Agricultural Policy Interventions in Developing Countries: Mapping the Nature, Degree and Progress of Reforms

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ABSTRACT

In many developing countries, governments rely on price-based measures (including border protection and subsidies on inputs and outputs) more than on budgetary payments to achieve agricultural policy objectives defined to include price stabilization or food self-sufficiency. Assessing the effects of these price-based measures is thus important to evaluating whether agriculture is being protected or disprotected by commodity or in the aggregate. This aspect of producer support estimates (PSEs) is simple to describe conceptually but difficult to evaluate well empirically. Developing countries may face higher international transport and port costs for imports and exports than developed countries or may have substantial internal handling, transportation and processing costs. Separating these structural effects on farmers from agricultural policy effects requires extensive data and judgments about simplifying assumptions.

In this paper, we describe the PSE measurement issues and illustrate their importance. The analysis is based on commodity-specific PSEs for three important agricultural commodities (wheat, rice and corn) in India (1985-2002), using representative disaggregated state-level results. We also explore how relaxing or changing certain standard PSE assumptions (such as altering the "scaling up" procedure) affects the results. Finally, for commodities that are near self-sufficiency, we follow Byerlee and Morris (1993) and define a relevant adjusted reference price based on the relationship between an estimated autarky price and the import and export prices. We discuss the procedure and use the implied reference price to compute the market price support component of the PSE for India. These assessments suggest that each of the factors (handling of internal costs, scaling up procedures and choice among reference prices) can have a substantial effect on reported PSEs.

With these caveats established, we also report preliminary PSE estimates for China and Indonesia. For China our results are based on five commodities (wheat, rice, corn, soybeans and sugar) over 1995-2001. For Indonesia, six commodities (rice, corn, soybeans, sugar, palm oil and rubber) over 1985-2003 are included in the analysis.

Based on our three-commodity PSE, support has a counter-cyclical facet in India, rising when world prices are low (as in the late 1980s and 1990s) and falling when world prices strengthen (as in the mid 1990s). For China, a trend decline in disprotection is evident, while Indonesia has generally supported its agriculture. Further research is needed to confirm and elaborate on these results.

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Various indicators of agricultural protection can be computed to measure the degree of subsidization or taxation of the agricultural sector as a whole and of important commodities individually. In contrast to the aggregate measure of support (AMS) on which production-related domestic support commitments are based under the World Trade Organization (WTO) Uruguay Round Agreement on Agriculture (URAA), the producer support estimate (PSE) is a broader measure of the transfers to farmers from border protection and domestic policy interventions. It is defined by the Organization for Economic Cooperation and Development (OECD) as "an indicator of the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farmgate level, arising from policy measures that support agriculture, regardless of their nature, objectives or impacts on farm production or income" (OECD, 2002 p. 59). Thus, the PSE includes transfers arising through market-intervention domestic and border policies, and direct budgetary payments to producers. The OECD's calculation of PSEs has focused on its member countries and some transition economies, but others have applied variants of the approach to several developing countries (Pursell and Gupta, 1996; Valdés, 1996; Cheng and Sun, 1998; Cheng 2001; Tian et al., 2002; Gulati and Narayanan, 2003; Mullen et al., 2004).

In this paper we describe and assess the PSE methodology and make applications to India, China and Indonesia.[1] Because developing countries often rely more on border support and other price-based policy measures (input and/or output price controls) than on fiscally-budgeted support payments, most of the protection or disprotection of producers may be given by the gap between domestic and international output or input prices. In comparing a country's domestic price to an international price, an accurate estimate of the policy-related gap must

account for factors such as external and internal transport costs and marketing margins, as well as processing costs and quality differences between the products being compared. Moreover, the net trade status of the commodity in question may itself be the result of policies in place and attention must be directed to determining the appropriate price that would prevail in the absence of the policies.

The Reform Process and Current Policy Setting in India, China and Indonesia

India, China and Indonesia are large countries and substantial agricultural producers, as well as important importers and exporters, and have undergone varying degrees of agricultural policy reforms. There were many similarities in their domestic market and foreign trade policies prior to reform. As in many other developing countries with smallholder dominated agricultural sectors and poorly developed market infrastructure and institutions, government interventions instead of the market were pursued to achieve the twin goals of self-sufficiency and low food prices for consumers. While similarities in the three countries' agricultural trade policies should not be overstated, a few basic similarities are as follows:

(1) India and China pursued a series of closed economy policies and formed an autarkic environment for agriculture. Self-sufficiency was believed to be the necessary and sufficient condition for the nation's food security (Srinivasan, 1994; Lin, 1994). The environment for agriculture in Indonesia also emphasized import substitution during the beginning of the Suharto era (1968-1998), but shifted toward export promotions in the 1980s (Temple, 2003).

(2) All three countries extremely restricted the market's role in balancing supply and demand of agricultural products. In India and Indonesia, a set of complicated agricultural price, procurement, distribution, storage and subsidy (mainly on inputs) policies were employed. The initial government interventions in the market in China were quite similar to those the

Indian government pursued; the market-mistrust, combined with Communist orthodoxy, resulted in the entire economy being almost fully planned by the government.

(3) In India and China, agricultural trade policies served as complementary instruments to make the economy effectively closed. Even though exports of some agricultural products had to be encouraged in order for foreign exchange earnings to cover imports of capital equipment and industrial intermediates, trade in major agricultural products, often called strategic commodities, was highly restricted. In Indonesia, oil export revenues provided a basis for supporting agriculture. To encourage domestic processing industries, export taxes were levied on primary products.

(4) India, China, and Indonesia have utilized many trade policy instruments, such as import tariffs, quantitative restrictions, import and export licensing, and marketing restrictions to limit foreign trade in agriculture, and all these policies had to be implemented by the state trading enterprises (STEs), which were extensions of the government bureaucratic system.

The policy reform processes in India, China, and Indonesia display a gradual transition from an autarkic and state-led setting to a more deregulated market environment with greater integration into the world economy and a new and larger role for the private sector. The reform process has not been uniform over time or across the three countries, and is marked by occasional policy reversals and setbacks. However, it has been two decades since reforms began in China and Indonesia and over ten years since India launched its broad-based economic reforms. At this juncture, it is useful to have the quantitative measure of agricultural protection from PSEs to evaluate the past and current level of protection (or disprotection) for major agricultural commodities. Such measures inform the debate on how to proceed with agricultural

reforms from a domestic policymaking perspective and from the standpoint of international trade negotiations currently ongoing in the WTO Doha Development Round.

