Measuring ‘strong’ [un]sustainability with a ‘weak’ sustainability indicator:

Where do small island economies stand with their development model(s)?

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Motivation

A ‘unique’ sustainable development path?

- **Sustainable development** - Gro Harlem Brundtland : “[a] *development that meets the **needs** of the present without compromising the ability of future generations to meet their own **needs***.”(WECD, 1978)

Sustainability - a central question for island economies

- Structurally vulnerable (Bertram et Poirine, 2007 ; Campbell, 2009), low diversity of productive assets
  - *Hyperspecialization* or "*Speciation*“ : MIRAB (Bertram et Watters, 1985), SITE (McSorley et McElroy, 2007; McElroy et Hamma, 2010), PROFIT (Oberst et McElroy, 2007 ; Baldacchino, 2015) models

Research question

How to analyze the sustainability trajectory of an economy?

- Result-based (welfare) approach
  - A path in which utility or consumption per capita does not decline (Hartwick, 1978; Hamilton et Clemens, 1999; Asheim, Buchholz and Withagen, 2003; Dasgupta, 2009; Arrow et al., 2012, etc.)

- Capacity-based (ecological) approach
  - A path in which the real per capita values of capital stocks are non-negative (American school of ecological economics: Constanza and Daly, 1992; Daly, 1996; Ekins et al., 2003, etc.)

- Sustainability reconciliation (double, result & capacity approach)
  - London School of Economics (Pearce, Atkinson…): ***capital theory*** and ('strong' vs 'weak') sustainability, in an economy-environment accounting framework

- $\dot{K} = \dot{K_m} + \dot{K_h} + \dot{K_n} \geq 0$ in a '***weak***' sustainability perspective

- $\dot{K} = f(\dot{K_m}, \dot{K_h}, \dot{K_n}) \geq 0$ assuming nonlinearities, and $\dot{K_n}, \geq 0$ in a '***strong***' sustainability perspective

Methodology

To attain sustainability…, it must be measurable

Genuine savings (GS) – WB's reference indicator

(Hamilton and Clemens, 1999)

- Firmly rooted in the SNA framework (SEEA) and available for a wide range of countries

Pros: evaluate capacity- and results-based approaches to sustainable development (Hanley et al., 2015); good prospective indicator of future well-being for periods up to 100 years (Greasley et al., 2014; Hanley et al., 2016);

Cons: weak empirical power to predict the intergenerational gaps in consumption levels, in particular when welfare is measured by mortality, HDI (Ferreira and Vincent, 2005; Gnegne, 2009)

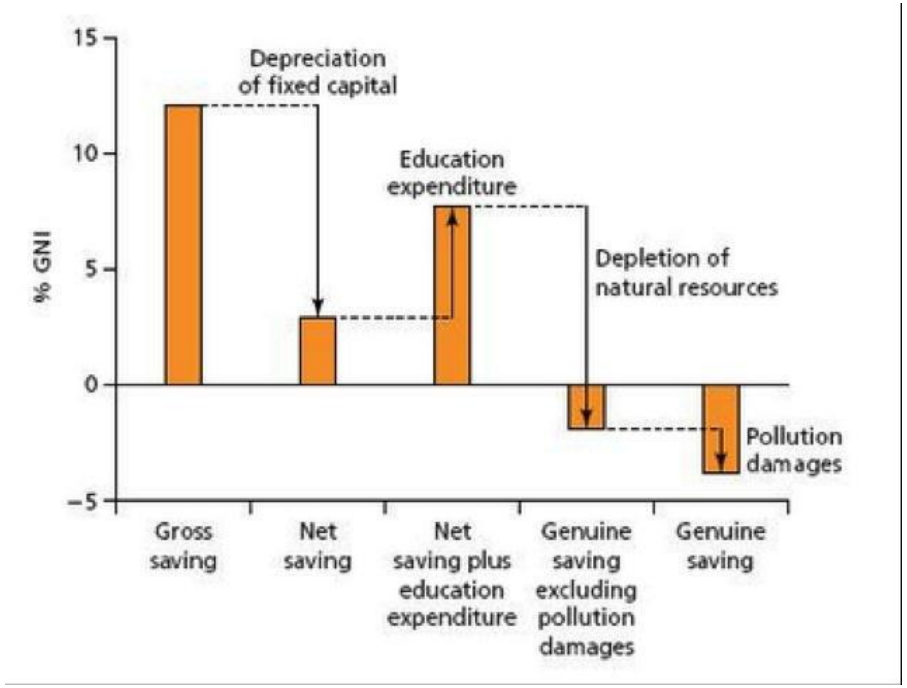


Figure-Adjusted net saving. Source: World Bank (2010).

