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# Comparing Consumption: A Curse or a Blessing?

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**Abstract.** Does it make us unhappier when we compare our current consumption with that of the Joneses or our own past achievements? This paper tries an answer without recurring on interpersonal utility comparisons. It calibrates an economy under three different assumptions, non-comparing utility, and inward-looking and outward-looking habit formation. Using consumption equivalents it then calculates how much individual welfare is affected in each economy by unexpected losses and gains of wealth.

*Keywords:* habit formation, happiness, welfare, economic growth

*JEL:* D60 D91 E21 O40

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## 1. INTRODUCTION

In evaluating our well-being we are continuously comparing our status quo with our past achievements and with others. While this fact was for some time mainly discussed among psychologists and sociologists it is by now also acknowledged and verified by many economists (see, for example, Oswald, 1997, Easterlin, 2001, Frey and Stutzer, 2002, Layard, 2004). While it is only rarely explicitly stated, one can frequently read between the lines that researchers opine that the character trait of building up reference stocks and comparing achievements is a vice rather than a virtue or, given that it is probably hard or impossible to change this behavior, a curse rather than a blessing.

For a description of the adaptation process Brickman and Campbell (1971) have created the image of the hedonic treadmill on which we all live, unable to draw perpetual happiness from the status quo. Frank (1985) has added the idea of the positional treadmill for our comparison with friends, neighbors, and colleagues, and in the vernacular the untiring endeavor to compare with others is known as “keeping up with the Joneses”. In his Lionel Robbins Memorial Lectures Richard Layard (2004) states that “obviously people are happier if they are able to appreciate what they have, whatever it is and if they do not always compare themselves with others.”

Yet, is this really true? If we are endowed with comparison utility a proof of the claim is actually not that easy because the non-comparing counterfactual is missing. Estimating the coefficients of the utility function and drawing inferences from happiness revelations does not provide any clue if we believe that utility functions are only defined up to an affine-linear transformation so that only relative changes can be compared. How should we know how happy we were if we – and the Joneses – lived in a world without comparison utility?

In this paper I propose one method of comparing comparison utility. Using the cross-country association of happiness and income I calibrate a simple model of economic growth under three different hypotheses, non-comparing utility, comparison with own past achievements, and comparison with past achievements of others. I then calculate how the economy reacts to negative and positive shocks and calculate welfare changes using the consumption equivalent according to Lucas’ (1990) methodology. This means, I compare each type of economy relative to its own balanced growth situation. For example, for a negative shock, I ask how much do people suffer from a 10 percent loss of wealth when they compare their consumption with own past achievements, that of the Joneses, and when they do not compare at all.

For that purpose I use the dynamic equilibrium model of Carroll, Overland, and Weil (1997, 2000). These authors have introduced comparison utility as formalized by Abel(1990) into a standard  $Ak$  growth model and shown that the modified version is capable of displaying reasonable adjustment dynamics including, in particular, a positive correlation between savings and growth. The model has become a kind of benchmark for theoretical and quantitative analyses of the impact of consumption reference stocks on growth and has been developed further in several other papers, for example, Alvarez-Cuadrado et al. (2004) and Alonso-Carrera et al (2005). Alvarez-Cuadrado et al. (2004) also calculate some welfare effects. The task of the current paper, however, i.e. a systematic quantitative comparison of welfare performance under different assumptions for the utility function has not been investigated before.

The next section briefly re-introduces the model of Carroll et al. and its steady-state solution. In Section 3 I try an calibration of the model using the implied correlation between initial income and life-time utility. In Section 4 I describe adjustment dynamics and the used method to obtain welfare effects. Section 5 investigates the effect of an unexpected wealth loss and how people with habitual preferences cope with the event compared to non-habitual types. Section 6 considers the joint effect of a positive and negative shock, i.e. the ups and downs of life, on welfare under the three regimes, and Section 7 concludes.

## 2. SETUP OF THE MODEL AND STEADY-STATE SOLUTION

This section contains a brief recap of Carroll et al.'s model. Consider an economy populated by identical households (of measure one) maximizing an infinite stream of utility derived from consumption relative to a reference stock. Consumption of a household  $i$  is denoted by  $c_i$ , the corresponding reference stock is  $h_i$ , and intertemporal utility is given by

$$V = \int_0^{\infty} \frac{(c_i/h_i^\gamma)^{1-\sigma}}{1-\sigma} \cdot e^{-\theta t} dt. \quad (1)$$

Here,  $\theta$  is the discount rate,  $\sigma$  the coefficient of relative risk aversion, and  $\gamma$  determines the importance of consumption habits. For  $\gamma = 0$  we are back to the standard problem, for  $\gamma = 1$  only consumption relative to the reference stock matters for utility.

Comparisons may be formed with respect to household  $i$ 's own past consumption (inward-looking preferences) or with respect to the past consumption of others (outward-looking preferences). In the latter case the reference stock evolve according to

$$\dot{h}_i = \rho(c - h_i), \quad (2)$$

whereas the case of inward looking preferences implies the law of motion

$$\dot{h}_i = \rho(c_i - h_i). \quad (3)$$

The speed with which the reference stock adjusts to current consumption is given by  $\rho$ . The larger  $\rho$  the more important is consumption of the recent past. The speed of adaptation after a gain or loss of wealth and thus income will be the major focus of investigation in this paper. Note that for  $\rho \rightarrow \infty$  people have what could be called with reference to the Grimm Brothers' fairy tale "Hans in Luck" preferences. After a change of wealth they immediately "forget" how life was and adapt to the new situation. Thus being equipped with the character trait of adjusting habits rapidly helps in coping with negative events. On the other hand, a large  $\rho$  lets people also get rapidly used to discrete improvements of the status quo and thus to derive less utility from unexpected gains in wealth.

