

# Is Anywhere Stuck in a Malthusian Trap?

Charles Kenny<sup>1</sup>

## Abstract

The key features of the Malthusian model are that (i) income determines population growth, with rising wages increasing survival rates and (ii) there is a vital factor of production (land) which is fixed, implying decreased returns to scale for all other factors. The equilibrium state in such a model is a population living on subsistence incomes. The analysis in this paper suggests that (i) the link between income and population growth is (almost) everywhere broken and (ii) there is little evidence of declining returns to scale because of constraints imposed by land carrying capacity at the macro level anywhere. Population dynamics are being driven by non-income factors in a manner that is reducing population growth rates everywhere. At the same time, output is increasing everywhere, in a manner inconsistent with significantly declining returns to scale based on land being a vital factor of production.

---

<sup>1</sup> Senior Economist, the World Bank. The views expressed are those of the author and do not necessarily reflect those of the World Bank, its Executive Directors, or the countries that they represent.

## Introduction

It is often suggested that the industrialized world's escape from Malthusian stagnation to modern economic growth at some point in the Eighteenth or Nineteenth Century<sup>2</sup> contains important lessons for the developing world of today (Galor and Weil, 1999, Lucas, 1998). This is based in part on the belief that large parts of the Developing World, and in particular the countries of Africa, are still caught in Malthusian stagnation. For example, Clark (2007) suggests that the region has declined over the last two centuries under Malthusian influences: "Material consumption standards in some countries, mainly those of Sub-Saharan Africa, are now well below the average pre-industrial society. These countries, such as Malawi and Tanzania, might be better off had they never had contact with the industrialized world, and instead continued in their pre-industrial state... the whole technological cornucopia of the last 200 years [has] succeeded mainly in producing material living standards that are likely the lowest ever experienced by any people in world history." Again, Conley et. al. (2007) argue that, for Africa, "the continent's countries remain mired in a Malthusian crisis..."

In this paper I would like to suggest that (almost) nowhere in the World today looks 'Malthusian.' Indeed, (almost) the whole World –including most if not all of Africa-- shares features of Malthus' vision for escaping the trap he outlined. As a result, 'lessons' from the history of Nineteenth Century Europe may be of little bearing to modern developing countries, and talk of a Malthusian crisis may need tempering.

The key features of the Malthusian model are that (i) income determines population growth, with rising wages increasing survival rates and (ii) there is a vital factor of production (land) which is fixed, implying decreased returns to scale for all other factors. The equilibrium state in such a model is a population living on subsistence incomes. In such a world, any shock to populations (such as war or plague) may have a short-term impact on raising wages, but this feeds through into population growth, returning long

---

<sup>2</sup> The timing is a subject of some debate.

run income and population levels to their equilibrium. Technological improvements that increase the carrying capacity of land will allow more output, but there is a limit to such improvements, and population increase in response to expanded output per capita will rapidly return incomes to subsistence levels.

The analysis in this paper suggests that (i) the link between income and population growth is (almost) everywhere broken and (ii) there is little evidence of declining returns to scale because of constraints imposed by land carrying capacity at the macro level anywhere. Population dynamics are being driven by non-income factors in a manner that is reducing population growth rates everywhere. At the same time, output is increasing everywhere, in a manner inconsistent with significantly declining returns to scale based on land being a vital factor of production.

### **The Malthusian Model**

Malthus was concerned with “the constant tendency in all animated life to increase beyond the nourishment prepared for it... The race of plants and the race of animals shrink under this great restrictive law; and the race of man cannot by any efforts of reason escape from it.” Populations, he suggested, naturally expanded until such time that the resources available to that population dictated a mortality rate high enough to stop growth. That checks to population were primarily linked to the limits to subsistence could be seen whenever there is a ‘sudden enlargement in the means of subsistence’ –as in the Eighteenth Century New World, where Malthus noted that populations had doubled in 25 years.

