Income distribution, growth and social-welfare: towards an economic solution to the growth-equality trade-off problem

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Abstract: This thesis assesses the social-welfare implications of modifications to the post transfer distribution of income, in the context of welfare maximising policy design. Both the inequality-distributional efficiency and inequality-growth relationship are assessed. An Atkinson social welfare function is employed in a novel fashion to model the inequality distributional efficiency relationship, including direct effects that result from the concavity of the personal utility function, and external losses operating via positional income effects. This analysis produces estimates of the social welfare losses from inequality across a data set of 137 countries, where the unweighted average of total losses is found to be equivalent to be 47% of GNI. The equality-growth relationship is analysed from the standpoint of both endogenous growth theory and post-Keynesian theories of demand and investment. The relationships between the functional and personal distribution of income and key macroeconomic variables including the rate of savings, and physical and human capital accumulation are assessed. Crucially, these relationships are found to be highly modifiable by economic policy and structural reform, and in theory, no growth–equality trade off need exist. On the contrary, equality may be growth promoting at moderate to high inequality levels. Combined with the large static welfare losses from inequality uncovered in this analysis, the welfare optimum level of inequality is likely to be close to the level associated with distributional efficiency maximisation. This is likely to be a very low level of inequality in comparison to existing levels in most countries and regions, and large welfare losses result from levels of inequality significantly above this level.

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This work contains no material which has been accepted for the award of any other degree or diploma in any university, and to the best of my knowledge and belief, this thesis contains no material previously published or written by another person except where due references is made in the text of the thesis.

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Introduction

What constitutes an ideal distribution of income and wealth is a pervasive question within philosophy, politics, political economy, and economics. It is a question which, more than any other, divides political and economic traditions. Despite the question's relevance in its own right, and it's relation to a series of other important questions, mainstream economic analysis has largely been unable, or unwilling to provide direct answers. Arguably, unwillingness, rather than inability, has been the larger barrier. Given a suitable degree of willingness, some pertinent answers can be obtained.

The basic tools for assessing distributional issues have existed for more than a century, with the framework being sketched by utilitarian pioneers such as Gossen and Marshall.[1] Unfortunately, genuine problems associated with operationalizing cardinal concepts of utility, alongside arguably specious and politically motivated positivist critiques, have led to utilitarian methods being overshadowed for much of the twentieth century. The dominant Paretian approach to welfare economics has, partly by design, being incapable of addressing distributional questions. However, from the 1970's onwards, neo-utilitarian approaches, as pioneered by Tony Atkinson and Amartya Sen, addressed some of the formal problems of traditional utilitarian welfare economics, providing a framework for conducting mathematical analysis of distributional efficiency.[2] More recently, following from Richard Easterlin's pioneering work on the relationship between income and happiness, a new literature focusing on the relationship between mean income, income inequality, and various indicators of wellbeing has emerged which cuts across the fields of epidemiology, psychology, political economy, and economics.[3] Together with the neo-utilitarian methods pioneered by Atkinson this fresh approach to welfare and distribution hold the promise of providing more satisfactory answers to classical questions of distribution. This thesis is a contribution to this literature. In particular, it re-examines the classical distributional issue- the growth-equity trade-off, in light of relatively recent advances in welfare economics and growth theory.

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[1] Hermann Heinreich Gossen, *The Laws of Human Relations and the Rules of Human Action Derived Therefrom*, trans. Rudolph C. Blitz (Michigan: The MIT Press, 1983).

[2] See these important works: Amartya K. Sen and E. Foster, *On Economic Equality*, Updated edition with substantial annexe. (New York: Norton, 1997); Anthony Atkinson, *Social Justice and Public Policy* (Sussex: Wheatsheaf, 1983).

