



ECONOMIC GROWTH, CO₂ EMISSIONS, FOSSIL FUELS CONSUMPTION AND RENEWABLE ENERGY CONSUMPTION IN AUSTRALIA

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Motivation

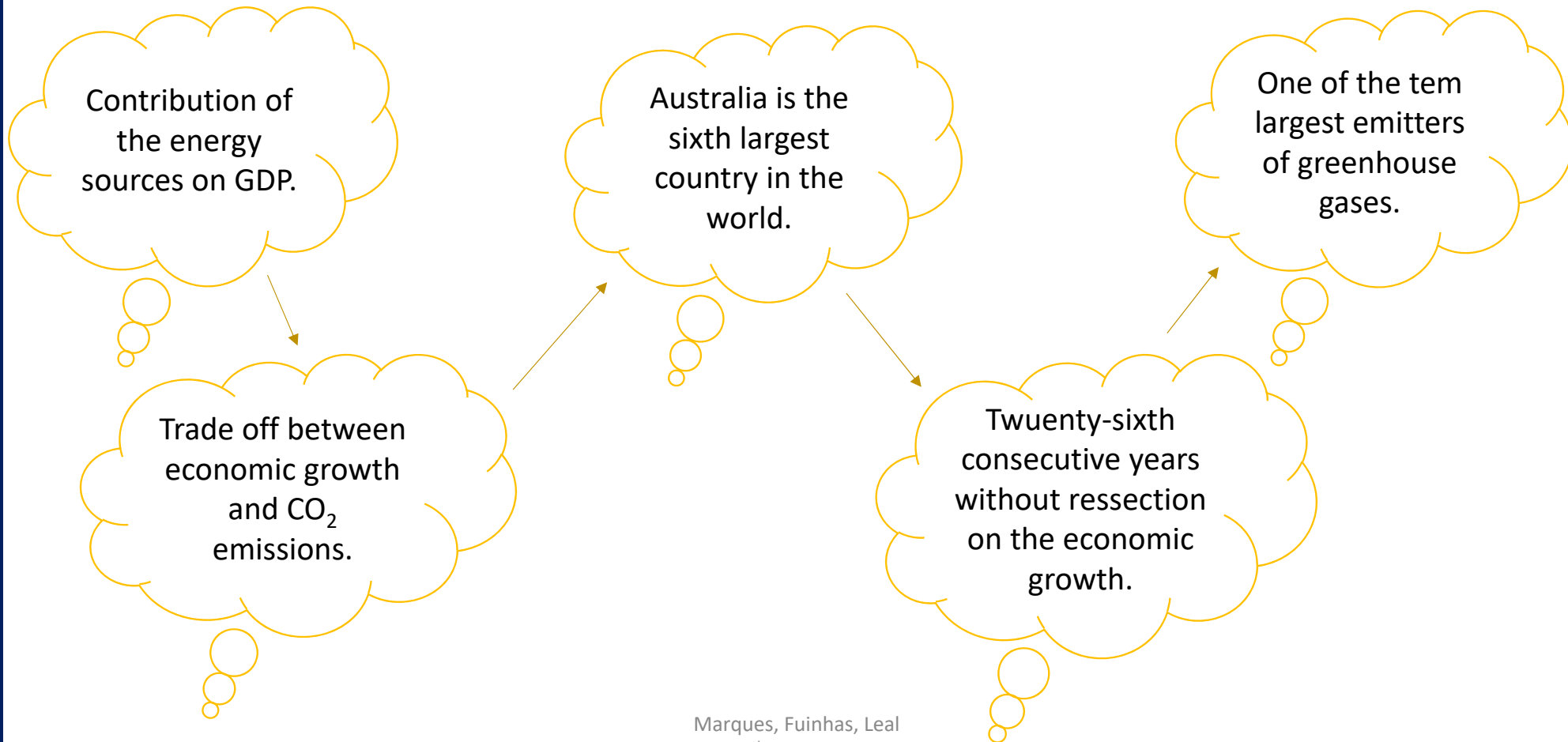
**Motivation
and Debate**

Methodology

Results

Main
achievements

Answering the
questions and
Contribution



Debate

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The first studies:

- Relationship between economic growth and energy consumption, (Kraft & Kraft, 1978)

The recent studies:

- Relationship between economic growth, energy and emissions, (Acaravci & Ozturk, 2010)
- ❖ Studies focused for different countries with different methodology obtain different results about the Energy -Growth Nexus.