PSE Methodology: Description and Issues in Applications to Developing Countries

The starting point of our analysis is the methodology utilized by the OECD to measure PSEs (Portugal, 2002). Within the PSE, policies are categorized into one of eight subcategories. Market price support (MPS) is defined as the component that is an "indicator of the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers arising from policy measures that create a gap between domestic market prices and border prices of a specific commodity measured at the farmgate level" (Portugal, p. 2). It is calculated based on the difference between the domestic price and an equivalent world price of a commodity. The seven other subcategories of support are measured by budgetary outlays for various types of government payments that support farmers. On average for OECD countries, the total MPS (for all of agriculture) accounted for 63 percent of the total PSE in 2000-2002 (OECD, 2003).

Estimating Market Price Support (MPS)

Assuming competitive markets, *ex post* price certainty, and a small country case whereby a nation's domestic and border policies do not affect world prices, the domestic farmgate price, P_d, is compared to an adjusted reference price, P_{ar}. The types of adjustments made to determine P_{ar} are shown for an imported and an exported commodity in equations (1) and (2). The reference price at the border, P_r, is the "world market" c.i.f. price for an importer or f.o.b. price for an exporter expressed in the domestic currency. The reference price is commonly measured either from observed unit values for imports and exports or from observed international prices adjusted by international transportation costs. The reference price is then adjusted by the costs of handling, transporting and marketing between the border and the wholesale market (C_p and T_{d1}),

Equations (1) and (2). Calculation of the Adjusted Reference Price

In the case of an importable:

(1) Adjusted reference price for an import = Reference price at border + (Port charges + Transportation, handling and marketing cost from port to internal wholesale market) - (Transportation and handling costs from farm to wholesale market + Marketing and processing costs from farm to wholesale market) - Quality adjustment

$$P_{ar} = P_r + (C_p + T_{d1}) - (T_{d2} + M) - Q_{adj}$$

In the case of an exportable:

(2) Adjusted reference price for an export = Reference price at border - (Port charges + Transportation, handling and marketing cost from port to internal wholesale market) - (Transportation and handling costs from farm to wholesale market + Marketing and processing costs from farm to wholesale market) - Quality adjustment

$$P_{ar} = P_r - (C_p + T_{d1}) - (T_{d2} + M) - Q_{adj}$$

Source: Adopted from Melyukhina (2002).
Note: $Q_{adj} > 0$ implies that the domestic quality is lower than the quality of the internationally traded commodity.

the costs of handling, transporting, marketing and processing the commodity between the farm and the wholesale market (T_{d2} and M), and by any needed adjustment for differences in quality between the domestic and internationally produced commodity (Q_{adj}). The price gap at the farmgate level, $\Delta P = P_d - P_{ar}$, then is a monetary measure of market price support per unit of output. Ideally, ΔP captures the differences induced by visible and invisible policy interventions. Expressed in percentage terms relative to the reference price ($\Delta P / P_{ar}$), the price gap is a traditional nominal rate of protection (NRP), or as we refer to it later, the "%MPS."

The ideal comparison is one thing, but practical comparison for empirical work is quite another. The difficulties in assessing market price gaps are likely to be particularly important in developing countries compared to developed countries for a number of reasons. First, the developing countries are even more likely than the OECD countries to utilize border policies or

commodity price support programs backed up by market interventions and government stockholding. These are policies whose effects are measured in an MPS. Exchange rate values may play an important role in interpretation of the results. Second, with less well-developed infrastructure, various costs associated with adjusting the reference price are likely to have larger magnitudes in developing than developed countries, so taking them into account (or not) will have a larger effect on the estimated MPS and its interpretation. For large developing countries, MPS or budgetary expenditures may differ substantially among different regions. Third, developing countries may be more likely than developed countries to switch from importer to exporter of a commodity across years, and the relevant reference price adjustments for internal costs can differ depending on the circumstances for a given period, as discussed further below. Fourth, the price gap in developing countries, and difficulties in assessing its policy component, may also be affected by imperfect competition in the handling, transportation, processing or marketing sectors. This would affect the observed price gap, but with different implications than border or price support interventions. Fifth, even if competitive market forces are functioning relatively well in the handling, transportation, processing and marketing sectors, acquiring the requisite data on various costs may be particularly resource intensive (beyond plausible research budgets) or consistent data over a range of years may simply not exist.

Since a substantial amount of data is required to calculate the price gaps, attempting to assess market price support in a developing country context requires making judgements on how to reduce the measurement error. The importance of errors related to various within-country adjustments to the reference price will vary among situations. For some commodities, there is complex processing, so a substantial determinant of the MPS will be associated with adjustments to the reference price for these processing costs. In such cases, a comparison might be made, for

simplicity, between the reference price of the processed commodity and the domestic price of that processed commodity at the wholesale level. Such a comparison would not separate protection (or disprotection) between domestic farmers and processors. This could be an important distinction, especially if processing is inefficient or non-competitive (see Cahill and Legg, 1990; Doyon et al., 2001).

Calculating PSEs

The total PSE expressed in nominal terms for all agricultural producers is the sum of an aggregate MPS (which is the price gap per unit of each output multiplied by the quantity of output, summed over all outputs included in the analysis) and aggregate budgetary transfers. The calculation of total MPS, according to the OECD approach consists of three steps. First, a nominal value of MPS is estimated for individual products, the set of which is known as the "MPS commodities." The second step is to sum the product-specific MPS results into an aggregate MPS_c. One method to estimate the nominal PSE for a country (not used by OECD) is to include only the market price support derived for covered commodities in the calculation: $PSE_c = MPS_c + BP$, where BP is the total budgetary payments to producers. In the OECD approach, a third step is made to calculate the PSE. The MPS_c for covered commodities is "scaled up" to all products based on the share (k) of the covered commodities in the total value of production. The final step or "MPS extrapolation procedure" can be expressed as $MPS = MPS_c/k$, where MPS is the estimated total market price support. Either approximation introduces error, and any error is relatively more or less important as the MPS component of the PSE increases relative to the budget payment component. For developing countries, feasible coverage is likely to be less than for the OECD countries, and the assumption imposed by scaling up may be unrealistic if support is concentrated among commodities included in the analysis.

With the scaling up, the OECD "Total PSE" is calculated as $PSE = MPS + BP$. Either measure can be expressed on a percentage basis, with $(VP + BP)$ as the denominator, where VP is the total value of agricultural production at domestic producer prices. These measures of percentage PSEs use a "subsidy counter's" denominator. An alternative ("trade economist's") measure (denominator) would be to express support received by farmers as a percentage of the value of their output at farmgate-equivalent international prices.