[3] See for example: Richard A. Easterlin et al., "The happiness–income paradox revisited," *Proceedings of the National Academy of Sciences* 107, no. 52 (December 28, 2010): 22463 -22468; R. Layard, *Happiness: has social science got a clue*, Lionel Robbins Memorial Lectures, 2003; Benjamin Radcliff, "Politics, Markets, and Life Satisfaction: The Political Economy of Human Happiness," *American Political Science Review* 95, no. 4 (2001); Betsey Stevenson and Justin Wolfers, "Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox," *Brookings Papers on Economic Activity* 2008 (April 1, 2008): 1-87; Mathias Binswanger, "Why does income growth fail to make us happier?: Searching for the treadmills behind the paradox of happiness," *Journal of Socio-Economics* 35, no. 2 (April 2006): 366-381.

This thesis applies a series of neo-utilitarian methods to analyse the relationship between income inequality and social welfare, both statically and dynamically. Firstly, the relationship between income inequality and a series of measures of social welfare is assessed, utilising a series of Atkinson social welfare functions. In this analysis, income is considered fixed, and equality is modelled as an income multiplier. Once time is incorporated into the analysis, the effect of inequality on growth, and hence future income levels, must also be assessed. This is the subject of the second part of the thesis. Together, the analysis in these two parts provides a framework to assess the likely impacts of changes to the distribution of income on long-run social welfare. I find that static social welfare losses from inequality, operating via reduced distributional efficiency, can be very large, on average close to 50% of GDP. In addition, greater equality imposes no strong negative effects on growth. On the contrary, equality may be conditionally conducive to growth, especially at high levels of inequality. In this situation, social-welfare maximisation in both the short and long-run implies a significant reduction in income inequality in all but the most equal countries. At low levels of inequality, negative growth affects may emerge, however the parameters of any trade-off are modifiable by economic policy. In particular, investment promoting policies can greatly modify the relationship between profitability and investment, attenuating any negative growth effects from egalitarian polices which reduce the rate to return to capital.

The first chapter introduces the Atkinson social welfare function (SWF) which is employed in this thesis, and presents some novel methods for addressing some potential shortcomings that emerge when utilising the standard Atkinson SWF. Utilising statistical analysis, a method for easily estimating the Atkinson SWF from the ubiquitous Gini index is derived. This is an imperfect method of estimation; however it is also rather accurate and greatly simplifies the estimation of the Atkinson SWF, hopefully enabling Atkinson adjusted income to be utilised as an alternative indicator of economic performance by non-econometricians.

The second chapter conducts a significant review of the existing literature devoted to estimation of the elasticity of marginal utility from income. This is a key parameter of the Atkinson SWF, and unfortunately existing estimates of the Atkinson index generally utilise arbitrary values for its calculation.[4] In this review, a value of 1.5 is obtained as a consensus value from the literature review. Utilising this value, the direct losses from income inequality that result from the concavity of the personal utility function can be readily estimated. These estimates are presented in the appendix.

The third chapter is devoted to an estimation of the total social-welfare losses from income inequality. These arise directly from the concavity of the personal utility function, as outlined in chapter 2. In addition various external and positional effects add to these direct losses. This chapter employs an Atkinson SWF to estimate total losses from inequality,

[4] For example, the U.S Census Bureau reports Atkinson indexes for arbitrary values of ε between .25 and .75, which, as demonstrated in this thesis, are far lower than existing empirical work suggest as plausible figures.

inclusive of these external effects, in regards to both health outcomes and total social welfare. The obtained parameters are then applied to discount the health and non-health portions of GNI for 137 countries. The unweighted average losses from inequality across this dataset are equivalent to 47% of GNI. These results are presented in the appendix.

Chapter four assesses the equality-growth-welfare relationship, from the standpoint of welfare maximising policy design. Due to the possibility of a negative equality-growth relationship, maximising long run welfare is not a simple question of maximising distributional efficiency, as over long period of time, relatively minor changes to the rate of growth can lead to large variations in total income, potentially offsetting any distributional efficiency gains. Firstly, I introduce the relevant theoretical and empirical issues via the formulation of a somewhat comprehensive semi-endogenous growth model. Secondly, I theoretically assess the potential growth and welfare impacts of shifts in the functional and personal distribution of income via a stylised systematisation of the relationship between distribution and physical and human-capital accumulation. This analysis breaks the determinants of the growth-equality relationship into several policy modifiable relationships:

