Economy-wide Impact of Electricity Price Increases in Bangladesh – A CGE Analysis

by
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Introduction

This paper presents an analysis of the economic impact of electricity price increases in Bangladesh. A computable general equilibrium (CGE) model is developed and used to trace through the impact of an increase in the price of electricity on GDP, household consumption, economy-wide investment, government income, the trade balance, inflation, and sectoral outputs and prices. The primary motivation for this analysis is the need to understand the impact of adjusting the price of electricity to reduce the significant fiscal burden of current budget transfers to the single buyer of wholesale power – de facto subsidies to the end-consumer. Another impetus is the fact that the impending import of liquefied natural gas (LNG) will result in a more expensive fuel mix for power generation, which will lead to a need to increase the price of electricity supplied to consumers. Both channels impacting the price of electricity are modeled and their impacts analyzed. The model takes into account the fact that a reduction in subsidies to the sector or an increase in the price of electricity will augment government revenues, which can be recycled towards productive ends. The value of the model lies in the indicative results, insights and options it provides for decision-makers to take into account in their planning and policy formulation. Going forward, it would be important to carry out a supplementary distributional analysis to understand the implications for the poor and thus the full potential impact of the policy changes being analyzed.

I. Background

The power sector in Bangladesh is partially liberalized. Prior to 1996, Bangladesh had a vertically-integrated power system, with the state-owned Bangladesh Power Development Board (BPDB) handling generation, high-voltage transmission, and urban transmission and distribution, and with the Bangladesh Rural Electrification Board (REB) handling rural transmission and distribution. Since then, BPDB has been unbundled into four generation companies, one transmission company, and four urban distribution companies. There is competition in generation, with power being produced by multiple public and private (independent power producers (IPPs) and short-term rental plants) generators. Although BPDB retains some generation assets, it is the single buyer, purchasing power from all generators and selling power at the bulk supply tariff to all distributors (the urban distribution companies, distribution zones of BPDB, the REB).[2] On the transmission side, the grid is managed by a single transmission company, the Power Grid Company of Bangladesh with dispatch managed by its subsidiary, the National Load Dispatch Center. The Bangladesh Energy Regulatory Commission sets tariffs throughout the sector value chain, including bulk and retail power tariffs. Government policy is to keep the bulk tariff at a level lower than the cost of power and make up the difference by explicit transfer payment to BPDB. The logic for this is explained below.

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[1] Timilsina (corresponding author), Pargal and Sahin are economists at the World Bank. Marinos Tsigas is at the USITC and was an adviser to the team. This study builds on an earlier effort to model the power sector in Bangladesh undertaken by a team led by Farzad Taheripour at GTAP in Purdue University. For very helpful comments and suggestions, the team thanks Andrew Burns, Global Lead for Macroeconomic Modelling and Statistics at the World Bank. Financial support from the Energy Sector Management Assistance Program (ESMAP) is gratefully acknowledged.

[2] The only exception to this is that small IPPs supply a small percentage of the rural system's power directly.

From around 2009-10 onward, the Government has contracted significant capacity, mostly through short-term (3-5 years) rental plants, run on liquid fuels.[3] This started out as an interim measure to address shortfalls in power generation due to delays in commissioning the large base-load power plants required to meet growing demand in combination with declining availability of domestic natural gas, the primary fuel for power generation in Bangladesh. Though these plants have helped to reduce power shortages, fuel oil, which is imported, is more expensive than domestic natural gas so average generation costs have been rising as the share of oil-fueled generation in the power mix has increased. Rather than passing through these higher costs to retail consumers, the Government has allowed a gap to form between the bulk supply tariff that the distribution utilities pay to BPDB and the price that BPDB pays to generate and purchase power, which it covers through a budget transfer or subsidy to BPDB. Table 1 presents the subsidy payments to BPDB as shown in the Medium Term Macroeconomic Policy Statement of the Ministry of Finance.[4]

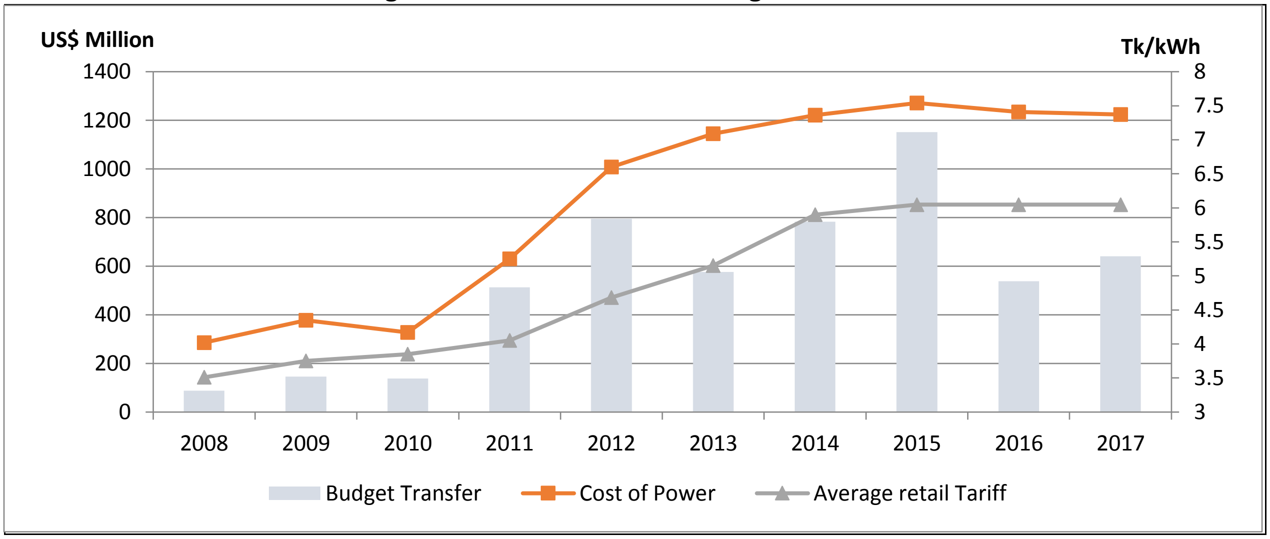
Table 1: Budget transfers (subsidies) to BPDB (Billion Taka)

Items	FY 08	FY 09	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15	FY16
	Actual								Revised
PDB	6.0	10.1	9.9	40.0	63.6	44.9	61	89.8	60

Source: FY08-FY13 numbers are from Ministry of Finance. "Medium Term Macroeconomic Policy Statement from 2014-15 to 2016-17" Table 3.7A: Cash and Loan Subsidies (Billion Taka). FY13-FY16 numbers are from "Medium Term Macroeconomic Policy Statement FY17-FY19, Table 3.9A: Cash Loan and Subsidy" Ministry of Finance, Government of Bangladesh.

Figure 1 taken from Sadeque and Bankuti (2017) depicts the evolution of these payments over time, also showing the gap between the average power tariff and cost per unit of power supplied (right hand vertical axis).

Figure 1. Sector deficit and budget transfer



Source: Sadeque and Bankuti, 2017

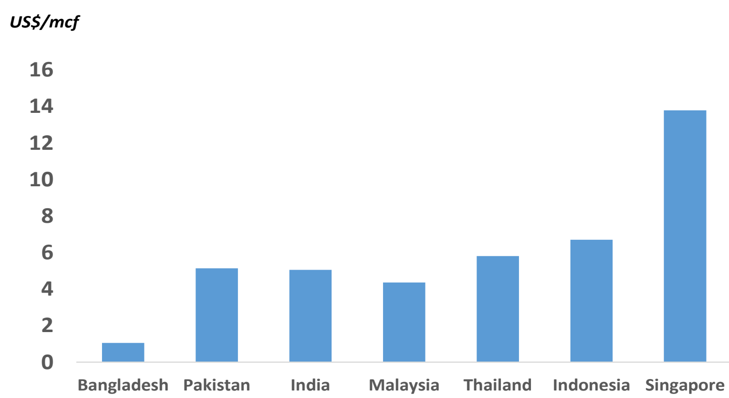
[3] Approximately 28% of installed generation capacity in the country is based on diesel or furnace oil, according to BPDB: http://www.bpdb.gov.bd/bpdb/index.php?option=com_content&view=article&id=5

[4] According to the World Bank Online Database, Bangladesh had GDP of 10,552 billion Taka in 2012, 11,989 billion Taka in 2013, 13,437 billion Taka in 2014 15,158 billion Taka in 2015 and 17,329 billion Taka in 2016. The budgetary subsidy to electricity presented in Table 1 above works out to 0.6%, 0.37%, 0.45%, 0.59% and 0.35% as a percentage of GDP, in 2012, 2013, 2014, 2015 and 2016, respectively.

Subsidies were intended to be temporary; to be phased out once large base-load plants came online and the cost of power declined. But that point is still some time away and the Government has contracted for more capacity in the interim.[5] Given the significant fiscal burden of continuing to protect consumers from the true cost of power, tariff increases are likely to be necessary in coming years.

Another driver of increased power tariffs is the price of natural gas. Power generation in Bangladesh has relied predominantly on domestic natural gas for many decades; even today about 63% of power generation is fueled by domestic natural gas. While gas is priced to cover the cost of production on average, this is far lower than its opportunity cost which, since it is traded, would be the import price. In fact, the price paid for gas by power producers in Bangladesh is among the lowest levels in the world.[6]

Figure 2. Price paid by Power Plants for Natural Gas in Selected Countries

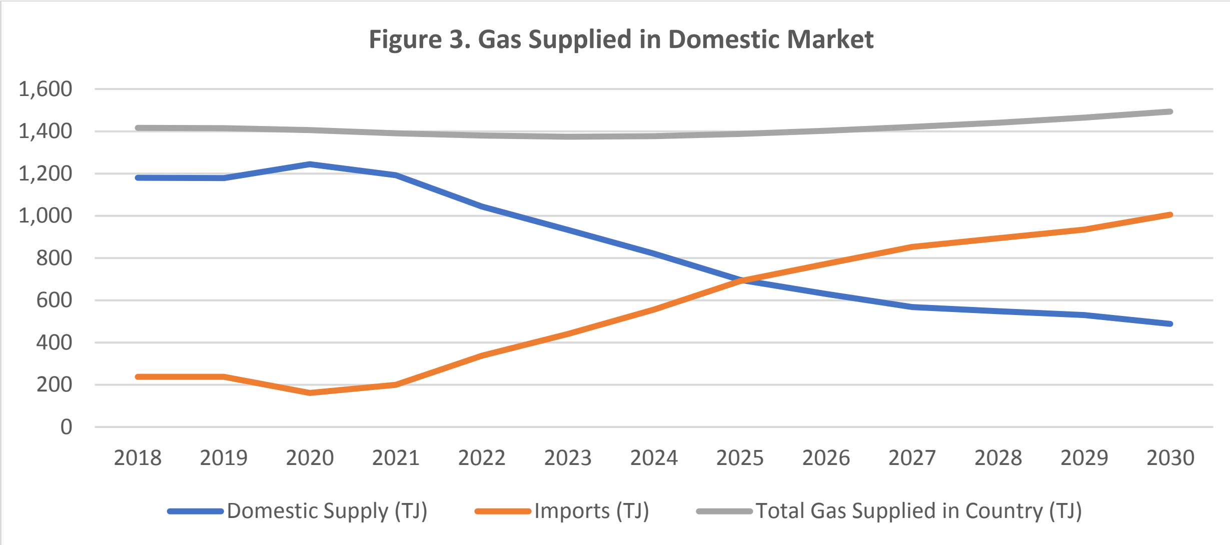


Source: Energy Policy Options for Sustainable Development in Bangladesh, Asian Development Bank 2013

Domestic reserves of gas are limited and supply at current prices is declining -- a shortage of domestic gas already means that about 1,000 MW of gas-fired capacity remains idle. In view of the large installed base of gas fired power plants, the Government has arranged to import liquefied natural gas (LNG), with the first shipments of LNG likely to arrive in Bangladesh in 2018. Figure 3 presents the evolution of the gas mix foreseen in the Implementation and Financing Plan for Gas Sector Development of 2012, prepared by Dorsch Consulting for Petrobangla. Over time, unless domestic exploration results in new finds and gas production, the gas mix fueling power generation will be increasingly weighted towards LNG as domestic gas supplies dry up.

