Children, Dynastic Altruism and the Wealth of Nations

Juan Carlos Cordoba

Iowa State University

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Abstract

Dynastic altruism implies that the effective life span of an individual, or effective quantity of life, is determined not only by her longevity but also by the number and longevity of her descendants. I provide measures of effective quantity of life and relative well-being for representative individuals of 116 countries between 1970 and 2005 using a calibrated version of the Barro-Becker model. I find that the gains in effective quantity of life arising from longevity improvements were on average more than offset by the losses due to fertility reductions. Effective quantity of life in the world fell by more than 7 percent during the period 1970-2005. Contrary to previous estimates, I find that the effective growth rate of well-being in the world, one that takes into account quantity and quality of life, was significantly below the growth rate of per-capita consumption.

Keywords: fertility, children, welfare, quantity of life, world inequality, life expectancy, income differences.

JEL classification: I10, I31, J17, O57

> " ... who is loved more but our children, they are the prolongation of our existence..." *Lyrics of a classic Colombian song.*

1. Introduction

It is well-recognized that GDP per capita is an imperfect indicator of average economic well-being. As a flow measure, GDP gauges the material *quality* of life in a given period but it is silent about the *quantity* of life, the number of years over which the flow of income is enjoyed. Thus, even if two countries have identical GDP per capita, average welfare may differ due to differences in longevity. Recent works by Becker *et al.* (2005), Jones and Klenow (2011), and Cordoba and Ripoll (2013) calculate full measures of income that take into account longevity differences across countries and across time.

The quantity of life, however, is not only determined by the life span of an individual. Parents who perceive their children as extensions of their own life increase their effective quantity of life through the life of their children, grandchildren, etc. The idea that longevity and children are equivalent is embedded in the infinitely-lived model commonly used in macroeconomics. The model is often motivated as really representing a dynasty, a sequence of finitely lived individuals linked by altruism. This idea is formalized by the Barro-Becker model of fertility (Becker and Barro 1988, and Barro and Becker 1989).

This paper uses quantitative versions of the Barro-Becker model to assess the welfare implications of fertility changes across time and space. The presumption that fertility may significantly affect welfare evaluations is based on two facts. First, as illustrated in Figures 1, net fertility rates differ significantly across countries and have changed substantially over time.[1] The lowest and highest net fertility rates in 2005 were 1.23 and 5.98 children per women in Poland and Niger respectively, with a world standard deviation of 1 child. Moreover, net fertility rates around the world fell by 2 children on average between 1970 and

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[1] Details about the definitions and the data set used are provided in Section 3.

2005. Second, parents spend a significant fraction of their resources, wealth and time, on their children suggesting that children are a major source of enjoyment. For example, the U.S. Department of Agriculture estimates that the total present value of expenses on a child born in 2009 for a middle-income husband-wife family with two children is $\$226,920$ in 2010 dollars (USDA, 2010, page 23). This is only a partial figure because it only includes direct parental expenses made on children through age 17 such as housing, food, transportation, health care, clothing, child care, and private education, but excludes time costs and forgone earnings by parents, college costs and other costs after age 17.

Part of the observed fertility reductions are the result of direct government interventions through family planning policies. Perhaps the most significant example is the One Child policy in China. The policy placed major restrictions on fertility choices with the goal of reducing poverty and alleviating social and environmental problems. Partly as a result of the policy, the net fertility rate dropped by 3.2 children between 1970 and 2005. During the same period, per capita consumption grew at an impressive rate of 5% per year, one of the largest in the world. But is the One Child Policy a welfare enhancing policy? After all, everything else equal, altruistic parents are better off by having more children. Was the observed consumption growth enough to compensate for the welfare loss due to lower fertility? What is the actual growth rate of well-being in China's taking into the cost of the policy? This paper sheds some light on these questions, and more generally, provides estimates of the evolution of well-being around the world that take into account fertility trends.

The key concept of the paper is the *effective* quantity of life, Q. Specifically, in dynastic altruistic models the lifetime utility of an individual can be written as $u(c)Q$ where $u(c)$ is the utility flow due to consumption, or quality of life, times Q. In the Barro-Becker model, $Q = Q(T)Q(n)$ where $Q(T)$ and $Q(n)$ measures effective longevity and effective dynasty size respectively given longevity T and fertility n. The core of the paper reports estimates of effective quantity of life, effective longevity, effective dynasty size and consumption equivalent measures of welfare for representative individuals in 116 countries and for the years 1970 and 2005 using calibrated versions of the model. The discipline of the quantitative exercise comes from requiring the model to match U.S. targets for the value of statistical life and the economic value of children.

The following are the main insights from the model. First, there is a large difference between longevity, T, and effective longevity, $Q(T)$. Effective longevity was 38 years on average around the world in 2005 while actual longevity was 67 years. The difference is driven by a small rate of time discounting, of only 2% per year, which implies than an additional year of life at age 60 is worth only 0.3 years of extra life at age 5. Second, children's welfare is significant discounted: the weight that a parent puts on the welfare of her child, relative to her own weight, is 0.098 on average. As a result effective dynasty size, $Q(n)$, is only 1.2 members even though the net fertility rate is 2.5 children on average. Effective quantity of life, Q, was 45 years on average around the world in 2005.

Third, effective quantity of life is weakly negative correlated with per-capita consumption in 2005. While longevity and effective longevity are strongly positively correlated with per-capita consumption, and fertility and effective dynasty size are strongly negative correlated, both effects largely offset each other overall although there are significant exceptions for specific countries. Simple regressions suggest that doubling per-capita consumption increases longevity and effective longevity by 3.58 and 1 years respectively on average for the world, reduces fertility and effective dynasty size by 0.56 and 0.04 respectively, and decreases effective quantity of life by 0.08 years. Relative to the U.S., the world on average losses an equivalent of 20% on its consumption due to its lower effective longevity but gains 16% due to its higher effective dynasty size. These figures show that taking into account fertility differentials have a first order effect on welfare calculations.

Fourth, effective quantity of life significantly decreased during the period 1970-2005. The gains due to added longevity, of around 6.4 years on average, were more than offset by the losses due to lower fertility, a loss of 2 children. On average for the world, effective longevity increased by 5.1% during the period but effective dynasty size fell by 11.6%. As a result, effective quantity of life fell by 7.1%. Fifth, the welfare consequences of the drop in effective quantity of life were significant. While consumption per capita grew on average at an annual rate of 2.6% during the period 1970-2005 around the world, welfare measured in consumption equivalent units grew at an annual rate of 1.9% during the same period. If only trends in longevity are considered, ignoring fertility trends, then annual welfare growth during the period would have been around 0.5% higher than consumption growth, consistent with the findings of Becker et al. (2005).[2] However, considering trends in both longevity and fertility, welfare growth is actually 0.7% lower than consumption growth, or around 1.2% lower than what was suggested by Becker et al.

In addition to the overall findings for the world, I also report results for individuals countries. The Chinese case is particularly telling. During the 1970-2005 period longevity increased by around 5 years but net fertility fell by 3.2 children. The net result was a large reduction in effective quantity of life of 15.4%. The net economic cost of these demographic trends together is equivalent to lowering the growth rate of consumption by 1.6 percentual points per year during the period. The growth rate of welfare remains one of the largest in the world for the period, of 3.4% per year, but significantly lower than consumption growth.

This paper makes part of a growing literature studying the links between economic growth and demographics changes (e.g., Galor and Weil 2001, Doepke 2004, Cervalatti and Sunde 2011). It is more closely related to a literature that goes beyond GDP as a measure of well-being including, among others: Becker et al. (2005) who study longevity; Cordoba and Verdier (2007), who consider inequality; Jones and Klenow (2011) who consider adjustments for longevity, inequality, leisure and consumption; Fleurbaey and Gaulier (2009) and the Stiglitz Commission (Stiglitz, Sen and Fitoussi, 2009) who consider a variety of adjust-

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[2] They find that increasing longevity around the world for the period 1960-2000 is equivalent to around 0.7 additional percentual points of economic growth for a sample of 96 countries.

ments. To the extent of my knowledge, this is the first paper to consider adjustments for fertility differences.

Regarding longevity, my results are similar to those of Becker et al. (2005). My estimates suggest 0.5 points of additional growth due to gains in longevity while Becker et al. estimate 0.7 additional points. Jones and Klenow (2011) estimate significantly larger impact of longevity on welfare. They finds longevity gains to be equivalent to 1.3 percentage points of additional economic growth. Most of the difference is due to the fact that they implicitly assume no time discounting while time discounting has a first order effect in my estimates, as I explain in Section 4. Furthermore, they define longevity as life expectancy at birth which increased substantially during the last few decades. In my exercise, individuals are born at age 5 so as to include only children who survive at least to age 5 in the calculations. As a result, my longevity variable is life expectancy at age 5 which has also increased significantly but not as much as life expectancy at birth. These papers, however, do not make any adjustment for fertility differences.

The remaining of the paper is organized as follows. Section 2 sets up the model, Section 3 describes the data and calibrates the model, Section 4 presents the results, and Section 5 concludes.

2. The Model

This section describes a standard dynastic altruistic model along the lines of Becker and Barro (1988) and Barro and Becker (1989). The distinguishing feature of the model is that parents are altruistic: they enjoy the well-being of their descendants. I use the model to derive expressions for the effective quantity of life, the value of statistical life, the value of children, and consumption-equivalent expressions of relative welfare.

2.1. Preferences

A representative individual born at time t lives for T_t periods, consumes a constant flow c_t during his/her lifetime and has n_t offsprings at age F_t. The lifetime utility is assumed to have the form

$$V_t = \sum_{i=0}^{T_t} \beta^i u(c_t) + \beta^{F_t} \Phi(n_t) V_{t+F_t}, \tag{1}$$

where $u(c)$ is an instaneous utility function, $\beta \in (0,1)$ is a time discount factor, V_{t+F_t} is the lifetime utility of a child, and $\Phi(n)$ is the altruistic weight a parent places on his/her n_t children. As in Becker and Barro (1988) I assume $u(c) = c^\gamma$ and $\Phi(n) = \alpha n^{1-\varepsilon}$ where $\alpha > 0,\ \gamma \in (0,1)$ and $\varepsilon \in (0,1)$. These assumptions guarantee $u(c) \geq 0$ so that both longevity, $T,$ and children, $n,$ are goods.[3]

I focus in balanced growth situations such that fertility, longevity and age of fertility are constant while consumption grows at the rate $(1+g)^F$ between generations: $c_{t+F} = (1+g)^F c_t$. I abstract from life cycle considerations and for simplicity assume a constant consumption during the lifetime of an individual. Under these assumptions, V_t can be written as:

$$\begin{aligned} V_t &= \sum_{s=t}^{\infty} \left[\left(\beta^F \Phi(n)\right)^{s-t} \sum_{i=0}^{T} \beta^i u(c_s) \right] \\ &= \frac{1-\beta^{T+1}}{1-\beta} u(c_t) \sum_{s=t}^{\infty} \left(\alpha n^{1-\varepsilon} \left(\beta (1+g)^\gamma\right)^F\right)^{s-t}. \end{aligned}$$

Lifetime utility is finite under the additional restriction $1 > \alpha n^{1-\varepsilon} \left(\beta (1+g)^\gamma\right)^F$. In that case, $V_t,$ or just V, simplifies to

$$V = V(c,T,n,F,g) = u(c) \cdot Q(T,n,F,g), \tag{2}$$

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[3] Alvarez (1999), Barro and Sala-i-Martin (2004) and Jones and Schoonbroodt (2010) analyze the more general case $u(c) = \frac{1}{\gamma} c^\gamma$ with $\gamma < 1$. I restrict attention only to the case $0 < \gamma < 1$ because in that case both fertility and longevity are goods. Allowing for $\gamma < 0$ and $\varepsilon > 1,$ as in the literature above, would result in fertility being a good but longevity would be a bad. Cordoba and Ripoll (2011) provides further discussion.

where

$$Q(T,n,F,g)=\left[\frac{1-\beta^{T+1}}{1-\beta}\right]\left[\frac{1}{1-\alpha n^{1-\varepsilon}\left(\beta\left(1+g\right)^{\gamma}\right)^{F}}\right]. \tag{3}$$

