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Effects of TRAIN fuel excise taxes on goods and prices

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In January 2018, the first package of the Tax Reform for Acceleration and Inclusion (TRAIN 1) Law took effect. Among others, it adjusted income brackets and personal income tax rates, excise tax rates, and value-added tax coverage. The increase in excise taxes in selected commodities is a complementary measure to the reduction of personal income tax rates. Specifically covered by excise tax adjustments are fossil fuels and petroleum products, automobiles, and sugar-sweetened beverages.

Like in many countries, excise taxes are imposed on fossil fuel products due to their negative spillovers to society arising from carbon dioxide (CO_2) emission, which is associated with global warming and climate change. The policy, however, does not exist in a vacuum and the short-run inflationary costs of higher fuel prices seem too high despite potential long-run benefits.

This *Policy Note* discusses the impacts of the increase in excise tax rates for fossil fuels under TRAIN 1 on productive activities and prices across the economy.

Assessing TRAIN impacts using CGE analysis

A computable general equilibrium (CGE) analysis was used to assess the impacts of the additional excise taxes under the TRAIN Law on productive activities and on prices across the economy. The CGE analysis, developed from the Arrow-Debreu (1954) Walrasian general equilibrium framework, is a tool that assesses all the direct and indirect effects of a policy reform. For instance, an increase in taxes on consumer goods raises the prices of goods for households and reduces the demand for these goods. This would then affect firm production and subsequently affect the demand for firm factors, including labor, thereby affecting employment and household incomes, which further affects the demand for goods. Capital is then also affected as decisions to postpone investment may result from the decline in terms of firm production. The economic flows are illustrated in Figure 1, which models the economy as a set of simultaneous optimization problems in equation form.

To assess the impacts of the fuel excise taxes under TRAIN, these economic flows are then translated into a macroeconomic database called the Social Accounting Matrix (SAM). The database contains actual data for a given period and its location in the matrix indicates the flow from one sector (i.e., the column account) to another (the row account). On the aggregate, the SAM therefore ensures that the total receipts of one sector

is equal to its total disbursement. To put it simply, the SAM can be considered an expansion of the input-output table that requires for the accounting of all income and expenditure in an economy, thereby necessitating a balanced square matrix.

In this study, a 2015 SAM is constructed from various data sources, including data from the National Income Accounts, the Family Income and Expenditure Survey, the annual survey of establishments, the government fiscal accounts, the balance of payments, and the flow of fund matrix for that year.

The data from SAM is then fed into the CGE model—the set of simultaneous equations—through a programming tool. The model used in this study is computed numerically using the Mathematical Programming System for General Equilibrium Analysis (MPSGE) through the Generalized Algebraic Modelling System software and the PATH solver. As noted above, in the MPSGE system, the underlying algebraic formulation of the functional forms need not be programmed into the system, and thus, only the general format of the underlying economic behavior and flows should be specified.