Modified Procedure to Account for Domestic Market-Clearing Prices

Beyond the practical difficulties in obtaining the necessary data to compute PSEs, another factor may be particularly relevant to their measurement and interpretation for developing countries. World price fluctuations, changes in the government intervention price levels, and domestic supply and demand shocks are all factors that affect whether a country will be importing or exporting, or, alternatively depleting or accumulating stocks (of storable commodities). Byerlee and Morris (1993) pointed out that the likelihood that any of these factors results in a change in the trade status (or direction of stock depletion or accumulation) of a country is greater if the country is near self-sufficiency in a particular commodity, or if it has relatively high internal or external transport costs, so that there is a wide gap between the adjusted reference prices for imports versus exports (from here on, the adjusted reference price for exports will be denoted P_e and for imports P_m). They suggest that under these circumstances (which describe the situation for cereals in many developing countries) agricultural protection indicators computed by the conventional methods of comparing the domestic price to an import or export adjusted reference price can lead to an incorrect estimate of the level and even the direction of protection. A corrected protection measure may need to be calculated based on a domestic market-clearing equilibrium price as the "adjusted reference price" rather than the

import or export price. To demonstrate, they use the example of Pakistan, which was more than 85 percent self-sufficient in wheat during 1985-90, had a controlled producer price slightly above the export price and well below the import price, and was a net importer of wheat. Conventional measures of support showed the domestic price as much as 40 percent lower than the adjusted import reference price. But Byerlee and Morris conclude that if controls were removed the price only would have increased by about 10 percent to a domestic market-clearing level.

Byerlee and Morris provide a more systematic approach than relying on the current direction of trade to dictate the adjusted reference price used to evaluate the MPS component of the PSE. In order to know which price will be relevant when the policy intervention is removed, one must know the relationships among the autarky equilibrium price, P^*, and the adjusted reference prices P_m and P_e. Because of international and domestic cost adjustments, it is always the case that $P_m > P_e$. When $P^* > P_m$, then P_m is the relevant P_{ar}; when $P_e > P^*$, then P_e is the relevant P_{ar}; and when $P_m > P^* > P_e$, then P^* is the relevant P_{ar}. This price relationship, not the observed trade under the policies in place, determines the level of protection or disprotection relative to the price level that would exist in the absence of the policy interventions. The argument is shown graphically in Figure 1.

PSEs for India

We now turn to our estimates of PSEs for India. Our calculations draw heavily on previous studies by Gulati et al. (1990), Gulati and Kelley (1999), Gulati and Narayanan, and Gulati and Pursell (forthcoming). Data for the computation of the MPS is taken primarily from the detailed database for 1964-65 to 2001-02 compiled in Gulati and Pursell. This database includes reference prices and international freight rates for all main Indian crops, exchange rates and port charges. Production quantities, farmgate or wholesale domestic prices, domestic

transport costs, and marketing and processing margins are included for important producing states. Estimates of port charges and domestic transportation costs are based on an earlier study by Sharma (1991) and are projected forward using the procedure described in Pursell and Gupta. Marketing costs are taken as a percentage of P_d of each commodity and vary from 5-10 percent. For some products requiring substantial processing, the prices included are at the wholesale (processed) level, not the farmgate level. Aggregate estimates of subsidies on fertilizer, power and irrigation are from Gulati and Narayanan and are projected for 2000-2003.

MPS Calculations

The starting point for estimation of the MPS components of the PSEs are equations (1) and (2). For many commodities in India, the direction of net trade varies among the years of our period of analysis, 1985-2002. For three commodities (wheat, rice and corn), we compute P_m and P_e under the conventional assumptions of either that the commodities are either importables ("importable hypothesis") or exportables ("exportable hypothesis"). Then, we compute P^* and compare this price to the adjusted reference price for an import commodity and an export commodity. Depending on the relationship between P^* and P_m and P_e we use the relevant reference price to compute the MPS, as discussed above.

In India, reference prices at the border for imported commodities are calculated from observed international prices for the quality level that most closely resembles that produced domestically.[2] Reference prices at the border for export commodities are taken as the export prices of major competitors for an equivalent quality level. This implicitly assumes that the international freight from the competing exporting country to a third-country importer and from India to a third-country importer are equal.

Given the operation of the national and state-level price support policies, the existence of other state-level agricultural policies, and the interstate movement restrictions that were in place for some commodities in India until 2002, farmers in various states are expected to receive different levels of protection or disprotection from the agricultural policy regime. For most of the major commodities in India, representative analysis at the state-level is conducted. Important producing states or regions are divided into "net surplus" and "net deficit" areas. In calculating the MPS price gap, the point of comparison between the imported commodity and the commodity produced in the surplus region is assumed to be the wholesale market in the port city. The adjusted reference price for a deficit region is then computed assuming that the price-gap point of comparison is in the deficit region, the adjusted reference price is that of a nearby surplus region plus the transportation, handling and marketing costs from the surplus region to the deficit region (see Pursell and Gupta and Mullen et al.). If the commodity is an export, only surplus regions are included in our analysis, with adjustments along the lines of equation 2.

Once state-level MPSs are computed, they are aggregated to obtain an estimate of the national average MPS using value of production at adjusted references prices as the weights. A national average P_m and P_e are computed, again using the value of production at adjusted reference prices as the weights. Using these prices, P_d, data on annual consumption, and demand elasticities, we solve for P^* to determine the appropriate adjusted reference price in various years. Consistent with the standard PSE methodology, we assume that *ex post* supply is fixed.

In terms of budgetary expenditures and input subsidies, Gulati and Narayanan's fertilizer subsidy estimates have been computed via a comparison of farm-level prices with comparable adjusted reference ("import parity") prices, analogously to the output price gap calculations. Since it is not possible to obtain an import parity price for non-tradable inputs, subsidies or taxes

on these factors of production must be measured via budgetary outlays, or if data allows on the difference between the cost to the government of supplying certain services (i.e. power or irrigation) and the fees charged for those services (Gulati and Narayanan). Fertilizer subsidies are allocated across commodities based on the commodity's share of fertilizer usage, while irrigation and power subsides are distributed based on the share of irrigated area (as reported in USDA, 1994).

Wheat: Recent Policy Setting in India

Starting with our results for wheat in India, we draw on the detailed data available to demonstrate how various adjustments to the reference price affect the resulting MPS values. India is the third largest producer and consumer of wheat. A minimum support price (MSP) has been and remains in place at which the government procures wheat, providing a price floor for farmers. The effects of the restrictions on domestic wheat movements among states and even districts, and the stocking limits on private traders were to drive down the "farm harvest price" to the MSP. Thus, throughout the period of our analysis, the MSP is effectively the price received by producers. Since wheat is a storable commodity, the gap between annual supply and demand can be attributed to a sum of stock accumulation and net exports. Over the period 1985-2003, there is considerable variability in net exports and changes in stocks.