Income is produced using capital  $k$  and a linear production function  $Ak$ . With depreciation rate  $\delta$  capital of household  $i$  evolves according to  $\dot{k}_i = (A - \delta)k_i - c_i$ . Carroll et al. show that the steady-state solution of the optimization problem is the same irrespective of whether habits are formed outward-looking or inward-looking and is given by

$$g_c \equiv \frac{\dot{c}}{c} = \frac{A - \delta - \theta}{\gamma(1 - \sigma) + \sigma}, \quad (4a)$$

$$\frac{c}{h} \equiv x = 1 + \frac{1}{\rho} \left( \frac{A - \delta - \theta}{\gamma(1 - \sigma) + \sigma} \right) = 1 + \frac{g_c}{\rho}, \quad (4b)$$

$$\frac{k}{h} \equiv p = \frac{1}{\rho} \left[ \frac{\rho(\gamma(1 - \sigma) + \sigma) + (A - \delta - \theta)}{(A - \delta)[(1 - \sigma)\gamma + \sigma - 1] + \theta} \right]. \quad (4c)$$

Individual indices have been dropped since all households are identical,  $c_i = c$  for all  $i$  etc.

Inspecting (4b) and (1) reveals the central trade-off. Habit adjusted consumption at the steady-state can be written as  $c/h^\gamma = c^{1-\gamma}(1 + g_c/\rho)^\gamma$ , i.e. as a weighted average of the current consumption level and consumption growth. If habits play a stronger role, i.e.  $\gamma$  is high, people derive to a lesser degree utility from the status quo and to a higher degree from the "sense

of getting ahead” Friedman (2004). One also sees that adapting fast, i.e. a high value of  $\rho$ , ceteris paribus, does not affect equilibrium growth but reduces instantaneous utility derived from growth, which lets us expect that the positive effect from adaptation – if there is any – will be a phenomenon of transitional dynamics.

### 3. HAPPINESS: A CALIBRATION EXERCISE

Suppose an economy evolves along the steady-state path (which is true by construction for  $\gamma = 0$  since the ordinary  $Ak$  growth model displays no adjustment dynamics) and that the currently observed capital stock per capita is  $k(0) = k_0$ . At the steady-state consumption grows at rate  $c(t) = c(0)e^{g_c t}$ . Inserting this and (4a) and (4b) in (1) and solving the utility integral yields (5).

$$V = \frac{x^{\gamma(1-\sigma)}}{1-\sigma} \cdot c(0)^{\frac{(1-\gamma)(1-\sigma)}{\theta - g_c(1-\gamma)(1-\sigma)}}. \quad (5)$$

Using the fact that that  $c(0) = (x/p) \cdot k(0)$  and inserting (4b) and (4c) provides intertemporal utility as a function of the initial capital stock per capita. Finally, substituting  $y_0 = y(0)$  as implied by the production function  $y(0) = Ak(0)$  we get intertemporal utility as a function of initial income per capita (6).

$$V(y_0) = \frac{1}{1-\sigma} \cdot \left( \frac{g_c + \rho}{\rho} \right)^{\gamma(1-\sigma)} \cdot \frac{[(A - \delta - g_c)/A]^{(1-\gamma)(1-\sigma)}}{\theta - g_c(1-\gamma)(1-\sigma)} \cdot y_0^{(1-\gamma)(1-\sigma)}. \quad (6)$$

This result can be employed for a calibration of preference parameters based on happiness results from world values surveys. Imagine a set of countries for which the above model applies. Countries differ by their initial capital stock and thus initial income per capita. Currently, we are at time  $t = 0$  and people are asked about their happiness. Imagine they evaluate their happiness according to a calculation of intertemporal utility (6).<sup>1</sup>

Figure 1 summarizes the calibration exercise. Dots in both panels show the association of happiness and income across countries according to the data. Happiness data is from the popular Inglehart and Klingermann (2000) study. The indicator is defined as the average of “happiness” and “life satisfaction” from surveys taken during the 1990s (Table 7.1 in Inglehart and Klingermann). Income  $y_0$  is GDP per capita measured at PPP exchange rates in 1995 according to Heston et al. (2002).

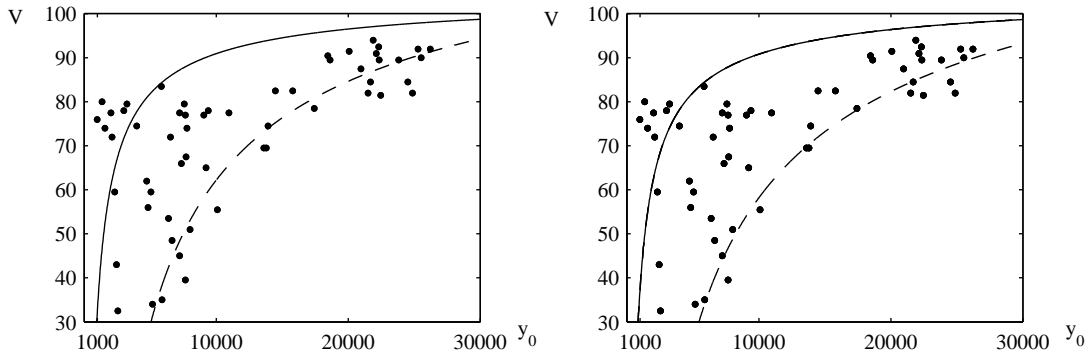
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<sup>1</sup>See Stutzer and Frey (2004) for arguments why empirically measured subjective well-being is a satisfactory approximation of utility.