The simplest version of the Malthusian model suggests that the birth rate is set by customs regulating fertility, the death rate by income, and income by the size of the population. Because of a fixed factor of production (land), any rise in population reduces

incomes, raising the death rate and so returning the population to an equilibrium level.<sup>3</sup> The population will rise until incomes fall to a ‘subsistence level’ where birth rates equal death rates.

This ‘subsistence’ level does not necessarily imply income adequate only to provide the biological necessary minimum of calories –both changes in the mortality-income relationship and differences in customs regulating fertility could create markedly different subsistence incomes. If a technological change allowed better mortality outcomes at a given income, for example, the ‘subsistence income’ of affected societies might fall as sustainable populations at a given income increased (Clark, 2007).

As a result, Malthus argued that improved health outcomes by themselves would have little or even a negative impact on the quality of life of the mass of people. He wrote at the time that Jenner invented the smallpox inoculation –but he argued against the hope that such innovations would make too much difference: “as the actual progress of population is, with very few exceptions, determined by the relative difficulty of procuring the means of subsistence, and not by the relative natural powers of increase, it is found by experience that, except in extreme cases, the actual progress of population is little affected by unhealthiness or healthiness”

Because Malthus saw technology change as a very slow process, the only hope for raising general standards of living was to change fertility behavior. A reduction in fertility would raise the income level at which death rates equaled birth rates (lower birth rates would reduce the population level, this would increase income and so the age of death).

---

<sup>3</sup> Malthus wrote that “The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction; and often finish the dreadful work themselves. But should they fail in this war of extermination, sickly seasons, epidemics, pestilence, and plague, advance in terrific array, and sweep off their thousands and tens of thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow levels the population with the food of the world.”

He was not, as a result, against inoculation, as he explained in the 1806 appendix to his *Essay* –he hoped that the reduced mortality which resulted might encourage poor people to have fewer children. “In making every exertion which I think likely to be effectual, to increase the comforts and diminish mortality among the poor, I act in the most exact conformity to my principles,” he protested. But this was a hope rather than a certainty – because the birth rate would have to fall alongside mortality if any improvement to the quality of life was to be sustained. : “in every point of view, a decrease in mortality at all ages is what we ought to aim at...if, at the same time, we can impress... children with the idea that, to possess the same advantages as their parents, they must defer marriage... if we cannot do this all our former efforts will be thrown away.” Malthus saw education (which promotes “industry, morality and good conduct”) as one key to this outcome.

Overall, however, Reverend Malthus argued that prudence in personal affairs, rather than institutional change, was the secret to progress: “the truth is that though human institutions appear to be the obvious and obtrusive causes of much mischief to mankind, they are, in reality, light and superficial in comparison with those deeper-seated causes of evil which result from the laws of nature” Indeed, “the principle and most permanent cause of poverty has little or no relation to forms of government, or the unequal division of property” -it was the law of nature.

### **Historical Evidence for Malthusian Traps**

Empirical support for the Malthusian model is considerable in the historical record. There is strong evidence of a close relationship in the UK between size of population and wages (and the marginal product of labor) until around the 1800s. Wages in the UK and across Western Europe rose dramatically after the Black Death before declining as populations recovered. Indeed, from 1200 to 1650 there was seemingly complete stagnation of the production technology of the British economy –GDP changed hardly at all, and any rise in population was offset by a proportionate decline in income per capita.

This was related to a very strong correlation between output per capita and land per capita (Clark, 2007).

From 1650 to the Nineteenth Century, technology change in the UK did allow for an expansion in output, but it was not at a fast enough rate to outpace population growth, so that GDP per capita remained stagnant. Only with the Industrial Revolution did the link between fertility rates and wages break down, allowing for rising income per capita (Pereira, 2006).

The exact nature of the relationship between rising incomes, declining fertility and improved health in the Nineteenth Century in the UK is debated. Pereira (2006) notes that there are strong correlations between literacy, GDP per capita growth rates, death and birth rates and because of these close correlations it is hard to robustly unpack the causal mechanisms at work. The existing literature divides between those who see declining child mortality as an important spur to economic growth and those who see those that see economic growth as a dominant force in determining the demographic transition.

