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Fuel tax, Cross Subsidy and Transport: Assessing the Effects on Income and Consumption Distribution in Brazil

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Presentation Outline:

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2. Literature review
3. Objective
4. Data Base
5. Empirical strategy
6. Closures and Policy Analysis
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Motivation

Transport: typical consumption item in the Brazilian family budget

- Tariff and cost structures have changed with the promotion of some microeconomic policies.
- The per capita income growth, credit policies and cost measures for the purchase and use of private vehicles have contributed to a shift in modal distribution: increasing the households preferences by private transport.
- Reduction to zero of automobile production tax (known as IPI zero);
- Low price of licensing and property taxes on motor vehicles (IPVA);
- Direct subsidies such as free parking on public roads;
- Decrease of the Economic Intervention Contribution (CIDE) tax on fuel – CIDE-fuels.

Motivation

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Transport: typical consumption item in the Brazilian family budget

- POF 2008-2009: 419 BRL (average monthly transportation expenses); 421 BRL (food). That is, 16.1% of total household expenses (transportation).
- 46.1% of total spending on ground passenger services is concentrated in households with up to 2075 BRL *per capita* income, the equivalent of 5 minimum wages.
- Poorer households: larger public transport demanders/largest consumer group.
- Higher-income households: demand more private transport.
- Notably, the Brazilian experience has prioritized private transport and changed household spending patterns for the use of private vehicles.
- More than half of Brazilian households (53%) have a car or motorcycle for daily trips.

