Automatic Fuel Pricing Mechanisms with Price Smoothing: Design, Implementation, and Fiscal Implications

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Abstract: Many developing and emerging countries do not fully pass-through increases in international fuel prices to domestic retail prices, with adverse consequences for fuel tax revenues and tax volatility. The adoption of an automatic fuel pricing mechanism can help to address this problem, and the incorporation of a price smoothing mechanism can ensure pass-through over the medium term but also avoid sharp increases (and decreases) in domestic prices. This technical note addresses the following issues: (i) the design of an automatic fuel pricing mechanism; (ii) the incorporation of domestic price smoothing and resulting tradeoffs; (iii) the transition from ad hoc pricing adjustments to an automatic mechanism; and (iv) policies to support this transition and the maintenance of an automatic mechanism. A standardized template for simulating and evaluating the implications of alternative pricing mechanisms for price and fiscal volatility is available on request.

I. Background

Recent volatility in international fuel prices has highlighted the fiscal risk inherent in the current approach to fuel pricing in many developing and emerging countries.[1] In these countries, domestic fuel prices are administratively determined and increases in international fuel prices are often not fully passed-through to domestic consumers. This has translated into increased volatility in fuel tax levels and revenues, and substantial fiscal costs over long periods, especially when there is more complete pass-through of international price decreases. For example, median pass-through of changes in international diesel and gasoline prices fluctuated widely between end-2003 and end-2011 with corresponding volatility in average fuel taxes and thus fuel tax revenues (Table 1). The resulting revenue volatility, and in particular large fiscal costs during periods of sustained increases in international prices (Coady and others, 2010; Coady, Flamini, and Antonio, 2012), present difficult challenges for short-term

[1] Fuel products include gasoline, diesel, kerosene, fuel oil, and liquefied petroleum gas (or LPG). Many of the issues discussed in this note will, however, also apply to the controlled pricing of other energy prices (such as electricity and natural gas), which is also common in many countries.

TABLE 1. VARIATION IN FUEL PRICE PASS-THROUGH AND FUEL TAX CHANGES			
(End-2003 to End-2011)			
	Median Pass-through (In percent)		
	End 2003 – Mid 2008	Mid 2008 – End 2008	End 2008 – End 2011
Emerging			
Gas	62.4	30.4	96.1
Diesel	78.4	17.8	95.2
Developing			
Gas	74.7	21.6	65.8
Diesel	84.3	28.2	73.7
	Average Fuel Tax (US$ per liter)		
	Mid-2008	End-2008	End-2011
Emerging (0.18)	0.07	0.37	0.29
Developing (0.13)	–0.02	0.43	0.26

Source: IMF staff estimates.

Note: Pass-through is defined as the ratio of the absolute change in retail prices divided by absolute change in world prices, both in local currency units. Number in parantheses in lower panel are end-2003 average tax levels.

and medium-term fiscal management and can disrupt the execution of high priority public expenditure programs.

Motivated by a desire to protect fuel tax revenues, some countries have adopted automatic fuel pricing mechanisms.[2] The adoption of such a mechanism is intended to ensure full pass-through of changes, both increases and decreases, in international fuel prices to domestic fuel prices. At the core of the mechanism is an explicit fuel pricing formula, which determines domestic prices as the sum of the import price of fuel products, domestic wholesale and retail distribution margins, and fuel taxes. Domestic fuel prices are then changed at pre-specified regular intervals (e.g., weekly, bi-weekly, or monthly) to fully reflect changes in international prices. In addition to protecting fuel tax revenues, this approach also protects the margins of distributors, thus avoiding the disruption of fuel markets that often results from distributors incurring subsidy arrears due to lack of full pass-through of international fuel price changes. The adoption of an automatic mechanism should also be viewed as the first stage of a transition to a fully liberalized pricing and supply regime, which has typically been a more effective approach to avoiding subsidies and protecting the budget (Baig and others, 2007).

The adoption of an automatic pricing mechanism with full pass-through of international price changes to domestic prices means that volatility in international prices is directly reflect-

[2] For a discussion of the economic, political, and social barriers to passing-through international fuel price increases to domestic consumers, and to the adoption of automatic pricing mechanisms, see Gupta and others (2000) and Coady and others (2010).

ed in domestic fuel price volatility. However, for political and social reasons, governments are often reluctant to pass-through large increases in international price changes instantaneously to domestic consumers. This is often reinforced by a belief that such large price increases may turn out to be transitory. Therefore, some countries have adopted pricing mechanisms that incorporate price smoothing mechanisms that delay the full pass-through of large price increases to domestic fuel prices, as well as delaying large price decreases.

