HS5.201 Growth and Development

Class Notes: Lecture 11

# Decoupling and the Possibility of Green Growth

## Readings:

- Robert Pollin (2019): Advancing a Viable Global Climate Stabilization Project: Degrowth versus the Green New Deal
- Review of Radical Political Economics
- Enno Schröder & Servaas Storm (2020): Economic Growth and Carbon Emissions: The Road to "Hothouse Earth" is Paved with Good Intentions, International Journal of Political Economy

## Green Growth and the decoupling strategy:

- Since Green House Gas emissions have been established as the most critical source of climate change, there has been a concerted effort to 'green and clean' the growth process by reducing harmful emissions, i.e. decoupling
- Relative decoupling: when the rate of growth of emissions is less than the rate of economic growth ( due to an increase in energy efficiency or use of cleaner energy sources)
- Absolute decoupling: when the rate of growth of emissions is zero or negative, i.e. output is 'decoupled' from emission in a net sense
- Green growth is seen as a strategy for accelerating the transition towards cleaner and more efficient energy sources and making decoupling a feasible reality.

## The Evidence of Decoupling:

- Most of the positive evidence on decoupling (both relative & absolute) comes from the wealthier OECD countries
- As expected, much of the hopeful findings pertain to relative decoupling, and there is less evidence of absolute decoupling
- Decoupling can be calculated with respect to various GhG emissions, and thus performance can vary across multiple dimensions
- Schröder and Storm ( 2020) provide a comprehensive overview of decoupling trajectories using different available data sets
- They use a modified Kaya identity to decompose $Co_2$ emissions into the various drivers
- They also use regression methodology to test a Carbon Kuznets Curve(CKC) hypothesis and try to identify relevant turning points

## The Kaya decomposition exercise:

- C^ = P^ + y^ + c^ + e^ (equation in terms of growth rates)
- C= carbon emissions, P = population size, y = per capita income, c = $CO_2$ emissions per unit of energy use and e = energy efficiency of Production
- Green growth has possible impacts on both c ( renewable energy) and e ( energy efficient technology)
- Table 1 calculates the projections with targets proposed in climate policy negotiations and economic growth rates derived as the residual.

**Table 1.** A Kaya identity decomposition of global $CO_2$ emissions, 1971–2017 and 2017–2050.

| | Actual change | | | Projection |
|---|---|---|---|---|
| | 1971–1990 | 1991–2017 | 1971–2017 | 85% Reduction in $CO_2$ emissions 2017–2050 |
| Global $CO_2$ emissions | 2.05 | 1.80 | 1.88 | −6.92 |
| World population | 1.81 | 1.30 | 1.52 | 0.79 |
| Real GDP per capita | 1.52 | 1.54 | 1.49 | −1.34 |
| Energy intensity (TPES/GDP) | −0.86 | −1.05 | −0.96 | −2.69 |
| Carbon intensity ($CO_2$/TPES) | −0.41 | 0.01 | −0.17 | −3.68 |

*Sources*: Data for 1971–2017 are from IEA (2019) "$CO_2$ Emissions from Fuel Combustion." The $CO_2$ intensity ($CO_2$/TPES) and energy intensity (TPES/GDP) in 2050 are from OECD (2017, Table 2.18), and refer to the G20 countries. Projected growth of world population is from UN DESA (2015), "World Population Prospects: The 2015 Revision."

*Notes*: Average annual growth rates are given in percentages. Average annual growth rate are compound average annual growth rates. Calculations are based on the IEA-IRENA (2017) and IEA 66% 2 °C scenario projections. The projected changes for the period 2014–2050 are consistent with the IEA 66% 2 °C scenario projections; the average annual reduction in global $CO_2$ emissions is consistent with the target to reduce emissions in 2050 by 85% below 1990 levels accepted in the 2050 Low Carbon Economy Roadmap adopted by the E.U. and the COP21. The projected average annual growth rate of per capita real GDP (2017–2050) has been estimated as a residual (using the Kaya identity (3)), as explained in the text.

