Human, All Too Human Growth

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Abstract

How do habits and interpersonal comparisons interact with economic growth? Under the standard macroeconomic formulation, a Cobb-Douglas aggregator of absolute and relative consumption nested in CRRA utility, a folk theorem holds: in canonical growth models, naive and sophisticated solutions deliver identical growth rates, observationally equivalent to a non-behavioural model with reparametrised utility curvature. This formulation, however, fails to capture that when absolute consumption increases, habits and comparisons become more salient. A minimal CES generalisation with complementarity is able to capture this intuition and breaks the folk theorem, implying inefficiently high growth, overwork, and rising inequality aversion along development.

Keywords: Habit formation, Interpersonal comparisons, Growth, Labour supply, Inequality
JEL Codes: D11, D63, E21, J22, O41

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1 Introduction

Behavioural economics has become deeply embedded in macroeconomic modelling: habits and interpersonal comparisons are standard ingredients in asset-pricing and business-cycle models (Abel, 1990; Constantinides, 1990; Galí, 1994; Christiano et al., 2005; Smets and Wouters, 2007), and behavioural departures from rational expectations are an emerging topic in heterogeneous-agent macroeconomics (e.g., Moll, 2026). Behavioural growth theory, by contrast, has been largely dormant since a brief late-1990s wave (Carroll et al., 1997; Barro, 1999; Carroll et al., 2000), with renewed interest only in the past few years (Acemoglu and Jensen, 2024).

This is surprising because habits and comparisons, the two most well-established behavioural features in macro, have natural interactions with growth. On one side, they shape incentives to consume and save, which in turn affect incentives to innovate; on the other, as it has been long recognised in the psychology literature, they become more salient as consumption rises. A feedback loop then may arise, in which habits and interpersonal comparisons stimulate growth, which in turn makes them more salient. If these two behavioural features introduce any inefficiency in the economy, such feedback would allow distortions to potentially become more and more significant along the development path.[1]

Since its inception, Veblen's notion of *conspicuous consumption* was framed as a characteristic of the affluent (Veblen, 1899), which resonates with modern analyses, such as Maslow (1943)'s *hierarchy of needs*, which treat relative concerns as luxuries, to be addressed only once more basic needs are satisfied. However, thanks to economic growth, the average household of the third millennium enjoys real consumption levels that would have identified her as affluent one hundred years before. Thus, what used to be a concern of the few can now represent a prominent driver for the average. At the same time, the literature on positionality (Hirsch, 1976; Frank, 2005) treats relative concerns as inherently scarce: the supply of relative standing can't by definition be increased, so as the supply of consumption grows, the binding constraint for welfare shifts to this dimension. Less attention has been devoted to the evolution of the salience of habits as consumption and income grow; however, the intuition for comparisons with past selves being luxuries is equally strong. Because of this affinity, and since habits and comparisons share a common modelling structure in macroeconomics, most of the analysis in the paper will be equally applicable to both behavioural features.

[1] The second half of the loop is what intuitively distinguishes habits and comparisons from other behavioural traits that introduce inefficiency in the growth process, but are likely not affected by the level of consumption. For an analysis of present bias, which falls into this category, see Barro (1999).

The starting point of the analysis, which helps rationalise the long dormancy of the field, is to show that the workhorse macroeconomic formulation of habits and comparisons — a Cobb-Douglas aggregator of absolute and relative consumption (where the latter is taken with respect to either others' or one's past selves') nested in CRRA utility — when introduced in canonical[2] endogenous-growth models generates an observational equivalence result: equilibrium growth rates are unchanged up to a reparametrisation of utility curvature, and are the same whether agents are naive about the law of motion of reference consumption or sophisticated about it. This result is termed a "folk theorem" of habits, comparisons and growth as it is implicit in Carroll et al. (1997, 2000). The key property of this standard behavioural utility that allows naive growth rates to coincide with sophisticated ones is that the ratio of naive to sophisticated marginal utility of consumption is constant and thus independent of the level of consumption.

However, the standard formulation fails to capture the intuitive fact that habits and comparisons should grow more salient when absolute consumption grows, as the Cobb-Douglas aggregator has unit elasticity of substitution. A minimal generalisation that captures this fact is to substitute the Cobb-Douglas aggregator with a CES aggregator in which absolute and relative consumption are complements. This modification exploits the fact that, as in the literature on positionality, relative consumption is scarce at equilibrium, while absolute consumption grows without bound along the development path, saturating its contribution to utility. This generalisation breaks the folk theorem, since the ratio of naive to sophisticated marginal utility evolves with consumption.

The paper then develops three applications of the generalised framework that highlight its flexibility:

- Generalised preferences are coherent with asymptotic balanced growth and, in canonical endogenous-growth models, naive and sophisticated growth rates diverge, with naive growth generally inefficiently high.
- Labour supply behaves in a qualitatively different way under the two solution concepts. While in the medium run hours decline under both (in line with the evidence in Boppart and Krusell, 2020), under naiveté hours eventually converge to a positive constant, while under sophistication they decline to zero at a constant rate.
- The welfare cost of proportional inequality in consumption equivalents, invariant in the level of aggregate consumption under CRRA utility (Atkinson, 1970), rises with

[2]By canonical I mean Romer (1990), Rebelo (1991), Aghion and Howitt (1992), and models that extend these.

development when absolute and relative consumption are complements. Generalised preferences exhibit increasing relative inequality aversion, generating a new channel through which growth and the demand for redistribution interact.

