

In contrast, the current study considers imperfect substitution between domestic and world market goods as well as general equilibrium effects. Moreover, the computable general equilibrium (CGE) framework allows direct computation of relative value added prices under various policy scenarios, which measure resource pulls in factor markets and provide a theoretically appropriate measure of effective rates of protection.[6] Bautista et al. (2001) compare analytically the partial and general equilibrium measures of bias, indicating the implications of the strong simplifying assumptions embodied in the partial equilibrium measures. They conclude that these simplifications are likely to lead to an overstatement of the policy bias against agriculture in a developing country.

3. Country Models and Data Sets

The analysis is based on a "standard" trade-focused computable general equilibrium (CGE) model fully described in Löfgren et al. (2002).[7] The model is applied to each of the sample countries with almost no differences in model specification across the countries. The applications are necessarily somewhat stylized to achieve comparability, neglecting

[5] NPRs are further reviewed below (Table 5).

[6] The implications of assuming imperfect "tradability" for the use of the ERP measure are explored in Devarajan and Sussangkarn (1992), and de Melo and Robinson (1981).

[7] The standard model arose from work on a number of country models with an agricultural focus. An early example is Arndt, Jensen, Robinson, and Tarp (2000). For more details on the application to the 15 countries in this paper see Jensen, Robinson, and Tarp (2002).

country-specific institutional details while capturing the wide differences in country data. References to more detailed case studies of all the countries in the sample are provided in the references section. The few cases where country-specific behavior has been imposed on the model are duly noted.

The data set consists of Social Accounting Matrices (SAM) for the 15 countries listed in Table 1. All SAM data sets are from the 1990s and include significant agricultural detail. The sample includes upper middle-income and high-income countries such as Argentina, Brazil, Korea, and Mexico, and lower middle-income and low-income countries such as Costa Rica, Egypt, Indonesia, Malawi, Morocco, Mozambique, Tanzania, Tunisia, Venezuela, Zambia, and Zimbabwe. The sample countries are geographically dispersed, including five countries from Southern Africa, three from Northern Africa, five from Latin America, and two from Asia. There is an overlap of six countries (Argentina, Brazil, Egypt, Korea, Morocco, and Zambia) with the sample used in KSV and SV.

[Table 1 around here]

The 15 SAM data sets differ in terms of (i) the disaggregation of production sectors, (ii) the disaggregation of primary factors of production, and (iii) the inclusion of marketing costs and home consumption of own production. The disaggregation of production sectors and production factors can be gauged from Table 1. All data sets account separately for value added by labor and capital, but nine data sets also include land as an agriculture-specific production factor. To make simulations comparable across countries, capital was disaggregated into agricultural and non-agricultural capital so as to create agricultural-specific production factors in all country models. Apart from being a reasonable assumption for the current type of medium-term simulations, it has the added benefit of making our factor market closure comparable to the KSV and SV studies. Accordingly, this closure rule allows us to focus attention on the tradability assumptions underlying the KSV and SV results.[8]

The economic structure of the 15 country models can be seen in Table 2. The countries differ widely according to the importance of the agricultural sector. Poorer southern African countries like Malawi, Mozambique, Tanzania, and Zambia are very dependent on agricultural production, while countries like Costa Rica and Zimbabwe have more specialized agricultural sectors. In contrast, more developed middle- and high-income countries like Argentina, Brazil, Korea, Mexico, and Venezuela have smaller agricultural sectors, whereas northern African countries like Egypt, Morocco, and Tunisia, as well as Indonesia, have moderately large agricultural sectors.

[Table 2 around here]

[8] The fisheries sector was inconsistently defined among the various SAM data sets. It was defined as an agricultural sector in Indonesia, Malawi, Mexico, Tanzania, and Zambia, and as an industry sector in Mozambique. In the Argentina, Korea, Morocco, Tunisia and Venezuela models, the fisheries sector was defined as an agricultural sector even though it used both agricultural and non-agricultural production factors. Finally, fishery was not defined as a separate production sector in the Brazil, Costa Rica, and Egypt country models.

Five countries including Argentina, Costa Rica, Malawi, Mexico, and Zimbabwe, have significantly higher agricultural export shares compared to their average non-agricultural export shares. Nevertheless, in the sample, the degree of dependence on trade in agricultural goods is unrelated to the relative size of the agricultural sector. Among the five countries with relatively high agricultural export shares, Argentina and Mexico are upper middle-income countries with small agricultural sectors; Costa Rica and Zimbabwe are lower-middle income and low-income countries with partly developed and moderately large agricultural sectors; and Malawi is a low-income country with a very large agricultural sector. Among the remaining 10 countries in the sample, there are six countries, including Korea, Venezuela, Mozambique, and the three northern African countries, which have relatively high agricultural import shares. Yet, these countries have higher average non-agricultural trade shares, due mainly to high industrial (import) trade shares. Finally, among the four countries with low agricultural trade shares, Tanzania, Zambia, and Indonesia have high non-agricultural trade shares, while Brazil is a relatively closed economy with low overall trade shares.

Seven of the country data sets include information on marketing margins, as shown in Table 3. The structure of marketing margin rates tends to provide an incentive bias against domestic agricultural production. An increase in the price of marketing services tends to increase industrial protection afforded by relatively high industrial import margin rates, and decrease relative agricultural price incentives by increasing relatively high domestic agricultural marketing costs.[9]

[Table 3 around here]

From the structure of trade taxes and tariffs, presented in Table 4, export taxes are virtually non-existent. Tariff rates vary widely across the sample. Industrial tariff rates are generally higher than agricultural rates, with a few major exceptions (Korea, Morocco, and Venezuela). Domestic indirect taxes are generally much smaller than tariffs, and vary widely across sectors. Production taxes do not consistently tend to favor particular sectors across the sample of countries, while consumption taxes are generally lower for agriculture.

