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Original Paper

Confirmation Bias, Data Manipulation and the Kuznets Curve: Original, Environmental and Financial

Ebrahim Merza[1*] & Mohammad Alawin[2]

[1] Ph.D. Economics Department, Kuwait University, Kuwait. E-mail: ebrahim.merza@ku.edu.kw

[2] Ph.D. Economics Department, Kuwait University, Kuwait

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Abstract

Empirical work in economics and finance involves data manipulation in ways that make it possible to confirm prior beliefs. The results typically turn out to be sensitive to model specification, sample period, variable definitions and estimation methods. The status quo provides the motivation for dealing with this problem using three versions of the Kuznets curve for the purpose of illustration. The underlying hypotheses are represented by quadratic functions of income per capita, with a different dependent variable for each version of the Kuznets curve. Both time series and cross-sectional data are used to estimate the equations. The results turn out to be highly sensitive to a number of factors, which provides an incentive for being selective in the reporting of results while exhibiting confirmation bias. To overcome the model uncertainty problem one can resort to the use of one of several methods that are based on the reporting of the distribution rather than the point estimation of the coefficients.

Keywords

Kuznets curve, confirmation bias, data manipulation

JEL: E01, O13, Q56, R11

1. Introduction

Confirmation bias (also called confirmatory bias or my-side bias) is the tendency to prefer information that confirms prior beliefs. This bias is displayed when information is collected, interpreted or remembered in a selective manner. Thus, confirmation bias boils down to the tendency to avoid rejecting prior beliefs, whether in searching for evidence, interpreting it, or recalling it from memory. This kind of behaviour is observed more conspicuously in conjunction with emotionally charged issues such as gun control and climate change. Confirmation bias creates the misconception that one's opinions are formed by paying attention to information that confirms prior beliefs while ignoring

information that challenges the same beliefs. There is no way, for example, that any piece of evidence would convince a hard-core global warming denier of the existence of this phenomenon.

Confirmation bias is evident in empirical work in economics and finance because of the possibility of using economic and financial data to produce results that confirm prior beliefs. For example, by using various sub-samples from a large sample on two variables, it is possible to demonstrate that the two variables are related positively, negatively or by a nonlinear relation, which can be represented by a U-shaped or an inverted U-shaped curve. Alternatively, it is possible to pick a relation that holds universally (on average) and select sub-samples showing that it does not work as envisaged. Nothing changes when multiple regression is used to "control" for other determining variables. The moral of the story is that economic data can be used to convey any message that the researcher wants to convey.

The results of empirical work in economics and finance are always a mixed bag, certainly so for the results of work on the environmental Kuznets curve. The original Kuznets curve, representing the relation between growth and inequality, is supported by those who do not believe in income redistribution, suggesting that growth beyond a certain level benefits the poor and reduces inequality, unlike those who believe that growth benefits the rich only. The environmental Kuznets curve is supported by those who do not wish to put limits on growth to protect the environment on the grounds that after a certain level of environmental degradation, economic growth leads to a better environment. The financial Kuznets curve, which is not yet a universally accepted concept, is disliked by those who wish to see a bigger financial sector on the grounds that finance facilitates growth (and even reduces inequality) and liked by those who believe that financialization beyond a certain level should not be allowed because an oversize financial sector has adverse economic consequences.

The objective of this paper is to illustrate how to produce favourable and unfavourable evidence on three versions of the Kuznets curve: original, environmental and financial. It can be demonstrated, by using the same data set, that those who like something can produce favourable evidence and those who dislike the same thing can produce evidence against. For the purpose of illustration, time series and cross-sectional data are used, covering a variety of countries and country groups. The three versions of the Kuznets curve are described in turn.

2. The Original Kuznets Curve

The original Kuznets curve, due to Simon Kuznets (1955), is a graphical representation of the proposition that as income rises in the process of development, inequality rises at first then it starts to decline, implying that the relation between income per capita and inequality takes the form of an inverted U-shaped curve. This pattern is explained as follows: in the early stages of development, inequality rises because entrepreneurs utilise abundant investment opportunities and the cheap rural labour moving to urban regions. In mature economies, on the other hand, human capital replaces physical capital as the main driver of growth, in which case incomes rise across the board. Other contributory factors are the rise of the welfare state and the trickle-down effect. The Kuznets curve

implies that growth produces inequality (at least initially) and that inequality is necessary for growth (for example, Galbraith, 2007). The empirical evidence on the validity of the original Kuznets curve is mixed (see, for example, Williamson, 1985; Lindert, 1986; Feinstein, 1988; Anand & Kanbur, 1993; Fields, 1995; Fields & Jakubson, 1993; Deininger & Squire, 1998; Schultz, 1998; Morrisson, 1999).

The proposition underlying the original Kuznets curve is criticised on the grounds that the inverted U-shape does not come from progression in the development of individual countries, but rather from historical differences between countries (that is, how they compare with respect to inequality). Deininger and Squire (1998) suggest that many of the middle-income countries used in Kuznets' data set were in Latin America, a region that is typically characterised by high levels of inequality. The implication of this criticism is that evidence for the Kuznets curve is more likely to be found in cross sectional rather than time series data. Lempert (1989) introduces a time dimension and a political dimension to the Kuznets curve, demonstrating how population and politics interact with economic inequality over time, leading either to long-term stability or collapse. Instead of the inverted U-shaped curve, it is suggested that the relation takes the form of a helix.