Each point on the curves represents the intertemporal utility  $V(y_0)$  according to (6) when the initial income is  $y_0$ . For numerical evaluation I set  $\delta = 0.05$ ,  $\theta = 0.02$  as in many calibration studies in quantitative growth theory and tried various values for the coefficient of relative risk aversion  $\sigma$  and the importance of habits  $\gamma$ . Productivity  $A$  is obtained endogenously according to (4a) such that in any case the steady-state growth rate equals 2 percent annually. Since utility is only determined up to an affine linear transformation, I normalized by adding a constant such that an income of 40000 dollars provides a utility value of 100.

The left panel shows results for  $\gamma = 0$ , i.e. for ordinary, non-habitual preferences. In that case values of  $\sigma$  between 1.55 and 1.7 seem to fit the data best. For the right panel I set  $\sigma = 2$  and get the best fit of  $V$  when  $\gamma$  is between 0.35 and 0.55.<sup>2</sup>

Figure 1: Intertemporal Utility for Alternative Initial Incomes  $y(0)$   
Left: Without Habit Formation, Right: With Habit Formation



Computation of  $V = \int_0^\infty (c/h^\gamma)^{1-\sigma} / (1-\sigma) \exp^{-\theta t} dt$ . generated by the model for alternative initial values  $k(0)$  and thus  $y(0) = Ak(0)$ . Parameters for both panels:  $\theta = 0.02$ ,  $\delta = 0.05$ ,  $g_c = 0.02$ . Left panel:  $\gamma = 0$ ,  $\sigma = 1.7$  (solid line) and  $\sigma = 1.55$  (dashed line). Right panel  $\sigma = 2$ ,  $\gamma = 0.35$  (solid line) and  $\gamma = 0.55$  (dashed line). Dots reflect real data points. Income from Heston et al. (2002), subjective wellbeing from Inglehart and Klingerman (2000, Table 7.1).

The most remarkable fact visible in Figure 1 is that there is not much variation of utility when income is high *irrespective* of the role of habits in preference formation. Thus, the observation “that over the last 30 years income went up tremendously with only comparatively little improvements of happiness” is not sufficient to establish habit formation of consumer behavior, in particular, if the country under observation was already quite rich initially. Little variation in happiness could be simply a consequence of the concave nature of the utility function. In

<sup>2</sup>Note that  $\sigma > 1$  and  $\gamma \leq 1$  (See Carroll et al., 2000, for details). This implies that, generally, the value of  $\gamma$  providing the best fit is increasing with  $\sigma$  in order to maintain position and concavity of the curve as suggested by the data. Concavity is determined by the intertemporal elasticity of substitution,  $1/[1 - (1 - \gamma)(1 - \sigma)]$ . For example, for  $\sigma = 4$  values of  $\gamma \in [0.85, 0.95]$  provide best results and for  $\sigma = 8$ ,  $\gamma$  should be around 0.98.

the limit, as income goes up extra happiness should go to zero irrespective of the presence and strength of habits, verifying that “having more money does not insure happiness. People with ten million dollars are no happier than people with nine million dollars.” (Hobart Brown).

Recalling that  $c/h^\gamma = c^{1-\gamma}(1 + g_c/\rho)^\gamma$  one sees that the values obtained for  $\gamma$  from the right panel,  $\gamma \in [0.35, 55]$ , imply that a permanent increase of current consumption or (because of linearity in production) of current income of ten percent would lead to an increase of happiness between 4.5 and 6.5 percent. The lower value is approximately supported by van Praag and van der Sar’s (1988) study, the higher value is approximately supported by Stutzer and Frey’s (2004) results. The mean value of  $\gamma$  derived from experiments by Alpizar et al. (2005) is 0.45, i.e. it is just lying in the middle of the  $\gamma$  estimates that provide a good fit of intertemporal utility according to the model when  $\sigma = 2$ .

Note that by construction of the model only persons with inward-looking preferences internalize their adaptation process (see Carroll et al, 1997). This implies that the utility functions derived in the right panel are probably most appropriate to describe their behavior. If people are endowed with outward-looking preferences, they take the behavior of others and the evolution of their reference stock not into account. They think – for example when answering a happiness questionnaire – that they are equipped with standard preferences. For calibration of their  $\sigma$ ’s the left hand panel is most appropriate. This implies that persons with outward-looking preferences overestimate their true capabilities of coping through consumption smoothing. They think their intertemporal elasticity of substitution is  $1/\sigma$  when it is actually  $1/[\sigma - \gamma(\sigma - 1)] > 1/\sigma$ . In other words, they overestimate their pain from bad events.

#### 4. COMPARING COMPARISON UTILITY: METHODOLOGY

How can we calculate whether comparing consumption with own past achievements or with that of the Joneses makes us unhappier without recurring on interpersonal utility comparisons? In this section I propose one possibility. Individuals are compared with their own self with and without the experience of a wealth shock. In order to avoid case differentiation, the explanation of methodology is focussed on a negative shock but, of course, it works symmetrically in case of a positive shock. In particular, we ask what is the percentage welfare loss experienced after a 10 percent loss of capital (caused, for example, by an unanticipated stock market breakdown). Compared to the standard case of ordinary, non-habitual preferences, do people lose more or less



relative to their own pre-shock situation when they compare their consumption with a reference stock?

The answer to this question is not obvious. On the one hand, we expect people with habitual preferences to suffer more. Income, investment and consumption decrease in line with the wealth shock and, in particular, shortly after the shock people are still used to their high pre-shock consumption habits. On the other hand, they adjust their reference stock to the new after-shock situation. If adjustment of the reference stock is fast, people are good in coping with negative events and may actually suffer less than people with ordinary, non-habitual preferences.

