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Dynamic General Equilibrium Approach to Measure the Size of the Shadow Economy of Sri Lanka

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Motivation...

- Importance of using good quality data for analytical or research purposes
- Quality of officially recorded statistics and extent of shadow economy activities
- Shadow economy impact the efficacy of macroeconomic policies while risking the credibility of policymakers
- Existing literature shows that,
 - in comparison to developed economies, developing economies have a high level of shadow economy
 - the size of the shadow economy as a percentage of GDP has declined over time
- What does literature find as the driving forces of the shadow economy?

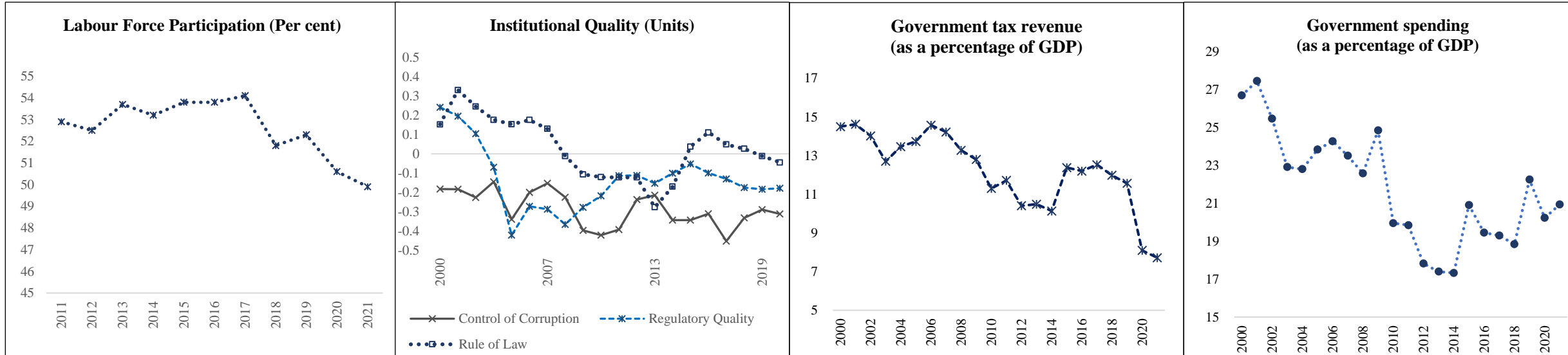
Table 01: Causes of Shadow economy

Causes	Source	Sample
Tax related factors: Induce shadow activities		
High tax rates/ Heavy burden of direct and indirect taxes	Friedman et al. (2000)	69 countries 1989-1995
	Schneider, Buehn, and Montenegro (2010b)	162 countries 1999-2007
Impact of taxes on the labour-leisure trade-off	Schneider and Enste (2000)	76 countries 1989–90 and 1990–93
Tax morale (willingness to cheat on tax)	Elgin and Schneider (2016)	38 OECD Countries 1999-2010
Institutional factors: Induce shadow activities		
Weaker legal environment, poor maintenance of the rule of law, higher level of corruption	Friedman et al. (2000)	69 countries 1989-1995
Weak enforcement of law (Quality of the legal system)	Dabla-Norris et al. (2008)	Over 4000 firms in 41 countries
Fiscal sector performance: Discourage shadow activities		
High quality public goods and services	Schneider, Buehn, and Montenegro (2010b)	162 countries 1999-2007
Greater openness to foreign trade and larger government size (Government expenditures/ GDP)	Goel, Saunoris, and Schneider (2019)	The United States 1870–2014

Motivation

Why Sri Lanka be a case study...

- Sri Lanka: A developing country, small open economy, civil conflicts, political instability, institutional quality



- Can the declining labour force move to the shadow sector?
- Can it be observed that there is an increase in the shadow economy when institutional factors are deteriorating?
- Can the decline in tax revenue be a result of increased shadow economy activity?
- Has the increase in government spending caused a reduction in the size of the shadow economy?

Therefore, it is important to know how the shadow economy has behaved over time

Definition...