**Table 2.** A Kaya Identity decomposition of $CO_2$ emissions, 1971–2017.

| | 1971–1990 | 1991–2017 | 1971–2017 |
|---|---|---|---|
| OECD | | | |
| $CO_2$ emissions | 0.89 | 0.16 | 0.47 |
| Population | 0.96 | 0.68 | 0.80 |
| GDP per capita | 2.28 | 1.42 | 1.75 |
| Energy intensity (TPES/GDP) | −1.62 | −1.53 | −1.54 |
| Carbon intensity ($CO_2$/TPES) | −0.73 | −0.41 | −0.55 |
| U.S.A. | | | |
| $CO_2$ emissions | 0.60 | 0.00 | 0.23 |
| Population | 0.98 | 0.97 | 0.98 |
| GDP per capita | 2.23 | 1.57 | 1.78 |
| Energy intensity (TPES/GDP) | −2.17 | −2.08 | −2.06 |
| Carbon intensity ($CO_2$/TPES) | −0.44 | −0.47 | −0.48 |
| E.U.-28 | | | |
| $CO_2$ emissions | 0.12 | −0.73 | −0.33 |
| Population | 0.33 | 0.41 | 0.38 |
| GDP per capita | 2.42 | 1.25 | 1.73 |
| Energy intensity (TPES/GDP) | −1.43 | −1.59 | −1.48 |
| Carbon intensity ($CO_2$/TPES) | −1.20 | −0.80 | −0.96 |
| Non-OECD | | | |
| $CO_2$ emissions | 4.15 | 3.15 | 3.51 |
| Population | 2.05 | 1.44 | 1.70 |
| GDP per capita | 1.61 | 3.22 | 2.47 |
| Energy intensity (TPES/GDP) | 0.10 | −1.82 | −1.02 |
| Carbon intensity ($CO_2$/TPES) | 0.40 | 0.30 | 0.36 |
| China | | | |
| $CO_2$ emissions | 5.32 | 5.68 | 5.52 |
| Population | 1.59 | 0.72 | 1.09 |
| GDP per capita | 6.09 | 8.96 | 7.74 |
| Energy intensity (TPES/GDP) | −3.20 | −4.26 | −3.98 |
| Carbon intensity ($CO_2$/TPES) | 0.85 | 0.27 | 0.68 |
| India | | | |
| $CO_2$ emissions | 5.81 | 5.26 | 5.54 |
| Population | 2.29 | 1.59 | 1.89 |
| GDP per capita | 2.08 | 5.16 | 3.74 |
| Energy intensity (TPES/GDP) | −0.63 | −2.66 | −1.70 |
| Carbon intensity ($CO_2$/TPES) | 2.07 | 1.16 | 1.61 |
| Indonesia | | | |

**The CKC and difference between Consumption-based and Production based carbon emissions:**

- Typically testing for an inverted U-shaped CKC relationship is done using production-based emission information
- But production-based estimates do not take into account the effect of international trade and the possibility of outsourcing carbon intensive Production to countries of the global South

- Consumption-based estimates incorporate the carbon content of goods and services consumed by a country and are, therefore, more authentic in capturing the genuine carbon footprint of a national population



