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Measuring Agricultural Policy Bias:
General Equilibrium Analysis of Fifteen Developing Countries

Henning Tarp Jensen, Sherman Robinson and Finn Tarp

Abstract

The measurement issue is the key issue in the literature on trade policy-induced agricultural price incentive bias. This paper introduces a general equilibrium effective rate of protection (GE-ERP) measure, which extends and generalizes earlier partial equilibrium nominal protection measures. For the 15 sample countries, the results indicate that the agricultural price incentive bias, which was generally perceived to exist during the 1980s, was largely eliminated during the 1990s. The results also demonstrate that general equilibrium effects and country-specific characteristics – including trade shares and intersectoral linkages – are crucial for determining the sign and magnitude of trade policy bias. The GE-ERP measure is therefore uniquely suited to capture the full impact of trade policies on agricultural price incentives. A Monte Carlo procedure confirms that the results are robust with respect to tradability assumptions. JEL codes: D58, O10, Q18.

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1. Introduction

"Getting prices right" was a rallying call when developing countries started reorienting their economic policies in the early 1980s. Trade and macroeconomic policies were generally perceived to favor urban industry over agricultural production. 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 general direction of Anne O. Krueger (Krueger, Schiff, and Valdés, 1988; Krueger, 1992; Schiff and Valdés, 1992; and Bautista and Valdés, 1993).[1] The country-studies relied on partial equilibrium analysis and measures of nominal protection rates (NPRs), with little attention to intersectoral linkages, degrees of tradability, and feedback effects from changes in incomes and relative prices. Based on data from the early 1960s to the mid-1980s, they concluded that reductions in trade distortions, in many developing countries, would reduce the incentive bias against agriculture, improve agricultural performance, increase export earnings, and contribute to economic growth. This line of reasoning has continued to play an influential role in the thinking about the way in which economic policy affects incentives and economic growth in developing countries (Krueger, 1998; Srinivasan and Bhagwati, 2001).

More recently, issues such as food security and rural development have been raised in WTO and regional trade negotiations. This shift has lead to a renewed interest in measuring price incentives and policy bias in agriculture (Anderson, 2007). Relative price incentives and policy bias are inherently general equilibrium issues. The adoption of a general equilibrium methodology to measure policy-induced incentive bias has been facilitated, over the past decade, by the increased availability of economy-wide data sets in the form of Social Accounting Matrices (SAMs). The Global Trade Analysis Project (GTAP) at Purdue University has e.g. developed a large scale trade-focused SAM data base to support the use of Computable General Equilibrium (CGE) models for global trade policy analysis. World Bank researchers have recently used the GTAP data base to revisit the issue of whether there exists a trade policy bias against poor agricultural farm households in developing countries. In a number of papers, Anderson et al. (2005, 2006a, 2006b) employ the dynamically recursive global computable general equilibrium LINKAGE model to study the effects of trade liberalization on developing countries. They find that "developing country agricultural production, employment and real net income would increase" with trade liberaliza-

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[1] This discussion formed part of a broader debate about development strategy and "urban bias". The existence of a pro-urban, anti-agricultural bias had been widely accepted since the seminal contribution by Lipton (1977).

tion. In addition, they hypothesize that “individual model simulations … may well get that result also” (Anderson et al., 2006a).[2]

To complement their global analyses, a new World Bank project on Distortions to Agricultural Incentives, under the direction of Kym Anderson, is revisiting the debate about agricultural price incentives through country case studies. This project aims at exploring (i) the extent of price distortions, (ii) the causes of underlying policy choices, and (iii) the consequences of resulting price distortions. The methodology is similar in spirit to Krueger’s project from the 1980s, but will extend that analysis to a wider set of less developed and transition economies (48 country studies). While the country studies rely on partial equilibrium analyses and nominal protection measures, they will be accompanied by “a CGE-based empirical analysis … to get a better global picture” as noted by Anderson (2007). The World Bank researchers have, in their previous CGE-based studies, focused on dynamically recursive analyses of welfare effects. This type of dynamic policy impact analysis is common in the CGE literature. However, it does not provide a clean measure of policy bias.

In contrast, the current study will employ a static single-country CGE model methodology, which will allow for clean measurement of policy-induced price incentive bias. The single-country CGE model methodology allows for tailoring models to incorporate the full range of country-specific distorting taxes and subsidies on both traded and non-traded goods. In addition, the methodology makes it possible to take account of intersectoral linkages, varying degrees of tradability, and feedback effects from relative price changes in the measurement of policy bias. As a consequence, the methodology allows us to move beyond the calculation of nominal protection rates, and calculate a general equilibrium based effective rate of protection (GE-ERP) measure. With the current study, we aim to clarify how the choice of methodology and protection measure affects the measurement of trade policy-induced price incentive bias. The results indicate that the use of partial equilibrium based nominal protection measures is problematic. Accounting for intersectoral linkages and general equilibrium effects turns out to be crucial for measuring the size and sign of the policy bias. It follows that a general equilibrium based effective protection measure is necessary to capture the full extent of policy bias.

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[2] The World Bank researchers also note that that “terms of trade effects of reforms by others are usually dominated by efficiency gains from own reforms except for the least-protected economies” (Anderson et al.; 2006b). This implies that changes in foreign tariffs and relative world market prices are of secondary importance, and casts doubt on the necessity of using a global CGE model.

Our analytical approach is to develop and apply static single-country CGE models, in order to derive GE-ERP measures of trade policy-induced agricultural price incentives. The CGE model framework will be used as a measuring device rather than a tool for policy analysis. We apply the methodology to our sample of 15 developing countries, with the aim to study (1) the historical variation of protection rates which arise from existing trade policy distortions, and (2) the experimental variation in protection rates which arises from imposing standard trade policy distortions on non-distorted base economies. A Monte Carlo procedure, based on variation in trade elasticities, is employed to provide a robustness check on the results. Further background on protection measures and modeling methodology is presented in Section 2; country models and data sets are summarized in Section 3; results of the various simulations and robustness checks are reviewed in Section 4; and conclusions are offered in Section 5.

2. Measuring Policy Incentive Bias

2.1. Partial Equilibrium Measures

To quantify the impact of trade policy regimes on relative agricultural price incentives, the original World Bank project from the late 1980s studied a representative group of 18 developing countries.[3] 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. Indirect policy measures were defined as economy-wide measures affecting the difference between relative agricultural producer and border prices, and can be classified under two main headings: (i) industrial protection policies, and (ii) overvaluation of the exchange rate. Industrial protection measures include 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, plus the exchange rate impact of other trade policy interventions.

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

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. 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. They concluded that nominal protection was negative for all types of (traded) agricultural goods. 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. Their results were qualitatively similar to those of KSV.

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 or of any qualitative differences from world market goods. Moreover, 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 takes distortions in input prices into account. However, "Due mainly to data inadequacy…" their study contains no results on ERPs.