1. The profit share-income inequality relationship
2. The profit share -investment relationship
3. The income inequality-human capital accumulation relationship
4. The income inequality-aggregate savings relationship

On the basis of theoretical and empirical insights, these functions can produce contradictory partial effects from modifications to the distribution of income, producing a non-linear and highly modifiable equality-growth relationship. At very low levels of inequality, negative growth effects may be present due to reduced physical capital accumulation, with this relationship operating via a positive relationship between inequality and profit share. However, relationships 1 and 2 are highly modifiable. Relationship two is modifiable via asset redistribution and egalitarian wages policy, whereas relationship one is determined by economic structure, including modes of enterprise financing and control, and industrial policy. In order to demonstrate the variability of relationship 1, I present estimates of the profitability-investment relationship for both China and the United States.

Section 5 presents a summary of key findings. On the basis of the analysis presented here, and abstracting from political constraints to policy formation, the welfare optimal distribution is likely to be very low in comparison to existing levels of inequality, and there is a very large scope to improve welfare outcomes via egalitarian reform, with the possible gains increasing in rough proportion to existing levels of inequality. The static welfare losses from inequality are calculated to be very large, and both theoretical and empirical examination of the relationship between inequality and growth suggest no strong negative growth effects at moderate levels of inequality. On the contrary, equality may be conductive to positive growth outcomes, especially at high levels of inequality. At low levels of

inequality, and where asset redistribution is constrained, there may be some negative effects on physical capital accumulation, but these effects can be greatly attenuated via investment promoting and stabilising policy. The welfare optimum long-run level of equality is likely to not be significantly higher than the distributional efficiency maximising level. In terms of a numerical estimate, the long-run welfare optimum level of post transfer inequality is likely to be somewhere between a Gini index of 0.15 and 0.20.

1 A novel method for estimating the Atkinson Social Welfare Function

Introduction

In this chapter, a method for estimating the direct social welfare losses from income inequality is presented, utilising the Atkinson social welfare function (SWF). Direct losses are defined as those that result from the concavity of the personal utility function. No external or positional effects are considered; they are addressed separately in the next chapter.

Firstly, a very brief outline of the rational for adopting a utilitarian framework is presented. Secondly, the Atkinson index is introduced, and some practical problems relating to its utilisation are addressed via statistical methods. Three potential problems exist in regards to the use of the Atkinson SWF.

- The function assumes perfect equality to be the social optimum. Any deviation from this incurs a social-welfare loss. However, when there is variability in needs and tastes, and hence in the shape of personal utility functions, some degree of inequality is associated with the equalisation of marginal utility from income, and hence optimal distributional efficiency.
- The basic function requires the estimation of the complete income distribution across all persons. In addition, the function is sensitive to very low incomes, and no income can be zero or negative. These downsides can both slow and complicate the estimation process, and make the results obtained sensitive to estimation procedure.
- Arguably, consumption inequality, rather than income inequality should be utilised as the inequality metric for input to the Atkinson SWF. However, consumption inequality data is often unavailable. Utilising income inequality data will arguably lead to an overestimation of the welfare losses from inequality.
- In order to apply the function as a proscriptive measure of social welfare, reliable estimates of the elasticity of marginal utility from income are required. This parameter determines the sensitivity of the SWF to income inequality.

This chapter addresses these potential problems via the following methods:

- An estimate for the warranted or ideal portion of inequality is obtained. This portion of inequality can then be subtracted from the total observed level of inequality.
- A method for estimating the Atkinson SWF from the ubiquitous Gini index, and for estimating consumption inequality from income inequality is derived via statistical methods.

The second chapter of this thesis addresses the problem of estimating the elasticity of marginal utility from income. Combined with the methods outlined here, the direct losses from income inequality can be calculated. Estimates of direct and total losses are given for 137 countries in table 27 (in appendix A).

1.1 The utilitarian approach to social-welfare

This thesis applies a series of utilitarian methods, in particular the Atkinson SWF, to estimate social welfare losses resulting from income inequality. The rational for this choice of framework is briefly outlined below.