II. Automatic Fuel Pricing Mechanisms

A. Objectives and Policy Options

The adoption of an automatic price adjustment mechanism is intended to achieve a number of objectives:

- *Ensure full pass-through of changes in international fuel prices to domestic retail prices so as to protect fuel tax revenues and avoid price subsidies.* Fuel taxes are often an efficient and equitable source of tax revenues that merit protection to avoid the need for higher distortionary taxes elsewhere in the economy. Alternatively, the fiscal cost of incomplete pass-through may crowd-out higher priority public spending with adverse impacts on growth and poverty reduction. Subsidized prices result in inefficient levels of energy intensity and magnify the adverse impact of price increases on the terms-of-trade and international reserves. They can also lead to cross-border smuggling and domestic supply shortages.
- *Contain the volatility of fuel tax revenues*. Excessive volatility of tax revenues creates cash management and financing problems, especially when financial markets are underdeveloped. However, lowering fiscal volatility comes at the cost of increasing retail price volatility.
- *Avoid reliance on an ad hoc approach to fuel pricing where governments change domestic prices at irregular intervals.* An ad-hoc approach to pricing can create political pressures that often result in long periods of fixed prices, unsustainable fiscal costs, and tensions between the government and fuel suppliers when government subsidy arrears to the sector accumulate.

Implementing an automatic pricing mechanism requires agreement on the appropriate level of taxes and distribution margins, as well as on how import price fluctuations are passed-through to retail prices. This involves a number of steps:

- *The specification of a fuel product price structure (i.e., pricing formula).* This structure establishes a clear link between retail prices and import prices based on import costs,[3]

[3] This note is written from the perspective of a fuel product importer. However, the issue applies equally to fuel product exporters but using the export price instead of the import price. Note also that many crude oil producers are importers of fuel products.

Box 1. The Level and Structure of Fuel Taxes

The level and structure of fuel taxes should reflect the revenue requirement of the government, as well as efficiency and equity objectives.

Revenue requirements. The higher the revenue requirements from indirect taxes, the higher should be the tax rate on all goods and services, including fuels.

Efficiency objectives. Since fuel taxation is seen as a relatively efficient source of revenue, due to fuel demand being relatively insensitive to price, the optimum fuel tax is typically thought to be above the average tax on other goods and services. This is reinforced by the negative externalities associated with fuel consumption, such as environmental pollution and traffic congestion. The structure of fuel taxes should also minimize the distortion in the pattern of consumption across fuel products; since different fuel products are thought to be very close substitutes, especially over the long run, an efficient structure of fuel taxes should involve little differentiation in tax rates across fuels. The argument for uniformity of fuel taxes is often thought to be relatively strong for diesel and kerosene since these are seen as being especially close substitutes even in the short term—it is common to mix these as transport fuel when kerosene prices are relatively low.

Income distribution. Concerns for income distribution mean that taxes on fuels for which the poorest households have a higher share in total consumption should be relatively low. This maximizes the share of the total budget subsidy accruing to these households and thus minimizes the fiscal cost of redistribution. Typically, kerosene (and , in some countries, LPG) is seen as being relatively more important for poor households and gasoline for non-poor households.

There is an inherent trade-off between efficiency and income distribution objectives when setting fuel taxes. Income distribution objectives suggest that it is desirable to have some differentiation across fuel products, with taxes being lowest on kerosene and highest on gasoline. Efficiency objectives, on the other hand, suggest that taxes should be similar across fuel products since they are close substitutes in consumption. Therefore, any distributional gains achieved through differential fuel taxes come at an efficiency cost in terms of a distorted fuel consumption pattern. It is therefore important to explore the possibility of using more efficient direct policy instruments to protect low-income households.

distribution margins, and tax levels. Import prices reflect both international fuel prices and the exchange rate. Import and distribution costs, including wholesaler and retailer margins, should be based on efficient operations by suppliers. The level and structure of taxes should reflect revenue, efficiency, and distributional objectives (Box 1).

- *The specification of a timeline for updating the components of the price structure.* The different components of the price structure should be updated according to an explicit and agreed timeline. For example, the import cost could be updated on a monthly basis. Distribution costs could be updated semi-annually based on a simple rule linked to validated

changes in costs such as wages, transport costs, and financing costs. More rigorous updates could be undertaken on a 3–5 year cycle based on a detailed market study. Once the government sets a desired tax level for fuel products, the implementation of the formula determines any tax changes. Deviations from these should be interpreted as a deviation from the mechanism.

- *The specification of a rule determining when retail prices are changed and by how much.* For example, retail prices could be changed monthly to ensure full pass-through of any changes in import or distribution costs so as to keep tax levels constant, or to reflect changes in tax policy by the government. A basic principle underlying the adjustment mechanism is that differences between changes in import prices and retail prices should be reflected in changes in tax levels and should not affect other components of the price structure. Fluctuations of import prices that are not passed-through to retail prices need to be fully reflected in specific taxes or explicit subsidies in the price structure to prevent development of arrears.