[Table 4 around here]

The structure of domestic trade policy taxes in our sample is contrasted with NPRs in Table 5 for the six countries (Argentina, Brazil, Egypt, Korea, Morocco, and Zambia) that overlap with the sample used in KSV and SV.[10] The direct NPRs from the SV study indicate that there was direct nominal dis-protection of agricultural production (domestic prices below world prices) in Argentina, Egypt, Morocco, and Zambia during 1960-84. These changed to direct tariff protection in our sample period. Moreover, while direct nominal protection of agriculture decreased in Korea and Brazil, tariff protection for these

[9] Large service production which does not incur marketing costs means that domestic non-agricultural marketing costs are relatively low on average. On the other hand, small service imports means that average non-agricultural marketing costs for imports are relatively high. The combined impact of marketing costs tends to reinforce the agricultural bias. The Zambian data set is unusual, since service sectors such as energy and construction incur marketing costs.

[10] Only import tariffs are tabulated in Table 4 since export taxes are absent for these six countries.

countries remained positive in our sample as well. A comparison between non-agricultural import tariffs and indirect NPRs is difficult. NPRs include exchange rate effects. Nevertheless, the SV study (page 16) asserts that "…industrial protection policies…had a greater effect on the indirect tax than did overvaluation of the real exchange rate." Under this assumption, the data indicate a general reduction in protection of non-agricultural products in this period. Moreover, structural adjustment programs are likely to have reduced the impact of exchange rate effects, implying a decrease in indirect nominal dis-protection of agriculture between the period 1960-84 and our sample period. Altogether, the data indicate that nominal dis-protection of agriculture is likely to have vanished between the two sample periods.

[Table 5 around here]

In sum, the sample countries represent a heterogeneous group; and it would appear that they provide a satisfactory degree of variation in the level of economic development, geographical location, and economic trade and tax structures for a comparative analysis of agricultural bias.

4. Simulation Results

This section presents two sets of simulations. Section 4.1 measures the historical level of agricultural bias, including the impact of indirect tax and tariff structures. Subsequently, Section 4.2 presents two groups of simulations along the lines of the single country-studies in Bautista et al. (2001) and Jensen and Tarp (2002), to assess the possible price incentive effects of a set of traditional ISI-type trade policies.

All simulations in Section 4 were carried out using a macro closure in which aggregate investment is specified as a fixed share of total absorption. This simple macro closure assumes no major swings in macro aggregates in response to external shocks, and maintains focus on the tradability assumptions underlying the studies by KSV and SV. To keep investment fixed as a share of nominal absorption, household savings rates were assumed to vary proportionately. Furthermore, in line with the public finance literature, all simulations were carried out using a revenue-neutral specification of the government budget. In order to fix government revenue, household tax rates were allowed to vary proportionately. The factor market closure specifies full employment of available factor supplies. Finally, all simulations were carried out using a flexible real exchange rate and fixed foreign savings, except for the set of exchange rate simulations in Section 4.2, where the impact of a pre-set level of exchange rate appreciation is analyzed.

We use the model in counterfactual mode, changing policy variables such as tax and tariff rates or introducing shocks to the exchange rate. Policy bias is measured by comparing the results for agriculture relative to non-agriculture before and after the change. For example, eliminating a policy which discriminates against agriculture will result in either an increase in agricultural prices or in additional resources being attracted to agriculture after the policy is removed. In the 15 country models used in this paper, fixed factors induce limitations on the movement of primary factors between the agricultural and non-agricultural sectors. In this situation elimination of policy bias will result in little change in relative agriculture/non-agricultural output. Instead the impact will be reflected mainly in changes of relative prices. This specification was chosen in order to make the results as comparable as possible with partial equilibrium measures that focus on relative price changes. To save space we report only the changes in relative prices below.[11]

4.1 Agricultural Bias in the 1990s

The first set of five tax and tariff simulations includes a base run and four alternative simulations to measure the cumulative impact of eliminating: (1) production taxes, (2) consumption taxes, (3) export taxes, and (4) import tariffs. The results are presented in Table 6 and Figure 1. In the table, countries are grouped according to structural characteristics discussed below.

[Table 6 around here]
[Figure 1 around here]

These experiments indicate that indirect taxes and tariffs significantly discriminated against agriculture in only one country (Malawi), were largely neutral in five (Argentina, Brazil, Costa Rica, Indonesia, and Zimbabwe), provided a moderate subsidy to agriculture in four (Mexico, Tanzania, Venezuela, and Zambia), and strongly favored agriculture in five (Egypt, Korea, Morocco, Mozambique, and Tunisia).

