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Issues relating to Agricultural Pricing Policies and their Analysis in Developing Countries

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Abstract

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Agricultural pricing policies in developing countries are often the result of complex interactions between producer, consumer and merchant groups and their relative effectiveness in influencing government decision making. Even within governments, various ministries often have opposing views. In this environment one of the contributions a policy analyst can make is to attempt to quantify the effects of different policy options. This permits a more informed discussion which hopefully leads to better decision-making and an improved incentive environment.

Many analyses of agricultural pricing policies have used the standard partial equilibrium analysis where no linkages between commodity markets were considered. In this paper we have considered cross-price effects. Also, we have discussed issues relating to other adjustments/refinements of the standard method so that a practitioner not familiar with the various methods can form an opinion of what the options are and what adjustments may be appropriate for a particular case in question. The adjustments relate to overvaluation of currencies, input price distortions, differences in the degree of distortions between producers and consumers, and variability of border prices.

The inclusion of cross-price elasticities was important for assessing production, consumption and trade effects for Argentina, but for the other countries it resulted in only somewhat improved accuracy. The adjustment for exchange rates had a large impact in Egypt and was important for other countries as well. This underlines the importance of exchange rates as key variables for agricultural pricing policies in general. The numbers show that the traditional taxation policies of agricultural products in the sample of developing countries is somewhat less widespread than in the past. These policies, however, continue to favor consumers over producers, with significant losses for some of the latter. The large size of welfare losses, especially compared to efficiency losses, highlights the importance of correcting distorted prices that adversely affect the poorest sections of society. Also, the usual government objective of taxing producers to raise revenues is frequently defeated by the large subsidies provided to consumers.

For the partitioner, for whom time is often of the essence, the assessment of welfare effects using the partial equilibrium method may provide reasonably good 'first cut' estimates of the order of magnitude of the impact of distortions. But often, these 'base case estimates' can and should be adjusted for a number of possible factors. The analyst needs to determine how important accurate estimates of key variables are to the policy makers; he or she then needs to compare the costs

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involved in generating or gathering the data and doing the calculations with the benefits of a broader and more accurate analysis of the distortionary effects of the particular case in question.

Introduction

Agricultural pricing policies in developing countries are important from a number of viewpoints. In most LDCs a large percentage of the population derives its livelihood from agriculture and their incomes are directly related to the prices they obtain for the commodities which they produce. On the other hand, consumers spend a significant portion of their income on food. Agricultural prices, therefore, are of great economic relevance for producers and consumers alike, and pricing policy decisions can be highly political. Agricultural pricing policies are also important for governments because of their revenue or expenditure implications.

The existing policies are often the result of complex interactions of producer, consumer and merchant groups and their effectiveness in influencing government decisions. Also, within the government structure various ministries and agencies often take conflicting sides in the policy-making process: agricultural ministries tend to advocate higher farm prices, the ministries of labor and industry tend to argue for cheap food policies in order to be able to keep wages low, and finance ministries are interested in interventions which raise revenues. The trade and pricing policies may, at times, depend more on the relative power of those ministries and their constituencies rather than clearly stated rational policy objectives. One of the contributions the policy analyst can make in these situations, is to quantify the effects of different policy options to permit an informed discussion and, hopefully, policy decisions which result in a more efficient incentive system. While in general the objective is to move toward an economy which is free of distortions, equity and environmental considerations require government intervention, but these should be designed in a way that minimizes distortions of market signals.

As far as the developing countries' agricultural pricing policies are concerned, the point has been made repeatedly that, in general, these countries are pursuing policies which tax the agricultural sector (Balassa and Associates, 1971; Schultz, 1978; Peterson, 1979; Lutz and Scandizzo, 1980; Binswanger and Scandizzo, 1983). This is in contrast to industrial countries, which have, with the exception of the traditional food exporters, pursued protectionist agricultural policies (McCalla, 1969; Gulbrandsen and Lindbeck, 1973; Bale and Lutz, 1981; Anderson and Baldwin, 1981; Tracy, 1982). The main motivation for taxing the farm sector in developing countries is to raise government revenues and to keep food prices low for the urban consumers. These objectives are achieved at the cost of reducing incentives and therefore output of the agricultural sector. Exceptions to the general policy of taxing the agricultural

sector are some newly industrializing countries such as Korea and Taiwan which have, in the course of their successful economic development, switched from taxing agriculture to protecting it (Anderson et al., 1986).

The purpose of this study is to determine the effects of agricultural pricing policies for a sample of developing countries, compare these with other key economic variables, and discuss some conceptional and methodological issues facing a practitioner. The results of the paper are derived with one methodological improvement over some earlier studies. Cross-price elasticities on the supply and demand side were used to capture the effects due to the interaction of pairs of the most interlinked commodities. Also, issues related to possible adjustments/refinements are discussed in the paper so that a practitioner not familiar with the various methods can form an opinion, based on an easily understandable review, of what the options are and what refinements may be appropriate for the particular case in question. The paper is based on background work for the World Development Report 1986.