Nonetheless, Bar and Leukhina (2006) suggest that the Industrial Revolution in the UK was not the cause of the demographic transition –that changes in total factor productivity, while dominant in explaining GDP per capita growth, are insignificant in accounting for the observed patterns in fertility behavior. Instead, about 60 percent of the fall in the crude birth rate can be accounted for by the decline in young-age mortality.<sup>4</sup> Thus the escape from the Malthusian trap in the UK involved moving from very slow economic change (GDP growth) accompanied by co-varying population and minimal fertility changes to comparatively rapid economic expansion accompanied by a rising population and declining fertility rates.

---

<sup>4</sup> Pereira (2006) finds that literacy and time are significantly related to declining birth rates whilst wages and death rates are not using data for Britain 1760-1900. Conversely, low death rates are associated with higher wages and time, but not literacy.

The global picture over time is available from data collected by Angus Maddison regarding long term trends in GDP at the regional level. Figure One presents this data over a 2,000 year period. For every region prior to 1700, GDP growth remained below one percent. After 1700, what Maddison labels the ‘Western Offshoots’ (North America and Australasia) see more rapid growth of the kind predicted by the Malthusian model. Two hundred years of decline brought on by the guns and germs of the old world are reversed as economies and populations expanded to take advantage of the ‘sudden increase in the means of subsistence.’ But only with the Nineteenth Century, as the Industrial Revolution spreads, do we see regional growth above one percent brought on by more rapid technological change.

### **Modern Global Evidence and the Malthusian Trap**

Figure Two provides country average and standard deviation statistics from Maddison regarding the rate of GDP growth. Again, the figure suggests that slow growing economies were the global rule prior to the Nineteenth Century. But it is also worth noting what both Figures One and Two suggest about more recent periods. The Nineteenth Century brought considerable diversity in GDP performance, with some regions including Asia and Africa seeing very sluggish growth whilst others took off. But the Twentieth Century has seen rapid growth everywhere –and in the post war period, developing countries saw particularly impressive GDP performance, with Asia leading the way. In 1800, Malthus suggested that “From the accounts we have in China and Japan, it may be fairly doubted whether the best-directed efforts of human industry could double the produce of these countries even once in any number of years.” In 1820, the GDP of the two countries combined was \$249 billion. It did take until 1952 for that combined GDP to double, but by 2003, Japan and China’s combined economies were 36 times as large as they were in 1820 (data from Maddison 2001).

Table One provides more detailed evidence regarding performance on GDP growth over the period 1960-2000, using World Bank data. Only the DR Congo amongst countries

for which we have data saw negative GDP growth rates –indeed it was the only country to manage GDP growth of below 0.5 percent, the average rate for Western Europe as a whole in the Malthusian period. Only eleven countries saw GDP growth of below 2 percent 1960-2000 –a figure around two standard deviations above the global average performance for countries over the 1700-1820 period. As this data suggests, countries rich and poor alike are seeing GDP growth. Indeed, poorer countries are, if anything, growing a little faster –there is no evidence of a binding constraint on economic expansion.<sup>5</sup>

In part because of the global increase in GDP growth rates, sustained per capita income increases have not required a decline in population as proposed by Malthus. Maddison (2001) provides population data 1950-2000 for 228 countries and economies, of these only Montserrat and St Kitts and Nevis have seen a population decline over that period. Meanwhile, GDP per capita has grown in 123 of the 140 countries and economies for which Maddison has data for 1950 and 2000.

Furthermore, this growing population is becoming more healthy. Global average life expectancy has increased from 51 to 69 years 1950-1999, while the standard deviation in life expectancy has fallen from 13 to 7 years. Global infant survival has increased from 924 to 978 per thousand live births over the past 40 years. Indeed, health is dramatically improving at the same level of income, especially amongst the poorest, without the decline in per capita incomes that Malthus feared would result. Predicted life expectancy at an income of \$300 per year was 33 years in 1950, it was 46 years in 1999. Education has also spread --over the period 1950-99, global literacy levels expanded from 52 percent to 81 percent of the world's population (Kenny, 2005).