For Malawi, Figure 1 shows that it is mainly consumption taxes which create the bias against agriculture. The major share of consumption tax revenue is derived from processed food, which indirectly taxes primary agricultural inputs. Malawi is a small, poor, densely populated country with a dualistic agriculture—extensive, small-holder subsistence farming alongside large-scale commercial farms. Marketing has historically been closely controlled by the Malawian government, with heavy indirect taxation of processing industries.[12]

At the other extreme, the tax structure in Morocco implies considerable protection of agricultural production. Figure 1 demonstrates that the whole Moroccan tax structure, including production and consumption taxes, but especially import tariffs, contributes to biasing price incentives in favor of agricultural production. The reason is to be found in the highly dispersed tariff structure, where very high tariffs protect domestic agricultural production sectors, including wheat and livestock, while high tariffs on manufactured imports are taxing domestic manufacturing sectors by increasing their input costs.[13]

Among the remaining 13 countries, three groups with broadly similar characteristics can be outlined as shown in Table 6. The first group (Argentina Zimbabwe, Brazil, and Costa Rica) has tax structures that are relatively neutral with respect to relative price incentives. Brazil and Argentina are upper middle-income countries with developed and competitive

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[11] For more details on this issue see Jensen, Robinson, and Tarp (2002).

[12] This Malawian system has been changing in the 1990s, especially for tobacco, where there has been rapid growth of production in small farms.

[13] The remaining selection of results presented in Figure 1 indicates how different countries put different weight on indirect tax instruments. The figure shows e.g. that Korea and Morocco use different measures, in the form of production taxes and import tariffs, to protect their agricultural sectors. The figure also indicates how e.g. Argentina, in contrast to Morocco, uses import tariffs to indirectly tax the agricultural sector.

agricultural sectors, specialized in livestock and cash crops, while the other two, Zimbabwe and Costa Rica, have competitive agricultural export sectors that are large-scale in nature and specialized in the production of cash crops, such as tobacco and cotton in the case of Zimbabwe. In spite of the relatively developed nature of agricultural (export) sectors, taxation of agricultural production remains relatively moderate. Moreover, indirect taxation of non-agricultural production has a relatively neutral impact on production incentives. In general, domestic indirect taxes tend to support relative agricultural price incentives, while import tariffs tend to protect non-agricultural production in this group of countries.

The second group of countries consists of Indonesia and three poorer southern African countries, including Zambia, Tanzania, and Mozambique. They can be characterized as low-income countries with relatively large and underdeveloped agricultural sectors. Trade in agricultural goods is generally small, except in Mozambique, where regional differences in land fertility and agricultural demand, in addition to recurring natural calamities, imply that agricultural imports are moderately high from time to time. Nevertheless, the relatively large size and underdeveloped nature of agricultural production make taxation of non-agricultural commodities the only viable means of raising tax revenue in these countries. Tariff structures, in particular, tend to be skewed towards taxation of non-agricultural imports. Since agricultural production technologies are very rudimentary while non-agricultural production technologies are more input-intensive, this tends to lower non-agricultural price incentives by increasing intermediate input costs. Combined with non-agricultural production and consumption taxes, which tend to lower producer prices, the tax structure of these countries discriminates against non-agricultural production at all levels. The implicit level of agricultural protection ranges from three percent in Indonesia, to 6-13 percent in the three southern African countries.

The third group of countries, including Venezuela, Egypt, Tunisia, and Korea, has structural characteristics similar to those of the Moroccan economy. They have relatively small agricultural sectors that are insufficient to feed their populations, and are therefore dependent on imports of agricultural goods. In order to maintain some level of self-sufficiency, these countries tend to impose tax-structures that favor agricultural production. In spite of fundamental similarities, they differ from Morocco in their approach to supporting agricultural price incentives. While Morocco relies strongly on agricultural import tariffs (e.g. to protect production of soft wheat), Korea relies more heavily on domestic differences between non-agricultural taxation and agricultural subsidization to generate price incentives in favor of agriculture (e.g. rice). Accordingly, the overall level of agricultural protection varies from seven percent in Venezuela and 17 percent in Korea, to between 11 and 32 percent in the northern African group of countries, including Egypt, Tunisia, and Morocco.

Finally, Mexico stands out as the country where import tariffs have the smallest effects on relative price incentives. While Mexico has one of the most open economies in the sample, it maintains a relatively balanced trade account in both agricultural and non-agricultural goods, as well as a relatively uniform and non-distorting structure of import tariffs. Accordingly, the Mexican indirect tax structure resembles that of Korea: the main distortions arise from domestic differences between non-agricultural taxes and (small) agricultural subsidies. This results in an overall level of agricultural price support of six percent.

To summarize, the impact of indirect tax structures on relative price incentives is relatively neutral in our sample countries with developed and internationally competitive agricultural sectors. A moderate bias against non-agricultural production, and hence in favor of agriculture, was found in poorer southern African countries where indirect taxes on non-agricultural commodities are the main source of government tax revenue. Finally, high levels of agricultural protection characterize the group of northern African countries and countries like Korea and Venezuela. Korea directly subsidizes agricultural production while Morocco maintains high protective tariffs on agricultural imports. In general, sectoral differences in tax and tariff rates (Table 4) account for the variation in results in Table 6. An empirical analysis of exchange rate overvaluation (not shown) is necessary to fully capture the direction and extent of the price incentive bias. The precise definition and measurement of a sustainable external deficit is a contentious issue. If the upper bound is set at three percent of absorption, only two sample countries show signs of agricultural bias. However, regardless of the choice of sustainable upper bound for the external deficit, most countries in our sample show no signs of agricultural bias in the 1990s.[14]

Section 4.2 Traditional ISI-policies

Core elements of the traditional Import Substitution Industrialization (ISI) policy strategy included an overvalued exchange rate as well as non-agricultural import tariffs to protect domestic non-agricultural production, and agricultural export taxes to raise revenue from the agricultural sector. In this section, we investigate the impact of each of these ISI-type policies on relative agricultural price incentives, by imposing a set of stylized tax and exchange rate policies on our sample of 15 single-country CGE models.