Expression (2) states that lifetime welfare is the product of two terms: an utility flow $u(\cdot)$, or quality of life, times *effective* quantity of life $Q(\cdot)$. $Q(T,n,F,g)$, is a positive function of the number of children, longevity and the growth rate, and a negative function of childbearing age F as long as the growth rate of the economy is not too large, i.e., $\beta\left(1+g\right)^{\gamma}<1$.[4] It is convenient to write $Q(T,n,F,g)$ as $Q(T,n,F,g)=Q(T)\cdot Q(n,F,g)$ where

$$Q(T)=\frac{1-\beta^{T+1}}{1-\beta}=\sum_{t=0}^{T}\beta^{t}\leq T, \text{ and} \tag{4}$$

$$Q(n,F,g)=\frac{1}{1-\alpha n^{1-\varepsilon}\left(\beta\left(1+g\right)^{\gamma}\right)^{F}}=\sum_{t=0}^{\infty}\left(\alpha n^{1-\varepsilon}\left(\beta\left(1+g\right)^{\gamma}\right)^{F}\right)^{t}\leq\infty. \tag{5}$$

In this representation, $Q(T)$ is the effective longevity of an individual, an interval smaller than T for $\beta\in(0,1)$, and $Q(n,F,g)$ is the *effective* dynasty size, including the parent, from the parent's perspective. In particular $Q(0,F,g)=1$. I use the word "effective" to distinguish it from the *actual* values of longevity, T, and dynasty size, $\sum_{t=0}^{\infty}n^{t}$. In particular, effective dynasty size can be written as $Q(n,F,g)=\sum_{t=0}^{\infty}\omega^{t}n^{t}$ where ω^{t} is the weight that parents place on generation t where $\omega\equiv\alpha n^{-\varepsilon}\left(\beta\left(1+g\right)^{\gamma}\right)^{F}$ takes into account degree of altruism, childbearing age, actual number of children per parent and the growth rate of the economy. For example, effective dynasty size is 2 when $F=0$, $n=1$ and $\alpha=0.5$ even though the actual size is infinite. Below I often writhe $Q(n)$ as a shorthand for $Q(n,F,g)$ because n turns out to play the central role in the quantitative results. Finally, an equivalence between infinitely-lived and dynastic models can be obtained from (2) by either setting $T=\infty$ and $\alpha=0$, or $T=1$, $g=0$ and $\alpha=F=n=1$. In both cases $Q(T,n,F,g)=\sum_{t=0}^{\infty}\beta^{t}$.

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[4] This condition is satisfied by all countries in our sample in the quantititive work reported below.

2.2. Welfare in Consumption Equivalent Units

Given parameters $[\beta, \gamma, \alpha, \varepsilon]$, (2) can be used to compare welfare of an hypothetical individual under alternative allocations $x \equiv [c, T, n, F, g]$. Let x_0 and x_i be allocations under two different scenarios referred to as the baseline and the alternative respectively. For *cross-country* comparisons x_0 and x_i would refer to typical bundles in two different countries in the same year, namely 2005, and x_0 would be the U.S. bundle. For *cross-time*, or time series, comparisons x_0 and x_i would refer to typical bundles in two different eras for the same country, namely 1970 and 2005, and x_0 would be the 1970 bundle. The thought experiment for time-series comparisons is that the country is in a balanced growth path in 1970 but a potentially different balanced growth path in 2005. The calculations assume that the structural changes leading to a different steady state are completely unexpected to the 1970 cohort.

The most common way to measure relative welfare differentials between alternative situations is by the ratio of consumptions, c_i/c_0. This ratio however only measures differences in quality but not quantity of life. A more comprehensive measure of relative welfare differentials, in consumption equivalent units, is given by the λ_i that solves the following equation:

$$V(\lambda_i c_0, T_0, n_0, F_0, g_0) = V(x_i). \tag{6}$$

In words, λ_i is the proportional change in baseline consumption needed to achieve the same welfare provided by the alternative allocation. For example, $\lambda_i = 2$ means that twice as much baseline consumption is needed to equalize welfare. Notice that λ_i equals c_i/c_0 in the special case $T_i = T_0$, $n_i = n_0$, $F_i = F_0$ and $g_i = g_0$. λ_i is more general because it takes into account differences in both quality and quantity of life. Using (2), it follows that:

$$\lambda_i = \frac{c_i}{c_0} \left[\frac{1 - \beta^{T_i+1}}{1 - \beta^{T_0+1}} \right]^{1/\gamma} \left[\frac{1 - \alpha n_0^{1-\varepsilon} \left(\beta \left(1 + g_0\right)^{\gamma}\right)^{F_0}}{1 - \alpha n_i^{1-\varepsilon} \left(\beta \left(1 + g_i\right)^{\gamma}\right)^{F_i}} \right]^{1/\gamma}. \tag{7}$$

Separate measures for the welfare contribution of each component, $\lambda_i(h)$ for $h \in \{c, T, n, F, g\}$, can be defined in different ways. I use the following definitions which guarantee that λ_i can be written as the product of the individual contributions:

$$V\left(\lambda_i(c)c_0, T_0, n_0, F_0, g_0\right) = V\left(c_i, T_0, n_0, F_0, g_0\right), \tag{8}$$

$$V\left(\lambda_i(T)c_0, T_0, n_0, F_0, g_0\right) = V\left(c_0, T_i, n_0, F_0, g_0\right), \tag{9}$$

$$V\left(\lambda_i(n)c_0, T_0, n_0, F_0, g_0\right) = V\left(c_0, T_0, n_i, F_0, g_0\right), \tag{10}$$

$$V\left(\lambda_i(n)c_0, T_0, n_i, F_0, g_0\right) = V\left(c_0, T_0, n_i, F_i, g_0\right), \text{ and} \tag{11}$$

$$V\left(\lambda_i(g)c_0, T_0, n_i, F_i, g_0\right) = V\left(c_0, T_0, n_i, F_i, g_i\right). \tag{12}$$

Thus $\lambda_i(c)$, $\lambda_i(T)$, $\lambda_i(n)$, $\lambda_i(F)$ and $\lambda_i(g)$ measure the relative welfare gain or loss, in consumption equivalent units, of changes in consumption, life span, fertility, childbearing age and growth rates respectively. For example, $\lambda_i(T) = 2$ means that gains in longevity alone, from T_0 to T_i, is equivalent to doubling baseline consumption. Notice the slightly different definitions of $\lambda_i(F)$ and $\lambda_i(g)$ requiring n_i rather than n_0 as well as F_i rather than F_0 for the case of $\lambda_i(g)$ on the left hand side of the expressions. Both definitions assess the marginal effects of F and g and have the advantage of allowing a product representation for λ_i. The following are the explicit solutions:

$$\begin{aligned}
\lambda_i(c) &= \frac{c_i}{c_0},\ \lambda_i(T) = \left[\frac{1-\beta^{T_i+1}}{1-\beta^{T_0+1}}\right]^{1/\gamma},\ \lambda_i(n) = \left[\frac{1-\alpha n_0^{1-\varepsilon}\beta^F\left(1+g_0\right)^{F\gamma}}{1-\alpha n_i^{1-\varepsilon}\beta^F\left(1+g_0\right)^{F\gamma}}\right]^{1/\gamma}, \\
\lambda_i(F) &= \left[\frac{1-\alpha n_i^{1-\varepsilon}\left(\beta\left(1+g_0\right)^{\gamma}\right)^{F_0}}{1-\alpha n_i^{1-\varepsilon}\left(\beta\left(1+g_0\right)^{\gamma}\right)^{F_i}}\right]^{1/\gamma} \text{ and } \lambda_i(g) = \left[\frac{1-\alpha n_i^{1-\varepsilon}\left(\beta\left(1+g_0\right)^{\gamma}\right)^{F_i}}{1-\alpha n_i^{1-\varepsilon}\left(\beta\left(1+g_i\right)^{\gamma}\right)^{F_i}}\right]^{1/\gamma}.
\end{aligned}$$

It is easy to check that λ_i satisfies

$$\lambda_i = \lambda_i(c)\lambda_i(Q) \text{ where } \lambda_i(Q) \equiv \lambda_i(T)\lambda_i(n)\lambda_i(F)\lambda_i(g).$$

$\lambda_i(Q)$ and $\lambda_i(c)$ are ratios of relative welfare associated to differences in effective quantity of life and quality of life respectively. For time series comparisons it is convenient to define welfare ratios in terms of annual growth rates as follows:

$$g(j) \equiv \frac{1}{i} \ln \lambda_i(j) \text{ for } j \in \{c, Q, T, n, g\} \text{ and } g^* = \frac{1}{i} \ln \lambda_i. \tag{13}$$

where $i = 2005 - 1970 = 35$ in the calculations below.

2.3. Value of Life

I now derive expressions for the shadow prices of life and children in the model. The expressions obtained are used later to calibrate key parameters of the model by matching the theoretical shadow prices with empirically plausible values estimated in the existing literature for the U.S.

Value of Statistical Life. In the model, the enjoyment of extra years of life comes only from the utility flow generated by consumption. As such, V is the value of being alive. The implicit value of not being alive, either dead or unborn, is zero.[5] V, however, is measured in "utils." The corresponding value of a life in terms of goods, known in the literature as the Value of Statistical Life (VSL) at birth, is given by:

$$VSL_t = \frac{V_t}{u'(c_t)} = \frac{1}{\gamma} c_t Q(T, n, F, g). \tag{14}$$

The first equality uses the marginal value of consumption to transform the util value of a life into a goods value. The second equality follows from using equation (2) and the functional form $u(c) = c^\gamma$. The value of a life in the model is thus proportional to both consumption and the effective quantity of life. Moreover, it depends on the parameter controlling the curvature of the utility function, γ,

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[5] Specifically, since $u(c) = c^\gamma$, the formulation normalizes the utility the unborn child to zero, or the inputed consumption of the unborn, ω, to zero. This assumption is consistent with the evidence that poor families, and individuals in very poor countries, have children in spite of their very low consumption. Since altruistic parents would not have children whose consumption is below ω, then ω must be very low. Golosov et al. (2007) and Cordoba and Ripoll (2011, 2014b) provide further discussion about the value of the unborn.

a property that is used below to identify γ based on empirical evidence about the value of statistical life. The larger the curvature of the utility function, or the lower the value of γ, the larger the value of life because it makes the perceived drop in consumption upon dead more costly.

Value of a Child. Similarly, the value of an additional child to the parent is $\partial V_t/\partial n_t$ in utils or $\frac{\partial V_t/\partial n_t}{u'(c_t)}$ in goods. The value of child n to the parent at the time the child is born is given by:

$$\begin{aligned} VC_t(n_t) &= \beta^{-F}\frac{\partial V_t/\partial n_t}{u'(c_t)} = \alpha\left(1-\varepsilon\right)n_t^{-\varepsilon}\frac{V_{t+F}}{u'(c_t)} \\ &= \alpha\left(1-\varepsilon\right)n_t^{-\varepsilon}\left(1+g\right)^{F\gamma}VSL_t. \end{aligned} \tag{15}$$

The last expression states that $VC_t(n_t)$ is the marginal degree of altruism towards the last child times the value of statistical life of the parent adjusted for economic growth. For example, if $\varepsilon = g = 0$, so that altruism is linear in the number of children and there is no economic growth then $VC(n) = \alpha VSL.$ Notice that economic growth increases the value of a child while a larger family, larger n, decreases the value of a child. The dependence of $VC(n)$ on α is used below to identify this parameter based on evidence about the cost of raising children. Furthermore, the fact that the elasticity of this willingness to pay with respect to the number of children is $-\varepsilon$ is used to identify $\varepsilon.$

The Longevity-Children Trade-off. Another shadow price of interest is the willingness to substitute parental life for children's life. This trade-off is described by $\frac{\partial T_t}{\partial n_t} = \frac{\partial V_t/\partial n_t}{\partial V_t/\partial T_t}$ or, along a balanced growth path,

$$\frac{\partial T_t}{\partial n_t} = \left(1-\varepsilon\right)\alpha n_t^{-\varepsilon}\left(1+g\right)^{\gamma F}\frac{\beta-1}{\ln\beta}\frac{Q(T_t,n_t,g)}{\beta^{T+1-F}}. \tag{16}$$

$\frac{\partial T}{\partial n}$ thus measures the value of having one more child in terms of extra years of life for the parent. $\frac{\partial T}{\partial n}$ increases with T and decreases with n. According to the model, the observed fall in fertility rates illustrated in Figures 1 and 2 is particularly costly since it took place during a period of rising longevity. The model also predicts that further reductions in fertility are increasingly costly and become unbearable as the number of children approaches zero.[6]

3. Calibration and data sources

To calculate cross-country and cross-time welfare measures requires data for consumption, c, longevity, T, fertility n, childbearing age F, and growth rates, g as well as parameters β, γ, α and ε. I assembled data for 116 countries for the period 1970-2005 using per-capita consumption from the Penn World Table Version 7.0., fertility and longevity from the World Development Indicators, and age of first marriage from the United Nations World Marriage Data 2012. I assume individuals are born at age 5 so that only children who survive at least to age 5 are included in the calculations. For the fertility variable, $n,$ I use number of surviving children to age 5 per women. For life span, T, and childbearing, F, I use life expectancy at age 5 and the average age of first marriage of men and women minus 5.[7] Direct estimates of childbearing age exist but only for a limited number of countries and years. Country specific growth rates are calculated as a simple average between a world growth and the actual growth rate of the country during the period. This specification combines the balanced growth assumption made by the model with the possibility of some transitional dynamics at the country level. The results are robust to various plausible assumptions about growth rates.[8]

The parameters of the model are chosen to match specific targets for the value of a child and the value of statistical life in the U.S. I pick $\beta = \frac{1}{1+0.02}$ so

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[6] Having zero children is never optimal in the original Barro-Becker formulation. Zero children could be optimal for alternative formulations of the altruism function. See Cordoba and Ripoll (2011).