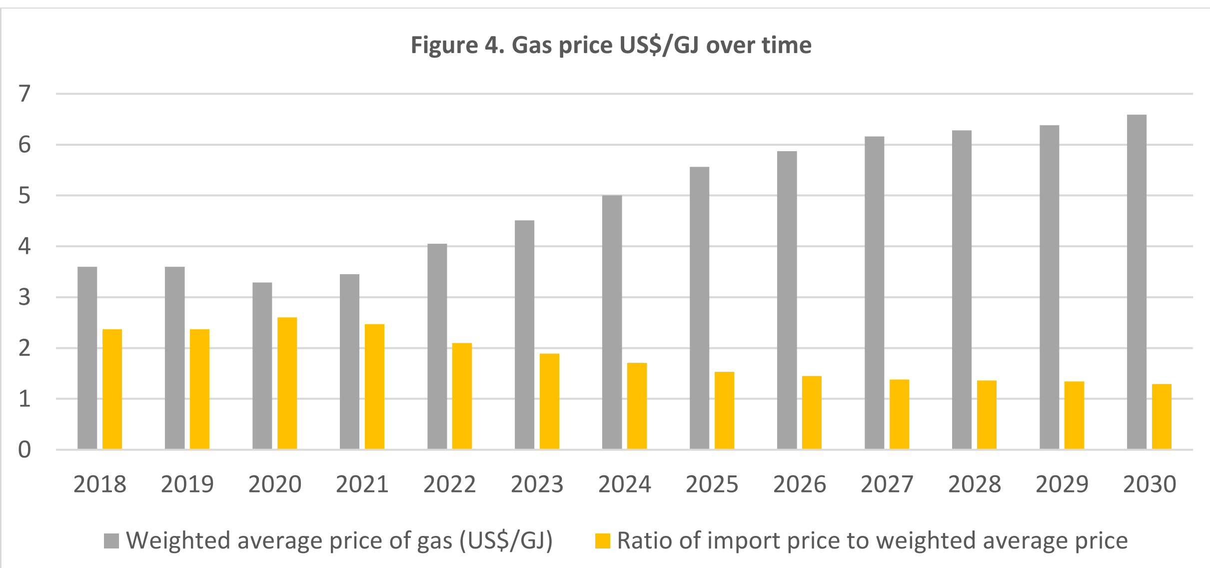
[5] See, for example recent (2017) press articles : http://www.thebangladeshpost.com/national/5554/pdf; http://www.dhakatribune.com/bangladesh/power-energy/2017/08/31/quick-rental-power-plants-extended/.

[6] 'The Cost of Electricity Distortions in South Asia' work in progress by Fan Zhang of the World Bank points out that the underpricing of domestic natural gas results in inefficiency of use that imposes a cost amounting to 3.63% of GDP on the economy.



Source: Dorsch Consulting 2012

Since the price of domestic gas is significantly lower than the likely delivered price of LNG in Bangladesh, the use of LNG for power generation will increase the average generation cost of electricity and require that prices be raised, unless the Government plans to subsidize consumers and maintain current tariffs – which would mean a huge fiscal burden. Assuming the 2015 price of domestically produced gas of $2.61/GJ and international price of $8.53/GJ (delivered price of LNG in the Indian market), the weighted average price of gas in Bangladesh would evolve as shown in Figure 4, approaching the international price as time goes by.



In the case of natural gas, the government does not provide a direct budget transfer or subsidy. Unlike electricity, natural gas is an internationally traded commodity. Its opportunity cost equals the imported price of liquefied natural gas (LNG). While Bangladesh has not yet started to import LNG, its neighbor India, does and we use the delivered price of LNG to proxy the international market price or opportunity cost of gas in Bangladesh. Bangladesh is expected to start importing LNG by 2018 with imports rising as its own reserves get depleted. In 2012 (the base year for the model), the average consumer price of domestic natural gas was around US$2.35/GJ whereas the price of LNG in India was about US$9.89/GJ, i.e., the opportunity cost of natural gas was more than four times the domestic price. In certain sectors, such as power and fertilizers, the price of gas was less than US$1/GJ or less than 10 percent of the opportunity cost.

Maintaining the domestic price of gas at current levels is not sustainable in a situation where domestic reserves are rapidly depleting and the country needs to import LNG to meet future demand. Not only would the budgetary resources required to subsidize the consumption of natural gas be significant but they would divert spending away from health, education and other essential public goods and services.

In this paper, we analyze two cases under which the price of electricity is expected to increase: (i) the removal of the price subsidy to electricity consumers implied by the budgetary transfer to BPDB; and (ii) an immediate increase in the price of domestically produced natural gas to international levels (proxied by the delivered price of LNG in India in 2015).

II. Methodology and Data

This paper uses a computable general equilibrium (CGE) model to specify the intersectoral linkages within the economy and assess the economy-wide impacts of the increase in the price of electricity under two policy scenarios -- the removal of subsidies to the sector and an immediate increase in the price of gas to international levels. CGE models permit analysis of the impacts of such policy changes as introducing a new tax or changing the tax rate on a range of macroeconomic variables such as GDP, sectoral outputs and value added, international trade, household income and welfare. CGE analysis is particularly useful for studying the impacts of energy subsidy reforms because it captures both the fiscal and economic implications of such reforms and can help delineate the channels through which these policy interventions work.

In this section, we describe the data used and CGE model developed for the study, followed by an explanation of how subsidy removal policies were incorporated and their impacts analyzed using the model.

Data

The main data required for this analysis are as follows:

- (i) Social Accounting Matrix (SAM) for Bangladesh
- (ii) Elasticity of substitution and other parameters
- (iii) Direct government transfers (subsidies) made to electric utilities in Bangladesh
- (iv) Prices of domestically supplied natural gas in Bangladesh and LNG delivered in India

The latest SAM available for Bangladesh is for 2012 and, because of this, 2012 is the base year for the analysis in this paper. The SAM was provided to us by Dr. Selim Raihan from SANEM, a think-tank in Dhaka. It was adjusted to overcome some missing values by distributing across the cells of the 'USE' matrix[7] the total value of domestically produced goods and services consumed by the productive sectors

[7] The 'USE' matrix in a SAM refers to inputs of different goods and services for the production of various goods and services.

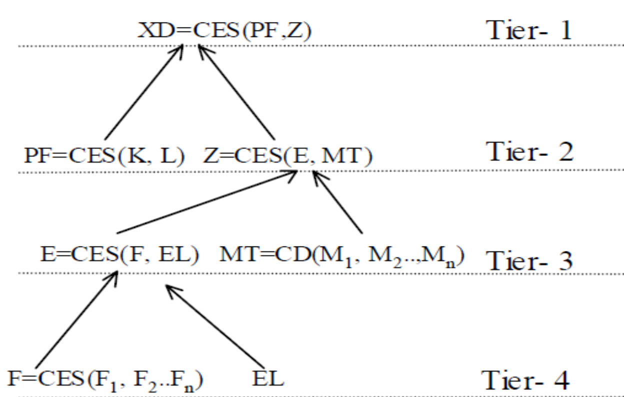
(intermediate consumption) in the SAM, using the technology coefficients from the GTAP[8] 2007 SAM for Bangladesh. The use of 2007 GTAP coefficients means ignoring possible structural change between 2007 and 2012 in the Bangladesh economy.

All elasticity parameters are taken from Timilsina and Shrestha (2007). As it is difficult to empirically estimate the elasticity of substitution across commodities for individual countries, using values from the literature is the norm. Data on government transfers to BPDB were obtained from the Medium Term Macroeconomic Policy Statement of the Ministry of Finance, Government of Bangladesh (see Table 1 above) while quantity forecasts for natural gas and LNG were obtained from Dorsch Consulting 2012, with natural gas price data for 2015 for Bangladesh coming from Petrobangla and LNG price data for India from Sen 2015.

The CGE Model

In the CGE model, the Bangladesh economy is aggregated into 17 production sectors. The sectors and commodities specified are Agriculture and fisheries; Forest, wood products, pulp and paper, printing; Food and beverage; Jute, textile and leather; Fertilizers and chemicals; Petroleum products; Non-metallic minerals; Primary and fabricated metals; Machinery and equipment; Other manufacturing products; Construction; Electricity; Natural gas; Mining; Wholesale and retail trade; Transport services; and, Other services. Note that sectors and commodities are the same in our model. The production behaviour of each sector is represented by nested constant elasticity of substitution (CES) production functions as illustrated in Figure 5.

Figure 5: Nested Structure of Production Sectors

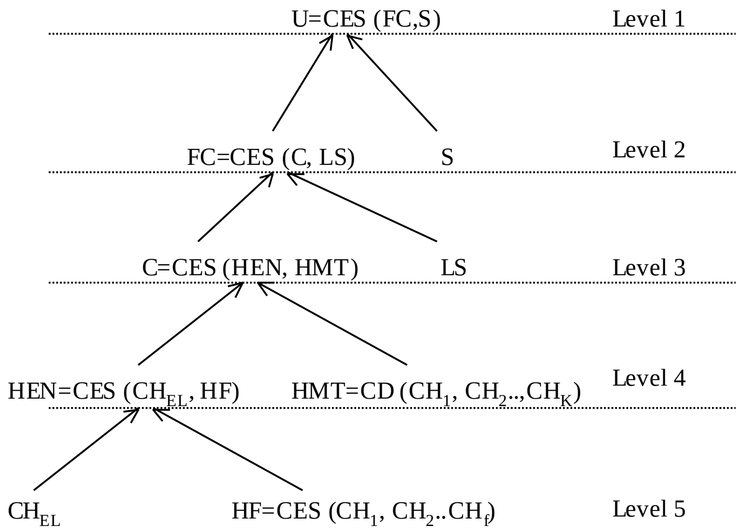


Note: CES refers to a constant elasticity of substitution functional form and CD refers to a Cobb-Douglas functional form, XD represents gross output, PF and Z refer to primary factors of production and intermediate inputs, respectively. E and MT refer to the energy composite and material composite; K, L, F and EL refer capital, labour, aggregate fossil fuels and electricity. Source: Timilsina and Shrestha (2007)

This study considers a representative household that follows a five-step hierarchical optimization process to maximize its utility (Figure 6).