Related literature. In the late-1990's two papers, Carroll et al. (1997, 2000) introduced the standard macroeconomic formulation of habits and comparisons in growth theory using it to study transitional dynamics and saving rates after shocks, implicitly deriving the "folk theorem" result described in this paper. Other papers have studied different behavioural features, such as Barro (1999) on present bias, or heterogeneity (Acemoglu and Jensen, 2024). The contribution of this paper is to identify the property of preferences that drives the standard model's lack of growth effects from habits and comparisons and to propose a natural generalisation that addresses an intuitive weakness of such framework.

A wider macroeconomic literature uses habits or interpersonal comparisons to address asset-pricing puzzles (Abel, 1990; Constantinides, 1990), business-cycle propagation (Christiano et al., 2005; Smets and Wouters, 2007), and monetary-policy transmission (Ljungqvist and Uhlig, 2000). The generalised preferences proposed in this paper potentially have implications beyond growth theory.

Finally, the labour-supply application connects to Boppart and Krusell (2020)'s analysis of long-run hours worked, and the redistribution application builds on Atkinson (1970)'s framework for measuring inequality.

Plan of the paper. The remainder of the paper proceeds as follows. Section 2 establishes the folk theorem and illustrates it in the AK model. Section 3 introduces the CES preference generalisation and argues it captures the fact that habits and comparisons grow more important with the level of consumption. Section 4 develops three applications: long run growth rates under canonical endogenous growth models, labour supply when productivity grows and the welfare cost of inequality under interpersonal comparisons. Section 5 concludes.

2 The folk theorem of habits, comparisons and growth

This section formalises a folk theorem: in canonical endogenous-growth models, introducing habits or interpersonal comparisons through the workhorse macroeconomic formulation of behavioural preferences leaves equilibrium growth rates unchanged — up to a reparametrisation of utility curvature — and insensitive to whether agents are naive or sophisticated about the law of motion of reference consumption.

Let c denote individual consumption and C a reference level, which might refer either to consumption by other individuals or one's past consumption. Utility is time-separable and the instantaneous utility flow depends on absolute consumption c and on relative consumption c/C through a smooth aggregator ϕ, composed with a CRRA utility function. The standard macroeconomic formulation specialises ϕ to Cobb-Douglas,

$$\phi\left(c, \frac{c}{C}\right) = c^{1-\zeta}\left(\frac{c}{C}\right)^{\zeta} ,$$

so that the instantaneous utility flow is

$$u(c, C) = \begin{cases} \dfrac{(cC^{-\zeta})^{1-\gamma} - 1}{1-\gamma} & \gamma \neq 1 , \\ \log(cC^{-\zeta}) & \gamma = 1 , \end{cases} \tag{1}$$

with $\gamma \geq 0$ and $\zeta \in [0, 1)$, which I will refer to as *standard behavioural preferences*. This functional form, due to Abel (1990), Constantinides (1990) and Galí (1994), is the workhorse for macro applications featuring habits or comparisons (Ljungqvist and Uhlig, 2000; Christiano et al., 2005; Smets and Wouters, 2007). The parameter ζ governs the weight on relative consumption in the aggregator, while γ governs the curvature of utility. The reference consumption C is determined at equilibrium, in the simplest case by

$$C = c . \tag{2}$$

Under interpersonal comparisons, this condition implies that households compare themselves with average contemporaneous consumption of other individuals (Galí's "Keeping Up with the Joneses") under a symmetric equilibrium; under habit formation, reference consumption usually depends on the agent's own past consumption history, while the specification in (2) can be said to capture "instantaneous habits". This instantaneous specification is chosen for expositional clarity; the results in the paper extend to slow-moving reference consumption.[3]

Models with habits or comparisons admit two natural solution concepts. A *naive* agent treats C as exogenous when solving her individual problem; a *sophisticated* agent internalises that own consumption raises the reference level. The two readings put different

[3] The standard way of modelling a slow-moving reference is by introducing the law of motion

$$\dot{C} = \theta(c - C) , \qquad \theta > 0 ,$$

where the instantaneous case can be interpreted as $\theta = \infty$. The key reason why results generalise is that along balanced growth paths the reference grows at the same rate as consumption, $\dot{C}/C = \dot{c}/c$.

content on naiveté: under habits, it is an individual behavioural failure — the agent does not anticipate her own hedonic adaptation; under comparisons, it is a coordination failure at the group level — each agent rationally takes others' consumption as given, but collectively agents fail to internalise the externality.[4]

In most canonical growth models, beginning with the seminal works of Romer (1990) and Aghion and Howitt (1992), the household side reduces to an Euler equation, i.e. solutions depend on preferences only through the growth rate of marginal utility of consumption.[5] In these models, it is then straightforward to introduce habits and comparisons and, under standard behavioural preferences, this property is enough to eliminate any wedge between naive and sophisticated solutions, as stated in the following theorem.