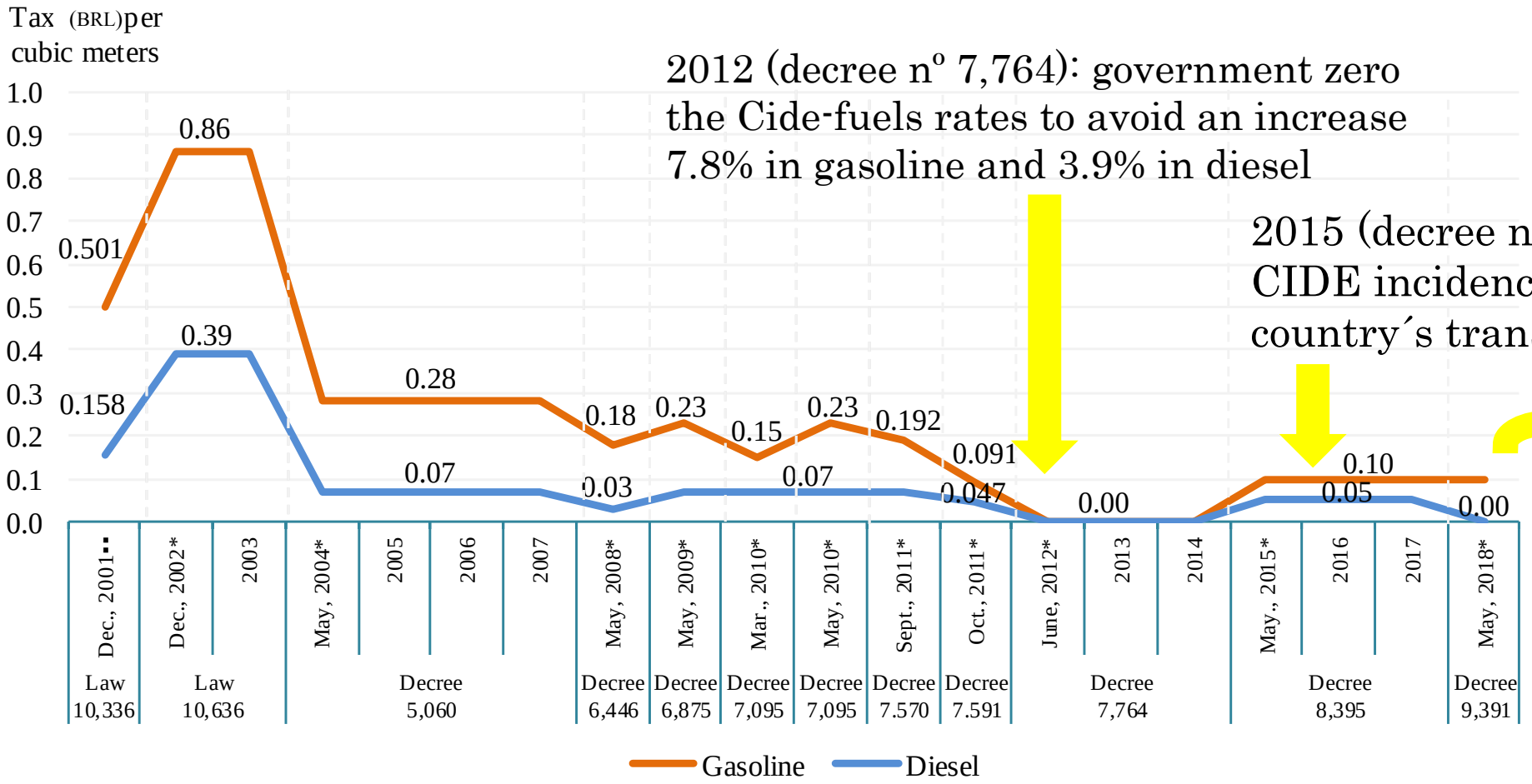
Motivation

CIDE-fuels policy in Brazil: was established in 2001

- Represents a tax on demand for domestic and imported petroleum products, such as gasoline, diesel, kerosene, fuel oils and liquefied petroleum gas.
- Fuel tax: finances the maintenance and expansion of highways or other transport infrastructure, as well as environmental and social projects to reduce and offset the negative externalities from multiple uses of roads and production at oil refineries.
- Gasoline tax sought to reduce the consumption of automotive fuels and use of private transport and improve urban transport routes, expanding public transport demand and passenger welfare.
- Brazilian government may change the Cide-fuels tax rate to reduce fuel cost pressure.

Motivation

Trajectory of the Cide-fuels rate (2001-2018)



2012 (decree nº 7,764): government zero the Cide-fuels rates to avoid an increase 7.8% in gasoline and 3.9% in diesel

2015 (decree nº 8,395): resumption of CIDE incidence directly affecting the country´s transport companies

2018 (decree nº 9,391): zero Cide-diesel due to the agreement made after the truckers´strike across Brazil

Source: Adapted from CNT (2015), according to Brazilian Constitution.

Note: ∴ Law no. 10,336/2001 and * its amendments.

Literature review: CGE approaches to passenger transport

- Bernard et al. (2018): analyze the impacts of improvements in urban transport;
- Tscharaktschiew and Hirte (2012): passenger transport subsidies;
- Xu et al. (2018): public transport subsidies;
- Dartanto (2013): elimination of fuel subsidies;
- Kim and Samudro (2019): reallocation of fuel subsidies to infrastructure investments;
- Verikios and Zhang (2015a): structural changes in Australian ports and rail freight services;
- **Brazil**: Haddad et al. (2015) assess the economic impacts of the existing underground metro infrastructure.

Objective

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- Our paper explores the links between consumption, income and transport in assessing the redistributive and economic effects of the fuel tax in Brazilian economy.

  - We developed a Dynamic CGE model which recognizes a Social Accounting Matrix (SAM).
  - Two scenarios are evaluated: **(1)** an overall cut of Cide-fuels to assess its role in economy; **(2)** the burden of the gasoline tax and reduction of the diesel tax to subsidize public transport services (cross subsidy) and influence an intermodal substitution from private transport to public transport.

Data Base: SAM

- **2010 Brazilian Social Accounting Matrix:** detailing the income generation and appropriation from different sources and structure of expenditures.
- SAM: shows the preferences of 10 representative families for 4 passenger transport services.
- The information on consumption and household income were obtained through the Consumer Expenditure Survey (POF) (POF, 2008-2009).
- Households are divided into 10 groups according to family income following Ferreira Filho and Horridge (2006).
- Compared to input-output (IO) table, a SAM shows not only the interindustry structure of the economy but the linkage between economic structure and an income generation, distribution and use by institutional sectors (Households, Enterprises, Government).