[7] The exact variable used was "singulate mean age at marriage" which measures the average length of single life.

[8] For the world growth rate, I use 2.6% for the 1970 cohort, which is the average growth rate of per-capita consumption for the 1970-2005 period, and 2% for the 2005 cohort, a rate similar to the U.S. long term growth rate.

that constant consumption is optimal for life time of an individual if the real annual interest rate is 2%.[9] An interest rate of 2% is in the range of estimates provided Mehra (2003, Table 1) for the U.S. Parameter ε determines the degree of diminishing altruism, and according to (15), it is the elasticity of the willingness to spend in children with respect to the number of children. To the best of my knowledge Dickie and Messman (2004) is the only study estimating this elasticity. They use survey evidence on parental willingness to pay to relieve symptoms in children's acute respiratory illnesses. The distinct feature of their study is that it estimates how parental willingness to pay varies with the number of children in the family. In addition to strongly supporting parental altruism toward their children, the paper estimates an elasticity of the parental willingness to pay with respect to the number of children in the family of -0.288 (see Table 5, p. 1159). Based on this evidence I set $\varepsilon = 0.288.$

The remaining two parameters are obtained from a system of two simultaneous equations in two unknowns: γ and α. The first equation is (15) which determines the value of the marginal child. Absent economic growth, $g = 0$, this equation fully identifies α given targets for the value of a child, the value of statistical life (VSL), fertility and ε. The second equation is (14) which defines the value of statistical life (VSL) in the model. Using 2005 U.S. values for c, T, n, F and g and a target for the VSL, this equation determines γ given α. Intuitively, the value of life increases with the curvature of the utility function because it makes the perceived drop in consumption upon dead more costly. A more traditional calibration of γ uses estimates of the elasticity of intertemporal substitution. Cordoba and Ripoll (2013) have shown that the parameter γ controls both the elasticity of intertemporal substitutions as well as the coefficient of death aversion. When they disentangle both parameters, using Epstein-Zin type of preferences, they find that the value of statistical life follows a formula similar to (14) but the parameter γ is the coefficient of death aversion, not the

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[9] At the same time, a growing intergenerational consumption can be justified by the existence of binding intergenerational transfers constraints, as in Cordoba and Ripoll (2014a).

intertemporal elasticity of substitution. In the current set up, with a single parameter controlling two aspects of preferences, it is important that the model delivers the correct predictions for the value of life. This motivates my identification procedure of matching the value of statistical life rather than the intertemporal elasticity of substitution.

There is a large literature estimating the value of statistical life. The VSL is often estimated from wage differential across occupations with different mortality risks or from market prices for products that reduce fatal injuries. Estimates of the VSL range between $\$4$ to $\$9$ millions (Viscusi 1993, Viscusi and Aldy 2003). The Environmental Protection Agency uses a value of $\$6.3$ millions in cost-benefit analysis. A similar value is used by Murphy and Topel (2006) when assessing the value of health and longevity. They also provide life-cycle estimates for VSL that range from $\$6.3$ million at birth, reaches $\$7$ million at age 30, declines to $\$5$ million by age 50 and $\$2$ million by age 70. (See their Figure 3). Hall and Jones (2007) calibrate their benchmark model to a VSL just below \$3 million while the calibrated model in Becker, Phillipson and Soares implies a VSL for developed countries of between \$1.5 and \$2 million. I target a VSL of $\$5$ millions in 2010 dollars which is in the midrange of estimates.

To the extent of my knowledge, estimates of the value of a child are unavailable. However, standard economic arguments suggest that if decisions are nearly optimal then the value of the last child to the parent must be similar to the cost of raising that child. Table 1 summarizes the main calculations that follow regarding the costs of raising a child.

The U.S. Department of Agriculture estimates that the total present value of expenses on a child born in 2009 for a middle-income husband-wife family with two children is $\$226,920$ in 2010 dollars (USDA, 2010, page 23). These expenses include direct parental expenses made on children through age 17 such as housing, food, transportation, health care, clothing, child care, and private expenses in education. Major items excluded are the time costs and forgone earnings by parents, college costs and other costs after age 17. The estimate implicitly assumes a zero real interest rate. If an interest rate of 2% is used, as I assume from now on, then the present value of the total cost of raising a child up to age 17 is $\$191,719.$

Adjustments for time costs of child rearing and college costs can be made. Regarding time costs, Folbre (2008, pg. 114) estimates an average amount of parental-care hours per child from birth to age eleven of about 40 hours per week, or around $2,080$ hours per year, for both parents. On the other hand, the Bureau of Labor and Statistics[10] estimates that the median hourly wage for all occupations was $\$20$ in 2010. These figures suggest an annual time cost of raising children, for both parents, of $\$41,600$ up to age 11. Folbre does not provide estimates for time costs after age 11. For the calculations below, I assume time costs between ages 12-17 to be 1/3 of the costs at earlier ages. Under these assumptions, the present value of the time costs of raising a child until age 17 for both parents is $\$511,203$.

Regarding college costs, the College Board (2011) estimates net costs of attending college in different types of institutions. Net costs includes tuition, fees, room and board minus grant aid from all sources, federal education tax credits and other deductions. The estimated annual costs for Full-Time Undergraduates in a Public Four-Year institution is $\$11,380$, $\$6,600$ in a Public Two-Year institution, and $\$23,060$ in a Private Nonprofit Four Year institution for the 2011-12 academic year. Enrollments in those institutions are 44%, 26% and 19% respectively which represents 89% of total enrollment. These figures suggest an average cost of $\$14,902$ per year for a 4 year college, or $\$40,525$ in present value at time of birth.

In summary, the present value at birth of the costs of raising a child for a middle-income family with two children, including college costs and parental-time cost, is in the order of $\$740,000$ for both parents or $\$370,000$ per parent. This figure is consistent with the estimates of Cordoba and Ripoll (2014) who use alternative assumptions.

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[10] http://www.bls.gov/oes/current/oes_nat.htm#00-0000. Last accessed on 10/13/2012.

The calibrated parameters required to match a VSL of 5 million and a value of a child per parent of $370,000 are $\gamma = 0.31$ and $\alpha = 0.148$. The curvature of the utility function is similar to the one used by Becker et al. (2005), and the implied elasticity of intertemporal substitution is still within the range of plausible values documented by Browning et al. (1999, pg. 614). The calibrated values imply a strong degree of child discounting. For example, effective dynasty size for a dynasty with no children is 1 and only 1.12 for a dynasty with one child in every generation, $F = 20$ and $g = 2\%$. Specifically, $Q(0, F, g) = 1$ while $Q(1, 20, 2\%) = 1.12$.

4. Results

I now report various measures of quantity of life as well as consumption equivalent measures of relative well-being across space and time.

4.1. Welfare Across Space

Consider first the quantity of life and welfare across countries in 2005. Table 2 reports descriptive statistics for various measures of quality and quantity of life. Regarding the population-weighted average, Table 2 shows that while longevity and net fertility in the world were around 67 years and 2.5 children respectively, effective longevity and effective dynasty size, $Q(T)$ and $Q(n, F, g)$, were significantly lower, of only around 38 years and 1.2 members. As a result, effective quantity of life, $Q(T, n, F, g)$, was of around 45 years on average for the world. The large difference between longevity and effective longevity, of 44%, is the result of time discounting. Although the rate of discount is relatively small, of only 2% per year, its compound effect is significant for the typical life span of an individual. For example, for the calibrated parameters $\beta^{60} \simeq 0.3$ meaning that an extra year of life at age 60 is equivalent to only 0.3 extra years of life at age 5.

An effective dynasty size of 1.2 members means that a typical individual values the whole family tree that follows, composed of $\sum_{t=1}^{\infty} n^t$ individuals, as equivalent to only 0.2 more replicas of himself or herself. This low value reflects a strong degree of child discounting. Specifically, $Q(n, F, g) = \sum_{t=0}^{\infty} \omega^t n^t$ where the child discount factor, ω, is on average 6.6% at parental birth, or 9.8% at the time the child is born, for the benchmark calibration. To assess the extent to which fertility rates alone determines $Q(n, F, g)$, Table 2 also reports descriptive statistics for effective dynasty sizes when fertility rates differ across countries, $Q(n, F_0, g_0)$, while F and g are set to U.S. values. The resulting values are remarkably similar to $Q(n, F, g)$ indicating that fertility rates are the key determinant of effective dynasty size.

Relative to the U.S., the average individual in the world has 91% lower consumption, 10% lower longevity and 12% higher fertility. However, due to time and child discounting, effective longevity and effective dynasty size are only 5% lower and 3% higher respectively than in the U.S. As a result, effective quantity of life is only 2% lower for the average individual in the world. Figure 3 displays effective longevity and effective quantities of life against (log) per-capita consumptions. Bubbles sizes are determined by the country's population size. The figure highlights the importance of including fertility rates in measures of quantity of life. While there exist a strong positive association between consumption and effective longevity, the association is much less clear for consumption and effective quantity of life and in fact the un-weighted correlation is negative. Simple regressions suggests that doubling per-capita consumption increases longevity and effective longevity by 3.58 and 1 years respectively on average for the world, reduces fertility and effective dynasty size by 0.56 and 0.04 respectively, and decreases effective quantity of life by 0.08 years.

The results above suggest that consumption ratios alone provide a fairly good description of relative welfare differences given the weak correlation between quantity of life and consumption. This impression is confirmed by looking at the dispersion of both (log) consumptions and the values of statistical life reported in Table 2. As shown by (14), the dispersion of (log) VSLs better describes the dispersion of well-being across countries because it takes into account differences in both quality and quantity of life. However, the standard deviations of both measures are remarkably similar, 1.11. Although the dispersion of per-capita consumption seems to provide a good description the dispersion of welfare in 2005, it has important shortcomings for specific countries as well as when analyzing the evolution of welfare since 1970, as we show below.

Table 2 also summarizes overall results for the welfare measures defined by (7) to (12). Relative to the U.S., the cost of lower longevity in the world is equivalent to a 15% permanent reduction of consumption on average, or 20% if the un-weighted column is used, while the gains associated to a higher fertility rate and a lower age of fertility are equivalent to a permanent increase of consumption of 7% and 3% respectively on average. Combining these results, the welfare cost of a lower effective quantity of life around the world is on average 5% of consumption. The variation, however, is large. The range of $\lambda(Q)$ goes from 0.43 to 1.38 and the standard deviation of $\ln \lambda(Q)$ is 9%.

Table 3 shows detailed results for the 30 most populated countries. Consider the column labeled $\lambda(Q),$ the relative welfare explained only by differences in effective quantity of life, or alternatively, the factor by which consumption needs to be multiplied to correctly reflect welfare differences. Significant downward adjustments are needed for some, typically poor, countries due to unusually low life expectancies but also countries with unusually low fertility rates, typically rich countries. The more significant cases are Afganistan(-18%), Poland (-18%), Thailand (-18%), Nigeria (-16%), Bangladesh (-13%), Congo (-13%), Germany (-12%), and Iran (-11%). Larger upward adjustments are unusual and reflect high fertility rates as in Pakistan (22%).

Finally, it is instructive to consider in detail the case of the two largest countries, China and India. While $Q(T, n, F, g)$ is similar for both countries, of around 44.5 years, their determinants are very different. China's life expectancy is around 6 years higher but India has around one more child per family. Furthermore, China's impressive growth rate makes up for its lower fertility rate so that effective dynasty size is the same as in the U.S.