And it appears that, as Malthus hoped might happen, improved health especially in children, aided by spreading education, has been behind the global decline in fertility

---

<sup>5</sup> A regression with average annual GDP growth 1960-2000 as the dependent variable and GDP per capita in 1960 as the independent variable produces the following result (probabilities from t-stats in parenthesis):  
GDP Growth = 4.76 (0.00) - 0.11\*GDPpc1960 (0.40) R= 0.01.

rates (See Conley et. al., 1997 on the role of improved child survival and Osili and Long, 2007, on the role of female education). Figure Three displays fertility rates against income per capita in 1980 and 2000 –even over this fairly brief period, it is clear that fertility is declining worldwide.<sup>6</sup>

### **Africa and The Malthusian Trap**

Because Africa is the most frequent subject of concern regarding Malthusian pressures, it is worth taking a closer look at evidence regarding the region in particular. Taking data from Maddison (2001), we can look at decade average GDP per capita and population growth to examine if there is a relationship. A Malthusian would predict that rising GDP per capita would lead to a rising population, whilst rising population would (with a smaller lag) lead to falling GDP per capita. The data for an African sample presented in Table Two suggests that there is no significant link between contemporaneous population and income growth, no significant positive link from GDP per capita growth in decade one to population growth in decade two and a significant but small impact of population growth in decade one on GDP per capita growth in decade two using a pooled sample. This provides scant evidence to support a theory that the region is caught in a Malthusian cycle.

Taking another approach and utilizing a different data source (World Bank, 2007), Table Three looks at the average values for within-country correlations between lagged quinquennial and annual population and GDP per capita growth. In no case is the average correlation coefficient across the 46 countries of the sample greater than 0.14 (suggesting none of the relationships are strong) and in the case of annual GDP per capita growth to population growth the coefficient carries the reverse of the expected sign.

---

<sup>6</sup> There are 109 countries for which the World Bank has income and fertility data in 1980 and 2000. Running a regression of fertility as the dependent variable against log GDP per capita as the independent variable, in 1980 the equation is fertility = 16 -1.4\*lnGDPpc (R=0.52). In 2000 the equation is fertility = 14 - 1.2\*lnGDPpc (R=0.72).

How many out of the 46 African countries displayed a Malthusian relationship in that they had contemporary population growth negatively correlated with income growth as well as income growth positively associated with subsequent population growth over this 45 year period? Thirteen countries do display such a pattern of correlation, but only in four cases are the correlations even marginally strong (greater than 0.3) suggesting that the relationship might be somewhat significant in determining overall economic outcomes. These four countries are Tanzania, Togo, Mauritius and Angola.

Table Four looks at fertility growth in the sample of sub-Saharan African countries. The number of countries in Africa seeing increasing fertility is rapidly declining over time (from 23 countries in the 1963-7 period to one in the 1998-2002 period), and the average fertility change has been increasingly strongly negative since 1973.

Of course, Malthus suggested a number of other causes were more likely to be behind changes in population than alterations in fertility, amongst them variation in “sickly seasons, epidemics, pestilence, and plague... [and] gigantic inevitable famine [which] stalks in the rear.” But as we have seen, there is little evidence of a relationship through such causes between income and population growth in the data. Furthermore, we have direct evidence that health has improved in the continent. Figure Four shows that under-five mortality dropped from an average of 262 per 1,000 live births to 147 1960-2005. Again, this improvement in health is consistently linked to lower fertility and declining population growth in Africa and around the World.

It appears that the birth rate is no longer dominated by static custom –it is declining rapidly under the influence of improved child health and spreading education. Furthermore, the death rate is impacted more by technology change than income, and because land appears not to be a binding constraint to output, population growth no longer determines changes in income. All of these statements appear to be as true about Africa as elsewhere in the World. Perhaps four countries in Africa show some evidence of not contradicting a Malthusian interpretation of economic and population change,

elsewhere in the region and the World the evidence is strongly and increasingly against such a model.