- OECD Definition, “the groups of activities most likely to be non-observed are those that are underground, informal sector, illegal, or undertaken by households for their own final use.”*
 - Underground and informal sector activities are entirely legal in terms of both production and distribution, both activities are not disclosed officially
 - Underground activities are not disclosed officially owing to benefits such as avoiding tax payments and other government regulations
 - Informal sector operations are conducted informally without any intention of getting benefits by avoiding taxes and other statutory payments

*OECD: Organisation for Economic Co-operation and Development

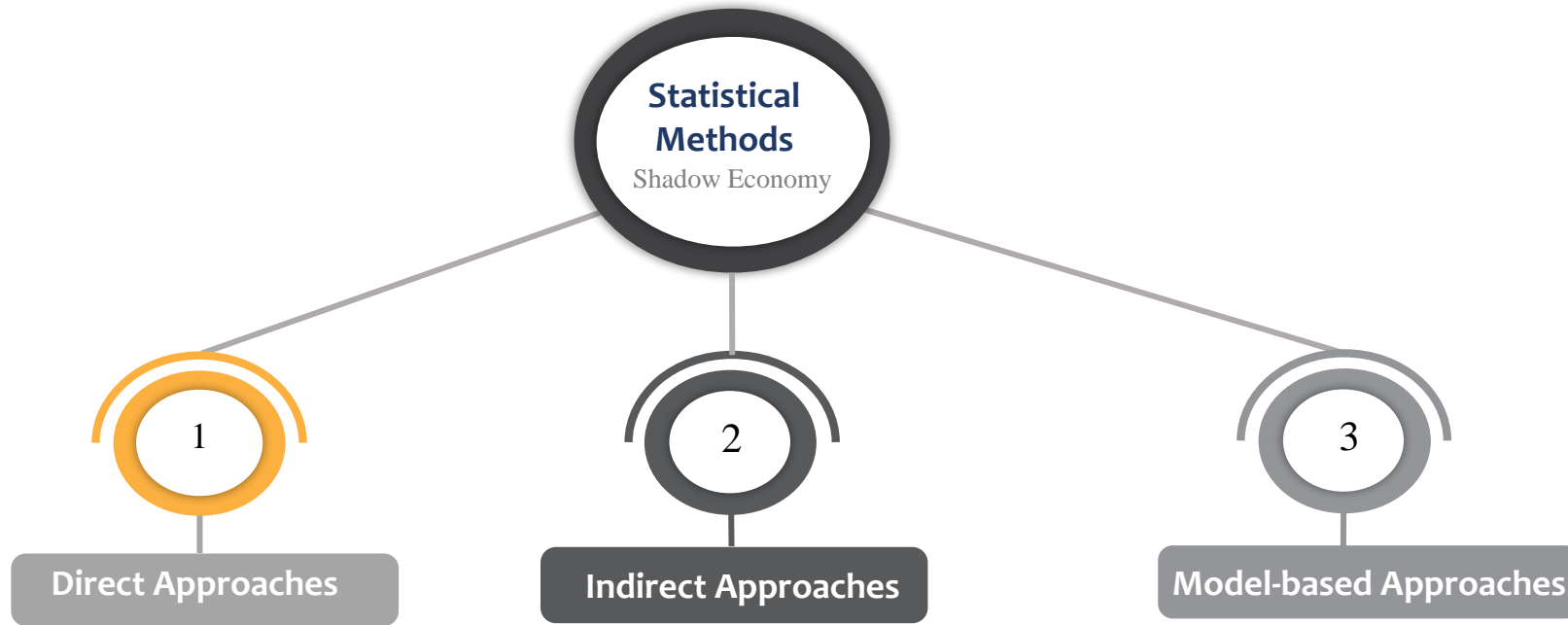
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Definition of the shadow economic activities under the purview of this study