Theorem 1 (Folk theorem) *Introducing habits and comparisons using standard behavioural preferences* (1)–(2) *in a canonical growth model has two implications:*

1. *naive and sophisticated equilibrium growth rates coincide;*
2. *the model is observationally equivalent, in terms of growth rates, to one with standard CRRA preferences and modified curvature*

$$\tilde{\gamma} = \zeta + (1 - \zeta)\gamma \ .$$

The Rebelo (1991) AK model offers the simplest framework in which to prove the result. The representative household solves the following simple consumption-saving problem,

$$\max_{[c_t, \mathbb{A}_t]_{t \geq 0}} \int_0^\infty e^{-\rho t} u(c_t, C_t) \, \mathrm{d}t \ , \qquad \dot{\mathbb{A}}_t = r_t \mathbb{A}_t - c_t \ ,$$

where u is given by (1), ρ is the discount rate, $\mathbb{A}$ is a safe asset that the household can save in and gives a one-to-one claim to the capital stock, and r_t is the rate of return on this asset. The representative firm maximises profits solving

$$\max_K AK - (r_t + \delta)K \ ,$$

where K is capital, A is productivity and δ is the depreciation rate of capital used in production. The asset market clears with $\mathbb{A}_t = K_t$, and the additional equilibrium condition

[4] In the paper by Carroll et al. (1997), agents are naive with respect to comparisons and sophisticated with respect to habits; this, paired with slow-moving references, causes transitional dynamics to differ between the two cases they term "inward-" and "outward-looking".

[5] Notably, even complex state of the art growth models retain a simple household block to which the results in this paper apply, see for example Acemoglu and Restrepo (2018) and Akcigit and Kerr (2018).

is $C = c$. Denote by λ_t the costate of the asset accumulation constraint. The household and firm first order conditions are standard,

$$\frac{\dot{\lambda}_t}{\lambda_t} = \rho - r_t \, , \qquad r_t = A - \delta \, , \tag{3}$$

and λ_t equals the marginal utility of consumption. However, this differs based on whether households are naive or sophisticated with respect to the law of motion of reference consumption. With a slight abuse of notation, in the remainder of the paper λ^n and λ^s denote naive and sophisticated marginal utility, respectively.

The naive marginal utility, computed treating C as exogenous and evaluated at equilibrium, is

$$\lambda_t^n = c_t^{-\zeta-(1-\zeta)\gamma} \, . \tag{4}$$

The sophisticated marginal utility, computed internalising $C = c$, is

$$\lambda_t^s = (1-\zeta)\, c_t^{-\zeta-(1-\zeta)\gamma} \, . \tag{5}$$

The two marginal utilities coincide up to the multiplicative factor $1 - \zeta$: the sophisticated marginal utility is uniformly lower than the naive one because the sophisticated agent recognises that any extra unit of consumption raises the reference and partially depresses utility. Crucially, the wedge $\lambda^s/\lambda^n = 1 - \zeta$ is constant in c — a property of the Cobb-Douglas aggregator that, as we now show, fully drives the folk theorem.

The proof is now immediate. Differentiating (4)–(5) along any equilibrium path yields

$$\frac{\dot{\lambda}_t^n}{\lambda_t^n} = \frac{\dot{\lambda}_t^s}{\lambda_t^s} = -\big(\zeta + (1-\zeta)\gamma\big)\frac{\dot{c}_t}{c_t} \, . \tag{6}$$

The two growth rates of marginal utility coincide and equal the one obtained under standard CRRA preferences with curvature $\tilde{\gamma} = \zeta + (1-\zeta)\gamma$. Any equilibrium condition involving λ_t only through $\dot{\lambda}_t/\lambda_t$ — in particular the Euler equation — therefore admits the same solution under naiveté, sophistication, and the standard non-behavioural model with modified curvature.

Combining (3) with (6), the unique balanced growth path features

$$\frac{\dot{c}_t}{c_t} = \frac{A - \delta - \rho}{\tilde{\gamma}} \, , \tag{7}$$

in both naive and sophisticated solutions, and is identical to the growth rate of an economy populated by non-behavioural agents with CRRA curvature $\tilde{\gamma}$.[6] Habits and comparisons affect the level of marginal utility but shift consumption growth only by reparametrising the elasticity of intertemporal substitution.

Equation (7) fixes the growth rate of optimal consumption paths; the optimality of the candidate path is pinned down by the transversality condition

$$\lim_{t\to\infty} e^{-\rho t}\,\lambda_t\,\mathbb{A}_t = 0\,. \tag{8}$$

From the costate equation (3), the present value of the costate decays at the net return, $e^{-\rho t}\lambda_t = \lambda_0\,e^{-(A-\delta)t}$, in both the naive and sophisticated solutions: the constant wedge $\lambda^s/\lambda^n = 1-\zeta$ leaves the decay rate unchanged, so the transversality condition is the same under the two solution concepts. Along the balanced growth path assets inherit the consumption growth rate $g_c = \dot{c}_t/c_t$, so (8) holds if and only if $g_c < A-\delta$, equivalently