Wheat exports were restricted until 1995, and from 1985 to 1994 India imported very little wheat except in two years (1988 and 1992). In 1995, the Indian government moved wheat onto the list of freely exportable goods. As exports started picking up, there was upward pressure on domestic wheat prices and the government hastily banned exports in 1996 and opened up imports of wheat at zero import duty. But in the following years, especially from 1998 onwards, the world prices of wheat and most other agricultural commodities fell, while Indian support

prices continued to rise. India imported some wheat in 1998 and 1999, despite bumper crops harvested in these years. This led to a situation where imports were coming in even as domestic food grain stocks reached unprecedented levels. To stem the flow of imports, the government raised the import duty from zero to 50 percent on December 1, 1999 against a WTO bound rate of 100 percent. The government also started offloading wheat stocks to private traders for export at concessional rates—about 75 percent of the minimum support price in 2001 (USDA, 2002).

MPS for Wheat with Import, Export and Domestic Market-Clearing Reference Prices

Price comparisons and annual estimates of the wheat %MPS for 1985 to 2003 are shown under several alternative assumptions in Table 1. We compute the MPS based on the difference between the MSP for wheat (P_d in Table 1) and the adjusted reference prices. The reference prices for U.S. exports ($P_{exporterfob}$ in Table 1) are taken in U.S. dollars as the price of U.S. hard red winter wheat f.o.b. U.S. Gulf.[3] Adding the international transportation costs from the U.S. Gulf to India and multiplication by the exchange rate gives the unadjusted border prices for imports (in rupees/ton), while the rupee equivalent of the U.S. export price is taken as the reference price for exports. The unadjusted reference prices are not shown in Table 1. Instead the average adjusted reference prices (P_m and P_e) are given. Our estimates of the market-clearing autarky prices (P^*) are also shown.

Under the importable hypothesis, we compute the wheat MPS for two key surplus states (Haryana and Punjab) and one main deficit state (Uttar Pradesh). We then aggregate the results to a national level. Under the exportable hypothesis, we compute the wheat MPS by state for Haryana and Punjab and derive our national estimate from these results. In the MPS results in Table 1, the national results based on the internal cost adjustments and state-based aggregation are shown under both the importable and exportable hypothesis (these estimates are labelled

"Adjusted Reference Price"). We also compute a simplified MPS based on the difference between the MSP and the unadjusted reference price at the border under both hypotheses.

Table 1 has several implications. Under the importable hypothesis, the results with internal adjustments do not differ significantly from those without internal adjustments. Recall in the specification of P_{ar}, that for imports some domestic costs are added and some are subtracted from the reference price. The effect is that the net adjustment is small when averaged across regions, and the difference between the %MPS with internal adjustments and at the border without internal adjustments is also small.

For an export, all domestic cost adjustments are subtracted from P_r. Thus there is a greater difference between P_r and P_{ar} under the exportable hypothesis than under the importable hypothesis. Under the exportable hypothesis, the %MPS results with the adjusted reference price are greater than for the unadjusted reference price by 12.0 percent (in 1996) to 59.9 percent (in 2000). The MPS for an export based on a comparison of domestic prices and unadjusted reference prices will have a large systematic downward bias if internal adjustments are large.

On the substantive issue of levels of protection or disprotection, we focus on our most detailed estimated of the %MPS; those computed with adjusted reference prices. As opposed to applying the importable or exportable hypothesis based on net trade in each particular year, we follow the Byerlee and Morris procedure to compute the level of protection or disprotection relative to the relevant adjusted reference price. To compute P^* requires some additional data on the price elasticity of demand and domestic consumption. The elasticity estimates available in the literature vary widely depending on the model and data used, and our calculation of P^* will vary depending on the elasticity assumed. Not binding ourselves to any particular estimate, we use -0.5 as an illustrative value, as used in Gulati and Kelly (1999).[5] We supplement the Gulati

and Pursell database with domestic consumption for 1985-2003 from the USDA-FAS Production, Supply and Demand database (USDA, 2004). We then compute the %MPS (labeled "Modified Procedure") using the relevant adjusted reference price after comparing our estimated P^* for each year to the adjusted reference prices P_m and P_e.

In addition to the variability in the direction of trade over the period of analysis, the relevant adjusted reference price, shown in bold in Table 1, also varies across years. Between 1985-1991, there is fluctuation from year to year. The relevant P_{ar} is P^* in 1986, 1989 and 1991, P_m in 1987 and 1988, and P_e in 1985 and 1990. In these various years, if the policy interventions were removed, wheat, in principle, would have been not traded, imported and exported, respectively. By 1990, the domestic price, P_d was below the relevant P_{ar} and %MPS was negative (-22.2 percent in 1990 and -9.0 percent in 1991). During 1992-1998, P_e is the relevant P_{ar}, meaning that without policy interventions, India would have been an exporter in these years. Because the %MPS is negative in all of these years except 1998, producers were disprotected relative to P_e. Partly the disprotection arises from relatively strong world prices during this period and partly from a nominal depreciation of the Indian currency of 80 percent between 1990 and 1993 (the latter effect raises the adjusted reference price in domestic currency). Had the currency not been depreciated, the calculated levels of disprotection under the exportable (or importable) hypothesis would not have been as large; conversely, overvaluation of the exchange rate before the depreciation leads to lower reported disprotection than otherwise in those years.

During 1999-2003, P^* is the relevant reference price for wheat in India, implying that without policy interventions India would be self-sufficient in wheat production, but would not import or export (or experience changes in intervention stock levels) because P_m is "too high" for imports to be competitive and P_e is "too low" relative to P^* for exports to compete on the world

market (as in Figure 1c). In 1998-2001, as world prices fell, cash subsidy payments to farmers in the United States and farm support in other developed countries were increased, allowing exports to continue even with low prices. In India, the MSP also rose, and wheat stocks built up that could not be exported without subsidies because the domestic price was higher than the world price. As a result of these international and domestic factors, the %MPS from our modified procedure reaches a high of 40.0 percent in 2000. But the estimated level of protection is less than under a conventional exportable assumption. In 2002 and 2003, the domestic price is slightly below P^*, corresponding to decreasing stocks, and resulting in a small negative %MPS in these years. Figure 2 shows the movements of the %MPS under this modified procedure compared with those under the importable and exportable hypotheses.

