THE IMPACT OF ECONOMIC GROWTH ON THE CO_2 EMISSIONS IN AUSTRALIA: ENVIRONMENTAL KUZNETS CURVE AND DECOUPLING INDEX

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Motivation

Motivation and Debate

Methodology

Results

Main achievements

Answering the questions and Contribution

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Global warming is a threat for the humanity.

It is possible growing without pollute? Trade off between economic growth and CO_2 emisisons.

Australia is the sixth largest country in the world.

Twuenty-sixth consecutive years without ressection on the economic growth.

One of the tem largest emitters of greenhouse gases.

Debate

Theoretical studies:

- Dinda, 2004
- Stern, 2004

Empirical studies:

- Relationship between CO2 emissions and economic growth in Algeria, with energy use, electricity consumption, exports and imports. (Bouznit & Pablo-Romero, 2016)
- EKC is not valid in Qatar with CO2 emissions but held with ecological footprint, ARDL model. (Mrabet & Alsamara, 2017)

Research Questions

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✓ Is the Environmental Kuznets Curve hypothesis verified in Australia?

✓ How the decoupling index in Australia behave?

✓ Australia has a trade-off between economic growth and CO_2 emissions?

Data

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❖This study uses annual data from 1965 to 2015 for Australia.

❖Variables used:

❖ Gross Domestic Product	(LGDP)	Constant Local Currency Unit
❖ CO_2 Emissions	(LCO2)	Millions of tonnes
❖ Oil Concumption	(LOIL)	Millions of tonnes
❖ Coal Consumprion	(LCOAL)	Millions of tonnes in oil equivalent
❖ Renewable Energy Consumption	(LRES)	Millions of tonnes in oil equivalent

Share of primary energy consumption

Hereafter, the prefixes "D" means the first differences and "L" means the natural logarithm.

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Data characteristics

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Unit Root Test - ADF, PP and KPSS

All variables are integrated of order one, I(1).

Structural Break Unit Root Test - Zivot and Andrews

Table: Results Zivot and Andrews unit root tests (4 lags)

| LCO2 | 2007 | 2007 | 2006 |

ARDL

Methodology

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ARDL

EKC

DI
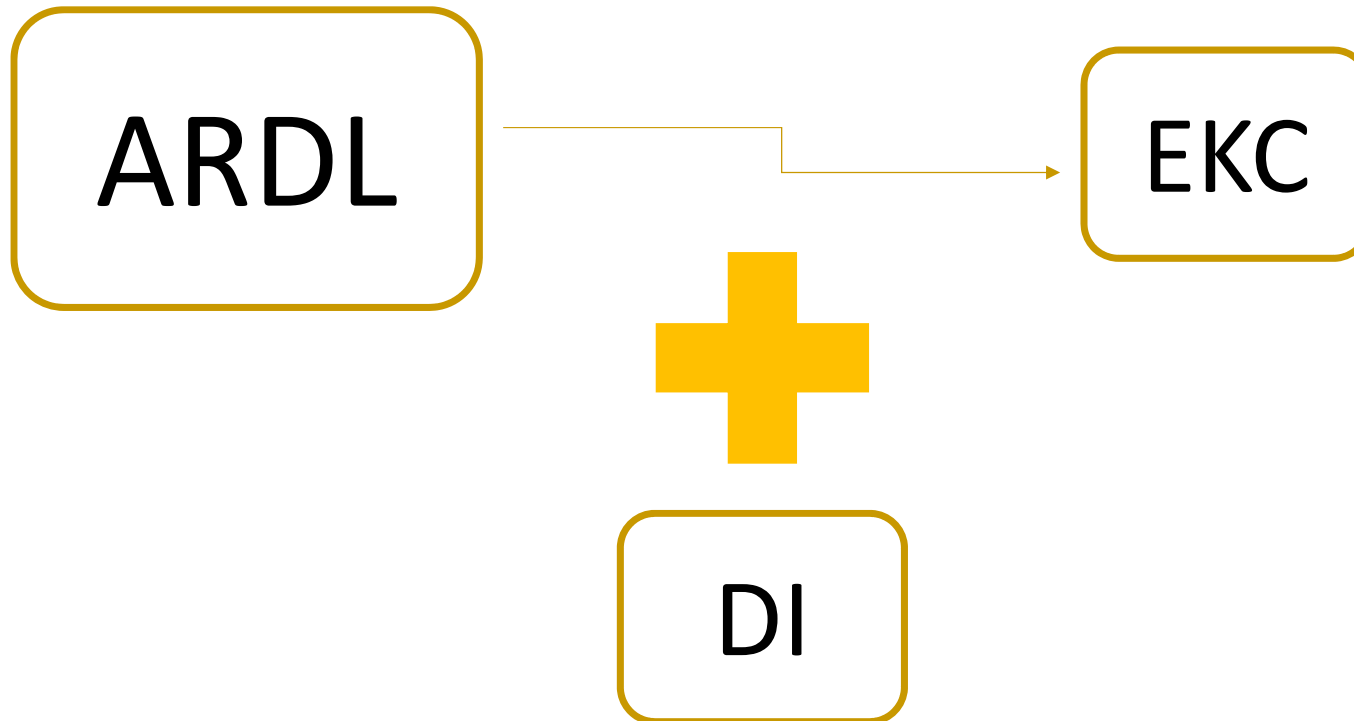
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Autoregressive Distributed Lag (ARDL)

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❖ Proposed by Pesaran, Shin, and Smith (2001).