[8] GTAP is a global network of researchers who conduct quantitative analysis of international economic policy issues, especially trade policy. A key output of the network is a global economic database, covering many sectors and all parts of the world. It is coordinated by the Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University, West Lafayette, IN.

Figure 6: Nested Structure for the Household Sector



Note: U represents the household utility, FC and S refer to full consumption and savings; C and LS refer to the aggregate goods/service consumption and leisure; HEN, HF, HMT and CH refer to the aggregate energy consumption, the aggregate fuel consumption, the aggregate material consumption; and the individual goods/service consumption; subscript EL refers to electricity. Source: Timilsina and Shrestha (2007)

The Government collects taxes, provides public goods, saves part of its income, and, also provides transfers to households. The Government is important in the model because removal of electricity subsidies and increase in the price of gas are both implemented through this sector. We assume domestically produced and imported goods are imperfect substitutes. The total demand for a good is assumed to be a CES composite of its domestic components and imported components. Export demand follows Timilsina and Shrestha (2007), which assumes export demands respond to the relative price of exports with respect to corresponding international prices. Total current investment demand in the economy is considered equal to the total delivery of investment goods in the economy.

We use the CGE model of Bangladesh to analyze the impacts of tariff increases due to subsidy removal in the energy sector, specifically considering two separate policy changes: (i) the elimination of budget support to the single buyer, the power development board, and, (ii) an increase in the price of domestic natural gas to its opportunity cost, which is the price of imported LNG.

In the model, the total production of a good equals the sum of domestic consumption and exports of the good. Total domestic demand consists of intermediate and final demand (i.e., household consumption, government consumption, capital goods, and inventory goods). The total time endowment (i.e., the active population) of the economy is assumed not to change with either policy change, implying that the total amount of labour supplied in the economy depends only on the wage rate and labour supply elasticity. It is assumed that total labour supply is equal to the total demand for labour in the economy (Walras' law). People who are legally eligible to work are assumed to spend their time either working or consuming leisure. The model permits capital mobility across the production sectors. However, the total capital stock in the economy is assumed to remain unchanged with a policy change. The difference between total value outflow (e.g., imports of goods and services) from the country and the total value inflow (e.g., exports and transfers from the rest of the world) to the country is defined as the current account balance while total investment is the sum of total savings comprising of household saving, government saving and the current balance.

Under both policies analyzed, a static, single period simulation is carried out. Under each policy scenario, four different 'schemes' or ways of using ('recycling') the additional savings or government revenues are examined, in order to assess possible subsidiary policies that would alleviate the fiscal burden from subsidies while protecting growth and inclusiveness. The four schemes considered are described in Table 2 below.

Table 2: Schemes to recycle savings to government budget or increase in revenues

Scenario Name	Scenario definition
Excise tax	Use the savings or revenue to cut excise or sales or indirect tax rates on all goods and services consumed in Bangladesh
Income tax	Use the savings or revenue to cut income or direct tax rates imposed on individual and firms in Bangladesh
Lump-sum	Transfer the savings or revenue to households increasing their disposable income
Investment	Invest in the economy to increase the total capital stock in Bangladesh

Note: Savings accrue from removal of the subsidy paid to BPDB while revenues increase from pricing domestic gas at the international level.

Incorporating Electricity Subsidy Removal in the CGE Model

The fiscal transfer to the power sector in 2012 was equivalent to 33% of the value of electricity output reported in the SAM. This means that the non-subsidized average price of electricity for consumers would have been 33% higher than the subsidized prices. The elimination of this subsidy would mean increasing the subsidized price 1.3 times. It is implemented in the model as a 30% tax added onto the subsidized price of electricity. This way of modeling the removal of the subsidy allows us to easily calculate the government's budgetary savings from the elimination of the subsidy since these savings equal the additional (new) tax collected by the government. In the absence of information on how the subsidy is financed, the four options specified in Table 2 are examined to recycle the budgetary savings resulting from the removal of the electricity subsidy.

Incorporating the Increase in the Price of Natural Gas in the CGE Model

Under the baseline (business as usual) the price of gas sold in Bangladesh is expected to be a weighted average of the prices of domestically produced and imported gas, as discussed above. Over time the gas mix used in Bangladesh will tend towards being 100 percent imported so the weighted average price of gas sold domestically will approach the price of imported gas.

Under the policy being simulated, *all gas sold domestically* would be priced at the international price (proxied by the delivered price of LNG in India), i.e., the price of domestically produced natural gas would go up immediately, even before imports come in.[9] In the model this policy shock is implemented through the imposition of an equivalent tax on the domestic price of gas such that the weighted average price increases by the desired percentage. Since this is a comparative static analysis, the price increase is imposed at a single point in time.[10]

[9] Over time, of course, the price difference between the baseline and the policy shock (in which domestically produced gas is priced at the same price as imported gas) will tend to zero.
[10] Section III presents the impact of price increases at three specific points in time, to illustrate this.

Table 3 depicts the evolution of the ratio between the imported price of natural gas and the weighted average price of gas (i.e., aggregated prices of domestically produced and imported gas). The forecast for the volume of gas supplied domestically and the volume of imports is taken from Dorsch Consulting 2012. It is beyond the scope of this analysis to investigate the merits of the gas consumption forecast.

Table 3: Evolution of gas price over time

Year	Domestic Supply (TJ)	Imports (TJ)	Weighted average price of gas (US$/GJ)	Ratio of import price to weighted average price
2018	1,179	237	3.60	2.37
2019	1,178	237	3.60	2.37
2020	1,244	161	3.29	2.60
2021	1,192	199	3.45	2.47
2022	1,043	337	4.05	2.10
2023	933	441	4.51	1.89
2024	820	556	5.00	1.71
2025	696	691	5.56	1.53
2026	630	772	5.87	1.45
2027	568	852	6.16	1.38
2028	548	893	6.28	1.36
2029	530	934	6.38	1.34
2030	488	1,005	6.59	1.29

Note: This uses domestic and imported prices for 2015, which are 2.61 and 8.53 US$/GJ, respectively.

Table 3 also shows that the weighted average price of natural gas increases over time *under the baseline* to eventually equal the price of imported natural gas, at which point the entire supply of gas would be priced at its opportunity cost. The ratio of the import price to the weighted average price decreases over time as the volume of (higher priced) imported gas increases.

The additional revenue generated for the government (through the state oil and gas company, Petrobangla) from increasing the price of domestically produced natural gas to the international price depends on the volume of domestically produced gas. These revenues are recycled within the economy in the same manner as for electricity subsidy removal (Table 2) and can act as a significant stimulus.

For example, increasing the price of natural gas in 2018 so that the weighted average price of $3.6/GJ reaches the import price of LNG ($8.51/GJ) would result in almost $7 billion of additional revenue (with consumption assumed to be unchanged – a simplifying assumption), which is more than 3% of Bangladesh's 2016 GDP. Recycling such a huge windfall to the economy would have enormous impacts. Since it seems unrealistic to expect the Government of Bangladesh to impose a 137% increase in the weighted average price of domestic gas immediately (i.e., in 2018) as would be required to bring the price of all gas sold domestically up to the international level, we have imposed a 53% increase (consistent with a gradual rise in the price of domestic gas so that it reaches the international price by 2025).

While the gas price increase would have negative impacts on the economy, the stimulus provided by the increased revenue would have positive impacts. The analysis shows the net impact from these two opposite impacts.

III. Results

Policies and scenarios

We consider two energy pricing policies and four scenarios under each policy. The policies are:

(i) Removal of electricity subsidy, which is 30% of the value of electricity sector gross output (or sales), and

(ii) Increasing the price of domestically produced natural gas to its opportunity cost, which is the price of LNG delivered in India.

When the electricity subsidy is removed (eliminating the fiscal transfer to BPDB), budgetary savings are generated. In the case of natural gas, the price increase would generate additional revenues for the state-owned gas monopoly; state-ownership, we assume, means that the government has discretion in the use of these revenues.

We examine four scenarios for recycling the saved budget (in the case of electricity subsidy removal) and increased revenues (in the case of gas price increase) within the economy: Excise tax, Income tax, Lump-sum transfer, and, Investment. These scenarios are defined in Table 2 above.

The key point illustrated by the CGE analysis is that increasing gas prices and/or removing the electricity subsidy would increase the cost of goods and services which are gas and/or electricity intensive, with a negative impact on the economy. On other hand, recycling the budgetary savings (electricity) and/or increased revenues (gas) would have a positive impact. On net, positive impacts are observed in both cases and in all scenarios considered. While the magnitude of the impact would be sensitive to the quality of the SAM, the elasticity of substitution and functional forms used in the CGE model to represent the behavior of economic agents (households, firms, government and rest of the world), the main message is the direction of the impacts.

In every scenario, the policy change (electricity subsidy removal or gas price increase) imposed is neutral with respect to the government budget, i.e., it does not itself change the government budget balance. In other words, ALL the savings generated by electricity subsidy removal or the additional revenue from the gas price increase are recycled to the economy. This does not mean, however, that taxes, transfers and public investment are unchanged. The total government budget is maintained at the same level as before the policy change, but the government's saving and expenditure (allocation) pattern changes so tax revenues, transfers and investments are different from levels/shares before the policy intervention.

Key results from policy simulations

While considering the results of the policy simulations, it should be noted that the CGE frame work requires all markets to clear. This means that the possibility of demand/supply imbalance on goods and services does not exist. If demand goes down, supply must go down for the system to remain in equilibrium -- it is not possible to have a situation of reduced demand and unchanged production. It is also not possible to avoid recycling the savings from subsidy removal – money saved has to be spent – so we cannot model cases in which the government retains the savings or deposits them in the bank without further use of these assets. The government could, of course, use the money to pay down domestic debt, but even that will ultimately be invested in the economy -- which has been captured in the "investment" recycling scenario presented. Also, since the value of the model lies in the indicative results, insights and options it provides decision makers, it would not have been particularly insightful to model scenarios in which government spending is not productive or is inefficient.

In a static analysis, as that undertaken here, the policy action (elimination of the budget subsidy to the electricity sector or increase in the price of gas) is implemented at a single point in time. However, the government is more likely to eliminate the subsidy gradually rather than discontinuing it abruptly. If prices increase gradually, the impacts seen will be commensurately lower.[11] The speed and severity of the impact in different sectors can vary as well. A dynamic extension to this model could be developed for deeper analysis of the options and trade-offs over time.

