The Incidence of Indirect Taxes and Subsidies:

Theory and method for calculating household-level welfare impacts

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Commitment to Equity
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Overview

- Estimating the incidence of indirect taxes

- What do we mean by indirect subsidies?

- Why are indirect impacts of indirect taxes/ subsidies important?

- What is a low-cost way of achieving micro-founded valuations of indirect welfare impacts?

- Tips and anticipated difficulties

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Indirect taxes: assumptions

- The burden of indirect taxes is assumed to fall entirely on the consumer in the form of increased prices.

- Given informality/evasion, Rajemison, Haggblade, and Younger (2003) show that using statutory rates can overestimate the impact of indirect taxes on incomes.

- Use the effective tax rate for tax τ:

$Effective\ rate {\downarrow} \tau = tax\ collection {\downarrow} \tau\ /tax\ base {\downarrow} \tau$

Indirect taxes: using an effective rate

- What is the appropriate tax base?
  - Alcohol excises: total consumption of alcohol
  - Tobacco excises: total consumption of tobacco
  - Sales taxes and customs duties: private consumption
  - VAT – private consumption

- National Accounts vs Household Survey
  - 2 economies – scaling problem?
  - Underreporting of top incomes?
  - More disaggregation may help

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Indirect subsidies

- Indirect consumption subsidies commonly reduce the price of goods and services to the consumer.
    - Fuel subsidies
    - Electricity subsidies

- Indirect production subsidies ensure producers are better off by either supplying market price support, direct support, or payments to factors of production.
    - Agriculture subsidies

- Price subsidies on inputs will be passed on to consumers through the cost structure of final consumption goods, both directly and indirectly

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Direct impact

- Requires household expenditure data.

- Calculate the budget share for each product for each household.
  - The budget share for a given product provides an estimate of the welfare impact of a change in price due to indirect taxes/subsidies absent any demand response.

- You can introduce a behavioral response if:
  - you have estimated elasticities
  - you can use the literature to put an upper and lower bound

- For most small price increases –the behavioral response will be very small (Verme and Araar, 2016)

Why consider indirect impacts?

1. Low- and middle-income countries achieve large fiscal collections/transfers through taxes/subsidies on consumption.

2. To the extent any taxed/subsidized good is an input into production, the reduction/enhancement of household welfare should be larger than that from the direct policy itself.

3. Recent studies indicate indirect impacts are substantial…

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Indirect impacts affect measured poverty

- Incidence changes noticeably when indirect impacts are included

- A 5-region, 32 country average – where energy is subsidized – indicates that all incomes are boosted more by energy-intensive consumption baskets than by actual direct energy consumption.