➢ **One-way indicator, showing "Unsustainability" rather than sustainability** (Hartwick (2003); Markandya and Pedroso-Galinato, 2007; Hamilton et Atkinson, 2006; Dietz, Neumayer et De Soysa, 2007; Blum, Ducoing and McLaughlin, 2016)

Methodology

- Empirical approach

  - Working assumptions:

    - ➢ *by relaxing (restrictive) assumptions about preferences and utility function, we are establishing a framework for analyzing (strong) sustainability where*

      - *the modelling framework allows for* ***nonlinearities*** *in and between* ***Xs*** *:* $\dot{K} = f(\dot{K_m}, \dot{K_h}, \dot{K_n}, \dot{NFA})$

      - *and the objective is to ensure a* ***non-declining future consumption potential****:* $\dot{K} \cong GS = f(X) \geq 0$

    - ➢ *given that, when a country fails a* ***weak*** *sustainability test, it is also likely to fail a* ***strong*** *sustainability test: we focus on the* ***probability to get negative GS***

      Probit: $Pr(Unsust = 1|X)$ with **Unsust=0** if GS>=0, **Unsust=1** if GS<0

  - ➢ Panel data: 1996-2020 for around 150 countries (of which 20 are SIDS)

Empirical results

Determinants of Genuine Savings

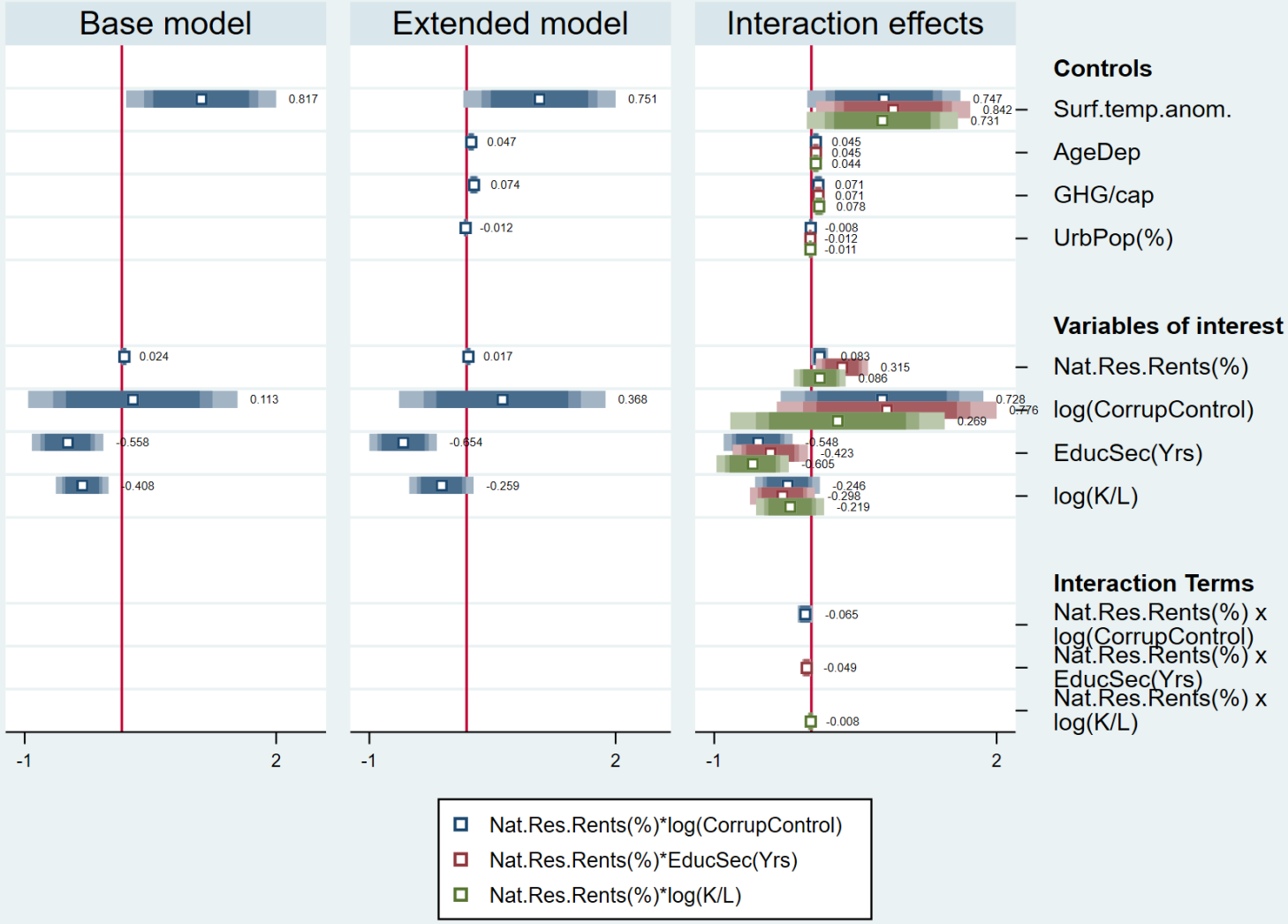
	VARIABLES	(1) GS($)	(2) GS(%GNI)	(3) P(GS<0)=1	(4) GS($)	(5) GS(%GNI)	(6) P(GS<0)=1	(7) GS($)
Institutions	Non-SIDS				-1.252e+10***	0.487***	-0.0341***	-1.348e+10***
	SIDS				3.532e+08	1.960***	-0.0241	3.476e+08
Surf.temp.anom.	Non-SIDS				-6.397e+08	-0.272	-0.00169	-1.626e+09
	SIDS				-4.218e+08	-0.194	0.688**	-4.186e+08
Log(K/L)	Non-SIDS	3.528e+10***	3.468***	-0.347***	3.072e+10***	3.668***	-0.298***	3.553e+10***
	SIDS	1.491e+09	1.796**	-0.366***	7.152e+08	0.543	-0.316***	7.300e+08
EducSec(Yrs)	Non-SIDS	-4.514e+09	-0.0629	0.204***	-4.425e+09	0.408	0.157***	-4.445e+09
	SIDS	-4.679e+09	6.011***	-0.557***	-2.269e+09	1.682	-0.490***	-2.250e+09
Log(NFA)	Non-SIDS	6.958e+10***	-3.022***	-0.124	1.154e+11***	-2.140**	0.0111	1.103e+11***
	SIDS	8.836e+11	-266.1**	0.0370	1.286e+12	-623.2***	0.142	1.286e+12
NatResExport(%)	Non-SIDS	-3.292e+07	0.00278	0.0342***	-4.170e+08	0.0293	0.0269***	-1.067e+10***
	SIDS	8.156e+07	0.00114	0.0452***	3.290e+07	0.402***	0.0301***	-7.943e+07
NatResExport(%)^2	Non-SIDS							3.927e+08***
	SIDS							5.129e+06
NatResExport(%)^3	Non-SIDS							-3.828e+06***
	SIDS							-64,032
	Constant	-5.740e+12	1,147**	4.530	-8.301e+12	2,436***	0.171	-8.178e+12
	Observations	3,620	3,620	3,620	2,663	2,663	2,663	2,663
	Nb of FE	157	157	157	149	149		149