The methodology of the new World Bank project on Distortions to Agricultural Incentives is in line with the KSV and SV studies. Accordingly, the outline of the new project states that "The empirical estimates will build on the pioneering work to the mid-1980s by Krueger, Schiff and Valdes … although the methodology will differ a little…" (Anderson et al., 2008). The new project relies on the Relative Rate of Assistance (RRA) measure. The RRA measure is similar to the NPR measure in the sense that both measures are nominal protection measures.[4] The new World Bank project also inherits the partial equilibrium methodology of the KSV and SV studies. The World Bank researchers do acknowledge the need to account for general equilibrium effects in the measurement of the full impact of trade distortions. Nevertheless, they

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[4] Moreover, the RRA and NPR measures are both indicators of relative agricultural vs. non-agricultural price incentives, and both measures focus on the relative difference between domestic and border prices.

explain that the reason for the exclusion of so-called “flow-on consequences” is that “if the direct distortions are accurately estimated, they can be incorporated into an appropriate country or global economy-wide computable general equilibrium (CGE) model which in turn will be able to capture the full general equilibrium impacts … of the various direct distortions …” (Anderson et al., 2008). Accordingly, the new World Bank project does not aim to measure the full extent of trade distortions and policy bias.

2.2. General Equilibrium Measures

Past and current World Bank projects have employed a partial equilibrium methodology for estimating nominal agricultural protection measures based on relative output prices. In contrast, we employ a general equilibrium methodology for estimating effective protection measures based on relative factor returns. The general equilibrium methodology allows us to measure the full extent of policy bias, by capturing both direct and indirect consequences of trade distortions. Specifically, our focus on relative factor returns allows us to account for changes in intermediate input prices, which may well affect relative agricultural price incentives. Accordingly, our methodology allows us to employ a, theoretically, appropriate general equilibrium version of the classical effective rate of protection measure (GE-ERP).[5]

Our approach is methodologically in line with the static, single-country, CGE model methodology, proposed by Jensen, Robinson and Tarp (2002) and Bautista, Robinson, Wobst, and Tarp (2001). The implementation of the methodology is based on a “standard” trade-focused Computable General Equilibrium model (Lofgren et al., 2002).[6] The model is neoclassical in spirit. It is based on profit- and utility-maximizing individuals, and competitive product and factor markets are cleared by flexible prices and factor returns. The extreme dichotomy between tradable and non-tradable goods, which is present in the partial equilibrium approach, is softened by assuming varying degrees of tradability. This provides a realistic link between world market prices and domestic prices of traded goods.

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[5] De Melo and Robinson (1981) and Devarajan and Sussangkarn (1992) describe the use of CGE models to measure the effective rate of protection and compare them to partial equilibrium measures.

[6] 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). Full details on the current modeling methodology can be found in an early working paper version of the current paper (Jensen, Robinson and Tarp, 2002).

To measure the agricultural policy bias, the CGE model is used to simulate the *removal* of *historical* trade policy distortions in section 4.1, and the *imposition* of *experimental* trade policy distortions in section 4.2. If the removal/imposition of a policy distortion yields a new equilibrium in which the agricultural sector is "better off"/"worse off", the policy distortion is said to generate a bias against agriculture. How to measure "better off" is an important issue. The classical choice is to use the nominal agricultural value added share as a measure of agricultural policy bias. An increase in the agricultural value added share can arise from two sources: (1) an increase in factor use in agriculture relative to non-agriculture, and/or (2) an improvement of factor returns in agriculture relative to non-agriculture. The removal of policy distortions will, typically, lead to changes in both prices and quantities. Under such circumstances, it is not appropriate to measure agricultural policy bias in terms of a relative price index.

The traditional partial equilibrium NPR and ERP measures, which focus, purely, on changes in relative prices, abstract from the quantity effects of policy changes, including shifts in employment, production, and trade. In particular, no attempt is made to measure the 'price adjustment'-equivalent of the quantity impact of trade distortions. In order to ensure that our general equilibrium effective rate of protection (GE-ERP) measure is an appropriate measure of policy bias (and, at the same time, remains comparable to the partial equilibrium measures), we segment the factor markets in our country models so that factors are allowed to move freely within agricultural and non-agricultural sector groups, but not to move between them. By restricting factor mobility in this way, agricultural supply response will be limited and adjustment in nominal value added shares will be fully reflected in equilibrium prices. With restricted factor mobility, our general equilibrium GE-ERP measure will, therefore, provide a theoretically appropriate measure of agricultural policy bias.

The current methodology aims to use the CGE model as a measuring instrument rather than as a tool for policy analysis. The result is not a "realistic" model, but a model that generates a benchmark general equilibrium measure of trade policy-induced incentive effects. The data sets underlying each of the country models, accurately reflects the economic environment of the specific country, but the behaviour of agents and markets is restricted to provide a policy bias measure that reflects the full extent of agricultural policy bias in relative equilibrium prices.

Our measurement methodology focuses on relative price incentives. In this way, it differs from previous CGE-based studies by World Bank researchers (Anderson et al., 2005, 2006a, 2006b). They rely on the dynamic global LINKAGE model framework to measure the welfare impact of trade distortions, arguing that the welfare changes reflect long-term efficiency gains. However, it is unclear to what extent these "efficiency gains" are due to static welfare gains from changes in relative price incentives, and/or to dynamic welfare gains arising from increased capital accumulation due to tax-reform induced income re-distribution between agents with different propensities to save.[7]

The analyses of the GE-ERP measure (section 4) will focus on key structural determinants, including relative trade shares and intersectoral linkages, and key general equilibrium effects including (i) trade policy-induced exchange rate adjustment, and (ii) trade policy and exchange rate induced adjustment in relative input costs (the input cost channel) and marketing margins (the marketing cost channel). We evaluate the input cost channel by comparing our GE-ERP measure to a general equilibrium version of the nominal protection rate (GE-NPR) measure.[8] This comparison also allows us to evaluate the sensitivity of our results to the choice of protection measure.

Finally, our experimental analyses of imposed trade distortions (section 4.2) start from a set of simulations, which defines distortion free base economies for our 15 sample countries. This includes the elimination of indirect taxes and current account imbalances. The counterfactual measurement of policy bias, on the basis of distortion free base economies, is important, since it allows for the elimination of sample variation in trade distortions. Accordingly, this allows us to focus on the importance of country-specific characteristics for the determination of the GE-ERP policy bias measure.

3. Country Models and Data Sets

The "standard" trade-focused CGE model framework (see Section 2.2) is used to calibrate country-specific models for each of the 15 sample countries, listed in Table 1. The applications are, necessarily, somewhat stylized to achieve comparability, neglecting country-specific institutional details while capturing country-specific differ-

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[7] Tax reforms may also be associated with long-lived transitory welfare losses. For an example of transitory welfare losses associated with labor market tax reform in labor-exporting Middle Eastern and Northern African countries, see Agénor, Nabli, Yousef and Jensen (2007).