Agricultural Export Tax and Non-Agricultural Import Tariff Simulations

The first policy simulation is a uniform 25 percent tariff on non-agricultural imports. Results are presented in Figure 2, indicating that non-agricultural import tariffs, on balance, tend to improve relative agricultural price incentives. The figure illustrates how strong general equilibrium effects can reverse the nominal protection effect of non-agricultural import tariffs. In general, the impact on relative agricultural price incentives are negatively related to the ratio of agricultural versus non-agricultural trade shares. This relationship points to the importance of accompanying tariff-induced exchange rate appreciation, which tends to worsen relative price incentives for the types of goods traded most intensively. Non-agricultural import tariffs are therefore most likely to yield relative protection for non-agricultural goods when relative agricultural trade shares are large. On the other hand, agricultural price incentives can improve strongly when relative agricultural trade shares are small.

[Figure 2 around here]

Figure 2 indicates that the strongest relative price *declines* occur among a group of countries, including Malawi, Costa Rica, and Argentina, which are characterised by high

[14] An expanded analysis of indirect tax structures and exchange rate overvaluation can be found in Jensen, Robinson and Tarp (2002).

agricultural trade shares vis-à-vis non-agricultural trade shares. The results indicate that pervasive tariff protection induces 6–11 percent appreciation of the real exchange rate in the three aforementioned countries, leading to an 8–15 percent drop in relative agricultural value added prices. Given high agricultural trade shares, the real appreciation leads to lower relative agricultural prices. Induced changes in input costs further reinforce the impact of the overvalued exchange rates. Production technologies employed in (some of the) agricultural sectors use relatively large quantities of marketed, import-intensive, non-agricultural inputs such as chemicals.

The biggest relative price *increases* occur among a group of countries, including Indonesia, Mozambique, and Tunisia, which are mostly characterised by low trade shares in agriculture versus non-agriculture. Relative agricultural value added prices improve by a maximum of 7–17 percent among this group. Indonesia, Mozambique and Tunisia experience a 5–8 percent tariff-induced appreciation of the real exchange rate, which, combined with low agricultural trade shares, works to improve relative agricultural price incentives. Tariff-induced increases in non-agricultural input costs and 5–10 percent drops in prices on marketing services also work to improve relative agricultural price incentives.[15]

Mexico is a special case since non-agricultural import tariffs raise relative agricultural price incentives (slightly), in an environment of large relative agricultural trade shares. A key reason for this result is that Mexican imports consist mainly of intermediate and capital goods for further processing, where possibilities for import substitution are limited, which helps to improve relative agricultural value added prices. Brazil, Zambia, and Morocco are special cases as well, since non-agricultural import tariffs lower agricultural price incentives (slightly) for these countries, in an environment of small relative agricultural trade shares. In these cases, the direct protective impact of the import tariffs dominates the impact of the exchange rate appreciation, leading to a (small) decline in agricultural price incentives.

A second policy simulation of a uniform 25 percent tax on agricultural exports (not shown) indicates that relative agricultural price incentives decline for every sample country. This general result holds regardless of the relative size of the agricultural trade share, showing that the direct terms-of-trade impact on agricultural producer prices in every case dominates the indirect impact of tax-induced exchange rate depreciation on nominal protection and input costs.

Exchange Rate Simulations

This set of experiments considers the effect of a 10 percent appreciation of the real exchange rate imposed exogenously for each sample country. The idea is to impose a uniform price shock for comparability with partial equilibrium studies. In order to conduct these experiments the macro-trade closure was changed from exogenous to endogenous trade-balance. Columns 1-2 in Table 7 present the current account deficit as a ratio of total

[15] The marketing margin rates presented in Table 3 indicate that services do not incur marketing margins in Mozambique and Tanzania. Average margin rates are therefore generally highest for marketed agricultural goods.

absorption before and after the 10 percent real appreciation. The change in this ratio is due entirely to a change in the balance of trade since external factor income flows are kept fixed. From the table, it is clear that initial current account deficits vary widely between sample countries ranging from a 19 percent deficit (Mozambique) to an 18 percent surplus (Venezuela). The table also shows that countries vary widely in the importance of trade. Column 3 in Table 7 presents trade shares (imports+exports/GDP), and they vary from around 15 percent (Argentina and Brazil) to around 85 percent (Costa Rica and Tunisia).

[Table 7 around here]

The sensitivity of the trade deficit to changes in the real exchange rate depends on: (i) initial trade shares, (ii) factor mobility which permits traded sectors to respond to changes in prices, and (iii) the sectoral trade substitution and transformation elasticities which also limit sectoral responses to price changes. The macro level responses presented in Table 7 demonstrate a lot of heterogeneity among sample countries. The countries which show the largest change in the trade deficit (Malawi, Costa Rica, and Tunisia) all have very large trade shares. Similarly, countries with low trade shares (Argentina and Brazil) show little effect. Other countries, including the middle group (Indonesia, Zambia, Tanzania, and Mozambique) show moderately high trade shares due to high levels of import dependence. The essential nature of intermediate and capital goods imports implies that the trade balance is relatively insensitive to real exchange rate appreciation for these countries.