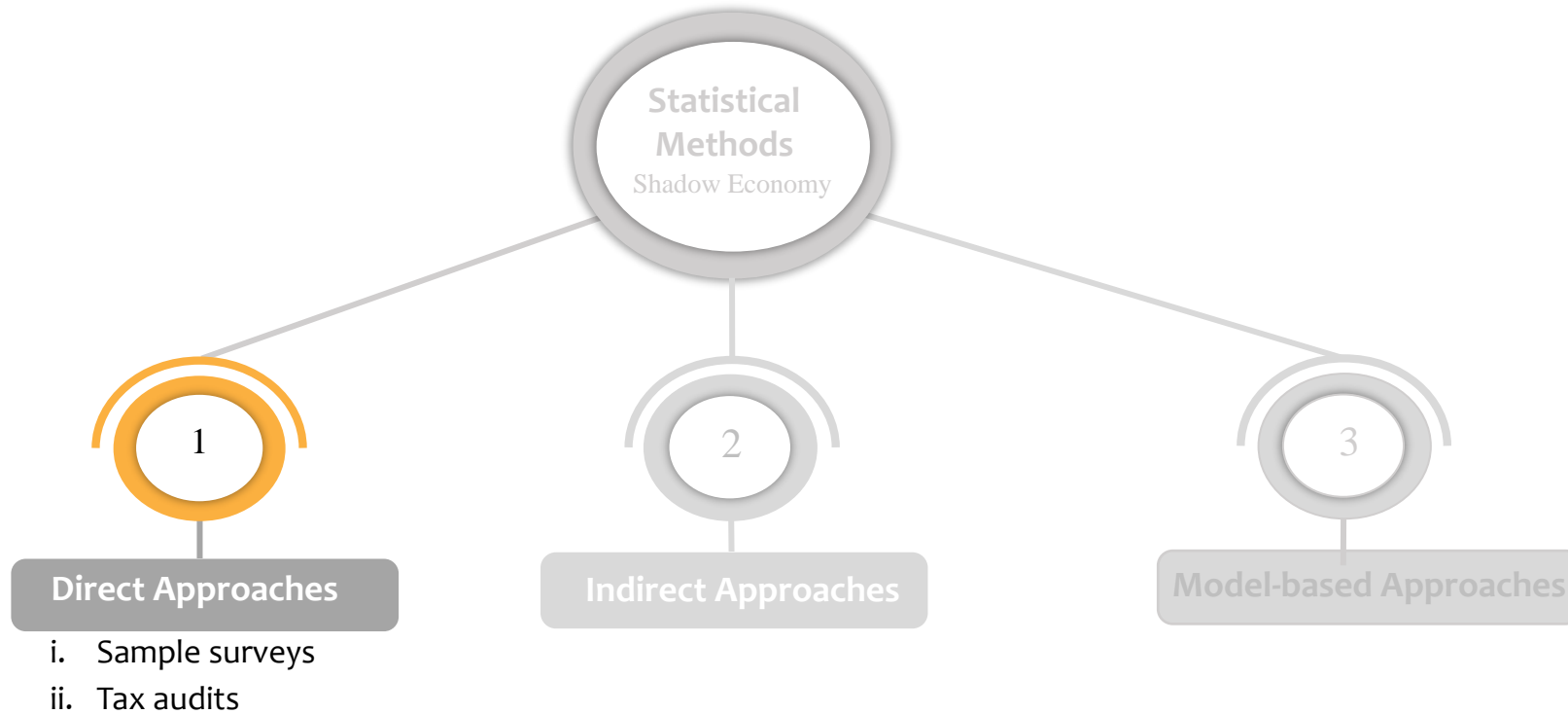
“supply products or services while intentionally or unintentionally ignoring the reporting of the revenue that would be subject to paying taxes or other statutory payments if reported to corresponding authorities”

Statistical methods to estimate the size of shadow economy...