I define an applied utilitarian approach to social-welfare via the following axioms;

- The life satisfaction or happiness of individuals, hereafter referred to as utility, is calculable, and can be expressed in cardinal terms.
- Utility, defined in the above manner, is comparable across persons
- The proper aim of social policy is to maximise total utility over an infinite timeframe[5]

Such an approach has a series of advantages for assessment of policy outcomes, and the approach is particularly useful for assessing the social-welfare effects of modifications to existing income distributions. Some of the obvious advantages of the utilitarian approach are outlined below;

- Only very minimal normative judgments are required to be made, chiefly a decision to assign equal utility weighting to all persons regardless of income level, sex, or race. Once such a basic and readily defensible normative framework is adopted, policy assessment can be undertaken largely on positive grounds.
- Within the utilitarian framework, the net effect of a policy change is in theory always calculable, via an assessment of the net effect on aggregate social utility. Given appropriate data, and sufficiently powerful econometric techniques, cost-benefit

[5] This definition removes the problem associated with an alternative aim of maximising mean utility, which could be achieved be drastically reducing population. The infinite timescale removes the alternative problem, of massively increasing population in order to maximise aggregate utility, as such an approach would be counterproductive in the context of an infinite timeframe. Practically, adopting a hypothetical fixed or given population or population growth rate is a valid heuristic device. This solution is presented in Sen and Foster, *On Economic Equality*.

analysis can be readily conducted for a whole series of policy options, in particular redistributive policy. This is clearly not the case when a Paretian approach is adopted.[6]

Under the first set of conditions, it has been long known that when total income is given, the maximisation of social utility requires that income be distributed such that the marginal utility from consumption across persons is equalised.[7]It has also been shown that a rational, personal utility maximising individual tasked with choosing an ideal distribution of income for a hypothetical society, into which they would be randomly placed, would adopt an identical approach. [8] This provides a normative rational for utilitarianism, which stems from a basic principle of impartiality and equality.[9]

Deviations from utilitarianism require unequal weights to be ascribed to the utility of different individuals. In practice, social policy has tended to adopt various forms of at least implicitly discriminatory and elitist utility weighting.[10] Without any plausible and valid rational for unequal utility weighting, classical utilitarianism appears to be the only valid option for conducting social-welfare calculations.[11]

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[6]Yew-Kwang Ng, "Beyond pareto optimality: The necessity of interpersonal cardinal utilities in distributional judgements and social choice," *Journal of Economics* 42, no. 3 (September 1, 1982): 207-233; Yew-Kwang Ng, "Welfarism and Utilitarianism:A Rehabilitation," *Utilitas* 2 (1990): 171-193. Some hybrid approaches have also been employed to address the shortcomings of ordinal utility, see Michael Mandler, "Cardinality versus Ordinality: A Suggested Compromise," *The American Economic Review* 96, no. 4 (2006): 1114-1136; C. Blackorby, "Degrees of Cardinality and Aggregate Partial Orderings," *Econometrica* 43, no. 5/6 (1975): 845-852.

[7]See for example, Gossen, *The Laws of Human Relations and the Rules of Human Action Derived Therefrom*; Abba Lerner, *The Economics of Control* (New York: Macmillan, 1944); R. Jennings, *Natural Elements of Political Economy* (London: Macmillan, 1855); J. Dupit, "On the measurement of utility of public works," *International Economic Papers* 2 (translated reprint of 1884 original 1992): 83-110.