Composition of Total Impact
(percent of total household consumption)
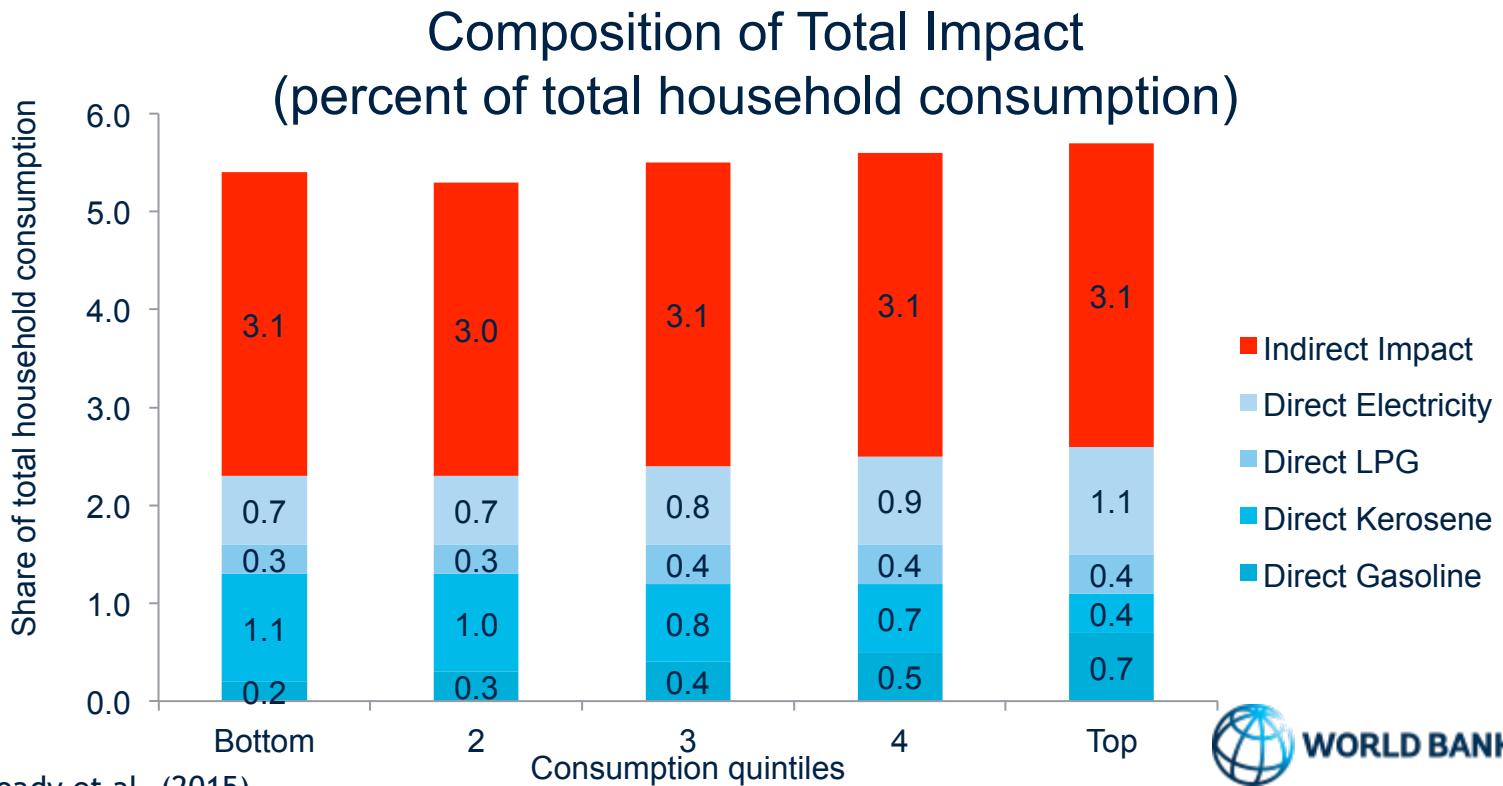
Source: Coady et al. (2015).

Indirect impacts affect measured inequality

- Concentration shares change when indirect impacts are included
- In a 5-region, 32-country average: middle deciles capture more energy subsidies (through fuel-intensive household consumption baskets) than direct consumption figures alone indicate.

### Distribution of Subsidy Benefits by Consumption Group

(In percent)

	Consumption Quintiles					All
	Bottom	2	3	4	Top	households
Total impact	7.0	11.0	15.6	21.9	45.0	100.0
Direct Impact	7.1	10.8	14.9	20.9	46.2	100.0
Direct Gasoline	2.4	5.0	9.0	18.2	65.0	100.0
Direct Kerosene	17.5	21.4	20.6	20.7	19.7	100.0
Direct LPG	4.4	8.3	13.5	22.0	51.9	100.0
Indirect Impact	7.2	11.3	16.0	22.1	43.3	100.0

Source: Coady et al. 2015.

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… with the distribution of benefits largely depending on the type of subsidized product.

Distribution of Subsidy Benefits by Income Group
(Percent of total subsidy benefit)

Gasoline   LPG   Kerosene

Quintiles
■ Bottom   ◪ 2   ■ 3   ⋯ 4   ▦ Top

Source: Coady et al. 2015.

