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What Explains India's Real Appreciation?

The price of nontradable goods in India has been growing much more rapidly than the price of tradable goods. This change is significant because the ratio of nontradable to tradable goods' prices is a critical relative price—it is a measure of the real exchange rate (RER). An increase in the relative price of nontradable goods therefore corresponds to a real exchange rate appreciation. Our earlier work identified major structural changes in India's economy that might be driving the real appreciation (Kohli and Mohapatra, 2006). Amongst other things, export growth has been robust since 1990 and the share of tradables in aggregate output has expanded to almost 31 percent in 2006–07 as against 18 percent in 1980. Productivity in the tradable sector has risen after 1990, while real per capita income growth has accelerated to an average 5.2 percent in 2000–06 from an average of 3.8 percent and 3.7 percent in the previous two decades. In summary, India is *catching up* with other countries—an ineluctable process where faster productivity growth in the tradable sector may be leading to resource shifts away from the nontradable sector, a higher inflation rate for nontradables, and a real appreciation of the exchange rate.

At first blush, this result seems unsurprising. For Balassa (1964) and Samuelson (1964) argued that real exchange rates typically appreciate as countries develop—and India has been developing rapidly. This hypothesis has been empirically documented in numerous cross-section studies. However, it does not fit the Indian case, or rather, does not fit it completely. For after 1990, precisely when the economy was opened up to foreign competition, we find that the tradable–nontradable productivity

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gap virtually disappeared. So then what explains India's real appreciation? This paper attempts to answer this question, which is critically important for the framing and conduct of macroeconomic policy.

One may well ask: Why define the real exchange rate as the relative price of nontradables instead of the familiar purchasing power parity (PPP)-based definition? Indeed, the bilateral real exchange rate (or the external RER), computed as the relative domestic to foreign currency price levels expressed in a common currency, is preferable for its availability, frequency, and resultant empirical utility. Nevertheless, the two measures differ from a conceptual perspective because one refers to competitiveness in terms of relative price levels, domestic and foreign, while the other refers to the relative price of two different categories of goods, tradable, and nontradable. The relative nontradable–tradable price therefore is an indicator of the incentives for production and consumption of the two categories of goods in an economy. Most recent theoretical works on real exchange rates (for example, Obstfeld and Rogoff, 1996) refer to the relative price of nontradables (also referred as the internal RER), and this definition is in the widest use for analytical purposes in a developing country context (Hinkle and Montiel, 1999). It not only identifies the incentives that guide resource allocation in an economy but is also a key relative price determining the external current account position of the economy.[1] Characterizing the real exchange rate as the relative price of nontradables thus allows us to examine competitiveness in terms of the factors that drives these price trends, making this definition a useful tool for analyzing competitiveness issues—an important area of concern for a country like India. Currently, no such framework of analysis exists for India.[2] This paper contributes by providing such a framework: it constructs a tradable–nontradable price series for India, traces relative price developments and analyzes their determinants, the post-reform triggers of relative price changes, and the implications of these shifts for macroeconomic policies.

The empirical literature research on the subject of real appreciation has grown rapidly in recent years though much of it relates to industrialized countries (Canzoneri et al., 1999; De Gregorio et al., 1993; De Gregorio and Wolf 1994, amongst others). As cross-country productivity levels among

1. A rise in the prices of tradable goods, for example, induces resources to move out of the nontradable to the tradable sector. It also creates incentives for consumers to reduce consumption of tradable goods through substitution with nontradable goods. The switching of production from tradable to nontradable and of expenditures from tradable to nontradable will therefore improve the external current account position (Hinkle and Montiel, 1999: 9).

2. Lal et al. (2003) use the nontraded to traded goods definition of the real exchange rate to analyze macroeconomic developments in India.

industrial countries have begun to converge, divergent inflation rates in the tradable and nontradable sectors in emerging and developing countries have inspired more empirical interest. A sizeable literature has emerged in the case of transition and accession countries in Central and Eastern Europe, where inflation divergence is an important issue for accession to the European Union.[3] Productivity growth-induced real exchange rate appreciation trends for some Asian and Asia-Pacific Economic Cooperation (APEC) economies have been analyzed by Chinn (2000) and Ito et al. (1997), while Choudhri and Khan (2004) have focused on a panel of 16 developing countries. Nonetheless, the non-industrialized country sample remains limited, with a lack of country-specific, longitudinal studies. In part, the gap is due to the lack of disaggregated information on prices and productivity, which is a major drawback to research on the subject.

This paper aims to fill this gap by analyzing the increase in the relative price of nontradables in India over 1980–2006. Using the integrated theoretical framework developed in Bergstrand (1991) and De Gregorio et al. (1994), we examine the role of both demand and supply factors. Our findings reveal that both demand and supply factors are relevant in explaining relative price developments. *After 1991, demand pressures originating from per capita income growth have been the key driving force behind relative nontradables inflation.* Fiscal and import price trends have also played an important role. Finally we find a small Balassa–Samuelson (B–S) effect, which we suspect to be underestimated due to data reasons.

The paper is organized as follows. The section, "The Evidence: A First Look," takes a preliminary look at the data, the section, "What Explains the Increase in Relative Price of Nontradables—Theory?" discusses the theoretical frameworks for explaining relative price developments, and the next section, "What is Driving the Relative Price Increase—Demand or Supply?" formally analyzes the role of different factors in relative price changes. The fifth section, "Determinants of the Relative Price of Nontradables: Formal Evidence," discusses the implications for nominal exchange rate and fiscal policies.

The Evidence: A First Look

This section takes a preliminary look at relative price trends and the relevant demand and supply indicators through descriptive statistics. In the absence of

3. See Backe, 2002 for a review.

a traded/nontraded goods price index, as is the case for India, it is a difficult task to compute this measure of the real exchange rate. Computing tradable and nontradable prices poses several conceptual and practical problems (see Hinkle and Montiel, 1999, for an extensive discussion). Defining tradability is a major conceptual issue, necessarily subjective in the absence of concrete and specific information on what goods might potentially be traded versus those that are absorbed domestically. Traditionally, "services and construction" have been assigned to the nontradable category, a notion that has changed with some services being traded. Many researchers also draw a distinction between tradable and traded: traded goods are defined as items *actually* entering into international trade (exports and imports) and subject to the law of one price, while items that have the *potential* to be traded (either at an appropriate relative price, as with improvement in competitiveness, or become transportable, for example, technological innovation, as with some services) are called tradable. Then there are methodological issues in determining the size and composition of export and import sectors as distinct subsets of the tradable and nontradable sectors.

The problem is compounded for India, which also lacks a services' price index.[4] Although an attempt has been made by Lal et al. (2003) to compute a traded/nontraded price series by classifying the components of the existing wholesale price index (WPI) into traded and nontraded goods, yet more than half of aggregate output is excluded in such a classification. To overcome these constraints and obtain a comprehensive price series for traded and nontraded sectors, we compute the relative price of nontradables by deriving an implicit price series from the nominal and real output data (Box 1).[5] The implicit price series are then classified by their tradability. To remove subjectivity attached to *a priori* reasoning in determining *potentially* tradable items, we determine our tradable and nontradable sectors on the basis of *actual* trade.[6] Further to reduce aggregation bias, we compute tradable/nontradable sectors using disaggregated data on gross domestic product (GDP) by sector of origin.

We then use the allocation criterion proposed by De Gregorio et al. (1994), which is based upon the degree of participation in foreign trade. Thus, if an

4. See T. N. Srinivasan (2008) "Some Aspects of Price Indices, Inflation Rates and the Services Sector in National Income Statistics" for an up-to-date discussion on these issues.

5. Two direct methods, namely, expenditure method, using expenditure data from the national accounts, and the production method, splitting sectors of production into tradable and nontradable categories, have been used in the literature. Valued added in current and constant prices are then used to derive implicit price deflators for the two sectors.

6. The two terms, tradable and traded, are used interchangeably throughout in this paper.

BOX 1. Implicit Price Series in Services Sector in India

The implicit price deflators represent farm gate prices of goods and services and are producer price inflation proxies in the case of goods. India currently lacks a services' price index, which complicates the task of deriving implicit price indices for services as services' output for some sub-categories is computed through extrapolation of wholesale and/or consumer price indices.

The implicit GDP deflators in the National Accounts Statistics (NAS) are derived as a ratio of Gross Value Added (GVA) at current prices to that of GVA at constant (base year) prices. The compilation of GVA at current and constant prices requires data on quantity of output as well as base and current year prices. These data are gathered by the Central Statistical Organisation (CSO) through both direct and indirect methods. Approximately 54 percent of the services GDP (28 percent of aggregate GDP) is estimated through the direct method, while the balance is estimated indirectly (24 percent of aggregate GDP).

Under the direct method data are gathered separately on output as a quantum index (QI) and prices as a producer price index (PPI) to estimate GVA at current and constant prices. The implicit GDP deflator derived through this methodology is thus statistically a fair approximation to the producer price trend observed in the sector. Service activities like banking and insurance, public administration and defense, railways, and all public sector as well as some private sector activities in trading, transport, storage, communication, education, medical, and media are estimated directly. In sectors where data on both quantities and prices are not available, the indirect method is used to estimate nominal output. Each service activity is extrapolated with respect to its relevant benchmark indicator. The GDP estimation for each item at current prices is extrapolated by an indicator of current prices while constant price items are extrapolated similarly by an indicator of constant prices. The relevant consumer price index (CPI) is used as the deflator in a majority of the cases, exceptions being trade (index of gross trading income), some transport (implicit price indices of road, air, and transport), ownership dwellings (index of house rent), recreation/entertainment (tax rate and collections), and so on.

The derived implicit GDP deflator using the indirect method is therefore a mix of producer and consumer prices; since producer and consumer prices in services are usually identical, the use of the CPI as price deflator in most cases is a fair approximation to the actual prices level for the sector. Potential circularity arising from the use of WPI/CPI as deflators is limited to 23 percent of services' GDP (12 percent of aggregate GDP).

Source: Computed by the authors.

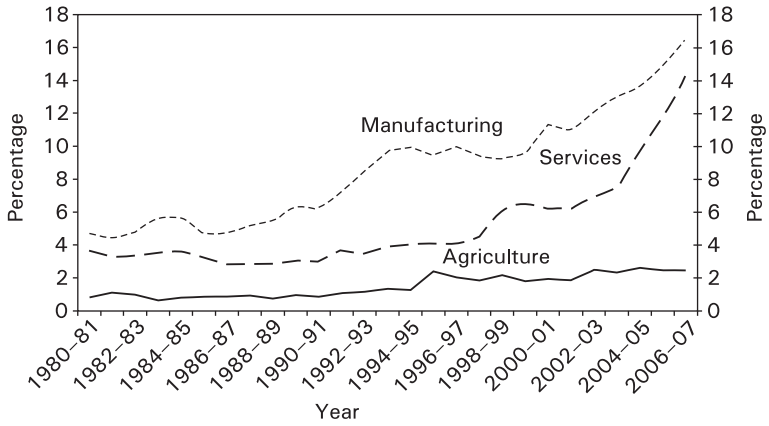
average of 5 percent or more of total production of a sector is exported, the category is considered tradable.[7] Compared to the convention of classifying agriculture and manufacturing as traded and services as nontraded goods, this method allows a more accurate tradable/nontradable characterization for some services might be traded while some agricultural and manufacturing goods might not. It thus reduces the bias in the measured relative price of nontradables, which could be potentially quite large for India, a significant

7. De Gregorio et al. (1994) used a 10 percent share of exports in production as the threshold level for defining tradability of a sector. Export/production ratios for India are far lower though with few manufacturing subsectors exporting more than 10 percent of their total value of output.

exporter of services (figure 1). The classification is also dynamic as it allows for changes over time. We do not consider imports in defining the tradable sector due to conceptual as well as practical problems. The inclusion of imports to determine the degree of participation in trade for each sector at a sufficiently disaggregated level involves identifying the degree to which domestic production of each industry is substitutable with imports, over and above which the production share could be considered import competing. This involves exercising a judgment or an assumption about the relevant prices, thereby increasing the subjectivity or arbitrariness in determining tradability. It also implies potential tradability rather than actual tradability, further increasing the subjectivity in the determination. Finally, in deriving price indices from the national accounts, the tradables are the exports on the production or the supply side of the economy;[8] were the indices to be derived from the expenditure accounts, then imports would be the tradables.[9]

The trends in sectoral export shares in the total value of production (agriculture, manufacturing, and services) show that the share of tradables in the value of total manufacturing output in India started rising in the mid-1980s,

FIGURE 1. Export/Value of Total Production, 1980–2006 (in percentage)



Source: WITS Database and CSO, India.

8. Imports would figure indirectly as raw materials plus intermediate goods to arrive at the value added numbers in the GDP computation.

9. Practical difficulties involve matching imports from the trade statistics at a sufficiently disaggregate level to the various production categories in the national accounts. While finished goods do not pose a problem, an enormous amount of judgment has to be exercised in the case of raw material/intermediate goods in the production of goods in different sectors. Moreover, many items (for example, oil, lubricants, many metals, alloys, and so on) would figure as inputs across several sectors.

accelerating in the next two decades (figure 1). The disaggregate sectoral trends in table 1 uncover further interesting features. Between 1980 and 2006, at least seven of the fifteen manufacturing subsectors more than trebled their export shares, with non-metallic products, textiles, other manufacturing, chemicals, electrical and non-electrical machinery, and basic metals as the primary drivers of export growth in the manufacturing sector.

In contrast to manufacturing, the share of tradable services in total value of its output changed little between 1980 and 1995, but almost doubled between 1993 (3.9 percent) and 2003 (7.4 percent) and then again in the fol-lowing three years reached 14.3 percent in 2006. Almost three-quarters of business services were tradable in 2006. Still, only three of the eleven categories classified as services under the *National Accounts Statistics* are tradable, namely, transportation, insurance and business, and legal and communication services. Finally, the export–production ratio of agriculture almost doubled

TABLE 1. Tradable/Nontradable Classification by Total Export/Total Production Ratios

	1980	*1990*	*2000*	*2006*	*1980–2006*	*1990–2006*	*T/NT*
Agriculture	**0.8**	**0.9**	**1.9**	**2.5**	**1.5**	**1.9**	**NT**
Mining	14.5	8.1	6.8	16.9	9	9.6	T
Manufacturing	4.7	6.2	11.3	16.6	8.6	10.7	
Food products	2.3	2.7	5.8	5.7	4.2	5.1	T
Beverages, tobacco, etc.	31	18.7	17.9	10.7	20.6	16.8	T
Textile group sub-total	8.6	16.3	35.6	36.5	20.3	26.6	T
Wood, furniture, etc.	2	0.5	1.4	8.2	1.9	2.4	NT
Paper and printing, etc.	0.2	0.2	2.1	2.9	1	1.5	NT
Leather and fur products	8.6	14.4	18.8	24.1	14.7	16.3	T
Chemicals, etc.	2.7	6	9.9	15.8	7.3	9.8	T
Rubber, petroleum, etc.	0.9	3.5	5.4	16.3	5.7	6.6	T
Non-metallic products	15.1	33.4	48.9	42.7	37.5	46.3	T
Basic metal industries	3.4	3.4	7.6	12.6	5.6	7.1	T
Metal products and machinery	3.4	3.4	7.6	12.6	5.6	7.1	T
Transport equipments	2.9	2.1	4.3	7.1	3.3	4.2	NT
Other manufacturing	4.7	3.7	12.1	20.7	9.5	12.1	T
Services	**3.7**	**3**	**6.2**	**14.3**	**5.1**	**6.2**	
Travel & transportation	33.6	22.1	26.6	39.2	28.1	29.7	T
Insurance	8.8	6.7	9.6	13.5	8.5	9.1	T
Business (incl software), legal and communication services*	56.7	43.8	45.8	71.4	52.9	51.1	T

Source: Staff calculations from CSO National Accounts data, RBI Handbook of Statistics, and WITS database.

Notes: *The three services have been clubbed together as the export data (miscellaneous exports) indicates export values in aggregate for these services. Export and GDP values in US dollars used for computation of the ratios.

T: Tradable; NT: Nontradable.

between 1990 and 2000, after remaining stagnant in the previous decade. With an average export share of 1.5 percent in total production over the sample period, however, agriculture lies much below the threshold value and is classified as nontradable.