[8] The usual caveat of ignoring offsetting efficiency effects applies. It can be shown that a rational individual operating behind a Rawlsian 'veil of ignorance' would operate in a similar manner to a utilitarian social planner, see; John C. Harsanyi, "Cardinal Welfare, Individualistic Ethics, and Interpersonal Comparisons of Utility," *Journal of Political Economy* 63, no. 4 (1955): 309-321; William Vickrey, "Measuring Marginal Utility by Reactions to Risk," *Econometrica* 13, no. 4 (October 1, 1945): 319-333; Juan D. Moreno-Ternero and John Roemer, "The Veil of Ignorance Violates Priority," *Economics and Philosophy* 24, no. 2 (2008): 233-257. On Rawl's 'veil of ignorance' see J. Rawls, *A theory of justice* (Cambridge Mass.: Harvard University Press, 1971). Although Rawl's use of this principle is the most widely acknowledged, precedence can be found in the works of both Harsanyi and Vickrey

[9] On this principle as a foundation of social justice, see Brian Barry, *Justice as impartiality* (Oxford: Oxford University Press, 1995).

[10]The existent of large, unaddressed differentials in income is equivalent to assigning a much larger weight to the utility of the rich than the poor.

[11] The approach suggested by Sen of additionally applying an aversion to inequality in total utility outcomes is rejected here, as there are no solid grounds for such an adjustment when external effects of total utility inequality (for example resentment, envy, and positional concerns) are incorporated into the analysis. These effects are explicitly incorporated into the analysis here, and so no further 'utility weighting' is applied. On maximising utility outcomes as a basis of public policy, including utility weighting, see Amartya K. Sen, "From Income Inequality to Economic Inequality," *Southern Economic Journal* 64, no. 2 (October 1, 1997): 384-401; Donald Davidson, "Judging interpersonal interests," ed. J. Elster and A. Hylland (Cambridge: Cambridge University Press, 1986); Sen and Foster, *On Economic Equality*; Amartya K. Sen, "Equality of What ?," in *Tanner lectures on human values*, ed. G. Peterson, vol. 1 (Cambridge: Cambridge University Press, 1980); G.A. Cohen,

The classical utilitarian principle of accounting for distributional efficiency in policy appraisal is now a somewhat common approach in formal cost benefit analysis.[12] For example, the British Treasury has adopted a practice of applying welfare weights to GDP increases in regions with varying income levels, with a greater weight given to poorer regions.[13] The logical next step would be to apply welfare weights to individuals. This approach, pioneered by Atkinson, is employed in this thesis.

1.2 The Atkinson Social Welfare Function

The Atkinson SWF utilises an isoelastic utility function to estimate personal utility at different income levels;[14]

$$\mathrm{U}_{\varepsilon}(y) = \begin{cases} \dfrac{y^{1-\varepsilon}}{1-\varepsilon} & \varepsilon \neq 1 \\ \ln y & \varepsilon = 1 \end{cases}$$

Where y is income, and ε is the elasticity of marginal utility from income as defined below;

$$\varepsilon = \frac{-yU''(y)}{U'}$$

Social welfare can then be calculated as mean personal utility

$$\overline{U}(y) = \begin{cases} \dfrac{1}{n}\displaystyle\sum_{i=1}^{n} \frac{y(n)^{1-\varepsilon}}{1-\varepsilon} & \varepsilon \neq 1 \\ \dfrac{1}{n}\displaystyle\sum_{i=1}^{n} \ln y(n) & \varepsilon = 1 \end{cases}$$

"Incentives, inequality, and community," in *Tanner lectures on human values*, vol. 12 (Salt Lake City: University of Utah Press, 1992); L. S. Temkin, *Inequality* (New York: Oxford University Press, 1993); Brian Barry, *Theories of Justice*, vol. 1 (Berkley: University of California Press., 1989); T. Scanlon, *What we owe to each other* (Cambridge Mass.: Harvard University Press, 1998). For arguments against this tradition, in particular the rejection of utility weighting, as adopted in this thesis, see Stefan Trautmann, "Individual fairness in Harsanyi's utilitarianism: operationalizing all-inclusive utility," *Theory and Decision* 68, no. 4 (April 1, 2010): 405-415; Joshua Greene and Jonathan Baron, "Intuitions about Declining Marginal Utility," *Journal of Behavioural Decision Making* 14 (2001): 243-255.