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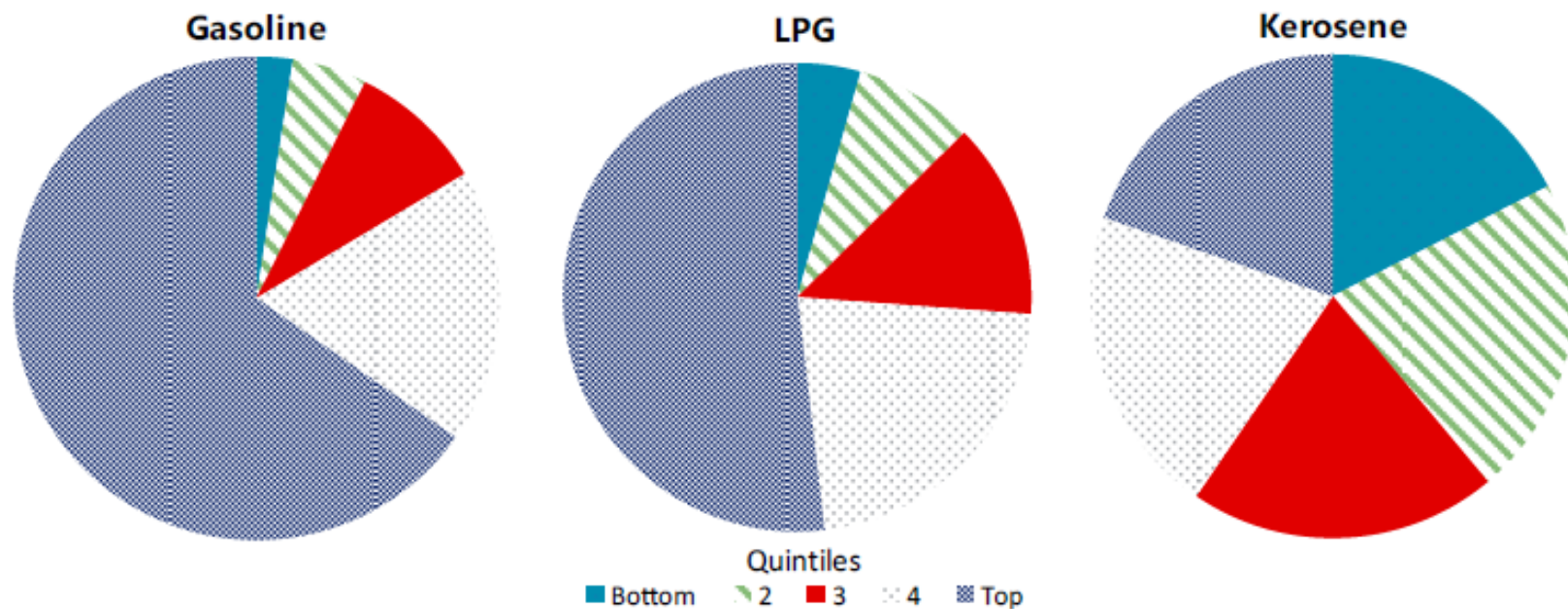
What model can be consistently applied for CEQ?

Desired characteristics:

- low information requirements
- transparency of assumptions
- clear links to household consumption behaviors (where the taxes are levied or subsidies applied)

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What model can be consistently applied for CEQ?

A general Price-Shifting Model can be solved empirically (under counterfactual scenarios) to derive the current value of subsidies received or taxes paid (see Gillingham, 2008 and Ahmad and Stern,1984 and 1991).

- low information requirements - Input/Output matrix
- transparency of assumptions
- links to household consumption behaviors

Limitations

- General, but not behavioral.
- Represents either a short-run ("overnight") estimate or the upper bound of a long-run estimate

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The Price-Shifting Model

Types of goods produced:

1. Cost push^c: higher producer prices (p) "pushed" onto retail (q) prices:

$$q{\uparrow}c = p{\uparrow}c + t{\uparrow}c \quad \text{and} \quad \Delta q{\uparrow}c = \Delta p{\uparrow}c + \Delta t{\uparrow}c$$

2. Traded*: where world prices (w) are fixed; higher input prices must be absorbed by other factors of production (labor, capital):

$$q{\uparrow}* = p{\uparrow}w + t{\uparrow}* \quad \text{and} \quad \Delta q{\uparrow}* = \Delta p{\uparrow}w + \Delta t{\uparrow}*$$

3. Controlled$^{\sim}$: where prices are administered by government:

$$q = p \quad \text{and} \quad \Delta q = \Delta p$$

$t{\uparrow}*$ and $t{\uparrow}c$ are policy rates and can be positive (tax) or negative (subsidy)

The Price-Shifting Model

When returns to factors are fixed (as in the Cost-push sector):

$$\Delta p\uparrow c = \Delta q\uparrow c\ \alpha A + \Delta q\uparrow * \ \beta A + \Delta q\ \gamma A \qquad (1)$$

where
- A is the (n×n) technology coefficients I/O matrix (n = # of sectors)

- α, β, and γ are n×n diagonal matrices representing Cost-Push, Traded, Controlled inputs (respectively) in sectoral outputs, where $\alpha + \beta + \gamma = 1$ and $0 \leq (\alpha, \beta, \gamma) \leq 1$.