## **Conclusion**

Malthus himself, in his *Political Economy*, argued that the best way to decrease birth rates was through “civil and political liberty, and education” which would encourage poor people to seek the “means of being respectable, virtuous and happy” through smaller families. He may have been partially right for the wrong reasons. It appears that civil and political liberty combined with education may play a role in reducing child mortality and (so) birth rates –even if in some cases declining birth rates are achieved through the morally suspect (to Malthus) use of contraceptives.

In turn, lower birth rates and longer lives lie behind the demographic transition as an important (if temporary) boost to per capita incomes as working-age populations increase as a proportion of the whole (Ahituv, 2001, Bloom et. al. 2001, Barro, 1998). This suggests that demographics can be important to economic outcomes, if not in the way predicted by Reverend Malthus.

Furthermore, we have seen that Malthus argued that the secret to progress was prudence in personal affairs rather than institutional change, but while prudence in personal affairs may be part of the story (through the demographic dividend), this very prudence appears to have its roots in the spread of education and health technologies that have required significant institutional change. Indeed, it is implausible to argue that institutions play no role in determining outcomes in Africa today –that, whatever institutional improvements occur, the region is condemned to poverty by the laws of nature (Easterly and Levine, 1997). This, and the fact that Africa in the post-war period looks completely unlike anywhere in the World prior to the Industrial Revolution in terms of economic and

demographic trends may mean that growth theories based on Nineteenth Century experiences have little relevance to Africa today.<sup>7</sup>

---

<sup>7</sup> Conversely, as Morris and Adelman (1988) and Taylor (1996) note, influences on growth posited by modern theories have very little explanatory power in explaining 19<sup>th</sup> Century growth

## Bibliography

- Ahuti, A. (2001) Be Fruitful or Multiply: On the Interplay Between Fertility and Economic Development *Journal of Population Economics* 14, 1.
- Bar, M. and O. Leukhina (2006) Demographic Transition and Industrial Revolution: A Coincidence? Mimeo, Department of Economics, San Francisco State University.
- Barro, R. (1998) Human Capital and Growth in Cross-Country Regressions, mimeo, Harvard University.
- Bloom, D., D. Canning and J. Sevilla (2001) Economic Growth and the Demographic Transition, NBER Working Paper 8685.
- Clark, G. (2007) *A Farewell to Alms: A Brief Economic History of the World* Princeton University Press
- Clark, G. (2007) The Long March of History: Farm Wages, Population, and Economic Growth, England 1209-1896 *Economic History Review* 60, 1.
- Conley, D., G. McCord and J. Sachs (2007) Africa's Lagging Demographic Transition: Evidence from Exogenous Impacts of Malaria Ecology and Agricultural Technology NBER Working Paper 12892.
- Easterly, W. and R. Levine (1997) "Africa's Growth Tragedy: Policies and Ethnic Divisions." *Quarterly Journal of Economics* 112 (November): 1203-50.
- Galor, O. and D. Weil (1999) From Malthusian Stagnation to Modern Growth, *American Economic Review* 89, 2.
- Kenny, C. (2005) Why Are We Worried About Income? Nearly Everything that Matters is Converging *World Development* 33, 1.
- Maddison, A (2001) *The World Economy: A Millennial Perspective* Paris: OECD.
- Morris, C., & Adelman, I. (1988) *Comparative Patterns of Economic Development: 1850-1914* Baltimore, MD: Johns Hopkins University Press.
- Osili, U. O. and B. Long (2007) Does Female Schooling Reduce Fertility? Evidence from Nigeria NBER Working Paper 13070.
- Pereira, A. (2006) When Did Modern Economic Growth Really Start? The Empirics of Malthus to Solow, mimeo, University of British Columbia.
- Riley, J. (2001) *Rising Life Expectancy: A Global History* Cambridge: CUP
- Taylor, A. (1996) Sources of Convergence in the Late Nineteenth Century NBER Working Paper, No. 5806.