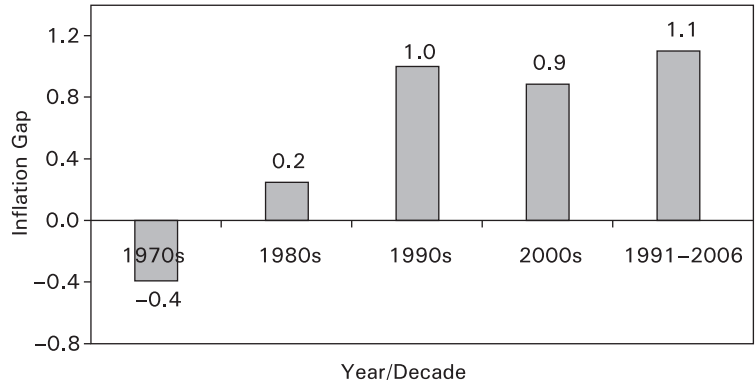
It can be seen that were a more aggregate classification or a higher threshold—10 percent—used to define tradability, the only tradable sector would be manufacturing. A lower threshold of 5 percent and disaggregated export shares in output allow us to include emerging export industries that increased their export–total production ratios substantially in the 1990s, for example, chemicals, metal products, non-electrical machinery, rubber, and so on. Likewise, our choice affects insurance in the services sector; at an average export share of 8.5 percent in its total output over the sample period, it falls between a 5 and 10 percent benchmark and is classified as tradable.

Rising Relative Nontradable Prices

Utilizing this classification, implicit inflation rates were derived for the tradable and nontradable sectors of the economy. The mean divergence in the nontradable–tradable inflation rate, or the relative nontradables' inflation rate, is plotted in figure 2 for every decade from 1970. The inflation differential turns positive in the 1980s and exceeds 1 percentage point from the 1990s till the end of the sample period, 2006–07. In the post-1991 period, it averages 1.10 percent, indicating that the relative nontradables' inflation rate accelerated in this period. The inflation divergence is robust to an alternate tradable/nontradable classification. To test whether the result is driven by an arbitrary choice of a threshold, we relaxed it to a 10 percent export share of each subsector in the total value of its production. The recomputed sectoral inflation rates confirm the robustness of the divergence trend (figure A-1 in appendix 1); nontradable inflation rate exceeded the tradable inflation rate from the 1980s, crossing the 1 percent bar in the post-reform period. Our quantitative criterion is further compared with an illustrative subjective criterion through the inclusion of agriculture as a tradable sector in the classification (figure A-2 in appendix 1). This throws up an interesting result: unlike the steady increase in the nontradable–tradable inflation gap from the 1980s, we observe a widening inflation differential between the two sectors only for the current decade and for the post-reform (1991–2006) average. But the gap is much smaller (0.4 percent) relative to the 1.1 percent differential observed when excluding agriculture, emphasizing the artificial repression of agriculture prices.[10]

10. We are indebted to Robert Lawrence for this suggestion.

FIGURE 2. Nontradables–Tradables Inflation Differential (Decade Means in percentage)



Source: WITS database and CSO, India.

Relative Nontradable Prices and Other Measures of the Real Exchange Rate

Since the relative price of nontradables is a measure of the real exchange rate and an increase in it corresponds to a real appreciation, how does its evolution compare with the bilateral real effective exchange rate (REER), the commonly used real exchange rate measure in India? While in theory the relationship between the external and the internal measure of the real exchange rate is clear, empirical movements of the two measures need not necessarily be similar simply because of the role of domestic/foreign country prices of traded goods and that of the internal real exchange rate of the foreign country. A lot depends upon whether the law of one price holds for tradable goods; if this does not hold for long periods of time then the two series will diverge as the effects of external real exchange rate movements upon the internal exchange rate are muted (Hinkle and Nsengiyumva, 1999).

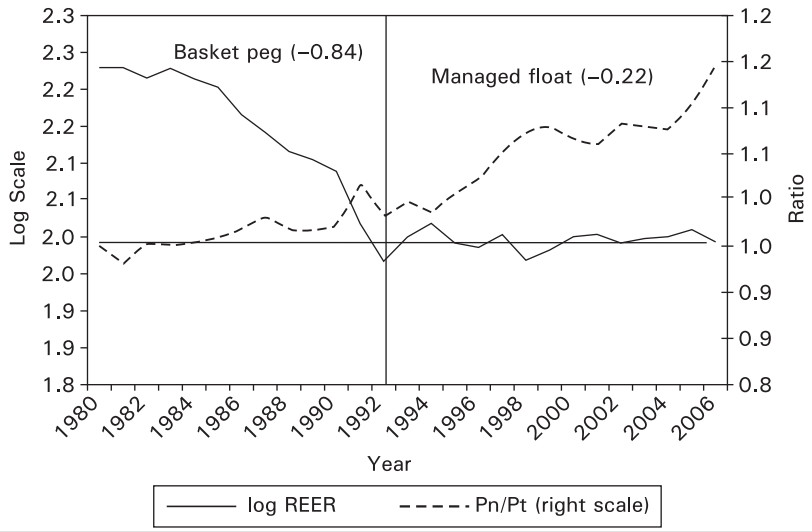
Figure 3 shows the nontradable–tradable price ratio and the thirty-six-country, trade-weighted REER moving in opposite directions before 1991 (correlation –0.84). After 1991, the negative correlation between the two measures is considerably diluted (–0.22). How can this difference be explained? Quite easily, it turns out.

Consider a simple, two-country formulation of the REER:

$$r = \frac{p}{e.p^*} \tag{1}$$

where r is the real exchange rate, p is the domestic price level, e is the nominal (spot) rate, and p^*, the foreign price level. Now consider the case

FIGURE 3. Nontradable/Tradable Price Ratio and the Real Effective Exchange Rate



Source: RBI, CSO and author's calculations.
Note: Figures in parentheses are correlations. Pn/Pt: Nontradable/tradable price ratio.

where tradable and nontradable shares, α and $(1 - \alpha)$ are the same in both countries. Then we can write:

$$r = \frac{P_T^{\alpha} P_N^{1-\alpha}}{(E.P_T^*)^{\alpha}(E.P_N^*)^{1-\alpha}} = \left[\frac{P_T}{E.P_N^*}\right]^{\alpha}\left[\frac{P_N}{E.P_N^*}\right]^{1-\alpha} \quad (2)$$

where P_T and P_N are the prices of tradable and nontradable goods respectively. It is then clear from inspection that the REER can appreciate if *(a)* there is a deviation from PPP in the traded sector or *(b)* the price of nontraded goods rises faster in the home country. Either or both of these conditions can hold, irrespective of the relative price of nontradables in the domestic country. In India's case, there is some indication that pre-1991, the first case was applying. From the mid-1980s, an active policy of nominal depreciation produced a real depreciation, correcting an earlier overvaluation. But starting in 1993, the shift to a more flexible exchange rate regime weakens the strong, negative association of the earlier pegged exchange rate regime.

Apart from change in exchange rate regime, an important role is played by trade taxes—when taxes on international trade or administered price effects are significant, the internal and external real exchange rates will diverge. *Ceteris paribus*, a decline in protection will appreciate the internal real exchange rate by lowering the domestic price of tradables. Table 2 presents

evidence on the role of trade tariffs in explaining differences in movements of the two exchange rate measures. Tariff rates in India fell sharply after 1991 as trade liberalization gathered momentum and their likely effect upon domestic prices was to reduce the divergence between the two measures of the real exchange rate. In fact, the steepest cuts in tariff rates are during 1992–96, which is coincident with a spurt in the nontradable–tradable price ratio (figure 3). Last of all, different rates of productivity growth in the tradable and nontradable sectors are one of the most important empirical factors affecting the relationship between internal and external real exchange rates. We again observe an empirical regularity in figure 3. The two phases of strong GDP growth, 1994–96 and 2003–06 are associated with a spurt in the nontradable–tradable price ratio; both these periods saw relatively faster productivity growth in the tradable sector, when it exceeded nontradable sector productivity growth by an annual average of 3 percentage points.

The next section discusses the various theoretical explanations offered in the literature.

What Explains the Increase in Relative Price of Nontradables: Theory?

Several theories explain the secular increase in the prices of nontradable goods as an economy develops. Supply-side models (Balassa, 1964; Samuelson, 1964) describe it as part of cross-country convergence in

TABLE 2. Weighted Average Import Duty Rates in India (in percentage)

	All commodities	*Peak customs duty*[1]	*No. of basic duty rates*[2]
1991–92	72.5	150	22
1992–93	60.6	110	20
1993–94	46.8	85	16
1994–95	38.2	65	16
1995–96	25.9	50	12
1996–97	24.6	52*	9
1997–98	25.4	45*	8
1998–99	29.2	45*	7
1999–00	31.4	40	7
2000–01	35.7	38.5	5
2001–02	35.1	35	4
2002–03	29	30	4

Source: Report of the Task Force on Employment Opportunities, Planning Commission, Government of India, July 2001. Estimates for 2002–03 from Ahluwalia, 2002.

Notes: [1] Includes the impact of surcharges in the years indicated by* in 2000–01, duties for many agricultural products were raised above the general peak in anticipation of the removal of quantitative restriction. This explains why the average for all commodities exceeds the peak rate in 2001–02.

[2] Refers to ad valorem duty rates.

productivity levels. Under the assumption of perfect integration of goods and capital markets, which sets tradable goods prices (P_t) and interest rates (R), faster technological progress and productivity growth in the tradable sector leads to an increase in the relative price of nontradables, where productivity growth is slower. Productivity gains in the tradable sector are accompanied by rising wages, and the assumption of labor mobility between the two sectors equalizes nominal wages across the two sectors. The relative price of nontradable goods (P) then rises because the wage increase is not accompanied by matching productivity growth in the nontradable sector. The B–S proposition can be summarized in a two-good (traded and nontraded) framework as follows.[11] The production functions of the two sectors are given by

$$Y_t = Q_t L_t^{\alpha_t} K_t^{1-\alpha_t} \tag{3}$$

and

$$Y_{nt} = Q_{nt} L_{nt}^{\alpha_{nt}} K_{nt}^{1-\alpha_{nt}} \tag{4}$$

where the subscripts t and nt denote tradable and nontradable goods, while Y, L, and K are output, labor, and capital respectively. The prices in the traded and nontraded sectors are

$$P_t = \frac{1}{\theta_t} W^{\alpha_t} R^{1-\alpha_t} \alpha_t^{-\alpha_t} (1-\alpha_t)^{-(1-\alpha_t)} \tag{5}$$

and

$$P_{nt} = \frac{1}{\theta_{nt}} W^{\alpha_{nt}} R^{1-\alpha_{nt}} \alpha_{nt}^{-\alpha_{nt}} (1-\alpha_{nt})^{-(1-\alpha_{nt})} \tag{6}$$

where W is the unit cost of labor and is the rate of return on capital. Since is set by the world interest rate, wages are determined by Equation 5 and with both and given, Equation 6 shows that nontradable prices are solely determined by technology. Log differentiating Equations 5 and 6, solving for the difference and through substitution, the change in the relative price of nontraded goods can be expressed as

$$\hat{P} = \frac{\alpha_{nt}}{\alpha_t} \hat{\theta}_t - \hat{\theta}_{nt} \tag{7}$$

11. This conceptual framework is based from De Gregorio et al. (1994).

where θ is productivity and $\hat{}$ is the rate of change. Equation 7 shows that the relative price of nontradable goods is solely driven by productivity growth in the tradable goods sector. Differential productivity growth rates in the two sectors translate directly into sectoral inflation differentials, which, in turn, correspond to a real exchange rate appreciation.

Demand conditions thus play no role in the determination of relative prices in the B-S framework, which is based upon productivity trends and essentially a long-term phenomenon. However, in conjunction with this supply-side impact, transitory demand disturbances could add to the relative price increase. For example, shocks like a rise in government spending could induce a temporary increase in the relative price of nontradables (Obstfeld and Rogoff, 1996). The role of government spending has also been the focus of recent models of equilibrium exchange rate determination, which show government expenditure falling exclusively (De Gregorio et al., 1994; Rogoff, 1992) or disproportionately (relative to private spending, Froot and Rogoff, 1991) upon nontradable goods.

Demand pressures originating from income growth could also induce an increase in the prices of nontradable goods (Bergstrand, 1991; Kravis and Lipsey, 1983, 1988). Assuming nonhomothetic tastes, that is, income elasticity of demand for services (goods) exceeds (is less than) unity, a rise in per capita income will induce an expenditure shift toward nontradables, as the latter are luxuries in consumption. This expenditure shift translates into a higher relative price of nontradables (particularly services) as resources shift toward the production of nontradable goods. A demand-induced relative price increase will thus be reflected in the rising share of nontradables in aggregate output. Similar demand influences could prevail due to shifts in technologies (Dornbusch, 1988).

Theoretical frameworks combining the supply and demand approaches can be found in several works. Bergstrand (1991) integrates the productivity growth and relative factor endowment (Bhagwati, 1984) models with the demand-oriented hypothesis, real income growth, for a cross-section of 21 countries. De Gregorio et al. (1993) incorporate demand shocks alongside productivity-growth induced supply shocks by relaxing the assumptions of perfect competition in goods and factors markets, law of one price in tradable goods, and perfect capital mobility in the B-S models.[12] Extending the two-good supply-side framework (equations 3–6) the integrated framework is

12. Another strand of literature extends the framework to include terms of trade shocks, identified as a major determinant of the relative price of nontradables (De Gregorio and Wolf, 1994; Edwards, 1989).

formalized by De Gregorio et al. (1993) in the following manner. The utility function of the representative consumer, who maximizes utility on a period-by-period basis is given by

$$u(C_{nt}, C_t) = C_{nt}^{\phi}(C_t - \bar{C})^{1-\phi} \tag{8}$$

where C_{nt} and C_t represent consumption of nontraded and traded goods and $\bar{C}$ is the subsistence level of traded goods consumption. The budget constraint, expressed in terms of traded goods, is given by

$$I = C_t + PC_{nt} + PG \tag{9}$$

where I is total income and G is total government expenditure, all on nontraded goods and financed by lump sum taxation. The demand functions are

$$C_t = \phi\bar{C}(1-\phi)(1-PG) \tag{10}$$

and

$$C_{nt} = \phi/P(1-\phi)(I - PG - \bar{C}) \tag{11}$$

Assuming government expenditure to be a constant fraction of total income, $PG = gI$, the total demand of the economy, public and private, is

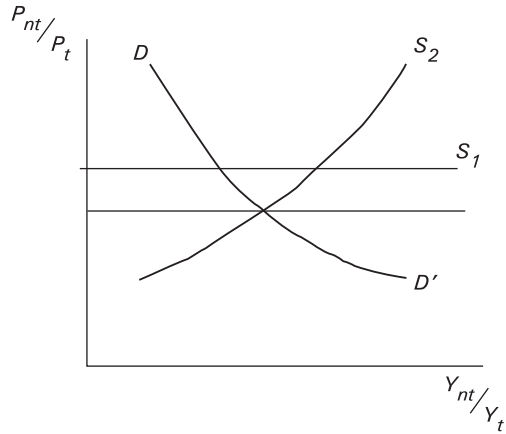
$$C_t = (1-\phi)(1-g)I + \phi\bar{C} \tag{12}$$

and

$$C_{nt} + G = \left[\phi + (1-\phi)g\right]I/P - \phi\bar{C}/P \tag{13}$$

For $\bar{C} > 0$, the income elasticity of demand for tradables is less than unity while that for nontradables is greater than 1. An increase in demand will thus increase the consumption share of nontradables. In the B-S framework, this will be reflected in the shrinking of the tradable sector as resources are directed toward the production of nontradables; however, relative prices are not affected by the demand increase. For demand-side effects upon the relative price of nontradables, Rogoff (1992) and De Gregorio et al. (1994) show that a relaxation of the perfect competition and capital mobility assumptions, which allows an upward sloping relative supply curve, is essential. The accompanying figure 4 illustrates the supply and demand impact upon the relative price and output of nontradables, which are determined at the intersection of a downward sloping demand schedule

FIGURE 4. Determination of Relative Nontradable Price and Output



DD' and a horizontal relative supply curve S_1 (perfect capital mobility assumption). A rightward shift in the demand curve does not change the equilibrium price but expands the relative production of nontradables, while supply shocks affect both relative prices and production. If however, the supply curve is upward sloping, that is, imperfect capital mobility, then it can be seen that an increase in demand is followed by a rise in the relative price and an expansion of the nontradable sector.

Changes in economic structure due to reforms in economic policies can also be a driving force for divergent inflation rates. This is particularly true for economies in transition, like India where the post-1991 period is characterized by fundamental structural changes in price and production structures. Following the macroeconomic crisis of 1991, liberalization policies were pursued in almost every economic sphere—from trade to prices. Trade liberalization accelerated after 1991: the average effective tariff rate was reduced steadily, non-tariff barriers were eased with removal of licensing restrictions on raw materials, intermediate and capital goods, while a tariff line-wise import policy was introduced in 1996 (table 2). These changes obviously impacted import prices—through lowered input costs, lower prices of tradable goods, and consequently, relatively higher inflation in nontradables. In terms of figure 4, the import liberalization case can be illustrated as a purely supply-side effect: a fall in the domestic price of imports raises the relative price of nontradables, followed by an expansion of the tradable sector as the supply curve shifts upwards.