Growth in East Asian countries is taken as evidence against the validity of the Kuznets curve, implying that right from the beginning, growth reduces inequality, which would happen if the benefits of rapid economic growth were distributed broadly among the population (which is the exception rather than the rule). Stiglitz (1996) argues that the East Asian experience of an intensive and successful economic development process, along with an immediate reduction in inequality, can be explained by the prompt re-investment of initial benefits in land reform (boosting productivity, income and savings), universal education (providing greater equality and what he calls an "intellectual infrastructure" for productivity), and industrial policies that are conducive to a more even income distribution by producing high and rising wages while putting limits on commodity prices. On the other hand, the historical experience of Western European countries provides some support for the Kuznets curve. In England, for example, the Gini coefficient rose from 0.400 in 1823 to 0.627 in 1871, but it fell to 0.443 in 1901 (Williamson, 1985). Acemoglu and Robinson (2002) suggest that while France, Sweden and Germany followed a similar pattern, the evidence from Norway and the Netherlands suggests monotonically declining inequality from the mid-nineteenth century.

No evidence for the Kuznets curve was found by Palma (2011) who concluded that "the statistical evidence for the upward-sloping sector of the curve seems to have vanished, as many low and low-middle income countries currently have a distribution of income that is similar to what is observed in most middle-income countries (other than those of Latin America and Southern Africa). He goes on to argue that two distributional trends take place in inequality within a country: one is centrifugal, taking place at the two tails of the distribution, whereas the other is centripetal, which is observed in the middle. Likewise, Fields (2001) considers as refuted the hypothesis that underpins the Kuznets curve.

Kuznets himself had reservations about the "fragility of the data", as pointed out by Fogel (1987) who brings attention to Kuznets' opinion that "even if the data turned out to be valid, they pertained to an

extremely limited period of time and to exceptional historical experiences". Fogel goes on to suggest that despite repeated warnings, Kuznets' caveats were overlooked. Sillers (2016) describes the Kuznets curve as "celebrated – and now thoroughly discredited". In particular he argues that changes in inequality over time tend to be relatively small compared with the initial level of inequality and that there is no general tendency for economic growth to change the distribution of income, either by intensifying or alleviating inequality. Rather, he argues, the evidence shows that growth in developing countries is accompanied by falling inequality as often as it is by rising inequality. On average across countries, growth leaves inequality broadly unchanged.

3. The Environmental Kuznets Curve

The environmental Kuznets curve (EKC) is a graphical representation of the relation between measures of environmental degradation and income per capita. The underlying idea is that at low-income levels, growth causes environmental degradation but beyond a certain point, growth leads to environmental improvement. In terms of casual empiricism, take for example the experience of the U.S. during the period 1970-2006 as documented by the Wall Street Journal (2006). During that period, GDP grew by 195%, the number of cars and trucks more than doubled, and the total number of miles driven went up by 178%. During that same time period, however, regulatory changes led to a fall in the emissions of carbon monoxide from 197 to 89 million tons. Likewise, emissions of nitrogen oxides fell from 27 to 19 million tons, sulphur dioxide emissions fell from 31 to 15 million tons, particulate emissions fell by 80%, and lead emissions fell by more than 98%.

A number of theoretical and intuitive explanations can be put forward as to why the impact of growth on the environment becomes less severe (even positive) as income rises. The first explanation is that environmental quality can be considered to be a normal good, which means that the demand for environmental quality rises as income rises (Beckerman, 1992; World Bank, 1992). The second possible explanation is that as the level of income rises, a tendency appears to use less pollution-intensive technology (Grossman & Krueger, 1995). Another explanation is that the share of pollution-intensive sectors in total output goes down as the share of service sectors goes up, which is associated with rising income (for example, Jänicke, Binder, & Mönch, 1997). Yet another explanation is that the tendency of people to breed declines as they become richer, thus alleviating pressure on the environment.

The empirical evidence on the EKC is far from clear, as studies using various model specifications, samples, definitions and estimation methods have produced evidence supporting or rejecting the EKC. Stern (2003) argues that the empirical work on the EKC is "econometrically weak". Specifically, he suggests that "little or no attention has been paid to the statistical properties of the data used such as serial dependence or stochastic trends". Perman and Stern (2003) contend that when these econometric considerations are taken care of, "we find that the EKC does not exist" and that "most indicators of environmental degradation are monotonically rising in income". This, however, is not necessarily the

case as the results are sensitive to more than considerations of stochastic trends and cointegration, notwithstanding the fact that the results are sensitive to the choice of the cointegration test. Those looking for supportive evidence go for the Johansen test, which tends to over-reject (or always reject) the null of no cointegration. On the other hand, those who want to demonstrate that the EKC does not exist would choose the residual-based test, which is rather difficult to pass.

It has become quite apparent that the empirical results produced by studies of the EKC are highly sensitive to model specification, estimation method, sample period, country-specific factors, and measures of income and environmental degradation. Harbaugh, Levinson, & Wilson, (2002) contend that the locations of the turning points for various pollutants (and their existence) are sensitive to variations in data and model specification. Stern and Common (2001) show that estimates of the EKC for sulphur emissions are very sensitive to the choice of sample. As far as measures of degradation are concerned, it has been found that local pollutants are likely to display an inverted U-shaped curve with income, while global emissions (such as CO2) are not. These sources of sensitivity have led to a mixed bag of results. For example, Robalino-López, Mena-Nieto, García-Ramos, and Golpe (2015) survey the literature on the EKC and produce the following contradictory results: (i) the EKC exists, (ii) bi-directional causality between emissions and income, (iii) unidirectional causality from energy to GDP, (iv) decoupling between CO2 emissions and economic growth, (v) 35% of the countries show EKC evidence, (vi) long-run relation between economic growth and CO2, (vii) EKC not fulfilled, and (viii) economic growth mainly modulate CO2 emissions. Three of the studies surveyed declare “mixed evidence”.

