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Merit and rent in a growing economy

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HIGHLIGHTS

- Interprets long run data on K/Y as changes in the steady state of an endogenous growth model.
- Extends Romer's model of technological change by adding a generational risky human capital choice.
- Interprets reduction in growth as outcome of choices favouring safe capital over risky effort.

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ABSTRACT

In the framework of Romer's (1990) growth model, we endogenize human capital accumulation as the risky outcome of an effort choice. Policies favouring the accumulation of physical capital may reduce the incentives to effort, leading the economy on a balanced path with a high capital intensity and a low growth rate.

0. Introduction

Thomas Piketty's book (Piketty (2014)) has refocused the attention of economists and public opinion on the long run evolution of fundamental economic variables: the capital–output ratio $\frac{K}{Y}$, the growth rate of output g and the average return on capital r.

If we call RENT a configuration with high $\frac{K}{Y}$, low g and low r, and MERIT a configuration with low $\frac{K}{Y}$, high g and high r, the broad picture emerging from Piketty's data seems to be that advanced economies are reasonably well described by RENT in the period 1870–1950, by MERIT in the period 1950–1980, and again by RENT since 1980.[1]

In this Letter we propose to interpret RENT and MERIT as different steady states of a long run growth model, influenced by institutional and political choices. We are particularly interested in the shift from MERIT to RENT which seems to have occurred in many advanced countries since the 80's, as documented in Table 1.

In the standard Ramsey–Cass–Koopmans model of growth, a shift from MERIT to RENT is explained by *an exogenous reduction in the growth rate g*, for example due to a slowing pace of innovation. At equilibrium this is corresponds to a lower r and a higher K/Y.

This conceptual framework has shaped the discussion of Piketty's data so far (see e.g. Krusell and Smith (2015), Rognlie (2015) and Jones (2015)) thus hindering the discussion of the role of policies and institutions in *jointly* influencing the steady state capital–output ratio $\frac{K}{Y}$, the rate of growth g and the return on capital r.

To help framing this discussion, in the next section we explore a variation of Romer (1990)'s model in which the individual's endowment of human capital is endogenously determined by an effort choice. As in Romer, capital accumulation and the accumulation of knowledge are modelled as two very different activities, the second one being more intensive in human capital and in the existing stock of ideas.[2] Our modelling of the saving/effort choice is then useful to highlight a trade-off between a safer activity of

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[1] See e.g. the synthesis in Piketty and Saez (2014). Data available at http://piketty.pse.ens.fr/en/capital21c2.

[2] This is the main difference with respect to the so called *AK* models of endogenous growth, and it is crucial for our purpose.

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Table 1
g, K/Y, and r over time.
Source: Piketty and Zucman 2013 database, http://piketty.pse.ens.fr/en/capitalisback. Tables FR.3c, FR.3e, DE.3c, DE.3e, IT.2, IT.3, IT.3b, J.2, J.3, J.3c.

	g		K/Y		r	
	1950–1979	1980–2010	1950–1979	1980–2010	1950–1979	1980–2010
France	3.6	1.3	2.7	3.8	8.3	6.6
Germany	4.3	1.5	2.0	3,2	11.7	8.2
Italy	4.0	1.1	2.8	5.0	11.2	8.5
Japan	5.6	1.6	3.7	5.8	7.6	5.1

capital accumulation (putting money into a mutual fund, buying a house, investing in mature technologies etc.) and a riskier activity (education and/or work in an innovative firm) influencing knowledge accumulation and long run growth.

This allows for an interpretation of the shift from MERIT to RENT as the outcome of an endogenous reduction of effort bought about by policies favouring the accumulation of safe capital at the expense of innovation and risk taking. A high K/Y may not only be a symptom of a low g, it may be one of the factors inducing it.

1. Model and example

In Section 1.1 we recall the main elements of Romer's model. In 1.2 we introduce our modelling of the generational effort/saving choice. The equations defining a steady state are derived in 1.3, while a simplified economy is analysed in Section 1.4 to illustrate a possible mechanism for the shift from MERIT to RENT.