Multiple Commodities and "Total" PSE Estimation

We evaluate the empirical impacts of alternative assumptions about scaling up of measured MPS using three commodities in India. To our MPS for wheat computed in the previous section, we add the MPS for rice and corn, using the modified MPS procedure as our best estimate of the price gap. Thus, we compute P^* for rice and corn for each year using the same procedure and demand elasticity as for wheat. Using the relevant P_{ar}, we compute the MPS for rice and corn in India similarly to wheat (see Mullen et al. for these results).

In Table 2, MPS_c refers to the sum of the nominal MPS for wheat, rice and corn. MPS is equal to MPS_c divided by the included commodities' share of the total value of agricultural production. The three included commodities represent about 26 percent of the total value of agricultural production (much less than the benchmark 70 percent that the OECD aims to cover). Yet, the three-commodity set is sufficient to illustrate, potentially in an exaggerated fashion, the

effects of scaling up. In both calculations, budgetary payments, which increase markedly in recent years, are the sum of fertilizer, power and irrigation subsidies for all agriculture.

The impact of the scaling up procedure is to magnify the positive or negative market price support for the included commodities. The MPS is greater in absolute value than the MPS_c (Table 2). The resulting PSE_c and PSE differ not only in magnitude, but also in sign for several years. For example, MPS_c and MPS are Rs. -117.0 billion and Rs. -447.1 billion, respectively, in 1999. Since the total budgetary payments are Rs. 357.5 billion, the PSE_c is Rs. 240.5 billion, while the PSE is Rs. -89.7 billion. Because of scaling up, the magnitude of the estimated (negative) market price support becomes greater than that of the (positive) budgetary payments. Overall, the PSE shows a pattern of disprotection during the 1990s and protection more recently. This pattern in muted in the PSE_c which only shows disprotection in a few years.

Table 2 also reports the %PSE using the OECD and "trade economist's" denominators. The results with the OECD denominator are larger (smaller) in absolute value than those for the trade economist denominator when the %PSE is negative (positive), but the differences are small in most years. Using either measure, the difference between the $\%PSE_c$ and %PSE can be large and they can be of different signs.

Figure 3 presents the aggregate conclusion from our analysis for India in graphical form. The first estimate is $\%PSE_c$ from Table 3 (using the Byerlee and Morris modified procedure, not scaling up, but using the OECD calculation of support as a percentage of domestic farm income). It shows policy to have been close to neutral in its aggregate effect from 1985 through the late 1990s, with a persistent increase in support since 1998. The second estimate is the %PSE (again using the Byerlee and Morris modified procedure, but now with scaling up). Here a more pronounced discrimination against agriculture is evident from the late 1980s to late 1990s,

followed again by a period of aggregate support for agriculture. Thus, by either measure policy in India has recently been to support agriculture and to do so more than in previous years. Additional analysis to extend the set of covered commodities is needed to determine with more precision where the PSE for India lies with respect to these two estimates.

Initial Results for China and Indonesia

We turn now briefly to some preliminary results for China and Indonesia. For China, we use unadjusted reference prices at the border computed primarily based on import or export unit values. We consider five commodities based on an analysis by Sun (2003) for the period 1995-2001.[4] Three commodities are assumed to be imports (wheat, soybeans, sugar) and two exports (rice and corn)—we have not applied the Byerlee-Morris procedure to the estimates for China or Indonesia. Over the period 1995-2001, the five commodities share in the total value of production falls from 44 percent to 22 percent; on average they accounts for about 32 percent. Budgetary payments for China include input subsidies, relief payments and regional assistance programs, agricultural taxes, and forgone agricultural taxes. Net budgetary "expenditures" can be negative, when the agricultural taxes are dominant.

For Indonesia, the commodity specific PSEs are computed for six agricultural commodities that account for about 50 percent of agricultural value of production for the period 1985-2003. Four of the crops are imports (rice, maize, sugar, soybeans) and two are exports (crude palm oil and natural rubber). The reference prices are world prices adjusted for international freight in the case of rice and maize, import unit values in the case of sugar and soybeans, and export unit values in the case of crude palm oil and natural rubber. Prices are adjusted by domestic transportation and marketing costs covering port to wholesale for the reference price and farm to wholesale when the domestic price is the producer price (there is no

adjustment if the domestic price is the wholesale price). Farm-level rice prices are adjusted to account for the difference in the processing level between produced and traded rice. Budgetary outlays cover fertilizer and irrigation subsidies from 1985 to 2000. Fertilizer subsidies were eliminated in 1999, and irrigation expenditures after 2000 were not available for the preliminary analysis.

Figures 4 and 5 present our estimates of the $\%PSE_c$ and %PSE (OECD denominator) for China and Indonesia. For China, we also present the results of Cheng and Sun for select years between 1982-1994 for comparison. Keeping caution in mind in evaluating these preliminary estimates in light of the measurement and interpretation issues we have raised, the results seem to indicate that the level of discrimination against agriculture has decreased in China. The $\%PSE_c$ again tends to be closer to zero and less variable over time than the scaled-up %PSE. The %PSE shows a more pronounced disprotection in 1996 and 1999. By either measure, the results for 1998 and 2001 indicate that policies in China provide producers with very small levels of protection. In contrast, Indonesia appears to have supported its agriculture on average over the past 18 years, except during the 1988-89 period, and in 1998, due to the large devaluation of the Rupiah during the 1997-98 financial crisis. Although estimates from 2001-2003 do not include budgetary expenditures, they indicate an acceleration in protection consistent with recent reports.

Conclusion

Using different variants of the PSE methodology, this paper has explored how various adjustments and assumptions impact the results for three important agricultural commodities (wheat, rice and corn) in India (1985-2002), using disaggregated analysis for representative surplus and deficit states. Preliminary results have also been presented based on five important commodities for China and six commodities for Indonesia. Space limitations preclude offering a

full summary or further discussion, but the contrasting results demonstrate how the three countries may have differing views of possible outcomes of the WTO Doha Development Round negotiations on agriculture. Care needs to be exercised in measurement and interpretation of agricultural support or disprotection estimates for developing countries. Further research is needed to create a body of knowledge for these countries that would correspond to the estimates widely available for the developed countries.

Footnotes

[1] Mullen and Gulati are responsible for the research on India in this paper, Sun (2003) for China, and Thomas and Orden (2004) for Indonesia. See also Sun et al. (2003).

[2] Given the small trade volumes of the major commodities in India, there is substantial variation between import and export unit values reported by FAO and the international prices (i.e. U.S. hard red winter wheat f.o.b. U.S. Gulf, U.S. number 2 yellow corn f.o.b. U.S. Gulf, and Thai 15 percent broken rice prices f.o.b. Bangkok). See Cheng (2004) for comparisons for major commodities in China, India and Indonesia.