In order to evaluate consequences of shocks on life-time utility we have to analyze the implied adjustment dynamics. Using the quasi-control variable  $x \equiv c/h$  and the quasi-state variable  $p \equiv k/h$  dynamics of the economy under outward-looking preferences are given by the following two-dimensional system (see Carroll et al., 1997, for details).

$$\dot{x} = x [g_c - \rho(x - 1)] \quad (7a)$$

$$\dot{p} = p [A - \delta - \rho(x - 1)] - x \quad (7b)$$

$$g_c = \frac{1}{\sigma} [A - \delta - \theta + \rho\gamma(\sigma - 1)(x - 1)]. \quad (7c)$$

Dynamics for the inward looking case are a little more involved because people take into account how their consumption affects the evolution of the reference stock. This implies a second dynamic constraint of the optimization problem and leads to the replacement of the algebraic equation (7c) by the differential equation (7d).

$$\begin{aligned} \dot{g}_c = & \sigma g_c^2 + g_c(2\theta + \rho + \delta - A - 2\gamma\rho(1 - \sigma)) - \rho^2\gamma(\gamma(1 - \sigma) + 1)x^2 + 2\gamma\rho(1 - \sigma)g_c x \quad (7d) \\ & + \frac{\rho\gamma}{\sigma}x(\rho\gamma(1 - \sigma)(2\sigma - 1) + \theta + \rho - \sigma(2\theta + \delta - A)) \\ & + \frac{1}{\sigma}((\rho + \theta)(\theta + \delta - A) + \rho\gamma(1 - \sigma)(\rho(\gamma(1 - \sigma) + 1) - (2\theta + 2\rho + \delta - A))). \end{aligned}$$

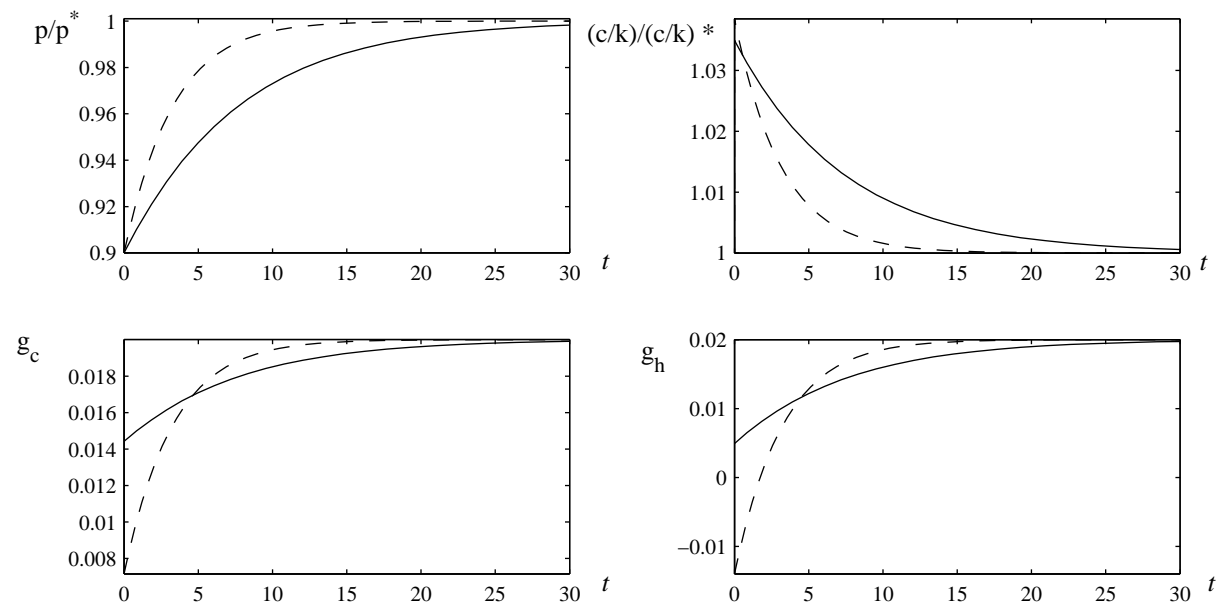
Adjustment dynamics are unique along the one-dimensional stable manifold towards the steady-state (again, see Carroll et al. for details).

Consider an economy calibrated as described in the last section (below Figure 1) and resting at the steady-state initially. Since the habit stock cannot jump (unless  $\rho$  is infinitely large), a 10 percent wealth shock is represented by a 10 percent shock of  $p$ . Using the method of backward integration I start arbitrary close to the steady-state (4) and integrate system (7) backwards

until  $p = 0.9p^*$ , where  $p^* = (k/h)^*$  according to (4c). The solution approximates the non-linear adjustment dynamics correctly up to a pre-specified, arbitrarily small error of discretization. A second reversion of time provides the forward looking solution. The initial closeness to the steady-state determines the approximation of the infinite time horizon. I decrease this value until a further decrease modifies the calculated welfare effect by less than  $10^{-5}$ . See Brunner and Strulik (2002) for details on the backward integration method.

Figure 2 shows adjustment dynamics for two example economies and households with inward-looking preferences. Both economies share the same steady-state growth rate of 2 percent and the same fundamentals except that individuals whose economy is represented by dashed lines adjusts their habits faster. More precisely, we have  $\rho = 0.2$  for adjustment along solid lines and  $\rho = 0.5$  for adjustment along dashed lines (the common parameters are given below the figure). At a steady-state, consumption and the habit stock grow at a common rate of 2 percent annually. During transition both  $g_c$  and  $c/h$  adjust from below implying that consumption grows at a higher rate than habits.

Figure 2: Adjustment Dynamics after a 10% Wealth Loss



Parameters:  $\theta = 0.02$ ,  $\delta = 0.05$ ,  $A = 0.1$ ,  $\gamma = 0.5$ , and  $\rho = 0.2$  for solid lines and  $\rho = 0.5$  for dashed lines. Inward looking preferences.  $g_h$  is the growth rate of the habit stock according to (3), i.e.  $g_h = \rho(x - 1)$ .