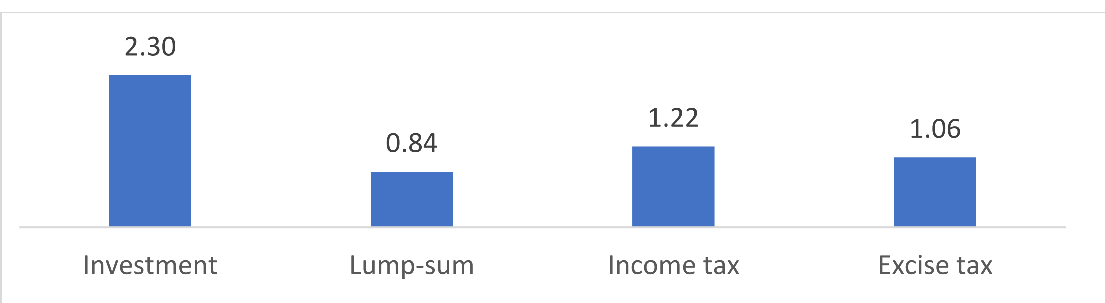
As noted earlier, the value of the analysis lies in the indicative results, insights and options provided for decision-makers to consider in their planning and policy formulation. A supplementary distributional analysis would be important to understand fully the potential impact of the policy changes analyzed. This will be carried out as a follow-up task.

Impacts of electricity subsidy removal

(i) Impact on GDP

Elimination of the electricity subsidy and recycling the associated budgetary savings within the economy would be beneficial to the country as the distortions caused by the electricity subsidy are also eliminated when the subsidy is removed (since the saved funds can be directed to areas where their opportunity cost is lower). GDP is seen to increase in all schemes of recycling the saved budget. However, the magnitude of the impact on GDP depends on the specific recycling scheme considered. If the saved budget is reinvested in the economy to increase the total capital stock, GDP gain would be the highest. A significant increase in GDP is also noticed when the saved budget is used to lower personal and corporate income taxes or to cut excise taxes. The results showing higher benefits to the economy when increased government revenue from a policy shock is used to cut existing distortionary taxes (e.g., income tax, sales tax) than when it is recycled to households as a lump-sum transfer, are consistent with the existing literature (Timilsina and Shrestha, 2007). Note that the size of the subsidy was 0.6% of GDP in 2012. The removal of the subsidy and re-directing the funds to more productive activities can potentially result in an increase of GDP from 1-2.3% depending on how the saved budget from subsidy elimination is recycled within the economy.

Figure 7. Impact on GDP (% change from the base year)

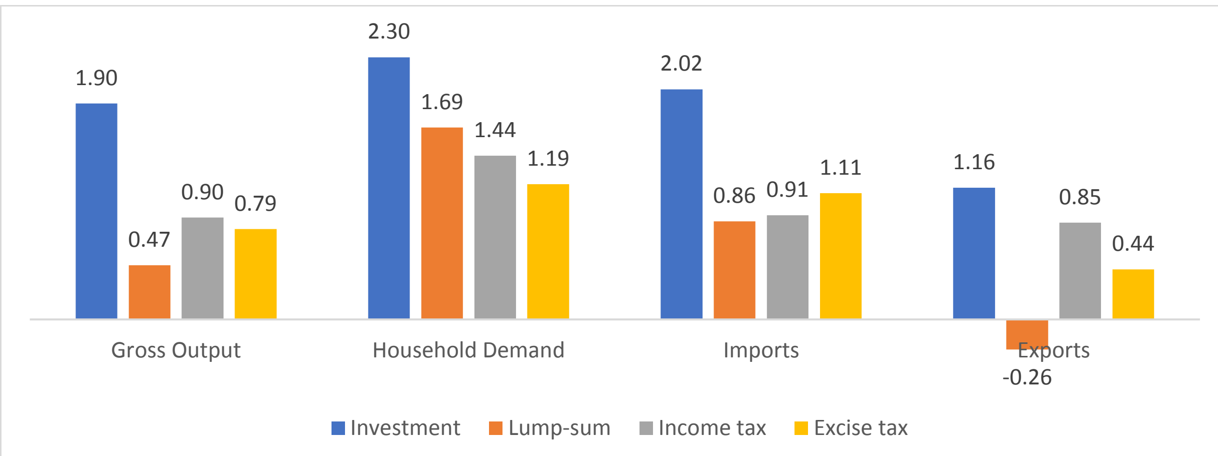


[11] Also, the unit of time over which adjustment occurs is not necessarily one year – it could be 5 or ten years. The model simply shows the percent change from the baseline once the economy has fully adjusted to the price.

(ii) Impact on gross outputs, household demand, exports, imports

The results are intuitive. Cutting the electricity subsidy and recycling the saved revenue to the economy enhances all economic activities thereby increasing gross output and household demand. On trade, further explanation is in order. The trade balance constitutes just 9% of GDP, i.e., 91% of GDP accrues from its other components (household and government consumption, capital goods), which are all increasing in the scenarios analyzed. Hence GDP can increase despite the fact that net exports (in all scenarios) move in the opposite direction.[12]

Figure 8. Impacts on total output, total household demand, total imports and total exports (% change from the base year)



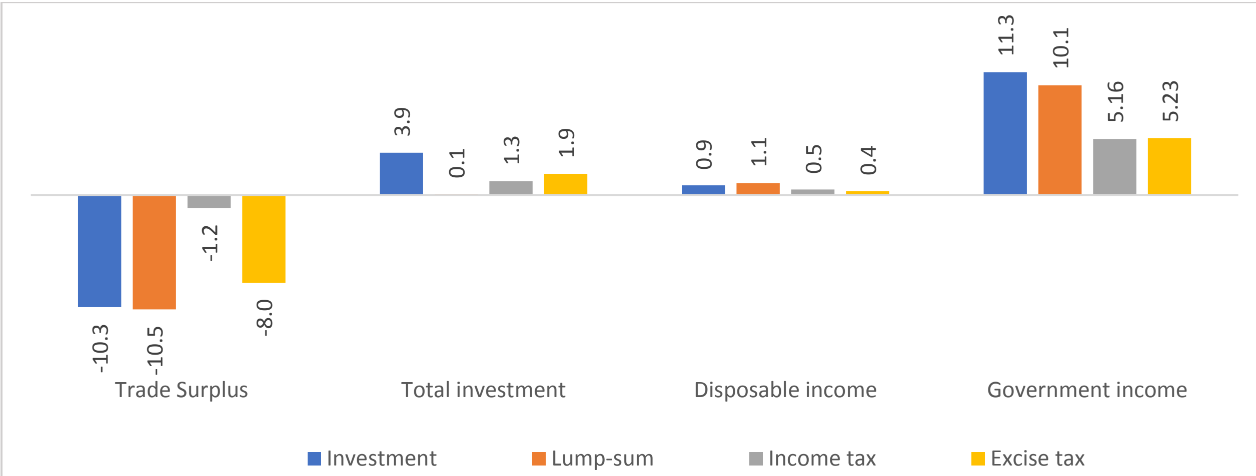
(iii) Impact on other macroeconomic variables

Figure 9 presents the impact on other macroeconomic variables such as current account balance/surplus, household income, and total investment. In the base year, Bangladesh has a surplus on the current account, i.e., the flow of value into the country (e.g., export revenues, remittances) is higher than the flow of value out of the country (e.g., cost of imports) amounting to 2.1% of GDP. The removal of the electricity subsidy causes the trade surplus to decrease substantially.

As would be expected, government revenues in the tax cut scenarios (income tax and excise tax cuts) would be smaller than in the two other scenarios (i.e., lump-sum transfer to households and increase in public investment spending) because of the reduction in existing income or excise taxes.

[12] The movement of exports depends on the movement of producer prices. When producer prices, which are export prices here, increase, domestic production becomes relatively expensive vis a vis imports (this is because international price remains the same since Bangladesh is a small country in trade terms and cannot influence world prices), so exports decrease and imports increase. Across the four scenarios studied, producer prices are the highest under the lump-sum case (see also in Figure 5).

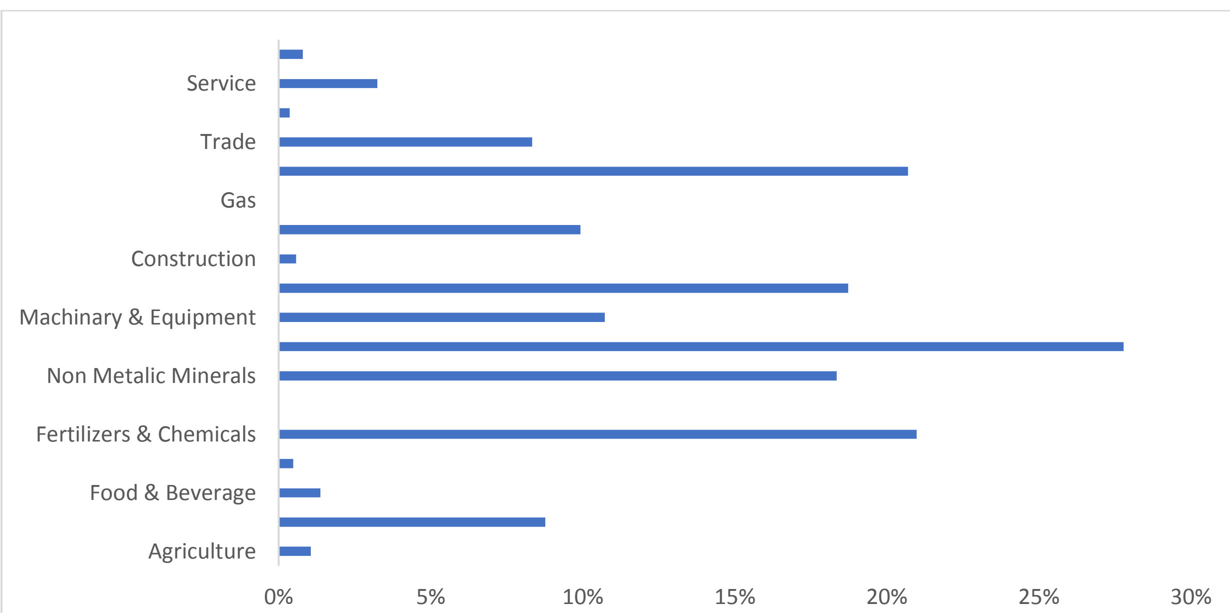
Figure 9. Impacts on other macroeconomic variables (% change from the base year)



(iv) Sectoral/commodity Impacts

Sectoral results reflect the electricity intensity of each sector, which is the main factor influencing the impact of subsidy removal or price increases. However, this is not the only factor to influence the impact on sectoral output and prices since indirect impacts mediated through other inputs (which are affected by the increase in electricity prices) can be expected to play a role in the overall impact as well. For example, activities that consume a lot of metals or chemicals which are both electricity intensive, may also see large effects even if their own direct electricity use is relatively low. Figure 10 below is derived directly from the social accounting matrix used in this study.