➢ Application of dummies without affecting the results.

➢ Unbiased long-run estimation.

$$DLCO_{2,t} = c + \propto_1 TREND + \propto_2 LNCO_{2,t-1} + \propto_3 LGDP_{t-1} + \propto_4 (LGDP_{t-1})^2 + \propto_5 LOIL_{t-1} + \propto_6 LCOAL_{t-1} + \propto_7 LRES_{t-1}$$

$$+ \sum_{i=1}^{k} \beta_{1i} DLCO_{2,t-1} + \sum_{i=0}^{k} \beta_{2i} DLGDP_{t-i} + \sum_{i=0}^{k} \beta_{3i} D(LGDP_{t-i})^2 + \sum_{i=0}^{k} \beta_{4i} DLOIL_{t-i} + \sum_{i=0}^{k} \beta_{5i} DLCOAL_{t-i}$$

$$+ \sum_{i=0}^{k} \beta_{6i} DLRES_{t-i} + \varepsilon_t$$

Environmental Kuznets Curve (EKC)

❖Proposed by Grossman and Krueger (1991).

❖Origin in the Inverted-U hypothesis developed by Kuznets (1955).
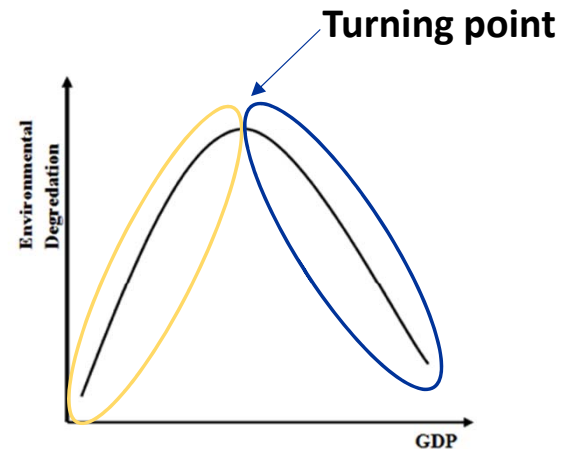
Turning point

➤ 1st phase: increase of the environmental degradation factors and the income

➤ 2nd phase: the turning point was achieved and the CO_2 emissions start to decrease

$B_1 > 0$, $\beta_2 < 0$ → Inverted U-shaped relationship, EKC.

$$LNCO_{2_{it}} = c + \beta_1 LGDP_{it} + \beta_2 LGDP^2{}_{it} + \beta_3 LOIL_{it} + \beta_4 LCOAL_{it} + \beta_5 LRES_{it} + \varepsilon_{it}$$

Decoupling Index (DI)

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• Proposed by OCDE (2002).

$$DI = 1 - \frac{\frac{M^t}{Y^t}}{\frac{M^0}{Y^0}} = 1 - \frac{EPI^t}{EPI^0} \Leftrightarrow DI = 1 - \frac{\frac{CO2t}{GDPt}}{\frac{CO20}{GDP0}}$$

• "0" - the starting year
• "t" - final year
• "M" - the indicator of environmental pressure
• "Y" - GDP in constant prices.

❖ **DI ≥ 1 -** there is strong decoupling (absolute decoupling).

❖ **0 < DI < 1** – there is a weak effect of decoupling (relative decoupling).

❖ **DI ≤ 0** – there is no decoupling effect (coupling) the DI is negative.

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EKC Results

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RES does not have impact on CO_2 emissions

ARDL estimation

Variable	Coefficient
D(LOIL_P)	0.411167***
D(LCOAL_P)	0.2964***
D(LGDP2)	0.457605**
D(LGDP)	-24.27403**
LCO2(-1) (ECM)	-0.181682***
LGDP(-1)	2.308582*
LGDP2(-1)	-0.040789*
C	-31.60444*
time dummies	
D_1982	-0.049319***
D_2006	0.060072***
D_2001	0.033516**