2010 Brazilian SAM

			Production	Factor input	Institution	Capital account	ROW
Production	Passenger transport	S UB STC III	Intermediate input		Final consumption	FBCF	Exports
	Non-transport goods	Other					
Factor input		K L	Value-added paid by the productive sectors		Value-added paid by the institutions	Value-added to investments	Income received from the ROW
Institution		F H G		Value-added received by institutions	Property income and current transfers		Current transfers received from ROW
Capital account		S			Savings	Capital transfers	Capital transfers received from ROW
ROW			Imports	Income sent to the ROW	Current transfers sent	Capital transfers sent to the ROW	

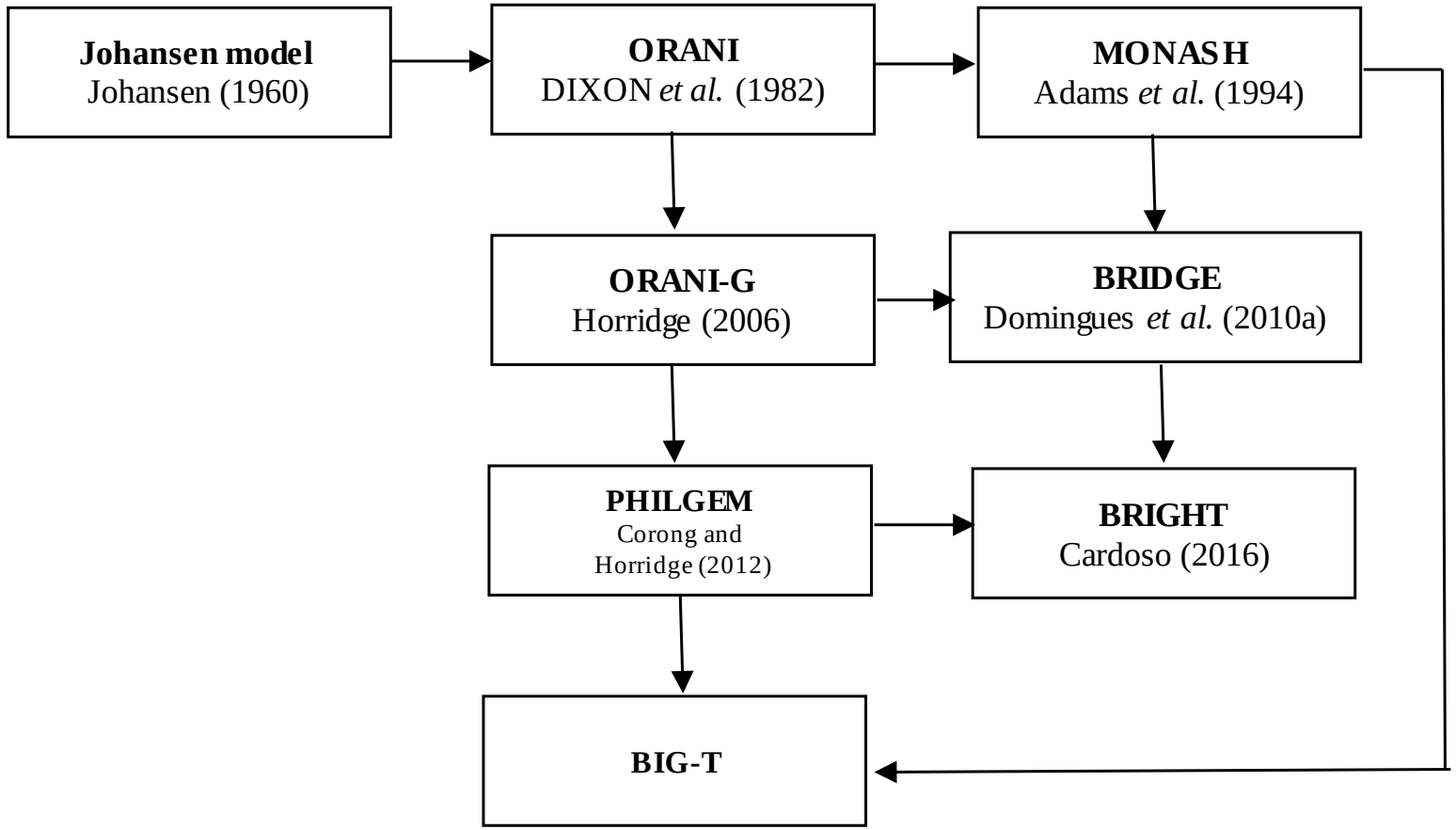
Source: Authors' own table.

- Passenger transport was disaggregated in: (1) subway (S); (2) municipal passenger road and in the metropolitan region (UB); (3) school, taxi and chartered passenger transport (STC); (4) intercity, interstate and international passenger transport (III).