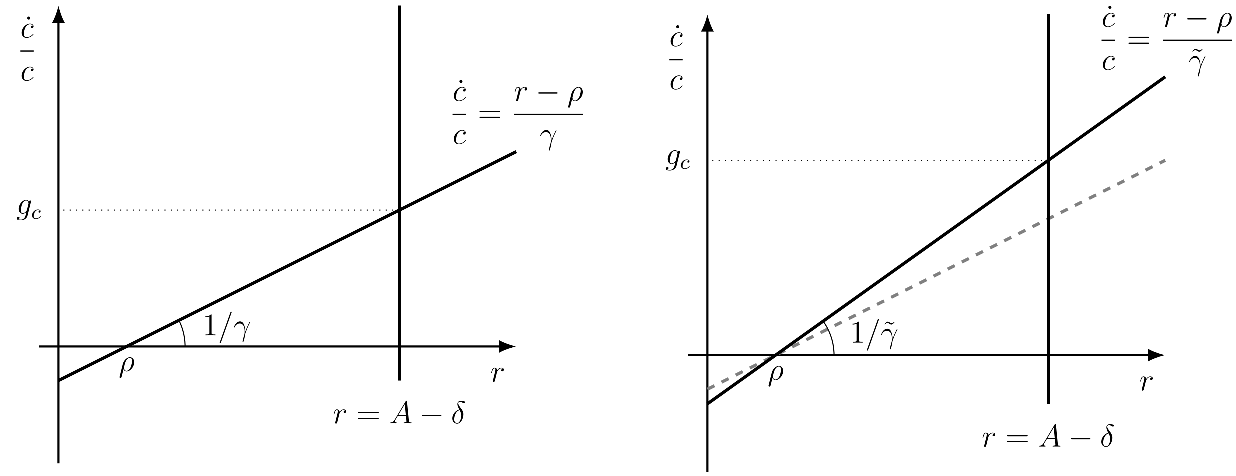
$$\rho > (1-\tilde{\gamma})(A-\delta)\,,$$

which is also the condition for lifetime utility to be finite. The folk theorem thus extends to the conditions for existence of an optimum: under standard behavioural preferences the requirement is identical to that of the non-behavioural model with curvature $\tilde{\gamma}$, and identical across naive and sophisticated households.

Figure 1 illustrates this point (for an economy with $\gamma > 1$). The AK model can be decomposed into two blocks: a household block that generates an upward sloping relationship between interest rate and consumption growth in the (r, g_c) space, the Euler equation, which can be interpreted as a demand for growth given an interest rate; and a firm block that generates a second, vertical relationship intuitively similar to an innovation supply. Introducing standard behavioural preferences rotates the household Euler line from slope $1/\gamma$ to slope $1/\tilde{\gamma}$ but leaves the structure of the equilibrium unchanged and identifies the same loci for naive and sophisticated solutions in the space of the diagram.

The AK illustration generalises. The canonical endogenous-growth models admit similar two-block representations: a household block that delivers the Euler equation, and a firm-entry block generating a second relationship in the (r, g_c) plane. The shape of this second locus is what varies across models — vertical in Rebelo (1991), downward-sloping in Romer (1990) and Aghion and Howitt (1992), inverse-U-shaped in Liu et al. (2022) — but in all cases behavioural preferences enter the model only through the household block. By (6), they shift this block identically in the naive and sophisticated solutions.

[6] Non-degenerate equilibrium growth requires $A-\delta > \rho$, an assumption that is maintained throughout the paper.



(a) Standard CRRA preferences

(b) Standard behavioural preferences

Figure 1: The AK model: standard and behavioural.

Equilibrium growth rates therefore coincide and reduce to those of the standard model with curvature $\tilde{\gamma}$, regardless of the shape of the firm-side locus.

3 Generalised behavioural preferences

The Cobb-Douglas aggregator introduced in Section 2 implies a unit elasticity of substitution between absolute and relative consumption: loosely speaking, the expenditure share of relative consumption in the aggregator is fixed at ζ, independent of the level of c. Equivalently, the marginal valuation of relative versus absolute consumption is invariant in the level of consumption.

Yet a long tradition in psychology suggests that habits and comparisons become more salient as consumption rises. Two complementary intuitions for why this is true have been explored. The first, associated with Veblen (1899) and Maslow (1943), treats relative concerns as luxuries: once basic needs are met, agents devote a growing share of attention to status and comparisons. As already discussed in the introduction of the paper, the same intuition holds for habits, which entail comparisons with past selves (although a substantive literature on this topic is lacking). The second, due to Hirsch (1976) and Frank (2005), treats relative concerns as inherently scarce: relative ranking is in inherently limited supply, so as absolute consumption grows, it becomes the binding constraint for utility. Intuitively, it is exactly the fact that standard behavioural preferences fail to capture this feedback from growth to habits and comparisons that gives rise to the folk theorem, as it prevents behavioural features from influencing choices with greater strength along the development path.

This section proposes a minimal generalisation of preferences to allow for the increasing saliency to be captured in growth models, by providing a formalisation of the scarcity intuition. This admits a particularly clean formalisation: at equilibrium, relative consumption c/C is pinned at one and hence in limited supply, so the idea that habits and comparison become more salient can be captured by an aggregator in which components saturate as they go to infinity (since relative consumption, at equilibrium, won't do so).