4.2. Welfare Across Time

Evolution of The Effective Quantity of Life. Table 4 reports descriptive statistics for various quantity of life measures for the same sample of 116 countries and for the years 1970 and 2005. The following discussion mainly focuses in the population-weighted average column. Two conflicting trends in quantity of life variables are evident. On the one hand, life expectancy at age 5 increased on average by around 6.4 years during the period, from 60.4 years in 1970 to 66.9 in 2005; on the other hand, net fertility rate fell by 2.0 children, from 4.46 to $2.46,$ on average. Proportionally, fertility dropped more than longevity increased: longevity grew by 10.9% while fertility fell by 43.3%, on average. Given the conflicting trends in T and n, it is unclear what happened to the effective quantity of life. The table further documents an increase in the age of fertility, of 2.2 years on average, and a reduction in the growth rate during the period, both of which work toward reducing effective quantity of life measures. Effective quantity of life decreases with F because $\beta\left(1+g\right)^{\gamma}$ is below 1 for all countries in the sample. In particular, the highest annual growth rate of per-capita consumption in the sample is 5.8%.

Table 4 also shows the level and evolution of $\partial T/\partial n,$ the marginal value of a child in terms of parental years of life. According to the benchmark calibration, the typical individual in 1970 was willing to trade 1 child for 6.9 extra years of his/her own life. By 2005 this shadow price had increased to 8.3 years of parental life. Since longevity during the period increased by 6.4 years while net fertility fell by 2 children, these figures already suggest that effective quantity of life measures should fall. Finally, the table shows divergence in longevity and age of fertility variables, as illustrated by the rise of their standard deviations, but convergence in fertility variables.[11]

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[11] Becker et al. (2005) documents convergence in life expectancies at birth. Life expectancy at age 5, which is not affected by the major reductions in infant and child mortality that took place

Table 5 reports overall statistics for the full sample on the evolution of effective longevity, $Q(T)$, effective dynasty size, $Q(n, F, g)$, and effective quantity of life, $Q(T, n, F, g)$, as described by equations (4), (5) and (3). According to the calibrated model effective longevity was 35.8 years on average in 1970, around 40% shorter than actual longevity at the time of 60.4 years. Time discounting explains this large difference. Time discounting also explains why effective longevity increased, on average between 1970 to $2005,$ by only 1.81 years even though longevity increased by 6.4 years during the same period. Surprisingly, the standard deviation of effective longevity fell during the period suggesting convergence in effective longevity which stand in stark contrast to the observed divergence in life expectancies. The difference is explained by time discounting together with a distinct pattern of mortality reductions which have particularly benefited children and young adults in poorer countries but the elderly in richer countries, as shown by Becker et al. (2005). For effective longevity measures, early reductions in mortality are more important than late reductions.

Regarding effective dynasty size, $Q(n, F, g),$ it was 1.35 in 1970 and 1.19 in 2005, a net reduction of 0.16 family members or a 11.6% fall. To assess the extent to which this fall is due only to changes in fertility, Table 5 reports descriptive statistics for $Q(n, F_0, g_0)$, a measure of effective dynasty size given 1970 values for F and g but 2005 values for n. The resulting values of $Q(n, F, g)$ for 2005 and $Q(n, F_0, g_0)$ are remarkably similar meaning that practically all changes in effective dynasty size are due to changes in fertility rates.

Proportionally, effective longevity $Q(T)$ grew by only 5.12% while effective dynasty size fell by 11.6%. As a result, effective quantity of life, $Q(n, T) = Q(n)Q(T)$, fell by 7.11 % during the period, a net loss of 3.61 years of effective life. This is the key finding of the paper. It shows that welfare losses due to fertility reductions are significant, large enough as to overshadow the welfare gains due to increases in longevity during the period, and overturn the results of Becker et. al. (2005) regarding the evolution of quantity of life in the world: taking together

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during the period, shows divergence.

the evolution of fertility and mortality, the first effect dominates and therefore effective quantity of life has decreased rather than increased around the world. This is in spite of the fact that parents in our calibrated model heavily discount children's welfare.

To further assess the magnitude of the welfare losses due to fertility reductions, for each country I calculate the 2005 life span needed to achieve the 1970 effective quantity of life given 2005 values for n, F and g. Specifically, T_c is defined implicitly by $Q(T_c)Q(n_i, F_i, g_i) = Q(T_0, n_0, F_0, g_0)$.[12] Table 4 reports summary statistic for T_c. According to the calibrated model, life span should have increased by 22.5 years during the 1970-2005 period in order to keep effective longevity constant, but the actual increase was of only 6.4 years. Finally, Table 5 shows significant convergence in effective quantity of life measures, as illustrated by a drop in the standard deviation of $Q(T, n, F, g)$ from 3.17 years in 1970 to 1.24 years in 2005, a 60% reduction! Contrary to what is suggested by BPS, this convergence is to a lower quantity of life value rather than to high value, consistent with the existence of a quantity-quality trade-off.

Table 6 reports detailed results for the 30 most populated countries. Overall statistics for this smaller sample are similar to those for the full sample but individual cases differ significantly from the average. Consider first the case of China. During the 1970-2005 period life expectancy at age 5 increased by 4.8 years, from 64.6 to 69.4. Effective quantity of life, however, dropped by 8 years, from 52.4 to $44.4,$ a 15.4% reduction. This fall is explained by a drop in the net fertility rate, from 4.9 to 1.7, which reduced effective dynasty size from around 1.4 effective members to 1.2 members, a 18.2% fall. Other countries that experienced similar large drops in their fertility rates as well as in their effective quantity of life are Mexico, Turkey, Iran, Thailand, Kenya, Algeria and Morocco. Effective life in the U.S. remained constant during the period.

The documented fall in effective quantity of life means that consumption growth alone overstates growth in well-being. We now discuss the evolution of

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[12] The exact formula is $T_c = \frac{\ln\left(1-(1-\beta)\frac{Q(T_0,n_0,F_0,g_0)}{Q(n_i,F_i,g_i)}\right)}{\ln\beta} - 1.$

welfare according to the model.

Evolution of Welfare. Table 7 reports descriptive statistics for quality and quantity of life variables as well as implied annual growth rates of various welfare measures in consumption equivalent units, as defined by equations (13). As is well-known, the quality of life significantly increased during the period. Average consumption per-capita increased from $\$2,791$ in 1970 to $\$6,100$ in 2005, for an average annual growth rate of 2.62% per year. In addition, the effect of longer longevity increased welfare at annual rate of 0.47%. Thus, taking into account consumption growth and gains in life expectancy, the growth rate of welfare would be, on average, 3.09%, consistent with the results reported by BPS.[13] However, lower fertility reduced welfare at an annual rate of 1.11% during the period. These figures means that the net average annual growth rate of welfare for the entire sample, in consumption equivalent units, was only 1.9%, which is 0.72 percentual points below that the growth rate of consumption, or 1.11 percentual points below what the corresponding value of BPS. The results summarized in Table 7 illustrate the major significance of fertility for welfare calculations. While recent exercises emphasize gains in the quantity of life due to gains in longevity, they ignore the losses due to lower fertility.

Table 8 reports detailed results for the 30 most populated countries. The overall findings for this smaller sample are similar to the ones obtained for the set of 116 countries. Individual cases, however, are particularly telling. Consider first the case of China. Between 1970 and 2005 per capita consumption grew at an annual growth rate of 5.0%, the second largest in the sample after Oman. The Chinese Miracle was also accompanied by a drastic reduction in net fertility, of 3.2 children, largely attributed to the One Child policy. The associated annual growth rate of effective quantity of life is -1.6% and as a result the the implied net annual growth rate of welfare is 3.4% per year, significantly less impressive than the growth rate of consumption. Once the costs of fertility

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[13] BPS report an average growth of full income of 2.6, with one quarter of the growth due to gains in life expectancy at birth. Our adjustment is smaller because we consider life expectancy at age 5.

changes is taken into account, most of the Chinese Miracle disappears. Thailand, another fast growing country, shows a similar result. The countries with the largest downward adjustments reported in Table 8, are China (-1.6%), Mexico (-1.6%), Turkey (-1.1%), Iran (-1.5%), Thailand (-1.6%), Kenya (-1.6%) and Algeria (-1.5%). The most extreme cases, not reported in Table 8, are those of Zimbabwe (-3.5%) and particularly Botswana (-2.5%), considered by some the African miracle. In those countries life expectancy dropped significantly and fertility declined by about half. The fastest growing country in welfare terms is Indonesia with an annual growth rate of 4.4%. Its impressive gain in life expectancy, of almost 16 years, largely compensated for the also large fertility drop of 2.4 children so that the effective quantity of life slightly fell. As for the U.S., the effective quantity of life mostly remained the same so that consumption growth reflect welfare growth.

In conclusion, the results suggest that increasing consumption growth through fertility reduction is far from a free lunch and that fertility matter when considering the well-being of individuals in a nation.

5. Conclusion

My parents have four children. We have two. While we enjoy a significantly higher quality of life than my parents did at the same age, as measured by the amount of material consumption in our home, it is not clear that I am actually better off than my parents were at the same age. Our kids are our main treasure for my wife and I, and my parents had twice as many. We decided not to have more children because of their high costs. We traded quantity for quality. While our generation derives most of its lifetime satisfaction from material consumption, a generation or two ago relied more on sharing time and events with family and friends. Taking into account the differences in the number of children, am I doing better than my parents did? More generally, is our generation better off than a generation ago? Analogous questions arise when comparing individuals of the same generation. My quality of life is significantly higher than the one of a typical individual in India of the same age but, at the same time, my family has one less child than a typical Indian family. Am I really better off?

This paper uses calibrated versions of the Barro-Becker model to answer questions like these. Although children clearly have a major effect on parental well-being and fertility rates vary substantially across time and space, the existing literature has ignored the impact of these differences on individual well-being. This paper finds that fertility changes have first order effects on welfare. The model suggests that in spite of the substantial gains in life expectancy the effective quantity of life mostly stagnated during the period due to the significant drop in fertility rates around the world. Given that effective quantity of life stagnated, welfare growth seems to be well approximated by consumption growth on average for the world, although it is a poor indicator for many countries such as China.

The exercise in the paper is an accounting exercise that uses standard dynastic altruistic preferences. The validity of the results depend on the validity of the assumed preferences and its parameters. Given preferences, I calculate welfare by simply plugging observed realizations of consumption, fertility and longevity. The strength of the exercise is that it is based on a sensible parametrization of standard dynastic preferences. I do not investigate the underlying determinants of consumption, fertility or longevity, nor the causes of the demographic transition. The results are robust to alternative explanations and do not depend on whether the analysis is partial or general equilibrium as long as the preferences are sound.

A literature on the demographic dividend (see Ashraf, et al 2011, Bloom et al. 2009 among others) emphasizes the economic gains of fertility reductions. The One Child policy in China is perhaps the most successful example of the potential gains of demographic policies: the policy is part of the mix responsible for the Chinese miracle of the last three decades. What is missing from this literature are the costs associated to demographic policies, as if those policies are really a free lunch. The results of this paper suggest that demographic polices can be enormously costly because children seem to be highly valued by their parents.