Figure 3 presents the results of the 10 percent appreciation on the ratio of agriculture versus non-agriculture prices shown against the initial structure of agriculture/non-agriculture trade shares. A trade share ratio of one indicates that the initial trade share in agriculture (agricultural imports plus agricultural exports divided by agricultural GDP) is the same as in non-agriculture sectors. An index greater than one indicates a higher trade share for agriculture. The simulation leads to declining agricultural price incentives in seven countries, and improving agricultural price incentives in eight. The first group includes countries with relatively high agricultural trade shares (Malawi, Argentina, Zimbabwe, Costa Rica, and Mexico), in addition to Brazil and Morocco, which have relatively small agricultural trade shares. In contrast, the second group include poorer southern African countries with underdeveloped agricultural (export) sectors (Zambia, Tanzania, and Mozambique), Indonesia with low trade-shares and traditional net-importers of food like Egypt, Morocco, Tunisia, Venezuela, and Korea.

[Figure 3 around here]

Among the group of countries with relatively large agricultural trade shares, agricultural price incentives decline in Malawi, Argentina, and Zimbabwe since reduced terms-of-trade for agricultural exports dominates the combination of (i) reduced terms-of-trade for non-agricultural exports and (ii) reduced protection of import-competing non-agricultural production. Reduced protection of import-competing agricultural products further adds to declining relative agricultural price incentives in Costa Rica and Mexico. Agricultural trade shares are relatively small in Brazil and Morocco. Nevertheless, the exchange rate appreciation leads to lower relative agricultural price incentives in both of these countries, since reduced protection of traded food processing sectors feeds through to agricultural production sectors.

Most of the sample countries with smaller agricultural trade shares are net-importers of agricultural goods. An overvalued exchange rate therefore induces disprotection for import-competing agricultural crops. More importantly, declining terms-of-trade for exports of non-agricultural goods and (tourist) services, and disprotection of import-competing non-agricultural production, feed through to domestic prices because of high non-agricultural trade shares. Agricultural price incentives improve relatively strongly in Tunisia, where non-agricultural trade shares are particularly high. Korea and Venezuela stand out since they are characterized by particularly large agricultural imports. The exchange rate appreciation, nevertheless, improves relative agricultural price incentives by lowering price incentives for exports of manufactured goods in the case of Korea, and oil and gas in the case of Venezuela.

With the exception of Brazil and Morocco, relative agricultural price incentives *decline* in countries which are characterized by having relative agricultural trade shares above one, and *increase* in countries where relative agricultural trade shares are below one. This result illustrates how the impact of exchange rate appreciation on relative price incentives depends crucially on the size of relative trade shares. Nevertheless, the importance of other country-specific characteristics such as marketing margins can also be judged by comparing the results of Tanzania and Mozambique to Zambia. Trade shares are similar, but relative agricultural price incentives increase particularly strongly in Zambia. The reason is that the price of marketing services increases in the two former cases, while it declines in the latter to the benefit of Zambian agriculture.

Summing-up, in the original KSV analysis, the basic presumption was that developing countries had overvalued exchange rates and that this overvaluation led to an incentive bias against agriculture. In the present day world, characterized by structural adjustment programs in many countries, overvaluation is no longer a general phenomenon. In addition, results from the simulations in this paper indicate that overvaluation does not necessarily lead to an incentive bias against agriculture.

5. Conclusion

Empirical studies from the 1980s, using partial equilibrium methodologies, supported the view that policies in many developing countries imparted a major incentive bias against agriculture. Eliminating this bias therefore became one of the goals of policy reform strategies, including structural adjustment programs, supported by the World Bank and others; and many countries undertook such reforms in the 1990s. Relying on new data, this study has taken a general equilibrium approach to analyzing and measuring how indirect taxes and exchange rates affected relative price incentives for agricultural production in a representative sample of 15 developing countries during the 1990s.

Our general equilibrium analysis indicates that the economywide system of indirect taxes, including tariffs and export taxes, significantly discriminated against agriculture in only one country, was largely neutral in five, provided a moderate subsidy to agriculture in four, and strongly favored agriculture in five.

Our sample includes six countries that were also included in a comparative World Bank study led by Krueger, Schiff, and Valdés, (1988): Argentina, Brazil, Egypt, Korea, Morocco, and Zambia. Our results show very limited signs of price incentive bias against agriculture in these countries during the 1990s. While estimated levels of agricultural protection in Brazil and Korea seems to have declined, findings in the Bank studies of strong levels of agricultural bias for Argentina, Egypt, Morocco, and Zambia are not borne out by our analyses. In sum, our results suggest that whatever bias there was to begin with, it was largely eliminated during the 1990s.

Our empirical analysis also indicate that traditional ISI-type policies, including non-agricultural import tariffs, agricultural export taxes, and overvalued exchange rates, can affect relative price incentives in strongly divergent directions, depending on country-specific characteristics. The impact of non-agricultural import tariffs was found to depend strongly on relative agricultural trade shares and the impact of real exchange rate appreciation induced by the introduction of pervasive tariffs.

Our stylized exchange rate simulations tend to reaffirm the conclusion from the World Bank studies that appreciation of the exchange rate, resulting from a current account deficit, can have a strong impact on relative price incentives for tradable goods, including tradable agriculture. Earlier partial equilibrium work, which assumed that agricultural goods were largely tradable, found that overvaluation of the exchange rate would always hurt the agricultural sector. However, in a general equilibrium setting, the impact of changes in the exchange rate on relative agriculture/non-agriculture incentives depends critically on relative trade shares, factor mobility, and sectoral trade elasticities. In our sample, overvaluation of the real exchange rate hurts agriculture relative to non-agriculture in seven countries, while it favors agriculture in eight, with wide variation in the size of the effect.