Method used

The results of the paper are derived using the standard partial equilibrium framework. The current policy interventions are analyzed in relation to a policy without distortions. The case of an export tax (or equivalent) policy is presented in Fig. 1; SS' represents the supply function and DD' the demand function of the exporting country. The absolute tariff level is $p_w - p_d$. As a result of this intervention, producers only obtain a price p_d as compared to p_w. They produce Q_d instead of Q_w and incur a producers' welfare loss of ACDH. Consumers on the other hand benefit from the lower price; they increase consumption from C_w to C_d and obtain a consumers' surplus gain of ABGH. The government obtains export tariff revenues of BCEF. Under the tariff policy, exports fall from $Q_w - C_w$ to $Q_d - C_d$ and foreign exchange receipts for the country drop from $p_w(Q_w - C_w)$ to $p_w(Q_d - C_d)$. The net social loss in production is CDE, the net social loss in consumption BFG and the total net social loss to society is the sum of the two.

Inclusion of cross-price effects. Most of the analyses of agricultural pricing policies have used the standard single market analysis and applied it for one or more agricultural commodities. But the single-market analysis may not provide results with sufficient precision for use as a basis for policy discussions and decisions. The reason is that substitution effects between commodities may be important. One of the purposes of our work was to investigate what difference the use of cross-price elasticities — at least with regard to the most closely related market — makes in determining the size of the effects. For our study, cross-price elasticities from Lui and Roningen (1985) were used.

In a single-market analysis the production adjustment as a result of a price

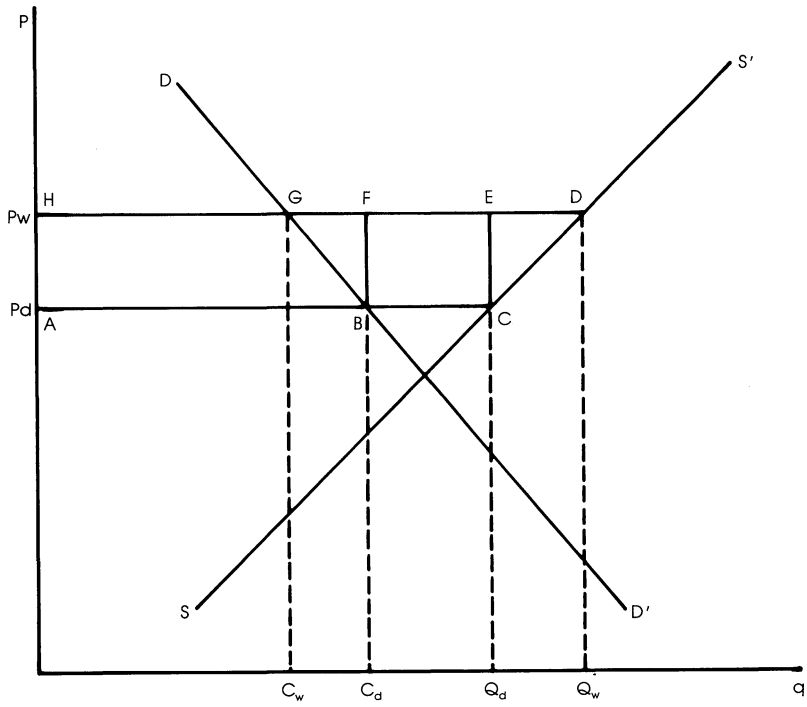

Fig. 1. Effects of export tariff or equivalent intervention.

distortion is as follows: $dQ_1 = e_{s1}\, dP_1\, Q_1/P_1$ where e_{s1} is the supply elasticity, dP_1 is the price impact of the distortion, Q_1 is the quantity supplied at the domestic price P_1. With the introduction of cross-price elasticities and considering two interrelated commodity markets, the effect on the supply of one commodity due to price distortions in both markets are as follows: $dQ_1 = e_{s1}\, dP_1\, Q_1/P_1 + e_{s12}\, dP_2\, Q_1/P_2$, where e_{s1} is the supply elasticity of commodity 1 with respect to own price and e_{s12} is the supply elasticity of commodity 1 with respect to the price of commodity 2, dP_1 and dP_2 are the price differences for commodities 1 and 2 caused by the interventions, and P_1 and P_2 are the domestic prices.

Demand effects due to price distortions are calculated analogously to the production effects. In a single-market framework demand adjustments are: $dD_1 = e_{d1}\, dP_1\, D_1/P_1$, where e_{d1} is the own price demand elasticity, D_1 is the domestic demand, and dP_1 and P_1 are as defined earlier. When two interlinked commodities are considered, which consumers substitute with each other, the demand effect of price distortions in both markets on the consumption of commodity 1 are: $dD_1 = e_{d1}\, dP_1\, D_1/P_1 + e_{d12}\, dP_2\, D_1/P_2$, where e_{d1} is the own price demand elasticity and e_{d12} the cross-price demand elasticity, D_1 is the domestic demand of commodity 1 and dP_1,P_1 and P_2 are as defined earlier.

On both the supply and demand side we are considering only the cross-price

effects of the single most closely related commodity on the commodity market in question. This is to keep the analysis relatively simple, but if empirical estimates of cross-price elasticities with a multiplicity of commodities are available in a country under consideration, the analysis could be extended. Also, income effects stemming from the price changes were assumed to be zero in our model and other shift variables of the supply or demand functions were not considered.