Yang, He, and Chen (2015) identify 141,312 model specifications arising from different combinations of the dependent variable (per capita emissions and total emissions), the explanatory variable (per capita and total GDP), the order of the polynomial (linear, quadratic and cubic), control variables (such as ratio of exports to GDP and population density), temporal and spatial heterogeneities (for example, random and fixed effects), and the use or otherwise of log-log specifications. Likewise, Aufhammer and Steinhauser (2012) identify several sources of variation in model specification, including the order of the polynomial in income per capita and population density, variations addressing temporal and spatial heterogeneity, the use of level versus log specification, and the inclusion or otherwise of lagged dependent and explanatory variables. Yang, He, and Chen (2015) contend that the EKC hypothesis cannot be considered valid for any of the seven emission indicators they use. Robalino-López, Mena-Nieto, García-Ramos, and Golpe (2015) examine the relation between economic growth and CO2 emissions in Venezuela and conclude that while there is no evidence for the EKC, environmental stabilisation can be accomplished by combining economic growth with increasing use of renewable energy as well as appropriated changes in the energy matrix and productive sectoral structure.

Dasgupta, Laplante, Wang, and Wheeler (2002) outline alternative scenarios that give the hypothesised relation between emissions and growth different shapes. According to the new toxics’ scenario, while some traditional pollutants may produce an inverted U-shaped curve, the new pollutants that are

replacing them do not. The race to the bottom scenario is that emissions have been reduced in developed countries by outsourcing dirty production to developing countries, which are not in a position to reduce emissions. According to the revised EKC scenario, the inverted U-shaped curve is not rejected—rather, it is shifting downwards and to the left-over time due to technological change. Dasgupta, Laplante, Wang, and Wheeler (2002) also review the theoretical literature and some of the econometric specification issues and present evidence indicating that environmental improvements are possible in developing countries and that peak levels of environmental degradation is lower than in countries that developed earlier.

4. The Financial Kuznets Curve

The financial Kuznets curve (FKC) is a relatively new concept on which little work has been done. According to one view, the financial Kuznets curve is a representation of the "finance curse", providing a warning signal against over-dependence on the financial sector. According to this view, economic growth is aided by increasing financialization initially but at a later stage the financial sector starts to exert an adverse effect on growth. In this case an inverted U-shaped curve is obtained by plotting a graph representing growth as a function of financialization, measured somehow. Another version of the FKC relates financial development to income inequality, as financial development leads to deterioration in income distribution initially (producing more inequality), but eventually inequality starts to fall (for example, Shahbaz, Loganathan, & Tiwari, 2015; Akan, Köksel, & Destek, 2017; Baiardi & Morana, 2016).

It is invariably the case that the term "financialization" is used in conjunction with the first view whereas "financial development" is used in conjunction with the second view. Financialization is a term that describes the dominance of the financial sector over other sectors of the economy, including manufacturing industry and agriculture. It refers to "the increasing importance of financial markets, financial motives, financial institutions, and financial elites in the operation of the economy and its governing institutions, both at the national and international levels" (Epstein, 2002). Komlik (2015) describes financialization simply as "the ascendancy of finance", suggesting that it represents "the capturing impact of financial markets, institutions, actors, instruments and logics on the real economy, households and daily life".

On the other hand, "financial development" has positive connotations, as it pertains to the ability of the financial sector to perform its key functions more effectively and efficiently (such as the allocation of capital, corporate governance and monitoring, risk management, the mobilisation of savings, and facilitating the exchange of goods and services). However, the same indicators may be used to measure financialization and financial development—for example, the ratio of debt securities to GDP and the ratio of stock market capitalisation to GDP. It may be plausible to suggest that financial development refers to the initial stages of financialization where it is useful, and excessive financialization when a too large financial sector starts to exert a negative effect on the economy.

According to the view that relates financialization to inequality, financialization is seen as being conducive to economic growth and the alleviation of inequality for several reasons. The first is that easy access to financial resources enhances investment activities, which in turn boosts the income of the poor segments of population by generating employment opportunities. Easy access to financial resources provides various opportunities and supports human capital formation by investing in education, health and various aspects of socioeconomic development. The reason that does not make sense, as stated by Shahbaz, Loganathan, and Tiwari (2015), is that "financial development reduces income and wealth inequalities and mitigates various problems". Presumably, the channel of causation from financialization to inequality involves the trickle-down effect that has been refuted (see, for example, Quiggin, 2009).

The view that the use of financial instruments reduces income inequality has been debated by economists. Galor and Zeira (1993) argue that the countries with insufficient financial depth, deregulation policies in financial system are detrimental to economic growth, thus aggravating income inequality. On the other hand, Canavire-Bacarreza and Rioja (2008) argue that facilitating the access of low-income households to financial resources widens the scope of investment possibilities and reduces income inequality. Similarly, Aghion and Bolton (1997) emphasise the role played by financial development in reducing income inequality. Moreover, Greenwood and Jovanovic (1990) adapt the Kuznets curve to accommodate the financial development-income inequality nexus and argue for the presence of an inverted U-shaped relation between financial development and income inequality. On the other hand, it has been argued that financialization is a major cause of inequality (for example, Bartlett, 2013).

The negative view of the effect of financialization is held mostly by post Keynesian economists. Black (2011) lists the ways in which the financial sector harms the real economy, describing its functions as "the sharp canines that the predator state uses to rend the nation". In addition to siphoning off capital for its own benefit, the financial sector, according to Black, misallocates the remaining capital in ways that harm the real economy. Kneer (2013) examines the effect of the absorption of talent into the financial sector on the productive sectors of the economy. Based on a sample of 13 countries observed over the period 1980-2005, he shows that financialization (which he calls "financial liberalisation") is associated with skill upgrading in the financial sector. His results suggest that a consequence of financialization is that the employment of skilled individuals grows disproportionally more slowly in skill-intensive relative to less skill-intensive industries. He also shows that financialization has an adverse effect on labour productivity, total factor productivity and value-added growth, disproportionally in industries that rely strongly on skilled labour. This result is consistent with the proposition that financialization hurts non-financial sectors by inflicting a brain-drain effect.