**Table 4.** Turning points calculated using TECO2 (2007–2015).

| | Production-based $CO_2$ | | | Consumption-based $CO_2$ | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Income | 3.490*** | 3.493*** | 3.490*** | 2.581** | 2.573** | 2.581** |
| | (1.000) | (0.996) | (1.000) | (0.965) | (0.959) | (0.965) |
| Income sq. | −0.144** | −0.144** | −0.144** | −0.085 | −0.084 | −0.085 |
| | (0.052) | (0.052) | (0.052) | (0.051) | (0.051) | (0.051) |
| Constant | −11.780* | −11.720* | −11.709* | −8.524 | −8.383 | −8.421 |
| | (4.787) | (4.770) | (4.786) | (4.600) | (4.572) | (4.597) |
| *N* | 174 | 174 | 174 | 174 | 174 | 174 |
| $R^2$ | 0.571 | 0.571 | 0.571 | 0.523 | 0.523 | 0.523 |
| *F*-statistic | 28.615 | 55.558 | 28.615 | 28.097 | 55.889 | 28.097 |
| Time | Dummies | Linear | Quadratic | Dummies | Linear | Quadratic |
| Turning point | 188,736 | 188,722 | 188,736 | 4,200,928 | 4,254,828 | 4,200,928 |

*Notes*: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. In the columns 1–3 the dependent variable is the log of production-based per-capita $CO_2$ emissions. In the columns 4–6 the dependent variable is the log of consumption-based per-capita $CO_2$ emissions. Income is the log of real per-capita GDP in international dollars. Inference is robust to serial correlation and heteroskedasticity (cluster-robust standard errors). The columns 1 and 4 include time-specific effects, the columns 2 and 5 include a linear time trend, and the columns 3 and 6 include a quadratic time trend. The *F*-statistic is the Wald test statistic for joint significance of time period dummies/time trends. The (within) $R^2$ measures the explained portion of the variance within countries over time.



**Table 5.** Turning points calculated using OECD-ICIO-2015 (1997–2011).

| | Production-based $CO_2$ | | | Consumption-based $CO_2$ | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Income | 3.366*** | 3.356*** | 3.358*** | 3.319*** | 3.295*** | 3.297*** |
| | (0.699) | (0.697) | (0.695) | (0.740) | (0.728) | (0.733) |
| Income sq. | −0.159*** | −0.159*** | −0.158*** | −0.148*** | −0.148*** | −0.146*** |
| | (0.036) | (0.036) | (0.036) | (0.040) | (0.039) | (0.039) |
| Constant | −9.057* | −8.943* | −9.105** | −9.512** | −9.319** | −9.544** |
| | (3.395) | (3.388) | (3.381) | (3.452) | (3.413) | (3.431) |
| *n* | 275 | 275 | 275 | 275 | 275 | 275 |
| $R^2$ | 0.550 | 0.515 | 0.543 | 0.642 | 0.593 | 0.634 |
| *F*-statistic | 11.525 | 2.280 | 10.503 | 12.827 | 4.803 | 15.856 |
| Time | Dummies | Linear | Quadratic | Dummies | Linear | Quadratic |
| Turning point | 39,874 | 38,864 | 41,310 | 72,070 | 70,754 | 77,860 |

*Notes:* *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. In the columns 1–3 the dependent variable is the log of production-based per-capita $CO_2$ emissions. In the columns 4–6 the dependent variable is the log of consumption-based per-capita $CO_2$ emissions. Income is the log of real per-capita GDP in international dollars. Inference is robust to serial correlation and heteroskedasticity (cluster-robust standard errors). The columns 1 and 4 include time-specific effects, the columns 2 and 5 include a linear time trend, and the columns 3 and 6 include a quadratic time trend. The *F*-statistic is the Wald test statistic for joint significance of time period dummies/time trends. The (within) $R^2$ measures the explained portion of the variance within countries over time.
*Sources*: PWT and OECD-ICIO-2015.