The net social loss for producers in market 1 (NSL_p) due to the distortions is $1/2\ dQ_1\ dP_1$, and the net social loss for consumers (NSL_c) $1/2\ dD_1\ dP_1$. These formulas apply whether cross-price effects are being considered or not, since the terms dQ_1 and dD_1 include those effects.

The welfare effect on producers in market 1 can be calculated as: $G_p = dP_1\ Q_1$-NSL_p, and the welfare effects on consumers as: $G_d = dP_1\ D_1$-NSL_c. The change in foreign exchange earnings amounts to: $dFEE = -P_w(dQ\text{-}dD)$, and the effects on government revenues is: $G_g = dP_1(Q_1\text{-}D_1)$. Similar calculations can be made for market 2 and other markets.

The purpose of this approach is to estimate the total gains that could be obtained and what other impacts would occur if the major commodity markets in a country were fully and simultaneously liberalized. The calculations are done market by market (most of whom are interrelated) and then the estimates are aggregated country by country. If important interrelationships existed between one or more of the major commodities considered with commodities outside the sample (for example, livestock products) we did not take that into consideration and thereby implicitly assumed those cross-price elasticities to be zero.

In practice a full liberalization of several commodities may not be possible. If, for example, distortions in only one commodity market were to be removed, the production adjustment in market 1 would be $dQ_1 = e_{s1}\ dP_1\ Q_1/P_1$ since dP_2 is zero. But even though there is no change in the price in market 2, production in market 2 would change by $dQ_2 = e_{s21}\ dP_1\ Q_1/P_1$, where e_{s21} is the supply elasticity of commodity 2 with respect to the price of commodity 1. Similar calculations would have to be made to determine the consumption and other effects. In general, the model to be developed and the equations to be used depend on the policy variables which a government contemplates changing and the major commodity markets which are expected to be affected. As far as net welfare gains to a country are concerned it is clear that, if only one or a subsample of the major commodities were liberalized, the net gains would be smaller than those calculated in this paper and shown in Table 4.

Results

The basic data inputs for our calculations are presented in Table 1 and part of Table 2. Effects of price distortions on real variables are shown in Table 2.

TABLE 1

Input data, 1983

Country commodity	Nominal protection coefficient			Supply elasticity	Related commodity	Cross supply elasticity	Demand elasticity	Related commodity	Cross demand elasticity	Border price (US$/t)
	1974	1978	1983							
Argentina										
Wheat	0.43	1.84	0.74	0.20	Soybeans	−0.10	−0.50	Maize	0.20	148
Soybeans	0.72	0.94	0.72	0.20	Maize	−0.10				228
Maize	0.60	0.99	0.76	0.19	Wheat	−0.10	−0.29	Beef	0.20	125
Sorghum	0.53	0.90	0.77	0.20	Soybeans	−0.10	−0.40	Maize	0.20	105
Brazil										
Wheat	0.83	1.46	1.30	0.18	Soybean	−0.09	−0.10	Maize	0.05	202
Maize	0.92	1.03	1.42	0.12	Soybean	−0.06	−0.15			99
Cotton	1.02	1.17	1.42	0.08	Sugar	−0.04	−0.05			1094
Sugar	0.44	0.89	0.73	0.17	Cotton	−0.01	−0.10			209
Soybeans	0.84	0.74	0.89	0.20			−0.16	Maize	0.08	247
Mexico										
Rice	0.59	0.52	1.40	0.20			−0.08	Wheat	0.04	230
Wheat	0.58	0.86	0.83	0.20			−0.27	Maize	0.06	141
Maize	0.75	0.99	1.15	0.20	Wheat	−0.10	−0.05	Wheat	0.02	146
Coarse grain	0.44	0.66	0.75	0.20	Wheat	−0.10	−0.70	Maize	0.30	135
Soybeans			1.06	0.20	Maize	−0.10	−0.36	Beef	0.15	257
Thailand										
Rice	0.57	0.54	0.85	0.20	Maize	−0.02	−0.04	Maize	0.01	247
Maize	0.76	0.74	0.75	0.33	Rice	−0.04	−0.41			138
Sugar	0.26	0.94	0.94	0.09	Rice	−0.03	−0.10	Rice	0.05	177
Indonesia										
Rice	0.33	0.96	0.78	0.05	Wheat	−0.02	−0.07	Wheat	0.01	350
Sugar	0.49	1.16	0.73	0.04	Rice	−0.01	−0.05	Rice	0.02	493
Egypt										
Wheat	0.66	0.57	0.75	0.20	Maize	−0.02	−0.18	Maize	0.09	200
Cotton	0.45	0.30	0.47	0.13	Sugar	−0.06	−0.05			2038
Sugar	0.18	0.78	1.02	0.11	Maize	−0.01	−0.06	Maize	0.03	275
Maize	0.69	1.03	1.10	0.20	Sugar	0.00	−0.29	Sugar	0.04	235
Kenya										
Maize	0.92	0.30	1.15	0.41	Wheat	−0.34	−0.02	Wheat	0.10	149
Coffee	1.16	1.09	0.94	0.48	Maize	−0.003				2631
Tea	1.62	1.90	0.89	0.22	Coffee	0.04				1839
Wheat		1.20	1.43	0.17	Cotton	−0.08	−0.32			164

Source: NPCs were computed as domestic price (adjusted for marketing margins)/border price (based on information from World Bank economic and sector reports); supply, demand and cross-price elasticities are from Lui and Roningen (1985); border prices were calculated implicitly from FAO Trade Yearbook (1985).
t, metric tonne = 1000 kg.