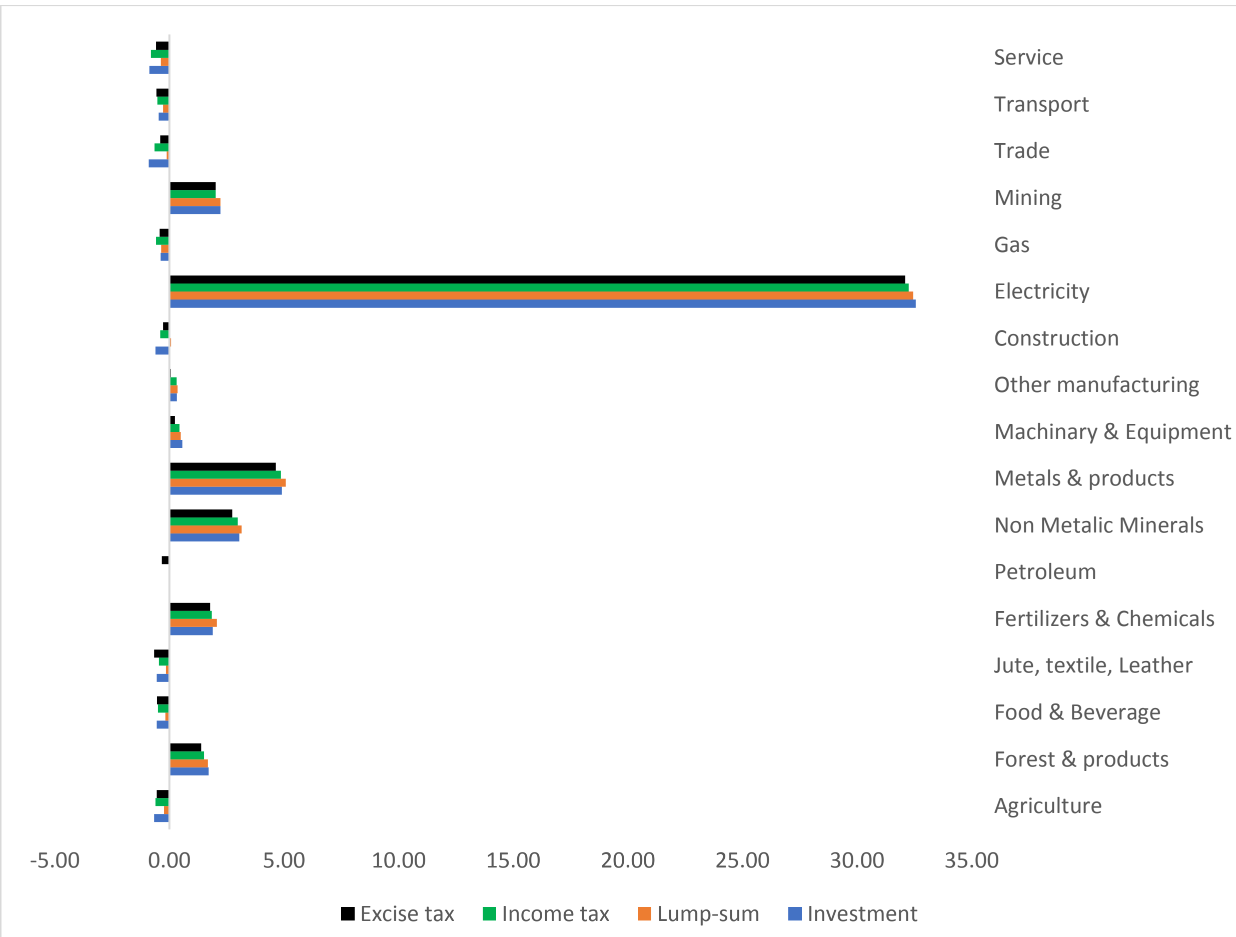
Figure 10. Share of electricity in the total consumption of goods and services by various sectors in 2012 (%)



Impact on sectoral prices

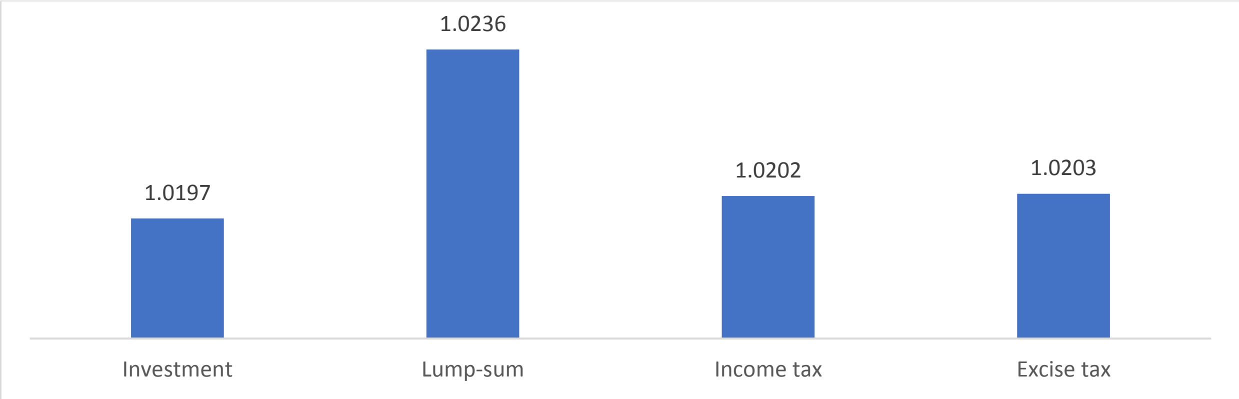
Figure 11 shows the impact on commodity prices (inclusive of taxes and subsidies) of electricity subsidy removal. Note that the original (before subsidy removal) price of electricity was 30% lower due to the direct subsidy on electricity. When the subsidy is removed, the final electricity price increases by 32 to 34% depending upon the scheme to recycle the budgetary savings within the economy. This increase in electricity prices would cause an increase in commodity prices, especially of those commodities produced from electricity intensive industries (e.g., metals and fabricated metals, minerals, fertilizers and chemicals, furniture). The change in prices differs in magnitude and direction under different recycling schemes because the second-round effects of the redistribution scheme in different scenarios can be large. For example, transfers to households will raise demand for goods consumed by households, while if money is recycled into investment it is investment goods whose demand and prices will rise. Interactions of policies among the economic agents would vary significantly under different recycling schemes.

Figure 11. Impacts on consumer prices (% change from the base year)



The aggregate change in commodity prices due to the removal of the subsidy on electricity is reflected in the consumer price index (CPI), as shown in Figure 12. The CPI increases by 2.36% when the budgetary savings are recycled through a lump-sum transfer to households; the impact is not significantly different in the other recycling scenarios.

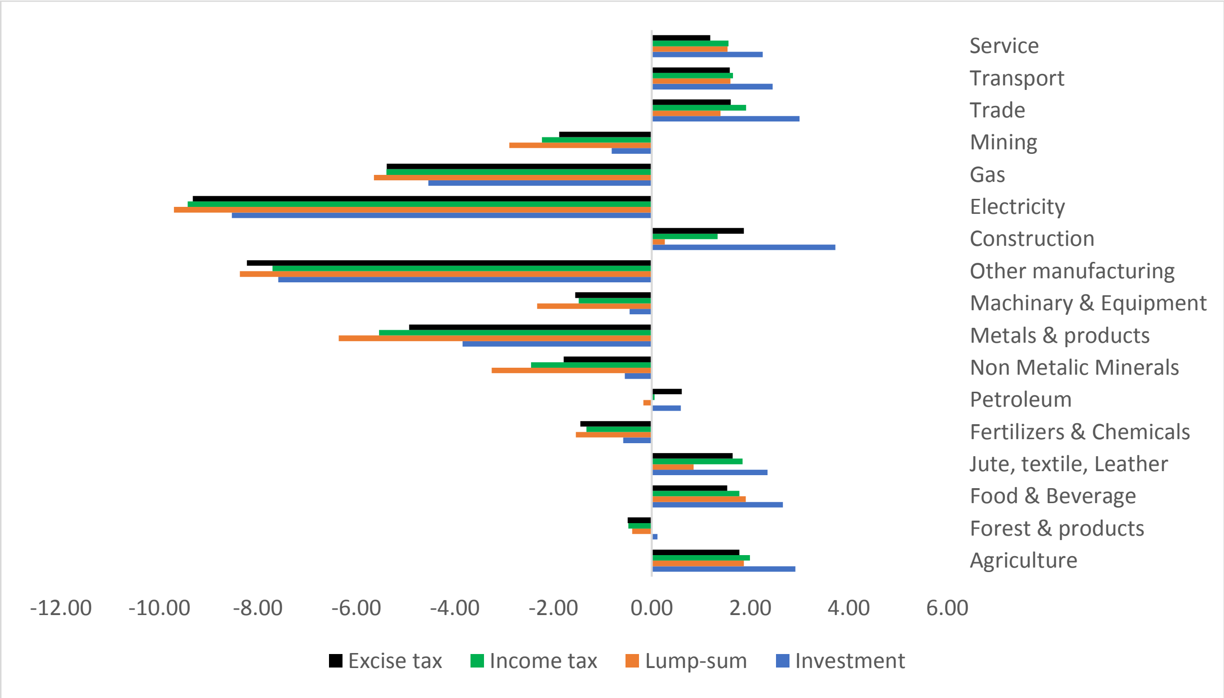
Figure 12. Impact on consumer prices (% change from the base year)



Impact on sectoral outputs

The removal of the electricity subsidy, which was 30% of the value of total output in the electricity sector, would reduce electricity output by 9 to 10% depending upon how the saved subsidy is recycled to the economy. Sectoral outputs of electricity intensive industries would also drop significantly (Figure 13). On the other hand, sectoral outputs of sectors relatively less electricity intensive would increase (e.g., agriculture, food and beverages, jute, textiles and leather, transport).