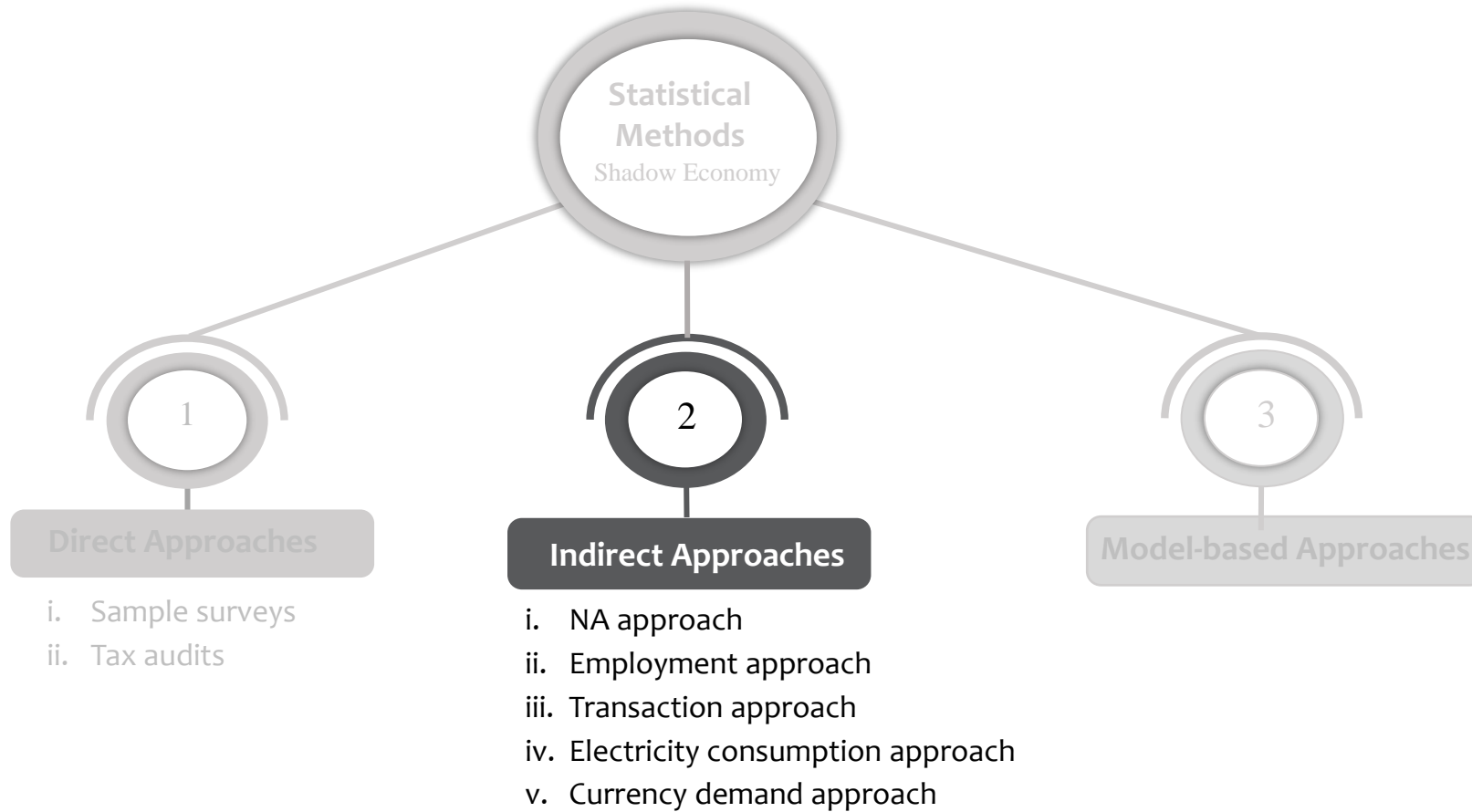
Sources: Schneider and Enste (2000), Dybca et. al (2017), Medina and Schneider (2018), Ohnsorge and Yu (2021)

Statistical methods to estimate the size of shadow economy...



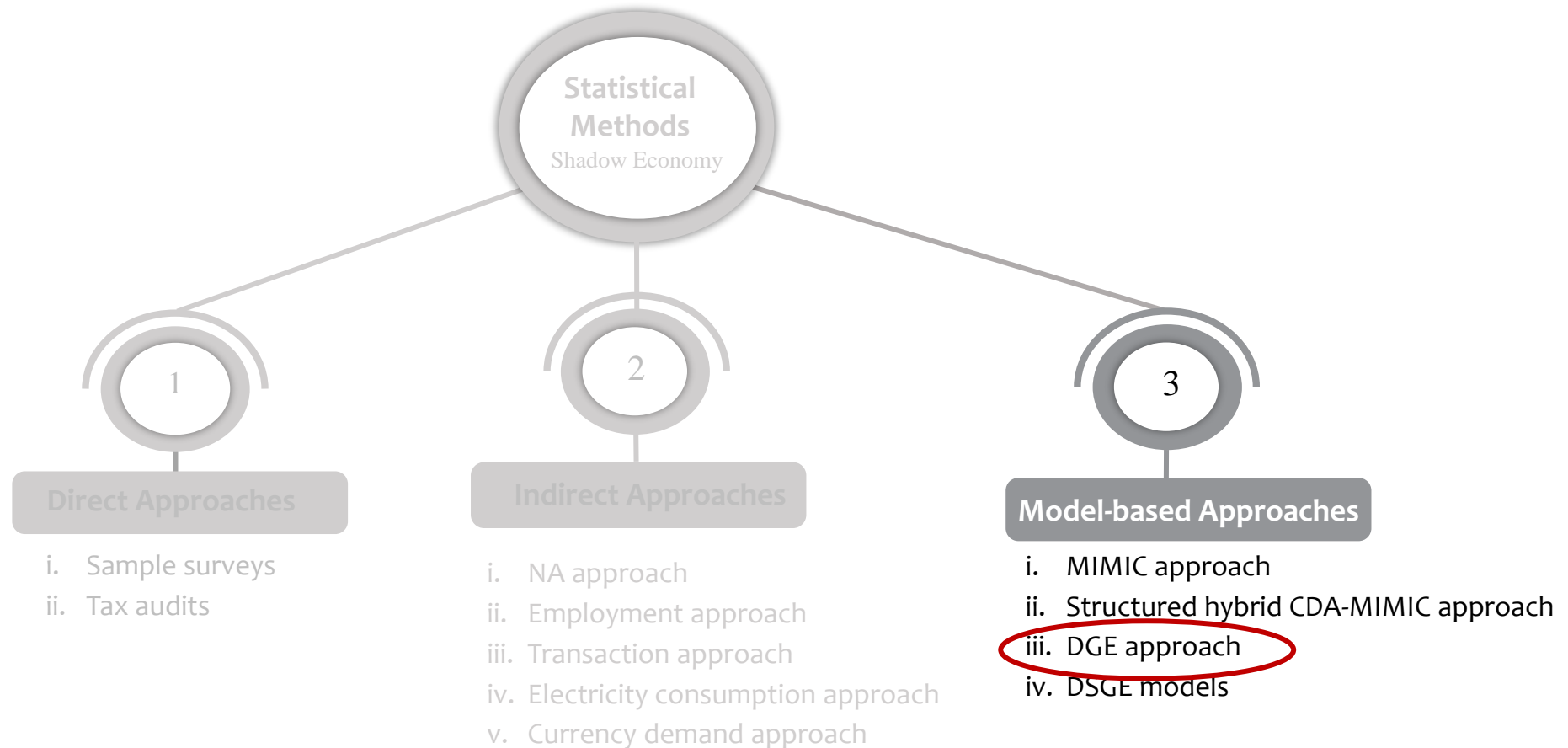
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Statistical methods to estimate the size of shadow economy...



