"The relationship between Health Care Expenditure and income in Latin American and Caribbean Countries: a Panel Time Series Approach"

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MOTIVATION

- Health care expenditure in Latin-American and Caribbean countries varies substantially over time and across countries.

- Extensive literature on what determines that amount of resources countries devote to health since the work of Newhouse (1977).

- Consensus reached about the importance of income. Empirical studies have found a strong and positive link between HCE and GDP for OECD countries.

- Elasticity of income has policy implications for the conduct and financing of health care as those who feel that health care is a "necessity" are often on the side of greater public involvement in health care.

MOTIVATION

- Concerns about stationarity of the series under study have led to a significant strand of the literature exploring time series properties of the variables in a panel set.

- This new area of econometric treatment of macro panels named *"Panel Time Series"* not only handles stationarity concerns but also:

  - rejects the assumption of slope homogeneity

  - recognizes that, if presence of cross sectional dependence can be found, efficiency loses will occur by operation with a panel.

- Relatively new area of study and increasing use of methods coded for Stata.
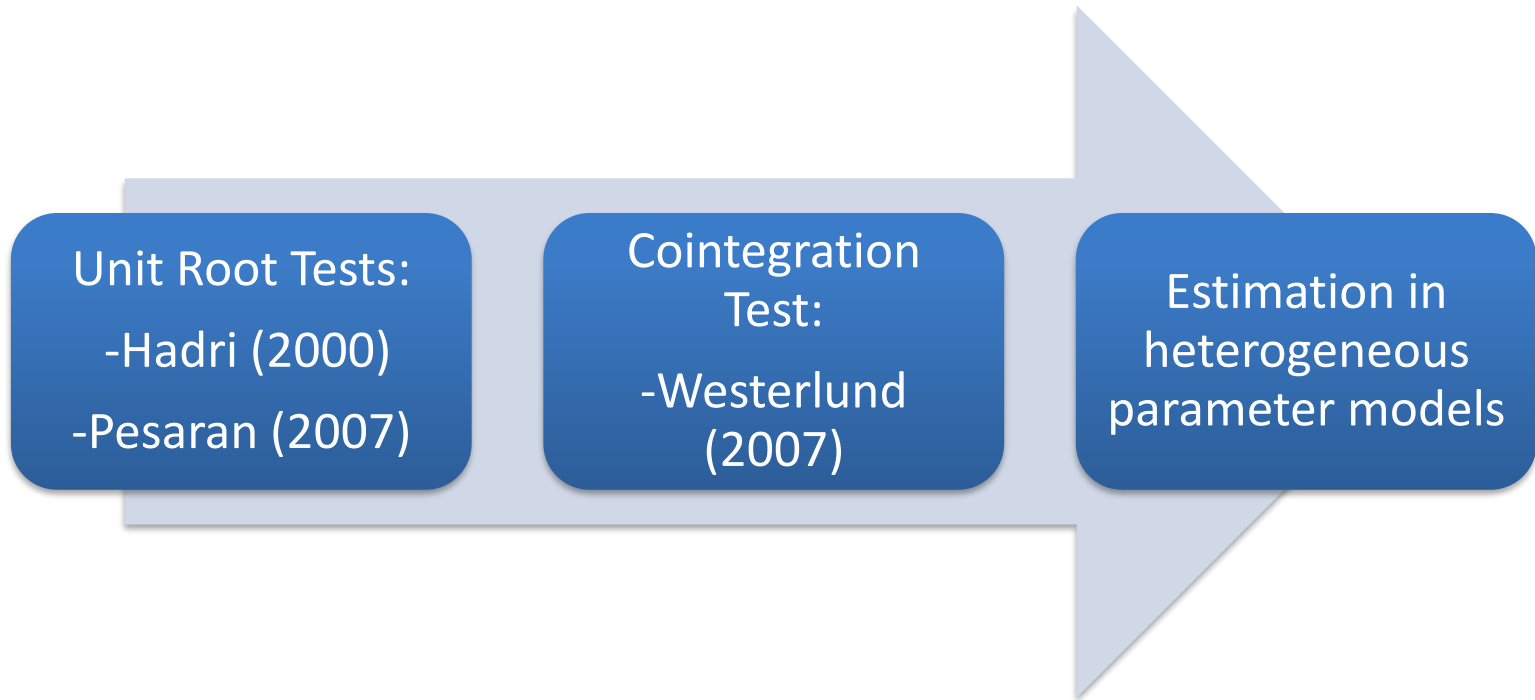
MAIN OBJECTIVE

To examine the effect of income on healthcare expenditure in Latin American and Caribbean countries by using a panel time series approach.

Testing the nonstationarity and cointegration properties of the variables to determine whether there is a long run equilibrium between health expenditure and income.

DATA

- 30 Latin-American and Caribbean countries for the period 1995 to 2014.