Empirical strategy: CGE Model

- Our model is a dynamic recursive version (Horridge, 2012) and implements 2 intermodal substitution modules for passenger transport services (public and private transport, and urban bus services and train/subway).
- Incorporating a fiscal balance module and with transfer payments in the economy according to a SAM as a database (Corong and Horridge, 2012; Corong, 2014).
- Recursive dynamics: ability to analyse the policy trajectory over time.
- It is possible to connect and update data dynamically from the solutions of each year: it is not possible in static models.
- Model: brings innovations by incorporating SAM flows within its theoretical framework and the details of the transport markets in Brazil.

BIG-TP (Brazilian Income Generation and Transport of Passengers)

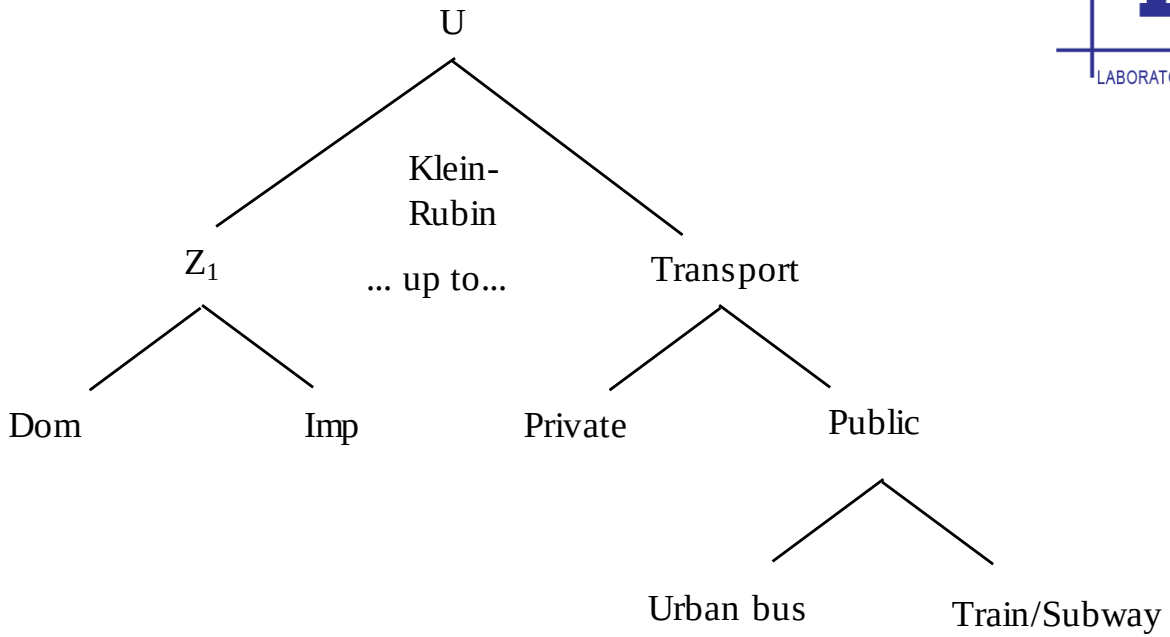


Source: Own elaboration.

General features:

BIG-TP (Brazilian Income Generation and Transport of Passengers)	
Type	National
Sectors	71
Commodities	129
Primary factors	2 (labor and capital)
Margins	2 (trade and transport)
Source of the commodities	2 (Domestic and Imported)
Institutional sectors	13 (10 households, firms, government and rest of the word)
Database	SAM database was calibrated for Brazilian economy's data from 2010
Model's features	dynamic recursive
Operationalization	GEMPACK

Core of the model



Source: Authors' own table.

- **Public transport**: a substitution is imposed between urban bus and train/subway, following Lennox and Adamns (2016), based on the approach of Bruvoll and Larsen (2004).

- The substitution via relative prices between passenger services (**private and public**) follows Alfsen et al. (1996), Bruvoll and Larsen (2004), Steininger et al. (2007), Kalinowska and Steininger (2009), Kalinowska (2010), Lennox and Adams (2016).

Closures and Policy Analysis:

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Real variations (%) of baseline shocks