Although full pass-through of international price movements to retail prices is desirable over the medium term, some smoothing of the adjustment may be desirable in the short term. Full pass-through over the medium term is necessary to achieve fiscal objectives and encourage efficient fuel consumption patterns. However, governments may wish to avoid sharp increases in domestic prices, especially if these are deemed to be temporary. This can be achieved through a range of approaches to price smoothing as discussed below. Under all these smoothing rules, suppliers always receive prices reflecting the actual import and distribution costs agreed in the formula, and so are indifferent to the choice of rule. Smoothing will also avoid a "wait-and-see" approach to passing-through increasing international prices, which typically leads to long periods of fixed retail prices and escalating fiscal costs.[4] However, reducing the volatility of retail prices is achieved at the expense of increasing fiscal volatility. Box 2 summarizes the economic arguments that can support such smoothing.

A range of smoothing mechanisms is available, including price band mechanisms and moving average mechanisms.

- Price band mechanisms (PB): This approach to smoothing sets a maximum limit on the magnitude of retail price changes. Caps can be set as a proportion of the current retail price or in absolute amounts, but absolute caps can become less effective as international prices increase. Under price caps, at the start of each period (e.g., each month) the retail price according to the full pass-through mechanism is determined based on

[4] Empirical evidence suggests that oil prices follow a random walk characterized by permanent shocks (Hausmann and others, 1993; Cashin and others, 1999; Mazaheri, 1999; Engel and Valdes, 2000; Hamilton, 2008). According to Hamilton (2008), "In terms of statistical regularities, changes in the real price of oil have historically tended to be: (1) permanent; (2) difficult to predict; and (3) governed by very different regimes at different points in time." This suggests that governments and consumers should treat shocks as permanent and adjust accordingly.

Box 2. The Economics of Fuel Price Smoothing[1]

The price smoothing discussed in this note is intended to reduce short-term price volatility. The net efficiency gains from fuel price smoothing will depend on the risk aversion of consumers to income fluctuations and substitution possibilities available to consumers:

Risk aversion. If the marginal utility of income decreases with income, risk-averse consumers will prefer stable to unstable prices—reducing prices when they are high and increasing them when they are low transfers income from periods of low marginal utility to periods of high marginal utility.

Substitution possibilities. Since price smoothing suppresses the incentives for consumers to substitute away from fuel when prices are high and towards fuel when they are low, this results in an efficiency cost, which can be high if close substitutes exist.

There is a general presumption that price smoothing results in a net efficiency loss. Focusing on the first two effects above, it has been shown (Turnovsky and others, 1980) that the sign of the net gain of price smoothing is the same as the sign of the expression $s(r - 2\mu)+\rho$ where s is the budget share of the commodity, r is the coefficient of relative risk aversion, μ is the income elasticity of demand, and ρ is the compensated price elasticity of demand. To illustrate, take the following parameters for fuel: $\rho s = 0.1$, $r = 1$, $\rho = -0.2$, and $\mu = 0.5$. These parameters result in a value for this expression equal to –0.2, i.e., an aggregate efficiency loss from fuel price smoothing.

This efficiency loss increases further with the marginal cost of public funds. Decreasing the volatility of consumer prices is typically achieved by increasing fiscal volatility. The cost of this volatility will depend on the marginal cost of public funds, which in turn depends on how inter-temporal fiscal balance is achieved (debt adjustments, tax changes, or expenditures changes). For example, if balance is achieved through expensive debt, inefficient tax increases, or inefficient expenditure reductions, then the net welfare gains from price smoothing are lower. Since consumers themselves are capable of smoothing income (e.g., through adjusting net savings), the efficiency loss is higher when they can do so more efficiently than the government.

However, equity considerations can motivate price smoothing, especially in the short-term where governments lack access to efficient social protection instruments. If poor consumers have relatively high fuel budget shares (including fuel indirectly consumed through the consumption of energy-intensive goods and services) and low fuel price and income elasticities, and are constrained in terms of access to income smoothing instruments, then this can provide a role for government in smoothing prices. But since the benefits of such universal price smoothing accrue disproportionately to higher income groups, there is a high return to developing more efficient transfer instruments.

[1]On the economics of price smoothing see Waugh (1944), Massell (1969), Turnovsky and others (1980); Newbery and Stiglitz (1981); Gilbert (1993); and Federico and others (2001).

last month's average import cost. If the required retail price increase is above the maximum allowed increase (i.e., the cap), then the maximum allowed increase is implemented. If the implied price increase is below this threshold, then the full adjustment is

allowed. For example, under a 3 percent price band, if the international price increases by 10 percent, the domestic retail price would increase by only 3 percent. In the subsequent period, if there is no further change in the international price, the domestic retail price would still increase by another 3 percent. This mechanism thus allows the domestic retail price to gradually catch up to international price levels. It would operate in both directions, and limiting the size of the price decline is important for medium term fiscal sustainability.