[8] The GE-NPR measure is defined in terms of relative output prices.

ences in economic structure.[9] The country models are calibrated on the basis of Social Accounting Matrix (SAM) data sets. 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 is 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 with the sample from the Krueger project, and 11 countries with the sample from the Anderson project.

Tabel 1. Sample Country Data

Country	SAM Year	SAM Sectors: Agriculture	SAM Sectors: Non-Agriculture	SAM Sectors: Factors	SAM Sectors: Marketing Margins	GNP per Capita (US$)
Mozambique	1995	12	27	4	3	80
Tanzania	1992	21	34	7*	3	120
Malawi	1998	7	26	11*	0	170
Zambia	1995	14	14	10*	3	400
Zimbabwe	1991	24	12	9*	3	540
Egypt	1997	13	14	5*	0	790
Indonesia	1995	5	18	23*	3	980
Morocco	1994	31	10	14*	0	1110
Tunisia	1996	2	17	4	3	1820
Costa Rica	1991	5	17	13	0	2610
Mexico	1996	57	14	45*	0	3320
Venezuela	1995	12	40	3	3	3020
Brazil	1995	36	6	39*	0	3640
Argentina	1993	13	31	3	0	8030
Korea	1990	12	28	3	0	9700

Source: SAM data from Trade and Macroeconomics Division, International Food Policy Research Institute – see references in Jensen, Robinson & Tarp (2002); 1995 GNP per capita data from *World Development Report, 1998.*
* Includes land as a factor.

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 differences can be gauged from Table 1. All data sets account separately for value added by labor and capital. In addition, nine out of 15 sample data sets include land as an agriculture-specific production factor. Nevertheless, in order for our country models to provide a

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[9] For further details on data sets and country models, including references to CGE-based case studies for the 15 sample countries, see Jensen, Robinson and Tarp (2002).

theoretically appropriate measure of agricultural policy bias (see Section 2.2), capital was disaggregated into agricultural and non-agricultural capital so as to create agriculture-specific production factors in all country models.[10]

The economic structure of the 15 country models is presented in Table 2. They 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 middle- and high-income countries like Argentina, Brazil, Korea, Mexico, and Venezuela have relatively small agricultural sectors. Nevertheless, relative trade shares turn out to be more important for the transmission of trade distortions to relative domestic prices. Table 2 indicates that agricultural export shares are higher than non-agricultural export shares in only five sample countries including Argentina, Costa Rica, Malawi, Mexico, and Zimbabwe.

Most developing countries show structural differences between marketing margins for agricultural and non-agricultural products. This has important implications for the measurement of policy-induced agricultural bias. Seven of the country data sets, including Indonesia, Mozambique, Tanzania, Tunesia, Venezuela, Zambia and Zimbabwe account for marketing margins. In general, services do not incur marketing costs. This means that domestic non-agricultural marketing costs are relatively low on average. At the same time, small service imports, generally, means that average non-agricultural marketing costs for imports are relatively high. The structure of marketing margin rates, therefore, 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 reduce agricultural protection due to relatively high agricultural domestic margin rates. In this way, marketing margins provides an important example of how intersectoral linkages may affect the determination of agricultural policy bias.

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[10] Capital was disaggregated into agricultural and non-agricultural capital in all country models, while labour remains mobile between sectors in most of the country models.

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.

Turning to the structure of indirect taxes and tariffs, export taxes are virtually non-existent while import tariff rates, generally, vary in the range between 0-25 percent. Industrial tariff rates are higher than agricultural tariff rates, with a few major exceptions (Korea, Morocco, and Venezuela). Furthermore, tariff rates are, generally, higher than domestic indirect tax rates. Production taxes do not, consistently, favor any particular sector, while consumption taxes, generally, are lower for agricultural goods.

4. Simulation Results

This section presents two sets of simulations where we apply our country-specific CGE models to derive general equilibrium effective rate of protection (GE-ERP) measures of agricultural policy bias. In section 4.1, we measure the historical variation of protection rates which arise from existing price distortions, including indirect tax and tariff structures. Subsequently, in Section 4.2, we measure the experimental variation in protection rates which arises from imposing standard trade distortions, including non-agricultural import tariffs and overvalued exchange rates, on non-distorted base economies.[11]

All simulations are carried out using a balanced 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 key issues of modeling methodology, tradability assumptions, country-specific characteristics, and the choice of protection measure. To keep investment fixed as a share of nominal absorption, household savings rates are assumed to vary proportionately. Furthermore, in line with the public finance literature, all simulations are carried out using a revenue-neutral specification of the government budget. In order to fix government revenue, household tax rates are allowed to vary proportionately. The factor market closure specifies full employment of available factor supplies. Finally, all simulations are carried out using a flexible real exchange rate and fixed foreign savings inflows, except for the experimental exchange rate simulations in Section 4.2.2, where the impact of a pre-set level of exchange rate appreciation is analyzed.

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[11] The choice of trade distortions is motivated by traditional Import Substitution Industrialization (ISI) strategies, and they are specified along the lines of the single country-studies in Jensen and Tarp (2002) and Bautista et al. (2001). For an extended analysis including experimental simulations of agricultural export taxes, see Jensen, Robinson & Tarp (2002).

Imperfect tradability is a key feature of the trade-focused CGE model framework employed in this study. The specification of trade elasticities is, therefore, a central feature of the model specification. In order to increase comparability among country models, similar agricultural and non-agricultural trade elasticity levels are imposed on all country models. Furthermore, in order to increase comparability with historical partial equilibrium studies, we impose a relatively high agricultural trade elasticity (1.8) and a relatively low non-agricultural trade elasticity (0.6). Monte Carlo simulations are undertaken in Section 4.2, to investigate the robustness of the GE-ERP effective protection measure with respect to variation in relative trade elasticity levels.[12]

4.1. Historical Variation in Policy Bias during the 1990s

The first set of simulations is used to measure the historical variation of agricultural bias which arise from existing trade distortions, including indirect tax and tariff structures, in our SAM data sets from the 1990s. The indirect tax and tariff simulations include a base run and four alternative simulations to measure the cumulative impact of eliminating production taxes (TA), consumption taxes (TQ), export taxes (TE), and import tariffs (TM). Results for our GE-ERP protection measure are presented in Table 3.[13]

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

At one extreme, Malawi is the only sample country where indirect taxes and tariffs discriminated, significantly, against agriculture. Malawi is a small, poor, densely populated country where consumption taxes, derived from processed food, account for the major share of domestic indirect tax revenues. Table 3 indicates that these consumption taxes represent the main source of bias against agriculture in Malawi. Furthermore, the effective protection index (GE-ERP = 107.2) is higher than the nominal index (GE-NPR = 105.5). Hence, Malawi is the only sample country where the input cost channel works in favor of the non-agricultural sector.