The adverse effects of financialization have been widely recognised as being mostly related to the accumulation of debt, which is exactly what "access to financial resources" means. As the level of debt rises, the corporate and household sectors divert increasing portions of their financial resources to debt

service, which in turn become profit for the financial sector. The problem is that the financial sector's receipts are not converted into fixed capital formation to boost output, but rather they are used to create new claims on aggregate output and income. Increasingly, firms become unable to invest in new physical capital equipment or buildings because they are obliged to use their operating revenue to pay creditors. In a financialised economy, those running the show do not aim at producing physical capital because they are in the business of generating interest, fees and commissions from mergers and acquisitions and other activities that do not involve the creation of new wealth (on the contrary, these activities are often described as "parasitic").

Financialization has adverse macroeconomic consequences because it makes the financial sector weaker by boosting leverage, opacity, complexity, spillover effects within and outside financial institutions, and by accelerating debt deflation (Sinapi, 2014). Furthermore, the dominance of finance fuels capital asset price inflation as suggested by Bellofiore (2013). Financialization is believed to have a depressive effect on productive investment, consumption and aggregate demand. For example, Lavoie (2012) suggests that financialization is associated with the development of a consumption-led accumulation regime, fuelled by growing debt as households strive to compensate for their stagnating purchasing power. Given that financial crises cause subsequent recessions and that financialization leads to a bigger and more unstable financial sector, the link between financialization and output becomes conspicuous. According to the IMF (2009), recessions associated with financial crises last on average 18 months longer than other recessions and take almost three years to go back to pre-recession output levels.

Cecchetti and Kharroubi (2015) examine the real effects of financial sector growth and conclude that the growth of a country's financial sector is a drag on productivity growth—that is, rapid growth in the financial sector reduces output growth because the financial sector competes for resources with the rest of the economy. In another paper, Cecchetti and Kharroubi (2012) conclude that financial sector size has an inverted U-shaped effect on productivity growth—that is, there comes a point where further enlargement of the financial sector can retard real growth. This is a description of the financial Kuznets curve.

5. Representation and Estimation

The Kuznets curve in all of its forms can be represented by a quadratic equation of the form

$$z = \beta_0 + \beta_1 y + \beta_2 y^2 \tag{1}$$

such that $\beta_2 < 0$ and $\beta_1 > 0$. In the original curve, z is inequality measured, for example, by the Gini coefficient whereas y is per capita income. In the environmental curve, z is environmental degradation measured by emissions and pollutants of various sorts as well as other indicators such as deforestation. In the case of the financial Kuznets curve, z is inequality in one version and economic growth in another whereas y is income per capita or the income growth rate. The second version is more valid for cross-sectional data, implying that countries with smaller (but not too small) financial

sectors tend to grow faster than countries with large financial sectors.

The turning point can be determined by differentiating equation (1) with respect to *y* and equating the derivative to 0. Thus

$$\frac{dz}{dy} = \beta_1 + 2\beta_2 y = 0 \tag{2}$$

which gives

$$z = -\frac{\beta_1}{2\beta_2} \tag{3}$$

The second derivative is given by

$$\frac{d^2 z}{dy^2} = 2\beta_2 y < 0 \tag{4}$$

which is another characteristic of the inverted U-shaped curve, implying that the rate of change of the first derivative is negative—that is, as *y* increases the slope of the curve changes from positive to negative. It is noteworthy that $dz/dy > 0$ when $z < (-\beta_1 / 2\beta_2)$ and $dz/dy < 0$ when $z > (-\beta_1 / 2\beta_2)$.

By estimating equation (1) and examining the sign and significance of the estimated coefficients for various samples, it can be demonstrated that the evidence for any of the three versions of the Kuznets curve is mixed. Evidence against the Kuznets curve is found if $\beta_2 = 0$ (statistically insignificant), which means that the relation is linear. Unsupportive evidence is also found when $\beta_2 > 0$ and $\beta_1 < 0$, which means that $d^2 z/dy^2 > 0$, $dz/dy < 0$ when $z < (-\beta_1 / 2\beta_2)$ and that $dz/dy > 0$ when $z > (-\beta_1 / 2\beta_2)$. In this case, the curve is U-shaped rather than inverted U-shaped.

Equation (1) is estimated by using the Phillips-Hansen (1990) fully-modified ordinary least squares (FMOLS) because straight OLS does not produce valid t statistics, whereas FMOLS does. This is because with integrated variables, the OLS standard errors (and hence the t statistics) do not follow an asymptotic normal distribution. Consequently, the conventional critical values of the t distribution cannot be used to derive inference on the significance of the estimated coefficients. To keep the reporting of the results manageable, three statistics are reported: the t statistics of β_1 and β_2 and the coefficient of determination (R^2). A valid Kuznets curve is obtained when β_1 is significantly positive and β_2 is significantly negative. The results are presented in Tables 1-3 and Figures 1-5.

The original Kuznets curve is estimated by using both cross-sectional and time series data. The sample of cross-sectional data covers 139 individual countries, whereas time series data are on Brazil for the period 1981-2018 (both sets of data were obtained from the World Bank). In Figure 1, we observe a scatter diagram of the Gini coefficient on GDP per capita, covering the whole cross-sectional sample, but the relation turns out to be insignificant (Table 1). There is no evidence here for the EKC for the countries classified into groups according to a range of GDP per capita. The relation turns out to be

significant only in the case of countries with a GDP per capita range of 10,000-80,000, but it takes the shape of a U curve rather than an inverted U curve. This means that as GDP rises beyond a certain level, inequality starts to rise, which is consistent with casual observation. In almost all high-income countries, inequality has risen sharply since the 1970s.