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Figure 1: Fertility and Longevity versus Consumption Per-Capita, 2005

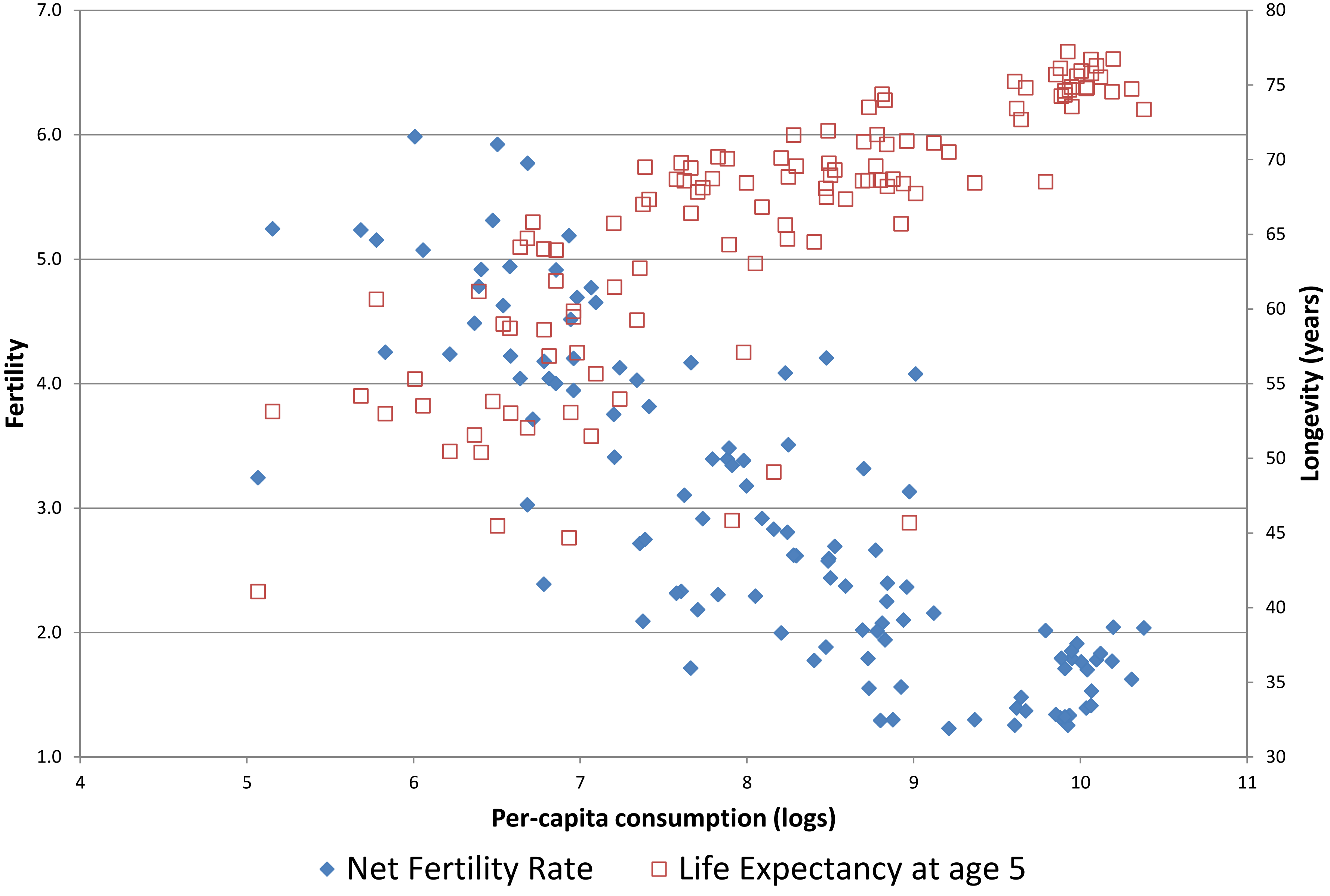

Figure 2: Consumption Per-Capita 2005 Vs. Change in Net Fertility Rate 1970-2005.

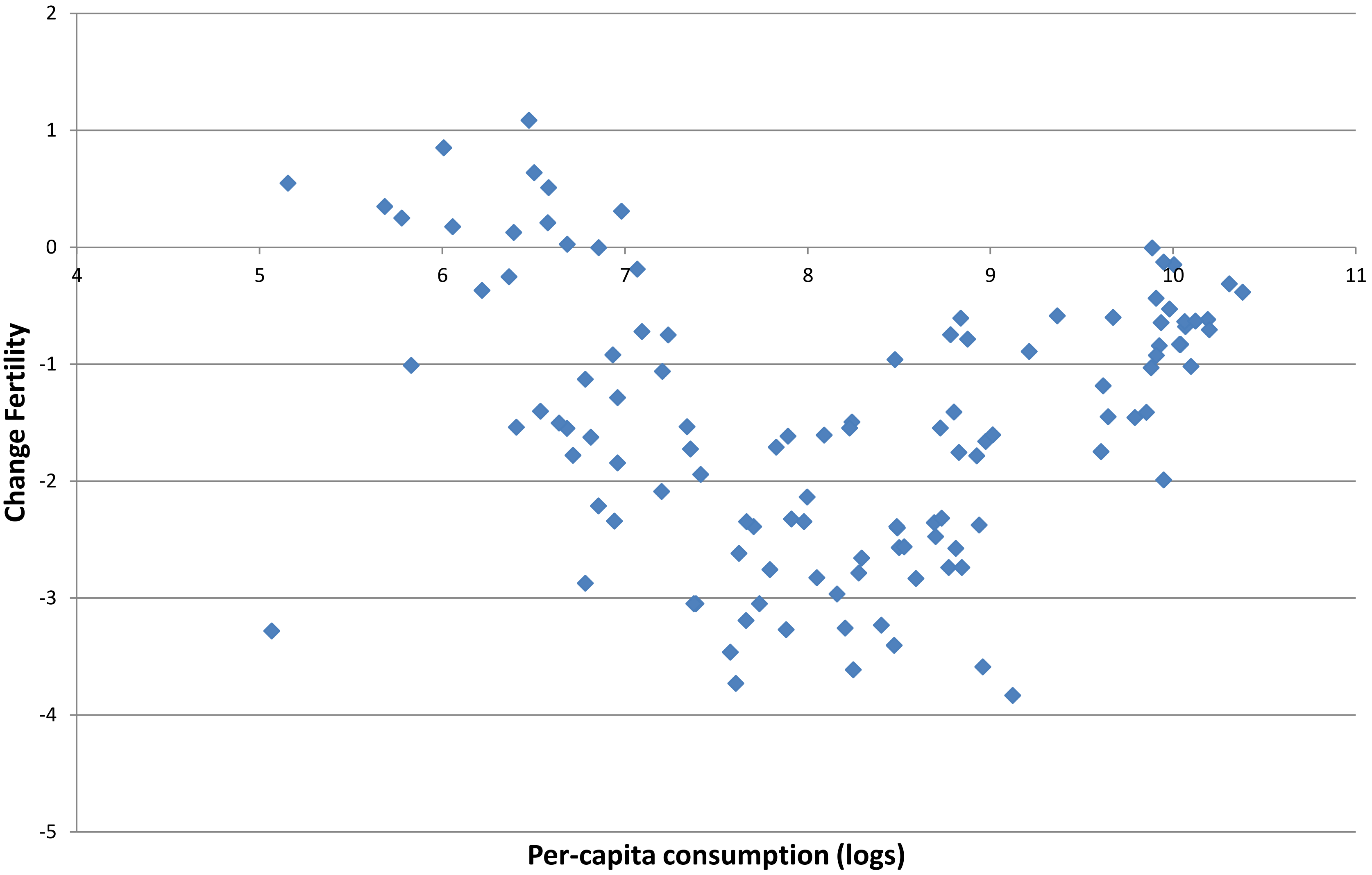

Figure 3: Effective Life Span and Effective Quantity of life

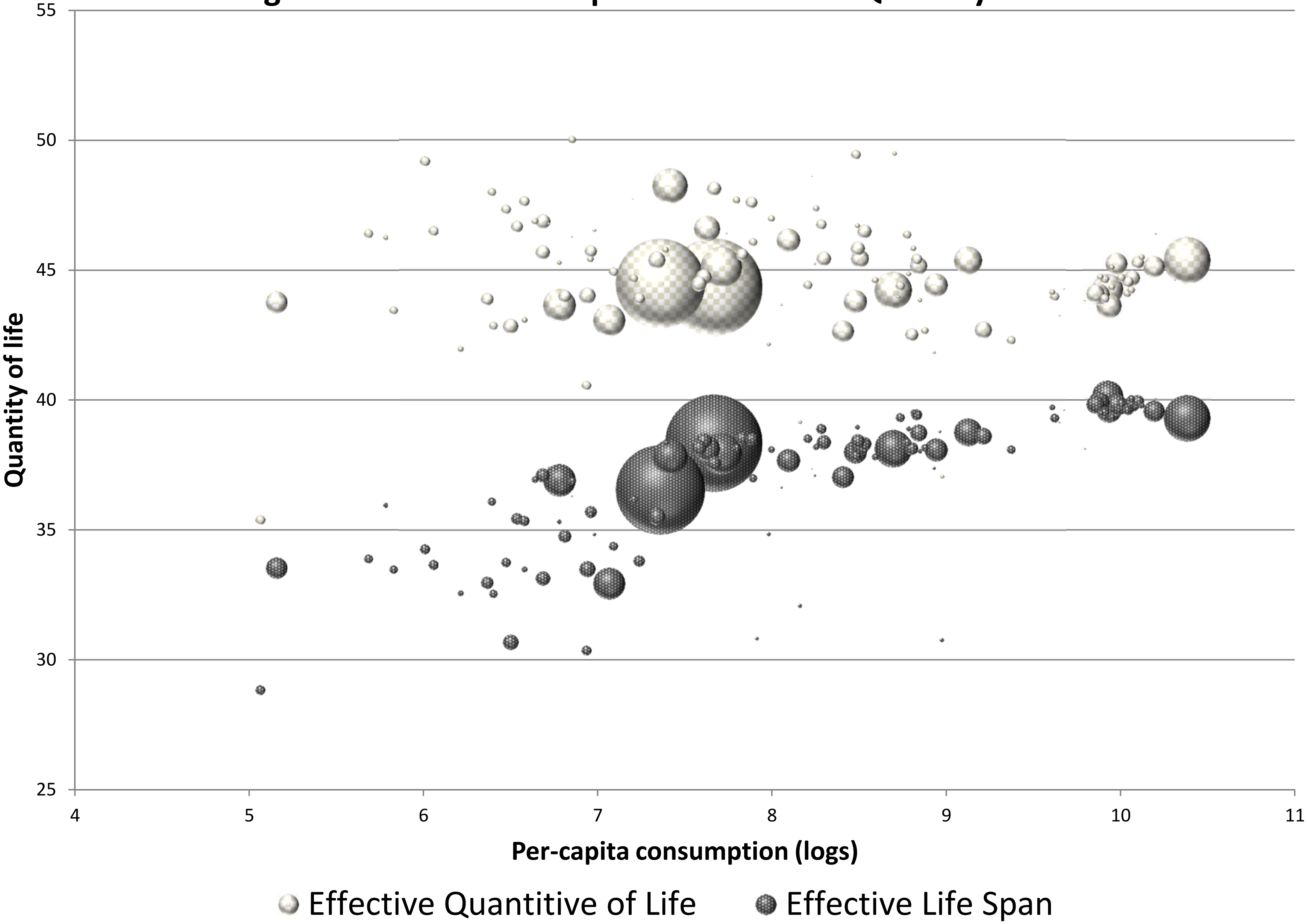

Table 1 ---- Costs of Raising a Child, 2010 Dollars, r=2%

age	year	$(1+r)^{-age}$	Basic Costs (1)	Time cost (2)	College costs (3)	Total
0	2010	1.00	11,950	41,600	-	53,550
1	2011	0.98	11,950	41,600	-	53,550
2	2012	0.96	11,950	41,600	-	53,550
3	2013	0.94	11,980	41,600	-	53,580
4	2014	0.92	11,980	41,600	-	53,580
5	2015	0.91	11,980	41,600	-	53,580
6	2016	0.89	11,880	41,600	-	53,480
7	2017	0.87	11,880	41,600	-	53,480
8	2018	0.85	11,880	41,600	-	53,480
9	2019	0.84	12,660	41,600	-	54,260
10	2020	0.82	12,660	41,600	-	54,260
11	2021	0.80	12,660	41,600	-	54,260
12	2022	0.79	13,340	13,867	-	27,207
13	2023	0.77	13,340	13,867	-	27,207
14	2024	0.76	13,340	13,867	-	27,207
15	2025	0.74	13,830	13,867	-	27,697
16	2026	0.73	13,830	13,867	-	27,697
17	2027	0.71	13,830	13,867	-	27,697
18	2028	0.70	-	-	14,903	14,903
19	2029	0.69	-	-	14,903	14,903
20	2030	0.67	-	-	14,903	14,903
21	2031	0.66	-	-	14,903	14,903
total PV			$ 191,719	$ 511,203	$ 40,525	$ 743,446

(1) Source: USDA "Expenditures on Children by Family", 2010, Table 1. Costs of raising a second child for a middle income family with 2 children. Costs includes housing, food, transportation, health care, clothing, child care, education and miscellaneous goods and services.

(2) Source: Folbre (2008) and author's calculations. Assumes a time investment of 40 hours per week until age 11 and 40/3 hours from ages 12-17 for both parents, and an hourly wage of $20.

(3) Source: College Board (2011). Colleges costs are average in a four-year institution and includes tuition, fees, room and board minus grant aid from all sources, federal education tax credits and other deductions.

