

# Structural change and sustainable development

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## Abstract

In this paper, we show that the commonly observed decline in primary (natural resource using) sector output and employment shares, often termed structural change, can be explained as an endogenous response to the presence of nature's constraint. Structural change takes place even if consumer preferences are homothetic, and technological progress does not discriminate against the primary sector. Under certain conditions, structural change allows an open economy to grow with natural resource sustainability. Sustained and environmentally sustainable economic growth is possible even if the natural resource is exploited under open access. Well-defined property rights are neither necessary, nor sufficient for sustainable growth. We show that there is no unique relationship between natural resource endowment and the rate of economic growth over the long run. Resource-rich economies may grow faster or slower than resource-poor ones.

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## 1. Introduction

While some economists remain concerned that continuous growth places unsustainable demands on the natural resources, others believe that improving technology makes growth and environmental sustainability compatible. In this paper we revisit this issue and ask three questions. First, given a distortion-free economy that uses a renewable natural resource as factor of production, what makes sustainable growth possible? Second, if the natural resource is characterized by ill-defined property rights, a pervasive feature in many countries [11], is sustainable growth still possible? Third, is the long-run rate of economic growth affected by ill-defined property rights?

We consider a small open economy which uses three assets to produce two final goods, one resource based and the other produced without using the resource. One asset is specific to the non-resource sector ("physical capital"), another is specific to the resource-based sector (natural capital) and the third asset ("human or knowledge capital") enhances the productivity of labor in both sectors. We present an intuitive but novel explanation for sustainable growth: endogenous structural change. Structural change refers to a reduction of

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output and employment shares of the primary or natural resource sector during the growth process, a widely accepted stylized fact of the modern growth process [13,24,26].

First we derive the conditions for sustainable development when property rights are well-defined on all assets including the natural resource, and markets are competitive using the “benevolent social planner” paradigm. Next we consider the case where the natural resource is subject to ill-defined property rights but property rights are well defined for the other two assets and markets are competitive. In both cases the model predicts a decreasing share of the primary (resource-based) sector’s output in total output, a decreasing share of the total labor force employed in the primary sector, and unbalanced asset accumulation causing a continuous change in the composition of factors of production toward those most intensively used by the non-primary sectors. The model thus predicts a broader version of structural change than usual. We also find that labor productivity grows in both the resource and non-resources sectors. These predictions seem consistent with well accepted stylized facts.<sup>1</sup>

We also show that property rights on the natural resource are neither necessary nor sufficient for sustainable economic growth. Lack of property rights cause a lower equilibrium level of the natural resource (and a lower welfare level at each point in time) but their absence threatens neither the feasibility nor the actual *rate* of economic growth over the long run. That is, the equilibrium rate of economic growth is unrelated to the level of natural resource endowment; resource-rich countries may not grow any faster over the long run than resource-poor ones.

Intuitively, structural change is an endogenous response to the nature’s constraint which implies that the natural resource remains constant over the long run. Even if technical change has identical impacts across sectors, growth in the productivity of man-made assets in the primary sector cannot match the growth in productivity in the non-resource sector where all assets continuously expand over time. This implies that the non-resource sector is able to continuously pull labor from the primary sector and to grow faster than the primary sector. Under open access, there is no investment in the natural asset, and the natural resource is over-harvested. However, despite these problems, labor market interactions preserve structural change and the level of the natural resource also remains constant over the long run, albeit at a lower level than under perfect property rights. Given well functioning markets elsewhere, increases in man-made capital still imply a divergence of productivity growth across the two sectors. To maintain equilibrium in the labor market, labor is drawn towards the non-resource sector.

The result that optimal environmental policy is not necessary for sustainable growth is in sharp contrast with the findings by the literature focusing on pollution rather than renewable natural resources, in which optimal environmental policy is a necessary condition for sustainable growth [1,38]. The reason is that this literature assumes that pollution only affects the utility function but it has no feed-back (negative) effects on the productivity of the production sector. Thus, in the absence of environmental policy that imposes a cost to pollution emissions, firms have no incentives to restrain emissions; sustainable growth is, therefore, infeasible. By contrast, when the environment is also a factor of production, as the natural resource becomes scarcer firms have an incentive to substitute and to shift toward non-resource using sectors.

The literature on sustainable growth is, with a few exceptions, based on models with a single final good where the growth of income and environmental damage derive from the same sector.<sup>2</sup> Often this implies that sustained and environmentally sustainable growth is possible only after making special assumptions. Smulders and Gradus [36] assume a unitary elasticity of substitution between pollution and physical capital in production and that abatement expenditures are relatively more effective in reducing pollution than increases in pollution from growth.<sup>3</sup> Similarly, Huang and Cai [23] assume the presence of government spending externalities on pollution control, and Schou [34] posits human capital externalities as sources of sustainable growth.

<sup>1</sup>See, for example, Parry [32] for empirical evidence regarding the latter prediction.

<sup>2</sup>See [10,35] for excellent surveys.

<sup>3</sup>Similar to [36] we assume a unitary elasticity of substitution between natural and physical capital, however, we do not assume that investment in natural capital (equivalent to pollution abatement) is more effective in expanding the natural resource than harvest (or pollution) is in reducing such resource.

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