Our results indicate that the partial-equilibrium measures used in earlier studies are likely to have overstated the bias against agriculture. In particular, our results point to the essential role of country-specific characteristics and the need to take them into account in a general-equilibrium framework when analyzing how tax and exchange rate policies affect relative price incentives for agricultural production.

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Table 1. Sample Country Data					
	SAM Year	# SAM Sectors			GNP per Capita
Country		Agriculture	Non-Agriculture	Factors	(US$)
Mozambique	1995	12	27	4	80
Tanzania	1992	21	34	7*	120
Malawi	1998	7	26	11*	170
Zambia	1995	14	14	10*	400
Zimbabwe	1991	24	12	9*	540
Egypt	1997	13	14	5*	790
Indonesia	1995	5	18	23*	980
Morocco	1994	31	10	14*	1110
Tunisia	1996	2	17	4	1820
Costa Rica	1991	5	17	13	2610
Mexico	1996	57	14	45*	3320
Venezuela	1995	12	40	3	3020
Brazil	1995	36	6	39*	3640
Argentina	1993	13	31	3	8030
Korea	1990	12	28	3	9700

Source: SAM data from Trade and Macroeconomics Division, International Food Policy Research Institute – see specific country references; 1995 GNP per capita data from the World Bank, *World Development Report, 1998.*
* Includes land as a factor.

Table 2. General Characteristics of Country Models

		Composition (percent)				Trade Ratios (percent)	
		VA	X	E	M	E/X	M/Q
Argentina	Agriculture	5.5	4.1	16.6	1.2	14.4	1.7
	Industry	15.3	25.3	66.8	66.7	9.4	13.4
	Services	79.3	70.6	16.6	32.1	0.8	2.1
Brazil	Agriculture	9.5	7.7	5.3	4.4	2.5	2.6
	Industry	26.4	43.6	81.9	80.7	6.9	8.8
	Services	64.1	48.7	12.8	14.9	1.0	1.3
Costa Rica	Agriculture	13.2	16.3	31.8	16.1	45.9	33.7
	Industry	18.5	32.6	37.9	65.9	27.9	44.0
	Services	68.3	51.1	30.3	18.0	13.9	9.9
Egypt	Agriculture	17.7	14.1	0.5	9.5	0.5	9.6
	Industry	24.7	36.9	37.7	77.3	12.9	28.3
	Services	57.6	49.0	61.8	13.2	15.9	4.3
Indonesia	Agriculture	18.4	12.8	2.1	2.9	1.7	2.9
	Industry	30.1	39.9	82.9	78.4	23.2	27.2
	Services	51.4	47.3	15.0	18.8	4.0	5.1
Korea	Agriculture	8.8	5.0	1.6	7.0	4.1	17.7
	Industry	30.1	50.2	79.6	85.3	20.3	23.0
	Services	61.1	44.8	18.8	7.7	5.4	2.3
Malawi	Agriculture	35.9	29.6	68.8	7.8	44.1	10.7
	Industry	16.1	31.4	13.6	65.7	8.2	38.4
	Services	48.0	38.9	17.7	26.5	8.7	15.8
Mexico	Agriculture	6.4	5.3	8.5	6.9	30.3	25.7
	Industry	22.4	38.0	91.5	93.1	45.7	44.6
	Services	71.2	56.7	0.0	0.0	0.0	0.0
Morocco	Agriculture	19.2	13.1	8.1	5.6	7.0	14.3
	Industry	24.3	38.5	51.2	75.7	15.2	29.8
	Services	56.6	48.4	40.8	18.7	9.6	5.6
Mozambique	Agriculture	25.9	16.6	4.9	6.0	2.3	22.2
	Industry	10.4	15.6	43.0	75.7	27.6	67.3
	Services	63.7	67.8	52.1	18.4	9.1	8.4
Tanzania	Agriculture	38.6	27.0	25.6	1.4	4.7	1.4
	Industry	13.3	25.3	30.5	83.5	5.4	44.1
	Services	48.1	47.8	43.9	15.1	5.3	6.1
Tunisia	Agriculture	14.8	9.8	1.2	4.4	1.9	9.6
	Industry	22.4	43.4	67.1	88.2	35.2	45.4
	Services	62.9	46.9	31.7	7.5	16.0	4.5
Venezuela	Agriculture	4.5	4.1	0.4	4.8	1.2	15.3
	Industry	41.4	46.3	93.2	70.1	44.3	29.5
	Services	54.1	49.6	6.5	25.1	3.0	6.5
Zambia	Agriculture	28.5	21.8	6.4	4.6	4.5	8.8
	Industry	29.2	33.6	85.7	73.7	40.3	47.1
	Services	42.3	44.6	7.9	21.8	2.5	10.9
Zimbabwe	Agriculture	15.3	13.6	41.9	0.6	36.1	1.6
	Industry	31.7	36.8	35.5	93.8	11.8	37.3
	Services	53.1	49.6	22.6	5.6	6.6	2.2

NOTE: VA – Value Added, E – Exports, X – Production, M – Imports, Q – Demand.