- Series: GDP, total, public and private health expenditures (measured in per-capita terms at constant 2011 international dollars, adjusted for purchasing power parity).

- Source: World Bank Development Indicators Database.

METHODOLOGY

Unit Root Tests:
-Hadri (2000)
-Pesaran (2007)

Cointegration Test:
-Westerlund (2007)

Estimation in heterogeneous parameter models

Need to deal with:
1. Residual correlation across countries in the panel due to common shocks or spillover effects.
2. Parameter heterogeneity ($HCE_{it} = \alpha_i + \gamma_i t + \boldsymbol{\beta}_i X_{it} + v_{it}$)
3. Variable non stationarity (test for cointegration to see whether the relationship is spurious or not)

PANEL TIME SERIES MODELLING IN STATA

Panel Unit Root Tests:

-Hadri (2000)

-Pesaran (2007)

Panel Cointegration Test:

-Westerlund (2007)

Estimation in heterogeneous parameter model

From First Generation:
- Hadri (2000), Levin-Lin-Chu (2002); Harris and Tzavalis (1999); Breitung (2000); Im-Pesaran and Chin (2003), Maddala and Wu (1999) (xtunitroot)

From Second Generation:
- Pesaran (2007) (xtcips)

Cross Section Dependence testing: xtcsi The Stata Journal (Burdiso and Sangiacomo, 2016), xtcd by Markus Eberhardt

Xtwest: The Stata Journal (Persyn and Westerlund, 2008) estimates error correction based cointegration test

New in Stata 15!

Xtmg: The Stata Journal (Eberhardt, 2012)

Unit Root Tests Results

Pesaran (2007) panel unit root test

Number of lags

	0	1	2	3
GDP	4.40	2.67	2.42	1.87
HCE	-1.83**	-0.40	3.78	6.40
PUBLIC HCE	-2.63*	-0.76	0.25	3.13
PRIVATE HCE	0.13	0.13	2.33	3.31

Hadri (2000) panel unit root test

	Statistic
GDP	27.93*
HCE	18.13*
PUBLIC HCE	17.29*
PRIVATE HCE	21.30*

- As we find evidence of cross-sectional dependence among countries, Pesaran (2007) test should give the more reliable inference.
- Both tests agree that the series are integrated of order 1.

COINTEGRATION TESTS RESULTS

Cointegration tests Westerlund (2007)

$$\Delta y_{it} = \delta_i' d_t + \alpha_i \left(y_{i,t-1} - \beta_i' x_{i,t-1} \right) + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=-q_i}^{p_i} \gamma_{ij} \Delta x_{i,t-j} + \varepsilon_{it}$$

Dependent Variable

Statistic	HCE		Public HCE		Private HCE	
	Value	p-value	Value	p-value	Value	p-value
G_t	-5.58	0.00	-7.25	0.00	-3.06	0.00
G_a	2.68	0.99	2.22	0.99	2.95	0.99
P_t	-3.47	0.07	-5.44	0.00	-2.85	0.00
P_a	-0.23	0.41	-1.33	0.09	0.15	0.56

All tests include a constant and a trend. The lags and leads were selected according to the AIC criteria with the maximum amount set to one, to preserve degrees of freedom.

- For the G_t and P_t statistics the hypothesis that the series are not-cointegrated is strongly rejected.

PANEL TIME SERIES ESTIMATORS WITH HETEROGENEOUS SLOPE

Pesaran and Smith (1995) & Pesaran (2006):

$$y_{it} = \beta_i x_{it} + u_{it} \text{ where } u_{it} = \alpha_{1i} + \lambda_i f_t + \varepsilon_{it}$$
$$x_{it} = \alpha_{2i} + \lambda_i f_t + \gamma_i g_t + \epsilon_{it}$$

Dependent Variable	Total HCE		Public HCE	
	MG	CCEMG	MG	CCEMG
GDP	1.077***	0.694**	1.077***	0.694**
DEMOG	-1.895 *	-0.766	-1.895*	-0.766
PUB	0.36	0.476	1.36***	1.476***
CD TEST STATISTIC	2.84***	0.82	2.84***	0.82

After controlling for common factors:
- ✓ Sizeable reduction of contemporaneous correlation
- ✓ Elasticity of income is considerably reduced
- ✓ Demographic composition is no longer significant

DISCUSSION

- This study adds to the existing literature on the effect of income on health care expenditure.

  1. It provides empirical evidence for Latin America and the Caribbean which could support decision making and public policies in the region.

  2. By using panel time series techniques, it serves as a valuable comparison to the works centering in dynamic pure panel models such as dynamic system GMM.

- Results obtained here support previous conclusions for the OECD region that public and private health expenditure are cointegrated with income and that healthcare expenditure is a necessity rather than a luxury.

- There are several potential areas in which the present study can be expanded such as the sensitivity of the results to the treatment of structural breaks in unit root tests. Recent developments in cointegration and unit root tests need to be coded in STATA for its use in applied research.

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