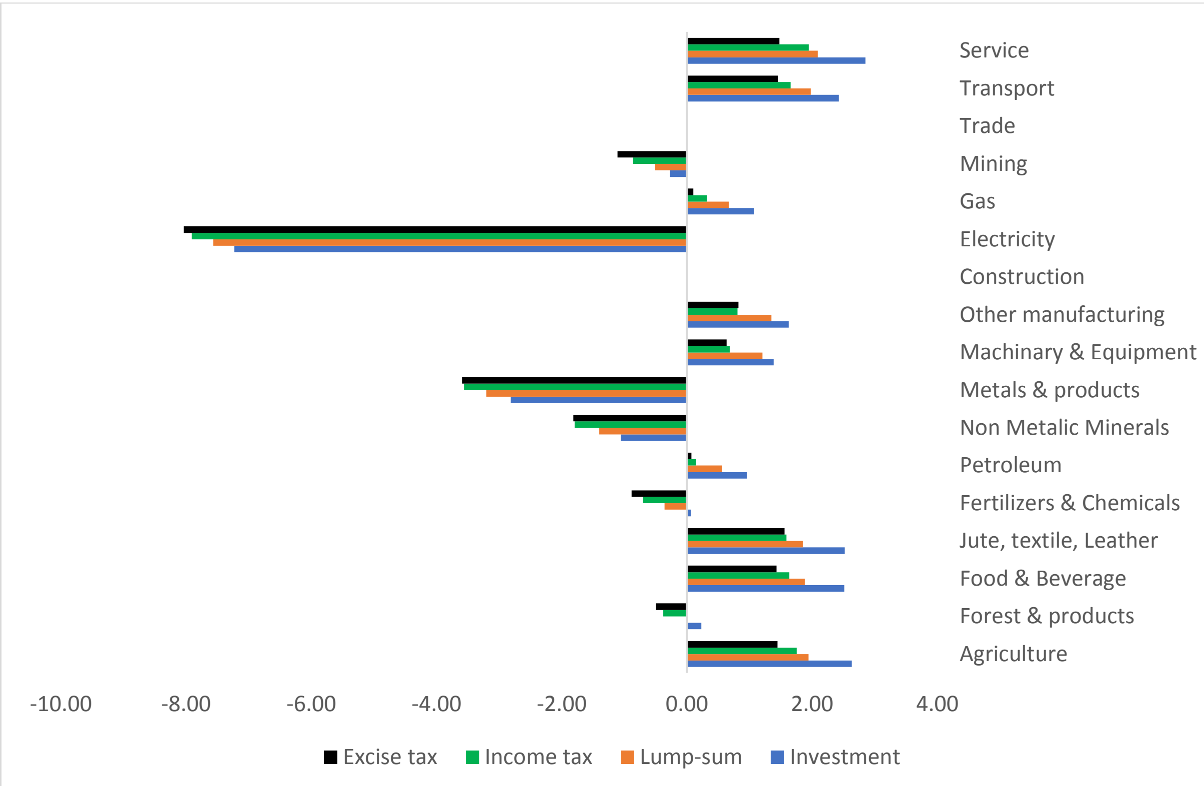
Figure 13. Impacts on sectoral outputs (% change from the base year)



Impact on household demand for goods and services

Household demand for goods and services that are relatively less electricity intensive (agriculture, food & beverages, jute, textiles and leather) would increase and vice versa (Figure 14). A small substitution of electricity with gas is also observed.

Figure 14. Impact on household demand for goods and services (% change from the base year)



Impacts of natural gas price increase

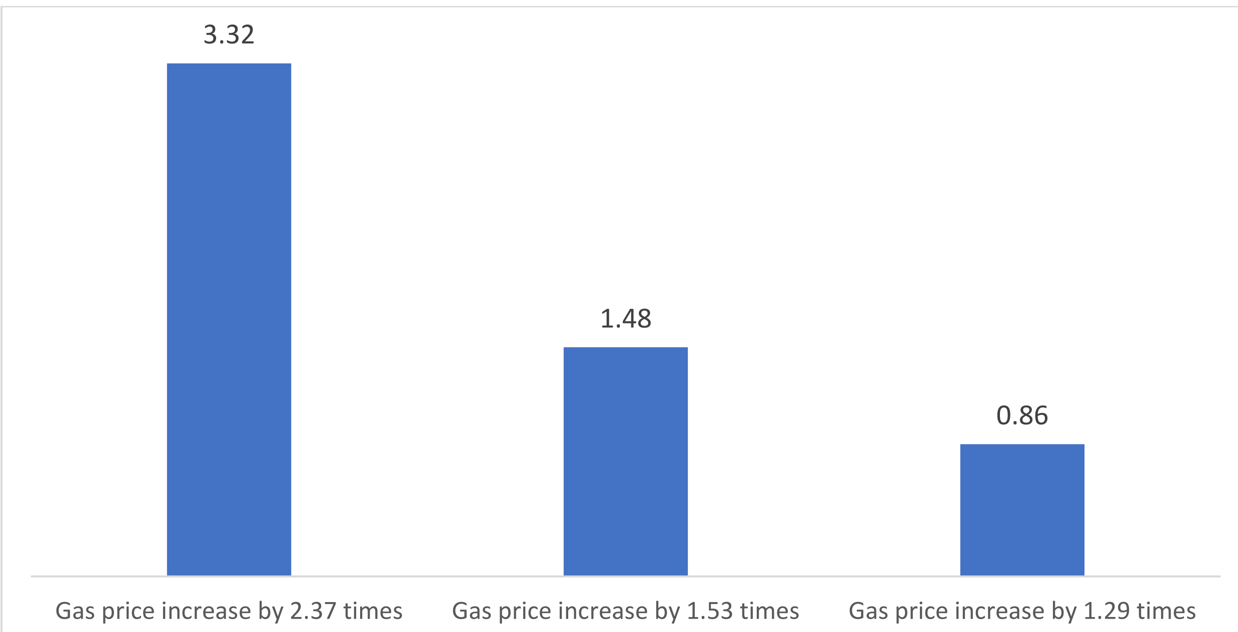
Table 3 shows how much the weighted average price of natural gas would need to be to ensure that the entire supply of gas is priced at its opportunity cost, which is proxied by the price of imported LNG in India. The policy shock analyzed is increasing the price of domestically produced natural gas to equal that of imported LNG. It is assumed that the full price of imported LNG will be passed through to consumers since the fiscal burden of subsidizing it at the price level of domestically produced gas would be huge. The magnitude of the increase in the weighted average price of gas depends on the mix of domestically produced gas and LNG, which will be imported into Bangladesh, starting in 2018.

It would be more appropriate to see how the economic impact of imposing the increase in the domestic price of gas varies at different points in time given the evolution of the baseline weighted average price of power. For illustrative purposes the impact on GDP of three cases is examined below (see Figure 15): (i) increasing the weighted average price by 2.37 times (required to reach the LNG import price in 2018); (ii) increasing the weighted average price by 1.53 times (required in 2025); and, (iii) increasing the weighted average price by 1.29 times (required in 2030, the end of the time horizon for this study). For the comparison, we have assumed that revenues from the increase in gas prices are recycled to households as a lump-sum rebate. In all instances, this is a static analysis comparing two discrete points in time. The results indicate what would happen to the economy if the weighted average gas price is increased by different multipliers (e.g., 1.29 times, 1.53 times, etc.) and the additional revenue generated from the gas price increase is recycled within the economy.[13]

(i) Impact on GDP

The model shows that there would be a net positive impact on GDP because of the significant Government revenues generated on account of the increased price of gas which are then injected back into the economy.

Figure 15. Impact on GDP of natural gas price increase by level of price increase



Note that the impact on GDP of the policy of increasing the price of natural gas to its opportunity cost is higher than when the subsidy to electricity is eliminated. This is because the volume of government revenues recycled to the economy under the first case is much higher than that under the case of the removal of the subsidy to electricity.[14]

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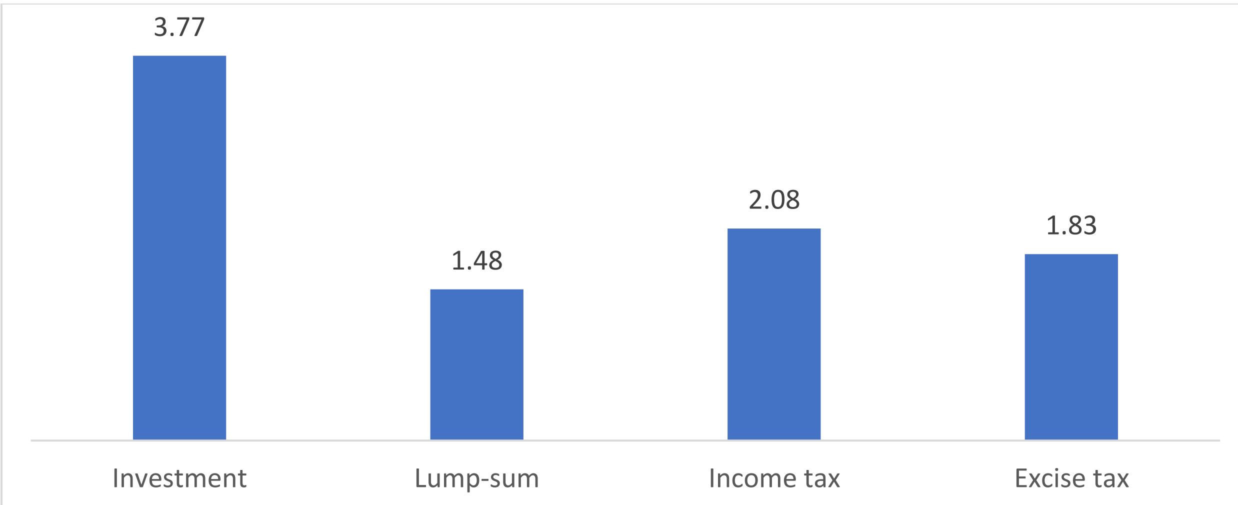
[13] The three cases/years are not linked and we have used the same SAM for all the analysis. In other words, the economic structure is assumed not to change significantly over the next 15 years. This is a strong assumption and the results should be interpreted with caution. Ideally, we would develop a baseline that would reflect the evolution of the structure of the economy over time. This is left for a future extension of this work.

[14] In the case of electricity we simply remove the budget transfer to the sector and let the increased price feed through the economy; the fact that the gas is subsidized by being priced at a level so far below its opportunity cost is not taken account of. Gas is not a big user of electricity so the impact of the price increase in electricity on gas production is not significant. In the case of gas, when the price of gas is increased that feeds into electricity production and affects sectors that use electricity as well as all the sectors that use gas.

Figure 16 shows how the impact on GDP varies by recycling scheme in the case when the gas price is increased 1.53 times.

Figure 16. Impact on GDP of natural gas price increase under different schemes for recycling the revenues generated, assuming the price is increased 1.53 times



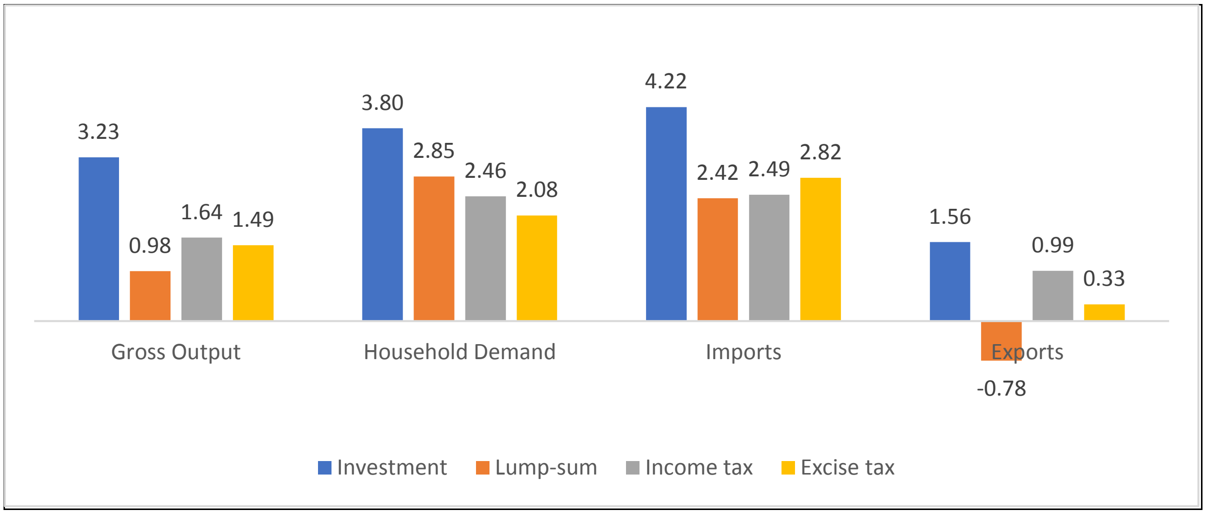
The ranking of revenue recycling schemes is similar to that in the electricity subsidy removal case. Re-investing the increased revenue would benefit the economy most, followed by cutting existing personal and corporate income taxes with the gains from a lump-sum transfer to households being least beneficial.