Notes: *** - 1%; ** - 5%; * - 1%; the results are based on F - statistic; () – lag order;
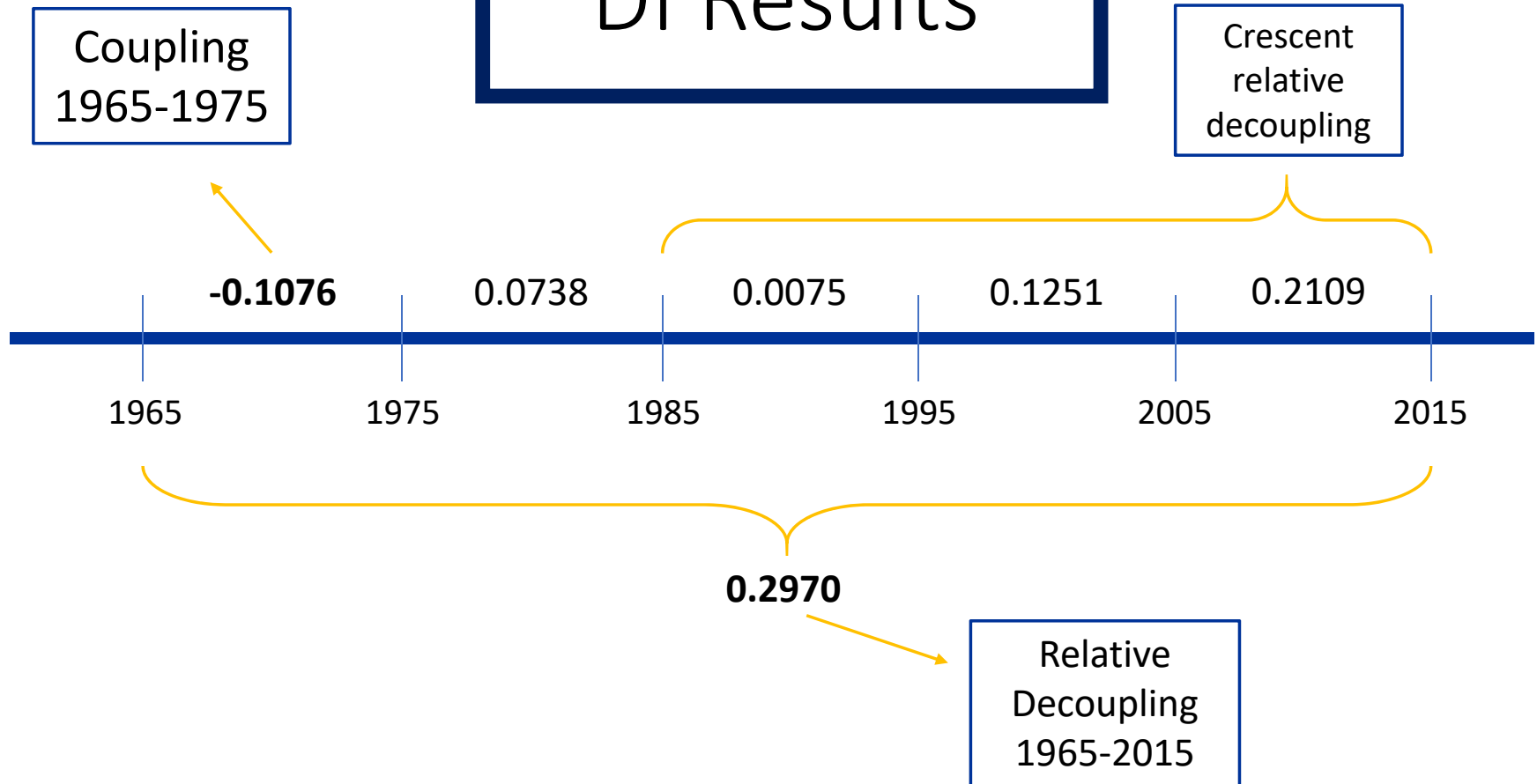
$\beta_1 > 0$

$\beta_2 < 0$

Is verified the EKC hypothesis

Diagnostics tests:
- Normal behavior of the residuals;
- Rejection of the serial correlation;
- Residuals homoscedastic;
- Well specification of the model;
- Parameters stable during the period used.

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EKC

Economic growth and CO_2 emissions increase.

Australia has not yet hit the turning point.

Relative Decoupling

The CO_2 emissions increase slower than the GDP.

Fossil fuels

Coal and oil consumption increase the CO_2 emissions.

Reduce the consumption of fossil fuels.

Agreement between the world's largest coal producers in 2006.

RES

The renewable energy consumption do not has impact on the CO_2 emissions.

Implement energy efficiency measures.

Answering the questions and Contribution

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- Turning Point

- Absolute decoupling

- Environmental targets

  - Energy demand management and control
  - Energy efficiency
  - Reduce the fossil fuels consumption
  - Invest on renewable energy technology

✓ It is possible has a sustainable develop? Growing without polluting?
  ✓ Australia has been growing and reducing your rate of CO_2 emissions.

Contribution

- Studied Australia individually.

- ARDL model

- Add energy variable to the EKC estimation: fossil fuels and renewable consumption.

- Decoupling Index.

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