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- Country specific shadow economy estimations are not available in the case of Sri Lanka
- Using a novel data set to represent the formal sector employment
 - labour force participation vs. active no of employees who receive EPF benefits + government sector employees
- Add to the shadow economy literature of Sri Lanka by producing the most up-to-date shadow economy estimations

The DGE model...

Irhig and Moe (2001) and Elgin and Oztunali (2012)

- The DGE model will consider two sectors, formal and shadow
- The infinitely lived consumer-investor-worker (household) choose to spend time in formal and informal sectors (H_t) are N_{F_t} and N_{S_t} , respectively; $H_t = N_{S_t} + N_{F_t}$
- Household maximises the lifetime utility subject to the resource feasibility and time constraints
- The formal sector is taxed at a rate of τ_t
- The formal sector follows a Cobb-Douglas form of technology
- Government policy is exogenous to the setup of this model
- Household:



$$Y_{F_t} = \tau_t \theta_{F_t} K_t^\alpha N_{F_t}^{1-\alpha}$$

$$Y_{S_t} = \theta_{S_t} N_{S_t}^\gamma$$

Solve the utility maximization problem of a household;

$$\max_{\{C_t, I_t, N_{S_t}, N_{F_t}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t U(C_t) \quad ; \text{Discount factor, } \beta < 1$$

$$U(C_t) = U(C_0) + \beta U(C_1) + \beta^2 U(C_2) + \dots + \beta^t U(C_t) + \dots + 0$$

$$C_t + I_t = (1 - \tau_t) \theta_{F_t} K_t^\alpha N_{F_t}^{1-\alpha} + \theta_{S_t} N_{S_t}^\gamma \quad (1)$$

The baseline model...

The size of the shadow economy as a share of GDP is;
$$\frac{\theta_{S_t} N_{S_t}^\gamma}{\theta_{F_t} K_t^\alpha N_{F_t}^{1-\alpha}} \quad (1)$$

Estimate N_{S_t} ;

Working hours in informal sector N_{S_t} is
$$\left\{ \frac{\gamma \theta_{S_t}}{(1 - \tau_t) (1 - \alpha) \theta_{F_t}} \left[\frac{1 + g_c - 1 + \delta}{\beta} \right]^{\frac{\alpha}{1-\alpha}} \right\}^{\frac{1}{1-\gamma}} \quad (2)$$

$$\frac{C_{t+1}}{C_t} = \beta \left[(1 - \tau_t) \alpha \frac{Y_{F_{t+1}}}{K_{t+1}} + 1 - \delta \right] \quad (3)$$

Capital stock, K_t is estimated using, $K_{t+1} = K_t (1 - \delta) + I_t$ and, Incremental capital stock, $K_0 = \frac{\Delta K_1}{\delta + g}$, is estimated using the average investments in first five years ([Wu, 2007](#))

Estimate θ_{S_t} ;

- Assume the growth of θ_{S_t} is equal to the average of the growth of K_t and θ_{F_t}
- To derive θ_{S_t} , refer to a base year estimate: 1998 = 47% (Shadow economy as a percentage of GDP) based on Elgin and Oztunali (2012) (DGE method, 46.99%) and Medina and Schneider (2018) (MIMIC with night light approach, 47.07%).