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[12] To save space, we only report results from the Monte Carlo simulations based on non-agricultural tariff experiments.

[13] In table 5, countries are grouped according to structural characteristics discussed below.

Table 3. Relative Agricultural Protection (GE-ERP) in the 1990s (Historical Indirect Tax Simulations)

	Base Run (INDEX)	Sim. 1 (TA)	Sim. 2 (TQ)	Sim. 3 (TE)	Sim. 4 (TM)
Malawi	100.0	100.0	106.3	106.5	107.2
Zimbabwe	100.0	99.2	99.2	99.2	104.2
Argentina	100.0	99.6	98.8	98.8	102.0
Brazil	100.0	97.0	97.0	97.0	98.0
Costa Rica	100.0	97.7	96.0	91.2	96.6
Mexico	100.0	95.4	94.4	94.4	94.3
Indonesia	100.0	100.0	98.9	98.9	97.0
Tanzania	100.0	97.5	94.3	94.3	92.6
Zambia	100.0	96.5	94.5	94.5	92.4
Mozambique	100.0	99.7	92.1	92.1	88.0
Egypt	100.0	99.1	95.5	95.5	91.6
Venezuela	100.0	98.9	93.6	93.6	90.9
Tunisia	100.0	99.7	93.2	93.2	89.1
Korea	100.0	84.7	84.7	84.7	82.2
Morocco	100.0	93.9	90.7	90.7	78.4

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).

At the other extreme, Morocco is the sample country where indirect taxes and tariffs discriminated, most strongly, in favor of agriculture. Table 3 demonstrates that the entire Moroccan tax structure, including production and consumption taxes, but especially import tariffs, contributes to biasing price incentives in favor of agricultural production. A highly dispersed tariff structure with high import tariffs on both agricultural imports, e.g. wheat and livestock, and manufactured imports, is protecting agricultural production and taxing manufacturing sectors by increasing their input costs. Incidentally, Morocco is the sample country (together with Korea) where the input cost channel works most strongly in favor of the agricultural sector.[14]

Among the remaining 13 countries, three groups with broadly similar characteristics can be outlined. The first group (Argentina, Brazil, Costa Rica, and Zimbabwe) has indirect tax structures that are relatively neutral with respect to relative price incentives. Argentina and Brazil are upper middle-income countries with developed and competitive agricultural sectors, specialized in livestock and cash crops, while the

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[14] Nominal and effective protection index measurements for Morocco (GE-ERP = 78.4; GE-NPR = 92.6) and Korea (GE-ERP = 82.2; GE-NPR = 99.4) indicates that the input cost structure strongly reinforces effective agricultural protection in these countries.

other two, Zimbabwe and Costa Rica, have competitive agricultural export sectors based on large-scale commercial farming 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. In general, domestic indirect taxes tend to support relative agricultural price incentives, while import tariffs tend to protect non-agricultural production among this group of countries.

Brazil represents a special case, since the effective protection index (GE-ERP = 98.0) and the nominal index (GE-NPR = 105.4) suggest different signs for the policy-induced price incentive bias. The elimination of production taxes, by itself, yields an effective protection index of GE-ERP = 97.0 and a nominal index of GE-NPR = 104.7. It follows that the Brazilian (production) tax structure at the same time creates *nominal* protection for the *non-agricultural* sector, and *effective* protection for the *agricultural* sector. This result demonstrates that the input cost channel plays a key role in measuring the size – and potentially the sign – of policy-induced price incentive bias, and it highlights that the choice of protection measure is not irrelevant.

The second group of countries consists of Indonesia and three poorer southern African countries, including Mozambique, Tanzania, and Zambia. They can be characterized as low-income countries with relatively large and underdeveloped agricultural sectors. Trade in agricultural goods is generally low. As a consequence, taxation of non-agricultural production and imports is the only viable means of raising indirect tax revenue in these countries. 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. Table 3 demonstrates that the tax structure of these countries tends to discriminate against non-agricultural production at all levels. The implicit level of agricultural protection ranges from three percent in Indonesia, to 7-12 percent in the three southern African countries.

The third group of countries, including Egypt, Venezuela, Tunisia, and Korea are, like Morocco, characterized by relatively small agricultural sectors that are insufficient to feed their populations. In order to maintain some level of self-sufficiency, these countries tend to impose tax-structures that favor agricultural production. 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). The overall level of agricultural protection varies from nine percent in Venezuela and 18 percent in Korea, to between 8 and 32 percent in the northern African group of countries.

Finally, Mexico stands out as the country where import tariffs have the smallest effect 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 policy bias 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, there are little signs of indirect tax and tariff policy induced agricultural bias among our sample countries. This indicates that the historical trade policy bias against agriculture was largely eliminated during the 1990s.[15] The results also indicate that the input cost channel work in favor of the agricultural sector in all countries (except Malawi), and that it may account for more than 90 percent of total effective protection (e.g. Korea). It follows that the use of nominal protection measurements would seriously underestimate actual effective rates of protection, and in one case (Brazil) lead to a spurious bias against the agricultural sector.

4.2. Experimental Variation in Policy Bias

In this section, we measure the experimental variation in policy bias by imposing standard trade distortions, including non-agricultural import tariffs and overvalued exchange rates, on non-distorted base economies. As explained in section 2.2, the use of non-distorted base economies eliminates the sample variation in trade distortions, and, focuses attention on the importance of country-specific characteristics for the determination of the GE-ERP policy bias measure. We investigate the impact of a uniform 25 percent non-agricultural import tariff in section 4.2.1, and the impact of a 10 percent exchange rate appreciation in section 4.2.2. Furthermore, we apply a Monte

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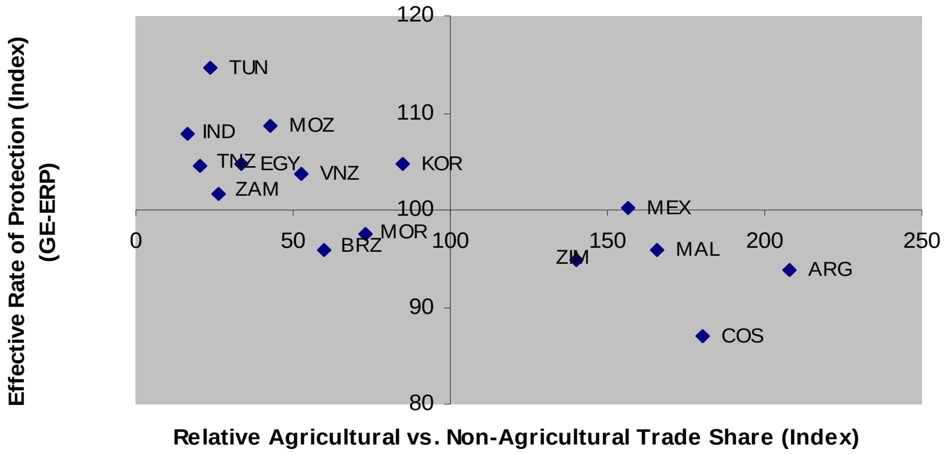
[15] An empirical analysis of exchange rate overvaluation (not shown) is necessary to fully capture the direction and extent of the price incentive bias in our sample countries. The precise definition and measurement of a sustainable external deficit is a contentious issue. However, regardless of the choice of sustainable upper bound for the external deficit, most countries in our sample show no signs of agricultural bias in the 1990s. For further details, see Jensen, Robinson and Tarp (2002).

