



A simple dynastic economy with parental time investment in children's patience[☆]



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ABSTRACT

This article explores the dynamics of a general equilibrium when an individual's rate of time preferences is endogenous in a dynastic competitive economy. We postulate that altruistic parents allocate time to make their children patient to improve their lifetime welfare. The paper shows multiplicity and instability of the competitive equilibrium. Local and global indeterminacy emerges due to complementarity between a balanced growth rate and parental time allocation. Indeterminacy implies income and growth disparity among generations. In contrast, a balanced growth path is unique and determinate in the corresponding social optimum. A unique social optimum introduces a potential policy instrument for stabilizing a cyclical competitive equilibrium.

1. Introduction

Time preference of the present vis-à-vis the future is a pivotal component of human decisions on a finite lifetime horizon. Future orientation is an important component of noncognitive abilities influenced by the members of a family as well as society. An individual makes a decision by balancing her own utility and her family's welfare, given that her time preferences are affected by intentional investment within the family and by an external habit formation in society. In particular, when parents make a conscious decision to influence the economic success of their children (Mulligan, 1997), they are altruistically motivated to invest their time and efforts to improve their children's cognitive and noncognitive abilities including knowledge, problem-solving, human capital, ingenuity, perseverance, discipline, patience, persistence, self-esteem, and other positive attributes.

While the conventional literature focuses on cognitive abilities for intergenerational correlations, recent empirical studies consider non-

cognitive abilities to explain human capital accumulation and skill formation (see the excellent survey in Carneiro and Heckman, 2003) and intergenerational transmission from parents to their offspring (Gouskova et al., 2010). However, the mechanism for observed intergenerational correlations across generations is not well understood in the literature. To fill this gap, we postulate that parents influence children's tastes or preferences and thereby shape children's attitudinal and personal traits toward future decisions.¹ The main purpose of this paper is to provide an underlying mechanism for intergenerational differences and similarities when parents devote their time and resources so that their children delay gratification of future outcomes and welfare.

The vehicle of our analysis is a dynamic general equilibrium model for a dynastic competitive equilibrium and its corresponding social optimum in an overlapping-generations economy. This paper, however, departs from the conventional overlapping-generations economy by introducing the formation of time discounting in a dynasty competitive

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¹ Cognitive abilities that combine innate intelligence and schooling with income and wealth constraints account for an estimated 23% of the intergenerational correlation in income difference (Bowles and Gintis, 2002). This finding suggests that noncognitive abilities play an important role in intergenerational interactions on economic outcome including income, savings, education, and on.

economy. In the spirit of [Becker and Mulligan \(1997\)](#) and [Doepke and Zilibotti \(2005a, 2005b\)](#),² we explore how parents instill children's future orientation and study the property of endogenous time discounting to delay gratification in a dynastic overlapping-generations economy. That is, our intention is to explain how parents shape the time-discounting characteristic of their children's attitudinal and personal traits and thereby determine the dynamics of macroeconomic allocations. Assuming parental influence on children's time preferences, children make their own future-oriented decisions on physical capital accumulation as well as their own consumption and leisure—parental choices and future generations' welfare. Investment on children's time preferences involves time-variant cost in the sense that parents must forgo their own leisure to rear and parent their children. We posit that parents allocate a flow of their time by forgoing leisure to instill patience into their children. That is, an altruistic individual's decision involves the balance between felicity from her own leisure and her children's well-being.³ Hence, our analysis helps us to understand a dynastic competitive economy by taking into account individual incentives and market structures on intergenerational correlations including consumption, leisure, income and wealth, capital accumulation, and economic growth.⁴

Our main results are as follows. Extending our analysis to an overlapping-generations economy with endogenous time discounting, we first define the convex value functions for the decentralized competitive equilibrium and its corresponding social optimum and then derive their associated equilibrium and optimum policy functions on two periods of parental time allocations. These policy functions characterize the evolution of endogenous time discounting and thereby pin down consumption, leisure, parenting, and capital over dynastic overlapping generations. We derive the conditions under which the dynastic competitive equilibrium exhibits a unique transitional path and a unique balanced growth path. Furthermore, under the standard conditions on the time discount function, we show the possibility of multiple competitive balanced growth paths. Multiplicity arises when (i) the marginal intensity of the time-discounting formation is strong; (ii) the marginal disutility of forgoing leisure is low for parental time spent with children given a constant marginal utility of consumption; and (iii) the parental time allocation in equilibrium is small enough, and thus children is relatively impatient. Therefore, the amount of parental time spent and the endogenous rate of time preferences are the primal sources of the multiplicity of balanced growth paths in a dynastic competitive economy.⁵

Indeterminacy in this paper is intuitive from the fact that the stationary equilibrium growth rate is non-monotonic with parental time spent with children in a dynastic competitive economy. Non-monotonicity arises because the immediate disutility of parenting is compensated by the altruistic reward from the future utility gain when children's patience stimulates saving and capital and thus increases the children's lifetime welfare. Non-monotonicity, therefore, induces the

² See [Doepke and Zilibotti \(2005a, 2005b\)](#) for an overlapping-generations economy in which each family chooses occupation and invests future-enhancing capital. [Becker and Mulligan \(1997\)](#) considered a finite lifetime model in which each individual invests her own future-enhancing capital throughout her lifetime horizon.