Indicators	Observed								Prospective projections
	2011	2012	2013	2014	2015	2016	2017	2018	2019-2030 (year-to-year)
GDP	3.97	1.92	3.00	0.50	-3.55	-3.46	1.00	1.70	2.00
Household consumption	4.82	3.50	3.47	2.25	-3.22	-4.30	-0.60	1.50	1.50
Government demands	2.20	2.28	1.51	0.81	-1.44	-0.06	-0.56	0.70	0.70
Exports	4.79	0.27	2.39	-1.13	6.82	1.92	5.18	4.60	4.60
Investment	6.83	0.78	5.83	-4.22	-13.95	-10.3	-3.70	1.70	1.70
Population	0.97	0.94	0.90	0.87	0.83	1.00	1.00	1.00	1.00
Employment	1.47	1.41	1.56	2.86	-3.34	-2.10	2.00	2.00	2.00
Imports price index, C. I. F.	14.28	0.95	-1.17	-1.97	-11.88	-8.94	4.06	3.00	3.00
Individual income tax	3.99	0.81	-0.97	1.63	3.52	2.28	-	-	-
Corporate income tax	0.99	-1.40	-6.47	-3.07	2.86	17.18	-	-	-

Source: IBGE; Funcex; BNDES (2018).

Closures and Policy Analysis:

Hypotheses underlying the BIG-TP dynamic model

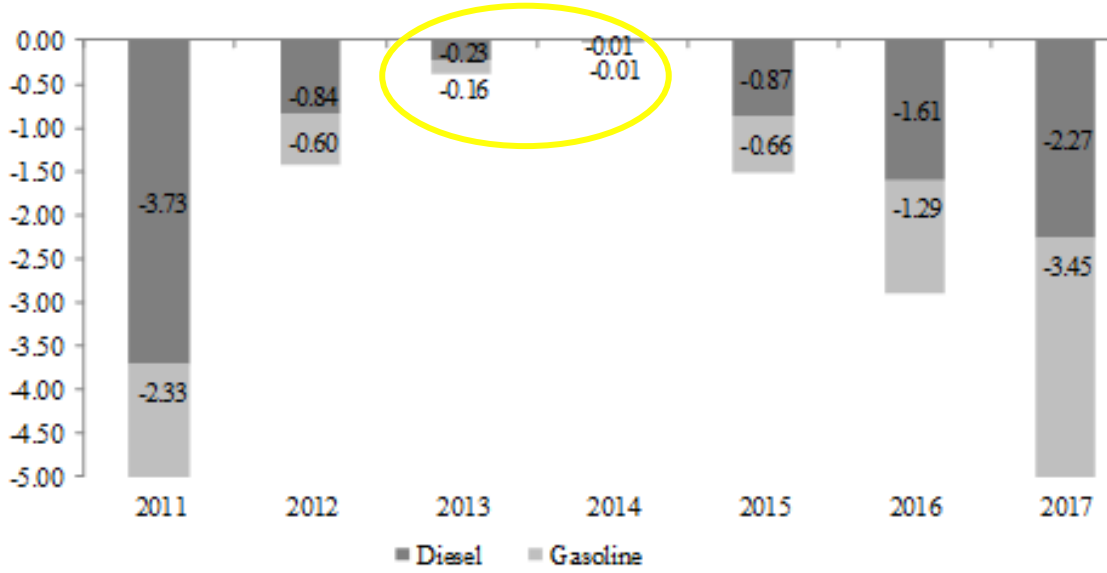
Type of scenario	Scenario objective	Baseline shock	Policy shock
Scenario 1: budgetary compensation (2011-2030)	An overall cut of CIDE-fuels to assess its role in Brazilian economy	a) Macroeconomic scenario: Shock in real GDP, investment, household consumption, government demands, imports price index, population and employment b) Indirect taxes: Shock in power tariff (IPI, ICMS, Other taxes less subsidies) c) Direct taxes: Shock in individual income tax and corporate income tax	a) Tariff power (2011-2017) Shock in diesel and gasoline (both cuts) Description: link beteween the variable nominal revenue and nominal government expenditure
Scenario 2: free government budget (2011-2030)	Burden the gasoline tax and reduce the diesel tax to subsidize public transport (cross subsidy) and influence an intermodal substitution of these transport services	a) Macroeconomic scenario: Shock in real GDP, investment, household consumption, government demands, imports price index, population and employment b) Indirect taxes: Shock in power tariff (IPI, ICMS, Other taxes less subsidies) c) Direct taxes: Shock in individual income tax and corporate income tax	a) Tariff power (2011-2017) Shock in diesel (cut) and gasoline (encumber 10%); and shock in production subsidy Description: transfer of CIDE-gasoline taxation to subsidize the production of urban buses

Source: Authors´own table.