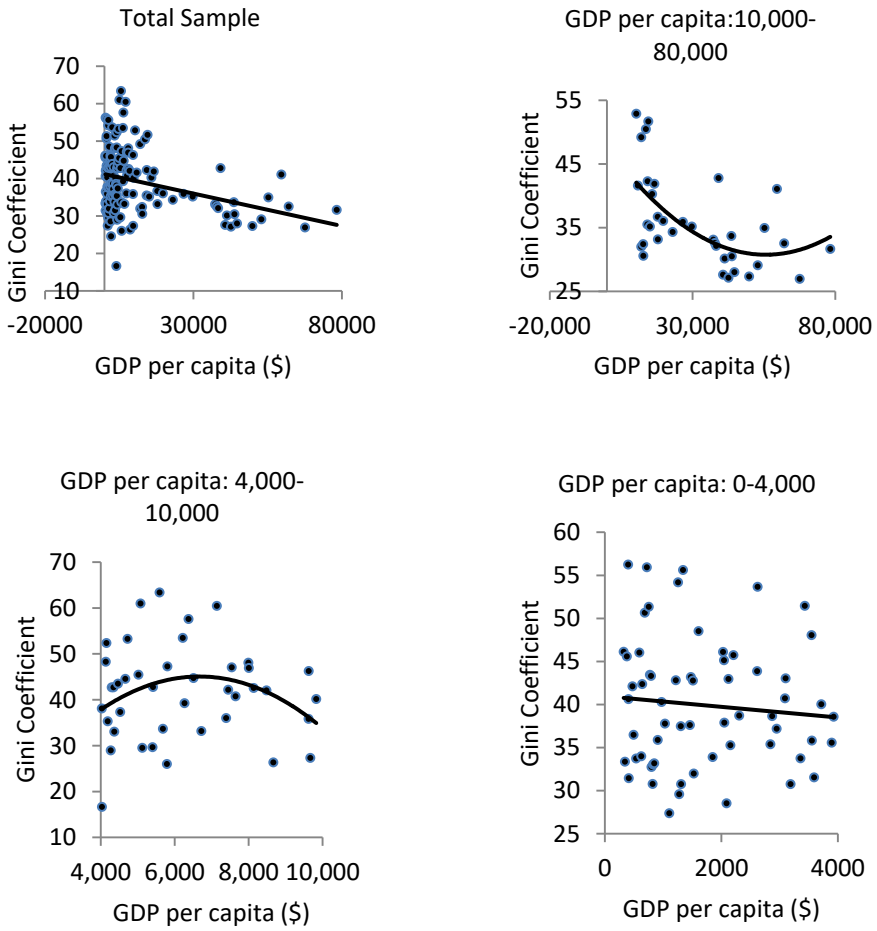


Figure 1. Original Kuznets Curve in Cross-Sectional Data

Based on time series, using Brazil as an example, the evidence is mixed, depending on measures of inequality and income per capita. In only one case do we get a significant inverted U-shaped curve—that is, when inequality is measured by the income share of the highest 10% and income per capita is measured in constant local currency (Figure 2 and Table 1).

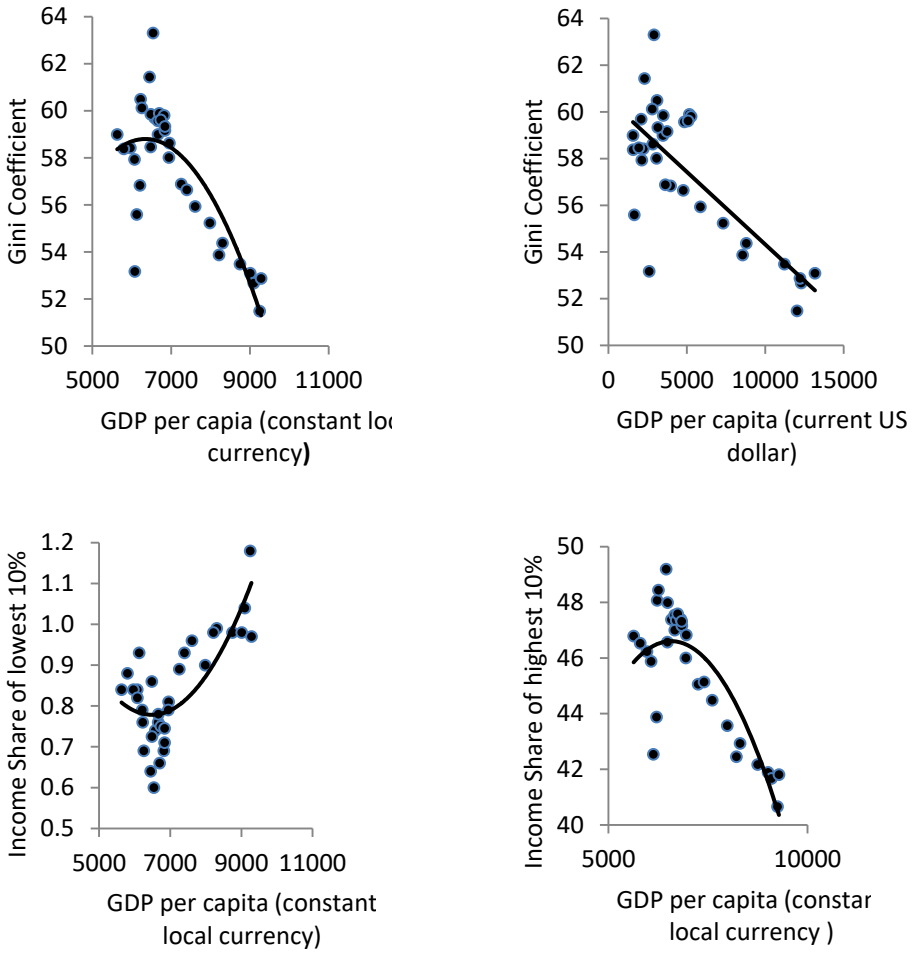


Figure 2. Original Kuznets Curve in Time Series Data (Brazil)