Carlo procedure in section 4.2.3, to investigate the robustness of our results with respect to underlying tradability assumptions.

4.2.1. Non-Agricultural Import Tariffs

The first policy simulation is a uniform 25 percent tariff on non-agricultural imports. The results for the 15 sample countries are presented in Figure 1, and they indicate that non-agricultural import tariffs, on balance, tend to increase the GE-ERP measure of agricultural protection. This result may seem counter-intuitive at first sight. Nevertheless, it is an indication that strong general equilibrium effects reverse the partial equilibrium based nominal protection impact of non-agricultural import tariffs. Key general equilibrium effects include (i) tariff-induced exchange rate adjustment, and (ii) tariff and exchange rate induced adjustment in relative input cost structures and marketing margins.

Figure 1. GE-ERP and Relative Trade Shares (25 Percent Non-Agricultural Import Tariff Experiments)



Note: Results based on uniform trade elasticities - (Agriculture, Non-Agriculture) = (18, 0.6)

While the uniform non-agricultural import tariff, on balance, tends to increase agricultural protection, the individual country impact varies between 15 percent *agricultural* protection (Tunisia), and 13 percent *non-agricultural* protection (Costa Rica). Two main groups of countries may be identified. The first group, including Argentina, Costa Rica, Malawi, and Zimbabwe, consists of countries with *high* relative agricultural trade shares where agricultural protection *declines*. The second group, including Egypt, Indonesia, Korea Mozambique, Tanzania, Tunisia, Venezuela, and Zambia, consists of countries with *low* relative agricultural trade shares where agricultural protection *increases*. Three countries, including Brazil, Mexico, and Morocco, fall outside the two main groups.

The characteristics of the two main groups demonstrate that the GE-ERP impact is negatively related to the relative agricultural trade share.[16] 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 that are traded most intensely. The real exchange rate appreciates by 4-10 percent in all cases, but leads to very different results in the two main groups. In the group with high relative agricultural trade shares, the tariff protection induces an average 7.7 percent exchange rate appreciation, and this contributes to an average 7.1 percent *decline* in effective agricultural protection. In the group with low relative agricultural trade shares, an average 6.1 percent exchange rate appreciation contributes to an average 5.6 percent *increase* in effective agricultural protection. These results indicate that general equilibrium effects, in the form of tariff-induced exchange rate adjustment, play a crucial role for measuring the relative size and sign of the trade policy bias for individual sample countries.

The importance of intersectoral linkages can be evaluated by comparing the GE-ERP results in Figure 1 with the GE-NPR results in Figure 2. The results demonstrate that the input cost channel is very important in the transmission of non-agricultural import tariffs. The GE-NPR measure, generally, underestimates effective *agricultural* protection among countries with *low* relative agricultural trade shares (avg. GE-NPR=1.5 percent; avg. GE-ERP = 5.6 percent), while it underestimates effective *non-agricultural* protection among countries with *high* relative agricultural trade shares (avg. GE-NPR=-5.0 percent; avg. GE-ERP=-7.1 percent). It follows that the input cost channel accounts for an average 4.1 percentage points (or 73 percent) of effective agricultural protection among countries with low relative agricultural trade shares,

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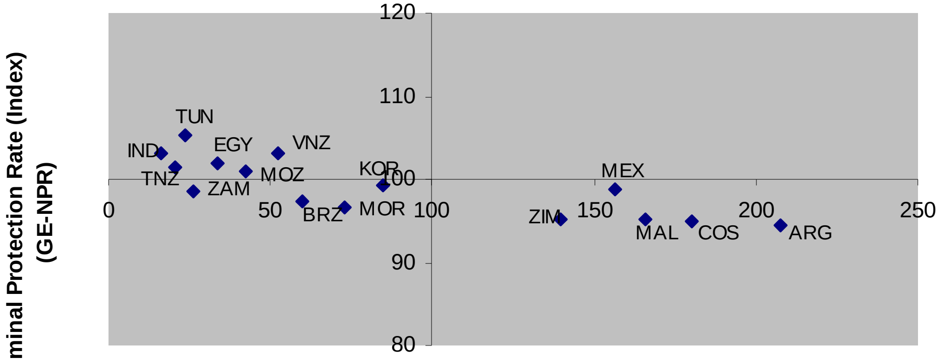
[16] The relative agricultural trade share is defined as the ratio of agricultural versus non-agricultural trade shares. A trade share ratio of one indicates that the initial trade share in agriculture (agricultural imports plus agricultural exports divided by agricultural GDP) is the same as in non-agriculture. An index greater than one indicates a higher trade share for agriculture compared to non-agriculture.

and an average 2.1 percentage points (or 29 percent) of effective non-agricultural protection among countries with high relative agricultural trade shares.

Figure 2. GE-NPR and Relative Trade Shares (25 Percent Non-Agricultural Import Tariff Experiments)



Note: Results based on uniform trade elasticities - (Agriculture, Non-Agriculture) = (18, 0.6)

These results suggest that the input cost channel work *for* the agricultural sector in countries with *low* relative agricultural trade shares and *against* the agricultural sector in countries with *high* relative agricultural trade shares. However, this conclusion does not stand up to closer scrutiny. A closer examination of Figures 1-2 shows that the input cost channel, generally, works in favor of agricultural price incentives, regardless of relative trade shares.[17] Nevertheless, the results also indicate that the input cost channel is more favorable for agriculture in countries with low relative agricultural trade shares, i.e. countries where trade consists – to a large extent – of imported intermediate goods.

The results also indicate that the marketing cost channel plays an important role for the transmission of non-agricultural tariffs to the domestic price system. Marketing costs are accounted for in seven country models, and the price of marketing services declines in all cases (due to reduced demand for transportation of traded goods). As

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[17] Argentina, Brazil, and Costa Rica are the only countries where the input cost channel work markedly in favour of the non-agricultural sector. The reason is that local agricultural production is relatively intensive in imported non-agricultural inputs such as fossil fuels, chemicals, and other industrial products.

explained in Section 3, reduced marketing costs tend to increase relative agricultural price incentives. The results indicate that the three countries with the largest increase in effective agricultural protection – Indonesia, Mozambique, and Tunisia – experience an average 7.9 percent reduction in marketing costs.