Table 3. Marketing Margins (Percent)

		MRG	DMRG/DC	EMRG/E	MMRG/M
Indonesia	Agriculture	19.3	13.7	15.1	11.1
	Industry	80.7	14.2	11.5	18.1
Mozambique	Agriculture	23.3	38.3	33.1	24.3
	Industry	76.7	31.6	15.4	23.9
Tanzania	Agriculture	49.9	17.6	15.3	5.7
	Industry	50.1	6.5	23.2	10.7
Tunisia	Agriculture	15.3	9.7	35.1	2.4
	Industry	84.7	10.5	3.5	9.7
Venezuela	Agriculture	20.3	37.2	43.3	38.5
	Industry	79.7	21.4	3.8	25.6
Zambia	Agriculture	16.2	17.3	22.8	15.3
	Industry	68.4	19.7	20.7	16.1
	Services	15.4	4.9	29.5	0.0
Zimbabwe	Agriculture	20.4	15.7	19.6	13.4
	Industry	79.6	15.0	16.2	15.2

NOTE: MRG – Total Marketing Margins, DC – Domestically Marketed Production, E – Exports, M – Imports, DMRG – Domestic Marketing Margins, EMRG – Export Marketing Margins, MMRG – Import Marketing Margins.

Table 4. Tax and Tariff Rates (Percent)

		TA	TQ	TE	TM
Argentina	agriculture	0.4	1.1	-	7.4
	industry	2.4	2.6	-	16.0
	services	0.4	3.2	-	2.8
Brazil	agriculture	2.7	-	-	5.9
	industry	6.6	-	-	12.1
	services	8.4	-	-	-
Costa Rica	agriculture	1.0	1.8	0.2	7.3
	industry	1.0	4.4	-2.2	8.1
	services	1.7	2.5	0.8	3.6
Egypt	agriculture	0.0	1.8	-	10.9
	industry	0.7	0.7	-	15.6
	services	0.5	2.2	-	-
Indonesia	agriculture	-	0.7	-	2.6
	industry	-	2.5	-	7.1
	services	-	2.4	-	0.3
Korea	agriculture	-4.9	-	-	13.9
	industry	4.2	-	-	9.0
	services	3.9	-	-	0.3
Malawi	agriculture	-	0.9	0.5	1.4
	industry	-	7.3	-	8.8
	services	-	-	-	-
Mexico	agriculture	-0.1	0.2	-	1.2
	industry	1.8	1.3	-	2.1
	services	2.2	0.8	-	-
Morocco	agriculture	-	-	-	159.8
	industry	1.1	3.7	-	31.6
	services	2.2	0.1	-	-
Mozambique	agriculture	-0.4	2.7	0.0	4.8
	industry	-0.1	5.3	0.0	8.9
	services	-0.1	1.3	-	-
Tanzania	agriculture	0.8	0.2	-	7.2
	industry	2.0	3.2	-	5.0
	services	0.5	0.1	-	-
Tunisia	agriculture	1.0	-3.6	-	2.5
	industry	0.8	6.5	-	9.3
	services	-0.8	1.7	-	-
Venezuela	agriculture	0.0	-	-	12.0
	industry	0.8	3.8	-	9.1
	services	0.7	1.8	-	-
Zambia	agriculture	0.6	0.1	-	7.4
	industry	4.2	1.9	-	13.5
	services	1.0	1.2	-	13.1
Zimbabwe	agriculture	3.3	-	-	20.2
	industry	2.9	-	-	23.8
	services	3.1	-	-	11.4

NOTE: Average tax rates in percent for Production (TA), Consumption (TQ), Exports (TE), and Imports (TM).

Table 5. Import Tariffs and Nominal Protection Rates (Percent)

	Import Tariff Rate, SAM Data			1960-84 NPR		
	Agriculture	Non-Ag.	Difference	Direct	Indirect	Total
Argentina	7.4	11.7	-4.3	-17.8	-21.3	-39.1
Brazil	5.9	10.3	-4.3	10.1	-18.4	-8.3
Egypt	10.9	13.3	-2.4	-24.8	-19.6	-44.4
Korea	13.9	8.3	5.6	39.0	-25.8	13.2
Morocco	159.8	25.3	134.5	-15.0	-17.4	-32.4
Zambia	7.4	13.4	-6.0	-16.4	-29.9	-46.3

Source: Import Tariff Rates from own calculations; 1960-84 NPRs from Table 2-1 in Schiff and Valdés (1992).

Table 6. Indirect Tax Simulations
(Relative Agricultural Value Added Prices)

	Base Run (INDEX)	Sim. 1 (TA)	Sim. 2 (TQ)	Sim. 3 (TE)	Sim. 4 (TM)
Malawi	100.0	100.0	107.0	107.4	108.5
Argentina	100.0	99.6	98.8	98.8	102.4
Zimbabwe	100.0	98.5	98.5	98.5	102.4
Brazil	100.0	99.3	99.3	99.3	100.3
Costa Rica	100.0	97.7	96.9	92.0	97.1
Mexico	100.0	95.2	94.2	94.2	94.0
Indonesia	100.0	100.0	99.2	99.2	97.1
Zambia	100.0	96.2	95.7	95.7	94.0
Tanzania	100.0	97.1	94.5	94.5	92.4
Mozambique	100.0	99.6	92.4	92.4	87.4
Venezuela	100.0	99.3	95.3	95.3	93.0
Egypt	100.0	99.1	94.3	94.3	89.4
Tunisia	100.0	99.4	92.5	92.5	86.9
Korea	100.0	85.6	85.6	85.6	82.8
Morocco	100.0	93.6	90.0	90.0	67.6

NOTE: The elimination of indirect taxes is measured additively. Simulation 1 represents the elimination of taxes on Production (TA), while Simulation 4 represents the elimination of all taxes on Production (TA), Consumption (TQ), Exports (TE), and Imports (TM).