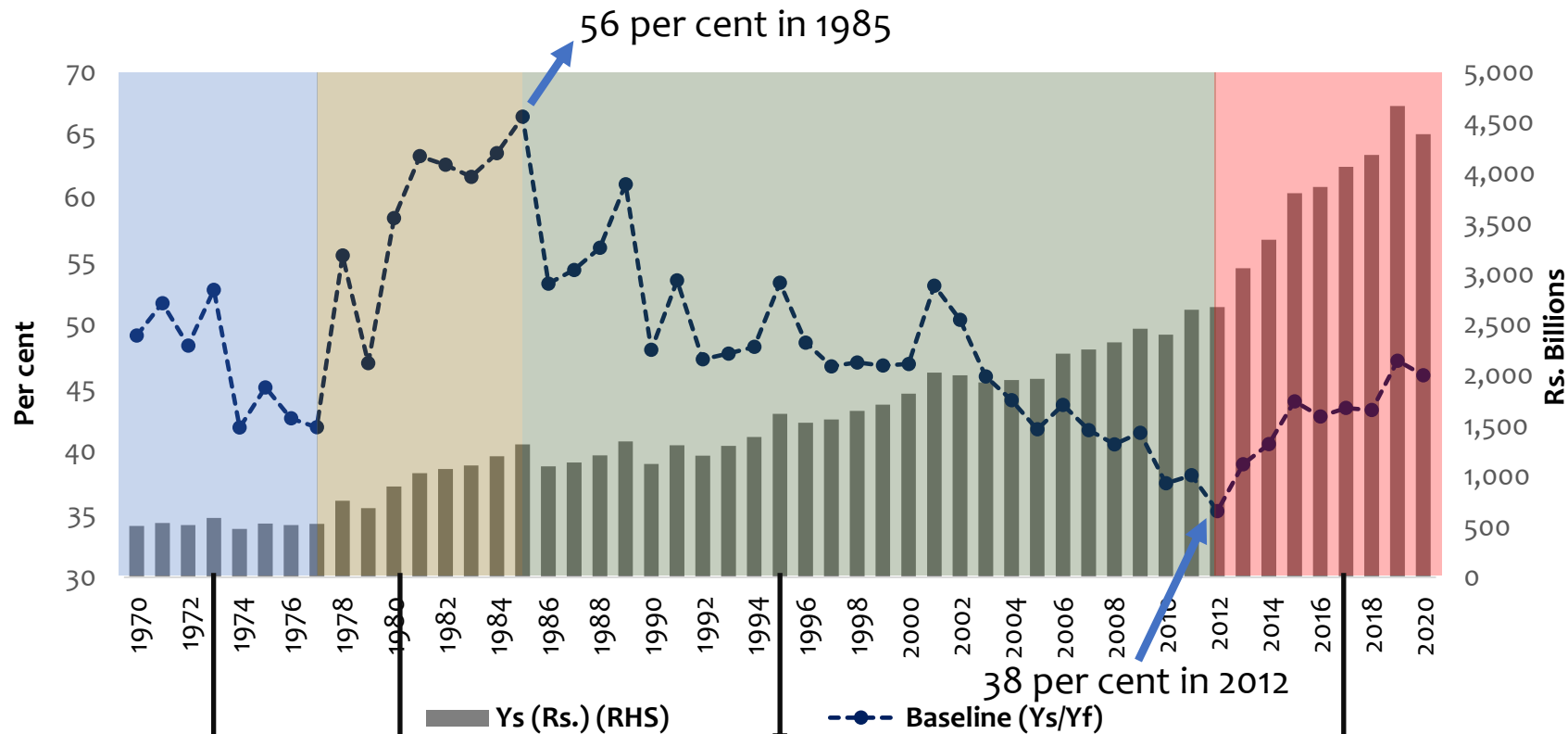
Calibration parameters...

α	0.33	} Irhig and Moe (2001) and other standard business cycle literature
δ	0.08	
γ	0.495	
β	Estimated	
N_{F_t}	Active no of employees who receive EPF benefits + government sector employees	
τ_t	Share of government spending in GDP	

Robustness Checks...