Table 2 ---- Quality and Quantity of Life Around the World, Benchmark Calibration, 2005

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	unweighted	unweighted	pop-weighted
Levels								
c	$ 159	$ 32,231	$ 32,072	$ 7,275	$ 6,100	$ 3,751	$ 8,296	$ 8,662
T	41.1	77.2	36.2	65.6	66.9	68.4	8.6	6.2
n	1.23	5.98	4.75	2.94	2.46	2.62	1.29	1.00
F	14.4	29.0	14.6	20.9	19.8	20.4	3.1	2.5
g (%)	-1.10	3.90	5.00	1.75	2.33	1.78	0.82	0.90
Q(T)	28.8	40.2	11.3	37.2	37.6	38.1	2.5	1.8
Q(n,F,g)	1.10	1.43	0.33	1.21	1.19	1.20	0.08	0.06
$Q(n,F_0,g_0)$	1.10	1.40	0.30	1.21	1.18	1.19	0.08	0.06
Q(T,n,F,g)	35.4	50.0	14.6	44.9	44.7	44.8	2.3	1.2
Ratios relative to the U.S. (in logs)								
c	-5.31	0.00	5.31	-2.23	-2.37	-2.15	1.33	1.11
T	-0.58	0.05	0.63	-0.12	-0.10	-0.07	0.14	0.10
n	-0.50	1.08	1.58	0.27	0.12	0.25	0.45	0.36
F	-0.46	0.24	0.70	-0.10	-0.15	-0.12	0.14	0.12
Q(T)	-0.31	0.02	0.33	-0.06	-0.05	-0.03	0.07	0.05
Q(n,F,g)	-0.05	0.22	0.26	0.05	0.03	0.04	0.07	0.05
Q(T,n,F,g)	-0.25	0.10	0.35	-0.01	-0.02	-0.01	0.05	0.03
VSL	-5.56	0.00	5.56	-2.24	-2.39	-2.14	1.33	1.11
Welfare Measures relative to the U.S. (in logs)								
λ(c)	-5.31	0.00		-2.23	-2.37	-2.15	1.33	1.11
λ(T)	-1.03	0.07		-0.20	-0.15	-0.10	0.24	0.16
λ(c)*λ(T)	-6.35	0.00		-2.43	-2.52	-2.32	1.51	1.23
λ(n)	-0.15	0.65		0.15	0.07	0.10	0.22	0.17
λ(F)	-0.05	0.17		0.03	0.03	0.02	0.04	0.02
λ(g)	-0.22	0.10		-0.02	0.00	-0.01	0.05	0.04
λ(Q)	-0.84	0.32		-0.04	-0.05	-0.05	0.17	0.09
λ =λ(c)×λ(Q)	-6.15	0.00		-2.27	-2.42	-2.18	1.33	1.12

Notes : c is consumption per-capita obtained from the Penn World Tables 7.1. n=TFR*(1-m) is a net fertility rate and T=LE/(1-m)-5 is life expectancy at age 5. Total fertility rates (TFR), mortality rates below age five (m) and life expectancy at birth (LE) are from the World Development Indicators of the World Bank. F is the average age at first marriage minus 5 form the United Nations World Marriage Data 2012. The growth rate, g, is a simple average between the actual annual growth rate of the country during the 1970-2005 period and an expected annual growth rate. The expected growth rate in 1970 is assumed to be the annual growth rate of world consumption during the 1970-2005 period and 2% for 2005. Q(T), Q(n,F,g) and Q(T,n,F,g) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations VSLis the value of statistical. λ(c), λ(T), λ(n), λ(F), λ(g), λ(Q), and λ, are the ratios of consumption, life span, fertily, age of fertility, growth, quantity of life and full consumption, all in consumption equivalent units, according to author's calculations. Sample includes 116 countries.

Table 3 ---- Welfare Around the World, Most Populated Countries, Benchmark Calibration, 2005

	Pop 2005 Mill	c	T	n	Q(T)	Q(n,F,g)	Q(T,n,F,g)	λ^c	λ^T	λ^n	λ^F	λ^g	λ^{nFg}	λ^Q	λ
China	1,298	2,127	69	1.7	38.4	1.16	44.4	0.07	0.92	0.94	1.02	1.05	1.01	0.93	0.06
India	1,091	1,569	63	2.7	36.6	1.22	44.5	0.05	0.79	1.13	1.05	1.01	1.19	0.94	0.05
United States	296	32,231	73	2.0	39.3	1.15	45.4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Indonesia	229	2,219	68	2.2	38.0	1.19	45.1	0.07	0.89	1.03	1.03	1.05	1.11	0.99	0.07
Brazil	189	5,962	69	2.0	38.1	1.16	44.2	0.18	0.90	1.00	1.02	0.99	1.01	0.92	0.17
Pakistan	169	1,659	67	3.8	37.8	1.28	48.2	0.05	0.88	1.35	1.04	0.99	1.39	1.22	0.06
Bangladesh	144	882	64	2.4	36.9	1.18	43.7	0.03	0.81	1.06	1.05	0.96	1.08	0.87	0.02
Nigeria	137	1,172	51	4.8	33.0	1.31	43.1	0.04	0.56	1.58	1.03	0.92	1.51	0.84	0.03
Japan	128	20,421	77	1.3	40.2	1.10	44.3	0.63	1.08	0.86	0.99	1.00	0.86	0.92	0.58
Mexico	106	9,152	71	2.2	38.8	1.17	45.4	0.28	0.96	1.02	1.03	0.99	1.05	1.00	0.28
Philippines	90	2,047	69	3.1	38.1	1.22	46.6	0.06	0.90	1.20	1.02	0.98	1.21	1.09	0.07
Germany	82	20,643	75	1.3	39.6	1.10	43.6	0.64	1.03	0.88	0.98	1.00	0.86	0.88	0.56
Turkey	73	7,618	68	2.1	38.1	1.17	44.4	0.24	0.90	1.01	1.02	1.00	1.03	0.93	0.22
Egypt, Arab Rep.	73	3,265	67	2.9	37.7	1.22	46.2	0.10	0.87	1.17	1.03	1.01	1.22	1.06	0.11
Iran, Islamic Rep.	72	4,790	68	1.9	38.0	1.15	43.8	0.15	0.89	0.97	1.02	1.00	0.99	0.89	0.13
Thailand	64	4,463	64	1.8	37.1	1.15	42.7	0.14	0.82	0.95	1.01	1.03	0.99	0.82	0.11
France	63	21,590	76	1.9	39.8	1.14	45.3	0.67	1.04	0.98	0.97	1.00	0.95	0.99	0.66
Congo, Dem. Rep.	61	173	53	5.2	33.5	1.30	43.8	0.01	0.59	1.71	1.07	0.81	1.47	0.87	0.00
United Kingdom	60	26,644	75	1.8	39.6	1.14	45.1	0.83	1.02	0.95	1.00	1.00	0.96	0.98	0.81
Italy	59	19,536	76	1.3	39.9	1.10	44.1	0.61	1.05	0.87	0.99	1.00	0.86	0.91	0.55
Spain	44	19,027	76	1.3	39.8	1.11	44.1	0.59	1.05	0.88	0.99	1.00	0.87	0.91	0.54
Colombia	41	4,919	69	2.4	38.2	1.19	45.4	0.15	0.91	1.07	1.03	1.00	1.10	1.01	0.15
Argentina	39	6,893	71	2.3	38.8	1.17	45.2	0.21	0.95	1.04	1.02	0.98	1.03	0.98	0.21
Poland	39	10,016	71	1.2	38.6	1.11	42.7	0.31	0.94	0.86	1.01	1.00	0.87	0.82	0.25
Sudan	38	1,540	59	4.0	35.5	1.28	45.4	0.05	0.71	1.40	1.03	0.96	1.40	1.00	0.05
Kenya	35	1,035	53	4.5	33.5	1.31	44.0	0.03	0.59	1.52	1.06	0.95	1.53	0.90	0.03
Algeria	33	2,011	70	2.3	38.4	1.16	44.7	0.06	0.93	1.05	0.99	0.98	1.03	0.95	0.06
Canada	32	23,564	76	1.5	39.9	1.12	44.7	0.73	1.05	0.91	1.00	1.00	0.91	0.95	0.70
Afghanistan	30	667	45	5.9	30.7	1.40	42.8	0.02	0.44	1.90	1.09	0.90	1.86	0.82	0.02
Morocco	30	1,953	69	2.3	38.2	1.17	44.5	0.06	0.91	1.05	0.99	0.99	1.03	0.94	0.06
Min	**30**	**173**	**45**	**1.2**	**30.7**	**1.10**	**42.7**	**0.01**	**0.44**	**0.86**	**0.97**	**0.81**	**0.86**	**0.82**	**0.00**
Max	**1,298**	**32,231**	**77**	**5.9**	**40.2**	**1.40**	**48.2**	**1.00**	**1.08**	**1.90**	**1.09**	**1.05**	**1.86**	**1.22**	**1.00**
Range	**1,268**	**32,057**	**32**	**4.7**	**9.5**	**0.29**	**5.6**	**0.99**	**0.64**	**1.05**	**0.11**	**0.24**	**1.01**	**0.41**	**1.00**
Average, unweigted	**162**	**8,660**	**67**	**2.54**	**37.7**	**1.19**	**44.6**	**0.27**	**0.88**	**1.11**	**1.02**	**0.99**	**1.11**	**0.94**	**0.25**
Average, pop-weighted	**662**	**6,175**	**67**	**2.34**	**37.7**	**1.18**	**44.6**	**0.19**	**0.88**	**1.06**	**1.03**	**1.01**	**1.10**	**0.95**	**0.18**
median	**68**	**4,626**	**69**	**2.17**	**38.2**	**1.17**	**44.5**	**0.14**	**0.91**	**1.02**	**1.02**	**1.00**	**1.03**	**0.93**	**0.12**
stdev (no weigted)	**289**	**9,364**	**8**	**1.24**	**2.3**	**0.07**	**1.2**	**0.29**	**0.16**	**0.27**	**0.03**	**0.05**	**0.24**	**0.09**	**0.28**
stdev (weighted)	**542**	**8,866**	**6**	**0.86**	**1.6**	**0.05**	**1.0**	**0.28**	**0.11**	**0.18**	**0.02**	**0.04**	**0.16**	**0.07**	**0.27**

Notes : c is consumption per-capita obtained from the Penn World Tables 7.1. Net fertility rate (n) and life expectancy at age 5 (T) are computed using data from the World Development Indicators of the World Bank adjusted by mortality rates up to age 5; Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively. λ(c), λ(n), λ(T), λ(Q), and λ, are the welfare ratios associated to consumption, fertily, life span, quantity of life and full consumption, all in consumption equivalent units, according to author's calculations.

Table 4 ---- Summary Statistics

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	Unweighted	unweighted	pop-weigthed
				1970				
T	46.03	70.66	24.62	60.28	60.44	60.64	6.45	5.90
n	1.80	7.12	5.32	4.46	4.46	4.91	1.43	1.10
F	13.60	26.35	12.75	18.34	17.70	18.20	1.88	1.76
g	-0.8%	4.2%	5.0%	2.1%	2.7%	2.1%	0.8%	0.9%
$\partial T/\partial n$	3.92	9.59	5.67	6.56	6.86	6.60	1.49	1.32
				2005				
T	41.08	77.24	36.15	65.62	66.88	68.40	8.60	6.18
n	1.23	5.98	4.75	2.94	2.46	2.62	1.29	1.00
F	14.40	29.00	14.60	20.88	19.85	20.35	3.07	2.49
g	-1.1%	3.9%	5.0%	1.7%	2.3%	1.8%	0.8%	0.9%
$\partial T/\partial n$	3.27	11.25	7.97	7.55	8.30	7.79	2.00	1.68
T_c	44.84	113.59	68.75	75.61	82.90	76.64	14.91	18.52
				Increment: 1970-2005				
T	(16.24)	15.85	32.09	5.34	6.44	5.88	5.08	3.52
n	(3.83)	1.09	4.92	(1.52)	(2.00)	(1.54)	1.16	1.10
F	(3.35)	8.50	11.85	2.54	2.15	2.00	2.45	1.89
g	-0.33%	-0.33%	0.00	-0.33%	-0.33%	-0.33%	0.00%	0.00%
$\partial T/\partial n$	(2.22)	3.52	5.74	0.99	1.44	1.11	1.00	0.78
T_c	(5.76)	49.75	55.51	15.33	22.46	13.00	11.97	15.50
				Growth Rates: 1970-2005				
T	(28.33)	30.49	58.82	8.87	10.89	9.42	9.07	6.74
n	(65.05)	25.69	90.74	(33.12)	(43.25)	(35.58)	20.96	19.52
F	(12.71)	47.37	60.08	14.00	12.33	11.35	13.21	10.43
$\partial T/\partial n$	(40.36)	59.08	99.44	14.74	21.04	15.90	16.55	13.05
T_c	(10.55)	77.92	88.46	25.10	36.45	20.99	19.53	23.79

Notes : n=TFR*(1-m) is a net fertility rate and T=LE/(1-m)-5 is life expectancy at age 5. Total fertility rates (TFR), mortality rates below age five (m) and life expectancy at birth (LE) are from the World Development Indicators of the World Bank. F is the average age at first marriage minus 5 form the United Nations World Marriage Data 2012. The growth rate, g, is a simple average between the actual annual growth rate of the country during the 1970-2005 period and an expected annual growth rate. The expected growth rate in 1970 is assumed to be the annual growth rate of world consumption during the 1970-2005 period and 2% for 2005. $\partial T/\partial n$ is the value of a child in terms of years of parental life. Sample includes 116 countries.