- *Moving average mechanisms (MA)*: This approach bases retail price adjustments on changes in the average of past import costs. For example, at the start of the month the retail price under the formula is calculated using an average of past import costs (say, the average of import costs for the last three months). Retail prices are then allowed to fully adjust to the smoothed formula import price. Using longer averaging periods will tend to reduce the magnitude of price changes.

While price bands smooth retail price adjustments by directly restricting the magnitude of monthly retail price changes, moving averages do so by smoothing changes in the import cost used in the formula. Although caps allow quick adjustment to current international price changes and are simple to explain and implement, they may result in continuously declining tax levels if international prices exhibit sustained and relatively large increases. In this case, additional "tax adjustment rules" may be warranted (see below). Moving average formulas can adjust more effectively to such sustained rapid international price increases. Nevertheless, their reliance on historical international prices means a longer period of time is needed to adjust to sharp changes in the direction of international price movements, especially when averages are based on prices over many past months.

B. Choice of Pricing Smoothing Mechanism

The appropriate choice of smoothing mechanism depends on the how the government views the trade-off between price and fiscal volatility. The analysis below presents the implications of alternative automatic pricing mechanisms for retail fuel prices and taxes.[5] Six smoothing mechanisms are considered: (i) 2-month, 4-month, and 6-month moving averages; and (ii) 3 percent, 5 percent, and 10 percent price bands. These mechanisms are compared to a hypothetical historical series of retail prices—based on series typically observed in a number of low-income countries—and to a full pass-through without smoothing. The simulations assume constant absolute margins and an initial desired tax level, both consistent with levels observed in many countries around the mid-2000s.

Smoothing mechanisms can substantially reduce the volatility of domestic price changes compared to immediate full pass-through, and also prevent the large price increases commonly experienced under ad hoc price adjustments. Compared to the full pass-through scenario, smoothing mechanisms reduce the volatility of retail prices, as shown both by the standard

[5] See Federico and others (2001) for an analysis of similar smoothing regimes.

TABLE 2. PRICE VOLATILITY UNDER DIFFERENT PRICING REGIMES								
	FPT	**HIST**	**MA2**	**MA4**	**MA6**	**PB3**	**PB5**	**PB10**
Std. deviation of prices	3.09	2.46	2.97	2.74	2.49	2.03	2.50	3.01
Rank	*8*	*2*	*6*	*5*	*3*	*1*	*4*	*7*
Avg. monthly price change (sq)	1.31	0.14	0.98	0.72	0.58	0.68	1.00	1.25
Rank	*8*	*1*	*5*	*4*	*2*	*3*	*6*	*7*
Largest single monthly price increase	3.22	3.72	2.58	2.15	1.24	0.98	1.76	3.14
Rank	*7*	*8*	*5*	*4*	*2*	*1*	*3*	*6*
Avg. of 2 largest monthly price inceases	3.18	2.95	2.42	1.88	1.10	0.97	1.72	2.97
Rank	*8*	*6*	*5*	*4*	*2*	*1*	*3*	*7*
Avg. of 3 largest monthly price increases	3.05	2.26	2.35	1.76	1.02	0.95	1.68	2.87
Rank	*8*	*5*	*6*	*4*	*2*	*1*	*3*	*7*
Sum of price volatility rankings	***39***	***22***	***27***	***21***	***11***	***7***	***19***	***34***
Rank order	***8***	***5***	***6***	***4***	***2***	***1***	***3***	***7***

Source: IMF staff estimates.

Note: Rank of (1) represents highest ranking in terms of minimizing the size of price increases and the volatility of prices. The price series are: FTP—full pass-through; HIST—historical/actual retail price series; MA—moving average; PB—percentage price band.

deviation of retail prices and the average of squared price changes, which puts greater weight on large price changes (Figure 1; Table 2). In particular, smoothing avoids full pass-through of temporary sharp increases in international prices: full pass-through in mid-2008 would have resulted in a substantially higher price level than under smoothing mechanisms. In addition, the smoothing mechanisms also avoid the long periods of fixed domestic prices that occurred in practice when import costs were rising between 2006 and mid-2008. As a result, it also avoids the large single price hikes that were required after these long periods of fixed prices. Averaging the ranks across pricing regimes, four of the six price smoothing regimes dominate the actual price series.