[3] The internationally traded wheat that is most similar in quality to Indian wheat is Australian Standard White or General Purpose (Stevens, 2003). Export prices of Australian wheat are not readily available, thus we follow earlier studies and use U.S. prices, recognizing that our results could fail to account for quality differences.

[4] This represents a subset of the twenty-one commodities covered by Sun (2003). By including only the major agricultural commodities, we avoid the difficulties of computing an appropriate adjusted reference price for some highly differentiated horticulture and livestock products, for which only very limited data is available.

[5] See Dev et al. (2004) for recent discussion of demand being even more inelastic, about -0.2.

Table 1. India Wheat %MPS Under Various Assumptions, 1985-2003

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Price Data																			
$P_{exporterfob}$ (US$/MT)	154	139	116	115	136	174	125	143	146	140	152	192	197	151	121	109	122	128	140
P_{cif} (US$/MT)	184	169	141	140	179	215	165	184	188	181	196	235	241	194	163	150	164	169	181
Exchange Rate (Rs/US$)	12.5	12.5	12.8	13.4	16.1	17.3	20.5	25.9	31.3	31.4	31.4	34.7	35.8	40.8	42.9	44.1	46.9	49.0	47.4
P_d (Rs/MT)	1520	1570	1620	1660	1730	1830	2150	2250	2750	3300	3500	3600	3800	4750	5100	5500	5800	6100	6200
P_m (Rs/MT)	2200	2009	**1693**	**1771**	2795	3608	3261	4654	5760	5537	6017	8061	8509	7747	6853	6482	7538	8125	8414
P_e (Rs/MT)	**1504**	1295	995	1007	1607	**2352**	1832	**2908**	**3652**	**3340**	**3614**	**5459**	**5767**	**4676**	3624	3146	4023	4459	4721
P^* (Rs/MT)	1496	**1468**	2318	1847	**1671**	1657	**2363**	2393	2355	3134	3411	4032	3789	4357	**4730**	**3928**	**5152**	**6225**	**6544**
Wheat %MPS Estimates																			
Importable Hypothesis																			
Adjusted Reference Prices	-31.0	-21.9	-4.3	-6.3	-38.2	-49.3	-34.1	-51.7	-52.3	-40.5	-41.9	-55.4	-55.4	-38.7	-25.6	-15.2	-23.1	-25.0	-26.4
Unadjusted border price (c.i.f.)	-33.7	-25.6	-9.9	-11.7	-40.1	-50.9	-36.6	-52.7	-53.3	-41.9	-43.1	-56.0	-55.9	-40.1	-27.1	-17.0	-24.7	-26.5	-27.8
Difference	2.8	3.7	5.5	5.4	1.9	1.6	2.4	1.0	1.0	1.5	1.3	0.6	0.5	1.3	1.5	1.8	1.6	1.5	1.4
Exportable Hypothesis																			
Adjusted Reference Prices	1.0	21.2	62.8	64.9	7.7	-22.2	17.4	-22.6	-24.7	-1.2	-3.1	-34.1	-34.1	1.6	40.7	74.8	44.2	36.8	31.3
Unadjusted border price (f.o.b.)	-21.0	-9.9	9.6	7.8	-21.2	-39.2	-16.1	-39.4	-40.0	-24.7	-26.5	-46.0	-46.2	-22.9	-2.1	14.9	1.0	-2.5	-6.2
Difference	22.1	31.1	53.2	57.1	28.9	17.1	33.4	16.8	15.3	23.5	23.4	12.0	12.1	24.5	42.8	59.9	43.2	39.3	37.5
Modified Procedure	1.0	7.0	-4.3	-6.3	3.5	-22.2	-9.0	-22.6	-24.7	-1.2	-3.1	-34.1	-34.1	1.6	7.8	40.0	12.6	-2.0	-5.3

Source: Authors' calculations.

Note: Relevant P_{ar} is in **bold** (see discussion in text). Multiplication of $P_{exporterfob}$ and P_{cif} by the exchange rate gives the unadjusted reference prices in rupees (P_r in equations 1 and 2, respectively, which are not shown in the table). P_m and P_e (shown above) are the adjusted reference prices from those equations (see text for discussion of the adjustments).

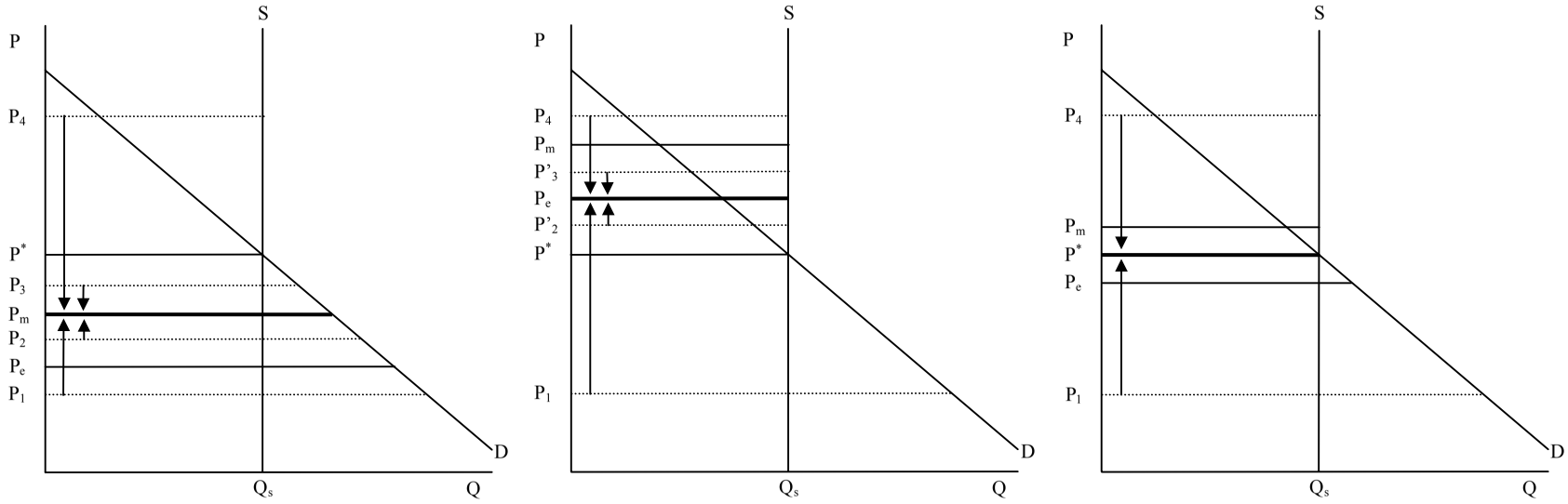
Table 2. India "Total" PSE Under the Modified Procedure and Alternative Adjustments, 1985-2002