People with habitual preferences cope with a negative shock by consumption smoothing. In particular, directly after the shock they are consuming relatively more than people with ordinary, non-habitual preferences. This can be seen from the upper right panel and by recalling that there are no adjustment dynamics of  $c/k$  for the standard model with ordinary preferences. As a result of the coping strategy we expect that people with comparative utility suffer less from a negative shock. But then, their utility consists also from the “sense of getting ahead”, i.e. growth of consumption itself, which is temporarily below steady-state level as a consequence of the coping strategy. From this effect alone we expect people with habitual preferences to suffer relatively more from a shock.

A second element of coping with negative shocks is that habits adjust to the new after-shock situation. In particular if the speed of adaptation  $\rho$  is large, growth of the reference stock  $g_h$  is not only below growth of consumption  $g_c$  but actually negative for a while after the shock. From adaptation alone we expect people with comparison utility to suffer less from a negative shock than ordinary, non-habitual persons. People with ordinary preferences are lacking the trait to adapt and are always comparing absolute consumption levels before and after the shock in evaluating their welfare loss.

Taken all three effects together it is impossible to infer analytically or from inspection of impulse responses whether comparison utility affects happiness positively or negatively. In order to evaluate and compare happiness I employ the methodology established in Lucas (1990) and measure the welfare effect caused by the wealth shock in consumption equivalents. I calculate the constant percentage change of consumption along the balanced growth path that equates intertemporal utility from remaining on the balanced path without shock and intertemporal utility including the adjustment dynamics induced by the shock. For ordinary, non-habitual preferences this is trivially easy since there are no adjustment dynamics and  $c/k$  stays constant everywhere. A ten percent loss of capital thus causes a ten percent decrease of consumption and the consumption equivalent is ten percent.

For the computation of welfare effects under comparison utility note that  $c/h^\gamma = x^\gamma c^{1-\gamma}$  and thus intertemporal utility experienced after the wealth shock is given by

$$V_0 = \frac{c(0)^{(1-\gamma)(1-\sigma)}}{1-\sigma} \underbrace{\int_0^\infty x(t)^{\gamma(1-\sigma)} e^{\int_0^t g_c(v)(1-\gamma)(1-\sigma)dv} e^{-\theta t} dt}_{=:v_0}$$

where  $c(0)$  is the initial consumption level after the shock. The time series for  $x(t)$  and  $g_c(t)$  are revealed by backward integration so that the integral, for simplicity abbreviated as  $v_0$ , can be obtained numerically by a second integration (in forward direction).

Without a shock the economy remains on the balanced path and intertemporal utility is obtained as

$$V_s = \frac{c(s)^{(1-\gamma)(1-\sigma)}}{1-\sigma} \underbrace{\int_0^\infty x^{*\gamma(1-\sigma)} e^{g_c^*(1-\gamma)(1-\sigma)t} e^{-\theta t} dt}_{=:v_s},$$

where a star indicates a steady-state value and  $c(s)$  is the (unknown) value of consumption along the steady-state at the time of the shock. The value of  $v_s$  can be computed analytically. The welfare effect of the shock, denoted by  $\xi$ , is computed as the percentage change of  $c(s)$  that equates welfare with and without shock, i.e. the value that solves  $c(0)^{(1-\gamma)(1-\sigma)}v_0 = [(1+\xi)c(s)]^{(1-\gamma)(1-\sigma)}v_s$ . Now, because the reference stock  $h$  cannot jump we have  $c_0 = x(0) \cdot h^*$  and  $c(s) = x^* \cdot h^*$  and since  $x(0)$  is revealed by backward integration and  $x^*$  is obtained analytically the welfare effect of the wealth shock is obtained as

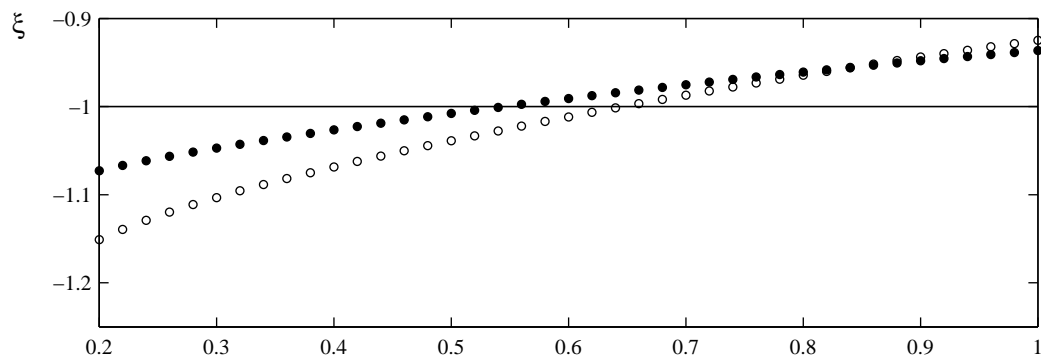
$$\xi = \frac{x(0)}{x^*} \cdot \left(\frac{v_0}{v_s}\right)^{\frac{1}{(1-\gamma)(1-\sigma)}} - 1.$$

## 5. COPING WITH UNEXPECTED LOSS

The welfare loss incurred by a ten percent loss of wealth under inward-looking preferences is visualized in Figure 3. Each dot represents one calculation of  $\xi$  for an alternative  $\rho$  and benchmark parameters as specified below Figure 1. Black dots represent the case of  $\gamma = 0.35$  and white dots the case of  $\gamma = 0.55$ . For comparison, the ten percent welfare loss implied by ordinary preferences is indicated by the -10%-line. It turns out that the welfare loss under comparison utility depends crucially on the speed of habit adjustment. One sees that habitual consumers suffer more from the wealth shock at low adjustments speeds and are better off at high adjustment speeds.