Research Questions

Motivation and Debate

Methodology

- ✓ Australia has a trade-off between economic growth and CO₂ emissions?

Results

- ✓ What is the impact of the energy consumption on the Australian GDP and on the environment?

Main achievements

Answering the questions and Contribution

- ✓ What is the impact between energy sources?

Data

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

❖ Variables used:

Intencity of primary energy consumption	❖ Gross Domestic Product	(LGDP)	Constant Local Currency Unit
	❖ CO ₂ Emissions	(LCO2)	Millions of tonnes
Share of primary energy consumption	❖ Oil Consumption	(LOIL)	Millions of tonnes
	❖ Coal Consumption	(LCOAL)	Millions of tonnes in oil equivalent
	❖ Renewable Energy Consumption	(LRES)	Millions of tonnes in oil equivalent

Hereafter, the prefixes “D” means the first differences and
 “L” means the natural logarithm

Data characteristics



Unit Root Test – ADF, PP and KPSS

Structural Break Unit Root Test - Zivot and Andrews

ARDL

Table 1: Results Zivot and Andrews unit root tests (4 lags)

	Break point	Break point	Break point
LGDP	1998	1993	1998
LCO ₂ _INT	2007	2006	2004
LOIL_P	1980	1990	1991
LCOAL_P	2007	2003	2002
LRES	1987	2008	2008

Notes: (a) – Intercept; (b) – Trend; (c) – Both; * - 10%; ** - 5%; *** - 1%

VIF test - Multicollinearity

- ✓ Multicollinearity between GDP and OIL.
- ✓ No change on the signs.

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Autoregressive Distributed Lag (ARDL)

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

- Application of dummies without affecting the results.
- Unbiased long-run estimation.
- Implicit causalities.

$$DY_t = \alpha_0 + \alpha_1 TREN D + \alpha_2 DZ_t + \alpha_3 \sum_{p=1}^k Y_{t-p} + \alpha_4 \sum_{p=1}^k Z_{t-p} + \varepsilon_t$$

D Means the first differences

DY_t Dependent variables

DZ_t Independent variables

α_{2i} Short-run coefficients

α_{3i} Error correction mechanism (ECM)

α_{4i} Long-run coefficients

Results

Variable	Model I: LGDP	Model II: LOIL_P	Model III: LCOAL_P	Model IV: LCO ₂ _INT	Model V: LRES
D(LCO ₂ _INT)	-1.1625***	4.2904***	3.1891***		-6.4745***
D(LRES)	-0.0923***	0.0572*	0.0488**	-0.0191***	
D(LCOAL_P)		-1.3965***		0.2580***	
D(LOIL_P)			-0.4796***	0.1114***	
LGDP(-1)	-0.2565***	-0.3239***	-0.0761***	0.0194***	0.4917***
LCO ₂ _INT(-1)	-0.6006***	2.9657***	1.7466***	-0.5040***	-3.5083***
LRES(-1)	-0.1189***			—	-0.6280***
LCOAL_P(-1)		-0.8863***	-0.5642***	0.1603***	
LOIL_P(-1)	0.2083***	-0.4799***	-0.3440***	0.0919***	0.3847***
C	6.7896***	10.2912***	3.4236***	-0.8821***	-10.0016***
@TREND	0.0130***	0.0074***			
ECM	-0.2565***	-0.4799***	-0.5642***	-0.5040***	-0.6280***

➤ **Negative impacts:**

- CO₂ intensity → GDP;
- RES → GDP;
- GDP → OIL and COAL.

➤ **Positive impacts:**

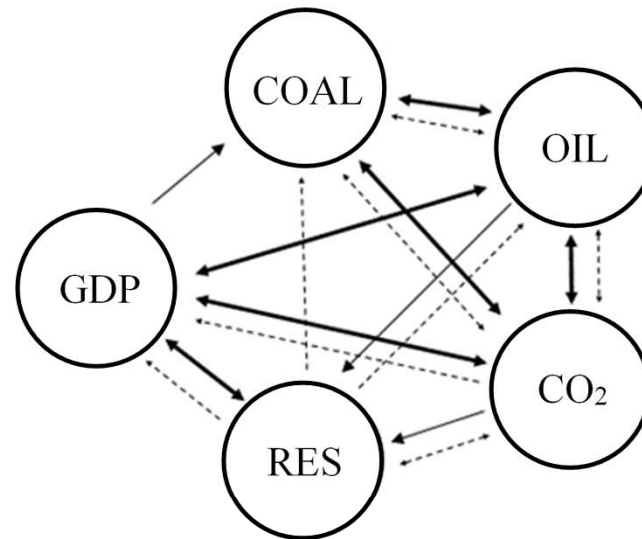
- CO₂ intensity → COAL and OIL;
- GDP → CO₂ intensity and RES;
- OIL → RES.