The total producer price change is equivalent to the (I/O matrix-weighted) change in all input prices.

The Price-Shifting Model

Additional substitution and solving for $\Delta p \uparrow c$ yields a recursive system that can be solved by inverting the I/O matrix:

- Substitute definitions of types of goods into (1)

$$\Delta p \uparrow c = \Delta t \uparrow c \ \alpha AK + \Delta p \uparrow w \ \beta AK + \Delta t \uparrow * \ \beta AK + \Delta p \ \gamma AK \qquad (2)$$

where $K = (I - \alpha A) \uparrow -1$ where I = nxn identity matrix

The $k \downarrow ij$ capture the combined direct and indirect use of cost-push sector i used to produce one unit of cost-push sector j.

The total producer price change is equivalent to the (I/O matrix-weighted) change in all input prices.

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The Price-Shifting Model

CEQ runs "all else equal" policy counterfactuals, so $\Delta p\uparrow w = 0$. Usually also assume that $\beta = 0$ so that:

$$\Delta q\uparrow c = \Delta t\uparrow c + \Delta t\uparrow c\ \alpha AK + \Delta p\ (1-\alpha)AK \quad (3)$$

Key results:

- Final price changes decomposable into direct effect (policy) and indirect effect
- The indirect effect can be solved by inverting the Input-Output matrix

The Price-Shifting Model

Caveats:

- The Input-Output matrix should be in "Leontief" or "Technology" coefficients: each input (in a sector) expressed as a share of the sector's total output

- Typically assume all non-Controlled sectors to be Cost-Push; however any sector's prices can be "fixed" and cordoned off from the mechanics of input-price ratcheting.

- Substitution/behavioral effects are not being considered

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Tips: Subsidies

A subsidized sector is a controlled sector:

- To calculate current welfare transfers via subsidy, the analyst should program a "full subsidy removal" counterfactual that would leave prices fixed at the country's reference price.

- Stepped/variable subsidies (e.g. electricity tariffs):
  - "full subsidy removal" can be thought of as bringing all unit prices back to the reference price;
  - this is equivalent to a producer-wide (volume-weighted) average price increase.

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Tips: Sales/Excise Taxes

Taxes are not simply the opposite of subsidies:

- Tax avoidance/malfeasance indicates the "effective" rate should be used to calculate welfare losses (direct or indirect).

- When tax base is broad, sales/excise taxes will cascade:
  - at final sale, a tax will be levied on the total cost, some portion of which will be taxes paid on inputs
  - In contrast, all subsidized prices are controlled and do not cascade.

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Tips: Value-added Taxes

VAT's reclamation chain means:

- A system with no exemptions will have direct effects only:
  - producer prices will not change when the VAT system is eliminated.
- A system with exemptions will have indirect effects:
  - in exempt sectors, producer and retail prices will fall; which means producer prices will fall in any non-exempt sectors using exempt-sector inputs.
- A system where refund system does not work well will have indirect effects.