Smoothing mechanisms also ensure higher and less volatile tax levels compared to the actual approach to pricing.[6] Although, by design, the reduced volatility of retail prices under a smoothing mechanism results in increased volatility in taxes relative to the full pass-through scenario (for which tax levels are fixed at the target benchmark level), the volatility is always lower than in the actual historical case (Figure 2; Table 3). The standard deviations of tax levels are lowest for the smoothing mechanisms. The smoothing mechanisms also perform better in terms

[6] Governments can manage this tax volatility in a number of ways. The volatility can be directly reflected in budget balances. Alternatively, a "price stabilization fund" could be established with transfers to the budget when actual taxes fall below target tax levels and from the budget when actual taxes are below target levels so as to protect the budget from price smoothing policies. Federico and others (2001) provide more discussion of price stabilization funds as well as the possible use of various hedging instruments. However, experience with price stabilization funds in developing and emerging economies has been unsatisfactory with funds regularly being exhausted or redirected towards other public expenditure needs.

TABLE 3. TAX VOLATILITY UNDER DIFFERENT PRICING REGIMES								
	FPT	**HIST**	**MA2**	**MA4**	**MA6**	**PB3**	**PB5**	**PB10**
Std. deviation of taxes	0.00	3.54	0.85	1.77	2.38	2.37	1.45	0.39
Rank	*1*	*8*	*3*	*5*	*7*	*6*	*4*	*2*
Avg. monthly tax change (sq)	0.00	2.69	1.14	2.11	2.65	1.92	1.04	0.17
Rank	*1*	*8*	*4*	*6*	*7*	*5*	*3*	*2*
Largest single monthly tax decrease	0.00	3.21	2.33	3.84	3.62	2.79	2.93	1.87
Rank	*1*	*6*	*3*	*8*	*7*	*4*	*5*	*2*
Avg. of 2 largest monthly tax decreases	0.00	3.01	2.24	3.32	3.41	2.60	2.41	1.21
Rank	*1*	*6*	*3*	*7*	*8*	*5*	*4*	*2*
Avg. of 3 largest monthly tax decreases	0.00	2.82	2.15	3.11	3.24	2.54	2.21	0.93
Rank	*1*	*6*	*3*	*7*	*8*	*5*	*4*	*2*
Sum of tax volatility rankings	***5***	***34***	***16***	***33***	***37***	***25***	***20***	***10***
Rank order	***1***	***7***	***3***	***6***	***8***	***5***	***4***	***2***

Source: IMF staff estimates.

Note: Rank of (1) represents highest ranking in terms of minimizing the size of tax decreases and the volatility of taxes. The price series are: FTP—full pass-through; HIST—historical/actual retail price series; MA—moving average; PB—percentage price band.

of avoiding large tax variations, which may be more difficult to manage under financing constraints. This is shown by the average of squared tax changes, which puts a greater weight on larger changes, being lower under smoothing mechanisms, especially the 5 and 10 percent price bands. Smoothing can also avoid the largest tax decreases that have occurred in practice.

The choice of a smoothing mechanism involves a trade-off between retail price and tax volatility. By design, greater smoothing of domestic prices results in greater tax volatility, as reflected in the standard deviation of prices and taxes being negatively related. Therefore, the choice among smoothing mechanisms will depend sensitively on the precise weights given to each of these objectives. From a political economy perspective, however, pricing mechanisms that avoid large retail price increases, especially when they turn out to be temporary, are desirable. From a fiscal management perspective, mechanisms that avoid large decreases in tax levels may also be desirable. Taking into consideration all these objectives, price bands perform best in our simulations in terms of the simple sum of rankings across price and tax volatility indicators (Table 4). Price bands also arguably have the added advantage of being easier to implement and explain publicly.

In the context of price smoothing mechanisms, additional tax adjustment rules may be desirable in the event of prolonged large increases in international prices. To illustrate, if international prices increase by more than 3 percent over a prolonged period then taxes will continuously decline and become more negative under a 3 percent price band. This outcome could be avoided by the adoption of an additional rule ensuring that tax levels do not fall be-

TABLE 4. RANKING OF PRICE SMOOTHING MECHANISMS								
Price volatility	**FPT**	**HIST**	**MA2**	**MA4**	**MA6**	**PB3**	**PB5**	**PB10**
Std. deviation of monthly prices	8	2	6	5	3	1	4	7
Avg. monthly price change (sq)	8	1	5	4	2	3	6	7
Largest single monthly price increase	7	8	5	4	2	1	3	6
Avg. of 2 largest monthly price inceases	8	6	5	4	2	1	3	7
Avg. of 3 largest monthly price increases	8	5	6	4	2	1	3	7
Sum of price volatility rankings	*39*	*22*	*27*	*21*	*11*	*7*	*19*	*34*
Rank order	*8*	*5*	*6*	*4*	*2*	*1*	*3*	*7*
Tax volatility	**FPT**	**HIST**	**MA2**	**MA4**	**MA6**	**PB3**	**PB5**	**PB10**
Std. deviation of taxes	1	8	3	5	7	6	4	2
Avg. monthly tax change (sq)	1	8	4	6	7	5	3	2
Largest single monthly tax decrease	1	6	3	8	7	4	5	2
Avg. of 2 largest monthly tax decreases	1	6	3	7	8	5	4	2
Avg. of 3 largest monthly tax decreases	1	6	3	7	8	5	4	2
Sum of tax volatility rankings	*5*	*34*	*16*	*33*	*37*	*25*	*20*	*10*
Rank order	*1*	*7*	*3*	*6*	*8*	*5*	*4*	*2*
Sum of all rankings	**44**	**56**	**43**	**54**	**48**	**32**	**39**	**44**
Overall ranking	***4***	***8***	***3***	***7***	***6***	***1***	***2***	***4***

Source: IMF staff estimates.