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

- **Man-made capital** can create the conditions of boundless economic development
- **Education** is a sustainability driver in the SIDS
- **Nat.Res.Rents** increase the likelihood of going down an unsustainable path
- **Institutional quality** reduces the scale of savings but increases their share in total income, by reducing probability to get unsustainable (sufficiency?)
- **Temperature anomalies** increase probability for SIDS to be unsustainable
- ***Thresholds*** in natural resource rents

Empirical results

Extended model with interaction effects



- **Nat.Res.Rents** increase the likelihood of going down an unsustainable path
- **BUT** such a probability is reduced in

✓ ***High educated countries***

✓ ***Low-corrupted economies***

- **Nat.Res.Rents**' impact on GS would not depend on the **manufacturing capital's** evolution

➢ ***Hartwick's rule extended to other (intangible) forms of capital***

Conclusion

- The discriminating element of a weak versus strong sustainability analysis is **not the operational indicator** (GS), **but the analysis framework itself** (provided that the starting point lies in the capital theory's accounting approach)
  - Analysis in line with the strong sustainability paradigm requires a modelling framework allowing for nonlinearities: thresholds and complementarities, by focusing on situations which are more likely to reflect unsustainable resource allocation (negative GS)
- Interesting preliminary results:
  - factors increasing [*decreasing*] the magnitude of GS do not necessarily reduce [*augment*] the chance of being unsustainable: e.g., NFA, Nat.Res.Rents… [*Institutional quality*]
  - Nat. Res. Rents have a non-linear impact on GS (thresholds), and depend on other forms of capital… essentially on intangible capital
  - Role of education for a sustainable path in the SIDS
  - Climate change (temperature anomalies, GHGs) threats the sustainable development of SIDS
  - The economic capital remains a significant driver for a sustainable development

Further research

- Refine measures of different capital stocks' evolution
- Perform a robust '*threshold panel regression model*' (but need balanced panel data)
- Further controls for countries' heterogeneity (developed, least developed, OECD, BRICS, SSA…)