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Measured Support (Rs. bil)																		
MPS_c	-15.1	23.4	12.3	-37.4	-50.7	-82.1	-59.2	-185.8	-111.5	-221.8	-112.9	-504.5	-374.3	-49.3	-117.0	203.2	4.6	122.3
BP	29.3	34.7	27.1	50.3	72.6	87.6	117.5	122.6	138.9	157.5	230.4	279.4	296.6	318.4	357.5	377.0	415.7	444.9
Covered Share	0.26	0.28	0.27	0.25	0.27	0.26	0.27	0.23	0.23	0.24	0.26	0.24	0.25	0.28	0.26	0.28	0.25	0.25
MPS (Rs. bil)	-56.9	82.2	45.8	-148.6	-190.4	-319.2	-219.2	-816.4	-478.7	-943.7	-440.5	-2101	-1509	-177.5	-447.1	728.4	18.4	493.0
PSE (Rs. bil)																		
PSE_c	14.3	58.1	39.4	12.9	21.8	5.5	58.3	-63.3	27.4	-64.3	117.6	-225.1	-77.7	269.0	240.5	580.1	420.3	567.2
PSE	-27.6	116.9	72.9	-98.2	-117.8	-231.6	-101.7	-693.8	-339.8	-786.2	-210.1	-1821	-1212	140.9	-89.7	1105.4	434.1	937.9
PSE (%)																		
OECD Denominator																		
PSE_c	1.7	6.8	4.5	1.4	1.9	0.4	3.7	-3.1	1.2	-2.2	3.8	-6.8	-2.1	6.9	5.1	11.8	8.2	10.1
PSE	-3.4	13.7	8.2	-10.8	-10.0	-16.9	-6.5	-33.5	-14.5	-27.3	-6.8	-55.0	-32.1	3.6	-1.9	22.4	8.5	16.7
Trade Economist Denominator																		
PSE_c	1.8	7.3	4.7	1.4	1.9	0.4	3.9	-3.0	1.2	-2.2	4.0	-6.4	-2.0	7.4	5.4	13.3	9.0	11.2
PSE	-3.3	15.8	9.0	-9.8	-9.1	-14.4	-6.1	-25.1	-12.7	-21.5	-6.4	-35.5	-24.3	3.7	-1.9	28.9	9.3	20.0

Source: Authors' calculations.

Note: MPS_c and PSE_c include only the market price support calculated for wheat, rice and corn; MPS and PSE are based on scaling up this market price support by dividing MPS_c by the share of these commodities in the total value of agricultural production (see text for discussion).

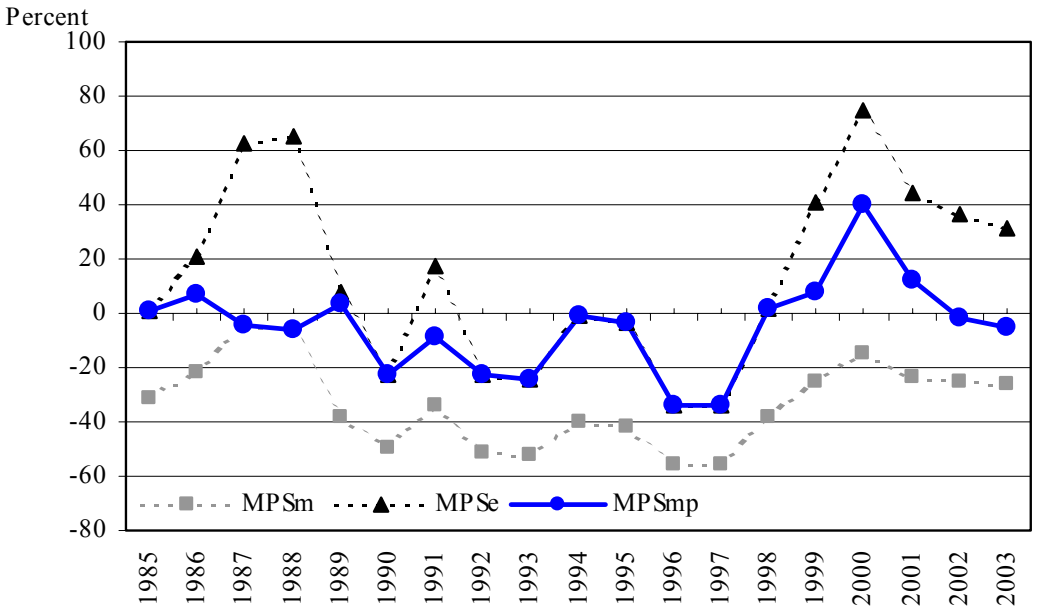
Figure 1. Computing the MPS Under Alternative Price Scenarios



a. If $P^*>P_m$, then P_m is the relevant P_{ar} b. If $P_e>P^*$, then P_e is the relevant P_{ar} c. If $P_m>P^*>P_e$, then P^* is the relevant P_{ar}

Figure 1 shows that the relevant reference price depends on the relationship between P^* and P_m and P_e. In the three panels, P_1 - P_4 are possible prices set by domestic policy. As shown in panel 1c, if $P_m>P^*>P_e$, then P^* is the relevant reference price. Whether the domestic policy supports agriculture (at P_4) or disprotects agriculture (at P_1), when the policy is removed the price becomes P^*. Likewise in panels 1a and 1b, regardless of the level of the domestic price set by policy or the corresponding trade pattern, P_m and P_e are the relevant reference prices under the price relationships specified. In the figure and our empirical calculations, we treat annual production as pre-determined (consistent with interpretation of PSEs as transfers to farmers given an observed fixed supply) but allow demand to adjust to clear the market in our counter-factual annual determinations of P^* . If we let the supply also adjust, the P* obviously would be different.