Table 7. Exchange Rate Simulations (%)

	Current Account Deficit as Percent of Absorption			Trade Share
	Column 1 Base Run	Column 2 10 % Appreciation	Column 3 Change	Column 4 (imports + exports)/GDP
Malawi	11.6	20.3	8.7	75.8
Argentina	2.7	3.8	1.1	13.5
Zimbabwe	5.1	8.7	3.6	51.1
Brazil	2.4	3.3	0.8	15.4
Costa Rica	4.9	12.2	7.3	85.1
Mexico	3.5	8.7	5.1	63.6
Indonesia	8.5	10.8	2.3	45.9
Zambia	14.4	16.6	2.2	70.8
Tanzania	9.1	11.3	2.2	46.4
Mozambique	18.9	20.3	1.4	67.7
Venezuela	-18.0	-11.6	6.4	56.5
Egypt	-2.9	0.4	3.3	45.5
Tunisia	2.5	10.6	8.1	85.6
Korea	0.0	4.9	4.9	58.7
Morocco	2.3	6.1	3.8	56.2

Figure 1. Tax and Tariff Experiments,
Relative Value Added (VA) Prices for Selected Countries

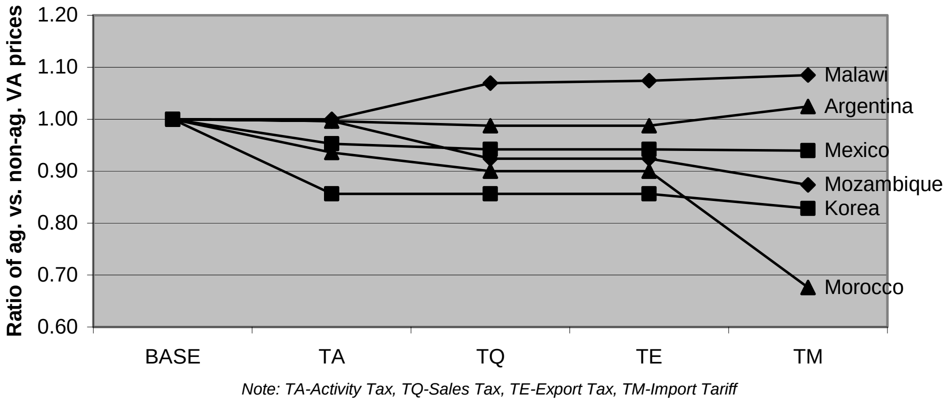
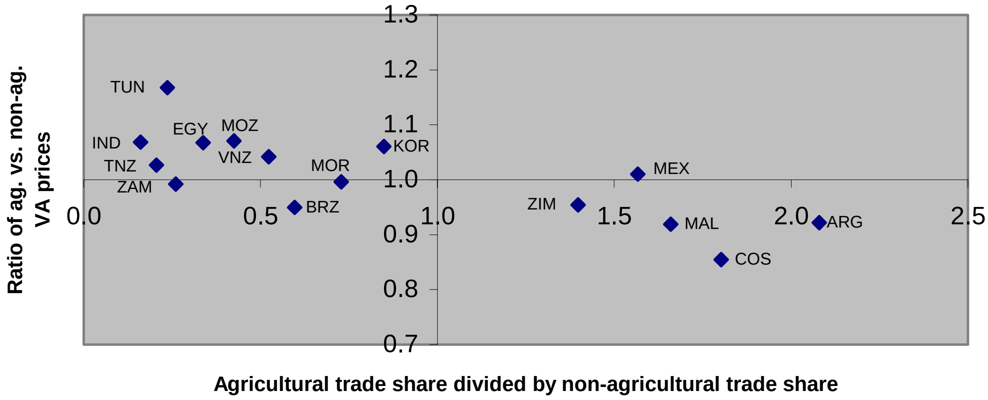
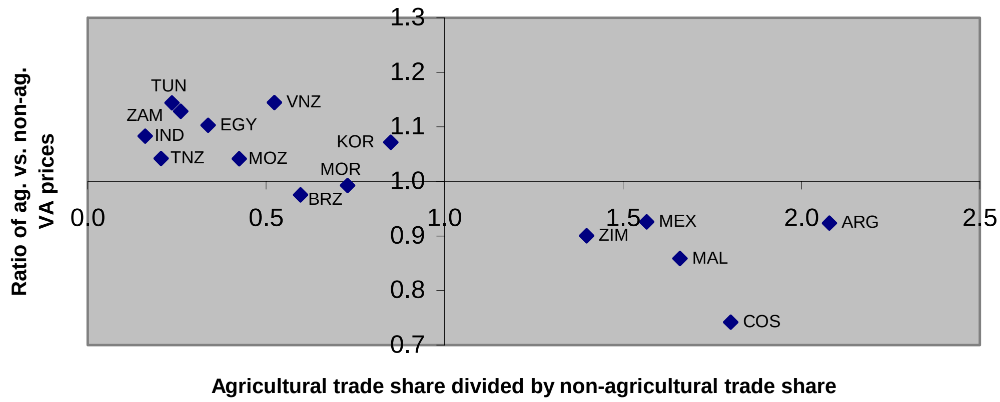


Figure 2. Stylized Import Tariff Experiments,
Relative Trade Shares and Value Added (VA) Prices



Note: The figure maps results from the 25 percent non-agricultural import tariff simulations

Figure 3. Stylized Exchange Rate Experiments
Relative Trade Shares and Value Added Prices.



Note: The figure maps results from the 10 percent exchange rate appreciation simulations