1.1. Production

Production is modelled as in Romer's original paper. A composite final good Y is produced by means of human capital H_Y, labour L and intermediate goods $(x_j), j = 1, \ldots, A$:

$$Y = H_Y^{1-\alpha-\beta} L^{\beta} \sum_{j=1}^{A} x_j^{\alpha}.$$

Each intermediate good is produced by a monopolist which has paid a fixed cost to obtain an exclusive license for the production of that particular variety of intermediate good. The cost of producing one unit of intermediate good is η units of the final good acquired in the previous period. At the interest rate r, producer j chooses p_j to maximize:

$$\pi_j = (p_j - (1+r)\eta)x_j(p_j). \tag{1}$$

Blueprints for new types of intermediate goods (ideas) are produced using human capital only, but the productivity of human capital used in the idea sector, H_A, is determined by the existing stock of ideas, as measured by the number of existing blueprints, A.

Along a balanced growth path, the allocation of human capital to the two sectors is constant over time, $H_Y = \lambda H$ and $H_A = (1-\lambda)H$, and ideas grow at a rate:

$$g = \frac{\Delta A}{A} = \delta(1-\lambda)H, \tag{2}$$

where $\delta > 0$ is just a scaling factor. This in turns implies that K and Y also grow at a rate g. Equalization of the wage for human capital in the two sectors gives an expression for λ as a function of r:

$$\lambda = \frac{\Omega}{\delta H} r \tag{3}$$

where we use the notation $\Omega = \frac{1-\alpha-\beta}{(1-\alpha)\alpha}$.

This equation, in conjunction with (2) defines a linear relation between the growth rate of the economy g and the interest rate r:

$$g = \delta H - \Omega r. \tag{4}$$

1.2. Consumption, effort and saving

Our innovation with respect to Romer's model comes in the modelling of household's choices. We introduce an explicit choice on the level of human capital that an individual accumulates. In doing this, we take seriously Romer's distinction between codified knowledge A, as embodied in blueprints, and human capital H, stored in each individual's brain. Codified knowledge is a nonrival good, and it accumulates over time at the level of the economy. Human capital is a rival good, and each individual chooses an effort which influences only *her own* stochastic endowment of human capital.[3]

Time is discrete, and at every t a continuum of individuals is born, living for two periods. We label the two periods 1 and 2.

In period 1 the individuals supply inelastically L units of unskilled labour to the final good sector, earn $w_L L$ and choose how much to save, s. The first period budget constraint is thus:

$$c_1 + s = w_L L.$$

Saving s is lent to the intermediate good producers, and pays back $(1+r)s$ to savers in period 2.

In period 1, each individual also chooses a learning effort $e \in \{0, 1\}$, which determines an idiosyncratic distribution $\mu(e)$ over a finite set of possible endowments of human capital in period 2, $h_1 < h_2 < \cdots < h_N$.

We assume that choosing the higher effort makes higher levels of human capital endowment more likely:

$$\sum_{i}^{k} \mu_i(1) \leq \sum_{i}^{k} \mu_i(0)$$

for all $1 \leq k \leq N$.

Individuals are ex-ante identical, with utility function over the two periods of their life equal to:

$$u(c_1) + \frac{1}{1+\rho} \sum_i \mu(e)_i u(c_{2i}) - v(e)$$

where ρ is the discount rate. The function $u(\cdot)$ is continuous, monotonic, concave and satisfies the Inada conditions. Higher effort has higher cost, $v(1) > v(0)$.

In period 2 individuals earn revenue by providing human capital to the final sector and to the production of ideas. On the balanced growth path, the wage w_H is the same in the two sectors. They also receive revenue from saving, $(1+r)s$, and from dividends as shareholders of the firms producing intermediate goods, Π. The second period budget constraint is thus:

$$c_{2i} = w_H h_i + (1+r)s + \Pi.$$

[3] There are no social or intergenerational transmission mechanisms. Whatever knowledge is codified and transmitted from one generation to the other is modelled as a part of A, not of H. This is an important difference with respect to other models of human capital and growth, e.g. Krebs (2003) or Lucas (2009).