Deregulation of administered prices and liberalization or the adjustment of regulated prices to cost-recovery levels during transition can also impact

relative prices, a process experienced by the European transition economies where initial adjustments of relative prices (specifically in the tradables sector) were associated with rapid price and trade liberalization in the early phase of transition (Backé, 2002). This was followed by a moderation of inflation, a relatively faster increase in nontradables' prices and a trend appreciation of the real exchange rate. Competition and labor market segmentation may also play a role in driving up the relative price of nontraded goods: since the nontradable sector is typically sheltered from competition as opposed to the tradable sector, inflation pressures tend to be higher in the former sector.[13]

In India, price deregulation in the nontradable (services) sector has been fairly recent, confined so far to banking, insurance, and communication sectors, and is yet to reach an advanced stage. Competition and interest rate deregulation were initiated in the banking sector from 1990 onwards and is complete, save for the administered interest rate on savings accounts. The insurance sector was deregulated in 1998–99 although insurance premia are set by the insurance regulatory body. Price liberalization in telecommunications followed the insurance sector in 1999–2000. Between 1998–99 and 1999–2000, the share of services with administered prices fell from 28.4 percent to 13.9 percent. The transition to market-based pricing is thus spread out over many years in India, making it difficult to identify the transition-related price dynamics. As prices still have to be freed in many sectors, it is reasonable to expect that price liberalization will continue to impact relative prices for quite some time.

Empirical evidence endorses both supply and demand side influences upon relative price movements. De Gregorio et al.'s (1994) study reveals income growth and higher productivity growth in the tradable sector as the key sources of the increase in relative nontradables' prices for fourteen Organization for Economic Cooperation and Development (OECD) economies over 1970–85. Canzoneri et al. (1999) confirm that the relative price of nontraded goods reflects the relative labor productivities in their panel study of fourteen OECD countries. These results are reinforced by Chinn and Johnston's (1996) panel estimates for fourteen OECD countries that identify productivity measures, government spending, and terms of trade as significant determinants of real exchange rate movements.

For emerging and developing countries, Chinn (2000) estimates a productivity-based model of relative prices and real exchange rates for nine East Asian economies and finds conflicting results. The hypothesis of

13. Differences in wage bargaining patterns in the two sectors (Canzoneri et al., 1999), or government regulation or support of inefficient firms (De Gregorio et al., 1993) could also give rise to divergent inflation rates.

productivity-driven real exchange rate appreciation is supported for Japan, Malaysia, and Philippines, but not for fast growing countries like China and Thailand in the time series samples; the panel estimates support the productivity effect with government spending and terms of trade emerging as insignificant factors. Ito et al. (1997) find that rapid growth is associated with real exchange rate appreciation only for some Asia-Pacific Economic Cooperation (APEC) and Association of South East Asian Nations (ASEAN) economies, namely, Japan, Korea, Taiwan, and to some extent, Hong Kong and Singapore, while countries like Indonesia, Malaysia, and Thailand did not experience any real appreciation. They point out three factors that might explain the lack of exchange rate appreciation—high productivity growth in service sectors, divergences in domestic–foreign tradable prices, and economic reforms that promote export and growth through nominal depreciation.

Only one study, Choudhri and Khan (2004), focuses solely upon developing countries. In a panel sample of sixteen countries, they find the traded–nontraded sector productivity growth differential to be a significant determinant of the relative price of nontraded goods, which, in turn, exerts a significant influence upon the real exchange rate. Empirical research on sectoral inflation differentials and, more broadly, on factors driving real exchange rate appreciation in the transition and accession countries of the European Union has also grown rapidly in recent years;[14] many cross-section studies establish the Balassa–Samuelson (B–S) phenomenon as a driving force of inflation divergence (De Grauwe and Skudelny, 2000; Halpern and Wyplosz, 2001; Jazbec, 2002, among others), and country studies confirm this feature.[15]

The next two sections explore the relevance of these factors in explaining relative price movements.

What is Driving the Relative Price Increase—Demand or Supply?

Relative Nontradable Prices and Nontradable/Tradable Sectors' Output Shares

How does the relative price of nontradables relate to changes in relative nontradable/tradable output shares? The B-S hypothesis predicts that a rise in relative nontradable prices will be accompanied by falling shares of nontradables in aggregate output as resources are reallocated toward the

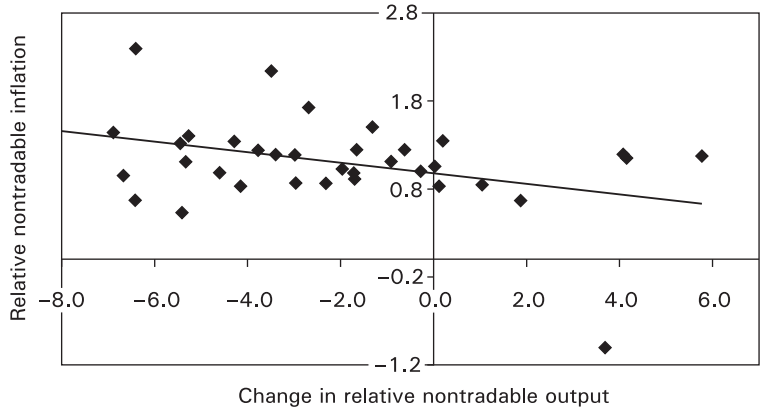
14. Backe (2002) reviews the empirical literature for transition and accession countries of the European Union.

15. Recent work by Altissimo et al. (2005) also identifies the role of productivity shocks affecting the nontradable sector, and to a lesser extent, mark-ups' shocks in driving the euro area inflation differentials.

tradable sector. Preliminary examination shows that the annual increase in the relative price of nontradables is associated with a fall in the share of nontradable output (figure 5).

The expanding share of tradables in the economy, from an average 20.1 percent (1980–89) to 25.1 percent during 1990–2006 undoubtedly reflects the post-reform trade, investment, and price liberalization effects (see the third sectionof this paper). Although resource allocation toward tradables is observed in both manufacturing and services sectors, the traded component of services increased relatively more. Traded services doubled from an average 6 percent share in GDP (1980–89) to an average 12 percent in the current decade (2000–06), while corresponding shares of traded manufacturing rose marginally from 12 percent to 14.2 percent of GDP.[16] The output shares of fast-growing export sectors increased significantly during this period (tables A-5–A-8, appendix 2). Figure A-3 (appendix 2) shows that most subsector inflation rates correlate negatively with respective changes in output.

FIGURE 5. Scatter Plot of Relative Nontradable Inflation and Output Share, 1970–2006



16. There is some suspicion of overstatement of services sector output. Acharya (2006) has suggested that the shift to a new series with 1999–2000 as base might be responsible for the services' output expansion after 1996–97, while Bosworth et al. (2006) suspect underestimation of price trends in services resulting in overstatement of output. Rajaraman (2007) contends that service sector growth in the new series starting 1999–2000 removed the earlier downward bias in measurement of services due to improvements in measurement methodology; the estimation of output in services, for which no formal data collection mechanism exists, was more closely aligned to the growth indicator of the corresponding service in the new GDP series of 1999–2000.

Relative Nontradable Prices and Labor Productivity Growth

Table 3 presents average labor productivity growth differentials between the tradable–nontradable and manufacturing–services sectors (table A-9, appendix 2, gives the disaggregated time series by subsectors). These estimates need to be interpreted with caution due to conceptual, measurement, and data problems. First, since these are partial productivity measures, changes in input proportions can influence these measures (for example, a rise in average productivity of labor due to substitution of capital for labor). The second problem relates to measurement of productivity in services sector; data quality of output measures, including the price deflators necessary for obtaining real output from nominal magnitudes, are key issues here.[17] Third, since the only information on services is confined to numbers employed, productivity measurement is based upon output and input quantities alone.[18] Last, data aggregation constraints prevent strict correspondence between the tradable–nontradable distinction used for computing productivity estimates and prices respectively. Thus the inclusion of tradable services in the nontradable sector biases labor productivity growth estimates for that sector upwards.[19] All these factors render the labor productivity estimates considerably noisy.

These caveats noted, the data shows the tradable–nontradable sector productivity growth gap narrowing steadily after the mid-1980s until 2000 (table 3). Column 2 of the table presents the gap computed with the conventional tradable/nontradable distinction of manufacturing and services.

17. Measurement issues in services' productivity have posed a challenge as changes in the nature of production, that is, increased role of services, have outpaced changes in the statistical system that were traditionally geared toward collection of data on the goods sectors. Real output in most service sector industries is not very well measured and is also difficult to measure. Measurement problems in finance and insurance sectors are particularly severe where the concept of output is unclear, making measurement of its price change and productivity difficult (see Bosworth and Triplett, 2004, for a review of measurement issues in services' productivity).

18. Labor productivity calculated as output per worker and is based upon total employment figures for agriculture, services, and manufacturing sectors, drawn from the CEIC database. These, however, are unadjusted for quality changes over time, and to that extent, pose a limitation.

19. The tradable component of services cannot be extracted from the employment shares data, which is disaggregated across categories different from the subsectors used to classify tradability; nontraded manufacturing employment shares similarly cannot be separated from overall manufacturing employment estimates. Services and agriculture are therefore clubbed together to arrive at productivity estimates of the nontradable sector. Cross-sector biases arising from gaps in formal/informal sector employment estimates are also likely to affect productivity measurement; as the extent of informal employment is larger in services like construction, transport, personal services, and so on, the size of the traded–nontraded productivity differential is likely to be smaller.

TABLE 3. Relative Labor Productivity Growth Differentials: Tradable–Nontradable and Manufacturing–Services, 1982–2004

Year	*Tradable (manufacturing only)–Nontradable (agriculture and services, including tradable services)* *(1)*	*Manufacturing–Services (including tradable services)* *(2)*
1982–86	4.23	2.77
1987–90	3.59	2.84
1992–95	2.71	1.92
1996–99	–1.12	–3.03
1982–90	3.95	2.80
1992–2004	1.58	0.46
2000–04	2.84	2.08

Source: NAS, CSO, and CEIC Database.

Note: Figures are period averages. Labor productivity estimates are confined to 1982–2004 due to data availability constraints. Labor productivity for the tradable sector is proxied by manufacturing sector, while services and agriculture are clubbed together for computing labor productivity in the nontradable sector.

Both definitions indicate that labor productivity growth in the services sector (including tradable services) narrowed the gap vis-à-vis manufacturing in the 1990s. The annual average labor productivity growth of the services sector increased from 4.2 to 7.6 percent between 1982–90 and 1992–2004 while that of manufacturing sector increased only marginally from 7.0 to 8.1 percent. Consequently, the tradable–nontradable labor productivity growth gap shrunk to an average 1.6 percent in 1992–2004 from a wider 4 percent in the previous decade (1982–90). Excluding agriculture, the manufacturing–services productivity growth gap almost disappears in the latter half of the sample (column 2). Disaggregate analysis shows that labor productivity growth in the services sector was significantly driven by the category "Transport, Storage and Communications"; average productivity growth almost trebled to 11.2 percent in 1992–2004 against the 4.3 percent clocked during 1982–90 (table A-9, appendix 2). It is worth noting that communication services were rapidly deregulated in the mid-1990s (see the third section of this paper). Further, transportation and communication services are categorized as tradable in our classification, but the lack of further disaggregation in employment data prevents separation of the tradable/nontradable components thereby biasing labor productivity growth estimates of nontradables upwards. This constrains pinpointing the exact location of the extraordinary labor productivity growth observed in the services, that is, it is not possible to determine whether it originated from the tradable or nontradable component of the sector. For services like communications, insurance, and banking, liberalization and deregulation of administered

prices were likely sources of labor productivity growth as communications and information technology prices fell as a consequence.[20]

The virtual disappearance of the relative labor productivity growth differential from almost 3 percentage points in the 1980s to almost zero during 1992–2004 is striking because the relative price of nontradables increased at a faster pace at the same time. Figure 6 depicts this paradox: accelerating productivity growth in nontradables closes the gap vis-à-vis tradable sector productivity growth, while the relative nontradable–tradable price ratio climbs at the same time. Adding to the puzzle is the negative (but weak) association observed between the relative productivity differential and relative nontradables inflation (figure 7), which *prima facie*, neither supports a B-S effect nor is it consistent with the rising share of tradables in aggregate output. What then explains the increase in relative nontradable prices when the relative productivity differential actually narrowed in the 1990s? Did demand factors dominate during this period? We explore this next.

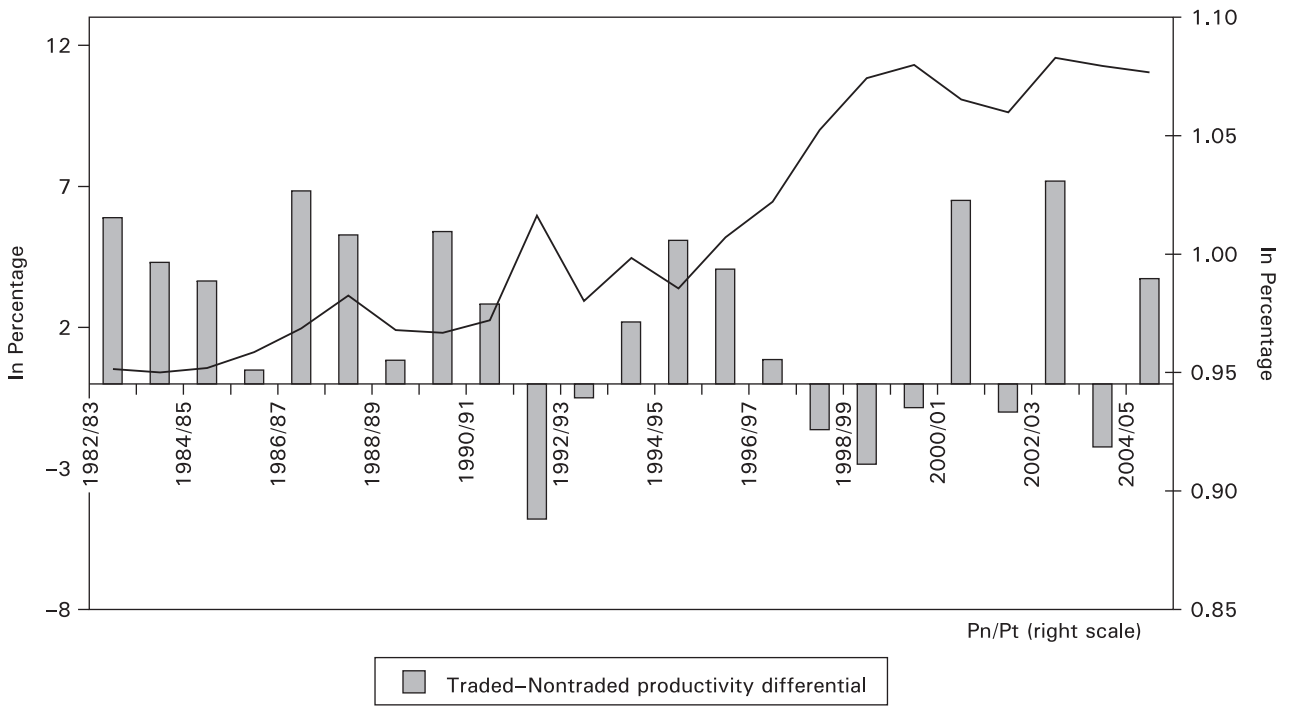
Relative Nontradable Prices and Demand Indicators

Table 4 uncovers a major demand shift, public as well as private, in the 1980s. Real government consumption expenditure growth averaged 6.9 percent of GDP in this decade, an increase of more than 2 percent over the 1970s. At the same time, real per capita income growth jumped to an average 3.7 percent from a minuscule 0.61 percent in the previous decade. The post-reform decade of 1992–2006 shows private demand accelerating further to average 4.6 percent even as fiscal growth slowed to average 5.9 percent in this period. Private demand accelerates further in the current decade, 2000–06, averaging close to 6 percent.