Overall, the results demonstrate the key importance of accounting for country-specific characteristics and general equilibrium effects in measuring the relative size and sign of tariff-induced policy bias. This has important implications. The existence of large general equilibrium effects and the importance of intersectoral linkages mean that it is crucial to use the GE-ERP measure for the evaluation of agricultural policy bias. The GE-NPR measure (as well as the classical NPR measure based on partial equilibrium analysis) does not provide a satisfactory measure of effective agricultural protection.

4.2.2. Exchange Rate Overvaluation

In this section, we investigate the effective agricultural protection impact of a 10 percent real exchange rate appreciation.[18] The results are presented in Figure 3 and they indicate that there exists a strong negative relationship between the GE-ERP measure of agricultural protection and relative agricultural trade shares. This mirrors the results from the previous section. Again, two major groups of countries may be identified. The first group (Argentina, Costa Rica, Malawi, Mexico, and Zimbabwe) consists of countries with *high* relative agricultural trade shares where agricultural protection *declines*. The second group (Egypt, Korea, Indonesia, Tanzania, Tunisia, and Venezuela) consists of countries with *low* relative agricultural trade shares where agricultural protection *increases*. Four countries (Brazil, Morocco, Mozambique, and Zambia) do not fall into either of the two main groups.

Among the first group of countries with relatively *large* agricultural trade shares, the GE-ERP impact for Argentina, Malawi, and Zimbabwe is dominated by reduced terms-of-trade for agricultural exports. Reduced protection for import-competing agricultural products further adds to declining agricultural price incentives in Costa Rica and Mexico. Among the second group of countries with relatively *small* agricultural trade shares, several countries are net-importers of agricultural goods. The exchange rate appreciation induces disprotection for agricultural crops in these countries. Nevertheless, this effect is, in all cases, dominated by the combined impact of (i) declin-

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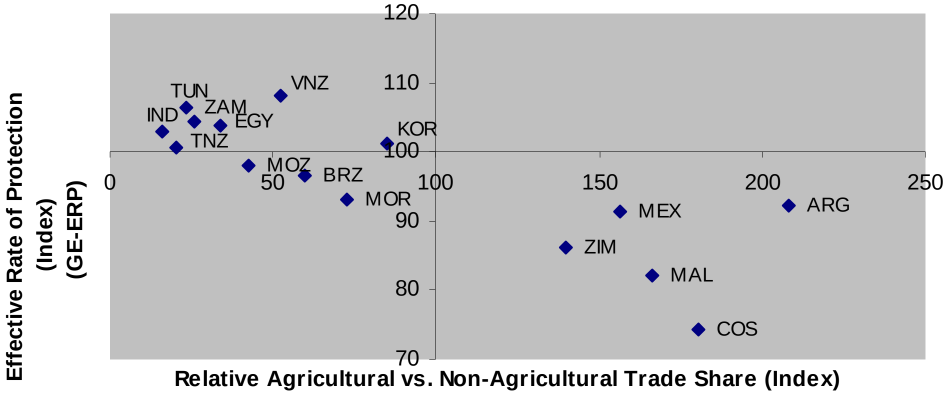
[18] The variation in base run trade shares leads to a strongly heterogenous current account impact among the 15 sample countries. However, this has little importance for relative price incentives, since we employ a balanced macro closure. For further details, see Jensen, Robinson & Tarp (2002).

ing terms-of-trade for exports of non-agricultural goods and (tourist) services, and (ii) disprotection of import-competing non-agricultural production.

Figure 3. GE-ERP and Relative Trade Shares (10 Percent Exchange Rate Overvaluation)

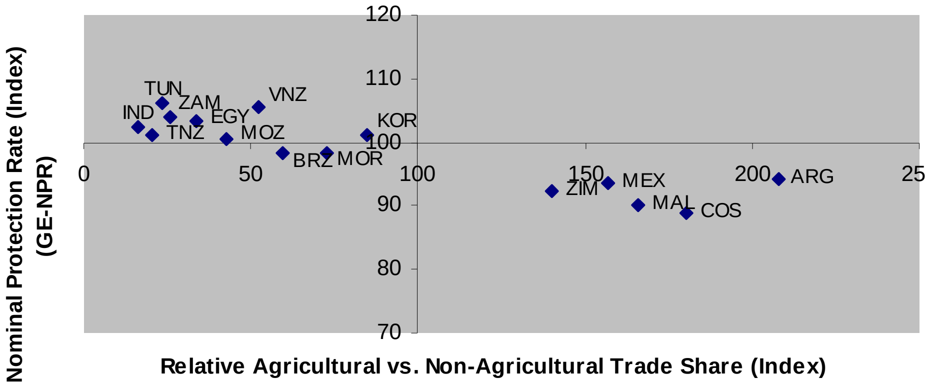


Note: Results based on uniform trade elasticities - (Agriculture, Non-Agriculture) = (18, 0.6)

The results illustrate how the relative agricultural protection impact of exchange rate appreciation depends crucially on the size of relative trade shares. In addition, the importance of general equilibrium effects – working through the marketing cost channel – can be judged by comparing the results of Zambia and Tunisia. Trade shares are similar, but relative agricultural price incentives increase particularly strongly in Tunisia. The reason is that the price of marketing services increases in Zambia (not shown), while it declines in Tunisia to the benefit of Tunisian agriculture.

In order to further study the importance of intersectoral linkages, Figure 4 presents the impact of the 10 percent exchange rate appreciation on the GE-NPR measure. In line with the import tariff simulations, the GE-NPR measure tends to underestimate effective *non-agricultural* protection among countries with *high* relative agricultural trade shares (average GE-NPR = -9.6 percent; average GE-ERP = -16.3 percent). However, in contrast to the import tariff simulations, the GE-NPR measure tends to be fairly accurate, when it comes to effective *agricultural* protection among countries with *low* relative agricultural trade shares (average GE-NPR = 2.7 percent; average GE-ERP = 2.6 percent). In the case of exchange rate appreciation, the input cost channel is therefore, mainly, important among sample countries where (i) agricultural (export) trade shares are relatively high, and (ii) agricultural production makes intensive use of non-agricultural production inputs.

Figure 4. GE-NPR and Relative Trade Shares (10 Percent Exchange Rate Overvaluation)



Note: Results based on uniform trade elasticities - (Agriculture, Non-Agriculture) = (18, 0.6)

The results of the exchange rate simulations put further perspective on the transmission of non-agricultural tariffs to the domestic price system. The results indicate that exchange rate changes – whether imposed exogenously or induced by other trade policies – mainly works through their impact on nominal protection in goods sectors with high relative trade shares. The main exception is sample countries with high agricultural (export) trade shares and (partly) developed agricultural production practices. In these countries, the input cost channel work as an important additional transmission mechanism for exchange rate appreciation, in favor of the non-agricultural sector.