Table 1. Estimates of the Original Kuznets Curve

Data	*z*	*y*	$t(\beta_1)$	$t(\beta_2)$	R^2
CS (109) Total	Gini Coefficient	GDP per capita	0.26	-0.11	0.10
CS (10,000-80,000)	Gini Coefficient	GDP per capita	-4.37	2.95	0.36
CS (4,000-10,000)	Gini Coefficient	GDP per capita	3.20	-3.19	0.08
CS (0-40,000)	Gini Coefficient	GDP per capita	-0.60	0.41	0.01
TS (Brazil)	Gini Coefficient	GDP per capita (constant local currency)	2.96	-3.49	0.64
TS (Brazil)	Gini Coefficient	GDP per capita (current US$)	1.01	-2.45	0.58
TS (Brazil)	Income Share (lowest 10%)	GDP per capita (constant local currency)	-2.74	3.06	0.60
TS (Brazil)	Income Share (highest 10%)	GDP per capita (constant local currency)	3.06	-3.42	0.50

CS: Cross-sectional data; TS: Time-series data.

Turning to the environmental Kuznets curve we find evidence for and against by using Australian and UK annual data covering the period 1970-2018 (obtained from the World Bank). For Australia, evidence is found for the EKC when environmental degradation is measured in terms of CO2 emissions and income per capita is measured in terms of the adjusted net national income (NNI) per capita measured at constant prices. One can reach the conclusion that environmental quality deteriorates or improves after a certain level of income per capita, depending on whether degradation is measured in terms of CO2 emissions from liquid fuel or total CO2 emissions (Figure 3 and Table 2). The same is true for the U.K. as evidence for the EKC is found only when environmental degradation is measured in terms of CO2 emissions from transport.

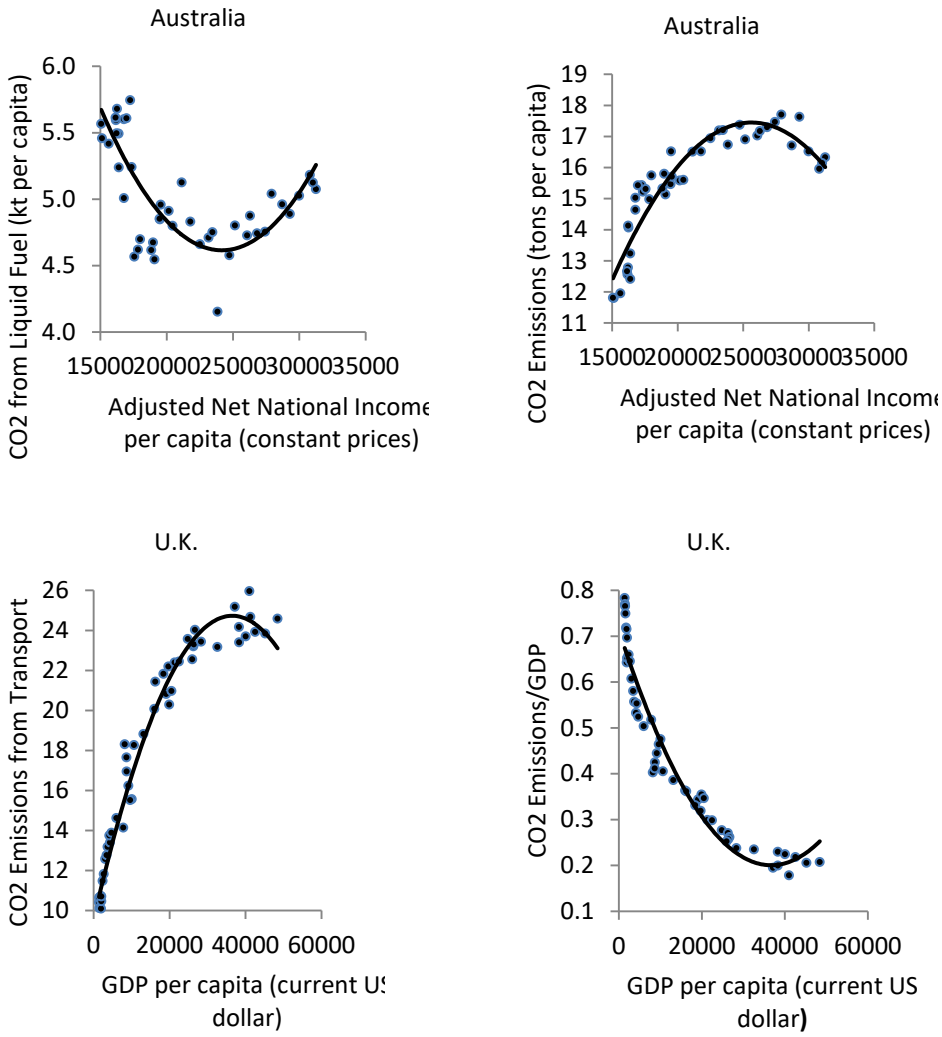


Figure 3. Environmental Kuznets Curve (Time Series Data on Australia and UK)

Table 2. Estimates of the Environmental Kuznets Curve

Data	*z*	*y*	$t(\beta_1)$	$t(\beta_2)$	R^2
TS (Australia)	CO2 from liquid fuel	Adjusted NNI (constant prices)	-5.39	5.11	0.59
TS (Australia)	CO2 Emissions per capita	Adjusted NNI (constant prices)	6.25	-5.65	0.86
TS (UK)	CO2 Emissions from Transport (%)	GDP per capita (current US $)	19.56	-11.77	0.97
TS (UK)	CO2 Emissions/ GDP	GDP per capita (current US $)	-9.66	5.56	0.94

CS: Cross-sectional data; TS: Time-series data.