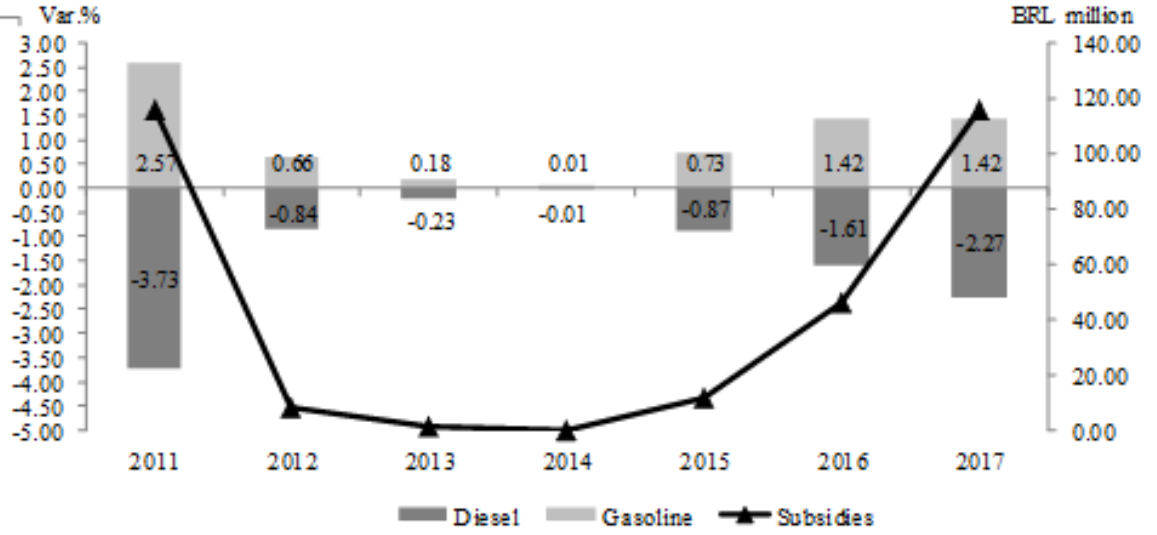
Closures and Policy Analysis:

Policy shocks

Panel (a): Real variations (%) (scenario 1)



Panel (b): Real variations (%) and BRL million (scenario 2)



Source: Research results.

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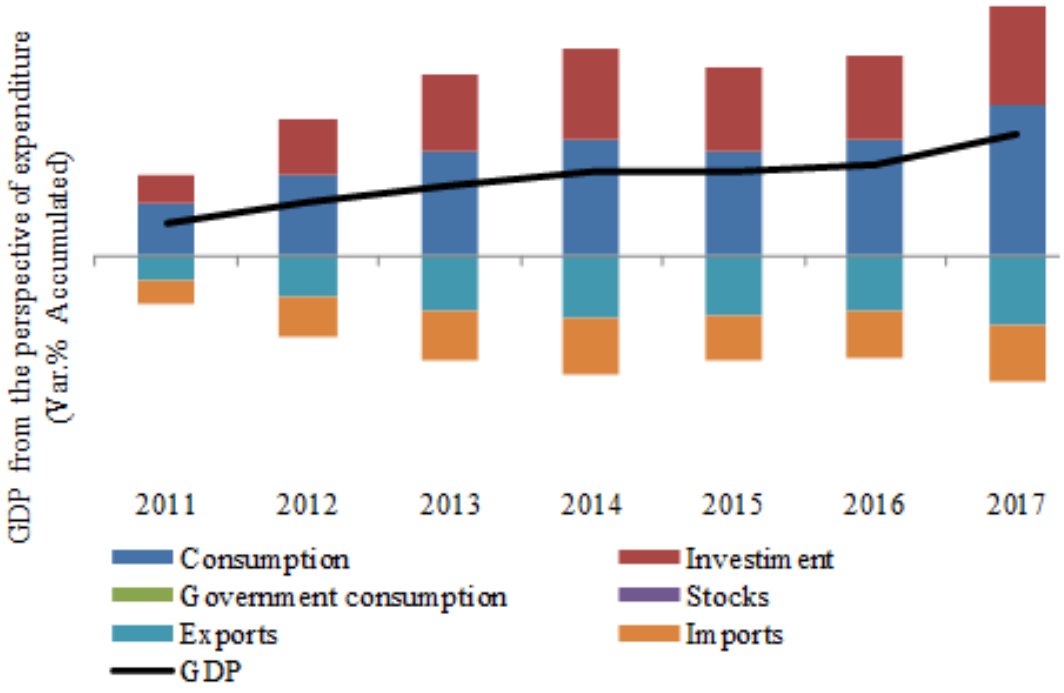
Macroeconomic impacts