Overall, the exchange rate simulations confirm the conclusion from the non-agricultural tariff simulations: Trade policy may lead to increased agricultural or non-agricultural protection depending on the country-specific context. Furthermore, the results confirm that general equilibrium effects, working through the input cost and marketing cost channels, are important in order to fully capture the protective impact of trade policies. It follows that proper measurement of trade policy-induced agricultural policy bias requires the use of the GE-ERP protection measure.

4.2.3. Monte Carlo Simulations

The results of the experimental simulations indicate that non-agricultural tariffs and exchange rate overvaluation may reduce or increase agricultural protection rates depending on whether relative agricultural trade shares are greater or smaller than one. However, due to the assumption of imperfect tradability, the results could, potentially, depend on the choice of relative trade elasticities. It is therefore important to investigate the extent to which the choice of trade elasticities affects the sign and size of the impact of trade policies on the GE-ERP measure. A set of robustness checks was undertaken to look into this question. Results are reported for the non-agricultural import tariff experiments.[19]

Following Abler, Rodriguez and Shortle (1999), we employ a Monte Carlo procedure to investigate the sensitivity of our GE-ERP results with respect to variations in trade elasticities. The procedure was based on 1000 sets of independent draws of uniform agricultural and non-agricultural trade elasticities from a rectangular distribution over the interval [0.5; 2.0]. The number of independent draws ensures that, for each sample country, the average point estimate is estimated with a precision of 0.1 percentage points at the usual 5 percent confidence level.[20] Each set of trade elasticities consists of one uniform agricultural trade elasticity and one uniform non-agricultural trade elasticity. Moreover, for each set of trade elasticities, the country model in focus was re-calibrated and subjected to the uniform 25 percent non-agricultural import tariff experiment. Detailed results for the 15 sample countries are given in Figure 5.

The results show that average protection rates vary between -14.6 percent (Costa Rica) and +16.6 percent (Tunisia). Altogether, 10 countries have point estimates which are significantly above 0, while five countries have point estimates that are significantly below 0. This mirrors the results from section 4.2.1, where non-agricultural import tariffs gave rise to agricultural protection in nine countries, and non-agricultural protection in six countries. Generally, the results indicate that the non-agricultural import tariffs may lead to anything between 16 percent *non-agricultural* protection (Costa Rica), and 19 percent *agricultural* protection (Tunisia). Again, this mirrors the results from section 4.2.1, where the tariff-induced policy bias varied be-

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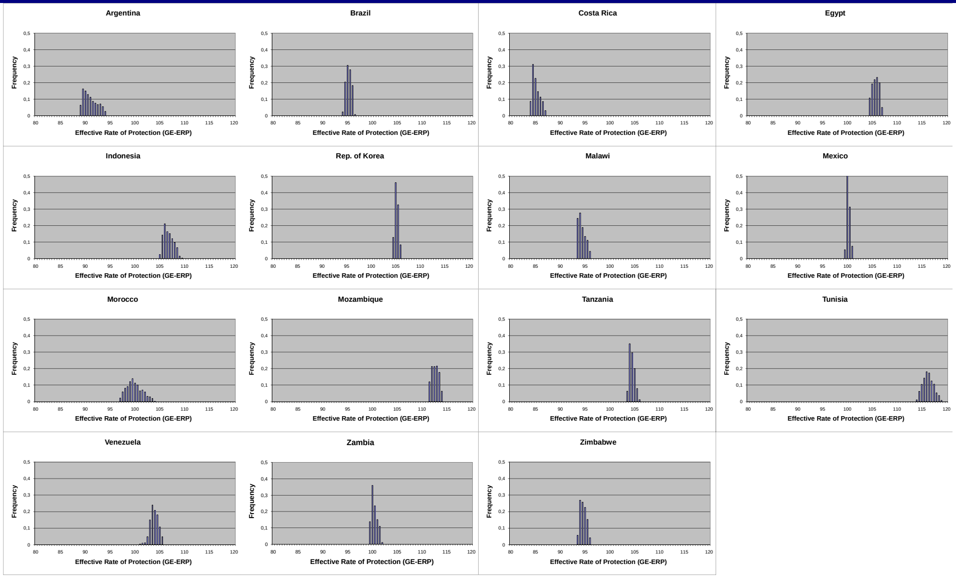
[19] Monte Carlo simulations for the exchange rate appreciation experiments gave, qualitatively, similar results.

[20] The number of independent draws, needed to achieve a precision of 0.1 percentage points for the average point estimate, varied between 45 draws in the case of Mexico and 919 draws in the case of Morocco.

tween 13 percent *non-agricultural* protection (Costa Rica), and 15 percent *agricultural* protection (Tunisia).

Figure 5. Sensitivity of GE-ERP in sample Countries: Variation in Trade Elasticities (25 percent Non-Agricultural Import Tariff Experiment)



Note: The sensitivity analysis was based on 1000 simulations for each single-country model. Uniform agricultural and non-agricultural trade elasticities were in each case drawn from a uniform distribution with a basis of [0.5; 2.0]. All simulations were measured relative to a distortion free base run, which included the elimination of indirect taxes and current account deficits and surpluses. The only exception from this rule was Mozambique, where the current account deficit amounted to 18.9 percent of total absorption, and where the base run only included the elimination of indirect taxes.

The results from the Monte Carlo procedure confirm that our conclusions are robust to variation in relative trade elasticities. Average GE-ERP point estimates vary strongly among sample countries. This confirms that country-specific characteristics – including relative trade shares and intersectoral linkages – play a crucial role in determining the size and sign of trade policy-induced price incentive bias. Furthermore, the sign of country-specific point estimates is independent of the variation in trade elasticities in all but a few cases. Sign variation only occurs for three countries (including Morocco, Zambia and Mexico), and size variation typically lies within a 3-5 percentage point range. This indicates that trade elasticities have only a minor impact on the size of relative price effects, and that country-specific analyses are likely to provide reliable point estimates, even when uncertainty surrounds relative trade elasticity estimates.

5. Conclusion

In this paper, we have argued that the measurement issue is the key issue in the literature on trade policy-induced agricultural price incentive bias. Historically, large-scale World Bank projects have used a single-country partial equilibrium approach to measure nominal protection rates. At the same time, World Bank researchers have acknowledged that effective rate of protection measures are more appropriate (Krueger, Schiff & Valdes, 1988), and that it is important to capture the general equilibrium effects of trade distortions (Anderson et al., 2008). We combine these ideas in the development of our general equilibrium approach to measuring agricultural policy bias.