Figure One: Historical GDP Growth Rates by Region (Source: Maddison, 2001)

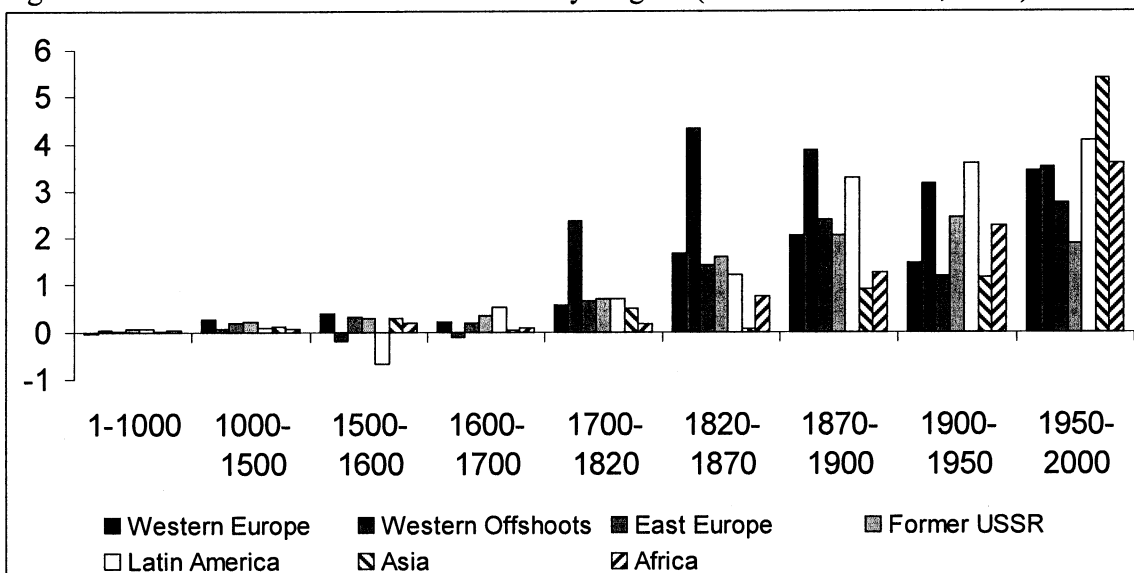
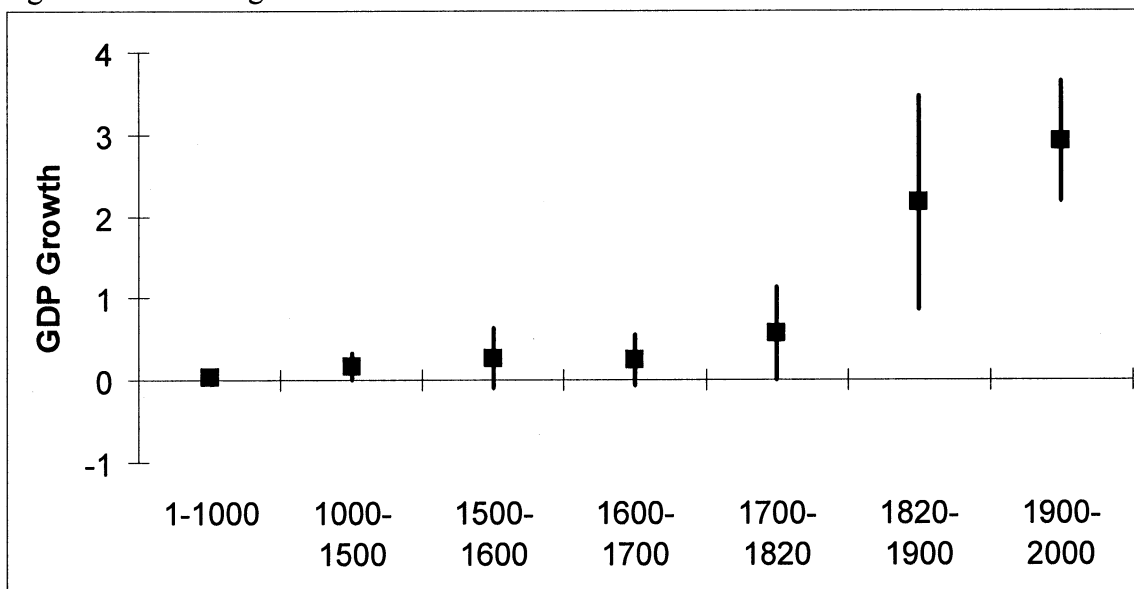