Panel (a): Macroeconomic impacts (cumulative %)

Variables	Scenario 1		Scenario 2	
	Short-run	Long-run	Short-run	Long-run
GDP	0.39	0.84	0.35	0.46
Investiment	2.31	1.93	1.67	0.55
Household consumption	0.74	1.31	0.71	0.88
Government consumption	-1.48	-2.31	0.00	0.00
Exports	-0.14	1.33	-1.47	-0.22
Imports	0.99	0.67	1.35	0.57
Trade balance	-1.13	0.66	-2.82	-0.79
Trade terms	0.10	-1.34	1.42	0.15
Employment	0.14	0.06	0.19	-0.01
Real wage	0.40	1.50	0.72	1.40
Capital stock	0.44	1.56	0.39	0.88
Real taxrevenue	-1.48	-2.31	-0.94	-1.49
GDP deflator	0.07	0.13	0.22	0.21
Factor cost index	0.75	0.88	0.60	0.59
Nominal taxrevenue	-1.23	-1.32	-0.41	-0.57
Nominal gov. expenditure	-1.23	-1.32	0.52	0.92

Source: Research results.

Panel (b): Effects of scenario 2 on GDP aggregates



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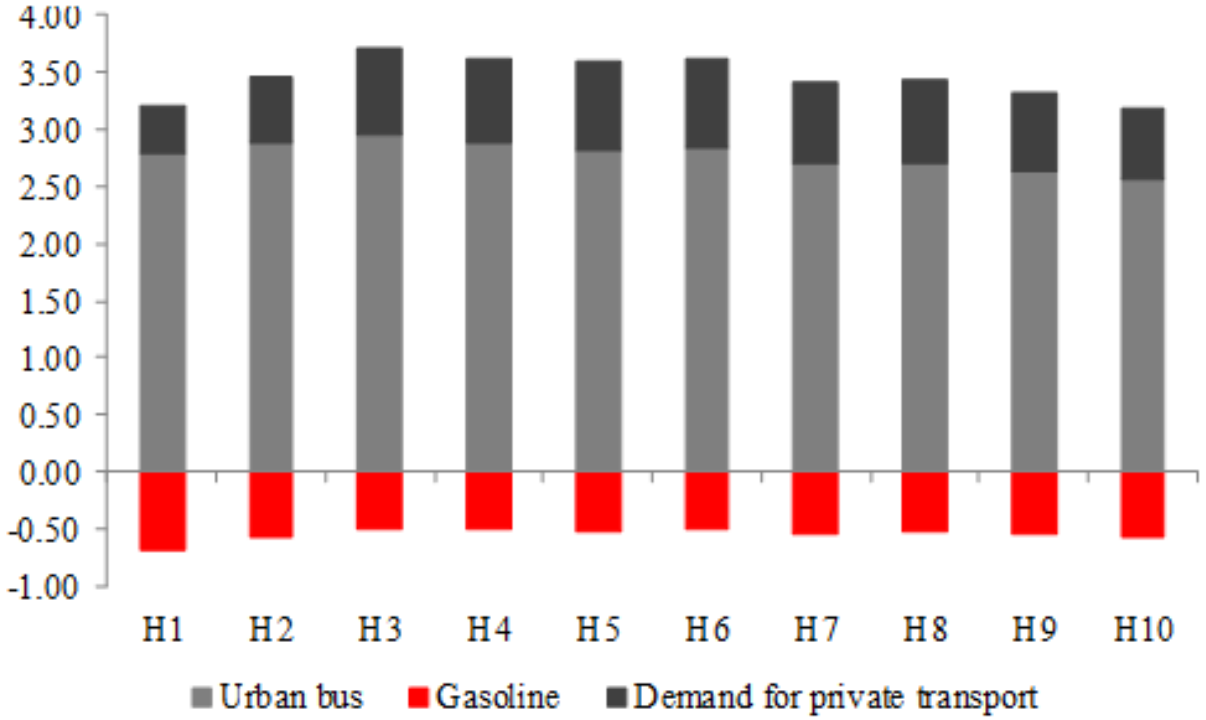
Impacts on household welfare and consumption

Panel (a): Effects on household utility

Households	Scenario 1		Scenario 2	
	Short-run	Long-run	Short-run	Long-run
H_1	1.65	2.52	1.23	1.41
H_2	1.73	2.76	1.48	1.72
H_3	1.89	2.97	1.66	1.91
H_4	1.78	2.86	1.58	1.83
H_5	1.70	2.69	1.55	1.78
H_6	1.66	2.64	1.58	1.8
H_7	1.31	2.29	1.36	1.61
H_8	1.30	2.15	1.40	1.55
H_9	1.29	2.15	1.31	1.50
H_{10}	0.84	1.79	1.17	1.44

Source: Research results.