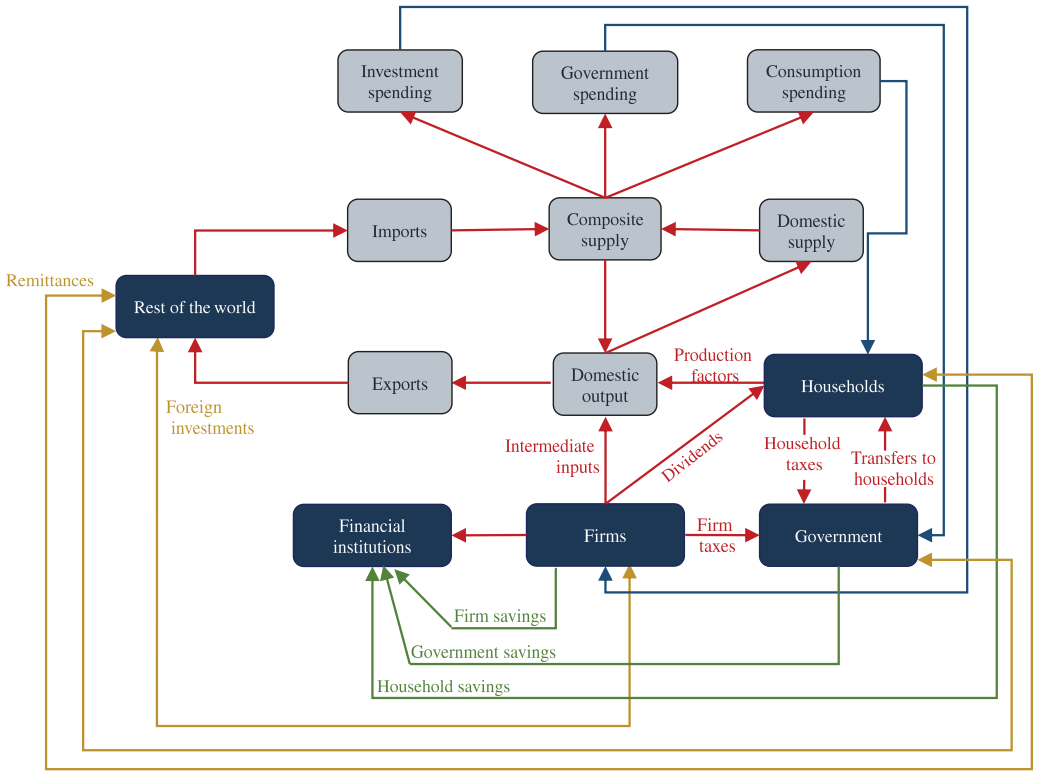
Simulation scenarios

Three scenarios were assessed in this study. The first scenario focused only on the changes in excise taxes in coal and petroleum while the second scenario included other salient features of TRAIN 1. The last scenario focused on the impacts of TRAIN 1 plus the provision of an unconditional cash transfer to the poorer half of families in the country provided under the law. Given that the CGE model requires ad valorem tax rates, there was a need to translate both the old and the new specific tax rates into their ad valorem counterparts.

Scenario 1

In the first scenario, the coal mining sector will experience an increase in excise tax from PHP 10 per metric ton to

Figure 1. Economic flows in a computable general equilibrium model



Source: Modified from Markusen and Rutherford (2004)

Table 1. Summary of changes in tax rates, excise tax rates, petroleum, and coal under TRAIN

Sectors with excise taxes	Estimated change in tax rate (%)
Mining	100.00
Coal	1,400.00
Crude oil	100.00
Petroleum	281.01

TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations.

PHP 150 per metric ton by 2020, which constitutes a 1,400-percent increase in the specific tax rate (Table 1).

In this case, all nonmetallic and metallic mineral products will be subjected to 4-percent increase in excise tax from 2 percent, which is equivalent to a 100-percent rise in the ad valorem rate. Similarly, the mining of indigenous petroleum (i.e., crude oil), previously subjected to 3-percent excise tax, will now be subjected to 6 percent, also equivalent to 100-percent increase in the ad valorem rate.

Scenario 2

In the second scenario, scenario 1 is extended by including changes in other excise taxes, changes in the value added tax, and the revision of personal income tax schedule. Another industry affected by TRAIN 1 is the beverage and tobacco sector. The sugar-sweetened beverages were targeted as new source of excise tax collection as a step to curb health issues related to overconsumption of sugar.

Table 2. Summary of changes in tax rates, excise tax rates, and other commodities under TRAIN

Sectors with excise taxes	Estimated change in tax rate (%)
Beverages and tobacco	37.17
Transport equipment	146.58

TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations.

As such, the weighted increase in ad valorem of beverages and tobacco is 37.17 percent. To simplify, only the first price range was considered, which experiences a substantial increase in ad valorem excise from 2 percent to 10 percent bringing about 400-percent change. Since the manufacture of vehicles is 36.44 percent of the entire transport equipment manufacture sector, the weighted increase in ad valorem is 146.58 percent (Table 2).

To compute the new tax due under the TRAIN, data from the 2015 Family Income and Expenditure Survey (FIES) (PSA 2015) were used. Total income was distributed among working household members and tax rates were applied to estimate the tax due per person (Table 3).