Note: Rank of (1) represents highest ranking in terms of minimizing the size of tax decreases and price increases, and minimizing the volatility of taxes and prices. The price series are: FTP—full pass-through; HIST—historical/actual retail price series; MA—moving average; PB—percentage price band.

TABLE 5. LOWEST TAX LEVELS UNDER DIFFERENT PRICING REGIMES								
Three-month moving average tax levels	**FPT**	**HIST**	**MA2**	**MA4**	**MA6**	**PB3**	**PB5**	**PB10**
Lowest 3-month MA tax level	8.52	3.37	7.30	5.63	4.40	3.99	6.41	8.34
Rank	*1*	*8*	*3*	*5*	*6*	*7*	*4*	*2*
Avg. of 2 lowest 3-month MA tax levels	8.52	3.54	7.38	5.70	4.70	4.30	6.47	8.34
Rank	*1*	*8*	*3*	*5*	*6*	*7*	*4*	*2*
Avg. of 3 lowest 3-month MA tax levels	8.52	3.76	7.44	5.79	5.02	4.70	6.56	5.56
Rank	*1*	*8*	*2*	*4*	*6*	*7*	*3*	*5*
Sum of average tax rankings	***3***	***24***	***8***	***14***	***18***	***21***	***11***	***9***
Sum of all rankings (Table 4)	***44***	***56***	***43***	***54***	***48***	***32***	***39***	***44***
Sum of all rankings	**47**	**80**	**51**	**68**	**66**	**53**	**50**	**53**
Overall ranking	***1***	***8***	***3***	***7***	***6***	***4***	***2***	***4***

Source: IMF staff estimates.

Note: Rank of (1) represents highest ranking in terms of maximizing tax levels and minimizing volatility of taxes and prices. The price series are: FTP—full pass-through; HIST—historical/actual retail price series; MA—moving average; PB—percentage price band.

low a set floor for a prolonged period. For example, if the average of the last four months net tax levels falls below some pre-specified floor, then an immediate adjustment could be made to bring the tax level to this floor and any further international price increases could be fully passed-through to maintain the floor tax level. Among the smoothing mechanisms, the price bands appear better at avoiding low tax levels (Table 5). When performance in this dimension is combined with the performance in terms of tax and price volatility from Table 3, price bands dominate all other smoothing mechanisms.

III. Transition Strategy

A. Pricing Mechanisms

The transition to a new automatic adjustment mechanism can usually begin immediately. The following sequential steps are required:

- *Identify the price structure (i.e., formula) to be used in the pricing mechanism.* In many countries, the existing pricing formula can be adopted over the short term, possibly with some minor restructuring to make it more transparent. On transparency grounds, there should be a formula for all of the products whose prices are controlled by the government.
- *Decide on the target net tax for each fuel product.* This tax level can vary across fuel product (see Box 1). If specific taxes are maintained then these could also be inflation indexed annually to protect the budget from inflation.
- *Specify the reference price, the approach to smoothing, and the timeline for price adjustments.* Since fuel products are internationally traded, the appropriate reference price is the world price, appropriately adjusted for transport margins.[7] For example, if a country is an importer of fuel and the 5 percent price cap is adopted with monthly price adjustment, then the reference price is last month's import price. The monthly price adjustment is then the difference between the new formula retail price and the current retail price, or 5 percent, whichever is smaller. This is achieved by adjusting the variable tax and allows a gradual adjustment to the new target net tax level. A floor on tax levels can be adopted if desirable.
- *Specify the responsibilities of each of the parties involved in the implementation of the pricing mechanism.* There needs to be clarity on the procedures that must be followed to announce and implement price changes. This is necessary to ensure the timely and routine implementation of the mechanism.

[7] The formula should not include any refinery margins. If a refinery makes losses at world prices for crude oil and petroleum products, then this should preferably be financed directly (and transparently) from the budget, rather than, say, through earmarked taxes in the fuel pricing formula.

- *If desirable, commission a study on the cost structures of all fuel products whose prices are government controlled.* In many countries, a study of the cost structure used in the pricing formula is warranted, as is the development of guidelines for updating the various cost components at regular intervals. Cost structures should also be identified for all products where they do not currently exist to ensure transparent pricing and to avoid hidden taxes or subsidies.