Panel (b): Effects on bus and gasoline consumption and demand for private transport (Scenario 2)



Results

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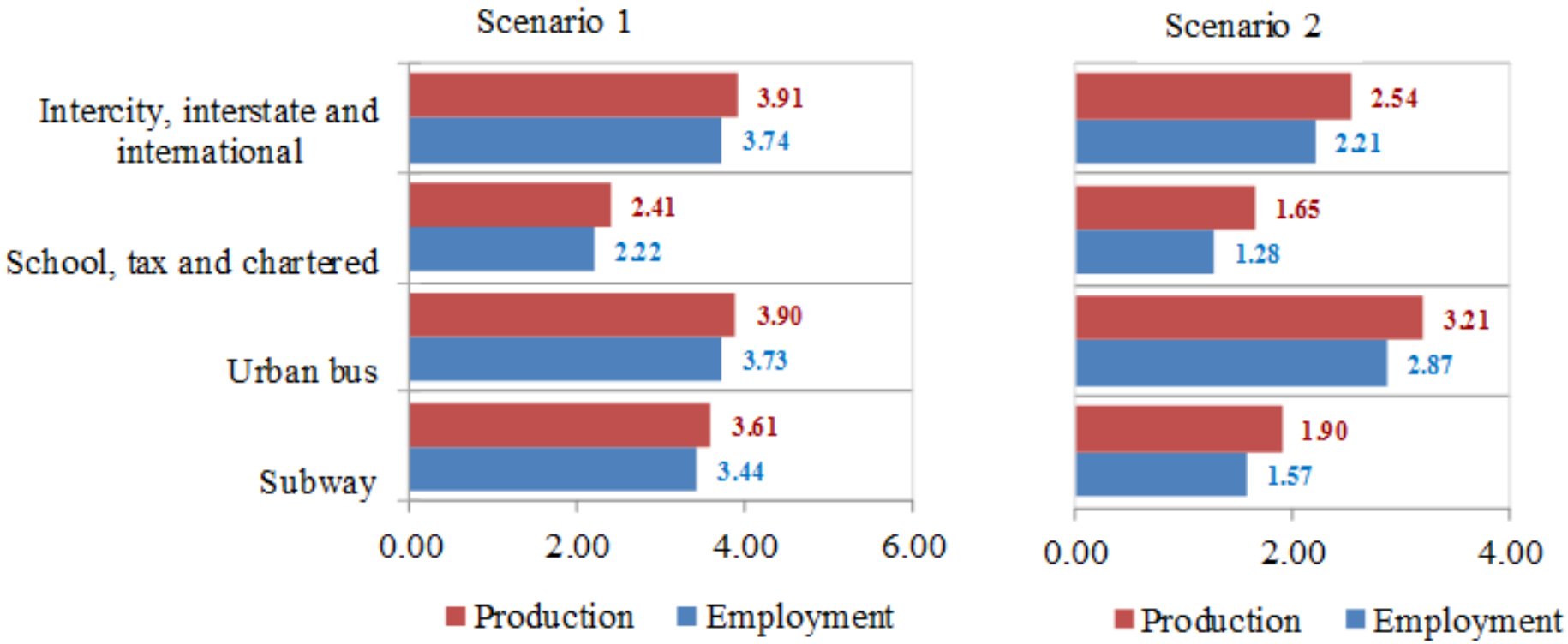
Main results of fuel policy simulations in the transport sectors



Source: Research results.
Note: % cumulative deviations from baseline.

Conclusion:

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- The results reveal that the fuel policy seems to benefit the Brazilian economy, regardless of how close it is to a fuel cut in general or a cross-subsidy policy.
- All income classes would obtain real gains in income and welfare with the simulated policies.
- The consumption of the poorest typical households is positively affected, since such policies would bring more benefit to these specific groups.
- Especially in developing countries, the two policy instruments work together in terms of economic efficiency and are aimed at providing access to mobility for the poorest people.
- **Future extensions**: A CGE-microsimulation could contribute to an analysis of the household poverty and inequality debate.

Thank you for your attention!

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