As far as the financial Kuznets curve is concerned, two measures of financialization are used: the credit to GDP ratio (obtained from the World Bank) and the ratio of the market value of publicly-traded shares to GDP. The choice of the second measure of financialization is consistent with the propositions put forward by Tomaskovic-Devey (2015) who observes the move of non-financial firms into more speculative assets such as stocks. It is also consistent with a characterisation of financialiastion that it involves a tendency of non-financial firms to channel a big portion of profits to the acquisition of financial assets (for example, Krippner, 2005). The ratio is obtained by dividing the value of traded shares by GDP measured on a PPP basis (the data were obtained from www.indexmundi.com). When financialization is measured in terms of the credit to GDP ratio, a valid FKC emerges only in the case of high-income OECD countries (Figure 4 and Table 3). For lower-middle income countries, growth actually rises with financialization after a certain level. This result makes sense because high-income OECD countries, unlike lower-middle income countries, already have high credit/GDP ratio. Finance is conducive to growth at low-medium levels of financialization, but excessive financialization puts a drag on economic growth. In Figure 5 we observe the same, now by using the ratio of traded shares to GDP as a measure of financialization. The relation is significant only for low-growth countries where growth is retarded when the ratio is around 0.5 (Figure 5 and Table 3).

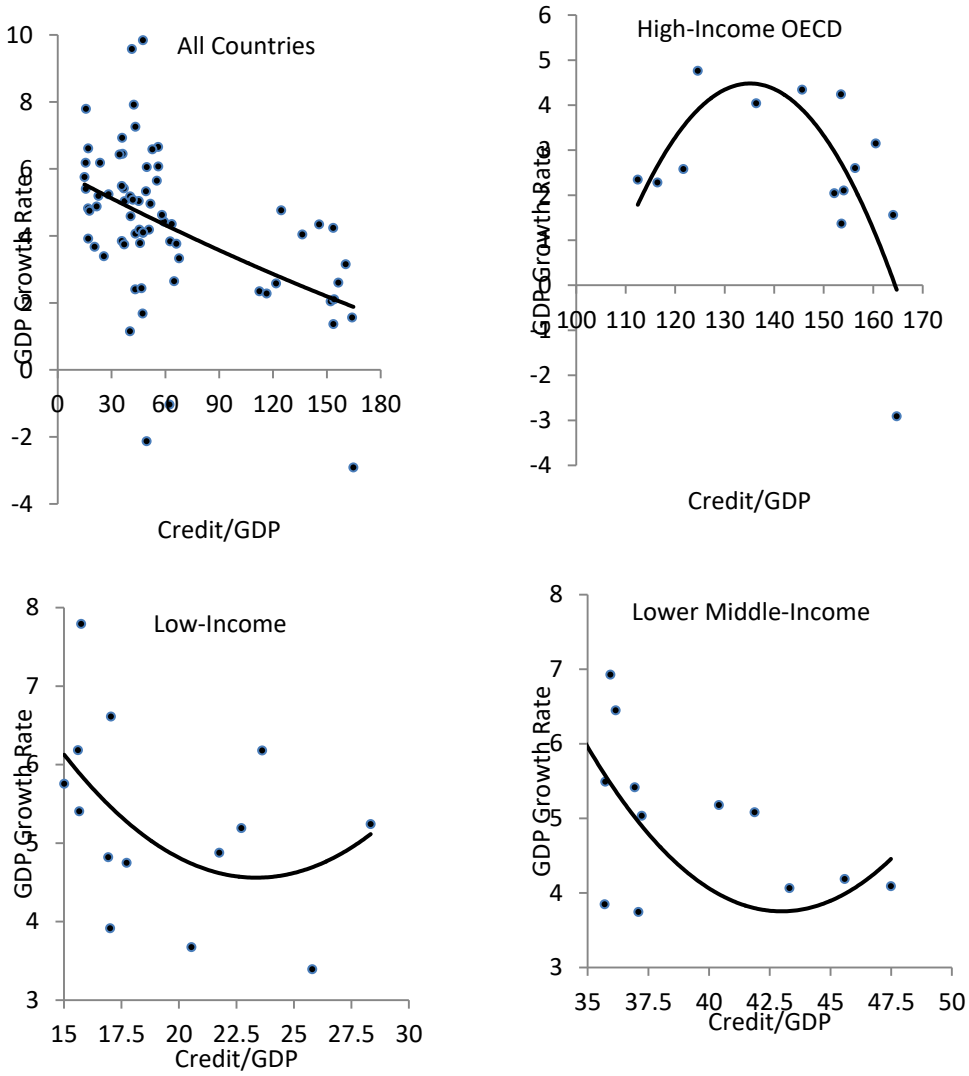
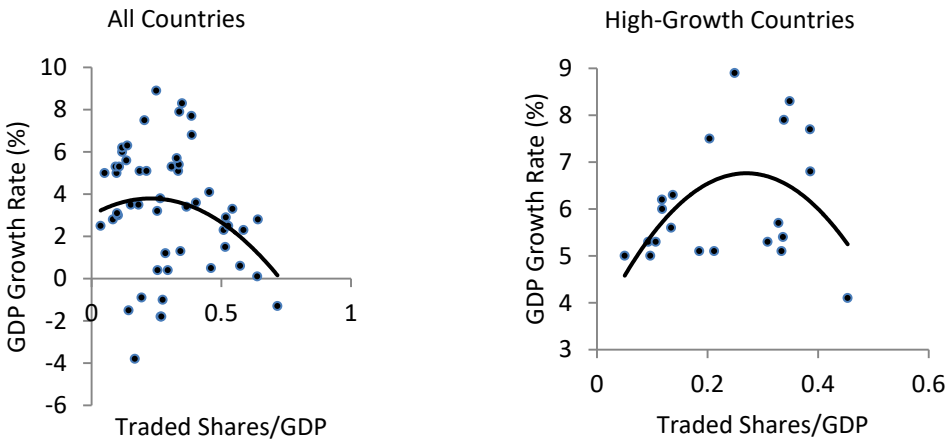