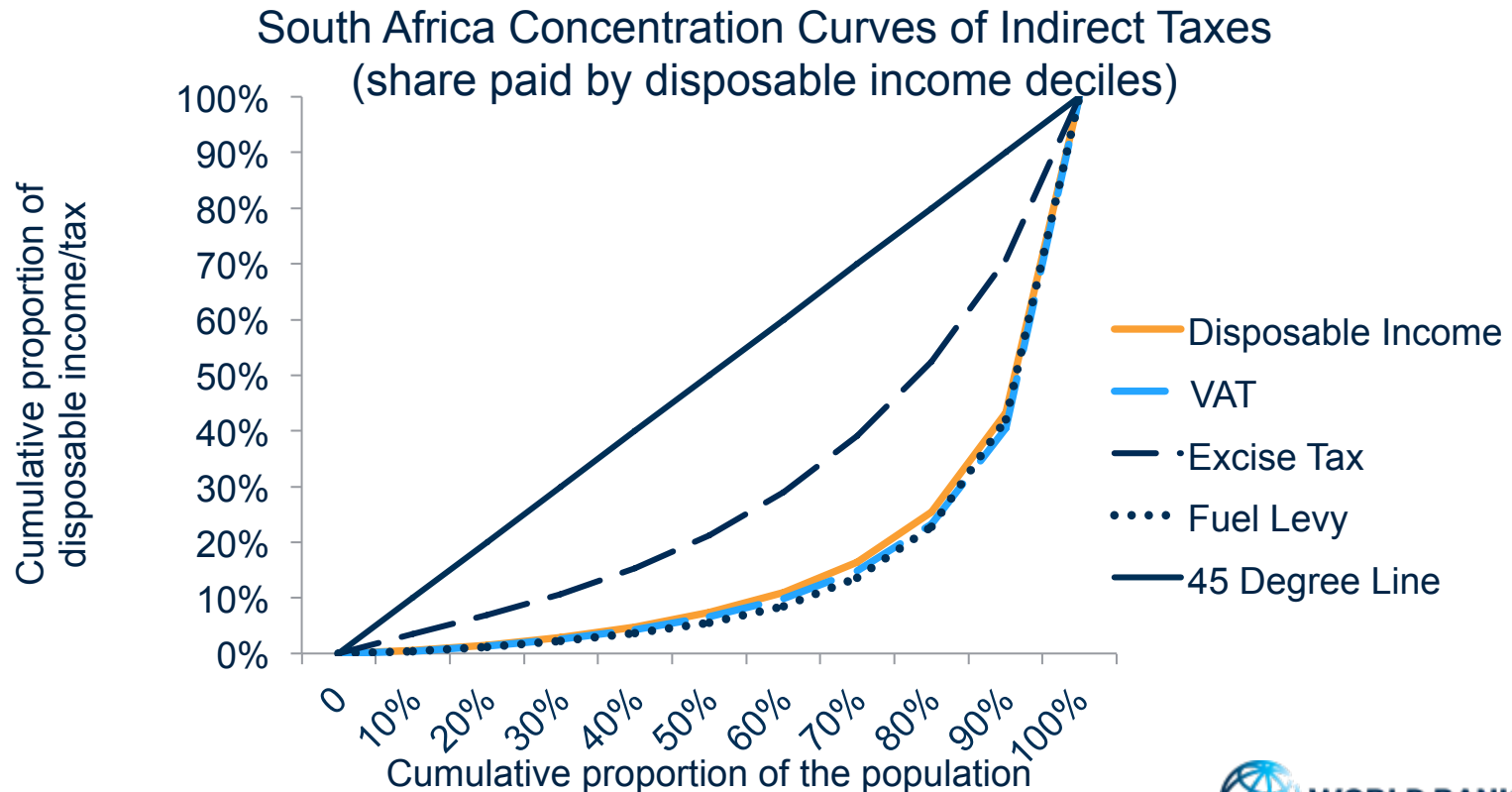## Import duties with exemptions for producers can be treated similarly.