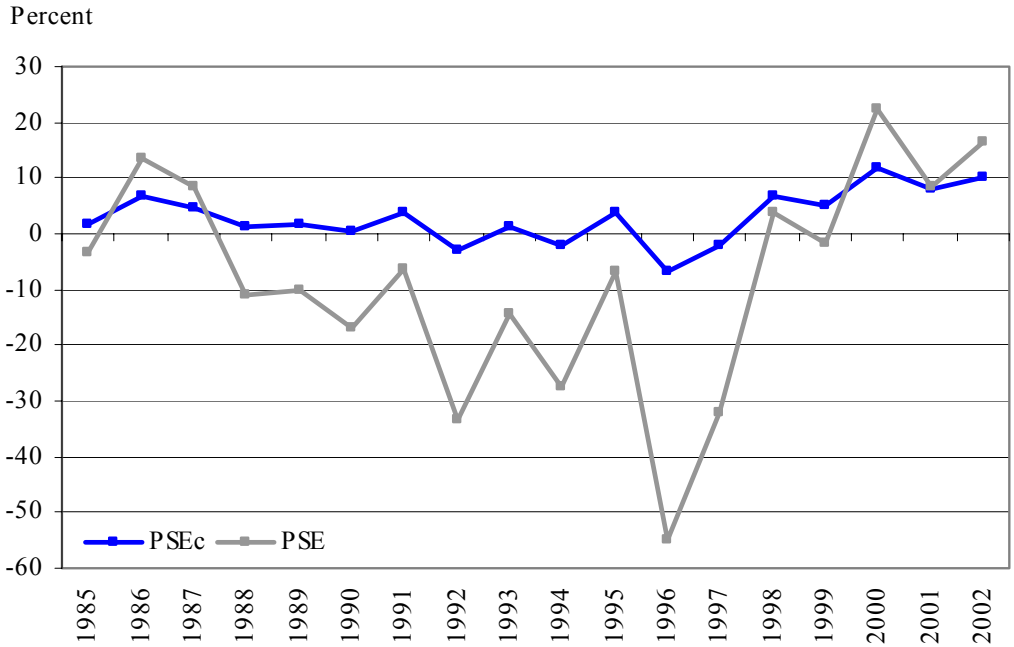
Figure 2. India Wheat %MPS Under the Modified Procedure versus Importable and Exportable Hypotheses, 1985-2003



Source: Authors' calculations.

Note: MPS_m, MPS_e and MPS_{mp} are computed under the importable and exportable hypotheses and the modified procedure, respectively.

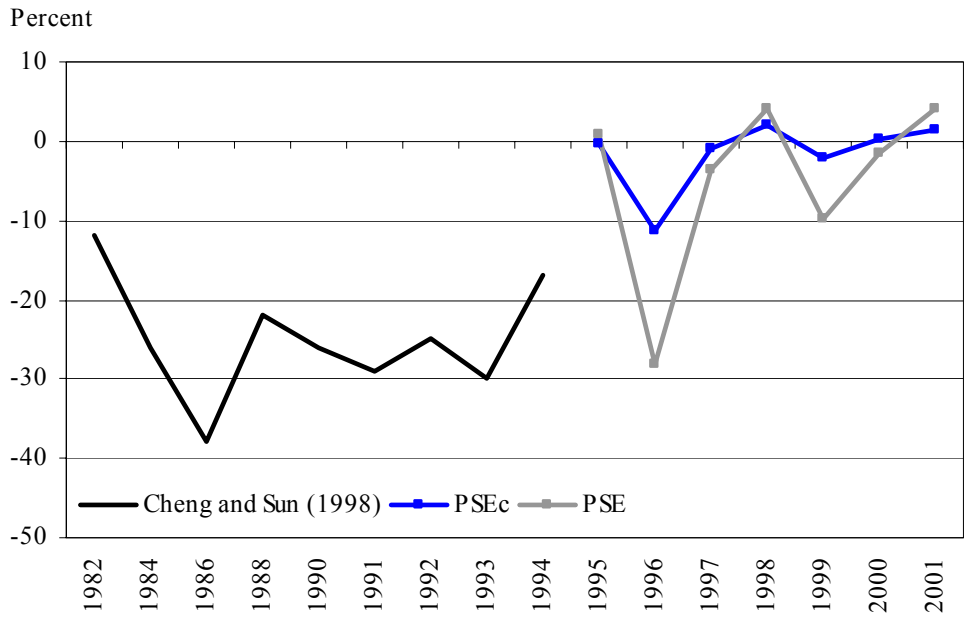
Figure 3. Estimates of India "Total" PSE Without and With "Scaling Up," 1985-2002



Source: Authors' calculations.

Note: PSE_c is without scaling up; PSE is with scaling up (see text for discussion).

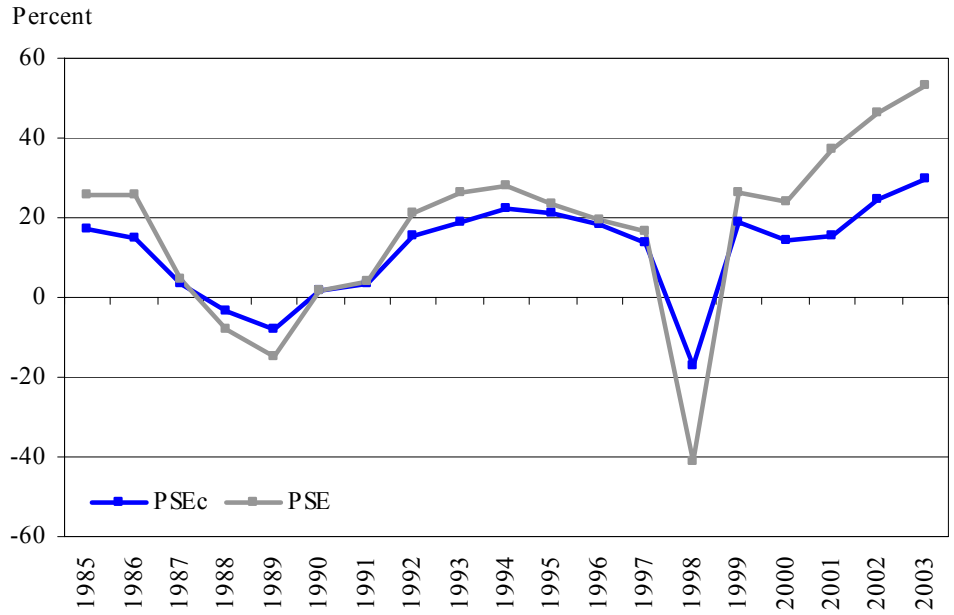
Figure 4. Estimates of China "Total" PSE, 1982-2001



Source: Authors' calculations; Cheng and Sun, 1998

Note: PSE_c is without scaling up; PSE is with scaling up (see text for discussion).

Figure 5. Estimates of Indonesia "Total" PSE, 1985-2003



Source: Authors' calculations.

Note: PSE_c is without scaling up; PSE is with scaling up (see text for discussion).

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