TABLE 2

Effects of price distortions on supply and demand of agricultural commodities, 1983

Country commodity	Production (1000 t)	Consumption (1000 t)	Exports (Imports) (1000 t)	Change in production (1000 t)	Change in consumption (1000 t)	Change in exports (1000 t)	Change in production/ production (%)	Change in consumption/ consumption (%)	Change in exports/ exports (%)
Argentina									
Wheat	11 700	1 470	10 230	−367	165	−532	−3.14	11.22	−5.20
Soybeans	3 750	2 331	1 419	−173	-	-	−4.61	-	-
Maize	9 200	2 675	6 525	−229	135	−364	−2.49	5.05	−5.58
Sorghum	8 250	2 955	5 295	−172	166	−338	−2.08	5.62	−6.38
Brazil									
Wheat	1 880	6 020	−4 140	99	−50	49	5.27	−0.83	−3.60
Maize	22 100	21 557	543	948	−956	1 904	4.29	−4.43	350.64
Cotton	639	583	56	24	−9	33	3.76	−1.54	58.93
Sugar	9 314	5 637	3 677	−613	−208	−821	−6.58	3.69	−22.33
Soybeans	12 900	5 210	7 690	−319	−226	−545	−2.47	4.34	−7.09
Mexico									
Rice	458	458		26	−14	40	5.68	−3.06	-
Wheat	3 460	3 882	−422	−142	245	−357	−4.10	5.54	84.60
Maize	13 061	17 748	−4 687	608	−189	797	4.66	−1.06	−17.00
Coarse grain	5 473	8 777	−894	−253	2 391	−2 644	−4.62	27.24	1.01
Soybeans	687	1 581	−3 304	−2	7	−9	−0.29	0.44	80.02
Thailand									
Rice	12 974	9 440	3 534	−371	35	−406	−2.86	0.37	−11.49
Maize	1 567	906	661	−161	124	−286	−10.27	14.00	−43.12
Sugar	2 268	677	1 591	−1	−2	1	−0.04	−0.30	0.06
Indonesia									
Rice	24 006	25 175	−1 169	−338	497	−835	−1.41	1.97	71.43
Sugar	1.650	1 828	440	−19	24	53	−0.80	1.86	12.00
Egypt									
Wheat	1 990	8 581	−6 591	−136	585	−3 425	−6.68	6.00	9.83
Cotton	421	231	190	−62	13	−75	−14.73	5.63	−39.47
Sugar	812	1 663	−851	1	3	−13	0.13	0.12	0.12
Maize	3 509	3 533	−24	64	−90	−1 008	1.82	−2.55	−641.67
Kenya									
Maize	2 178	2 249	−251	−106	10	−45	−4.87	0.41	46.22
Coffee	95	-	95	−3	-	-	−3.15	-	-
Tea	119	-	119	−3	-	-	−2.52	-	-
Wheat	242	352	−110	11	−34	45	4.55	−9.66	−40.91

Source: Production; FAO, Production Yearbook (1985); consumption; derived as difference between production (column 1) and exports (column 3); Export/Imports; FAO Trade Yearbook (1985); changes in production, consumption and exports were calculated using formulas in the text; columns 6 to 9; derived by dividing columns 4 to 6 by columns 1 to 3.

Table 3 presents the monetary effects by country and commodity. In Table 4 a summary of monetary effects by country is shown that includes the estimates with and without cross-price effects. Table 5 compares the monetary effects of distortions with a number of important indicators.

Tables 2 to 5 represent our *base case estimates* of a complete liberalization, which, in our paper includes cross-price effects of the commodities in question with the single most interrelated market. In addition to the base case we could have constructed and presented a large number of tables showing various variations around the base case: various degrees of liberalization; effects of two, three or more cross-price elasticities for each commodity; estimates with and without corrections for overvaluations, input distortions, differential distortions for consumers and producers, and different border prices. Some of these are discussed later in the paper, but for space reasons the large number of variations could obviously not be shown in tabular form in the paper.

In general, the results depend on the size of the price distortions as measured by the gross nominal protection coefficients, the responsiveness of supply and demand as measured by the supply and demand elasticities, and the interaction between commodity markets as measured by the cross-price elasticities. The absolute levels of demand, supply and border prices also affect the results. The estimated effects discussed below include cross-price interactions but no other adjustments, which are discussed subsequently.

Real effects. From the nominal protection coefficients (NPCs), one can conclude that in 1983, 17 of the cases studied were affected by negative protection (NPC below 1.0) and that 10 commodities enjoyed positive protection (NPC larger than 1.0). This is a relatively more even distribution between negative and positive protection than what one might have expected. Low international commodity prices may have been a contributing factor. For the cases with negative protection the largest relative production declines are for Thailand, maize (NPC 0.75) with 10% and Egypt, cotton (NPC 0.47) with about 15%. The highest positive levels of protection are for Kenya, wheat (NPC 1.43), Brazil, maize and cotton (NPCs 1.42) and Mexico, rice (NPC 1.40), and the corresponding increases in production are about 5% in each of these cases. In eight out of 24 cases is consumption negatively affected by the pricing policies, i.e. government intervention in food commodities appears to be generally favorable to consumers.