³ We assume intergenerational altruism (which is also called "pure altruism"). The literature widely uses this modeling approach to capture inter vivos transfer or bequest motives (e.g., [Barro 1974](#); [de la Croix and Michel, 2002](#)). However, empirical studies challenge these altruistic models and, in general, point out their poor empirical performance (see [Altonji et al., 1997](#)). Nonetheless, as an effective working hypothesis to catch a clear-cut alternative to self-interest motives, we use the altruistic approach to create the parental incentive to invest in children's patience.

⁴ [Guryan et al. \(2008\)](#) pointed out that parental time spent with children is different from the patterns of leisure or home production. Following their view of time spent with children, we treat parental time allocation as investment for children.

⁵ In an infinite horizon model with the patient capital stock, [Strulik \(2012\)](#) found the conditions for the unique transitional and balanced growth path, whereas [Kawagishi \(2014\)](#) showed, in the presence of consumption and investment externalities, indeterminate transitional paths in conjunction with multiple balanced growth paths.

complementarity between savings and investment in patience. Thus, each balanced growth path enjoys a different long-run growth rate among rational expectations competitive equilibria. That is, global indeterminacy emerges, and the sunspot equilibrium is self-fulfilled in a dynastic competitive economy (see [Benhabib and Farmer, 1999](#); [Cazzavilan and Pintus, 2004](#)). An important implication is that indeterminacy can be used as an instrument to explain income and growth disparities within the same generation or across different generations in dynastic competitive economies with the same fundamentals, including preferences and technology ([Galor and Zeira, 1993](#)). Hence, the self-fulfilling equilibrium exhibits income and growth disparities in a dynastic competitive equilibrium with endogenous children's time preferences. This finding therefore implies that, with the endogenous time preference formation, parental time spent with children can account for income and growth disparity within and/or across generations.

Notwithstanding global indeterminacy in a dynastic competitive economy, we establish global determinacy in the corresponding social planning economy. The balanced growth path is unique because a social planner takes into account the intertemporal external effects of parental time allocation over dynastic generations. That is, the social optimum allocation completely internalizes the spillover effects of the parental effort to shape children's time preferences and thus restores the uniqueness of the social optimum allocation under parental altruism to children within the same family. Consequently, the balanced growth rate of the social optimum is determined under the standard joint conditions on felicity and technology, including the intensity of altruistic preferences, and is independent of the parental time allocation for children's time preferences. Thus, the social planning mechanism is properly designed for Pareto improvement in the long run even though time discounting is endogenously shaped over generations in dynastic competitive economies. This invites a potential policy instrument under which a Pareto efficient allocation can be implemented in the decentralized competitive economy.

We, however, discern that local indeterminacy, if exists, is likely to arise in the corresponding social optimum allocation when the parental time allocation is small so that a propositional rate of time discounting is large with respect to the inverse of the leisure allocation. Hence, both the level and marginal changes of the time discount function are critical to the possibility of local indeterminacy in the transitional social optimum. The increasing marginal impatience in this paper is consistent with the indeterminacy condition in the literature including (e.g., [Jafarey and Park, 1998](#)). We also demonstrate that endogenous time preferences generate non-monotonicity of the balanced growth path with respect the parental time allocation so that complementarity arises between saving and investment in patience. The conditions on the local indeterminacy in the social optimum are compatible to those in the dynastic competitive equilibrium. Hence, a social planning mechanism in the short run, if indeterminacy exists, fails to select the unique transitional dynamic path around the unique balanced growth path in an overlapping-generations economy with endogenous time preferences.

To verify our analytic results, we demonstrate numerical examples for theoretically and empirically plausible parameter values in a dynastic competitive economy and its corresponding social optimum allocation. We use a set of parameter values that verifies the uniqueness or multiplicity of a balanced growth path and a transition dynamic path in both the decentralized competitive equilibrium and its corresponding social optimum allocation. Furthermore, a set of parameter values illustrates the local stability of the balanced growth path and thus the local indeterminacy in the competitive transitional paths. The numerical exercises also allow us to pin down the bifurcation parameter values on time preferences of parental time allocation for Hopf and Flip bifurcation in the decentralized competitive economy.

Finally, the paper exercises a simple comparative dynamic analysis to provide theoretical justification for a few empirical observations on

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