Based on a sample data set of Social Accounting Matrices from the 1990s, we calibrated 15 country models to undertake historical and experimental simulations. Our historical simulations demonstrated that the economy-wide system of indirect taxes significantly discriminated against agriculture in only one country, was largely neutral in five countries, provided a moderate subsidy to agriculture in four countries, and strongly favored agriculture in five countries. Our results, therefore, support the prevailing understanding that the agricultural price incentive bias, which was generally perceived to characterize developing countries during the 1980s, was largely eliminated during the 1990s.

Our experimental simulations showed that traditional trade policies affect relative price incentives in strongly divergent directions, and that country-specific characteristics – including relative trade shares and intersectoral linkages – are crucial for determining the size and magnitude of the policy bias. Furthermore, a Monte Carlo procedure confirmed that our conclusions are robust to underlying tradability assumptions. The results showed that variation in trade elasticities has little qualitative and quantitative impact on our results. This implies that country-specific analyses are likely to provide reliable point estimates, even when uncertainty surrounds relative trade elasticity estimates.

Finally, our analyses demonstrated that the choice of protection measure is crucial. General equilibrium price effects – transmitted through input and marketing cost structures – account for a large part of the policy bias. It follows that the GE-NPR nominal protection measure (as well as the classical NPR measure based on partial equilibrium analysis) does not fully capture the protective impact of traditional trade policies. Instead, proper measurement of the price incentive bias requires the use of the general equilibrium effective rate of protection GE-ERP measure.

Overall, we find that the size and the sign of the GE-ERP measure vary strongly across countries depending on country-specific characteristics. This implies that there are no simple rules of thumb regarding the impact of trade policy reform on relative agricultural price incentives. Country-specific analysis is, in each case, required to determine the policy bias. Similarly, assessment of the need for complementary domestic redistributive policy initiatives (in relation to unilateral trade reform) or compensating measures (in relation to multilateral trade reform) will need to be done on a country-by-country basis.

References

Abler, David G., Adrian G. Rodriguez, and James S. Shortle, (1999). "Parameter Uncertainty in CGE Modeling of the Environmental Impact of Economic Policies." *Environmental and Resource Economics Vol. 14(1).*

Agénor, Pierre-Richard, Mustapha K. Nabli, Tarik Yousef, and Henning T. Jensen, (2007). "Labor Market Reform, Growth, and Unemployment in Labor-Exporting Countries in the Middle East and North Africa." *Journal of Policy Modelling Vol. 29(2).*

Anderson, Kym, (2006). "Reducing Distortions to Agricultural Incentives: Progress, Pitfalls, and Prospects." *American Journal of Agricultural Economics Vol. 88(5),* pp. 1135-46.

Anderson, Kym, (2007). "Outline of the research project on Distortions to Agricultural Incentives." World Bank, Washington DC.

Anderson, Kym, William J. Martin and Dominique van der Mensbrugghe (2005). "Would Multilateral Trade Reform Benefit Sub-Saharan Africans." *World Bank Policy Research Working Paper 3616,* World Bank, Washington DC.

Anderson, Kym, William J. Martin and Dominique van der Mensbrugghe (2006a). "Distortions to World Trade: Impacts on Agricultural Markets and Farm Incomes." *Review of Agricultural Economics,* Vol. 28(2), pp. 168-94.

Anderson, Kym, William J. Martin and Dominique van der Mensbrugghe (2006b). "Doha Merchandise Trade Reform: What's at Stake for Developing Countries." *World Bank Policy Research Working Paper 3848,* World Bank, Washington DC.

Anderson, Kym, Marianne Kurzweil, William J. Martin, Damiano Sandri, and Ernesto Valenzuela (2008). "Methodology for Measuring Distortions to Agricultural Incentives." Agricultural Distortions Research Project Working Paper No. 2, World Bank, Washington DC.

Arndt, Channing, Henning T. Jensen, Sherman Robinson, and Finn Tarp (2000). "Marketing Margins and Agricultural Technology in Mozambique." *Journal of Development Studies*, Vol. 37(1), pp. 121-37.

Bautista, Romeo M., Sherman Robinson, Peter Wobst, and Finn Tarp (2001). "Policy Bias and Agriculture: Partial and General Equilibrium Measures." *Review of Development Economics*, Vol. 5(1), pp. 89-104.

Bautista, Romeo M. and Alberto Valdés, eds. (1993). *The Bias Against Agriculture.* San Francisco: ICS Press.

Devarajan, Shantayanan and Chalongphob Sussangkarn (1992). "Effective Rates of Protection When Domestic and Foreign Goods Are Imperfect Substitutes: The Case of Thailand." *The Review of Economics and Statistics,* Vol. 74(4), pp. 701-711.

Jensen, Henning T. and Finn Tarp (2002). "CGE Modelling and Trade Policy: Reassessing the Agricultural Bias." *Journal of Agricultural Economics,* Vol. 53(2), pp. 383-405.

Jensen, Henning T., Sherman Robinson and Finn Tarp (2002). "General Equilibrium Measures of Agricultural Bias in Fifteen Developing Countries". IFPRI, Trade and Macroeconomics Division Discussion Paper No. 105, Washington, IFPRI.

Krueger, Anne O. (1992). *The Political Economy of Agricultural Pricing Policy, Volume 5.* A World Bank Comparative Study. Baltimore and London: Johns Hopkins University Press for the World Bank.

Krueger, Anne O. (1998). "Why Trade Liberalization is Good for Growth." *Economic Journal*, Vol. 108 (September), Issue 450, pp. 1513-1522.

Krueger, Anne O., Maurice Schiff, and Alberto Valdés (1988). "Agricultural Incentives in Developing Countries: Measuring the Effect of Sectoral and Economy-wide Policies." *World Bank Economic Review*, Vol. 2(3), pp. 255-71.

Lipton, Michael (1977). *Why Poor People Stay Poor: Urban Bias in World Development*. Cambridge, Mass.: Harvard University Press.

Löfgren, Hans, Rebecca L. Harris, and Sherman Robinson (2002). *A Standard Computable General Equilibrium (CGE) Model in GAMS*. Microcomputers and Policy Research 5, International Food Policy Research Institute, Washington, DC, USA.

Melo, Jaime de and Sherman Robinson (1981). “Trade Policy and Resource Allocation in the Presence of Product Differentiation.” *The Review of Economics and Statistics*, Vol. 63 (May), pp. 169-177.

Srinivasan, T. N. and Jagdish Bhagwati (2001). ”Outward-Orientation and Development: Are the Revisionists Right?” in *Trade, Development and Political Economy: Essays in Honour of Anne Krueger*, Deepak Lal & Richard Shape (Eds.)

Schiff, Maurice and Alberto Valdés (1992). *The Political Economy of Agricultural Pricing Policy, Volume 4. A Synthesis of the Economics in Developing Countries.* A World Bank Comparative Study. Baltimore and London: Johns Hopkins University Press for the World Bank.

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