Table 3. Reduction in income tax rates under TRAIN

Decile	Tax Revenue (millions PHP)		Estimated Total Income per Decile (millions PHP)	Effective rates		
	Old	TRAIN (end game)		Old	TRAIN	Estimated % Change in Tax Rate
1	139.72	2.54	126,145.29	0.111	0.002	98.2
2	732.89	2.09	199,650.12	0.367	0.001	99.7
3	1,543.97	9.17	254,135.44	0.608	0.004	99.4
4	3,213.58	5.63	308,565.23	1.041	0.002	99.8
5	5,600.35	7.15	371,437.86	1.508	0.002	99.9
6	11,218.40	25.93	452,633.09	2.478	0.006	99.8
7	20,917.56	371.96	565,353.17	3.700	0.066	98.2
8	41,836.66	4,744.44	725,575.49	5.766	0.654	88.7
9	92,268.40	18,353.80	999,842.85	9.228	1.836	80.1
10	339,198.26	117,897.06	2,064,823.94	16.427	5.710	65.2
Total	516,669.78	141,419.78	6,068,162.49			

PHP = Philippine peso; TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations

In estimating the impacts of changes in personal income tax, the categorization of households into deciles in the 2015 FIES is utilized. In using deciles, the 2015 FIES ranks all households according to total income or per capita income and then divides them into 10 groups. Households belonging to the first decile are those in the lowest 10 percent of all households in the Philippines according to the household's total income. This means that the tenth decile refers to the richest 10 percent of all families according to total income.

Scenario 3

The last scenario considers all the salient features of TRAIN 1 discussed above plus the introduction of the PHP 3,600 annual (or PHP 300 pesos per month) per family unconditional cash transfer subsidy provided to the poorest five income deciles under the law and implemented under the Memorandum Circular 3, series of 2018, of the Department of Social Welfare and Development. Similar to the tax scenario above, the scenario considers the "end game" as the government will be providing this subsidy for 2019 and 2020.

Simulation results on output, supply, and prices

Utilizing the three scenarios described above, a summary of the results of the CGE model in terms of changes in domestic output, domestic supply, and prices for each of the sectors is shown below. The results highlight changes in all the eight electricity sectors. On the other hand, the impacts on the rest of the 36 sectors are ranked and separated in terms of which sectors experience a decline or an increase.

Effect on sectoral output

Tables 4a and 4b show the changes in production output based on the various scenarios discussed above. Ranked in ascending order based on the first scenario, results from the petroleum and coal excise tax simulation showed that the sectors affected by the increased commodities tax rates were the ones that suffered from a significant decline in output, including the following: petroleum and other fuel products (-4.3%), coal (-1.3%), and crude oil (-1.4%). Scenarios 2 and 3 bring improvement for the electricity sectors, albeit differences between the results of these two scenarios are not significant. For the rest of the sectors, scenarios 2 and 3 bring mixed results. Notable is the significant decline in manufacturing of engines and turbines.

Table 4a. Changes in production output of electricity sectors under TRAIN

Sector	% change from the base		
	Scenario 1	Scenario 2	Scenario 3
Electric transmission	-0.1	0.8	0.9
Coal power generation	-0.1	3.5	3.8
Natural gas power generation	-0.4	5.1	5.9
Hydroelectric power generation	0.0	0.6	0.7
Wind power generation	0.0	0.6	0.7
Oil power generation	-2.5	1.5	1.6
Solar power generation	0.0	0.4	0.5
Other energy generation	-0.5	0.8	0.9

TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations

Effect on domestic supply

The changes in domestic supply, which include both domestic production and imports, are presented in Tables 5a and 5b. Also ranked in ascending order based on first scenario, the changes in domestic supply followed the same trend as the changes in domestic production. Scenarios 2 and 3 also bring improvement for the electricity sectors. In this set of results, the slight decrease in domestic supply in the first scenario can be explained by foreign exchange devaluation, in the case of excise tax imposition, which reduced the amount of imports for many of the industrial and service sectors. For example, the reduction in petroleum supply was more than five percent, but the reduction in domestic output was only slightly above four percent.

On the other hand, there is a revaluation in the full TRAIN 1 (Scenario 2) that caused the domestic supply to decline marginally, subsequently decreasing the amount of imports in many of the sectors, although the change