Efficiency-type losses. Total net social losses in production by country, and aggregated for the commodities, studied, range from a low of US$2.2 million for Kenya to US$50.0 million for Brazil (Table 4). Net social losses in consumption are highest for Mexico with US$45.9 million. For the other countries they range from US$1.3 million for Kenya to US$32.3 million for Brazil. These are losses to the economy in terms of smaller national incomes. Compared to the

TABLE 3

Monetary effects of price distortions, 1983 (US$ million)

Country commodity	Net loss in production	Net loss in consumption	Welfare gain producers	Welfare gain consumers	Change in foreign exchange earnings	Change in government revenue
Argentina						
Wheat	7.1	3.2	−457.3	53.3	−78.8	393.6
Soybeans	5.5	n.a.	−244.9	n.a.	n.a.	n.a.
Maize	3.4	2.0	−279.4	78.2	45.5	195.7
Sorghum	2.1	2.0	−201.3	69.3	−35.5	127.9
Brazil						
Wheat	3.0	1.5	110.9	−366.3	30.1	250.9
Maize	19.7	19.9	899.2	−916.2	188.6	−22.6
Cotton	5.6	1.9	287.9	−269.8	36.3	−25.7
Sugarcane	17.3	5.9	−542.9	312.2	−171.7	207.5
Soybeans	4.3	3.1	−354.8	−219.7	−134.7	567.1
Mexico						
Rice	1.2	0.6	40.4	−42.2	9.1	0
Wheat	1.7	2.9	−84.6	78.6	−54.5	1.4
Maize	6.7	2.1	279.4	−392.5	116.4	104.4
Coarse grain	4.3	40.3	−188.9	255.9	−357.2	−111.5
Soybeans	0.0	0.0	10.6	−24.3	−2.3	3.8
Thailand						
Rice	6.9	0.6	−487.6	349.1	−100.4	130.9
Maize	2.8	2.1	−56.8	291.2	−39.3	22.8
Sugarcane	0.0	0.0	−24.1	9.6	0.2	14.5
Indonesia						
Rice	13.0	19.1	−1 861.5	1 919.3	−292.5	−90.0
Sugar	1.3	1.6	−220.9	241.8	−21.3	−23.7
Egypt						
Wheat	3.4	14.6	−103.0	415.5	−144.5	−330.2
Cotton	33.6	7.0	−488.3	242.5	−153.3	205.2
Sugarcane	0.0	0.0	4.5	−9.1	−0.4	4.6
Maize	0.7	1.1	81.7	−84.1	36.3	0.6
Kenya						
Coffee	0.2	n.a.	−15.2	n.a.	n.a.	n.a.
Maize	1.2	0.1	47.5	−54.4	−17.3	5.6
Tea	0.3	n.a.	−24.3	n.a.	n.a.	n.a.
Wheat	0.4	1.2	16.7	−26.1	7.4	7.7

Source: Calculated based on equations in text and figures in Tables 1 and 2.

agricultural GNP's of the sample countries, the sum of the losses in production and consumption amount to between 0.02 and 4.2% with an average of 0.09% These efficiency-type losses are not very large; nevertheless, phased policy changes in the right direction are still advisable.

TABLE 4

Summary by country of monetary effects of price distortions with and without cross-price effects, 1983 (US$ million)

Country	Net social loss in production		Net social loss in consumption		Welfare gain of producers		Welfare gain of consumers		Change in foreign exchange earnings		Change in government revenue
	With	Without	With	Without	With	Without	With	Without	With	Without	With and without
Argentina	18.1	39.3	7.2	13.0	−1 182.9	−1 205.7	200.9	195.3	−159.9	−348.4	717.3
Brazil	50.0	43.0	32.3	33.3	400.4	407.4	−1 460.0	−1 460.8	−51.4	−28.1	977.2
Mexico	13.8	12.7	45.9	39.1	56.8	57.7	−124.6	−117.8	−288.1	−290.7	8.1
Thailand	9.7	11.5	2.8	3.3	−568.5	−570.3	387.8	387.2	−139.6	−173.8	168.2
Indonesia	14.3	14.6	20.7	21.3	−2 082.4	−2 082.7	2 161.1	2 160.4	−313.8	−321.1	−113.7
Egypt	37.7	37.3	22.7	21.0	−505.2	−504.9	564.4	566.3	−262.1	−244.1	−119.7
Kenya	2.2	0.0	1.3	0.5	24.5	30.0	−80.4	−79.5	−9.9	34.4	13.4

Source: The values for the effects with cross-price consideration are the sums, by country, of the values reported in Table 3. The values excluding the cross-price effects (i.e. cross-price elasticies equal to zero) were computed separately. Note that government revenues are the same in the 'with' and 'without' case.