- Scenario 1 In this scenario, the sensitivity of the model to different estimates of the capital stock, i.e., investments in the first 10 years to estimate the incremental capital stock instead of 5 years, is considered.
- Scenario 2 A higher depreciation rate of 10 per cent for the war-affected period from 1983 to 2009 and 12 per cent for 1987-1989 is considered instead of 08 per cent
- Scenario 3 Sensitivity of the results on the changes in the base year estimates
 Scenario 3(1): 2000 = 45%, Elgin and Oztunali (2012) (DGE method, 45.57%) and Medina and Schneider (2018) (MIMIC with night light approach, 44.60%)
 Scenario 3(2): 1998 = 52%, 10% increase in baseline value
 Scenario 3(3): 1998 = 42%, 10% decrease in baseline value
- Scenario 4 Changes in productivity in shadow sector, θ_{S_t}
 Scenario 4(1): 5% increase in θ_{S_t}
 Scenario 4(2): 5% decrease in θ_{S_t}

Figure 1: Sri Lanka shadow economy (% of GDP)



Average size of shadow economy (SE)
48 % of GDP

- Although Sri Lanka's shadow economy has followed a declining path, on average, until 2012, it has been on a rising trend since then

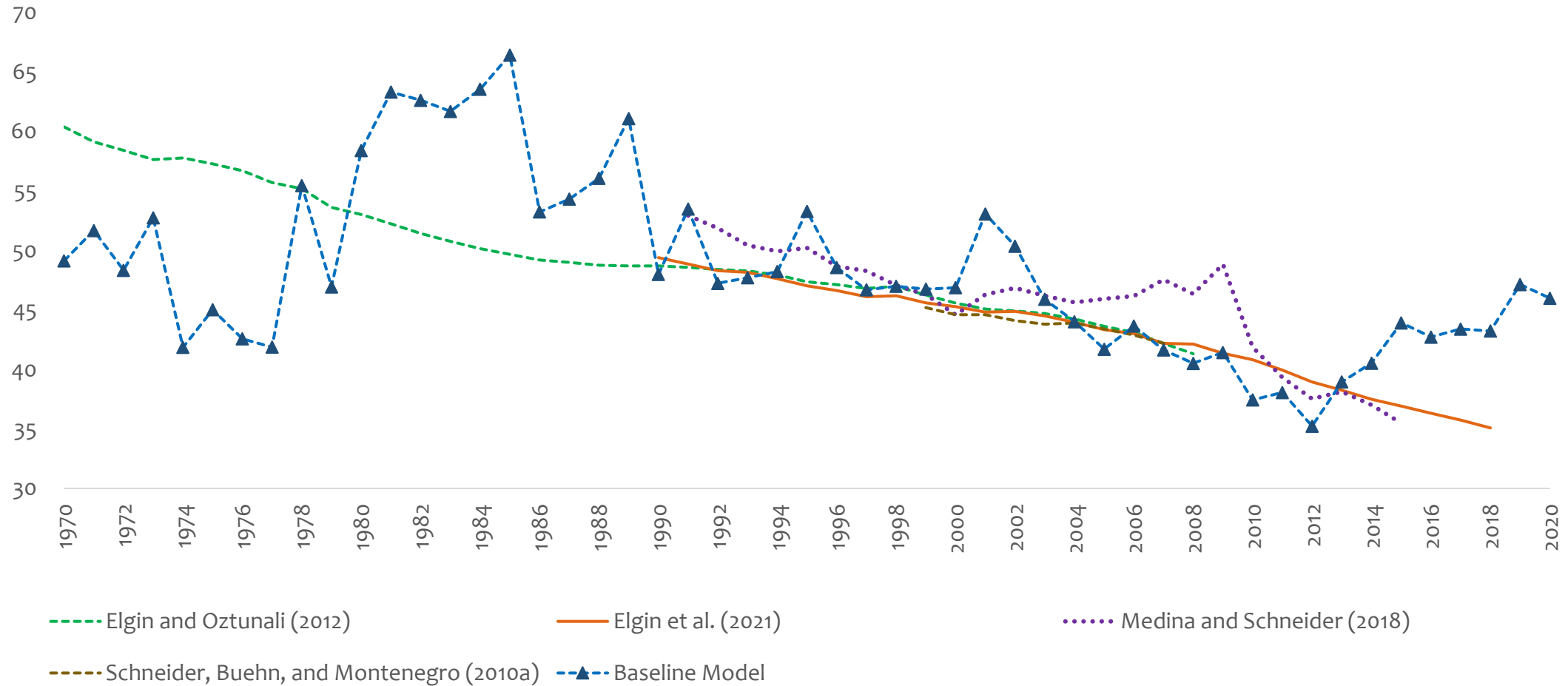
Period 1: High and steady level - Government mediated 'closed' economic system