Table 4b. Changes in production output in other sectors under TRAIN

Rank	Sector	% change from the base		
		Scenario 1	Scenario 2	Scenario 3
Sectors with biggest decline in output based on Scenario 1				
1	Petroleum and other fuel products	-4.3	-1.3	-1.2
2	Metals (except for Iron and Steel)	-3.5	-5.7	-5.6
3	Iron and steel	-2.5	-8.1	-8.1
4	Transport services and storage	-1.8	0.5	0.7
5	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	-1.5	-43.5	-43.5
6	Crude oil	-1.4	1.2	1.3
7	Coal	-1.3	-5.2	-5.2
8	Transport equipment	-1.1	-2.5	-2.4
9	Computer, electronic and optical products	-0.9	-6.0	-5.9
10	Textile and garments, tanneries and leather	-0.8	5.2	5.5
Sectors with an increase in output based on Scenario 1				
29	Forestry	0.1	3.0	3.4
30	Wholesale and retail trade and maintenance and repair of motor vehicles	0.1	-0.2	-0.2
31	Other services, including business services, and tourism	0.1	2.4	2.5
32	Utilities, excluding electricity	0.2	1.5	1.5
33	Machineries and equipment (except for engine and turbines, etc.)	1.0	-6.9	-6.9
34	Public administration, education and health	1.1	-0.5	-0.8
35	Financial services	1.2	-4.1	-4.6
36	Telephone and communications	1.6	-1.8	-2.4

TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations

Table 5a. Changes in domestic supply of electricity sectors under TRAIN

Sector	% change from the base		
	Scenario 1	Scenario 2	Scenario 3
Electric transmission	-0.3	0.5	0.9
Coal power generation	-0.5	3.5	3.8
Natural gas power generation	-1.4	5.1	5.3
Hydroelectric power generation	-0.1	0.6	0.7
Wind power generation	-0.2	0.6	0.7
Oil power generation	-5.7	1.5	1.6
Solar power generation	-0.1	0.4	0.5
Other energy generation	-1.2	0.0	0.1

TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations

was very marginal. For example, the increase in domestic output of palay in the two scenarios was 3.6 percent and 3.9 percent, respectively; however, in terms of domestic supply, the increase was 3.35 percent and 3.5 percent, respectively. This change also holds true for the other sectors in agriculture and also in industrial and service sectors. In terms of energy output, there was no difference in the change in supply and output as the electricity transmission and generation are nontradable goods.

Effect on prices

The changes in sectoral prices were then assessed in terms of the different scenarios. Results are shown in Tables 6a and 6b. In the excise tax scenario, coal prices increased by around 0.4 percent, mining increased by 5.2 percent while petroleum increased by 8.5 percent. For this set, results are ranked in descending order according to the results of Scenario 1. Agriculture products showed a slight increase between 0.1 and 0.3 percent, including rice (+0.2%), corn (+0.2%), sugar (+0.3%), and livestock (+0.2%). Prices of metallic products, which are dependent on petroleum and energy, increased significantly at 1.9 percent, while prices of iron and steel increased at 1.6 percent. Natural gas prices increased by 2.1 percent. Among most other industrial sectors, prices increased by around 0.2 percent

Table 5b. Changes in domestic supply in other sectors under TRAIN

Rank	Sector	% change from the base		
		Scenario 1	Scenario 2	Scenario 3
Sectors with biggest decline in output based on Scenario 1				
1	Petroleum and other fuel products	-5.2	-2.6	-2.5
2	Mining and quarrying	-4.1	-0.9	-0.8
3	Crude oil	-1.6	-2.5	-2.4
4	Manufacture of engines and turbines, except aircraft, vehicle, and cycle engines	-1.5	15.5	15.6
5	Transport services and storage	-1.3	-0.5	-0.3
6	Coal	-1.2	-6.8	-0.3
7	Transport equipment	-1.1	-0.3	-2.4
8	Metals (except for Iron and Steel)	-1.0	-2.0	-2.0
9	Iron and steel	-0.9	-1.2	-8.1
10	Other manufactured goods	-0.8	0.6	-0.7
Sectors with an increase in output based on Scenario 1				
29	Forestry	0.1	2.9	3.3
30	Paper and printing	0.1	-2.3	-1.4
31	Wholesale and retail trade and maintenance and repair of motor vehicles	0.1	-0.6	0.6
32	Utilities, excluding electricity	0.2	1.5	1.5
33	Other services, including business services, and tourism	0.2	1	1.0
34	Public administration, education, and health	1.1	-0.6	1.0
35	Financial services	1.2	-4.1	-4.6
36	Telephone and communications	1.6	-2.2	-2.8

TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations

Table 6a. Changes in domestic supply of electricity sectors under TRAIN

Sector	% change from the base		
	Scenario 1	Scenario 2	Scenario 3
Electric transmission	0.1	3.4	4.7
Coal power generation	0.1	0.7	2.0
Natural gas power generation	0.8	-0.4	-2.9
Hydroelectric power generation	-0.1	4.1	5.4
Wind power generation	0.0	4.0	5.3
Oil power generation	6.4	2.3	3.5
Solar power generation	-0.1	4.5	5.8
Other energy generation	1.3	3.6	4.8

TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations

Table 6b. Changes in domestic supply in other sectors under TRAIN

Rank	Sector	% change from the base		
		Scenario 1	Scenario 2	Scenario 3
Sectors with biggest increase in output based on Scenario 1				
1	Petroleum and other fuel products	8.5	9.1	10.5
2	Mining and quarrying	5.2	-0.4	0.8
3	Natural gas	2.1	2.0	3.2
4	Transport services and storage	2.0	5.4	6.7
5	Metals (except for Iron and Steel)	1.9	1.5	2.8
6	Iron and steel	1.6	-0.1	1.1
7	Wood and wood products	0.8	-1.9	-0.7
8	Construction	0.8	2.2	3.4
9	Nonmetallic mineral products	0.7	4.9	6.1
10	Paper and printing	0.5	3.8	5.0
Sectors with a decrease in prices based on Scenario 1				
31	Corn	-0.1	1.2	1.4
32	Fishery	-0.1	1.9	2.2
33	Crude oil	-0.1	8.1	9.4
34	Paddy rice	-0.2	3.3	3.5
35	Sugarcane	-0.2	2.0	2.2
36	Livestock and other animal products	-0.3	0.9	1.0

TRAIN = Tax Reform for Acceleration and Inclusion
Source: Authors' calculations

This study finds that the increased taxes on petroleum in the country under the Tax Reform for Acceleration and Inclusion Law would have a slight impact in terms of sectoral output and prices. This means that sectors that are energy-intensive would see a slight decline in output and there would be a slight increase in poverty given heightened prices. Photo by: Brian Evans/Flickr

to 0.8 percent. But as the addition of Scenarios 2 and 3 show, the changes in prices are mixed across sectors.

Effect on carbon emissions

Lastly, the change in emissions resulting from production activities was assessed using the information on the CO_2 emission multipliers (CO_2 emissions in kilograms per PHP 1 billion output in each sector). Table 7 shows the changes in emissions across the different scenarios. The results show that under the first scenario of increased excise taxes, CO_2 emissions declined by around 0.8 percent. This was primarily due to the decline in transport service activities and the decline in the electricity-generating sector, particularly from oil and coal. Under the second and third scenarios, the improvements in output due to increased productive

Table 7. Changes in CO_2 emissions, various scenarios under TRAIN

Sector	Baseline	Scenario 1	Scenario 2	Scenario 3
CO_2 emissions	97,670.3	96,904.5	98,920.3	99,147.3
Change from baseline	0.0	-0.78%	1.28%	1.51%

TRAIN = Tax Reform for Acceleration and Inclusion; CO_2 = carbon dioxide
Source: Authors' calculations

activity resulted in carbon emissions slightly increasing by 1.3 percent and 1.5 percent, respectively.

Conclusions

This study analyzed the impacts of increased taxes on petroleum and coal in the country during increasing energy utilization. The initial results show that the excise tax component in the TRAIN 1 would have a slight impact in terms of sectoral output and prices, and therefore in household welfare through incomes and employment and in carbon emissions in the country. Sectors that are energy-intensive would see a slight decline in output and there would be a slight increase in poverty given heightened prices.

On the other hand, TRAIN 1 would increase domestic output in most industries and increase the output of power. This is due to the increased economic activity following increased consumption brought about by lower income tax rates, especially among the highest income deciles. The increased economic activity, however, would come at the expense of the welfare of marginalized groups and increased energy and carbon emissions in the country. Given that the contribution of non-fossil fuel sources of power is significantly low, any short-term increase in economic activity would favor the growth of sources of electricity that are based on oil, gas, and coal.

This leads to several considerations that policymakers must undertake in designing tax policies. While the goal of the TRAIN as a tax reform law is very commendable, which is to raise public revenues to improve the delivery of basic services and improve social and economic outcomes in the future, there are considerations that the government should make in designing tax policy. One would be the impact of the policy reform on the welfare of the poorer sectors in the country and the other would be to be able to take into consideration the impact on the targets that the Philippines must observe in terms of emissions.

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