➤ **No impact:**

- RES → CO₂ intensity in the long-run.

Main achievements and their implications

Short- and long-run causalities



Source: Own elaboration

Notes: long-run unidirectional relationship →; long-run bidirectional relationship ↔; short-run unidirectional relationship ➤; short-run bidirectional relationship ↔➤

Main achievements and their implications

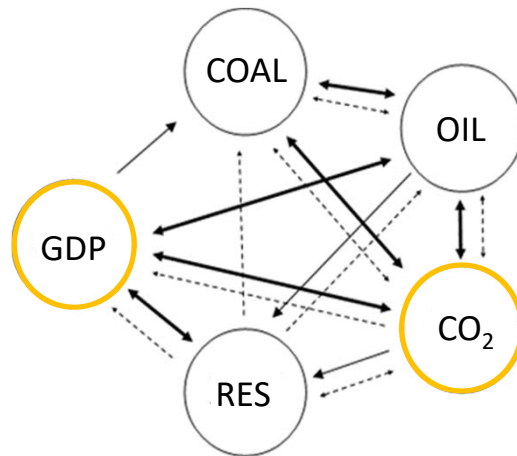
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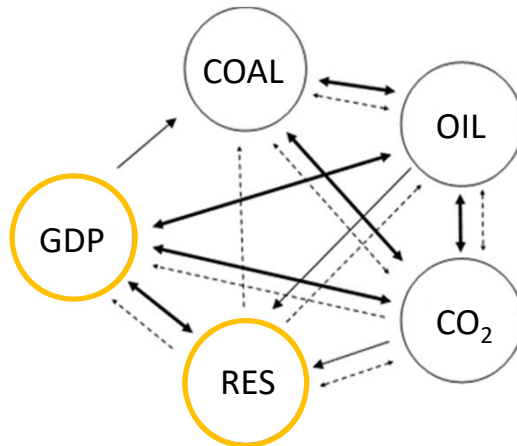
**Main
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❖ **Negative impact of the CO₂ intensity on GDP:**

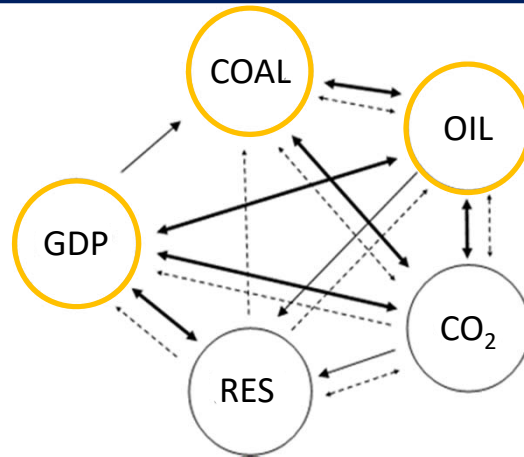
- Restrictive energy consumption policies that reduce the CO₂ intensity ratio and consequently reduce the GDP.



❖ **Negative impact of the RES on GDP:**

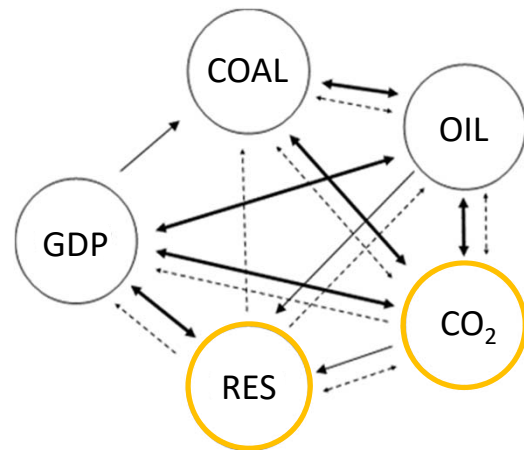
- Huge investment that is necessary for expand the RES capacity.