The simplest generalisation of Cobb-Douglas that admits saturation in absolute consumption is a CES aggregator with complementarity between absolute and relative consumption,

$$\phi\Big(c, \frac{c}{C}\Big) = \left[(1-\zeta)c^{\frac{\eta-1}{\eta}} + \zeta\left(\frac{c}{C}\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}} , \qquad \eta < 1 , \tag{9}$$

to be composed with CRRA utility as before. The equilibrium condition $C = c$ is unchanged (and could again be generalised to $\dot{C} = \theta(c - C)$). The restriction $\eta < 1$ encodes complementarity between absolute and relative consumption; the Cobb-Douglas case is recovered as $\eta \to 1$.[7]

Notice that the aggregator exhibits saturation in absolute consumption: holding c/C fixed and letting $c \to \infty$, pointwise

$$\phi\Big(c, \frac{c}{C}\Big) \to \zeta^{\frac{\eta}{\eta-1}} \frac{c}{C} .$$

As consumption increases, the marginal return to absolute consumption vanishes and the aggregator is increasingly driven by relative consumption.

Under the CES aggregator, the marginal utilities lose the clean Cobb-Douglas scaling. For a given level of consumption c, the naive and sophisticated marginal utilities are

$$\lambda^s = (1-\zeta)\, c^{-\frac{1}{\eta}} \left[(1-\zeta)\, c^{\frac{\eta-1}{\eta}} + \zeta\right]^{\frac{\eta}{\eta-1}(1-\gamma)-1} ,$$
$$\lambda^n = \left[(1-\zeta)\, c^{-\frac{1}{\eta}} + \zeta\, c^{-1}\right] \left[(1-\zeta)\, c^{\frac{\eta-1}{\eta}} + \zeta\right]^{\frac{\eta}{\eta-1}(1-\gamma)-1} ,$$

and their ratio

$$\frac{\lambda^s}{\lambda^n} = \frac{1-\zeta}{1-\zeta+\zeta\, c^{-\frac{\eta-1}{\eta}}}$$

depends on the level of consumption whenever $\eta \neq 1$. Under complementarity ($\eta < 1$), the ratio of sophisticated to naive marginal utility goes to zero as $c \to \infty$ at an asymptotically constant rate (if $\dot{c}/c$ is constant), suggesting that growth effects from sophistication

[7] Appendix A explores the behaviour of the case $\eta > 1$.

are possible.

Under complementarity ($\eta < 1$), the growth rates of marginal utility satisfy, when $c \to \infty$,

$$\frac{\dot{\lambda}^s}{\lambda^s} \to -\frac{1}{\eta}\frac{\dot{c}}{c}\,, \qquad \frac{\dot{\lambda}^n}{\lambda^n} \to -\frac{\dot{c}}{c}\,. \tag{10}$$

Two features of (10) are central. First, both limits are linear in $\dot{c}/c$, so asymptotic balanced growth paths remain a well-defined object of analysis. Second — and crucially — the functional forms of the two limits differ: the wedge between naive and sophisticated marginal-utility that vanished under Cobb-Douglas when transforming to growth rates no longer does so. Notice also that the CRRA curvature γ will not affect limiting behaviour of solutions under complementarity.

4 Applications

This section studies three applications of generalising preferences to allow for habits and comparisons to become more salient as consumption grows. The first shows that naive and sophisticated growth rates can diverge in canonical endogenous-growth models; the second shows that the evolution of labour supply depends in a qualitative way on whether the solution considered entails naiveté versus sophistication; the third explores the interactions between growth and the welfare cost of inequality with interpersonal comparisons. Together, these applications demonstrate both the flexibility of the framework and its potentially substantive implications for growth.

4.1 Growth rates in canonical endogenous-growth models

The folk theorem shows that, somewhat unexpectedly, introducing habits and interpersonal comparisons in a canonical growth model may not generate growth distortions. However, when these behavioural features are allowed to become more important when consumption grows, the gap between naive and sophisticated solutions becomes wider with development, and naive growth rates differ from sophisticated ones.

It is easy to show this result in the AK framework already analysed in Section 2. Combining (10) with the household first-order condition $\dot{\lambda}_t/\lambda_t = \rho - r_t$ yields two distinct asymptotic Euler equations, the first under naiveté and the second under sophistication,

$$\frac{\dot{c}_t^n}{c_t^n} \to r_t - \rho\,, \qquad \frac{\dot{c}_t^s}{c_t^s} \to \eta\,(r_t - \rho)\,.$$

This means that the naive and sophisticated solutions identify different loci in the (r, g_c) space, and that the sophisticated Euler line is flatter.

In the AK model, where $r_t = A - \delta$, the system approaches different asymptotic balanced growth paths in the two solutions, where

$$g_c^n = A - \delta - \rho \,, \qquad g_c^s = \eta \left(A - \delta - \rho \right) .$$

Naive growth is inefficiently[8] high: $g_c^s < g_c^n$ whenever $\eta < 1$. Figure 2 illustrates how the two solutions differ: under complementarity the naive and sophisticated household loci have different slopes (1 and $\eta < 1$ respectively), and they cross the vertical firm-side locus at different points.