Figure 4. Financial Kuznets Curve (Time Series Data)



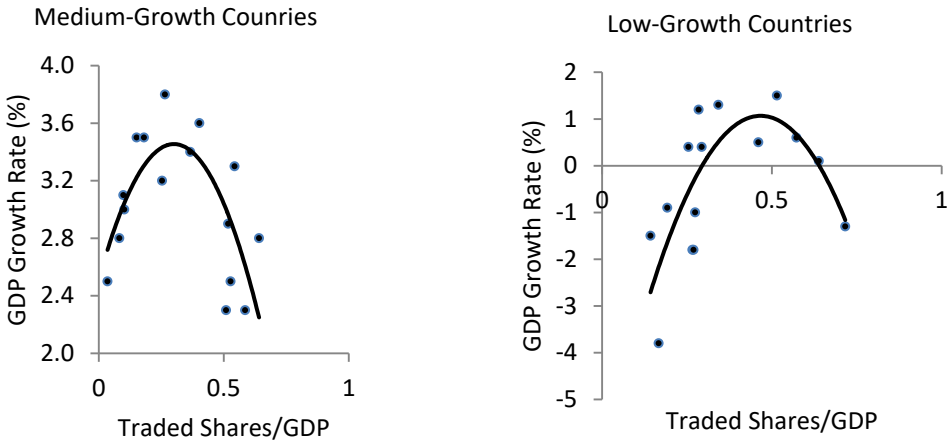


Figure 5. Financial Kuznets Curve (Cross-Sectional Data)

Table 3. Estimates of the Financial Kuznets Curve

Data	*Z*	*y*	$t(\beta_1)$	$t(\beta_2)$	R^2
Pooled Country Groups	GDP growth rate	Credit/GDP	-1.02	-0.08	0.23
TS (OECD)	GDP growth rate	Credit/GDP	3.24	-3.55	0.52
TS (low income)	GDP growth rate	Credit/GDP	-1.62	1.13	0.22
TS (lower-middle income)	GDP growth rate	Credit/GDP	-4.53	4.31	0.30
CS (all countries)	GDP growth rate	Traded Shares/GDP	0.56	-0.99	0.06
CS (high growth)	GDP growth rate	Traded Shares/GDP	0.69	-0.65	0.13
CS (medium growth)	GDP growth rate	Traded Shares/GDP	0.52	-0.90	0.23
CS (low growth)	GDP growth rate	Traded Shares/GDP	3.37	-2.99	0.55

CS: Cross-sectional data; TS: Time-series data.

The results are indeed mixed. Given the Kuznets curve (whether it is original, environmental or financial) represents issues on which there are significant ideological differences, confirmation bias is likely to be rampant and the reporting of results may be biased. Unfortunately, this is always true for empirical research in economics and finance, something that a physicist testing Boyle's law does not encounter.

6. Conclusion

Empirical work in economics and finance involves data manipulation in various shapes and forms, producing different, often contradictory, results. The results are typically sensitive to model specification, sample period, variable definitions and estimation methods. If the underlying issue attracts ideological bias, the reporting of the results tends to be selective, intended to confirm prior beliefs. This proposition is illustrated with estimates of three versions of the Kuznets curve: original,

environmental and financial.

The economic rationale for accepting or rejecting various forms of the Kuznets curve involves a significant element of ideology. There are those who believe that growth brings with it rising inequality, which may or may not be the case, depending on how the benefits of growth are distributed. There are those who believe that the environment benefits from growth and those who believe that growth should be checked to protect the environment. And there are those who believe that a large financial sector is good for the economy and others who envisage a negative impact of an excessively large financial sector on the economy. These contrasting views can be supported or refuted by empirical results as we can tell by examining the results presented in this study.

The use of the Kuznets curve in this paper is meant to be for illustration, as the model uncertainty problem arises in any field of economics and finance. This problem was identified a long time ago by Edward Leamer in his 1983 article “Let’s Take the Con out of Econometrics” (Leamer, 1983). Yet, the practice of estimating 1000 regressions and reporting one only (the one that tells a good story) remains dominant in empirical work. This problem can be dealt with by reporting distributions, rather than point values, of the estimated coefficients along the lines suggested by Young and Holsteen (2017), Slez (2019), Auffhammer and Steinhauser (2012) and by Yang, He, and Chen (2015).

One limitation of this paper is that the methods suggested to deal with the model uncertainty problem are not applied to estimate the three versions of the Kuznets curve. However, this paper has the limited objective of illustrating the problem rather than dealing with it. Identifying the problem and dealing with requires more than one short paper. This is why a future line of research is do exactly that, applying the methodologies suggested by Young and Holsteen (2017), Slez (2019), Auffhammer and Steinhauser (2012) and by Yang, He, and Chen (2015). By applying these methodologies, robust and unbiased results would be obtained to resolve the issues implicit in the estimation and testing of the three versions of the Kuznets curve. These issues have highly critical implications for public policy, which is why robust and unbiased empirical results are needed.

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