Main achievements and their implications



❖ **Negative impact of the GDP on OIL and COAL:**

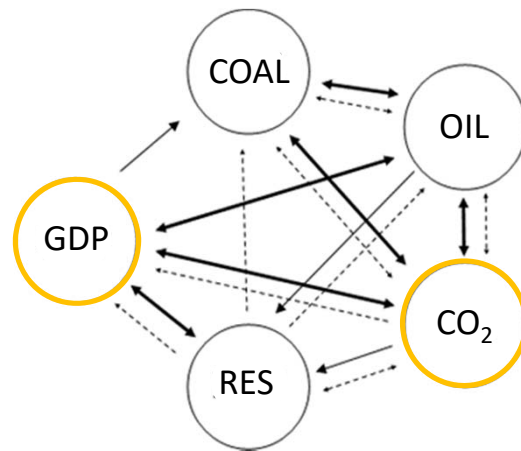
- For achieved the environmental targets, with the increase of GDP the country increase the primary energy consumption with clean energy.



❖ **No impact of the RES on CO₂ intensity on the long-run:**

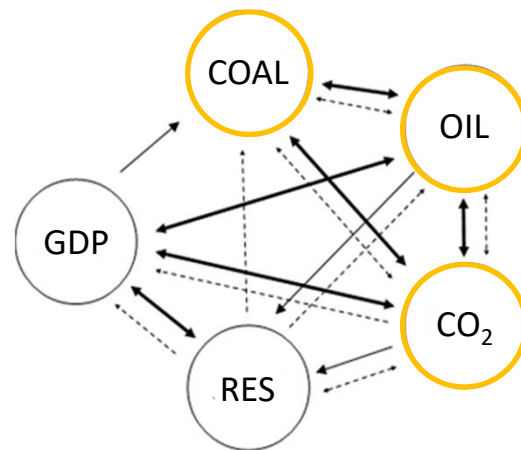
- Limited and insignificant growth of renewable technology.

Main achievements and their implications



❖ **Positive impact of the GDP on CO₂ intensity :**

- Increasing GDP implies more energy consumption. Due to the limited renewable technology the energy consumed are the fossil fuels that increase the CO₂ emissions.



❖ **Positive impact of the CO₂ intensity on OIL and COAL:**

- How much higher the CO₂ emissions higher the fossil fuels consumption.

Main achievements and their implications

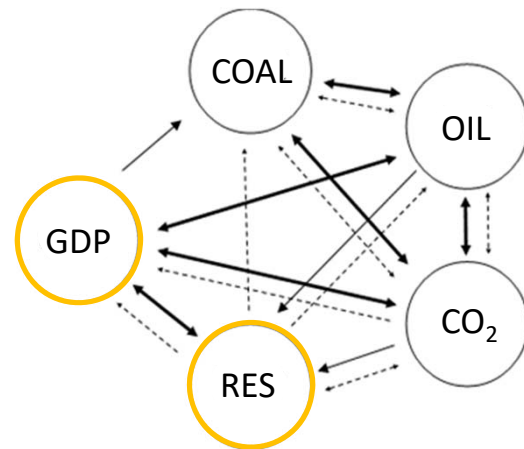
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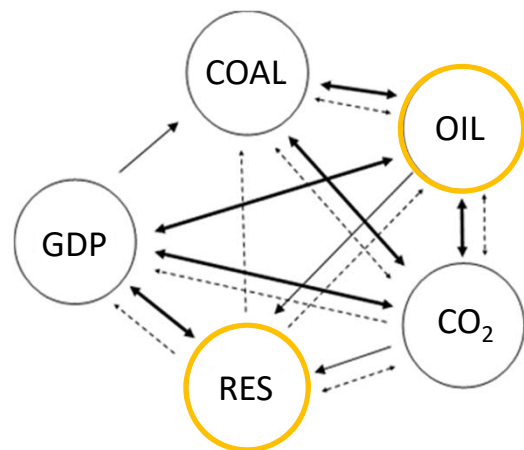
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❖ **Positive impact of the GDP on RES:**

- With the increase of GDP the country invest more in renewable energy.



❖ **Positive impact of the OIL on RES:**

- The effect of the growing economy. Dependency of oil help the economic growth, and investment on renewable energy.

Answering the questions and Contribution

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Contribution**

- Invest on renewable energy.
- Implement energy efficiency measures.
- Reduce the coal consumption.

Achieved the
environmental
targets.

Contribution

- Studied Australia individually.
- ARDL approach.
- Relationship between all variables.



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