Di Tella et al. (2007) estimate that  $8/23 = 34\%$  of an income shock have still an impact on happiness after 4 years. Solving the back-of-the envelope calculation  $e^{-4\rho} = 0.34$  provides an estimate of  $\rho = 0.27$ . This is slightly larger than Carroll et al.'s (2000) benchmark case where  $\rho = 0.2$ . In both cases the suffering from the wealth shock is a little larger under habitual preferences. For higher values of  $\rho$  between 0.5 and 0.6 as, for example, considered by

Figure 3: Welfare Loss after an Un-anticipated 10 percent Loss of Wealth  
Inward Looking Preferences

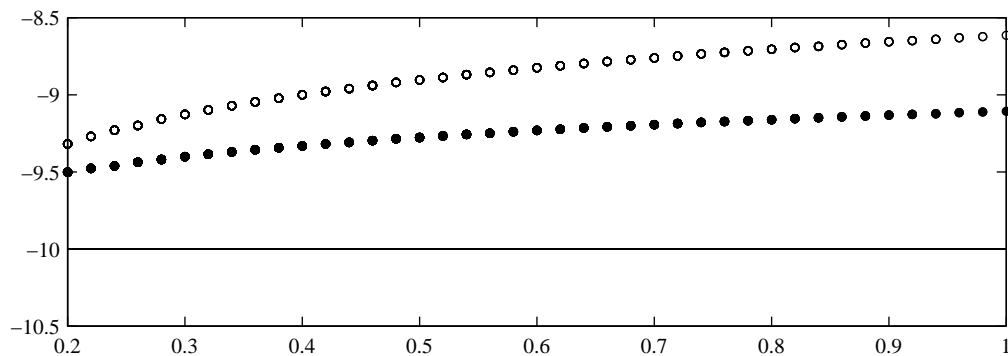


Loss computed in terms of consumption equivalents, see text. Parameters as for Figure 1, i.e.  $\sigma = 1.6$  and  $\gamma = 0$  (straight line) for ordinary preferences, and  $\sigma = 2$  and  $\gamma = 0.35$  (black dots),  $\gamma = 0.55$  (white dots). for comparison utility.

Constantinides (1990) both comparing and non-comparing utility let people experience about the same welfare loss of 10 percent.

In the case of outward looking preferences, people are not taking the external effect of consumption on the reference stock of others into account and think they face an ordinary life-time utility function as displayed in the left panel of Figure 1. I have approximated this case by setting  $\sigma = 1.6$ . Again, Figure 4 shows results for  $\gamma = 0.35$  and  $\gamma = 0.55$  and alternative speeds of adaptation  $\rho$ . Interestingly, people with comparison utility suffer less from a wealth shock than people with ordinary preferences over the whole range of empirical plausible parameters.

Figure 4: Welfare Loss after an Un-anticipated 10 percent Loss of Wealth  
Outward Looking Preferences



Parameters as for Figure 1, i.e.  $\sigma = 1.6$  and  $\gamma = 0$  (straight line),  $\gamma = 0.35$  (black dots), and  $\gamma = 0.55$  (white dots).

For an explanation of the result recall that people with outward-oriented preferences overestimate the damage from a wealth loss. Graphically, they overestimate the curvature of their utility function by thinking their coefficient of risk aversion is  $\sigma$  where actually it is just  $\sigma - \gamma(\sigma - 1)$ . In coping with the shock they do not take into account that the Joneses have also to cope and reduce their consumption as well which feeds back into an unexpected reduction of the reference stock and reduce the effectively felt welfare loss.

At first sight the positive performance of outward-looking preferences seems to be inconsistent with the claim in the literature (e.g. Carroll et al., 1997, p. 361) that utility with outward-oriented preferences along transition paths will be lower than for the inward-looking case because outward-looking persons do not take the feedback effect of consumption to habits into account. This statement is, of course, true when we compare two economies sharing the same set of parameter values. However, if we want to fit an inward- and an outward looking case to the actually revealed happiness data, as in Figure 1, the economies cannot share the same set of parameter values. In particular, the coefficient of relative risk aversion  $\sigma$  must be higher for the inward looking case (in the calibration around 2) than in the cases of non-comparing and outward-looking utility (in the calibration both around 1.6).

Sensitivity analysis reveals that the results are generally robust against variations of parameter values for equilibrium growth  $g_c$  and depreciation rate  $\delta$ . Higher values for time preferences  $\theta$  and risk aversion  $\sigma$  let people with comparison utility and small  $\rho$ 's suffer somewhat more from a shock while the opposite is true for larger  $\theta$ 's and lower  $\sigma$ 's. But then, if lifetime utility is shaped as requested by the data in Figure 1, there is only little scope for independent variation of  $\theta$  and  $\sigma$ .<sup>3</sup> Altogether these results suggest that our comparisons of current consumption with past achievements make us not fundamentally worse off after a wealth shock and if we compare with the Joneses we are probably slightly less worse off than if we had ordinary, non-comparing preferences.