Column 3 shows that growth in the share of services in private final consumption expenditure—a closer indicator of the nonhomothetic preferences hypothesis—spurted to 7.6 percent during 1992–2006 and a further 9 percent between 2000–06. This trend suggests that private consumption growth has been biased toward services/nontradable goods after 1990—a familiar enough trend associated with rising per capita incomes. Bivariate regressions of each of the demand indicators upon the relative nontradables inflation

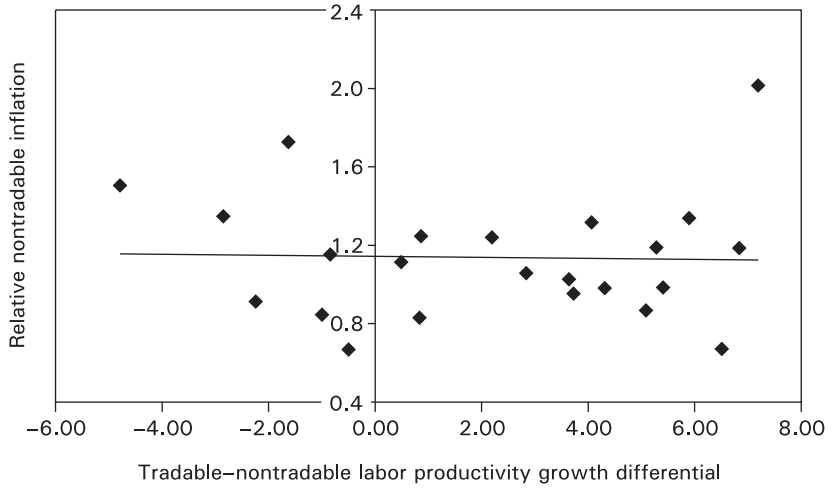
20. The empirical evidence on productivity growth trends in the post-reform period is inconclusive though trends in recent years show significant increases in productivity (see RBI, 2004; Reddy, 2005 for recent summaries). There is some evidence to show relatively faster total factor productivity growth, particularly in the export-oriented industries. All these studies however, focus on the manufacturing sector, which, as our classification shows, is an incomplete representation of the tradable sector.

FIGURE 6. Tradable–Nontradable Labor Productivity Growth Differential



Source: Authors' calculations.
Note: Pn/Pt = Price of nontradables by price of tradables.

FIGURE 7. Tradable–Nontradable Productivity Differential and Relative Nontradable Inflation



Source: Author's calculations,

TABLE 4. Evolution of Demand Indicators, 1970–2006 (decade averages, percent)

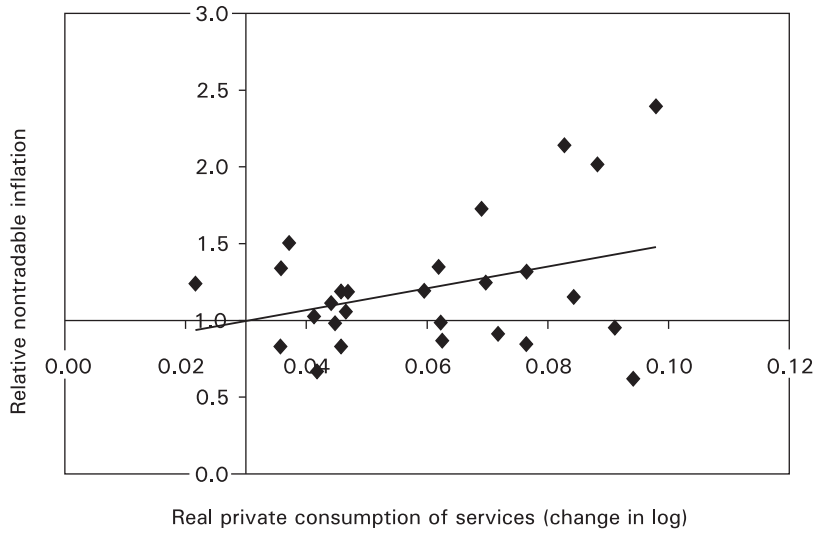
Year range	*Real government consumption expenditure growth*	*Real per capita income growth*	*Growth in private consumption of services*
	1	2	3
1970s	5.04	0.62	3.97
1980s	6.92	3.46	4.73
1990s	6.3	3.57	5.89
2000–06	4.12	5.17	9
1992–06	5.9	4.63	7.56*

Source: Authors' calculations with data from NAS, CSO, and *Handbook of Statistics*, RBI.
Note: *Average for 2000–06.

rate (figures 8–10) reveal that growth in real private consumption of services and government consumption expenditure are positively associated with the change in relative nontradable prices. But the negative association with real per capita income growth contradicts theoretical priors.[21]

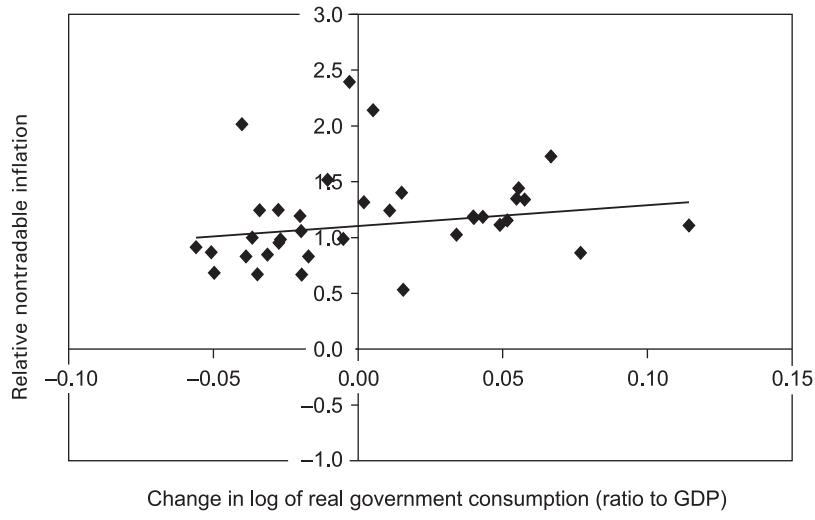
21. 1979 and 1991 are years of oil shock and macroeconomic crisis respectively when per capita income was negatively impacted. Likewise, labor productivity growth was adversely affected during exchange rate depreciation episodes (1991, 1997, 1998, and 2001) through increases in the price of imported inputs.

FIGURE 8. Real Private Consumption of Services and Relative Nontradable Inflation



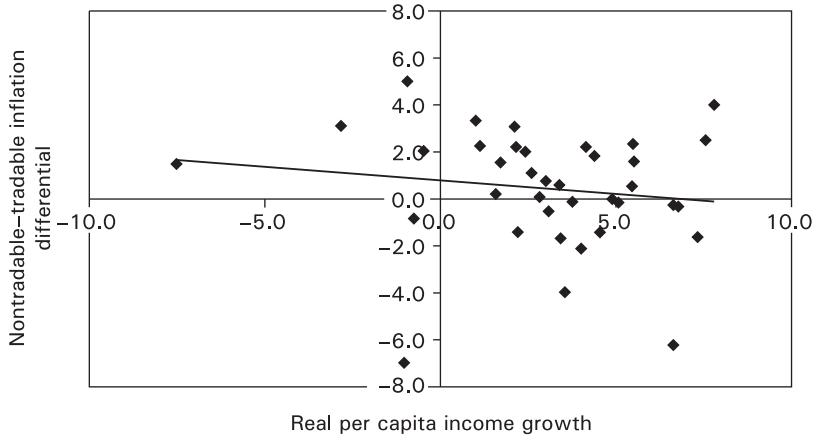
Source: Authors' calculations.

FIGURE 9. Real Government Consumption and Relative Nontradable Inflation



Source: Authors' calculations.

FIGURE 10. Real Per Capita Income and Inflation Differential



Source: Authors' calculations.

Preliminary evidence thus suggests the following:

1. Since the 1980s, there has been a divergence between the prices of nontradables and tradables.
2. Relative to the prices of tradables, nontradable price changes accelerated after 1991, exceeding 1 percentage point per year, on an average, during 1991–2006.
3. The relative nontradable price (with an increase implying a real appreciation) becomes broadly consistent with the 36-country trade weighted real effective exchange rate during the liberalization phase of the economy. In the 1980s, however, the two measures actually move in opposite directions. This indicates that the post-1991 reforms—correction of an overvaluation, which kept the domestic price of tradables unsustainably higher relative to the foreign price, change of exchange rate regime, import liberalization, and faster productivity growth in tradable sector—played a significant role in the alignment of internal and external real exchange rate measures.
4. The share of the tradable sector, defined as those exporting at least 5 percent of their total value of production, rose from an average of 20 percent between 1980 and 1989 to 25 percent during 1990–2006. In the current decade, the tradable sector's share averages 28 percent. This trend is contrary to the commonly held perception that the

share of nontradables in output is rising in India; our disaggregate analysis of changes in respective output shares shows that it is actually the opposite. The confusion arises from equating services with nontradability; close to a quarter percent (23 percent) of services' output was traded in 2006, and the share of traded services in total production, driven by communication and business services, averaged 9 percent in 1990–2006.

5. On average, tradable–nontradable labor productivity growth differentials widened in the 1980–89 period, but narrowed significantly during 1992–2004. Relative nontradable prices, on the other hand, rose throughout the sample period. The narrowing of the tradable–nontradable productivity growth gap in 1992–2004 along with acceleration in relative price of nontradables at the same time is inconsistent with the B-S hypothesis.
6. The increase in the relative price of nontradables is positively associated with change in the share of tradables in total output, suggesting classic B-S effects via widening productivity growth differentials between the tradable and nontradable sectors. However, the labor productivity growth gap narrowed in the 1990s, possibly reflecting liberalization and deregulation effects.
7. Both private and public demand show big increases in the 1980s. Although growth in public demand slows down in the post-reform phase, private demand accelerates. Preliminary trends reveal increased demand for services (nontradable) after 1990, which ought to reflect in an expansion of the nontradable sector. However, the tradable sector actually expands during this period! This suggests a role for liberalization effects in the economy—increased competitiveness via lower import (input) prices, exchange rate correction (overvaluation) that possibly made some individual sectors more tradable, and competition and deregulation effects upon prices. For instance, the emergence of new tradables like services (through improvement in telecommunications), pharmaceuticals, auto components, and so on (internationally competitive at the new prices) would be reflected as a shift in the supply curve in the framework in the previous section (figure 4)—the relative price of nontradables thus rises but the relative composition of output changes with a shrinking of the nontradable sector. Alternately, it could be a case of supply constraints in the nontradable sector, which leads to a relative price increase along with an expansion of the tradable sector.[22]

22. We are grateful to Robert Lawrence for these insights.

Initial evidence thus suggests that both supply and demand factors might play a role in the observed increase in the relative prices of nontradables since the 1980s. The evidence that productivity growth gap between the tradable and nontradable sectors actually narrowed in the 1990s but relative nontradable prices rose throughout the two decades suggests a real appreciation via—B-S effect in the 1980s and through demand channels in the 1990s. The next section examines these aspects econometrically.

Determinants of the Relative Price of Nontradables: Formal Evidence

Based upon the theoretical discussion in the second section, the relative price of nontradables is posited as a function of both supply and demand factors. The estimated equation takes the form of Equation 1, where the dependent variable, P_{nt}/P_t, is the relative price level of nontraded goods. The explanatory variables are g_t, the log of government consumption expenditure as share of GDP (both in real terms); $a_t - an_t$, the labor productivity growth differential between the traded and nontraded sectors; y_t, the real per capita income growth; ε_t is the error term:

$$P_{nt}/P_t = \alpha + \beta_0(g_t) + \beta_1(a_t - a_{nt}) + \beta_2(y_t) + \varepsilon_t \qquad (14)$$

Equation 15 augments the standard productivity model to incorporate the impact of import liberalization, allowing additional supply influences upon the relative price of nontradables:

$$P_{nt}/P_t = \alpha + \beta_0(g_t) + \beta_1(a_t - a_{nt}) + \beta_2(y_t) + \beta_3(m_t) + \varepsilon_t \qquad (15)$$

where m_t is the average applied tariff rate. The expected values of respective coefficients on these variables, β_0, β_1, β_2 are greater than zero, while that on β_3 is expected to be negative.

The sample length, 1980–2006, is guided solely by data availability on sectoral employment shares. A full description of the data sources and variables is provided in appendix 3. Except for tariff rates, all variables are in logs and the equation is estimated in first differences.[23] Table A-1 in the appendix 2 presents different versions of the benchmark equations 1 and 2 through both ordinary least squares (OLS) and instrument variables

23. All variables were tested for unit roots and found to be level nonstationary in levels and I (1).

(IV) methods to control for possible endogeneity and collinearity of the independent variables.[24]

The estimated regular productivity model (regressions 1 and 2, table A-1, appendix 2), with real government expenditure and per capita income growth capturing the demand influences, shows that only fiscal growth exerts a significant impact in both OLS and IV versions, while both real income and productivity growth enter with a wrong sign. A scan of recursive residuals of the regression reveals 1991, a crisis year, is an influential outlier: the recursive residuals stray outside the two standard error bounds, rejecting the hypothesis of parameter constancy (*p-value* less than 0.05). Regression 2 controls for the 1991 outlier, resulting in overall improvement in the goodness-of-fit measures with all coefficients correctly signed. β_1, the coefficient upon relative labor productivity ($a_t - a_{nt}$) is now significant; in terms of magnitude, a 6 percent increase in the tradable–nontradable labor productivity growth differential results in a 1 percent increase in the relative nontradable inflation rate. Both regressions indicate that *ceteris paribus*, a 1 percentage point rise in fiscal growth, g_t, is matched by a little over a 0.33 percentage point rise in the relative nontradable inflation rate. Thus a 3 percent fiscal expansion in real terms leads to almost 1 percentage point rise in the relative rate of inflation in nontradable goods. Private demand influence (β_2) is equally strong: a 4 percent increase in real per capita income results in a percentage point increase in the relative inflation rate via demand pressures.

Regressions 3 and 4 allow for additional supply shocks to determine relative price changes by including relative price shifts of tradables. The import tariff variable, (m_t), enters with a negative sign and is significant (Regression 3). The coefficients on all other variables increase in magnitude and significance, pointing toward an omitted variables bias in the benchmark specification. In particular, the productivity influence is considerable in size, indicating that a percentage point increase in the tradable–nontradable productivity growth gap is associated with a 0.21 percent increase in the nontradables' inflation rate. The import price coefficient indicates that a price decrease corresponds to a rise in the relative price of nontradable; the coefficient magnitude implies a pass-through between 0.02 and 0.06, suggesting that a very small portion of a positive (negative) external shock is absorbed into the economy through changes in domestic nominal prices.

24. The correlation coefficient between changes in log real per capita income and log import prices is 0.37. Productivity growth is also positively correlated with real per capita income growth, but at 0.10, the correlation coefficient is weak.

Both fiscal growth and relative labor productivity are robust across all specifications and estimation methods.

The estimated magnitude of the B-S impact, 0.21, for India compares favorably with the panel regression estimates obtained for the OECD[25] but are relatively lower in comparison with Chinn's estimates for a panel of East Asian economies.[26] Estimates for the transition and accession countries of the European Union are also generally higher,[27] though these mask wide, within-group variation.[28] The relatively small magnitude of the B-S impact for India could be due to several reasons. First, problems in the measurement and quality of data on labor productivity may be affecting the results. In particular, the—B-S hypothesis also refers to total factor productivity whereas the lack of data on sectoral capital stock limits our relevant measure to labor productivity. Two, the assumption of open capital markets is strained for much of the sample period; capital account restrictions were relaxed only after 1991 and the process has been slow, qualified, and still incomplete. Similarly, rigidities in intersectoral resource allocation question the assumption of labor mobility in the model.[29]

The significant role of demand factors uncovered in the exercise supports the imperfect capital mobility assumption for India.[30] The demand influence originating from a real private income growth lies in the range of 0.15–0.26, which, in conjunction with the coefficient of 0.30 for fiscal

25. These range between 0.10 and 0.76 with the labor productivity measure (see Chinn and Johnston, 1996, for a summary of empirical estimates). De Gregorio et al. (1994) estimates range between 0.10 and 0.26, with the total factor productivity measure. Rogoff (1992) estimates a manufacturing labor productivity shock of –0.6 to –0.7 for the Yen/US Dollar real exchange rate.

26. Chinn's (2000) estimates for a panel of East Asian economies lie between 0.21 and 0.63.

27. Jazbec (2002) panel estimates range from 0.86–1.33 for a panel of nineteen EU transition economies over 1990–1998.

28. Backe (2002) reviews the important empirical literature, pointing out that the annual B–S effects estimated across these studies varies from a low 0.8 percent for the Czech Republic to 3.5 percent for Slovenia, 5.6 percent for Hungary, and 9.4 percent for Poland.

29. Recent empirical work on the impact of trade liberalization on poverty in India finds no evidence of labor reallocation after 1991, confirming a sluggish labor market response (Topalova, 2004). Consistent with low structural reallocation, employment labor shares remained constant with returns to factors (wages and industry premia) responding to the adjustment.