Figure Two: GDP growth and Standard Deviation<sup>8</sup>



<sup>8</sup> Data is from Maddison, 2001, sample size is between 27 countries (1-1000) and 39 countries (1900-2000). The dataset is largely made up of wealthy countries, but the Twentieth Century sample does include countries such as Brazil, China, India, Indonesia and Mexico.

Figure Three: Fertility in Global Decline

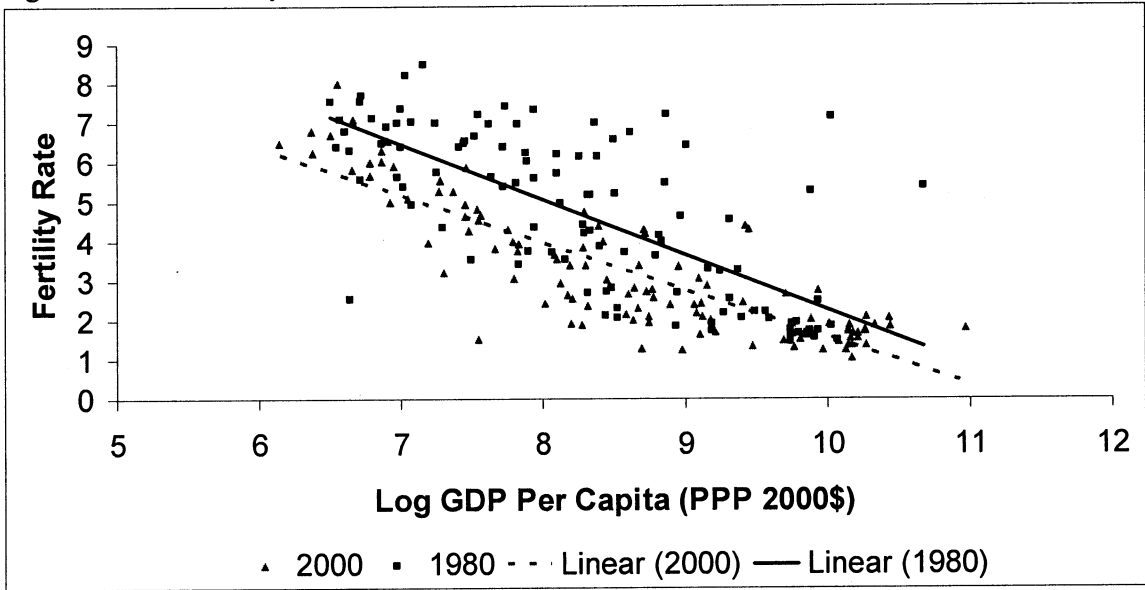


Figure Four: Child Mortality in Sub-Saharan Africa

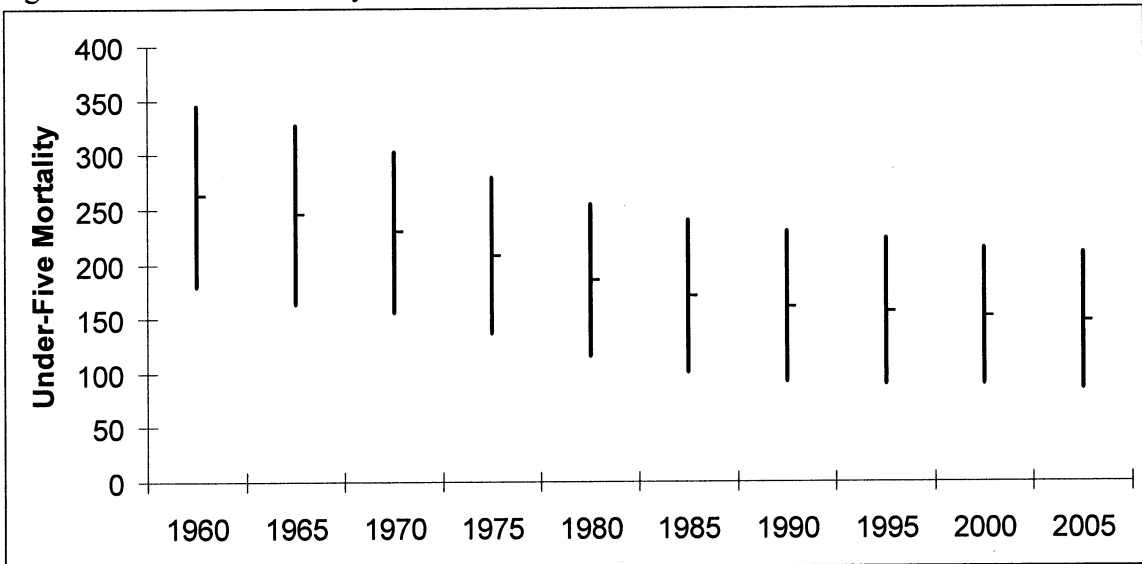


Table One: GDP Growth Rates Since 1960

	1960s	1970s	1980s	1990s	1960-2000
Average	5.40	4.57	2.85	2.71	4.00
Standard Deviation	3.15	2.80	2.74	3.34	1.77
Negative Growth	0	4	13	26	1
Below 0.5% Growth	1	4	17	27	1
Below 2% Growth	9	23	51	59	11
Number	107	126	147	177	102

Notes: Source World Bank (2007)

Table Two: Population Growth and GDPPC Growth: Decadal Regressions for an African Sample 1950-2000

		C	IV	N	RSQ
DV	Population Growth Decade Two	0.32	0.00	212	0.00
IV	GDPPC Growth Decade One	<i>0.00</i>	<i>0.99</i>		
DV	GDPPC Growth	1.89	0.00	265	0.01
IV	Population Growth	<i>-0.35</i>	<i>0.09</i>		
DV	GDDPC Growth Decade Two	2.26	-0.60	212	0.03
IV	Population Growth Decade One	<i>0.00</i>	<i>0.01</i>		
DV	GDPPC Growth Decade Two	0.32	0.37	212	0.10