To ensure optimality of solutions, both asymptotic balanced growth paths need to be checked against the transversality condition (8). As in Section 2, the present value of the costate decays at the net return $A - \delta$ in both solutions, so the condition again reduces, asymptotically, to $g_c < A - \delta$. For the naive path this is $A - \delta - \rho < A - \delta$, i.e. $\rho > 0$; for the sophisticated path it is $\eta(A - \delta - \rho) < A - \delta$, which is implied by complementarity $\eta < 1$. Both solutions therefore satisfy transversality under the maintained assumptions $A - \delta > \rho > 0$ and $\eta < 1$, the naive path being the binding case since $g_c^n > g_c^s$. In contrast to the standard model, here at equilibrium $c/C = 1$, so per-period utility converges to a constant as absolute consumption grows and lifetime utility is finite for any $\rho > 0$, irrespective of the growth rate.

The argument extends beyond AK. In any model whose firm-side locus is downward-sloping in (r, g_c) — including Romer (1990) and Aghion and Howitt (1992) — the sophisticated household-side locus identifies a lower equilibrium growth rate than the naive one, so naive growth remains inefficiently high. At the same time, the equilibrium rate of return is inefficiently low in the naive solution. However, this is not a general result. A notable example is the model by Liu et al. (2022), which features an inverse-U shaped relationship between interest rates and growth arising from the firm problem. On the upward-sloping branch of this locus, naiveté generates both lower growth and lower interest rates.

[8] Under interpersonal comparisons, the sophisticated solution can only be achieved by a planner, so "inefficient" has the usual meaning. Under habits the use of the word is slightly more subtle, as sophistication is the solution under full anticipation of one's own hedonic adaptation, in principle attainable by an individual internalising the law of motion of reference consumption.

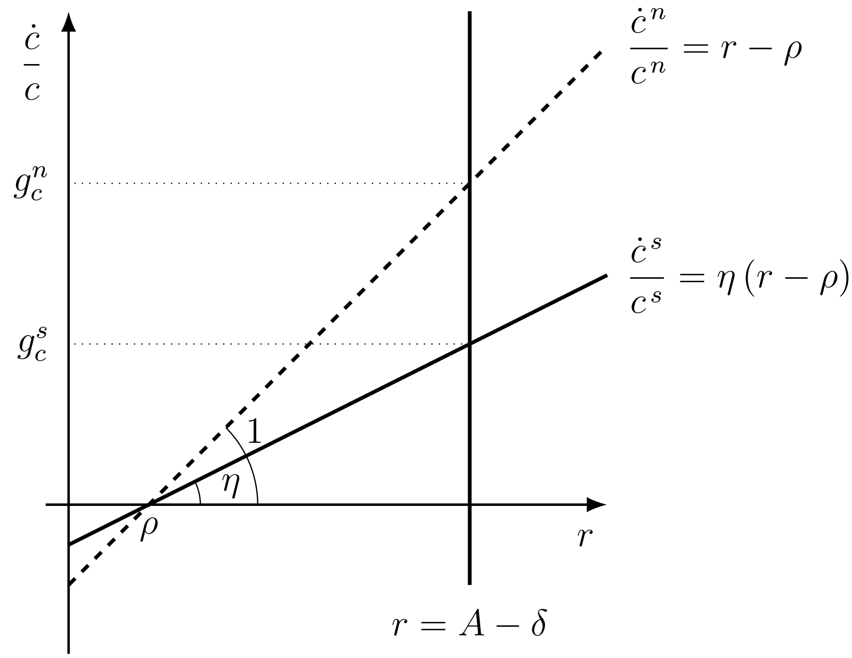


Figure 2: The AK model under CES preferences with complementarity.

4.2 Long-run labour supply

Hours worked exhibit a secular decline in advanced economies (panel a of Figure 3 plots hours worked per worker in nine such economies from 1950 onwards). Boppart and Krusell (2020) show that this trajectory is consistent with balanced growth under a class of preferences in which the income effect of wage changes is stronger than the substitution effect. Embedding habits and comparisons into such preferences using standard behavioural preferences doesn't change the result qualitatively.[9] However, when absolute and relative consumption are complements, predictions change and the long run behaviour of labour supply depends on whether households are naive or sophisticated.

To illustrate this point, consider a minimal labour-supply problem with MaCurdy (1981) preferences in which habits and comparisons are introduced,

$$\max\ u(c, C) - \frac{h^{1+\varphi}}{1+\varphi} \quad \text{s.t.} \quad c = wh\,, \qquad \frac{\dot{w}}{w} > 0\,.$$

Here u is again composed from the CES aggregator (9) and CRRA utility, and the wage grows at a constant rate. As usual, at equilibrium $C = c$. Denoting by λ the multiplier of the budget constraint $c = wh$, the intratemporal first-order condition $h^{\varphi} = \lambda w$, in growth

[9]The consumption-leisure tradeoff in growth rates that gives rise to the decline in hours in the BK framework depends on utility from consumption through the growth rate of the marginal utility only, so the result in the Folk Theorem generalises.