TABLE 5

Comparison of monetary effects of price distortions with key indicators, 1983

Country	Balance of current account (US$ million)	Change in foreign exchange earnings/ balance of current account (%)	Fiscal deficit (US$ million)	Change in government revenue/ fiscal deficit (%)	Agricultural GDP (US$ million)	Producer gain/ agricultural GDP (%)	Official development assistance (ODA) (US$ million)	Change in government revenue/ODA (US$ million)	Change in foreign exchange earnings/ ODA (%)
Argentina	−2 436	7.0	−8 262	−9	8 559	−14.0	46.0	1 559.0	−348.0
Brazil	−16 312	0.3	39	2 506	25 073	2.0	208.1	469.6	−24.7
Mexico	5 328	− 5.3	0	0	11 316	0.5	130.8	6.2	217.0
Thailand	−2 874	5.0	−992	−17	9 261	−6.0	431.1	39.0	32.0
Indonesia	−6 338	4.9	−1 145	10	20 645	10.0	738.8	−15.0	−42.5
Egypt	− 411	60.0	−3 376	3	7 862	−6.4	1 444.3	−8.0	−17.1
Kenya	−121	8.0	−120	−11	83	32.0	397.3	3.0	−2.0

Sources: Balance of current account, fiscal deficit and agricultural GDP from the International Financial Statistics of the IMF (various issues). Official development assistance: OECD (1984).

Monetary effects. Compared to the efficiency-type losses, which are relatively small, the monetary-type welfare gains (or losses) for producers and consumers are large. For example the welfare losses to producers in Egypt, Thailand, Argentina, and Indonesia are US$505; 568; 1,183; 2,082 million, respectively. They are from 13 times (Egypt) to 146 times (Indonesia) as large as the net social losses in production. In two of the countries studied, Mexico and Kenya, producers gain US$57 and 27 million, respectively. In Brazil their gains are US$400 million. One tentative conclusion is that, at least for the sample of countries studied, and using no analytical refinements, a significant minority of developing countries (3 out of 7) did not directly discriminate against agriculture (any longer) in 1983. On the other hand, consumers still appear to be the gainers from agricultural pricing policies in a majority cases (4 out of 7), and in all seven countries studied, foreign exchange earnings appear to have still been negatively affected by the particular policies. In the base case, five of the countries (Kenya, Thailand, Argentina, Brazil and Mexico) have obtained net revenues from the interventions whereas the policies of the two other countries were such that, on a net basis, the government incurred a deficit. This means that taxes, if any, were more than fully offset by subsidies.

In comparing efficiency type net social losses with monetary type welfare gains or losses one can make the generally applicable conclusion that social losses are much smaller than welfare gains or losses. This means that, for example, for cases with negative distortions, the monetary losses to producers are very much larger than the efficiency losses. Therefore, in view of the high incidences of poverty in rural areas, equity considerations would appear to be very important along with efficiency arguments in advocating phased adjustments toward less negative intervention.

The comparison of the change in foreign exchange earnings with the current account balance shows that they vary from 0.3 to 8.0% with the exception of Egypt for which it is 60.0%. The changes in government revenues due to the interventions compared to the countries' fiscal deficits are between 3 and 17%, with the exception of Brazil, where the government budget was almost in balance (in 1982) and where therefore the ratio was very large. Producers' monetary gains or losses in relation to total agricultural GDP varies from -14% in Argentina to 32% for Kenya. The changes in government revenues due to agricultural pricing policies compared to ODA are fairly small for Egypt which receives large foreign aid flows and very large for Argentina which obtains little aid. The above comparisons are sufficiently significant to justify continued attention to pricing policies along with other sectoral issues.

Impact of including cross-price effects. The inclusion of cross-price effects on *production* results in a reversal of the sign in 2 of the 24 cases considered. Of the

22 remaining ones, where the sign has not been affected, the inclusion of cross-price effects results on average in an adjustment of the single market estimates by 23.8%. The production impact of the adjustments are largest for Argentina. Based on the single market method, Argentine production would be estimated to be reduced on average for the four crops by 6.7%. With the cross-price adjustments the estimated production impact would be only 3.1%. The difference in the estimates would therefore be 6.7 minus 3.1 divided by 6.7, which represents a sizeable 54% correction of the single market estimate due to consideration of cross-price effects. Excluding Argentina from the sample would on average reduce the adjustments from 23.8 to 13.4%. For the six countries excluding Argentina one can conclude that, while the consideration of cross-price effects improves the accuracy of the estimates, the single market method nevertheless produces reasonably good 'first-cut' estimates. The inclusion of the cross-price effects on *consumption* and *trade* produces similar results and conclusions as those for production stated above, but the *welfare gains* for both *producers* and *consumers* are affected only marginally.

The *total effect* of including interrelationships with the single most important commodities for the *countries* considered is shown in Table 4, where the 'with' and 'without' situations have been compared. Again, cross-price effects are significant in the case of Argentina, particularly as far as net welfare effects and foreign exchange effects are concerned. However, in terms of welfare effects for producers and consumers the adjustments are small, and the government revenues are unchanged. For the countries other than Argentina, the values of the 'with' and 'without' situations are generally very close. For some countries one of the reasons is that a liberalization of several commodities jointly produces offsetting effects when some commodities are being protected while others are being taxed. In a sense the cross-price effects are less visible in those situations than when one or more commodities are being considered which face similar distortions. The largest absolute differences occur in foreign exchange earnings for Brazil, Thailand and Kenya (US$23 million, US$34 million and US$44 million, respectively). In relative terms compared to total exports, these differences are small for Brazil and Thailand (0.1% and 0.5%, respectively); for Kenya they amount to 5%.