30. De Gregorio et al. (1994) argue that demand-side factors will affect relative prices only if the assumptions of perfect competition in goods and factor markets, purchasing power parity for traded goods, and perfect capital mobility are relaxed.

growth, reveals a pronounced role of demand factors in determining domestic relative price changes. The supply side influences, represented by relative labor productivity growth and change in import prices, are relatively smaller, though it would be reasonable to assume a stronger effect were more accurate productivity growth measures available.

Stability: Accounting for Post-1991 Reforms/Liberalization Effect

The equations fitted here assume that no relevant factors other than public and private demand, productivity growth differentials, and tradable prices were changing over the period considered. But this assumption is violated in the latter half of the sample, which is characterized by changing production and price structures due to economic reforms instituted after the 1991 crisis. The discussion in the third section mentioned trade liberalization, deregulation of prices, and increased competition in some sectors. These reforms possibly impacted relative prices, in which case the non-inclusion of this factor in the estimated equation could possibly overestimate the importance of demand and supply factors.

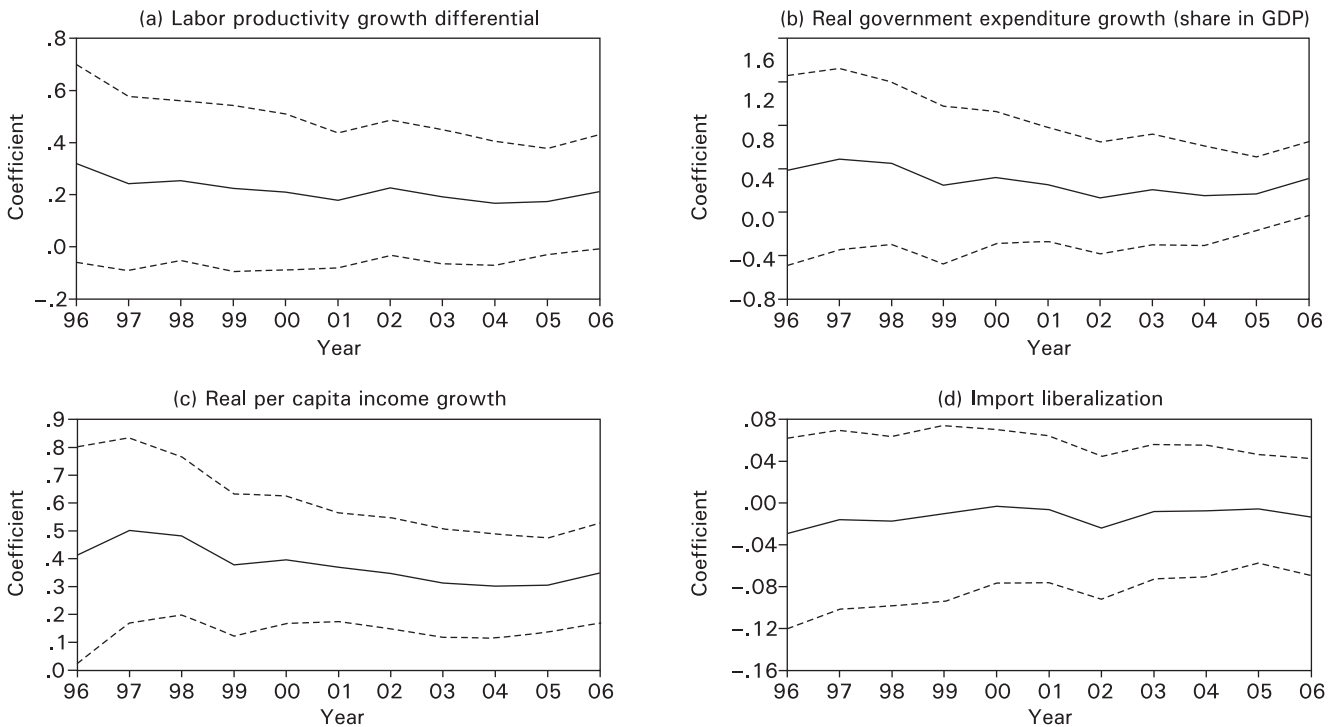
Regression 4 therefore re-runs the augmented productivity specification with a post-reform binary variable to capture structural changes during the transition process. The coefficient on the reforms dummy is, however, negative and statistically insignificant, suggesting that other than import liberalization, the post-1991 changes have not so far contributed toward a higher rate of inflation in nontradables.

To push the stability investigation further, the full specification was re-estimated through recursive least squares, where the equation is estimated repeatedly, using ever larger subsets of the sample data. Figure 11 (a–d)—trace the evolution of coefficient estimates for all feasible recursive estimations of $(a_t - a_{nt})$, g_t, y_t and m_t, along with the two standard error bands. The recursive coefficient estimates indicate no evidence of parameter instability for any of the explanatory variables. However, fiscal growth impact tends to weaken after 1996 and private demand influence acquires greater significance toward the end of the sample period, which is not surprising as per capita income growth has been extraordinarily strong, averaging more than 7 percent annually (2003–06).

Sensitivity Analysis

Apart from robustness to different estimation methods and stability checks, the above regressions were also subjected to sensitivity analysis of the

FIGURE 11. Recursive Coefficient Estimates



Source: Authors' calculations.
Note: Dotted lines are +/–2 standard error (SE) bands.

explanatory variables to substitution with other proxy measures.[31] The following checks were carried out to assess the robustness of the results:

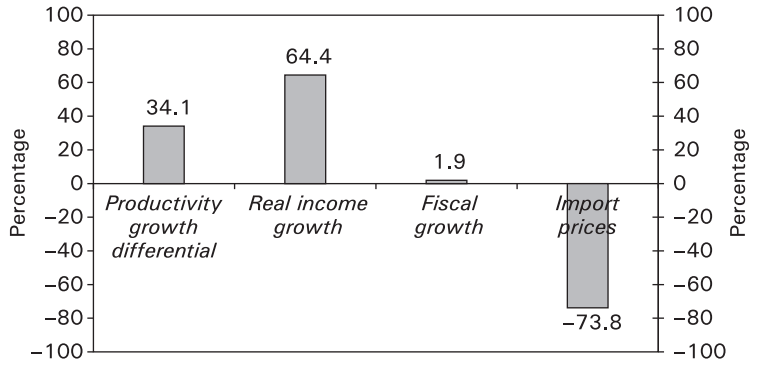
- Productivity growth in the tradable and nontradable sectors was entered as separate variables to test whether productivity gains in nontradable services' categories played a role in inflation divergence. The result confirms that productivity growth in the tradable sector is the source of supply-side influence with a mean point estimate of 0.31. The coefficient on nontradables' productivity growth is correctly signed but insignificant across all estimations. Both fiscal and income growth variables are robust to this substitution.
- Real government consumption was entered as two separate variables—compensation to employees and purchases—to test the proposition that government expenditure falls more heavily on nontradable goods. The results from these regressions are slightly ambiguous: the impact of wages is always significant in all versions of the regression equation with a coefficient size of 0.10, while the coefficient on government purchases is inconsistent. All other explanatory variables are robust to the substitution except the coefficient on real per capita income growth, which turns totally insignificant in this version. The results suggest that the aggregate consumption measure g_t is a better indicator of fiscal growth.
- Real per capita income growth was substituted by the growth in the real share of services in private final consumption expenditure (ratio to GDP), using a closer measure of the 'preferences' hypothesis. Although this definition of "preferences" is upheld in the basic specification, where the significant coefficient is estimated between 0.18 and –0.21, the hypothesis is rejected in the augmented specification with import price changes. All other variables are robust to this definition.
- The import tariff rate was replaced by change in log of unit value of imports. The coefficient size remained unchanged but is somewhat lost in significance, confirming that the import tariff rate captured the trade liberalization impact more accurately.

The Relative Contribution of Demand and Supply Factors

To further disentangle the relative contribution of demand and supply factors, the coefficient estimates from the regression results [(two stage least squares) 2SLS Regression 3] are used to decompose the mean relative price change over the sample period. Figure 12 displays the approximate

31. These regressions are not reported here but obtainable from the authors on request.

FIGURE 12. Percentage Contribution to Relative Nontradable Inflation: Demand and Supply Factors, 1982–2006



Source: Authors' calculations.

contributions of each independent variable to the mean of the dependent variable. The decomposition shows that demand factors—income and fiscal growth—accounted for almost three-fourths of the average relative price increase over the sample period, but for the offsetting impact of lowered import prices. Accounting for 73.8 percent of the average increase in relative prices during the sample period, the role of import prices in widening inflation differentials is not inconsiderable. Noting the rapid decline in import tariffs after 1991, this result underscores the role of convergence in tradable prices and its contribution to the divergence in sectoral inflation rates. In contrast, supply side influences stemming from labor productivity growth in the tradable sector account for only 35 percent of the mean of the dependent variable.

An Application to Macroeconomic Policies

The prominent role of demand factors in driving the relative price of nontradables uncovered in our empirical exercise serves to illuminate the evolution of exchange rate and fiscal policies during much of the sample period. Between 1980 and 1998, the nominal exchange rate depreciated by an average 5 percent annually, including an "active" devaluation phase (1986–90) of an annual average of 9.7 percent, which slowed to 2.8 percent between 1993 and 1998.[32] Fiscal policy, on the other hand, was expansionary throughout this period (figure 13).

32. Joshi and Little, (1994) point out that the rupee was devalued to keep the real exchange rate constant between 1983 and 1985, followed by an active nominal devaluation policy between 1986 and 1990 to produce a real depreciation that helped export growth (Joshi and Little, 1994: 277).

Corresponding to the depreciation episodes, the consolidated fiscal deficit to GDP ratio averaged 9.2 and 7.4 percent for 1993 and 1998 respectively. The extent of internal real appreciation implied by the change in the relative price of nontradables during these nominal depreciation episodes is 1.03 percent (1986–90) and 1.29 percent (1993–98) annually. Our results demonstrate that along with productivity and income growth, this fiscal expansion added considerably to the relative price increase throughout the 1980s and the early 1990s. As fiscal support was absent in correcting relative price distortions, nominal exchange rate policy was actively deployed to recover competitiveness and offset the impact of fiscal expansion during this period. The scrutiny of past macroeconomic policies thus illustrates how the exchange rate regime is determined to adjust the real exchange rate when fiscal imbalances are persistent and reforms are delayed.

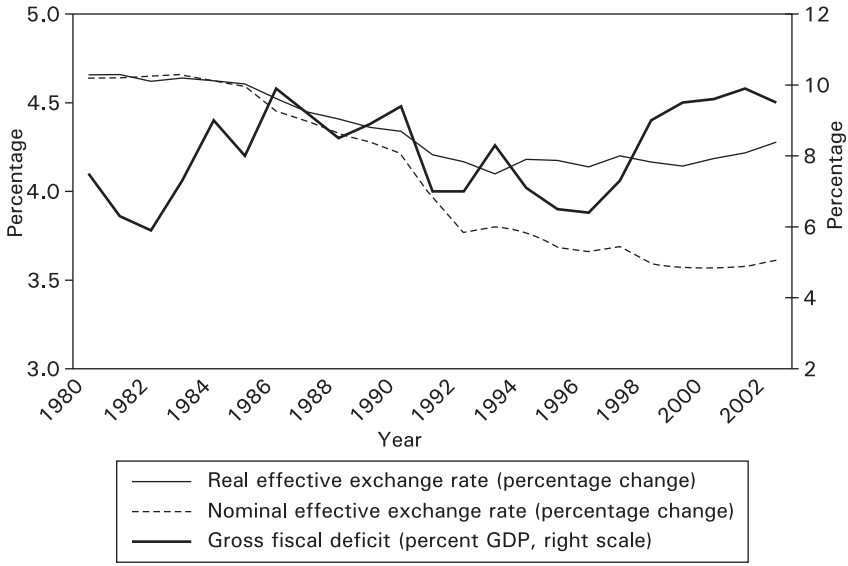
Structural reforms to restore fiscal balance were initiated only after the macroeconomic crisis in 1991; after a brief phase of correction from 1992 to 1996, fiscal reforms were again delayed until 1998–99.[33] Our results can be used further to endorse the role of fiscal policy in correcting relative price changes induced by structural factors in a fast-growing economy. For each year since 2000, the stacked columns (adding up to the fitted values from the regression) in figure 14 trace the dynamics of each variable (column portions) in explaining the relative price level. This shows that on average, private demand and productivity growth have contributed the most to the relative nontradable price level in the recent period of strong GDP growth that averages 8.7 percent during 2003–06. Simultaneous fiscal correction, leading to a decline in the gross fiscal deficit of magnitudes ranging from 0.3–1.1 percentage points every year, restrained relative prices from accelerating more than they might have during this period of rapid growth. Figure 13 traces the dynamic contribution of fiscal reforms in this process, underlining the role of fiscal policy in reducing appreciation pressures.

Policy Implications and Conclusion

This paper examines the evolution of prices in the nontradable and tradable sectors of the Indian economy over 1980–2006 and finds widening inflation differentials between the two sectors. After 1990, the nontradable sector is characterized by acceleration in the rate of inflation that is coincident with

33. Commitment to fiscal reforms has become binding with the rule-based Fiscal Responsibility and Budget Management Act, 2003. Under this, fiscal deficit is to be brought down to 3 per cent of GDP and revenue deficit to be completely eliminated by March 2009.

FIGURE 13. Exchange Rate and Fiscal Policy, 1980–2002



Source: Authors' calculations.

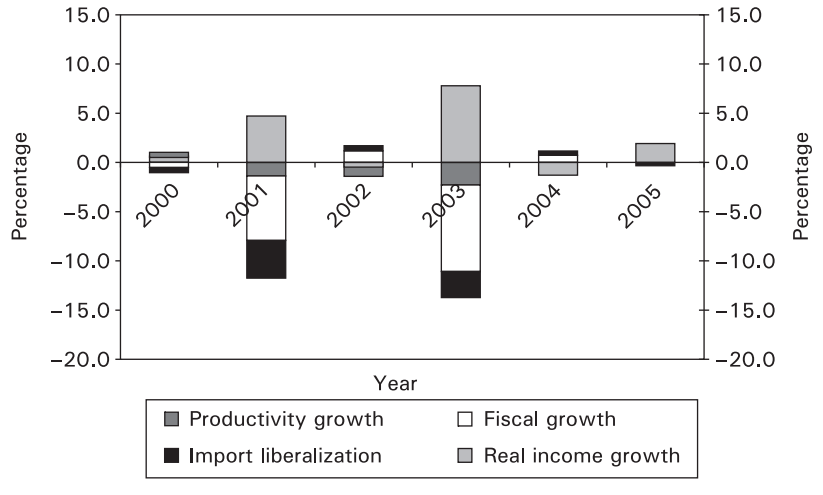
narrowing relative labor productivity growth differentials and expanding tradable sector output. Our results show that both demand and supply factors have contributed to this real appreciation. For the period as a whole, real income growth and fiscal expansion along with a relatively faster labor productivity growth in the tradable sector have been the key drivers of the relative price increase. After 1990, real per capita income growth has been the major source of the higher rate of inflation observed in the nontradable sector. The simultaneous increase in the share of tradables in total output indicates that demand influences did not, however, result in a resource shift away from the tradable sector. By increasing competitiveness and rendering some sectors more tradable through correction of overvaluation, reforms like import liberalization and change in exchange rate regime played an important part in this process.

The research draws particular attention to the importance of relative price shifts within the tradable sector, that is, reduction in import prices, in changing domestic relative prices. As goods and services markets get integrated, structural factors such as convergence in domestic–foreign price levels due to progress in trade reforms will contribute significantly to inflation divergence. So the real appreciation may well continue. In the light of the beneficial impact of import liberalization and an increasing share of

imported inputs in domestic production, the necessity of continuing trade reforms deserves emphasis with the use of other policies like fiscal policy, to achieve inflation convergence.[34]

This conclusion is reinforced when the picture is extended beyond our study period. Emerging trends in the economy strongly point toward an acceleration of forces impacting relative price movements. These are, *inter alia*, a strong GDP growth rate averaging 8.8 percent over 2003–07, an average export growth of 24.1 percent during the same period, an above average 7.0 percent real per capita income growth along with sizeable productivity gains in export-oriented industries.[35] A steadily rising inflow of portfolio capital, which averaged US$8.8 billion over 2003–06, adds force to these trends. Although our results do not include the impact of capital inflows, we recognize that the tendency for real appreciation induced by relative price changes is reinforced by capital inflows that impact the real exchange rate via the nominal rate and through the FDI channel. Last of all, an economy

FIGURE 14. Accounting for Relative Price Levels: Role of Fiscal Reforms



Source: Author's calculations.