(ii) **Impact on key economic variables**

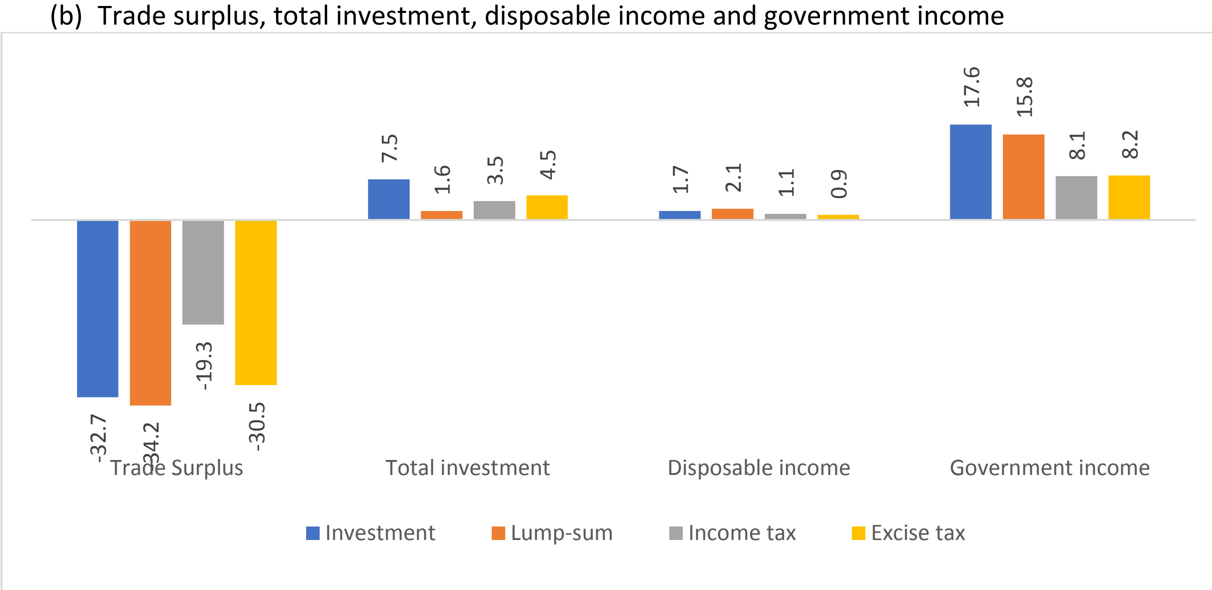
The pattern of impacts on other economic variables are also similar to that seen in the case of electricity subsidy removal. Please see Figure 17 (a) and (b).

Figure 17. Impacts of natural gas price increase on key economic variables when gas price is increased 1.53 times

(a) Gross output, total household demand, total trade of goods and services



(b) Trade surplus, total investment, disposable income and government income



(iii) Sectoral impacts

Impact on commodity prices

Figure 18 presents the impact on commodity prices when the weighted average gas price is increased 1.53 times (i.e., a 53% increase over the baseline). The increase in the price of electricity would be 30%. The changes in final prices are not significantly different across the revenue recycling schemes. The prices of other gas and electricity intensive sectors (e.g., fertilizers and chemicals, metals and non-metals) are also seen to increase, in line with the gas intensity of sectors and households depicted in Figure 13. The relative prices of goods and services which are less gas and electricity intensive will drop, but these drops are, however, quite small (less than 1%).

Figure 18. Impacts on commodity prices of 53% increase of gas price

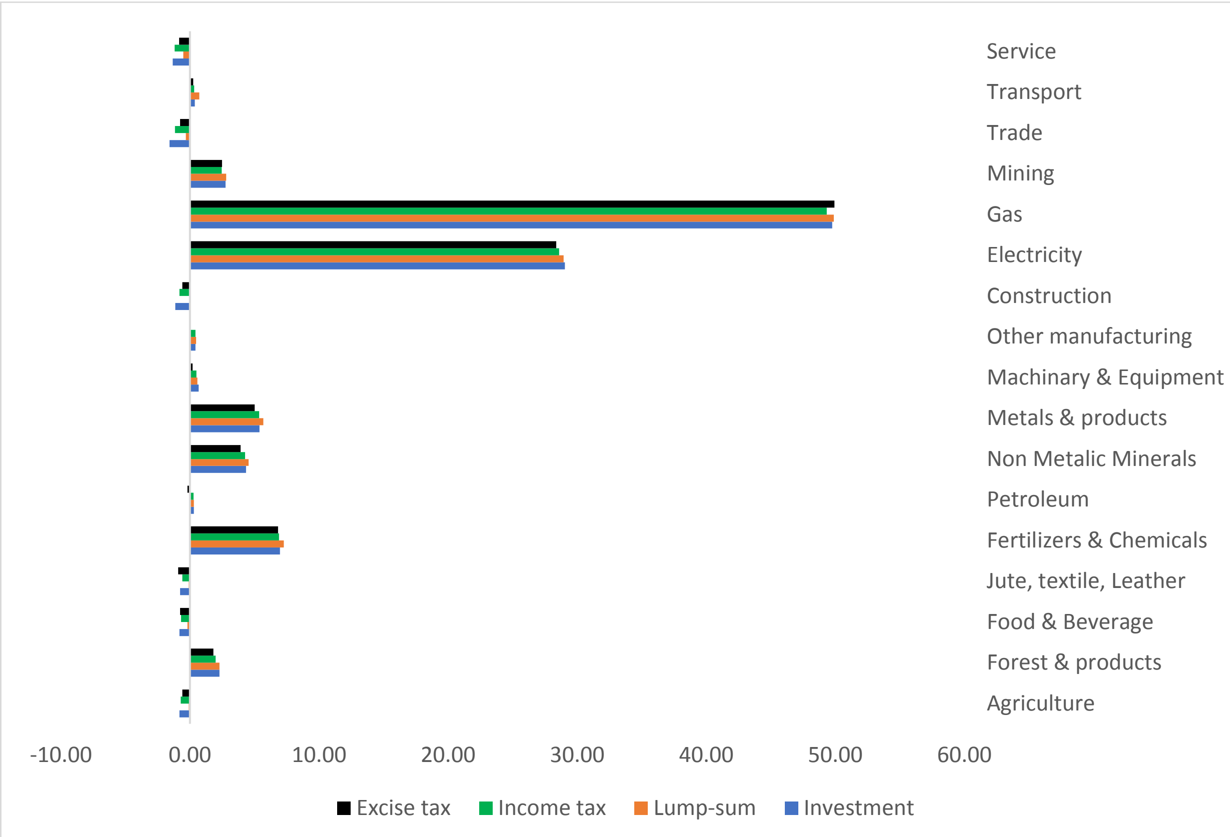
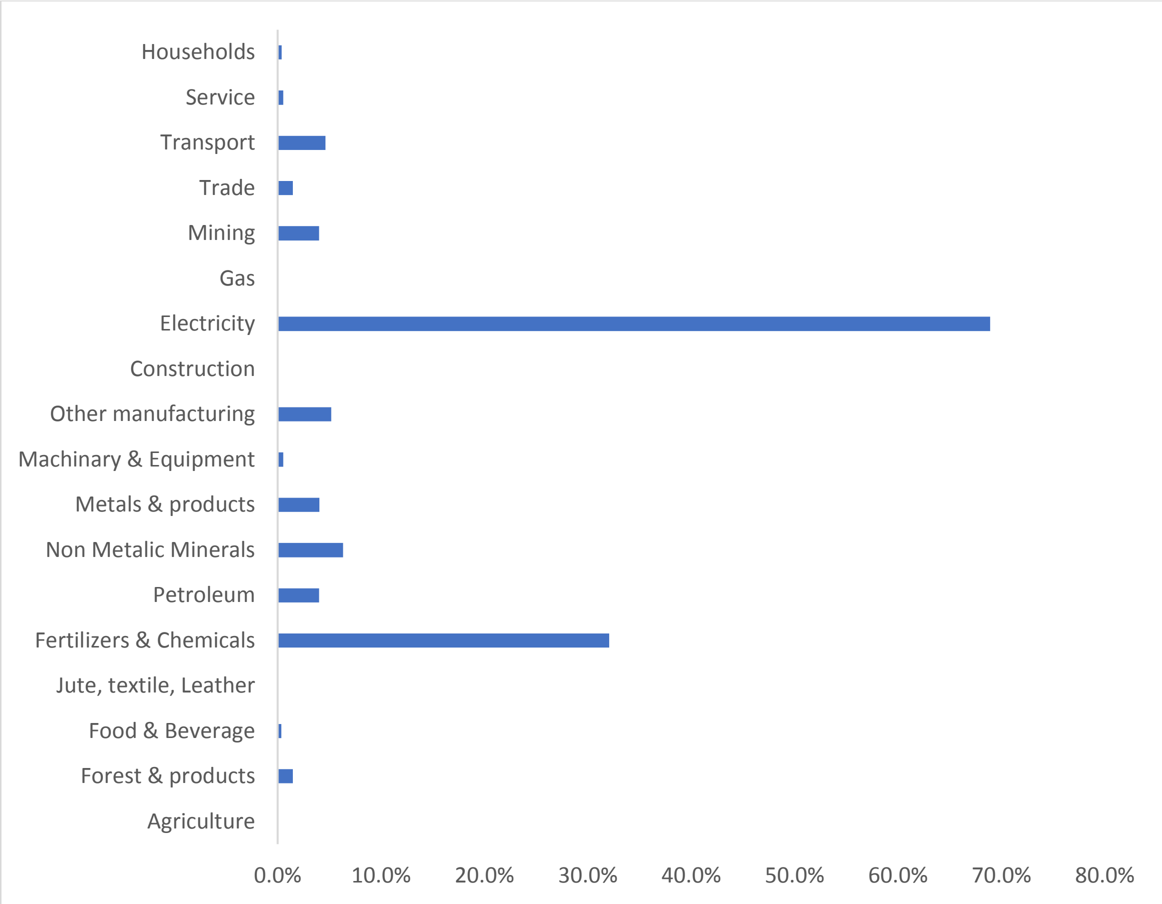