Limitations. The input data (as shown in Table 1 and 2) is largely from official sources. It contains the usual inaccuracies based on the way the data has been collected, but it is the best available data for the particular indicator. The largest inaccuracies may relate to the nominal protection coefficients as they have been computed based on adjustments which, at times, include personal judgements. The estimation of NPCs is simple for cases of commodities with an export tax or an import tariff and a relatively competitive marketing system. But where quotas or other instruments are used for trade intervention, import or

export parity prices need to be derived by computing equivalent tariffs, where that is possible, or by estimating marketing costs, which need to be added to farmgate prices and then compared with the border prices. An average annual farmgate price itself is an indicator composed of prices which often vary significantly between localities and seasons. Also, where data on marketing costs are available, they vary significantly, and the computed average should include only real costs which exclude oligopolistic profits for those marketing systems which are not fully competitive. For the purposes of this study, where no information on taxes/tariffs or marketing costs were available, the authors used information from Ahmed and Rustagi (1985) who estimated marketing costs for a sample of five African and four Asian countries. They concluded that farmers in Malawi, Kenya, and Tanzania generally receive only 35–50% of the final price, farmers in Nigeria and Sudan 55–60% and farmers in the Asian economies 75–90%.

Other limitations of the analysis are more conceptual in nature. Issues are whether: (a) official or free market exchange rates should be used for computing NPCs; (b) distortions of agricultural input prices should be considered; (c) separate NPCs should be computed for producers and consumers; (d) multiple cross-price effects should be considered; (e) pricing policies should be analyzed for more than the most recent year in order to arrive at a proper judgement about the kind of policy which is being used; and (f) whether other, more general, economic variables such as wage rates and rural/urban terms of trade should be considered in the analysis. These issues are discussed below.

Some possible adjustments/refinements

Exchange rate adjustments. In many developing countries governments intervene in foreign exchange markets either directly, such as through exchange restrictions, or indirectly through import tariffs, with the result that their currencies are typically overvalued. This acts like a tax on exports and like a subsidy on imports. If the true equilibrium exchange rate was used in the computation on NPCs (for translating the border price into domestic currency) the latter would all be smaller. This means that the use of undistorted exchange rates would indicate a larger negative distortion against agricultural goods or a reduced positive distortion for goods with positive rates of protection. The degrees of currency overvaluation for the countries, studied (year 1983) (Brazil 1982) are: Argentina -10%, Brazil 20%, Mexico 5%, Thailand 5%, Indonesia 0%, Egypt 50%, and Kenya 10%. These are rounded rates based on information from Pick's World Currency Yearbook, 1985. Because of uncertainties in determining the degree of overvaluation of currencies, sensitivity analyses around the estimated values would be appropriate. Compared to the results presented in Tables 2–5, the use of revised NPCs, based on equilibrium exchange rates, would result in efficiency losses that are twice as high on average and signifi-

cantly larger producer and consumer welfare effects. The total losses in producer welfare would be about US$4 billion compared to about US$2 billion in the base case, while consumers receive a welfare gain of approximately US$2 billion as opposed to a net loss of about US$\frac{1}{2}$ billion. The use of adjusted NPCs reveals the hidden tax/subsidy effect of overvalued exchange rates for the producer/consumer groups. Egypt is a prime example of how an overpriced currency (+50%) adversely affects the producers (welfare loss twice as high as before), government revenues (losses 4 times higher), and foreign exchange reanings (losses 3 times higher), while benefiting the consumers (gains twice as large).

In conclusion, where exchange rates are distorted, estimates of equilibrium exchange rates should be used to assess the effects of price distortions. In a country, for example, with average NPCs of 0.8 and an exchange rate which is overvalued by 30%, a narrow focus on agricultural price distortions is inadequate. As a matter of priority, or simultaneously with reforms in agricultural pricing, the imbalances which cause the exchange rate distortion must be addressed. This points out a need for Ministers of Agriculture and other people concerned with agriculture to be actively involved with macro policy issues in addition to agricultural pricing policies per se.

Adjustments for input price distortions. Government pricing policies may not only affect prices of outputs but of inputs as well. In order to capture input price distortions, one calculates the ratio of value added of the production of a certain product at domestic cost over the value added valued at border prices. Such a ratio is termed Effective Protection Coefficient (EPC). If prices for inputs such as fertilizer, credit and irrigation water are subsidized, the resulting EPC is higher than the corresponding NPC. An EPC higher than 1.0 implies that the producer is receiving a greater return on his resources than he would without intervention. An EPC of less than 1.0 implies that trade, price or other distortions have a negative impact on the farmer. Unfortunately, data in the area of input distortions is weak or non-existent for the countries studied; it was therefore not possible to evaluate these effects.

Separate NPCs for producers and consumers. In an economy where there is, for example, a trade distortion, but where the internal marketing system is fully competitive, the nominal rate of protection is the same for producers and consumers. If consumers receive a subsidy or if the marketing system is not fully competitive, the rates of protection for producers and consumers differ. In order to assess the effects from such distortions more accurately one should, if data permit, use separate NPCs for producers and consumers. The model was run separately using different producer and consumer prices for Egypt, Brazil,

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billion (US) = 10^9.

and Mexico, countries, for which information on consumer subsidies are available. For Mexico and Brazil, the consumer price of maize and wheat was at 85% of the world price. For Egypt, the consumer price of wheat and maize is equal to 32% and 49%, respectively, of the world price. The introduction of different prices for consumers and producers has obviously a significant impact on government budgets and the foreign exchange earnings. For example, in Egypt, the government budgetary deficit is 13 times larger than in the base case and foreign exchange earnings are only a fourth of what they otherwise would be.