Table 5 ---- Quantity of Life in the World, Benchmark Calibration, 1970-2005

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	Unweighted	unweighted	pop-weigthed
1970								
Q(T)	30.91	38.66	7.75	35.72	35.79	35.95	1.97	1.81
Q(n,F,g)	1.15	1.52	0.37	1.33	1.35	1.36	0.10	0.08
Q(T,n,F,g)	41.40	53.51	12.10	47.51	48.33	46.65	2.98	3.17
2005								
Q(T)	28.84	40.17	11.33	37.16	37.60	38.10	2.53	1.76
Q(n,F,g)	1.10	1.43	0.33	1.21	1.19	1.20	0.08	0.06
Q(T,n,F,g)	35.38	50.02	14.63	44.93	44.71	44.76	2.27	1.24
Q(n,F_0,g_0)	1.11	1.44	0.33	1.23	1.20	1.21	0.08	0.06
Increment: 1970-2005								
Q(T)	(6.09)	4.81	10.91	1.44	1.81	1.57	1.59	1.12
Q(n,F,g)	(0.30)	0.08	0.38	(0.12)	(0.16)	(0.12)	0.08	0.08
Q(T,n,F,g)	(15.56)	3.90	19.46	(2.58)	(3.61)	(2.03)	3.28	3.23
Growth: 1970-2005								
Q(T)	(17.45)	15.19	32.64	4.04	5.12	4.29	4.66	3.37
Q(n,F,g)	(20.46)	6.40	26.86	(8.76)	(11.61)	(9.14)	5.78	5.67
Q(T,n,F,g)	(30.54)	8.85	39.39	(5.13)	(7.11)	(4.36)	6.59	6.15

Q(T), Q(n,F,g) and Q(T,n,F,g)=Q(T)*Q(T,n,F,g) are the effective life span (years), effective dynasty size (people) and effective quantitive of life (years) respectively according to author's calculations for given values of the net fertility rate, n, life expectancy at age 5, T, age of fertility, F, and the growth rate of consumption, g. Q(n,F_0,g_0) is effective dynasty size using 2005 fertility rates and 1970 values for F and g. Sample includes 116 countries.

Table 6 ---- Quantity of Life in the Most Populated Countries, Benchmark Calibration, 1970-2005

	POP 2005	1970					2005						Increments						Growth Rates (%)					
Country Name	mill	T	n	Q(T)	Q(n)	Q(T,n)	T	T_c	n	Q(T)	Q(n)	Q(n,T)	T	T_c	n	Q(T)	Q(n)	Q(n,T)	T	T_c	n	Q(T)	Q(n)	Q(n,T)
China	1,298	64.6	4.9	37.1	1.4	52.4	69.4	109.8	1.7	38.4	1.2	44.4	4.8	45.2	(3.2)	1.3	(0.3)	(8.0)	7.5	69.9	(65.0)	3.4	(18.2)	(15.4)
India	1,091	55.1	4.4	34.2	1.4	46.5	62.7	68.9	2.7	36.6	1.2	44.5	7.6	13.8	(1.7)	2.4	(0.1)	(2.0)	13.8	25.1	(38.8)	6.9	(10.5)	(4.4)
United States	296	67.5	2.4	37.9	1.2	45.4	73.4	73.4	2.0	39.3	1.2	45.4	5.9	5.9	(0.4)	1.4	(0.0)	0.0	8.7	8.7	(15.9)	3.8	(3.7)	0.0
Indonesia	229	52.0	4.6	33.1	1.4	46.0	67.8	71.0	2.2	38.0	1.2	45.1	15.9	19.0	(2.4)	4.8	(0.2)	(0.9)	30.5	36.5	(52.2)	14.5	(14.4)	(2.0)
Brazil	189	62.2	4.4	36.4	1.3	48.1	68.6	83.9	2.0	38.1	1.2	44.2	6.4	21.7	(2.4)	1.7	(0.2)	(3.9)	10.2	34.8	(53.8)	4.7	(12.3)	(8.1)
Pakistan	169	60.6	5.8	36.0	1.4	51.5	67.3	78.3	3.8	37.8	1.3	48.2	6.7	17.6	(1.9)	1.9	(0.2)	(3.3)	11.0	29.1	(33.7)	5.2	(11.0)	(6.4)
Bangladesh	144	52.6	5.3	33.3	1.4	46.5	64.0	73.6	2.4	36.9	1.2	43.7	11.5	21.1	(2.9)	3.6	(0.2)	(2.9)	21.8	40.1	(54.6)	10.8	(15.3)	(6.2)
Nigeria	137	48.9	5.0	32.0	1.3	42.9	51.5	51.2	4.8	33.0	1.3	43.1	2.6	2.3	(0.2)	0.9	(0.0)	0.1	5.3	4.7	(3.8)	3.0	(2.6)	0.3
Japan	128	68.2	2.1	38.1	1.2	44.5	77.2	78.1	1.3	40.2	1.1	44.3	9.0	9.8	(0.8)	2.1	(0.1)	(0.2)	13.2	14.4	(40.2)	5.6	(5.7)	(0.4)
Mexico	106	63.8	6.0	36.9	1.5	53.5	71.1	113.6	2.2	38.8	1.2	45.4	7.3	49.7	(3.8)	1.9	(0.3)	(8.1)	11.4	77.9	(64.0)	5.1	(19.4)	(15.2)
Philippines	90	57.6	5.7	35.0	1.4	49.5	68.6	79.0	3.1	38.1	1.2	46.6	11.0	21.3	(2.6)	3.1	(0.2)	(2.9)	19.0	37.0	(45.7)	8.9	(13.6)	(5.9)
Germany	82	67.3	2.0	37.8	1.2	43.7	74.7	74.8	1.3	39.6	1.1	43.6	7.4	7.4	(0.6)	1.8	(0.1)	(0.0)	10.9	11.1	(32.6)	4.7	(4.6)	(0.1)
Turkey	73	64.6	4.5	37.1	1.3	49.9	68.4	91.4	2.1	38.1	1.2	44.4	3.8	26.8	(2.4)	1.0	(0.2)	(5.5)	5.9	41.4	(53.1)	2.7	(13.4)	(11.0)
Egypt	73	61.1	4.5	36.1	1.4	48.9	66.8	76.3	2.9	37.7	1.2	46.2	5.8	15.2	(1.6)	1.6	(0.1)	(2.8)	9.4	24.9	(35.5)	4.5	(9.7)	(5.7)
Iran	72	62.1	5.3	36.4	1.4	51.4	68.1	103.8	1.9	38.0	1.2	43.8	6.0	41.7	(3.4)	1.6	(0.3)	(7.6)	9.7	67.2	(64.4)	4.5	(18.4)	(14.8)
Thailand	64	61.2	5.0	36.1	1.4	50.7	64.5	99.3	1.8	37.1	1.2	42.7	3.3	38.2	(3.2)	0.9	(0.3)	(8.0)	5.4	62.4	(64.5)	2.6	(17.9)	(15.8)
France	63	68.3	2.4	38.1	1.2	45.5	75.6	76.6	1.9	39.8	1.1	45.3	7.2	8.3	(0.5)	1.7	(0.1)	(0.3)	10.6	12.1	(21.6)	4.5	(4.9)	(0.6)
Congo	61	52.9	4.7	33.5	1.3	42.5	53.1	50.5	5.2	33.5	1.3	43.8	0.3	(2.4)	0.5	0.1	0.0	1.2	0.5	(4.5)	11.7	0.3	2.6	2.9
United Kingdom	60	68.5	2.4	38.1	1.2	45.6	74.5	76.5	1.8	39.6	1.1	45.1	6.0	8.0	(0.6)	1.5	(0.1)	(0.5)	8.8	11.7	(25.8)	3.8	(4.7)	(1.1)
Italy	59	69.0	2.3	38.2	1.2	45.4	76.1	81.7	1.3	39.9	1.1	44.1	7.1	12.7	(1.0)	1.7	(0.1)	(1.3)	10.3	18.4	(44.0)	4.4	(6.9)	(2.8)
Spain	44	69.2	2.8	38.3	1.2	46.5	75.7	86.4	1.3	39.8	1.1	44.1	6.5	17.2	(1.4)	1.5	(0.1)	(2.4)	9.4	24.9	(51.3)	4.0	(8.7)	(5.1)
Colombia	41	63.1	5.0	36.7	1.4	50.3	68.9	88.5	2.4	38.2	1.2	45.4	5.9	25.4	(2.6)	1.6	(0.2)	(4.9)	9.3	40.2	(51.3)	4.3	(13.4)	(9.7)
Argentina	39	66.6	2.9	37.6	1.2	45.6	71.0	72.5	2.3	38.8	1.2	45.2	4.4	5.9	(0.6)	1.1	(0.0)	(0.4)	6.6	8.9	(21.2)	3.0	(3.8)	(0.9)
Poland	39	67.4	2.1	37.9	1.2	44.5	70.5	77.4	1.2	38.6	1.1	42.7	3.1	10.0	(0.9)	0.8	(0.1)	(1.8)	4.5	14.8	(42.0)	2.0	(5.9)	(3.9)
Sudan	38	50.1	5.6	32.4	1.4	45.8	59.3	60.3	4.0	35.5	1.3	45.4	9.2	10.2	(1.5)	3.1	(0.1)	(0.4)	18.4	20.4	(27.6)	9.5	(9.5)	(0.9)
Kenya	35	56.5	6.9	34.7	1.5	52.1	53.1	74.8	4.5	33.5	1.3	44.0	(3.4)	18.3	(2.3)	(1.1)	(0.2)	(8.0)	(6.1)	32.5	(34.1)	(3.3)	(12.5)	(15.4)
Algeria	33	59.6	6.1	35.6	1.5	52.1	69.8	105.4	2.3	38.4	1.2	44.7	10.2	45.8	(3.7)	2.8	(0.3)	(7.4)	17.1	76.9	(61.5)	7.9	(20.5)	(14.2)
Canada	32	69.3	2.2	38.3	1.2	45.2	75.8	77.9	1.5	39.9	1.1	44.7	6.5	8.6	(0.7)	1.5	(0.1)	(0.5)	9.3	12.4	(30.7)	4.0	(4.9)	(1.1)
Afghanistan	30	46.0	5.3	30.9	1.4	42.5	45.5	44.8	5.9	30.7	1.4	42.8	(0.6)	(1.2)	0.6	(0.2)	0.0	0.4	(1.2)	(2.6)	12.1	(0.7)	1.6	0.9
Morocco	30	58.1	5.8	35.2	1.4	50.6	68.7	95.2	2.3	38.2	1.2	44.5	10.6	37.1	(3.5)	3.0	(0.3)	(6.1)	18.3	64.0	(59.9)	8.5	(19.0)	(12.1)
min	**30**	**46.0**	**2.0**	**30.9**	**1.2**	**42.5**	**45.5**	**44.8**	**1.2**	**30.7**	**1.1**	**42.7**	**(3.4)**	**(2.4)**	**(3.8)**	**(1.1)**	**(0.3)**	**(8.1)**	**(6.1)**	**(4.5)**	**(65.0)**	**(3.3)**	**(20.5)**	**(15.8)**
max	**1,298**	**69.3**	**6.9**	**38.3**	**1.5**	**53.5**	**77.2**	**113.6**	**5.9**	**40.2**	**1.4**	**48.2**	**15.9**	**49.7**	**0.6**	**4.8**	**0.0**	**1.2**	**30.5**	**77.9**	**12.1**	**14.5**	**2.6**	**2.9**
range	**1,268**	**23.3**	**4.9**	**7.4**	**0.3**	**11.0**	**31.8**	**68.8**	**4.7**	**9.5**	**0.3**	**5.6**	**19.3**	**52.1**	**4.5**	**6.0**	**0.3**	**9.4**	**36.5**	**82.4**	**77.1**	**17.8**	**23.1**	**18.7**
Average, unw.	**162**	**61.1**	**4.3**	**36.0**	**1.3**	**47.5**	**67.4**	**79.8**	**2.5**	**37.7**	**1.2**	**44.6**	**6.3**	**18.7**	**(1.7)**	**1.7**	**(0.1)**	**(2.9)**	**10.3**	**30.5**	**(38.8)**	**4.8**	**(10.0)**	**(5.8)**
Average, weig.	**662**	**60.6**	**4.4**	**35.8**	**1.4**	**48.4**	**67.3**	**84.5**	**2.3**	**37.7**	**1.2**	**44.6**	**6.7**	**23.9**	**(2.1)**	**1.9**	**(0.2)**	**(3.8)**	**11.3**	**38.7**	**(45.4)**	**5.3**	**(12.2)**	**(7.5)**
Median	**68**	**62.1**	**4.6**	**36.4**	**1.4**	**46.5**	**68.6**	**77.7**	**2.2**	**38.2**	**1.2**	**44.5**	**6.4**	**16.2**	**(1.7)**	**1.6**	**(0.1)**	**(2.2)**	**9.6**	**25.0**	**(41.1)**	**4.4**	**(10.1)**	**(4.7)**
Std Dev	**289**	**6.8**	**1.5**	**2.1**	**0.1**	**3.3**	**7.9**	**16.5**	**1.2**	**2.3**	**0.1**	**1.2**	**3.8**	**14.4**	**1.3**	**1.2**	**0.1**	**3.1**	**7.1**	**23.5**	**21.0**	**3.4**	**6.3**	**5.9**
Std Dev, weig.	**542**	**5.8**	**1.1**	**1.8**	**0.1**	**3.2**	**5.6**	**18.6**	**0.9**	**1.6**	**0.1**	**1.0**	**3.0**	**15.7**	**1.1**	**1.0**	**0.1**	**3.2**	**6.0**	**23.9**	**18.4**	**3.0**	**5.5**	**6.0**