34. At the firm level, trade liberalization has been particularly beneficial to total factor productivity growth in industries close to the technological frontier (Aghion et al., 2003; Siddharthan and Lal, 2004), firms located in regions or sectors with a more flexible labor environment, and those that were privately managed (Topalova, 2004).

35. Reddy (2005) points out that productivity and per capita income growth-induced pressures have grown considerably since 2000, particularly in manufacturing (also see Dholakia and Kapur, 2001; Unel, 2003).

undergoing structural changes, as India is, will experience relative price shifts due to factors like liberalization, adjustment of regulated prices, and competition, as mentioned earlier in the paper.

What do these trends signify for future macroeconomic policy? To the extent that a real exchange rate appreciation (increase in the relative prices of nontradable goods) is productivity driven, it is an equilibrium phenomenon and reflects a natural evolution of the economy. This trend appreciation will also be reinforced by the associated increases in incomes, particularly if demand is biased toward services as living standards rise to converge toward those in more advanced economies.[36] As these evolutionary processes cannot be restrained and must be absorbed, they bring to the fore the necessity of freeing the exchange rate regime to absorb these effects through a nominal appreciation. In this context, a welcome development in recent times is a more flexible exchange rate regime. From 1998 to 2003, nominal devaluation against the US dollar has been only 0.03 percent; since 2003, both the nominal and real exchange rates have appreciated by 0.8 and 1.6 percent respectively, signifying some absorption of appreciation pressures.

Real appreciation arising from persistent fiscal deficits, however, is not an equilibrium phenomenon. Our results suggest that an approximate 0.25 percent cut in real government expenditure to GDP ratio could result in a 1 percent real depreciation through a decline in the inflation rate in the nontradable goods sector. In addition, fiscal consolidation that reorients spending toward education and infrastructure would boost the productivity of the nontradable sector, further reducing the relative gap vis-à-vis the tradable sector. Thus, continuing fiscal reforms could significantly facilitate absorption of equilibrium shifts induced by productivity and income growth.

Finally, our research contributes by providing a tradable/nontradable characterization of the economy, which, to the best of our knowledge, has not been attempted so far. With the growing openness of the economy in every sphere, this distinction provides a useful framework of analysis. In addition, our paper raises a number of critical data issues, not the least of which is the absence of a services' price index in India. Our implicit price series strongly suggest an understatement of generalized inflation through

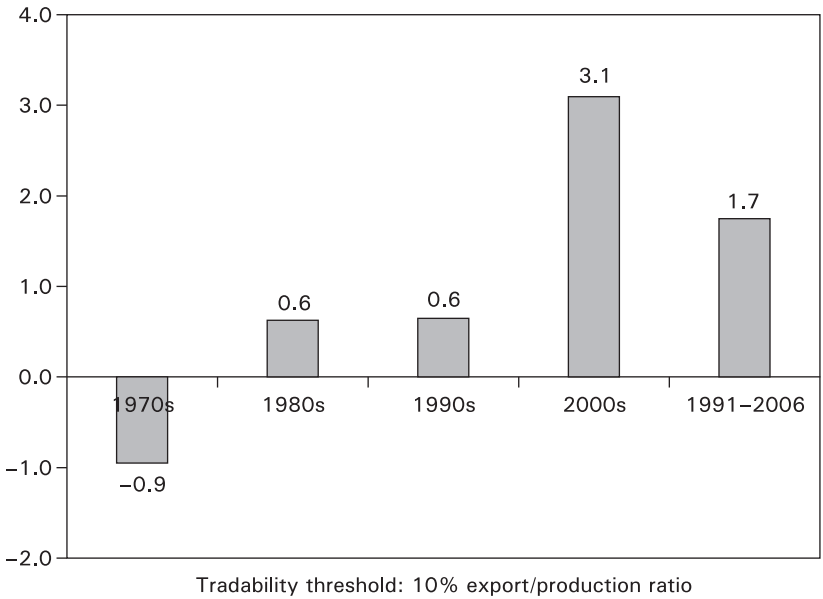
36. Illustratively, strong demand pressures originating from rapid income growth could affect competitiveness if it leads to wage pressures in the tradable sector. In a competitive environment, a strong and persistent demand bias toward nontradable goods (many services) could induce productivity growth and consequent wage increases in the nontradable sector.

the current inflation indicator, the wholesale price index (WPI), which can be misleading. It also identifies gaps in data on sectoral employment shares, emphasizing the need for sufficiently disaggregated information to enable fruitful analysis and informed policy-making.

APPENDICES

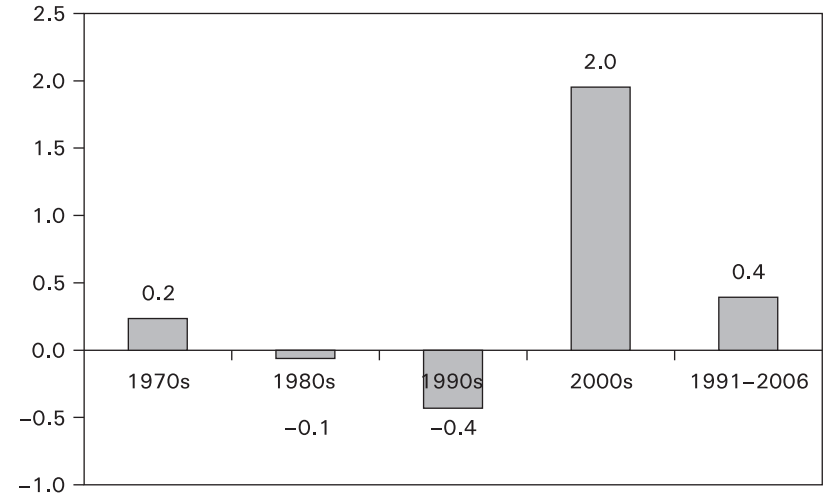
Appendix 1

FIGURE A-1. Nontradables–Tradables Inflation Differential (decade means)



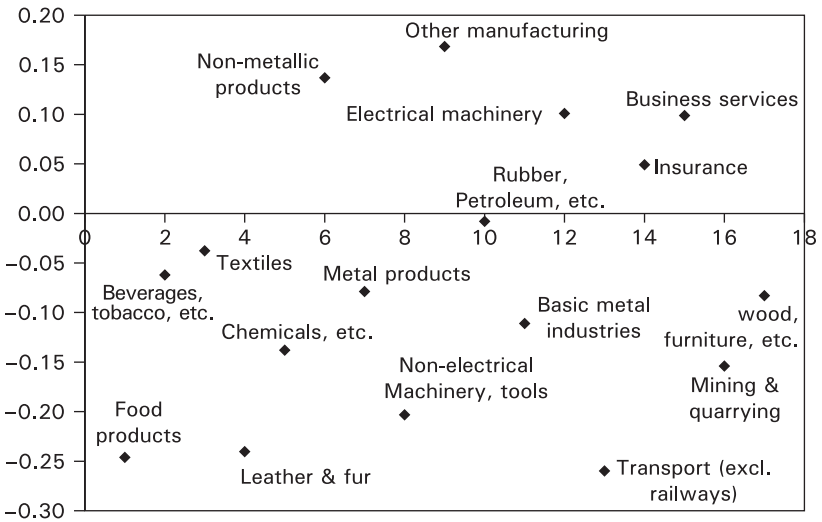
Source: Authors' calculations.

FIGURE A-2. Nontradables–Tradables Inflation Differential Including Agriculture (decade means)



Source: Authors' calculations.

FIGURE A-3. Correlations: Change in Output and Inflation Rates



Source: Authors' calculations.

Appendix 2

TABLE A-1. Basic and Augmented Productivity Model Estimates, 1981–2006

	Basic productivity model				*Augmented productivity model*			
	(1)		*(2)*		*(3)*		*(4) With reforms*	
Dependent variable $\Delta P_{nt} / \Delta P_t$	*OLS*	*IV*	*OLS*	*IV*	*OLS*	*IV*	*OLS*	*IV*
Productivity growth differential	–0.07	–0.07	0.15*	0.06*	0.21*	0.21*	0.18*	0.19*
	(0.67)	(0.67)	(1.67)	(1.92)	(1.88)	(2.10)	(2.01)	(1.79)
Real government consumption	0.18***	0.22**	0.30***	0.25***	0.34***	0.32***	0.31***	0.317***
(share of GDP)	(2.57)	(1.81)	(3.30)	(3.83)	(3.82)	(4.10)	(4.22)	(3.62)
Real per capita income (share	–0.03	0.21	0.35**	0.15*	0.26	0.24**	0.20	0.17*
of GDP)	(0.12)	(0.43)	(1.90)	(1.70)	(1.40)	(2.44)	(1.22)	(0.95)
Terms of trade								
Price of imports					–0.03	–0.02**	–0.06	–0.04
					(2.95)	(2.21)	(1.88)	(1.43)
1991 dummy			4.74***	5.76***	8.33***	8.67***	9.30***	9.30***
			(4.73)	(16.1)	(4.63)	(4.81)	(3.97)	(3.94)
Reforms dummy							–2.10*	–1.54*
							(1.16)	(0.83)
Adjusted R-square	0.17	–0.04	0.52	0.38	0.54	0.54	0.56	0.51
Durbin-Watson Statistic	2.30	2.71	1.85	1.72	2.11	2.04	2.04	1.93
Standard Error	1.81	1.92	1.41	1.47	1.27	1.19	1.24	1.23
Observations	25	23	25	23	25	23	25	23

Source: Authors' calculations.

Notes: OLS and IV specifications with heteroskedasticity consistent errors. ***, **, and * indicate 1, 5, and 10 percent significance levels respectively.

TABLE A-2. Implicit Inflation Rates—Tradable Manufacturing Subsectors

	Food products	*Beverages, tobacco, etc.*	*Textile products*	*Leather and fur products*	*Rubber, petroleum, etc.*	*Chemicals, etc.*	*Non-metallic products*	*Basic metal industries*	*Metal products and machinery*	*Electrical machinery*	*Other manu-facturing*	*Total traded manu-facturing*
1980–81	10.5	–5.4	5.7	–3.0	27.3	19.7	24.8	5.5	18.4	8.2	20.5	12.3
1981–82	–1.4	3.6	1.9	–3.7	22.0	13.5	13.0	19.7	11.8	6.1	3.7	8.0
1982–83	–7.9	0.4	4.4	–1.5	5.0	0.1	22.6	12.3	6.8	5.3	0.4	4.7
1983–84	27.2	16.4	8.4	6.7	5.5	5.6	9.0	8.1	7.3	4.3	2.9	8.5
1984–85	3.6	3.0	9.9	8.2	3.5	3.9	7.2	5.9	5.2	7.0	6.0	6.9
1985–86	5.7	14.5	1.9	17.6	10.0	6.8	5.0	14.8	11.2	7.7	6.5	8.1
1986–87	8.6	19.7	0.7	4.7	2.8	5.9	–0.7	1.3	2.8	5.6	5.2	4.7
1987–88	6.4	3.4	12.8	5.1	7.4	8.0	2.3	12.7	6.6	2.7	3.0	8.2
1988–89	2.9	6.8	7.3	14.0	0.8	6.9	4.0	21.5	13.8	14.6	2.3	7.6
1989–90	13.8	14.2	16.3	13.0	1.1	3.7	10.9	11.9	18.9	9.7	7.0	11.8
1990–91	14.0	17.7	8.3	20.2	11.6	6.3	12.2	6.9	10.6	7.4	4.3	9.9
1991–92	13.2	10.5	9.7	4.2	9.7	14.4	17.2	6.5	12.0	13.5	8.8	10.9
1992–93	6.9	11.0	9.9	–3.1	12.5	16.4	7.1	9.6	13.2	6.7	13.6	10.4
1993–94	9.3	4.5	9.6	8.7	6.3	8.6	9.7	8.3	1.6	9.8	1.7	6.9
1994–95	13.4	19.4	15.6	8.1	6.5	17.2	12.0	10.2	7.6	6.1	12.3	12.8
1995–96	3.8	8.3	13.0	9.3	9.0	10.9	17.3	12.9	9.0	4.5	10.2	9.8
1996–97	5.7	6.6	–1.2	1.7	9.4	3.8	3.0	5.1	7.1	–0.4	2.6	4.1
1997–98	10.4	12.5	–0.7	7.0	5.6	4.5	–1.7	3.8	1.8	–3.8	3.2	3.0
1998–99	17.4	11.8	3.5	3.7	1.2	7.5	2.4	1.7	2.4	–1.5	4.8	5.1
1999–00	1.3	5.1	–0.7	17.1	5.9	6.6	–2.9	1.8	1.4	–1.3	3.8	2.6

(*Table A-2 continued*)

(*Table A-2 continued*)

	Food products	*Beverages, tobacco, etc.*	*Textile products*	*Leather and fur products*	*Rubber, petroleum, etc.*	*Chemicals, etc.*	*Non-metallic products*	*Basic metal industries*	*Metal products and machinery*	*Electrical machinery*	*Other manu-facturing*	*Total traded manu-facturing*
2000–01	–4.0	2.0	4.6	–3.5	37.1	6.4	5.0	4.0	4.2	8.7	3.5	5.9
2001–02	–0.8	5.4	–0.5	–6.1	5.6	2.9	7.6	0.5	5.1	3.6	1.9	2.7
2002–03	7.4	5.2	2.6	–7.4	6.5	3.0	–0.4	3.7	3.0	–0.9	2.8	3.1
2003–04	11.3	–0.7	7.6	12.3	7.1	2.1	3.5	18.3	3.5	0.2	6.1	6.6
2004–05	4.6	8.9	3.5	6.5	13.2	2.9	6.4	23.1	8.9	4.4	7.1	7.9
2005–06	0.4	8.7	–5.0	6.9	13.2	3.9	8.7	8.6	7.7	3.3	3.7	4.8
2006–07	7.3	11.8	2.4	–4.4	8.7	3.3	14.4	8.6	4.0	9.0	4.9	6.8
Means												
1980–89	6.9	7.7	6.9	6.1	8.5	7.4	9.8	11.4	10.3	7.1	5.7	8.1
1990–2006	7.1	8.8	4.8	4.8	9.9	7.1	7.1	7.8	6.1	4.1	5.6	6.7

Source: Authors' calculations.

TABLE A-3. Implicit Inflation Rates—Tradable Services Subsectors

	Transport (excluding railways)	*Insurance*	*Communication services*	*Legal services*	*Business services*
1980–81	1.0	21.8	–2.1	12.3	11.8
1981–82	12.5	5.3	7.0	14.0	7.8
1982–83	13.2	2.8	17.2	14.4	9.7
1983–84	12.3	10.8	12.3	15.9	18.1
1984–85	10.5	19.2	3.4	9.0	11.8
1985–86	9.8	–2.6	7.9	7.8	10.1
1986–87	11.4	15.7	17.4	9.2	11.6
1987–88	10.8	10.6	36.2	9.9	10.3
1988–89	13.9	19.5	23.0	10.0	10.7
1989–90	10.5	–11.1	6.0	7.9	9.8
1990–91	13.6	25.7	13.7	12.1	12.6
1991–92	12.4	–0.7	15.7	15.0	13.2
1992–93	14.4	22.7	16.6	11.9	12.0
1993–94	11.1	9.8	14.8	8.0	8.2
1994–95	8.1	32.3	10.9	11.0	11.3
1995–96	5.4	–7.1	3.4	10.1	11.7
1996–97	14.1	15.1	9.3	9.2	10.7
1997–98	12.6	–33.5	–2.0	6.3	8.7
1998–99	13.5	4.0	1.0	11.8	15.0
1999–00	6.4	18.7	–16.6	4.8	2.9

(*Table A-3 continued*)

(*Table A-3 continued*)

	Transport (excluding railways)	*Insurance*	*Communication services*	*Legal services*	*Business services*
2000–01	5.3	10.8	–15.1	3.0	5.6
2001–02	4.4	34.3	–0.4	3.8	5.2
2002–03	3.4	–7.3	–28.9	4.1	4.8
2003–04	6.3	8.6	–6.6	3.9	4.7
2004–05	5.3	–10.8	–5.3	3.9	5.0
2005–06	3.7	–3.2	–8.6	4.3	5.3
2006–07	3.2	–2.4	–6.7	7.2	8.3
Means					
1980–89	10.6	9.2	12.9	11.0	11.2
1990–2006	8.4	6.9	–0.3	7.7	8.5

Source: Authors' calculations.