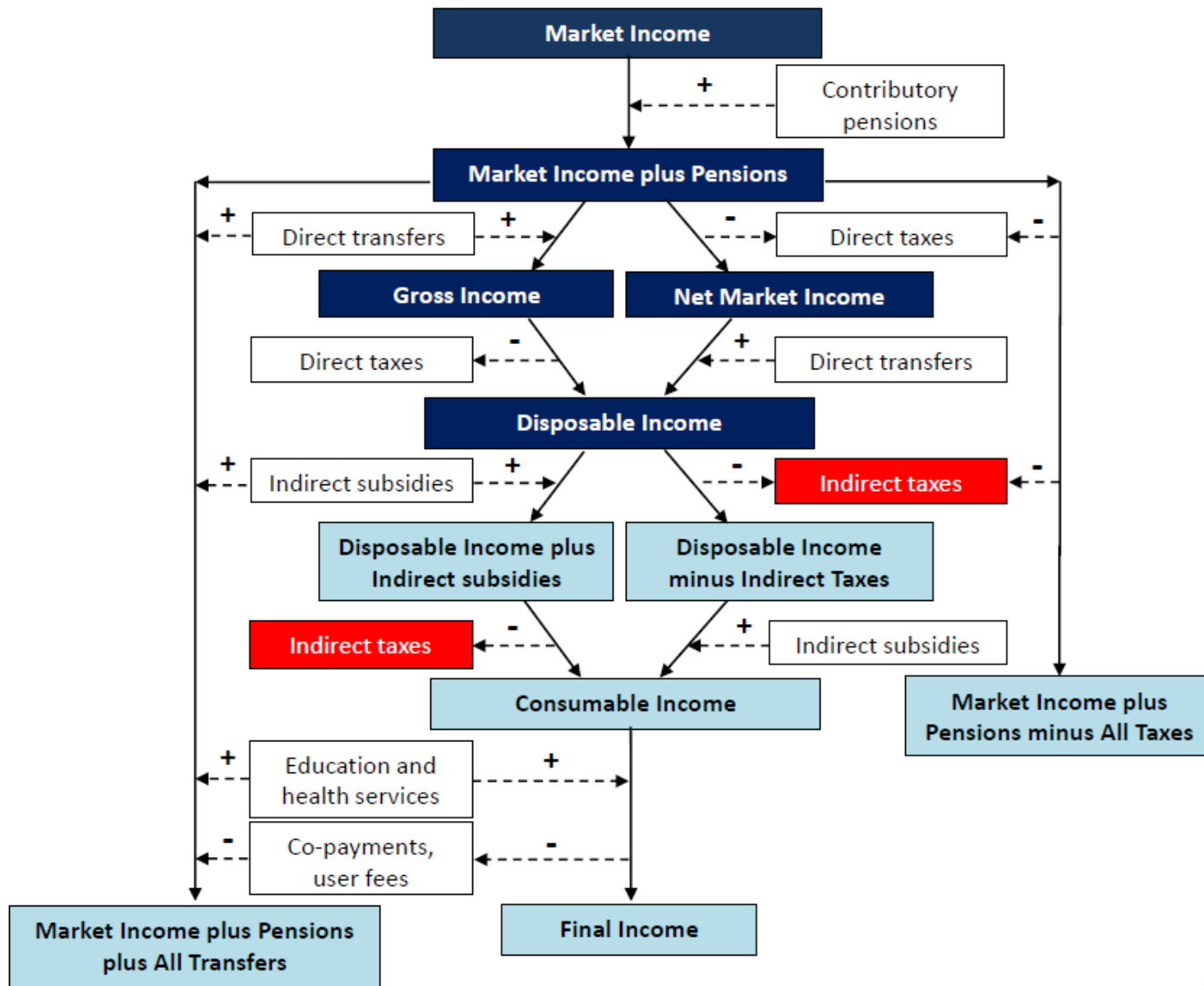# Tips: Social Accounting Matrix

A SAM has an I/O matrix embedded:

- The I/O matrix can be extracted (by hand) or some software suites (e.g. SimSIP_SAM) will create it automatically.

- A SAM typically includes Labor as a sector and Labor's price is tied directly to the price of a consumption basket: the analyst must take care to keep labor exogenous (cordoned off) when calculating welfare impacts from consumption taxes/subsidies.

What is the relevant income concept for indirect taxes/subsidies?

To decide whether indirect taxes/subsidies are progressive – use disposable income/consumption:

South Africa Concentration Curves of Indirect Taxes
(share paid by disposable income deciles)

Source: Inchauste et al (2015)

Tips: What if consumption >> disposable income?

Tips: What if consumption >> disposable income

- Mis-measurement, income underreporting could mean that consumption >> disposable income

- Could result in indirect taxes > reported disposable income which would → negative disposable income minus indirect taxes (and maybe negative consumable income)

- Solution:

$$T_i = \sum_{k=1}^{K} t_k\, c_k \;/\; \sum_{k=1}^{K} c_k \;*d$$

Thank You!

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