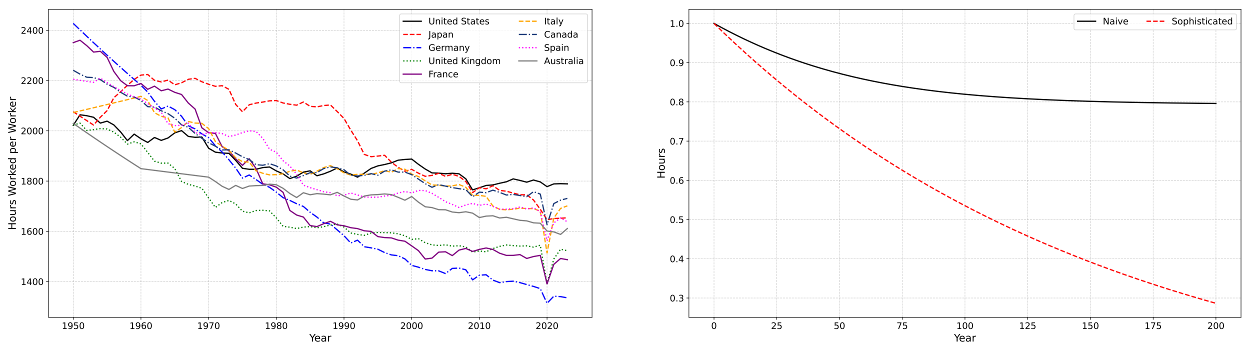
form together with the budget constraint, yields

$$\varphi \frac{\dot{h}}{h} = \frac{\dot{\lambda}}{\lambda} + \frac{\dot{w}}{w}\,, \qquad \frac{\dot{c}}{c} = \frac{\dot{w}}{w} + \frac{\dot{h}}{h}\,.$$

Substituting the asymptotic limits (10) gives

$$\frac{\dot{h}^n}{h^n} \to 0\,, \qquad \frac{\dot{h}^s}{h^s} \to \frac{\eta - 1}{\eta\,\varphi + 1}\,\frac{\dot{w}}{w} < 0\,.$$

Under naiveté, hours converge to a positive constant $\bar{h} > 0$, while still potentially declining in the medium run; under sophistication, hours decline to zero at an asymptotically constant rate. Panel b of Figure 3 plots two such paths.



(a) Hours per worker, secular evidence

(b) Asymptotic naive and sophisticated paths

Figure 3: Hours worked: evidence and theory.

4.3 Growth and redistribution

Allowing interpersonal comparisons to become more salient when absolute consumption grows also generates a new channel through which growth and inequality interact.

The seminal work of Atkinson (1970) showed that CRRA is the unique utility function exhibiting constant relative inequality aversion: under this utility specification, the welfare cost of proportional inequality to a utilitarian planner is invariant in the level of aggregate consumption. Atkinson then used CRRA utility to define a utility-based metric for inequality, which the literature refers to as the Atkinson index, that is invariant to the level of aggregate consumption (a property shared by other, non-utility based indices such as the Gini coefficient). This is a desirable property of a measure of inequality, since it allows to compare inequality between countries at different stages of development. However, for the same reason, the construction also implies that economic growth will have no effect on the welfare loss from stable inequality, as long as this is proportional.

Since the Atkinson framework and growth theory share the same utility structure, we can use it to study how introducing interpersonal comparisons affects the welfare loss from inequality.

The standard framework (with no behavioural features) is the following. Consider a continuum of agents indexed by $i \in [0, 1]$. Each agent enjoys utility from consumption though a utility function u and consumes $c_i = \omega_i \, c$ with $\int_0^1 \omega_i \, di = 1$ so that c equals aggregate consumption. The utilitarian welfare is

$$\mathcal{W}([c_i]_{i\in[0,1]}) = \int_0^1 u(c_i) di \; .$$

The *equally distributed equivalent* c_{EDE} is defined as the consumption level that, if it were to be consumed by all agents, would deliver the same welfare. As such, it satisfies

$$u(c_{EDE}) = \int_0^1 u(c_i) \, di \; ,$$

and it is invariant under affine transformations of utility. It is straightforward to show that, under CRRA utility, the equally distributed equivalent consumption is

$$c_{EDE} = \left(\int_0^1 \omega_i^{1-\gamma} \, di \right)^{\frac{1}{1-\gamma}} c \; .$$

By Jensen's inequality, $c_{EDE} < c$. This implies that proportional inequality causes a proportional loss in consumption equivalent, which is independent of the aggregate consumption level.

The Atkinson (1970) index of inequality is then defined as

$$I = 1 - \frac{c_{EDE}}{c} \; .$$

Introducing interpersonal comparisons using standard behavioural preferences (1), Galí (1994)'s "Keeping Up with the Joneses", the equally distributed consumption equivalent becomes

$$c_{EDE}^{KUJ} = \left(\int_0^1 \omega_i^{1-\gamma} \, di \right)^{\frac{1}{(1-\gamma)(1-\zeta)}} c \; .$$

The resulting implication is that introducing interpersonal comparisons strengthens the loss, since $\left(\int_0^1 \omega_i^{1-\gamma} \, di \right)^{\frac{1}{1-\gamma}} < 1$ and the exponent $1/(1-\zeta)$ is greater than one. However, the loss remains constant as a fraction of aggregate consumption and in this sense there is still no interaction between growth and inequality.