IV	GDPPC Growth Decade One	<i>0.15</i>	<i>0.00</i>		
DV	Population Growth Decade Two	1.50	0.43	212	0.19
IV	Population Growth Decade One	<i>0.00</i>	<i>0.00</i>		

Note: numbers in italics are probabilities from t-tests. Data from Maddison (2001)

Table Three: Lagged Correlations Between Population and Income Growth, African Sample 1960-2005

	Average Correlation African Country Sample (46 Countries)
Population Growth Quinquennium Two GDPCC Growth Quinquennium One	0.01
Population Growth Year Two GDPCC Growth Year One	-0.06
GDPCC Growth Quinquennium Two Population Growth Quinquennium One	-0.09
GDPCC Growth Year Two Population Growth Year One	-0.08
GDPCC and Population Growth Same Quinquennium	-0.14
GDPCC Growth and Population Growth Same Year	-0.09

Notes: Source: World Bank (2007), up to eight (quinquennium) or 44 (annual) datapoints for each country.

Table Four: Fertility Change in an African Sample

	How many SSA countries Have Increase in Fertility?	Average Change Over Five Years Across SSA Sample	Count
1963-67	23	0.95	45
1968-72	24	0.74	45
1973-77	11	-0.61	45
1978-82	5	-2.31	47
1982-87	2	-4.25	47
1988-92	1	-5.56	47
1993-97	1	-6.63	47
1998-2002	1	-5.89	46

Note: Source World Bank 2007, 'Malthusian' relationship is positive-positive or negative-negative GDPpc and fertility growth