**Table 6.** Turning points calculated using Eora (1992–2015).

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| | Production-based $CO_2$ | | | Consumption-based $CO_2$ | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Income | 0.734 | 0.744 | 0.731 | 0.519 | 0.498 | 0.511 |
| | (0.493) | (0.489) | (0.492) | (0.337) | (0.343) | (0.337) |
| Income sq. | −0.031 | −0.032 | −0.030 | −0.011 | −0.008 | −0.010 |
| | (0.027) | (0.027) | (0.027) | (0.019) | (0.019) | (0.019) |
| Constant | 3.390 | 3.408 | 3.376 | 3.939* | 3.895* | 3.928* |
| | (2.237) | (2.212) | (2.236) | (1.553) | (1.568) | (1.550) |
| *n* | 1044 | 1044 | 1044 | 1044 | 1044 | 1044 |
| $R^2$ | 0.217 | 0.210 | 0.216 | 0.355 | 0.337 | 0.342 |
| *F*-statistic | 2.185 | 1.688 | 3.635 | 9.199 | 0.008 | 2.312 |
| Time | Dummies | Linear | Quadratic | Dummies | Linear | Quadratic |
| Turning point | 162,120 | 123,852 | 162,280 | 1.98e + 10 | 6.83e + 12 | 2.68e + 11 |

*Notes*: $*p < 0.05$; $**p < 0.01$; $***p < 0.001$. In the columns 1–3 the dependent variable is the log of production-based per-capita $CO_2$ emissions. In the columns 4–6 the dependent variable is the log of consumption-based per-capita $CO_2$ emissions. Income is the log of real per-capita GDP in international dollars. Inference is robust to serial correlation and heteroskedasticity (cluster-robust standard errors). The columns 1 and 4 include time-specific effects, the columns 2 and 5 include a linear time trend, and the columns 3 and 6 include a quadratic time trend. The *F*-statistic is the Wald test statistic for joint significance of time period dummies/time trends. The (within) $R^2$ measures the explained portion of the variance within countries over time.

*Sources*: PWT and Eora.

**Key Takeaways:**

- The CKC relationship does not hold up statistically universally for the different data sets.
- The consumption-based estimates yield significantly higher ( often impossibly high ) turning points
- Decoupling in any real sense is not likely in the foreseeable future without transformative change
- Degrowth as the only answer?

Green Growth vs. Degrowth: The Contours of the Debate

**Readings:**

- Giorgos Kallis et al. ( 2018) Research on Degrowth, *Annual Review of Environment and Resources*
- Robert Pollin ( 2019): Advancing a Viable Global Climate Stabilization Project: Degrowth versus the Green New Deal, *Review of Radical Political Economics*

**Egalitarian green growth or the 'Green New Deal.'**

- ' …a worldwide program whose central aim is to invest 1.5–2 per cent of global GDP per year in raising energy-efficiency standards and expanding clean renewable energy supply could realistically bring global $CO_2$ emissions down by 40 per cent relative to today within 20 years, while also supporting rising living standards and expanding job opportunities.' (Pollin, 2019)
- The two-pronged strategy of increasing energy efficiency and transitioning towards clean energy
- This strategy will imply transformation in the growth process ( from fossil fuel production to renewable energy production, more energy-efficient Production and consumption ) driven by significant investment
- Directed Public investment is critical to crowd in private investment and kickstart the process (Green Keynesianism)
- An important additional role of public investment in generating jobs and ensuring resource transfers to those who lose out from the greening process ( Resembling the original New Deal in the USA during the Great Depression)
- This approach is mindful of intra and international inequalities and proposes a progressive financial burden of green investment on wealthy countries and wealthy citizens

**Degrowth:**

- 'Degrowth is a new term that signifies radical political and economic reorganization leading to drastically reduced resource and energy throughput.' ( Kallis et.al. 2018)
- Though the objective is not on negative growth directly, it is likely to be an outcome of effectively and significantly reducing resource and energy use
- Sacrificing growth does not imply sacrificing well-being as long as that can be delinked from consuming commodities with a resource depletion and carbon-emitting trail.
- The proponents themselves recognize the utopianism of the degrowth as they acknowledge the inherent growth imperative of a capitalist system, but they maintain a radical rethink at a systemic level is essential given the seriousness of the climate emergency
- Green growth is not a feasible alternative, as faith in absolute decoupling through clean energy transition and energy efficiency is not realistic

**What is the basis of a choice?**

- Ecological
- Economic
- Political