Period 2: Increasing SE - After the introduction of the 'open' economic policies in 1977

Period 3: Decline in the size of the SE (on average)

Period 4: Size of the SE is on an increasing path

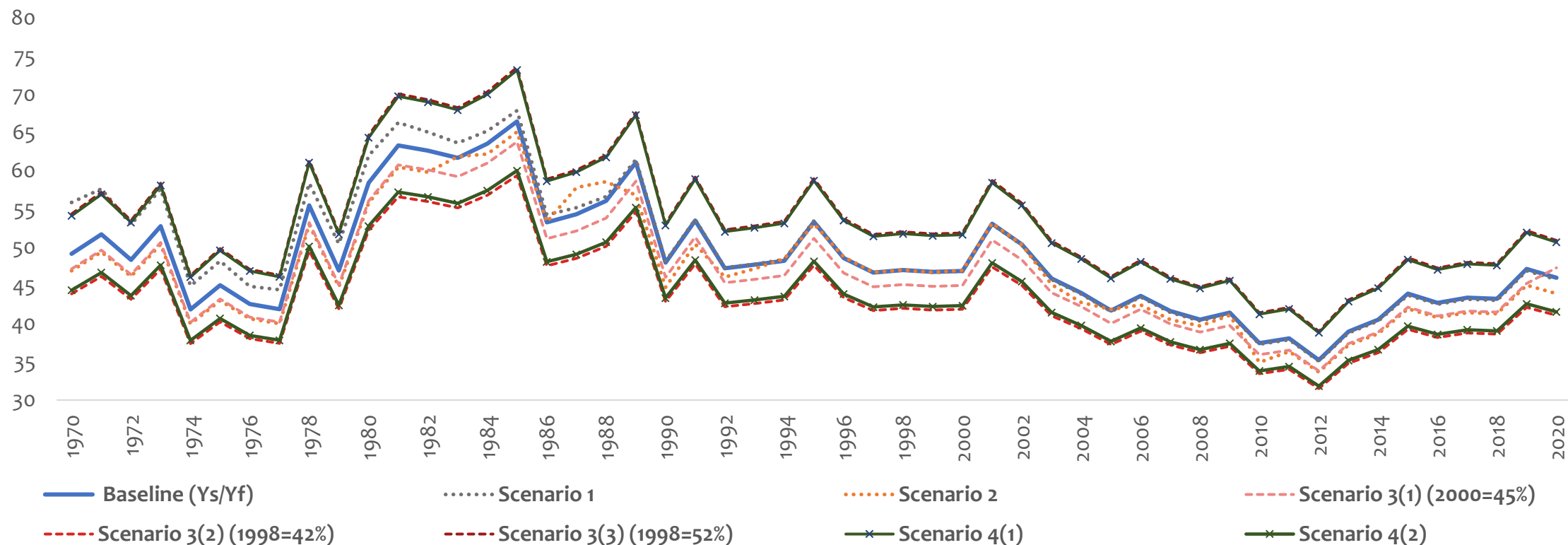
Figure 2: Comparison of estimates_ size of shadow economy as % of GDP



Robustness check...

- Scenario 1 Change in the incremental capital stock
- Scenario 2 A higher depreciation rate
- Scenario 3 Changes in the base year estimates
- Scenario 4 Changes in productivity in shadow sector

Figure 3 : Scenario analysis_ size of shadow economy as % of GDP



Conclusion...

- The shadow economy's influential behaviour on the socio-economic condition of the economy should never be ignored, since it has a significant potential to impair data quality as well as policy effectiveness
- Sri Lanka's shadow economy accounts for almost half of the country's officially declared GDP
- Upon realising this, it is vital to emphasise the importance of concentrating on economic policies that encourage the formalisation of shadow activities
- It is of utmost importance to figure out why there has been an increase in the shadow economy activities recently

Work in progress and future research...

- The present study is subject to a number of limitations and restrictions
- Enhance the accuracy of base year estimates
- To make the research more sophisticated, it may be expanded by including the characteristics of more realistic economic agents
- Develop an open economy DSGE model to examine the shadow economy's behaviour considering household production and check its response to macroeconomic shocks

Thank You

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