Multiple cross-price effects. In this paper we only considered interactions of the single most closely related products with the major commodities studied. In our sample of countries, except for Argentina, these effects were generally small (but not necessarily negligible) in line with the relatively small cross-price elasticities and the values of the other variables which entered the equations (quantities and prices). For the sake of simplicity we did not consider cross-price effects of additional commodities. In general one would expect that the size of cross-price effects of additional commodities would become smaller and smaller. While that may be generally the case, it cannot be stated with certainty. First, even if the cross-price elasticity e_{s13} of commodity 1 with regard to price P_3 was smaller than e_{s12}, the term $Q_1\,dP_3/P_3$ could be larger than $Q_1\,dP_2/P_2$ and therefore the effects may be larger. Second, in the case of Argentina, additional commodities which, for example, might have cross-price elasticities with commodity 1 of as low as 0.05 would still result in sizeable adjustments of the partial estimates and should therefore be included if possible.

A general issue with regard to consideration of interrelationships arises in cases where no reliable econometric estimates of cross-price elasticities are available, a situation which may be quite common in LDCs. Ignoring all interrelationships would implicitly mean assigning zero values to cross-price elasticities; this could lead to significant errors in estimation in certain situations. The alternative would be to make an informed guess of the likely values of key relationships which the analyst knows or thinks are significantly different from zero and which might have a bearing on the key variables which are of interest to the policymakers. The robustness of results based on these informed guesses should then be checked with sensitivity analysis around these choices.

Longer-run analyses. The analysis of agricultural pricing policies uses border prices as benchmarks against which domestic prices are compared; pricing policies are judged protective or discriminating based on these comparisons. The reason is that border prices represent opportunity costs at which goods can be exported or imported. However, from year to year commodity prices fluctuate and with them the benchmarks. Also, domestic policies may from time to time be adjusted in the light of changing circumstances. Both factors can imply

different protection levels including possible switches from positive to negative protection and vice-versa. Therefore, we did not only look at the latest available year in a snapshot type approach, but we also analyzed domestic pricing policies for 1974 and 1978 for which NPCs were computed (Table 1). Distortions against agriculture (as measured by the NPCs) had been reduced in 17 out of 25 cases between 1974 and 1978. Comparing 1983 with 1978 one finds that in 13 cases distortions against agriculture were lower in 1983, and in 11 cases they were higher. The reduced discrimination against agriculture in the sample countries is probably partly the result of declining world prices and partly of 'improved policies'. Further research should compare and analyse complete time series for as large a sample of countries as possible so that also regional and commodity groupings can be made and more reliable conclusions derived about the extent to which pricing policies have changed over time. Such analysis should compare domestic prices with long-run trend border prices rather than (or at least in addition to) yearly ones.

More elaborate methods. In this paper a standard partial equilibrium approach has been used with adjustments that considered cross-price effects with the single most closely related market. Other, more elaborate but technically more complex methods have been and are being developed. The analysis of pricing policies with linear programming models has recently been undertaken by Kutcher et al. (1985). Braverman et al. (1987a) have extended the partial equilibrium method to include income distribution and some general equilibrium considerations. A simpler, more operational version of their model has since been developed and applied to the analysis of pricing policies in a number of other developing countries including Cyprus (Braverman et al. 1987b), Hungary (Braverman et al., 1987c), and Brazil (Braverman et al., 1987d). Their approach uses user-friendly computer software adapted to each country which captures the key interrelationships of markets and the particular policy issues that are of interest to the government. Accordingly, for each study, the basic software is modified and data such as cross-price elasticities are collected. The method is useful for facilitating policy discussion as much as for precise estimation. Studies of this sort can be completed within the time constraints faced by operational economists, but the use of this method requires skills with personal computer as well as access to and understanding of the software.

Conclusions

For the practitioner, for whom time is often of the essence, the assessment of welfare effects using a partial equilibrium, single market approach without refinements may provide reasonably good 'first cut' estimates of the order of magnitude of the impact of distortions. But often, the 'base case estimates' can and should be adjusted/improved for one or more of the following: cross-price

effects, overvaluation of the currencies, input price distortions, differences in the degree of distortions between producers and consumers, and variability of border prices. Without knowing a country and commodiity market situation in some detail one should not, a priori, assume that possible adjustments are small or negligible. Some refinements will no doubt be more important than others; the ranking of their importance would be expected to differ from country to country. The analyst has to assess the size of various possible distortionary factors one by one and determine which one(s) warrent(s) a refinement of the simple, unadjusted, single market estimates. In our paper the inclusion of cross-price effects proved to be important for assessing production, consumption and trade effects for Argentina, but for the other countries it resulted in only somewhat improved accuracy. In general, the analyst needs to determine how important accurate estimates of key variables are to the policy makers; he or she then needs to compare the costs involved in generating or gathering the data and doing the calculations with the benefits of a broader and more accurate analysis of the distortionary effects of the particular case in question.

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