TABLE A-4. Implicit Inflation Rates—Nontradable Subsectors

	Mining and quarrying	*Agriculture and allied sector*	*Wood, furniture, etc.*	*Paper, printing, etc.*	*Transport equipment*	*Electricity, gas, and water supply*	*Construction*	*Trade, hotels, and restaurant*	*Railways, transport, and storage*	*Banking, insurance, real estate, etc.*	*Community, social & personal services*
1980–81	12.5	12.9	21.6	–36.4	14.0	9.9	16.9	17.9	0.4	8.5	13.0
1981–82	64.6	8.1	14.6	8.3	15.0	6.7	8.8	16.5	29.0	10.3	11.5
1982–83	11.5	8.1	4.7	6.1	4.1	11.7	20.4	5.3	23.7	4.9	8.4
1983–84	9.1	9.2	11.7	9.9	–0.5	11.2	9.6	10.4	14.5	4.5	10.1
1984–85	11.3	6.3	4.0	13.7	5.7	10.1	13.9	11.8	3.3	6.1	8.1
1985–86	1.5	6.9	3.9	3.9	13.7	12.9	11.0	8.2	11.2	5.1	7.4
1986–87	4.3	7.7	–0.1	4.7	5.4	3.4	12.7	5.1	9.1	3.1	7.5
1987–88	1.0	12.8	4.0	3.5	5.8	4.5	12.8	7.0	10.7	5.8	8.7
1988–89	14.6	7.9	11.5	6.9	14.7	6.6	9.6	11.4	10.1	5.2	9.9
1989–90	2.8	9.3	0.7	17.9	11.5	9.9	9.0	9.4	12.4	6.8	6.7
1990–91	2.8	12.7	0.9	7.3	11.3	13.5	9.7	11.7	9.9	8.4	10.9
1991–92	6.2	18.8	1.6	18.5	11.6	12.7	10.3	13.3	6.7	12.1	13.6
1992–93	14.4	5.5	94.6	16.0	7.2	19.3	10.6	10.6	16.5	3.3	10.2
1993–94	14.9	12.7	20.2	6.3	2.9	10.4	9.9	10.4	15.0	9.8	7.8
1994–95	3.5	10.4	10.8	6.7	8.8	16.1	9.5	9.3	12.4	7.2	9.6
1995–96	5.6	9.4	8.8	25.3	11.9	9.7	11.6	8.2	4.2	13.1	10.8
1996–97	9.1	10.3	2.9	–0.1	6.0	2.5	12.0	9.8	3.3	3.0	10.7
1997–98	10.8	8.7	24.2	–3.1	3.7	9.9	13.7	5.7	10.8	3.1	7.7
1998–99	3.9	8.5	29.2	3.5	2.5	16.7	12.1	5.9	–0.4	8.3	12.5

(*Table A-4 continued*)

(*Table A·4 continued*)

	Mining and quarrying	*Agriculture and allied sector*	*Wood, furniture, etc.*	*Paper, printing, etc.*	*Transport equipment*	*Electricity, gas, and water supply*	*Construction*	*Trade, hotels, and restaurant*	*Railways, transport, and storage*	*Banking, insurance, real estate, etc.*	*Community, social & personal services*
1999–00	12.5	3.5	–2.2	14.3	3.8	–8.6	6.5	4.2	2.4	11.3	3.7
2000–01	7.5	0.9	–7.4	9.8	5.8	1.3	3.6	5.4	–2.2	4.7	3.2
2001–02	3.0	2.0	–2.8	4.6	2.5	1.4	3.9	1.8	–2.1	6.4	3.8
2002–03	22.2	4.3	2.2	0.7	0.5	10.1	3.9	4.0	4.7	5.2	3.7
2003–04	–1.3	2.8	0.2	–0.5	–0.1	–0.8	4.0	3.8	3.1	7.1	3.4
2004–05	24.6	3.8	0.1	0.8	4.9	–2.2	19.6	9.0	3.0	0.7	3.9
2005–06	6.2	5.6	7.9	2.2	4.1	2.9	7.9	7.3	4.0	–0.4	4.2
2006–07	2.4	9.2	7.8	7.4	1.8	3.6	8.8	8.6	7.9	1.1	6.4
Means											
1980–89	13.3	8.9	7.7	3.9	9.0	8.7	12.5	10.3	12.4	6.0	9.1
1990–2006	8.7	7.6	11.7	7.0	5.3	7.0	9.3	7.6	5.8	6.1	7.4

Source: Authors' calculations.

TABLE A-5. Tradable Manufacturing—Within-sector Output Shares (% Total Output)

	Food products	*Beverages, tobacco, etc.*	*Textile products*	*Leather, fur products*	*Rubber, petroleum, etc.*	*Chemicals, etc.*	*Non-metallic products*	*Basic metal industries*	*Metal products and machinery*	*Electrical machinery*	*Other manu-facturing*	*Total traded manu-facturing*
1980–81	1.47	0.48	2.34	0.30	0.50	1.19	0.53	1.31	1.73	0.38	0.48	10.71
1981–82	1.62	0.50	2.19	0.31	0.54	1.32	0.55	1.33	1.77	0.37	0.61	11.12
1982–83	1.73	0.49	2.15	0.31	0.63	1.33	0.61	1.21	1.87	0.45	0.67	11.45
1983–84	1.82	0.60	2.12	0.31	0.65	1.50	0.62	1.19	1.89	0.45	0.55	11.71
1984–85	1.74	0.54	2.13	0.31	0.74	1.51	0.67	1.19	2.01	0.53	0.63	12.00
1985–86	1.74	0.46	2.18	0.28	0.69	1.52	0.67	1.24	1.92	0.47	0.75	11.93
1986–87	1.70	0.49	2.22	0.28	0.88	1.49	0.66	1.12	1.86	0.50	0.91	12.10
1987–88	1.70	0.44	2.09	0.29	0.95	1.59	0.69	1.14	2.06	0.63	0.98	12.58
1988–89	1.93	0.53	1.91	0.27	0.98	1.63	0.70	1.36	1.93	0.61	0.82	12.68
1989–90	1.96	0.48	2.06	0.26	1.00	1.81	0.75	1.21	1.95	0.69	0.89	13.06
1990–91	1.76	0.48	2.12	0.27	1.07	1.92	0.78	1.38	1.87	0.72	0.80	13.16
1991–92	1.72	0.51	2.04	0.27	1.04	1.95	0.81	1.44	1.78	0.62	0.67	12.86
1992–93	1.61	0.51	2.02	0.33	1.03	2.16	0.69	1.30	1.72	0.63	0.72	12.73
1993–94	1.79	0.49	2.33	0.37	1.07	2.21	0.66	1.31	1.66	0.60	0.78	13.26
1994–95	1.99	0.49	2.31	0.29	1.05	2.15	0.68	1.50	1.71	0.82	0.77	13.76
1995–96	1.90	0.46	2.12	0.29	1.11	2.51	0.79	1.65	1.94	0.77	0.84	14.36
1996–97	1.74	0.53	2.35	0.27	1.28	2.57	0.91	1.65	1.93	0.73	0.83	14.79
1997–98	1.87	0.55	2.38	0.29	1.11	2.40	0.81	1.57	1.74	0.82	0.92	14.44
1998–99	1.74	0.57	2.08	0.30	1.05	2.66	0.73	1.51	1.81	0.84	0.90	14.18
1999–00	1.64	0.61	2.08	0.29	0.95	2.56	0.92	1.51	1.76	0.76	0.85	13.92

(*Table A-5 continued*)

(*Table A-5 continued*)

	Food products	*Beverages, tobacco, etc.*	*Textile products*	*Leather, fur products*	*Rubber, petroleum, etc.*	*Chemicals, etc.*	*Non-metallic products*	*Basic metal industries*	*Metal products and machinery*	*Electrical machinery*	*Other manu-facturing*	*Total traded manu-facturing*
2000–01	1.75	0.57	2.17	0.31	1.03	2.64	0.87	1.47	1.75	0.84	0.88	14.29
2001–02	1.66	0.52	1.97	0.31	1.08	2.62	0.83	1.46	1.49	0.92	0.89	13.74
2002–03	1.80	0.56	2.04	0.29	1.10	2.62	0.84	1.53	1.61	0.79	0.89	14.08
2003–04	1.73	0.53	1.85	0.25	1.06	2.61	0.81	1.54	1.60	0.87	0.87	13.72
2004–05	1.62	0.54	1.94	0.26	1.00	2.79	0.76	1.51	1.65	1.03	0.90	14.00
2005–06	1.51	0.61	1.95	0.22	0.96	2.76	0.77	1.60	1.61	1.06	1.02	14.07
2006–07	1.49	0.62	1.98	0.20	0.99	2.76	0.79	1.79	1.63	1.12	0.99	14.36
Means												
1980–89	1.74	0.50	2.14	0.29	0.76	1.49	0.64	1.23	1.90	0.51	0.73	11.93
1990–2006	1.72	0.54	2.10	0.28	1.06	2.46	0.79	1.51	1.72	0.82	0.85	13.87

Source: Authors' calculations.

TABLE A-6. Tradable Services—Within-sector Output Shares (% Total Output)

	Transport (excluding railways)	*Insurance*	*Communication services*	*Legal services*	*Business services*	*Total traded services*
1980–81	3.59	0.55	0.66	0.13	0.42	5.35
1981–82	3.60	0.59	0.68	0.14	0.43	5.43
1982–83	3.68	0.63	0.69	0.14	0.45	5.59
1983–84	3.66	0.67	0.67	0.15	0.55	5.71
1984–85	3.76	0.59	0.70	0.17	0.58	5.80
1985–86	3.85	0.66	0.68	0.17	0.62	5.98
1986–87	3.90	0.70	0.70	0.17	0.67	6.14
1987–88	4.09	0.62	0.71	0.18	0.63	6.23
1988–89	3.96	0.57	0.68	0.17	0.60	5.98
1989–90	4.00	0.90	0.69	0.17	0.61	6.37
1990–91	3.97	0.62	0.70	0.17	0.68	6.14
1991–92	4.14	0.86	0.75	0.18	0.70	6.62
1992–93	4.16	0.68	0.81	0.18	0.71	6.54
1993–94	4.24	0.74	0.88	0.18	0.74	6.79
1994–95	4.39	0.42	0.96	0.18	0.80	6.75
1995–96	4.49	0.56	1.03	0.19	0.92	7.19
1996–97	4.52	0.49	1.05	0.18	0.99	7.24
1997–98	4.58	0.77	1.21	0.17	1.24	7.98
1998–99	4.55	0.77	1.36	0.17	1.44	8.29
1999–00	4.55	0.64	1.57	0.17	0.95	7.87

(*Table A-6 continued*)

(*Table A-6 continued*)

	Transport (excluding railways)	*Insurance*	*Communication services*	*Legal services*	*Business services*	*Total traded services*
2000–01	4.71	0.61	1.91	0.17	1.38	8.77
2001–02	4.64	0.66	2.18	0.17	1.57	9.21
2002–03	4.93	0.96	2.68	0.17	1.78	10.52
2003–04	5.08	0.88	3.12	0.16	2.09	11.33
2004–05	5.30	0.94	3.61	0.15	2.42	12.43
2005–06	5.24	0.89	4.17	0.14	2.75	13.18
2006–07	5.22	1.09	4.86	0.14	3.05	14.36
Means						
1980–89	3.8	0.6	0.7	0.2	0.6	5.9
1990–2006	4.6	0.7	1.9	0.2	1.4	8.9

Source: Authors' calculations.

TABLE A-7. Nontraded Manufacturing/Agriculture—Within-sector Output Shares (% Total Output)

	Mining and quarrying	*Agriculture and allied sector*	*Wood, furniture, etc.*	*Paper and printing, etc.*	*Transport equipments*	*Total nontraded manufacturing*
1980–81	2.01	37.80	2.21	0.52	0.66	3.39
1981–82	2.16	37.41	2.14	0.52	0.70	3.36
1982–83	2.35	36.23	1.87	0.48	0.76	3.11
1983–84	2.24	36.99	1.87	0.52	0.77	3.17
1984–85	2.18	36.14	1.53	0.58	0.82	2.93
1985–86	2.20	34.80	1.62	0.56	0.71	2.88
1986–87	2.37	33.21	1.48	0.63	0.80	2.91
1987–88	2.37	31.54	1.44	0.61	0.73	2.78
1988–89	2.50	33.12	1.13	0.60	0.71	2.44
1989–90	2.54	31.55	1.10	0.67	0.74	2.51
1990–91	2.66	31.12	1.01	0.68	0.78	2.47
1991–92	2.70	30.01	0.93	0.71	0.76	2.40
1992–93	2.59	30.42	0.87	0.56	0.68	2.11
1993–94	2.48	29.67	0.84	0.62	0.71	2.16
1994–95	2.55	29.22	0.78	0.64	0.79	2.21
1995–96	2.52	27.08	0.89	0.63	1.11	2.64
1996–97	2.34	27.54	0.90	0.61	1.00	2.51
1997–98	2.46	25.70	0.82	0.54	0.93	2.30
1998–99	2.37	25.60	0.75	0.55	0.76	2.06
1999–00	2.30	24.65	0.60	0.53	0.90	2.03
2000–01	2.26	23.63	0.59	0.46	0.85	1.90

(*Table A-7 continued*)

(*Table A-7 continued*)

	Mining and quarrying	*Agriculture and allied sector*	*Wood, furniture, etc.*	*Paper and printing, etc.*	*Transport equipments*	*Total nontraded manufacturing*
2001–02	2.18	23.78	0.50	0.45	0.86	1.81
2002–03	2.28	21.26	0.40	0.46	0.95	1.81
2003–04	2.17	21.54	0.39	0.49	1.02	1.91
2004–05	2.18	20.03	0.33	0.51	0.99	1.83
2005–06	2.09	19.38	0.29	0.46	1.02	1.76
2006–07	2.02	18.33	0.34	0.45	1.07	1.86
Means						
1980–89	2.3	34.9	1.6	0.6	0.7	2.9
1990–2006	2.4	25.2	0.7	0.5	0.9	2.1

Source: Authors' calculations.

TABLE A-8. Nontraded Services—Within-sector Output Shares (% Total Output)

	Electricity, gas and water supply	*Construction*	*Trade, hotels and restaurant*	*Railway transport and storage*	*Banking, real estate, dwellings and business services*	*Community, social and personal services*	*Total nontraded services*
1980–81	1.61	6.57	11.41	1.73	6.36	13.06	39.14
1981–82	1.66	6.56	11.41	1.79	6.48	12.62	38.85
1982–83	1.72	5.93	11.75	1.77	6.90	13.20	39.55
1983–84	1.71	5.79	11.46	1.63	6.90	12.70	38.48
1984–85	1.82	5.76	11.50	1.60	7.21	13.06	39.14
1985–86	1.88	5.84	11.94	1.72	7.56	13.25	40.32
1986–87	1.99	5.73	12.10	1.79	8.00	13.65	41.28
1987–88	2.07	5.85	12.19	1.80	8.46	14.13	42.42
1988–89	2.06	5.69	11.80	1.61	8.51	13.61	41.21
1989–90	2.13	5.73	11.99	1.58	8.74	13.82	41.85
1990–91	2.16	6.07	11.96	1.56	9.03	13.67	42.30
1991–92	2.33	6.10	11.84	1.64	9.71	13.80	43.08
1992–93	2.37	6.00	11.92	1.52	9.90	13.90	43.24
1993–94	2.40	5.69	12.05	1.42	10.38	13.71	43.24
1994–95	2.47	5.64	12.50	1.36	10.35	13.18	43.04
1995–96	2.46	5.58	13.40	1.38	10.20	13.21	43.76
1996–97	2.40	5.26	13.40	1.32	9.99	13.20	43.18
1997–98	2.48	5.56	13.82	1.28	10.29	13.69	44.65
1998–99	2.48	5.54	13.95	1.22	10.22	14.08	45.01
1999–00	2.46	5.63	14.03	1.24	11.14	14.72	46.77

(*Table A-8 continued*)

(*Table A-8 continued*)

	Electricity, gas and water supply	*Construction*	*Trade, hotels and restaurant*	*Railway transport and storage*	*Banking, real estate, dwellings and business services*	*Community, social and personal services*	*Total nontraded services*
2000–01	2.41	5.75	14.18	1.25	10.74	14.81	46.73
2001–02	2.32	5.66	14.73	1.26	10.71	14.61	46.96
2002–03	2.35	5.89	15.17	1.27	10.73	14.64	47.70
2003–04	2.26	6.08	15.39	1.24	10.14	14.22	47.06
2004–05	2.27	6.57	15.41	1.24	9.90	14.13	47.26
2005–06	2.17	6.99	15.41	1.24	9.87	13.84	47.34
2006–07	2.10	7.13	15.23	1.23	9.90	13.48	46.98
Means							
1980–89	1.9	5.9	11.8	1.7	7.5	13.3	40.2
1990–2006	2.3	5.9	13.8	1.3	10.2	13.9	45.2

Source: Authors' calculations.