## 6. DEALING WITH UPS AND DOWNS

Of course, we do not only suffer from windfall losses but we also enjoy windfall gains from time to time. Qualitatively, positive events turn the previous results upside down. Now, being

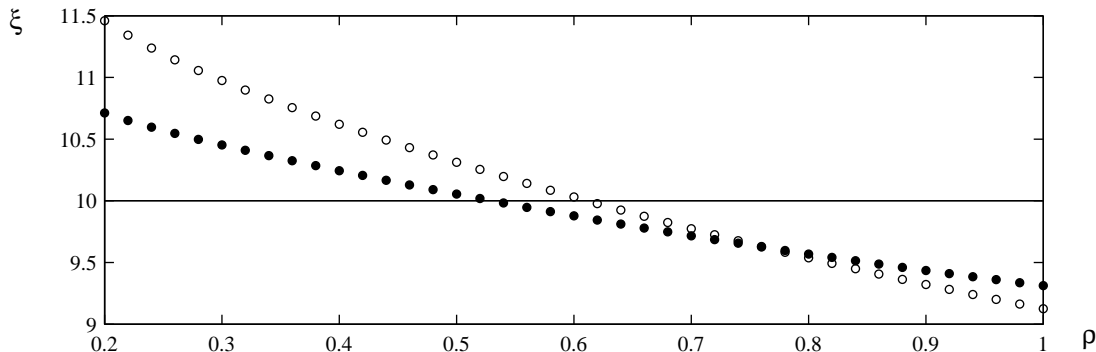
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<sup>3</sup>Results depend also somewhat on the severity of the shock. For example, persons with inward-looking preferences suffer relatively more from a 50 percent loss of wealth. A welfare loss of 50 percent (i.e. equality with non-comparing persons) is reached for  $\rho$ 's between 0.7 and 0.8 (instead of between 0.55 and 0.65 as for the 10 percent loss).

equipped with comparison utility and outward-looking behavior lets us experience only comparatively small welfare gains because we do not anticipate that the Joneses upgrade their consumption as well. On the other hand, we can expect comparison utility to be particularly enjoyable if we follow inward-looking behavior and reference stocks adjust slowly to the new after shock situation.

The welfare gains from an unexpected 10 percent increase of wealth are shown in Figure 5 for benchmark parameters and inward looking behavior. For low values of  $\rho$ , within in the range suggested by Di Tella et al. and the basic case in Carroll et al., habits adjust slowly enough for people with habitual preferences enjoying their gain a little more than people with ordinary, non-habitual preferences (whose gain is represented by the 10-percent line). For higher values of  $\rho$  around one-half, as suggested by Constantinides, habitual preferences provide about equal welfare gains than ordinary, non-comparing preferences.

Figure 5: Welfare Gain from an Un-anticipated 10 percent Increase of Wealth  
Inward-Looking Case



Parameters as for Figure 1, i.e.  $\sigma = 1.6$  and  $\gamma = 0$  (straight line),  $\gamma = 0.35$  (black dots), and  $\gamma = 0.55$  (white dots).

Finally, we ask how comparison utility performs altogether, i.e. how welfare is affected by the joint impact of positive and negative shocks of equal size. Given the simple structure of the  $Ak$  growth model, we know that the joint impact is exactly zero under ordinary preferences. Is this also true for comparison utility? Or are people with habitual preference consistently unhappier? Table 1 shows results within the plausible range of parameters and the inward-looking case. Recall that for inward looking behavior people are taking the adaptation process into account so we cannot independently change  $\gamma$ . The curvature of the utility function has to be maintained

according to the data. Table 1 shows changes of  $\sigma$  and  $\gamma$  keeping the “real” intertemporal elasticity of substitution constant.

Table 1: Joint Welfare Impact of a 10 percent Loss and Gain of Wealth  
Inward Looking Preferences

	$\sigma = 2.0$	$\sigma = 2.5$	$\sigma = 3.0$
	$\gamma = 0.50$	$\gamma = 0.66$	$\gamma = 0.75$
$\rho = 0.2$	0.07	2.24	12.2
$\rho = 0.5$	-0.05	1.54	8.20
$\rho = 0.8$	-0.15	1.19	6.75

Other parameters:  $\delta = 0.05$ ,  $\theta = 0.02$ ,  $A$  adjusted such that equilibrium growth  $g_c = 0.02$  in any case. Entries show welfare effects in percent.

For relatively low values of the coefficient of relative risk aversion the joint effect of the shocks is close to zero indicating that persons with habitual preferences are approximately equally affected by the business cycles’ up and downs as persons with ordinary, non-comparing persons. If  $\sigma$  is higher habitual persons manage to get positive welfare out of the business cycle. In particular, if habits adjust sluggishly the welfare gain is significant.

There is, however, also a price being paid for welfare gains around the business cycle. This price is not visible from the aggregate effect shown in the table. High values of the degree of positionality  $\gamma$  and low values of the speed of adaptation  $\rho$  imply that persons are highly affected by changes of the growth rate, i.e. by transitional dynamics, and high  $\sigma$ ’s imply that adjustment dynamics are slow, which altogether means that personalities described by parameters for the upper right corner of Table 1 live a life high on adrenaline. They experience a 47.3 percent welfare increase from an unexpected 10 percent increase of wealth but suffer also from 35.1 percent welfare loss after an unexpected 10 percent loss of wealth. For comparison, people with preferences that support the lower left corner of Table 1 experience a 9.6 percent welfare increase from the positive shock and a 9.8 welfare loss from the negative shock implying that they are not only in aggregate but also in its parts more or less equally affected by up and downs as non-habitual types.

Results for outward-looking behavior are summarized in Table 2. Here, adjustment of reference stocks is not taken into account in individual behavior and  $\gamma$  can be varied independently from  $\sigma$ . For  $\sigma$  in turn there is little scope for variation because it is fixed by the data which suggests that it is around 1.6 for outward looking behavior. Results are shown for  $\gamma$  equal to 0.35 and



Table 2: Joint Welfare Impact of a 10 percent Loss and Gain of Wealth  
Outward Looking Preferences

	$\gamma = 0.35$	$\gamma = 0.55$	$\gamma = 0.9$
$\rho = 0.2$	-0.07	-0.11	-0.12
$\rho = 0.5$	-0.08	-0.12	-0.17
$\rho = 0.8$	-0.09	-0.13	-0.19

Other parameters:  $\delta = 0.05$ ,  $\theta = 0.02$ ,  $\sigma = 1.6$ ,  $A$  adjusted such that equilibrium growth  $g_c = 0.02$  in any case. Entries show welfare effects in percent.