The speed of adjustment to target net tax levels, and thus the magnitude of short-term price increases, will depend on three factors.[8] First, the higher the target net tax relative to current levels, then the larger the price increases that are required. Second, the greater the extent of price smoothing adopted, the smaller the price increases but the longer the period of convergence to target tax levels. Third, the greater the increase in international fuel prices, the slower the speed of convergence to target tax levels. For example, if (starting on September 30, 2012) the gap between the existing retail price and the target tax-inclusive price is 15 cents per liter, then with instant full pass-through and no change in international fuel prices, the retail price would increase by the full 15 cents on October 1, 2012 (Figure 3). Under the 3 percent price band, monthly prices would increase by approximately 1.83 cents per liter over the next 8 months before reaching the target net tax by May 2013. Under the larger 10 percent price band, monthly prices would each increase by 6.1 cents per liter over the next three months at which time it would reach the target net tax. Increases in international prices would delay the period of convergence.

Additional measures can be implemented over the medium term to refine and reinforce the pricing mechanism. First, the margins in the formula can be updated based on the findings of the commissioned study, and regular adjustments made thereafter as warranted. Second, consider creating an autonomous body responsible for implementing the new automatic mechanism. This should help to reinforce the public perception that price changes are determined by changes in international prices and outside the control of the government, and thus de-politicize fuel pricing. Many countries have an Energy Regulation Commission that already carries out similar functions for other energy products.[9] Finally, set out a plan for liberalizing fuel product supply and pricing. In a liberalized market, the regulator's main role is to ensure competition among suppliers and efficient operations. The only role for a formula

[8] Note that public sector users of fuel products (such as the power and fertilizer sectors) should also pass on higher fuel product input costs to their product prices. Otherwise, subsidy reforms will simply re-label fuel subsidies (e.g., as electricity or fertilizer consumer subsidies).

[9] In addition to the representatives from different government ministries, members could include representation from industry stakeholders, e.g., representatives of importers, distributors, transporters, retailers, and industry and consumer groups. Once the design of the mechanism and the components of the pricing formula are determined, the implementation of the mechanism could be delegated to the responsible body by allowing it to take the lead role in monitoring, announcing, and enforcing price changes. In addition, consideration should be given to eventually housing the committee, comprising the permanent staff responsible for implementing the mechanism, away from government buildings. It could eventually be financed from an associated charge explicitly included in the formula and its permanent staff should not be paid through the budget. In line with its increased independence, corresponding provisions to ensure accountability such as through ex-post transparency and audit requirements would be needed. Regular reporting to the public on the operations of the body and the implementation of the mechanism would also help strengthen its accountability.

under liberalized pricing is as part of the regulation process intended to detect the presence of uncompetitive pricing practices.

B. Supporting Measures

Although fuel subsidies are an inefficient and fiscally expensive approach to protecting the poor from rising international fuel prices, eliminating them can still have a sizeable adverse impact on poor households. A review by Arze del Granado, Coady, and Gillingham (2012) finds that, on average, a US$0.25 per liter increase in domestic prices decreases household real incomes by 5 percent, with this impact being similar across all income groups. Therefore, it is important that reform strategies include measures to mitigate this adverse impact.

Where an effective social safety net exists, expanding the budget for these programs can address concerns about poverty while containing the fiscal cost. For countries that do not have access to effective safety net programs, a more gradual reform approach is desirable if fiscal conditions allow. This could involve maintaining kerosene subsidies over the short term and using existing programs that can be expanded quickly, possibly with some improvements in targeting effectiveness (for instance, school meals, reduced education and health user fees, subsidized mass urban transport, cash transfers to vulnerable groups, or subsidies for consumption of water and electricity below a specified threshold). Similarly, other public expenditures, such as education and health expenditures, as well as infrastructure expenditures such as roads and electrification schemes, which tend to benefit the broader population, could be expanded. Box 3 provides some examples of measures adopted during subsidy reform in a number of countries.

Although increasing retail prices to reduce fuel subsidies is always a politically sensitive issue, an effective public information campaign prior to reforms can increase public support. This campaign should inform the potential beneficiaries (consumers and taxpayers) about the drawbacks of existing subsidies and the benefits of reform. It can also help if the messages are reinforced by independent analysts, e.g., via well publicized workshops run by policy think-tanks. Such a campaign should highlight the following:

- Subsidies have a high fiscal cost and crowd-out financing for priority public expenditures such as investments in education, health, and physical infrastructure. It is important that the full extent of subsidies is transparently recorded in the budget.
- Subsidies promote cross-border smuggling, shortages, black market activities, and corruption.
- Higher-income groups capture most of the benefits from fuel subsidies.
- Although international prices are outside the control of the government, the automatic pricing formula will protect the population from large increases in retail prices while simultaneously protecting the budget (and associated priority spending) from escalating

Box 3. Mitigating Measures—Country Experience

Gabon increased gasoline and diesel prices by 26 percent in March 2007.

