

# Abstract

This study investigates the long-run implications of automation in an economy reliant on exhaustible natural resources. Building on Stiglitz's (1974) framework and extending it with Steigum's (2011) treatment of automation as a perfect substitute for labor, we compare two production regimes: one with automation and one without. We analyze their respective dynamics under both the Solow regime, with exogenous savings, and the Ramsey regime, with endogenous household optimization.

Under the Solow regime, analytical conditions reveal that the long-run effects of automation depend critically on the interaction between consumption behavior, technological progress, and resource intensity. When exogenous technological growth is strong, automation promotes lower resource extraction and higher economic growth—but only if consumption rates are not too high. Conversely, in the absence of sufficient technological progress, automation can lead to both higher extraction rates and lower growth.

In the Ramsey regime, numerical simulations show that automation reduces output-to-asset and consumption-to-asset ratios due to capital deepening. Its impact on resource use hinges on intertemporal preferences: economies with high elasticity of intertemporal substitution extract resources more aggressively under automation, while those with low elasticity delay extraction. Crucially, the long-run growth advantage of automation exists only when technological progress is sufficiently high.

These results emphasize the essential role of productivity growth in realizing automation's long-term benefits. Without it, automation may slow growth and hasten resource depletion. Policy interventions that support innovation, shape consumption behavior, and regulate resource use are therefore critical to aligning automation with sustainable development.