0.55 and the extreme case of  $\gamma = 0.9$ , i.e. where current consumption contributes 10 percent and economic growth 90 percent to instantaneous utility.<sup>4</sup> The overall result is that persons with outward looking behavior suffer slightly from the up and downs of their wealth. On average they experience a welfare loss of about 0.1 percent from the shocks. Note that 10 percent losses and gains of wealth are not everyday experiences. From a business cycle type of shock of 1 percent up and down they would experience a welfare reduction of about a 0.01 percent, a figure which certainly does not justify to call habitual preferences a curse.

There is also a benefit from comparing with the Joneses. It guarantees a more balanced life than under ordinary, non-comparing preferences. Because the adjustment of reference stocks of others comes unexpected people gain and lose less from ups and downs. For example, for preferences supporting the lower right corner of Table 2 people experience only an 8.0 welfare gain from a ten percent wealth increase and lose only 8.2 percent welfare from ten percent wealth loss.

## 7. CONCLUSIONS

Using consumption equivalents it has been shown in this paper that the welfare loss after an unexpected wealth loss is slightly higher for inward-looking behavior and slightly lower for outward-looking behavior than under non-comparing utility. The opposite is true for unexpected positive events. If both negative and positive events are equally likely, the overall conclusion is thus that their joint effect on happiness is approximately the same irrespective of the type of utility function.

<sup>4</sup>The case of almost complete dependency of utility on reference stocks,  $\gamma \rightarrow 1$ , is interesting although it seems to be not empirically supported because it solves the Easterlin (2001) puzzle.

Of course, these results have so far only been found for wealth shocks and comparison utility with respect to consumption (and thus income) in a very simple model of economic growth. It remains to be shown whether they are robust against more complicated dynamic models that include further elements which interact with consumption in generating our (un-) happiness like, for example, leisure and public goods. What can be concluded so far is that evidence for the claim that comparing consumption with past own achievements or that of others makes us markedly unhappier is less easily been provided than we may have thought initially. A new claim that could be derived from the present approach is that it is not the comparing activity as such that makes people (un-) happy but the unequal distribution of initial endowments and good and bad luck across people and nations.

## References

- Abel, A.B., 1990, Asset pricing under habit formation and catching up with the Joneses, *American Economic Review* 80, 38-42.
- Alonso-Carrera, J., J. Caballe, and X. Rauch, 2005, Growth habit formation, and catching up with the Joneses, *European Economic Review* 49, 1665-1691.
- Alvarez-Cuadrado, F., G. Monteiro, and S.J. Turnovsky, 2004, Habit formation, catching up with the Joneses, and economic growth, *Journal of Economic Growth* 9, 47-80.
- Alpizar, F., Carlsson, F., and O.-J. Johannsson-Stenman, 2005, How much do we care about absolute versus relative income and consumption? *Journal of Economic Behavior and Organization* 56, 405-421.
- Brickman, P. and D. Campbell, 1977, Hedonic relativism and planning the good society, in M.H. Appley (ed.), *Social Comparison Processes: Theoretical and Empirical Perspectives*, Wiley, New York.
- Brunner, M. and H. Strulik, 2002, Solution of perfect foresight saddlepoint problems: a simple method and applications, *Journal of Economic Dynamics and Control* 26, 737-753.
- Carroll, C.D.; J. Overland, and D.N. Weil, 1997, Comparison utility in a growth model, *Journal of Economic Growth* 2, 339-367.
- Carroll, C.D.; J. Overland, and D.N. Weil, 2000, Savings and growth with habit formation, *American Economic Review* 90, 341-355.
- Constantinides, G.M., 1990, Habit formation: a resolution of the equity premium puzzle, *Journal of Political Economy* 98, 519-43.
- di Tella, R., J. Haisken-De New, and R. MacCulloch, 2007, Happiness adaptations to income and to status in an individual panel, NBER Working Paper 13159.
- Easterlin, R.A., 2001, Income and happiness: towards a unified theory, *Economic Journal* 111, 465-484.
- Frank, R.H., 1985, *Choosing the Right Pond*, Oxford University Press, New York.

- Frey, B.S. and A. Stutzer, 2002, What can economists learn from happiness research?, *Journal of Economic Literature* 40, 402-435.
- Friedman, B.M., 2005, *The Moral Consequences of Economic Growth* Alfred A. Knopf, New York.
- Heston, A., R. Summers, and B. Aten, 2002, Penn World Table Version 6.1, Center for International Comparisons, University of Pennsylvania.
- Inglehart, R., and H.-D. Klingemann, 2000, Genes, culture, democracy and happiness, in: *Subjective Well-being Across Cultures*, E. Diener and E.M. Suh (eds.), Cambridge, MA, MIT Press.
- Layard, Richard, 2003, *Happiness: Has Social Science A Clue?*, Lionel Robbins Memorial Lectures, Centre for Economic Performance, London.
- Lucas, Robert E., Jr., 1990, Supply-side economics, an analytical review, *Oxford Economic Papers* 42, 293-316.
- Oswald, A.J., 1997, Happiness and economic performance, *Economic Journal* 107, 1815-1831.
- Stutzer A. and B.S. Frey, 2004, Reported subjective well-being: a challenge for economic theory and economic policy, *Schmollers Jahrbuch* 124, 2004, 191-231.
- van Praag, Bernard M.S. and Nico L. van der Sar, 1988, Household cost functions and equivalence scales, *Journal of Human Resources* 23(2), 193-210