- National Social Guarantee Fund cash payments to the poor were resumed, while conducting a new and improved census of lower income households.
- Assistance to single mothers via the existing program in the Ministry for the Family was increased, as was funding for microcredit program targeting disadvantaged women in rural areas.
- Households with monthly electricity and water bills of less than the expenditure thresholds for subscribers who already received the social rates were eligible for free electricity and water up to a limited quantity.
- School enrollment fees were waived for pupils enrolled in public schools and school text books given free of charge to all primary school pupils.
- PRSP investments related to the expansion of rural health services, electrification, and drinking water supply were accelerated.
- The mass public transport network in Libreville was expanded (27 buses).

Ghana increased domestic fuel prices by 50 percent in February 2005.

- Fees for attending primary and junior-secondary school were eliminated.
- Extra funds were made available for primary health care programs concentrated in the poorest areas through the existing Community Health Compound Scheme.
- Investment in the provision of mass urban transport was expanded and expedited.
- Extra funds were made available to expand a rural electrification scheme.

Mozambique increased fuel prices by 38 percent in 2008.

- Budgetary allocations to a range of social protection programs were increased substantially (Direct Social Support, Social benefits Through Work, Income Generation and Community Development)
- The level of cash benefits received by beneficiaries of the Food Subsidy Program was increased, with the minimum benefit increasing from 70 MT to 100 MT and the maximum benefit from 140 MT to 300 MT.
- The number of branches of the National Institute for Social protection was increased from 19 to 30 to facilitate an expansion of the program.

subsidies and high inflation. Price increases reflect fluctuations in international prices, which are out of the control of the government. Transparently publishing the key parameters of the formula can help to reinforce this perception.

- Passing-through price increases will encourage greater energy efficiency, which in turn will help to reduce the adverse macroeconomic impact of international price volatility on the country through higher external current account deficits, and lower growth and poverty reduction.

Box 3. Mitigating Measures—Country Experience (*concluded*)

Indonesia increased domestic fuel prices in both March and October 2005 (more than doubling prices) and again in May 2008 (prices of fuel products were increased by 25–33 percent).

- A temporary cash transfer program to 19 million poor families, with targeting relying on existing databases, was implemented in 2005 to mitigate the impact of fuel price increases. A similar cash transfer accompanied the fuel price increases in 2008 for a period of seven months.
- Some budgetary savings from reducing subsidies were reallocated to existing education, health and infrastructure programs that benefit low- and middle-income households.
- The subsidies on kerosene are being reduced in conjunction with a program to increase the use of LPG as an alternative fuel source.

Jordan initiated a gradual reduction of fuel subsidies in 2005, culminating in full price pass-through in February 2008 when fuel prices were increased by 33–76 percent.

- The minimum wage was increased, and low-paid government employees received higher wage increases than other employees.
- A one-time bonus was given to low-income government employees and pensioners.
- An electricity lifeline tariff was maintained at current low levels—electricity access is almost universal.
- Cash transfers were provided to other low-income households whose head is a non-government worker or pensioner. The government announced a plan to increase funding to the National Aid Fund as part of a program to improve the design and implementation of this national safety net program with World Bank assistance.

Appropriate packaging and timing of pricing reforms can also help to reinforce public support. This can help to increase the likelihood of successful reform.

- The adoption of the mechanism should be explicitly linked to specific public expenditure increases. It should be made clear that pricing reforms are necessary to protect planned expenditure increases and finance additional expenditures. These expenditures should include both those that benefit the population more broadly (e.g., education, health, and public infrastructure) as well as safety net expenditures to protect the most vulnerable. A package of temporary and targeted measures to help internationally traded energy-intensive sectors become more energy efficient may also be warranted (e.g., improved access to credit at competitive rates to finance more energy-efficient investment).
- If possible, launch the mechanism during a period when inflation is low or international fuel prices are falling. This avoids the public associating the mechanism with price inflation and also mitigates the adverse impact on real incomes. In particular, being prepared

to more quickly implement the pricing mechanism in the event of a decrease in international prices can emphasize that the formula also passes on price decreases.

- If current net tax levels are well below target levels, then implementing a price increase well before the adoption of the mechanism will help to avoid large increases subsequent to its adoption and the public perception that the mechanism will only increase fuel prices.
- Emphasizing the gradual adjustment of prices for more socially sensitive commodities (kerosene and diesel) can also reinforce public support. Increasing taxes or decreasing subsidies for some less socially sensitive products (such as gasoline) can help to finance any short-term fiscal loss from gradual adjustment.