TABLE A-9. Labor Productivity Growth in Agriculture, Mining, Manufacturing, and Services, 1982–2006

						Services				
	Agriculture	*Mining and quarrying*	*Manufacturing*	*Electricity, gas and water*	*Services*	*Construction*	*Wholesale and retail trade, etc.*	*Transport, storage and communication*	*Finance, insurance, real estate etc.*	*Community, social and personal services*
1982–83	–0.83	5.27	2.52	1.04	–1.15	–9.14	5.70	–1.15	–3.43	0.95
1983–84	10.81	–0.88	11.87	5.11	3.57	5.58	3.43	2.84	5.21	1.70
1984–85	1.71	–2.96	6.70	7.94	3.14	0.91	2.27	5.82	1.84	2.27
1985–86	–2.47	6.50	2.59	4.93	6.36	2.78	8.20	6.01	5.90	8.06
1986–87	–4.68	18.36	6.81	10.00	4.71	2.97	5.00	4.84	8.35	4.48
1987–88	–0.84	1.85	7.48	0.28	4.67	3.98	1.62	5.64	4.47	5.65
1988–89	13.68	14.67	9.12	8.74	5.71	11.35	3.35	5.31	9.43	3.58
1989–90	1.13	6.00	10.16	8.03	7.06	8.19	6.55	5.23	9.70	6.54
1990–91	2.52	7.26	6.10	6.48	4.06	10.05	2.95	4.42	3.65	1.88
1991–92	–4.07	4.15	–5.06	9.12	3.35	1.40	0.02	4.97	9.58	1.59
1992–93	6.29	1.25	4.64	5.59	4.24	3.65	7.23	4.91	2.47	3.50
1993–94	7.77	–0.62	8.19	–1.74	5.58	1.40	3.86	6.15	11.22	2.19
1994–95	4.64	8.90	11.12	9.75	6.32	5.51	8.79	8.99	4.15	2.84
1995–96	–2.63	7.76	9.41	5.37	9.55	6.66	12.28	11.40	7.48	7.20
1996–97	10.67	3.29	7.85	4.38	5.33	4.08	7.22	8.12	4.90	4.30
1997–98	–1.68	14.32	2.27	8.09	9.70	10.80	6.75	8.42	10.80	11.47
1998–99	9.88	4.34	4.27	6.25	7.52	6.66	7.34	7.95	5.92	9.60
1999–00	–1.95	4.15	6.04	6.94	10.02	10.73	5.70	11.27	10.46	12.24
2000–01	–1.29	7.86	10.32	4.33	5.39	7.69	2.14	13.28	3.65	4.57
2001–02	13.98	5.23	7.40	6.02	7.79	9.39	11.30	10.39	6.47	5.86
2002–03	–11.17	10.92	10.31	3.18	8.07	17.02	–1.98	15.10	–2.28	4.92

(*Table A-8 continued*)

(*Table A·9 continued*)

						Services				
	Agriculture	*Mining and quarrying*	*Manufacturing*	*Electricity, gas and water*	*Services*	*Construction*	*Wholesale and retail trade, etc.*	*Transport, storage and communication*	*Finance, insurance, real estate etc.*	*Community, social and personal services*
2003–04	8.90	–11.65	13.02	8.65	11.32	8.33	11.23	21.73	3.31	8.85
2004–05	–3.64	5.49	10.33	6.63	8.41	7.41	3.16	17.57	3.80	5.76
Means										
1982–90	2.34	6.23	7.04	5.84	4.24	4.07	4.34	4.33	5.01	3.90
1992–2004	3.06	4.71	8.09	5.65	7.63	7.64	6.54	11.17	5.57	6.41

Source: Authors' calculations.

Appendix 3: Data Sources

Variable name	*Definition/Construction of variable*	*Source*
P_{mt}/P_t	Sectoral gross value added deflator, classified as described in the text	CSO, National Accounts Statistics
g_t	Government Final Consumption Expenditure/GDP at Constant prices	CSO, National Accounts Statistics
y_t	Per capita Income	World Development Indicators (WDI)
$a_t - a_{mt}$	Relative Labor Productivity growth in Manufacturing and services (plus agricultural sector)	CSO, National Accounts Statistics & CEIC data base
m_t	Average Applied Tariff Rate	World Bank

Comments and Discussion

Robert Lawrence: This paper seeks to account for the trend appreciation of India's internal real exchange rate—the ratio of the prices of nontraded to traded goods. This variable is of particular interest in price-taking economies because it affects both macroeconomic and microeconomic adjustments. It has implications for inflation: If India is to accommodate a trend real appreciation, it must allow its nominal exchange rate to appreciate over time to maintain price stability. Alternatively, if it had a fixed exchange rate, it would have to live with a higher trend inflation rate. It also has implications for maintaining external balance: real appreciation in excess of productivity differentials, for example, can present problems for the profitability of traded goods production.

The source of India's real exchange rate appreciation is puzzling. Samuelson and Balassa pointed out long ago that real appreciation is generally to be expected when a country develops rapidly and productivity growth in tradables exceeds that of nontradables. But the authors find, surprisingly, that since 1991 such productivity differentials are not the explanation for real appreciation in India's case. Indeed, by some of their measures, productivity growth was actually similar in both the traded and nontraded sectors, and by other measures the difference actually narrowed during the period of real appreciation. Instead, they argue that the most important drivers of the real appreciation were increases in both private and public demand for services. Another anomalous finding from this perspective is that the period of real appreciation was associated with a relative increase in the output share in tradables. The authors argue that supply side shifts and other reforms that increased the tradability of services were responsible for this. Finally, the authors argue that their findings point to the need for nominal exchange rate, flexibility, and increased discipline over government expenditure.

I must confess to not being entirely persuaded by the paper. I had particular problems with the way the real exchange rate (RER) was measured. I am still not sure that the conclusion that the Indian real exchange rate has had a strong upward trend since the early 1990s is warranted. Indeed, one could make the case that there has actually been little or no change in the internal real exchange rate since the early 1990s—a result that would then square

with the finding that differentials in productivity growth between tradables and nontradables have not been large.

To measure the real exchange rate it is necessary to define precisely which prices will be used to represent tradable and nontradable goods and services. The authors, unwisely in my view, follow others in the literature and define tradability on the basis of a threshold share of exports in output. This approach confuses tradability and exportability and neglects imports and importables. By this definition, in India's case, the agricultural sector is classified as part of the nontraded sector. This is a serious deficiency in light of why we care about the internal real exchange rate in the first place. It implicitly neglects the roles that prices of import-competing goods could play in inflation and that import substitution plays in adjustments to maintain external balance.

In fact, using the prices of the goods and services that actually enter into international trade gives a very different picture of the real exchange rate's behavior. I constructed an alternative measure of the internal real exchange rate using the ratio of the Indian GDP deflator to the sum of Indian export and import price deflators for goods and services. I found that this variable does not have an upward trend after 1991. Indeed, it looks much more like the (external) real exchange rate measure based on Indian and foreign prices reported in figure 3, which shows very little change after 1991.

The paper suggests that while the real exchange rate has risen within India, the conventional real exchange rate, as captured by Indian and foreign inflation rates measured in a common currency, has remained constant. It is certainly possible that with changes in tariffs and productivity growth, the two measures of the real exchange rate can give different results, but if they are correct, it implies that the changes in the relative price of tradables to nontradables in India has been the same as the changes in the relative price of tradables to nontradables in the rest of the world. This is certainly possible, but it seems like a remarkable coincidence.

The authors conclude that productivity growth differentials between traded and nontraded goods cannot explain the real exchange rate appreciation. But they have problems in precisely matching the sectors included in their measures of prices with those in their measures of productivity. This is another serious measurement weakness.

At the end of the day, though, there is another puzzle—the rising share of tradables in output. In the face of a real appreciation in excess of productivity growth, we might have expected resources to be drawn away from the tradables sector since production in tradables should have become relatively less profitable. Indeed, trade liberalization might have added to

the pressures on profits. And yet, the share of tradables in Indian output appears to have expanded dramatically. This is not what we might expect, particularly if the authors are right that demand—and thus the relative price of nontradables—has been rising rapidly because of strong income elasticity of demand and public expenditures. On this issue, I agree with the authors that supply-side improvements, some which are not captured in product prices (such as improvements in telecommunications), are likely to be an important part of the story. An innovation such as the internet which dramatically reduced the transactions costs for exports—of call centers and business process outsourcing firms—could make it possible to export more without actually reducing export prices. Similarly, access to imported inputs and equipments at reduced prices could stimulate exports even though measures of the internal real exchange rate might show an appreciation. These improvements in tradables' profitability would not be easily captured in traditional sectoral productivity measures, but they could imply a larger tradables sector associated with any given real exchange rate. As such, the paper performs a useful service in reminding us of the need to integrate both demand and supply considerations when accounting for real exchange rate changes.

Sisira Jayasuriya: This paper analyzes the behavior of the real exchange rate in India and its determinants using the tradables/nontradables framework, following renewed interest in applying this so-called "Australian model" or the "Swan-Salter model" to analyze exchange rate policy issues in India. Kohli and Mohapatra have clearly done some very detailed and careful work to develop measures of relative sectoral price movements and to assess if there has been any real exchange rate appreciation in recent years in India by looking at the relative price of nontradables to tradables. They have also attempted to assess if any observed appreciation can be attributed to policy measures, rather than to price changes reflecting differential sectoral productivity changes associated with opening up of the Indian economy [Balassa–Samuelson (B–S) effects]. They argue that B–S effects cannot explain the real appreciation in the post-1990 period as the productivity differential between the tradables (T) and nontradables (NT) sectors virtually disappeared, rather than widened, during this time. The real appreciation during the post-reform period, according to the authors, was largely due to services biased demand from income growth in the 1990s, falling import prices, and an expansion in tradable output; as these represent an equilibrium phenomenon reflecting a natural evolution of the economy, they must be

absorbed by a nominal appreciation. In this context a more flexible exchange rate policy is welcome.

I agree with the main policy conclusion that a more flexible exchange rate policy is a good thing. But I am not entirely persuaded of the strength of the empirical analysis itself for several reasons. However, before getting to specific issues, I want to congratulate the authors for the effort that has gone into constructing the detailed data base to generate sectoral price indices. This is not a trivial task.

First, consider the problem of classification. While conceptually simple, the tradables/nontradables classification is not easy to implement in practice. It used to be the case that a simple classification of "goods" as tradables and "services" as nontradables provided a reasonable first cut approximation. But this is no longer the case today. Many services are traded or (in principle) tradable. And, opening up of an economy through trade policy reforms brings several sectors that were previously nontradable into the tradable category. The problems are magnified when the classification has to be assumed valid for a fairly long period as required to conduct an econometric analysis of medium-term developments based on time series data in a country that is undergoing major structural changes. In the case of India, as documented in the paper, industries that used to be nontradable have increasingly become tradable. For example, in the services sector new tradable services have emerged and expanded while others have become increasingly tradable. Sectors such as agriculture—previously largely nontraded because of administrative measures—have also tended to become more tradable (though actual trade volumes have not been large). Hence it is important to explore how robust results are to changing definitions of tradability; the authors have recognized this issue by, for example, testing the robustness of results to the inclusion of agriculture in the tradables category. However, the extent to which a particular classification was valid for the entire duration of the study—a period that has seen major reforms and hence changes in tradability— remains an issue.

Second, the underlying assumption of the standard tradables/nontradables model that commodities are produced only using domestically sourced primary factors has never been strictly correct but is much less so in today's world. Indeed tradables and nontradables not only require imported intermediate inputs but are also increasingly important as inputs into each other. Policy changes affecting imported intermediates affect both sectors while productivity changes can be interdependent with changes in one sector impacting on the other. How important are these in India? It seems very likely that import liberalization that has reduced prices and increased availability of better equipment has had a strong positive effect on some

of the major nontradables, including some of the nontraded services. Improved communications would undoubtedly have enhanced tradable sector productivity. To what extent are these possible explanatory factors for the finding that productivity differentials between tradables and nontradables have not followed the hypothesized B–S path?

From an empirical point of view, it is also pertinent to point to the fact that the analysis of productivity differentials uses "labor productivity" as the measure rather than total factor productivity (TFP). Measurement of sectoral productivity is not an easy task and it is easy to be critical of empirical estimates. However, it is at least important to recognize that the implications of using labor productivity as a substitute for TFP are non-trivial and may strongly bias the results. In a recent review, Lee and Tang (2007: p. 183) point out:

> Whether productivity growth leads to appreciation or depreciation of the real exchange rate depends on the measure of productivity used. When labor productivity is used to measure productivity, the classical positive association between productivity and the real exchange rate shows up in the data…. When total factor productivity (TFP) is used to measure productivity, the classical positive association between productivity and the real exchange rate dissipates. Higher productivity in the tradable sector, if any, tends to lead to depreciation of the real exchange rate…

In this context, it is not advisable to place much reliance on (admittedly noisy) estimates of labor productivity to draw strong conclusions.

Third, markets in India continue to be imperfectly competitive in many cases and the law of one price is widely violated. Intersectoral factor mobility is limited and costly. These too have non-trivial implications for model implications. [See, for example, Lee and Tang (2007) and MacDonald and Ricci (2007).]

The analytical rigor of the paper would be much improved and the discussions of the paper will be richer if these issues—so clearly important in the Indian context—are recognized, acknowledged, and brought into the interpretation of results and policy conclusions drawn from them. These would, in my view, seriously limit the usefulness of this framework for analyzing real exchange rate issues over the fairly long period covered in the study.

I am also concerned that the analysis, even using a somewhat hybrid specification, finds no explicit role for capital flows as a factor influencing real exchange rate appreciation. Clearly the issue of capital inflows is an important one in the Indian context, certainly during the later years of the study period; it is widely considered to be an important driver of nominal

exchange rate changes. It does seem rather strange for a paper on Indian real exchange rate issues not to pay greater attention to the role of capital flows. (In any case, the statement that portfolio capital inflows reinforce "the tendency for real appreciation induced by relative price changes" should be rephrased; in fact, capital inflows induce relative price changes between tradables and nontradables.)

While I broadly agree with the major policy conclusions of the paper, I am not quite sure that several of them are strictly implied by the results. In this situation, why should fiscal deficits be a concern? Of course fiscal deficits and government expenditure are related but one should not advocate lower fiscal deficits simply because cuts in government expenditure produce real depreciations. Note that there is no evidence provided in the paper that the real exchange rate has been or is overvalued. Is there something intrinsically bad about intersectoral relative price or productivity differentials? While greater investment in education and infrastructure are certainly welcome, surely that is not because such investment will reduce the productivity gap between tradables and nontradables (it may or may not!). If real appreciation occurs due to factors such as import liberalization, why should fiscal or other policies aim to achieve "inflation convergence" between sectors?

General Discussion

T. N. Srinivasan opened the general discussion by making three points. First, he agreed with Lawrence that it is important to take into account imports as well as exports in drawing a line between tradable and nontradable products. The second point was in regard to the data. The way the services sector is measured in the Indian national accounts varies according to the type of services. In some service-producing industries for example, they project the employment, multiply it by a base-year estimate of value added, and then inflate it to obtain a nominal value. So some service industries inflate the output numbers rather than deflating them. Therefore, the prices that are used are value-added prices, not the gross output prices that are desired to measure the supply–demand response. Lastly, he expressed a word of caution on the use of the term inflation to refer to an increase in relative prices. He argued that if the relative prices of nontradables increases it is not inflation though it could become inflation if other things happen.

John Williamson also expressed concern over what seemed like some semantic confusion in parts of the discussion. He pointed out that the term "bilateral real effective exchange rate" is a contradiction. If an exchange rate

is bilateral, it is not effective, and if it is effective, then it is not bilateral. He went on to highlight a more general point: there are basically two concepts of the real exchange rate. One is an external measure based on export prices relative to import prices, and the other is an internal concept of the price of exportables relative to import-competing goods. Both are relative price concepts, but they are distinct and do not always move together. In countries that export primary products, the relative price of nontradables to tradables can be thought of as a measure of the real exchange rate. However in a country like India, where this is not the case, it is quite misleading to think of the relative price as a measure of the real exchange rate. He found the paper useful in showing the importance of demand factors in driving up the relative price of nontradables in India, but did not believe that it had anything to do with the real exchange rate.

Anne Krueger agreed with the distinction between the two different concepts of the real exchange rate, but she also did not think the two would necessarily move together over a period in which India has substantially altered its trade regime and eliminated many quantitative restrictions.

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