



Università degli Studi di Padova  
Dipartimento di Ing. Civile, Edile e Ambientale

---

Corso di Laurea in Mathematical Engineering

Project in Dynamical Systems

# Economic growth model with open-access natural resources

November 2023

Candidato:  
Timofei Leahu  
Matricola 2039113

Docente:  
Prof. Antonio Ponno

Anno Accademico 2023-24

## Contents

|          |  |          |
|----------|--|----------|
| <b>1</b> | <b>Introduction</b>  | <b>2</b> |
| <b>2</b> | <b>The environmental pollution model</b>                     | <b>2</b> |
| <b>3</b> | <b>Growth and Environmental pollution in the Solow model</b> | <b>2</b> |
| <b>4</b> | <b>Optimal growth and Environmental pollution</b>            | <b>2</b> |
| 4.1      | The Ramsey–Cass–Koopmans model with environmental pollution  | 2        |
| <b>5</b> | <b>Conclusion</b>  | <b>2</b> |
|          | <b>References</b>  | <b>3</b> |

## **1 Introduction**

TBA

## **2 The model**

TBA

## **3 Growth and Environmental pollution in the Solow model**

Write down here the text

## **4 Optimal growth and Environmental pollution**

Write down here the text

### **4.1 The Ramsey–Cass–Koopmans model with environmental pollution**

Write down here the text

## **5 Conclusion**

Write down the conclusions here!!!

## References

- [1] William A. Brock. A polluted golden age. In: *Smith, V.L. (Ed.), Economics of Natural and Environmental Resources*. Gordon & Breach, New York, pages 441–461, 1973.
- [2] Andrea Caravaggio and Mauro Sodini. Nonlinear Dynamics in Coevolution of Economic and Environmental Systems. *Frontiers in Applied Mathematics and Statistics*, 4, 2018.
- [3] David Cass. Optimum Growth in an Aggregative Model of Capital Accumulation. *The Review of Economic Studies*, 32(3):233–240, 1965.
- [4] Geoffrey Heal. Chapter 21 Intertemporal Welfare Economics and the Environment. In Karl-Göran Mäler and Jeffrey R. Vincent, editors, *Handbook of Environmental Economics*, volume 3 of *Economywide and International Environmental Issues*, pages 1105–1145. Elsevier, January 2005.
- [5] Tjalling Koopmans. On the Concept of Optimal Economic Growth. Cowles Foundation Discussion Papers 163, Cowles Foundation for Research in Economics, Yale University, 1963.
- [6] Kenneth J. Arrow Kruz, Mordecai. *Public Investment, the Rate of Return, and Optimal Fiscal Policy*. Johns Hopkins University Press for Resources for the Future, Baltimore, New York, 1970.
- [7] Robert E. Lucas. On the mechanics of economic development. *Journal of Monetary Economics*, 22(1):3–42, 1988.
- [8] F. P. Ramsey. A Mathematical Theory of Saving. *The Economic Journal*, 38(152):543–559, 1928.
- [9] Paul M. Romer. The Origins of Endogenous Growth. *Journal of Economic Perspectives*, 8(1):3–22, March 1994.
- [10] Robert M. Solow. A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, 70(1):65–94, 1956.
- [11] T. W. Swan. Economic Growth and Capital Accumulation. *Economic Record*, 32(2):334–361, 1956.
- [12] Anastasios Xepapadeas. Chapter 23 Economic growth and the environment. In Karl-Göran Mäler and Jeffrey R. Vincent, editors, *Economywide and International Environmental Issues*, volume 3 of *Handbook of Environmental Economics*, pages 1219–1271. Elsevier, 2005.