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Chapter 1 : CiteSeerX â€” The Green Solow Model

NBER Program(s):Economic Fluctuations and Growth, Environment and Energy Economics We demonstrate that a key empirical finding in environmental economics - The Environmental Kuznets Curve - and the core model of modern macroeconomics - the Solow model - are intimately related.

We extend the Solow-Swan model with a logistic-type population growth, introduced by Ferrara and Guerrini , by incorporating technological progress in pollution abatement, in a way similar to Brock and Taylor In addition, we investigate sustainable growth and show that this occurs if technological progress in abatement is faster than technological progress in production. Moreover, an environmental Kuznets curve may result along the transition to the balanced growth path. Green Solow, Logistic population, Environmental Kuznets curve. The traditional neoclassical model of economic Brock and Taylor have demonstrated growth, first developed by Solow and Swan that the Solow-Swan model and the environmental , who independently proposed similar one- Kuznets curve hereafter EKC are intimately re- sector models, provides a theoretical framework for lated for the EKC, see, for example, Grossman and understanding world-wide growth of output and the Krueger, Amending the Solow-Swan model to persistence of geographical differences in per capita incorporate technological progress in abatement, the output. The key concept of this model, famously EKC is a necessary by-product of convergence to a known as the Solow-Swan model, is the neoclassical sustainable growth path. The resulting model, which form of production function with declining returns to they called the Green-Solow model, generates an EKC capital combined with a fixed saving rate. On the ba- relationship between the flow of pollution emissions sis of these assumptions, an economy, regardless of its and income per capita, and the stock of environmental starting point, converges to a balanced growth path, quality and income per capita. The two research lines we aim at joining Ferrara and Guerrini have analyzed the together are, respectively, the one studying the effects role of a variable population growth rate within the of including emissions, abatement and a stock of pol- Solow-Swan model by assuming a logistic-type pop- lution in the Solow-Swan model Brock and Taylor, ulation growth law. Within this set up, the model is , and that analyzing the role of a variable popu- proved to have a unique equilibrium, which is globally lation growth rate within the Solow-Swan model Fer- asymptotically stable. As well, its solution is shown rara and Guerrini, As is typical in the neoclassical model, the by a three dimensional dynamical system, whose so- human population size is assumed to be equal to the lution can be explicitly determined, and proved to be labor force. An assumption of that model, however, is convergent in the long-run. Finally, we prove that that the growth rate of population is constant, yielding sustainable growth occurs if technological progress in an exponential behavior of population size over time. An EKC may result along the transition to more importantly, unsustainable in the very long-run. In addition, we must adopt some assumption concerning natural regeneration. We treat pollution as We start considering the standard Solow-Swan model, a flow that either dissipates instantaneously, such as i. In other words, the stock of pollution Xt Lt according to a constant returns to scale produc- is related to the flow of emissions Et according to tion function. Technological progress is introduced in. The model assumes constant returns Lt to capital Kt and effective labor input Bt Lt , and per- where, for simplicity, the initial population has been fect competition. The saving rate s and the depreci- normalized to one, i. The evolution of capital can be described as exponentially. What is often observed instead is To model the impact of pollution we follow that as the population grows, some members interfere Copeland and Taylor by assuming that pollu- with each other in competition for some critical re- tion is jointly produced with output, and take this re- source. That competition diminishes the growth rate, lationship to be proportional. Every unit of economic until the population ceases to grow. Pollution able that a good population model must therefore re- emitted Et is equal to pollution created minus pollu- produce this behavior. The logistic population growth tion abated. Abatement of pollution At takes as in- model, written in equation 4 , which was first inves- puts the flow of pollution, which is proportional to tigated by Verhulst in the late s, is just such a the gross flow of output F , and abatement inputs, de- model. The abatement production function is Putting these assumptions together and trans- standard, i. This means that the fraction of total Lemma 1. The statement is obtained by separating the

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Remark 4. Lt and t dependent parts of equation 7 , integrating lution of 5. Moreover, k t is positive resp. For all t, the time path of the stock of pollution mea- sured in intensive units is given by Proposition 3. The corresponding equation, equation. For the second part, we rewrite 12 as. This yields either stay constant or grow at a constant rate. In this framework, the growth rate of the variable z. The statement follows taking logs and time growth to be possible, technological progress in abate- derivatives of equations 1 , 2 , as well as recalling ment has to be faster than technological progress in that consumption and output are proportional. An EKC may result along the transition to the balanced growth path. Along a New York, Taylor, The Green Solow be constant. Next, divide both sides of 3 by Xt , and note that a constant rate of change in Xt re- [4] B. The statement now follows from Lemma 7. Guerrini, The neoclassical Remark 9. We recall that our require- There exists sustainable growth if nomics, , , pp. Technological progress in abatement must [7] R. Solow, A contribution to the theory of eco- exceed growth in aggregate output in order for pollu- nomic growth, Quarterly Journal of Economics, tion to fall and the environment to improve. Brock and Taylor showed that [8] T. Verhulst, Notice sur la loi que la popula- One final observation. This implies that the model produces a transition path for income per capita and environmental quality, which traces out an environ- mental Kuznets curve an inverted-U shaped relation- ship between emissions and income. Technological progress especially in pollution abatement is primar- ily responsible to the inverse U-shape of this model.

Chapter 2 : The Green Solow Model by Mauwicho Soto el Olaiz on Prezi

We argue that a key empirical finding in environmental economicsâ€"the Environmental Kuznets Curve (EKC)â€"and the core model of modern macroeconomicsâ€"the Solow modelâ€"are intimately related. Once we amend the Solow model to incorporate technological progress in abatement, the EKC is a necessary.

Chapter 3 : EconPapers: The Green Solow Model

The Green Solow Model William A. Brock M. Scott Taylor** Abstract: We demonstrate that a key empirical nding in environmental economics - The Environmental Kuznets Curve - and the core model of modern.*

Chapter 4 : The Green Solow Model

Once we amend the Solow model to incorporate technological progress in abatement, the EKC is a necessary by product of convergence to a sustainable growth path. Our amended model, which we dub the Green Solow', generates an EKC relationship between both the flow of pollution emissions and income per capita, and the stock of environmental.

Chapter 5 : More on the Green Solow model with logistic population change | Luca Guerrini - www.nxgvisic

Our amended model, which we dub the Green Solow', generates an EKC relationship between both the flow of pollution emissions and income per capita, and the stock of environmental quality and income per capita.

Chapter 6 : The Green Solow model

The Green Solow model The Green Solow model Brock, William; Taylor, M. We argue that a key empirical finding in environmental economicsâ€"the Environmental Kuznets Curve (EKC)â€"and the core model of modern macroeconomicsâ€"the Solow modelâ€"are intimately related.

Chapter 7 : "The Green Solow Model" by M. Scott Taylor

Once we amend the Solow model to incorporate technological progress in abatement, the EKC is a necessary by product of convergence to a sustainable growth path.

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Chapter 8 : The Green Solow Model - CORE

Once we amend the Solow model to incorporate technological progress in abatement, the EKC is a necessary by product of convergence to a sustainable growth path. Our amended model, which we dub the "Green Solow", generates an EKC relationship between both the flow of pollution emissions and income per capita, and the stock of environmental.