Notes: n=TFR*(1-m) is a net fertility rate and T=LE/(1-m)-5 is life expectancy at age 5. Total fertility rates (TFR), mortality rates below age five (m) and life expectancy at birth (LE) are from the World Development Indicators of the World Bank. Q(T), Q(n) and Q(n,T)=Q(T)*Q(n) are the effective life span (in years), effective dynasty size (in number of people) and effective quantity of life (in years) respectively according to author's calculations. Tc is the 2005 life span needed to keep effective quantitive of life at the 1970 level.

Table 7 ---- Evolution of Welfare Around the World, Benchmark Calibration, 1970-2005

	min	max	range	Average		Median	Standard Deviation	
				unweighted	pop-weighted	Unweighted	unweighted	pop-weigthed
1970 (logs)								
c	5.13	9.68	4.55	7.63	7.09	7.41	1.12	1.20
Q(T)	3.43	3.65	0.22	3.57	3.58	3.58	0.06	0.05
Q(n)	0.14	0.42	0.28	0.28	0.30	0.31	0.08	0.06
Q(n,T)	3.72	3.98	0.26	3.86	3.88	3.84	0.06	0.07
VSL(c,T)	8.68	13.33	4.64	11.21	10.67	11.01	1.16	1.23
VSL(c,T,n)	3.36	7.77	4.41	5.79	5.26	5.61	1.11	1.18
2005 (logs)								
c	5.07	10.38	5.31	8.15	8.01	8.23	1.33	1.11
Q(T)	3.36	3.69	0.33	3.61	3.63	3.64	0.07	0.05
Q(n)	0.10	0.36	0.26	0.19	0.17	0.18	0.07	0.05
Q(n,T)	3.57	3.91	0.35	3.80	3.80	3.80	0.05	0.03
VSL(c,T)	8.43	14.05	5.62	11.76	11.63	11.86	1.38	1.14
VSL(c,T,n)	2.93	8.49	5.56	6.25	6.10	6.35	1.33	1.11
difference								
c	(0.06)	0.70	0.77	0.51	0.92	0.82	0.21	(0.10)
Q(T)	(0.07)	0.04	0.11	0.04	0.05	0.06	0.02	(0.00)
Q(n)	(0.04)	(0.06)	(0.01)	(0.09)	(0.13)	(0.13)	(0.01)	(0.02)
Q(n,T)	(0.16)	(0.07)	0.09	(0.06)	(0.08)	(0.04)	(0.01)	(0.04)
VSL(c,T)	(0.26)	0.73	0.98	0.55	0.97	0.85	0.22	(0.09)
VSL(c,T,n)	(0.43)	0.72	1.15	0.46	0.84	0.74	0.22	(0.07)
Annual Growth Rates of Well-being in Consumption Equivalent Units (%)								
g^c	(4.30)	5.63	9.93	1.47	2.62	1.55	1.62	1.76
g^T	(1.83)	1.35	3.17	0.37	0.47	0.40	0.44	0.31
g^n	(1.99)	0.55	2.54	(0.79)	(1.11)	(0.78)	0.60	0.63
g^c+g^T	(3.93)	6.71	10.64	1.84	3.09	2.06	1.73	1.81
$g^Q = g^n+g^T$	(3.47)	0.81	4.28	(0.52)	(0.72)	(0.42)	0.68	0.64
$g^* = g^c+g^Q$	(4.01)	5.11	9.11	0.95	1.90	1.03	1.62	1.47

Notes: c is consumption per-capita obtained from the Penn World Tables 7.1. Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. g^c, g^n, g^T, g^Q, and g^*, are the annual growth rates of consumption, fertily, life span, quantity of life and full consumption all in consumption equivalent units according to author's calculations.

Table 8 ---- Evolution of Welfare, Most Populated Countries, Benchmark Calibration, 1970-2005

	POP 2005	1970				2005				Annual Growth Rates of Welfare (%)				
Country Name	mill	c	Q(T)	Q(n)	Q(n,T)	c	Q(T)	Q(n)	Q(n,T)	g^c	g^T	g^n	g^Q	g*
China	1,298	368	37.1	1.4	52.4	2,127	38.4	1.2	44.4	5.0	0.32	(1.9)	(1.6)	3.4
India	1,091	652	34.2	1.4	46.5	1,569	36.6	1.2	44.5	2.5	0.6	(1.0)	(0.4)	2.1
United States	296	15,209	37.9	1.2	45.4	32,231	39.3	1.2	45.4	2.1	0.4	(0.2)	0.0	2.1
Indonesia	229	438	33.1	1.4	46.0	2,219	38.0	1.2	45.1	4.6	1.3	(1.4)	(0.2)	4.4
Brazil	189	3,160	36.4	1.3	48.1	5,962	38.1	1.2	44.2	1.8	0.4	(1.2)	(0.8)	1.0
Pakistan	169	928	36.0	1.4	51.5	1,659	37.8	1.3	48.2	1.7	0.5	(1.0)	(0.6)	1.0
Bangladesh	144	814	33.3	1.4	46.5	882	36.9	1.2	43.7	0.2	1.0	(1.5)	(0.6)	(0.4)
Nigeria	137	1,239	32.0	1.3	42.9	1,172	33.0	1.3	43.1	(0.2)	0.3	(0.1)	0.0	(0.1)
Japan	128	8,601	38.1	1.2	44.5	20,421	40.2	1.1	44.3	2.5	0.5	(0.5)	(0.0)	2.4
Mexico	106	4,990	36.9	1.5	53.5	9,152	38.8	1.2	45.4	1.7	0.5	(2.0)	(1.6)	0.2
Philippines	90	1,278	35.0	1.4	49.5	2,047	38.1	1.2	46.6	1.3	0.8	(1.3)	(0.6)	0.8
Germany	82	10,204	37.8	1.2	43.7	20,643	39.6	1.1	43.6	2.0	0.4	(0.4)	(0.0)	2.0
Turkey	73	3,698	37.1	1.3	49.9	7,618	38.1	1.2	44.4	2.1	0.3	(1.3)	(1.1)	1.0
Egypt	73	1,312	36.1	1.4	48.9	3,265	37.7	1.2	46.2	2.6	0.4	(0.9)	(0.6)	2.0
Iran	72	2,192	36.4	1.4	51.4	4,790	38.0	1.2	43.8	2.2	0.4	(1.9)	(1.5)	0.7
Thailand	64	1,201	36.1	1.4	50.7	4,463	37.1	1.2	42.7	3.8	0.2	(1.8)	(1.6)	2.1
France	63	10,573	38.1	1.2	45.5	21,590	39.8	1.1	45.3	2.0	0.4	(0.3)	(0.1)	2.0
Congo	61	692	33.5	1.3	42.5	173	33.5	1.3	43.8	(4.0)	0.0	0.2	0.3	(3.7)
United Kingdom	60	11,467	38.1	1.2	45.6	26,644	39.6	1.1	45.1	2.4	0.4	(0.4)	(0.1)	2.3
Italy	59	9,376	38.2	1.2	45.4	19,536	39.9	1.1	44.1	2.1	0.4	(0.6)	(0.3)	1.8
Spain	44	8,089	38.3	1.2	46.5	19,027	39.8	1.1	44.1	2.4	0.4	(0.8)	(0.5)	1.9
Colombia	41	2,302	36.7	1.4	50.3	4,919	38.2	1.2	45.4	2.2	0.4	(1.3)	(1.0)	1.2
Argentina	39	5,064	37.6	1.2	45.6	6,893	38.8	1.2	45.2	0.9	0.3	(0.3)	(0.1)	0.8
Poland	39	4,441	37.9	1.2	44.5	10,016	38.6	1.1	42.7	2.3	0.2	(0.5)	(0.4)	1.9
Sudan	38	1,100	32.4	1.4	45.8	1,540	35.5	1.3	45.4	1.0	0.9	(0.8)	(0.1)	0.9
Kenya	35	859	34.7	1.5	52.1	1,035	33.5	1.3	44.0	0.5	(0.3)	(1.2)	(1.6)	(1.1)
Algeria	33	1,314	35.6	1.5	52.1	2,011	38.4	1.2	44.7	1.2	0.7	(2.0)	(1.5)	(0.2)
Canada	32	12,355	38.3	1.2	45.2	23,564	39.9	1.1	44.7	1.8	0.4	(0.4)	(0.1)	1.7
Afghanistan	30	751	30.9	1.4	42.5	667	30.7	1.4	42.8	(0.3)	(0.1)	0.3	0.1	(0.3)
Morocco	30	1,121	35.2	1.4	50.6	1,953	38.2	1.2	44.5	1.6	0.8	(1.8)	(1.2)	0.4
min	**30**	**368**	**30.9**	**1.2**	**42.5**	**173**	**30.7**	**1.1**	**42.7**	**(4.0)**	**(0.3)**	**(2.0)**	**(1.6)**	**(3.7)**
max	**1,298**	**15,209**	**38.3**	**1.5**	**53.5**	**32,231**	**40.2**	**1.4**	**48.2**	**5.0**	**1.3**	**0.3**	**0.3**	**4.4**
range	**1,268**	**14,841**	**7.4**	**0.3**	**11.0**	**32,057**	**9.5**	**0.3**	**5.6**	**9.0**	**1.6**	**2.3**	**1.9**	**8.1**
Average, unwg.	**162**	**4,193**	**36.0**	**1.3**	**47.5**	**8,660**	**37.7**	**1.2**	**44.6**	**1.7**	**0.4**	**(0.9)**	**(0.6)**	**1.2**
Average, wg.	**662**	**2,756**	**35.8**	**1.4**	**48.4**	**6,175**	**37.7**	**1.2**	**44.6**	**2.8**	**0.5**	**(1.2)**	**(0.8)**	**2.1**
Median	**68**	**1,753**	**36.4**	**1.4**	**46.5**	**4,626**	**38.2**	**1.2**	**44.5**	**2.0**	**0.4**	**(0.9)**	**(0.5)**	**1.1**
Std Dev	**289**	**4,354**	**2.1**	**0.1**	**3.3**	**9,364**	**2.3**	**0.1**	**1.2**	**1.6**	**0.3**	**0.7**	**0.6**	**1.5**
Std Dev, wg.	**542**	**4,241**	**1.8**	**0.1**	**3.2**	**8,866**	**1.6**	**0.1**	**1.0**	**1.7**	**0.3**	**0.6**	**0.6**	**1.4**

Notes: c is consumption per-capita obtained from the Penn World Tables 7.1. Q(T), Q(n) and Q(n,T) are the effective life span, effective dynasty size and effective quantity of life respectively according to author's calculations. g^c, g^n, g^T, g^Q, and g, are the annual growth rates of consumption, fertily, life span, quantity of life and full consumption all in consumption equivalent units according to author's calculations.