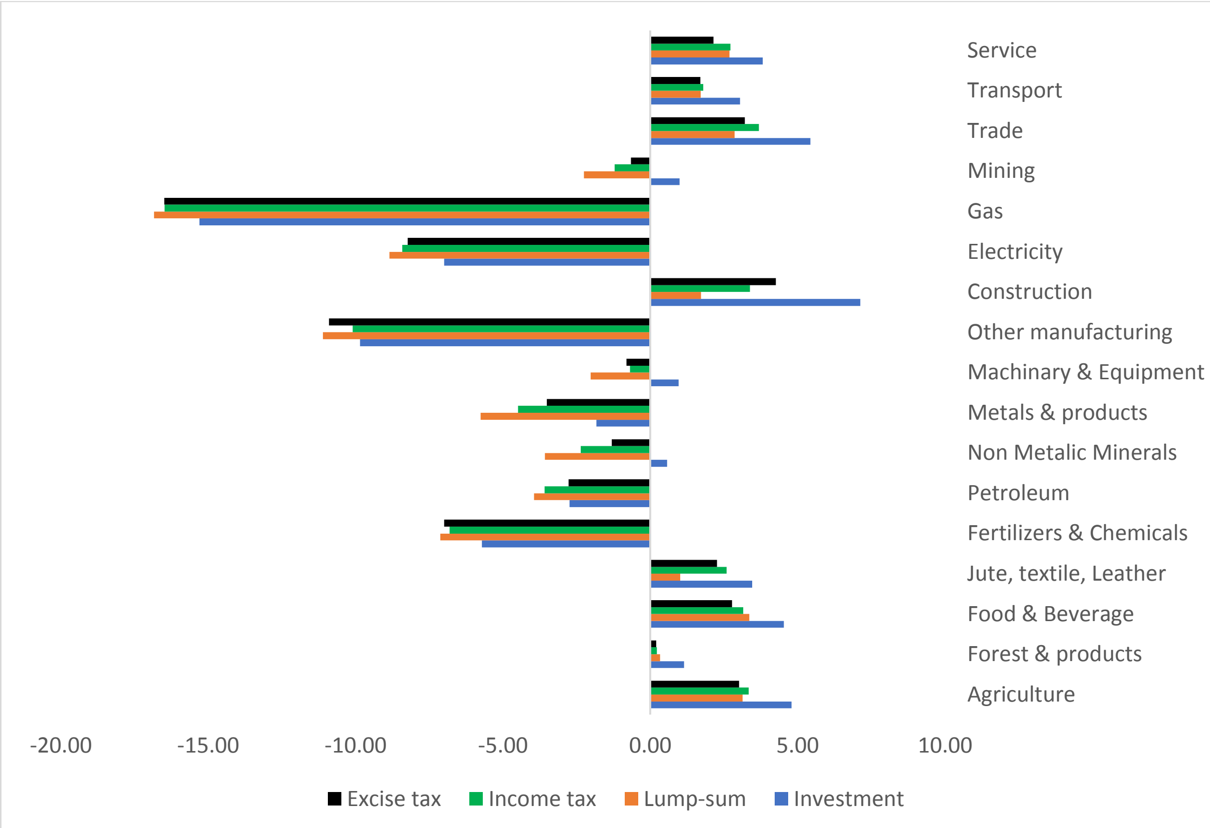
Figure 19. Share of gas (as an input) in total consumption of goods and services by sectors and households in 2012 (%)



Impacts on sectoral outputs

The impacts on sectoral outputs of a 53 percent gas price increase are presented in Figure 20. The 53% increase in gas price would cause a decline of 15-16% in gas demand and supply in the equilibrium, depending on the revenue recycling scenario. Electricity output would drop by 7-8% again depending on the revenue recycling scenario. Consistent with the price changes shown in Figure 18 above, sectoral outputs of gas and electricity intensive industries would also drop.

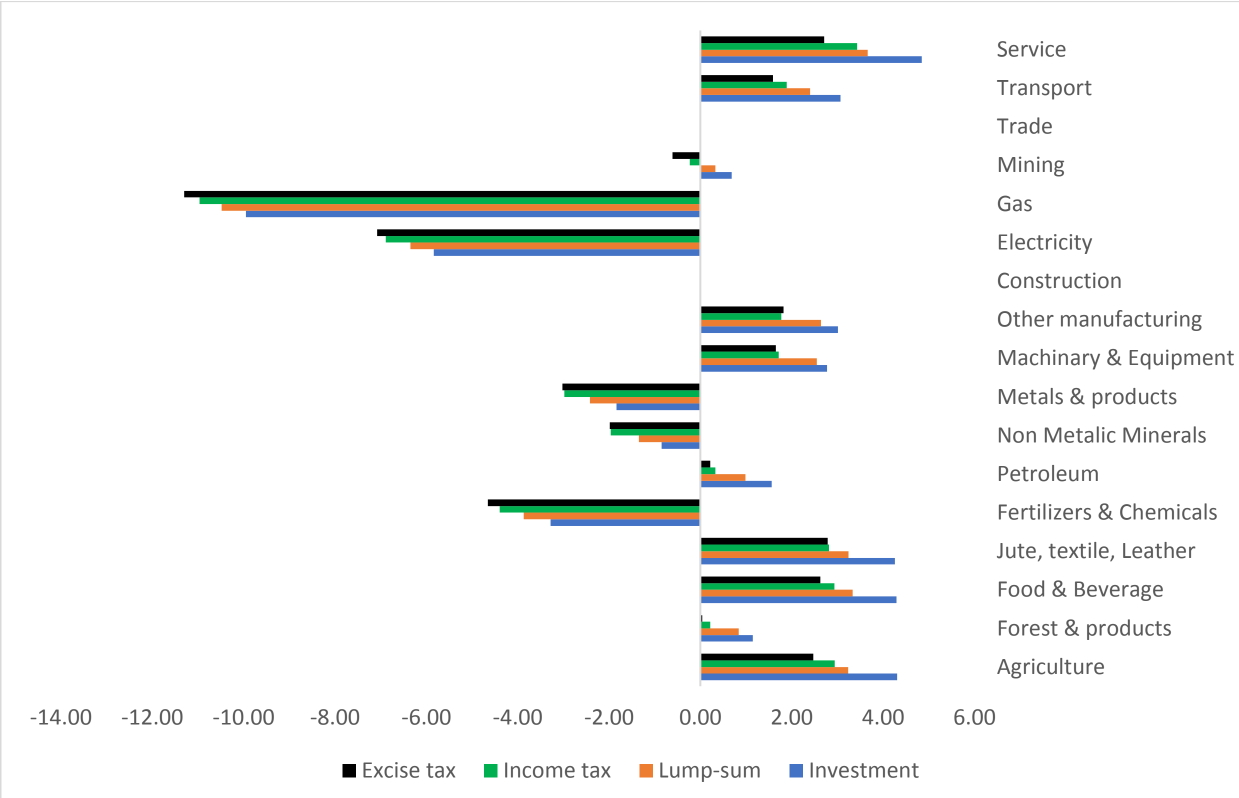
Figure 20. Impacts on sectoral outputs of a 53% increase in gas price



Impacts on household consumption

Impacts on household consumption of a 53% increase in gas price are presented in Figure 21. The increase in the price of gas would cause a 10-12% drop, depending on the revenue recycling scenario, in household gas demand. Electricity output would drop by 7-8%, again depending on the revenue recycling scenario. Consistent with the prices changes shown in Figure 18 household consumption of products from gas and electricity intensive industries would also drop.

Figure 21. Impacts on household consumption of 53% increase of gas price



IV. Conclusions

Removal of electricity subsidies or increasing gas prices has a negative impact on producers and consumers as electricity and gas become more expensive than before. This analysis has shown, however, that the net impact on key economic indicators of both policy shocks is positive. Removing electricity subsidies frees up budgetary resources and pricing domestically produced gas at the international price of gas generates additional revenues for the state, both of which, when returned to the economy, boost demand. The size of the stimulus is so large that it outweighs the short-term negative impact of the increase in price of electricity and gas, respectively, which, as key inputs would put pressure on economy-wide production costs and on consumption in a cascading effect.

Key to maximizing the impact on GDP and its constituents is the route chosen for recycling the budgetary savings/revenues generated. This study has shown that if the savings from electricity subsidy removal are recycled in the form of investment in productive sectors, it would increase GDP and economic welfare and improve the trade surplus. Similar impacts are seen in the analysis of a hike in gas prices, but to understand the full impact of pricing gas at its opportunity cost would require a dynamic model, which is left for a future effort.

It is worth emphasizing that the static analysis undertaken here shows the full impact of the policy changes imposed, i.e., the percent change from the baseline once the economy has fully adjusted to the new prices for electricity and gas respectively. The static model does not specify the period over which this transition occurs, but it is likely to be longer than one year since different sectors will shrink or grow at different rates as they adjust to the prices they face and, given that capital is sunk, as long as firms are covering their operating costs they will continue to operate (and could potentially keep growing albeit at a slower rate than before). It is only after their capital is fully depreciated and not replaced by new investment that the new equilibrium generated by the model in terms of industrial closures, etc., will be achieved. [15]

Depending on the speed of adjustment in different sectors, the impact of the shock on the economy could be more or less disruptive and warrants consideration of a glide path to the new equilibrium. Given the magnitude of GDP and sectoral impacts (considerably higher for the gas policy change than for electricity), and the fact that for gas the deviation from baseline and impact is likely to be lower in outer years, a gradual reduction of subsidies as opposed to a big bag seems reasonable. Of course the gains to the budget will be lower but the political and other costs of reform will also be more manageable.

The impacts (on prices and outputs) are likely to be dislocative in many sectors. Particularly for the sectors that are hardest hit by the increase in gas price, such as manufacturing (output decline of 10%), fertilizers and chemicals (declines of ~7%), metals and petroleum (~5%), transition support is likely to be essential. Even starting from a low base and acknowledging that these may not have been sectors of greatest competitiveness for Bangladesh, the size of declines is significant and will need to be managed with sensitivity through active support for social safety net extension, retraining, and similar initiatives. Several of these same sectors would also be negatively impacted with the removal of electricity price subsidies alone so the same approach would apply there as well.

A distributional analysis of the impacts of overall and sectoral price adjustments is an important supplement to the macro-economic analysis presented here and will be carried out as a follow-on activity. This is essential to provide a more complete understanding of the poverty and welfare implications of the policy changes discussed, and thus an important input into formulation of appropriate safety net or other schemes to mitigate the impact, even if transitory, on vulnerable sections.

A clear take-away from this analysis, however, is that there is a tremendous opportunity cost to the subsidies to electricity and gas being provided by the Government and welfare could be enhanced by redirecting the spending to more productive channels as outlined by the recycling schemes presented here.

[15] We are indebted to Andrew Burns for this and the following points on managing the sectoral impact of the policy changes analysed.

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