However, allowing interpersonal comparisons to become more salient as the level of consumption grows qualitatively changes the implications. Under the CES aggregator (9) with complementarity, the equally distributed equivalent admits the closed form

$$c_{EDE} = \left[\left(\int_0^1 \omega_i^{1-\gamma} \, di \right)^{\frac{1}{1-\gamma} \cdot \frac{\eta-1}{\eta}} \left(c^{\frac{\eta-1}{\eta}} + \frac{\zeta}{1-\zeta} \right) - \frac{\zeta}{1-\zeta} \right]^{\frac{\eta}{\eta-1}} .$$

For $\eta < 1$, the expression in brackets converges as $c \to \infty$ to a strictly positive constant, so that

$$\frac{c_{EDE}}{c} \to 0 \,, \qquad I \to 1 \,.$$

for any non-degenerate weights schedule $[\omega_i]_{i \in [0,1]}$, however small the dispersion.

The welfare loss from inequality is no longer invariant in aggregate consumption: under complementarity between absolute and relative consumption, preferences exhibit increasing relative inequality aversion along the development path, strengthening gains from redistribution. As economies develop, agents care more about how their consumption compares to that of others, and the welfare cost of cross-sectional inequality increases even when the relative distribution $\{\omega_i\}_{i \in [0,1]}$ is unchanged. This breaks the separation result between inequality and growth under both CRRA utility and standard behavioural preferences derived earlier in the Atkinson framework, identifying a channel through which growth, inequality and redistribution interact, even in settings in which aggregate consumption growth is taken to be exogenous. A second, potentially deeper channel could arise when introducing the generalised preferences proposed in the paper in a model of endogenous growth with heterogeneity, and is left for future research.

5 Conclusion

The standard way of modelling habits and interpersonal comparisons in macroeconomics — a Cobb-Douglas aggregator of absolute and relative consumption composed with CRRA utility — yields a folk theorem: in canonical growth models, naive and sophisticated growth rates coincide and are observationally equivalent to those of a standard non-behavioural model with reparametrised utility curvature. Yet this formulation misses a basic intuition: habits and comparisons grow more salient as we consume more. This paper proposed a minimal and tractable generalisation of preferences able to restore this feature, introducing complementarity between absolute and relative consumption, which, in turn, causes the folk theorem to break down. Three implications follow: naive growth is inefficiently high, naive labour supply is higher than sophisticated, and welfare losses from inequality rise along development. These results show how relaxing the assumptions behind the folk theorem in a natural way to allow habits and comparisons to matter more when we consume more opens up promising areas for research in growth theory.

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A Naive and sophisticated marginal utility

We can derive the growth rate of sophisticated marginal utility under the CES aggregator explicitly as

$$\frac{\dot{\lambda}^s}{\lambda^s} = -\frac{1}{\eta}\frac{\dot{c}}{c} + \left(-\gamma + \frac{1}{\eta}\right)\frac{(1-\zeta)c^{\frac{\eta-1}{\eta}}}{(1-\zeta)c^{\frac{\eta-1}{\eta}} + \zeta}\frac{\dot{c}}{c}$$

so that if $\eta = 1$ we find again $\frac{\dot{\lambda}^s}{\lambda^s} = -(\zeta + (1-\zeta)\gamma)\frac{\dot{c}}{c}$ and exact balanced growth paths, while if the elasticity is not equal to one models will generally allow asymptotic balanced growth paths. In particular, as $c \to \infty$,

$$\frac{\dot{\lambda}^s}{\lambda^s} \to \begin{cases} -\gamma \frac{\dot{c}}{c} & \eta > 1 \\ -(\zeta + (1-\zeta)\gamma)\frac{\dot{c}}{c} & \eta = 1 \\ -\frac{1}{\eta}\frac{\dot{c}}{c} & \eta < 1 \end{cases}$$

Instead, in the naive case, we have

$$\frac{\dot{\lambda}^n}{\lambda^n} = -\frac{1}{\eta}\frac{(1-\zeta)c^{-\frac{1}{\eta}}}{(1-\zeta)c^{-\frac{1}{\eta}} + \zeta c^{-1}}\frac{\dot{c}}{c} - \frac{\zeta c^{-1}}{(1-\zeta)c^{-\frac{1}{\eta}} + \zeta c^{-1}}\frac{\dot{c}}{c} + \left(-\gamma + \frac{1}{\eta}\right)\frac{(1-\zeta)c^{\frac{\eta-1}{\eta}}}{(1-\zeta)c^{\frac{\eta-1}{\eta}} + \zeta}\frac{\dot{c}}{c}$$

so that if $\eta = 1$ we find again $\frac{\dot{\lambda}^n}{\lambda^n} = -(\zeta + (1-\zeta)\gamma)\frac{\dot{c}}{c}$, but if the elasticity is different from one, in the limit we get

$$\frac{\dot{\lambda}^n}{\lambda^n} \to \begin{cases} -\gamma \frac{\dot{c}}{c} & \eta > 1 \\ -(\zeta + (1-\zeta)\gamma)\frac{\dot{c}}{c} & \eta = 1 \\ -\frac{\dot{c}}{c} & \eta < 1 \end{cases}$$

Overall, the wedge between naive and sophisticated marginal-utility growth persists asymptotically only under complementarity ($\eta < 1$); for $\eta > 1$ the two solutions converge to a common limit, since under imperfect substitutability the contribution of relative consumption becomes negligible as absolute consumption diverges; the Cobb-Douglas case ($\eta = 1$) is the knife-edge in which the two growth rates coincide along the entire path.