[12] For some pioneering works in this tradition, see R. Layard, *Cost–benefit Analysis* (London: Penguin, 1972); A. R. Prest, "Cost–benefit analysis; a survey," *Economic Journal* 75 (1965): 683-735; F. Seton, *Shadow Wages in the Chilean Economy* (Paris: OECD, 1972); E. Neal Blue and Luther Tweeten, "The estimation of marginal utility of income for application to agricultural policy analysis," *Agricultural Economics* 16, no. 3 (August 1997): 155-169.

[13] David J. Evans, E. Kula, and H. Sezer, "Regional welfare weights for the UK: England, Scotland, Wales and Northern Ireland," *Regional Studies* 39, no. 7 (2005): 923-937.

[14] Anthony Atkinson, "On the measurement of inequality," *Journal of Economic Theory* 2, no. 3 (September 1970): 244-263.

The Atkinson Index is a derived coefficient which expresses social welfare losses from inequality as the proportion of income that could be sacrificed by a society and still maintain an identical level of mean utility, if income inequality was also reduced to zero. This property can be formalised as;

$$W = \bar{y}(1 - A)$$

Where A is the Atkinson index, and W is the equally distributed equivalent income.

This property makes the Atkinson incredibly useful for assessing policies which have inverse effects on inequality and income levels. The percentage increase in mean incomes, required to exactly offset a percentage increase in the Atkinson index is given by;

$$\frac{d\overline{y}/\overline{y}}{dA/A} = \frac{1}{1 - A}$$

The equation for calculating the Atkinson index is given below;

$$A = 1 - \frac{1}{\overline{Y}}\left(\frac{1}{N}\sum_{i=1}^{N} Y_i^{1-\varepsilon}\right)^{1/(1-\varepsilon)}$$

The Atkinson index has been employed for some time as a measure of social-welfare losses from inequality, however, its utility as a proscriptive measure for policy assessment is dependent on methodologically sound and empirically accurate methods for estimating ε. Some estimation methods and the results obtained are presented in Chapter 2.

1.2.1 Optimal levels of inequality

The Atkinson SWF implicitly treats full equality as the distributional-efficiency optimum. This is a result of attributing to all persons an identical utility function. In reality, the shape of the personal utility function is likely to vary across individuals, due to variation in 'needs' and 'tastes'. Due to this variation, equalising the marginal utility of income across persons requires some dispersion in incomes.[15] Ideally, this level of inequality should be associated

[15] It is worth noting that this dispersion should not, as suggested by Amartya Sen and others, lead to significant variation in *total* utility outcomes. For example, those who have lower total utility due to some disability, for example health problem, are likely to obtain more sustained benefit from increases in expenditure on certain classes of goods (for example healthcare) than those without such problems, suggesting their marginal utility curves will intersect. Beyond this intersection point, more resources should be allocated to those with greater needs and less total utility. In addition, feelings of resentment that result from highly unequal outcomes should be incorporated into the analysis as external effects. Together, these points suggest that in practice utilitarianism is somewhat consistent with some of the concerns of 'utility egalitarians'. On external effects of this sort, see Trautmann, "Individual fairness in Harsanyi's utilitarianism: operationalizing all-inclusive utility." In addition, the approach of consistent utilitarianism, in which varying needs are incorporated into the analysis, is consistent with Marx's principle of 'to each according to their needs'. On Marx and utilitarianism, see George G. Brenkert, "Marx and Utilitarianism" 5, no. 3 (November 1975); Michael Green, "Marx, Utility, and Right," *Political Theory* 11, no. 3 (1983): 433-446; Rescher Nicholas, "The Utilitarianism of Marx and

with zero welfare losses when imputed to the Atkinson SWF. This outcome can be achieved, via estimating this ideal portion of inequality, and then subtracting it from the observed level.[16] This section provides an estimate of this level of inequality.

In an ideal world with equal earnings capacities, flexible labour hours, and equal non-work responsibilities, the only source of income inequality would be differing needs and tastes. These variables would induce different trade-offs between work and leisure and hence result in some modest level of income inequality. This level of inequality would approach the optimum level associated with marginal utility equalisation.[17] In this case, desired working hours can be utilised as an imperfect proxy for needs or tastes, and the dispersion in desired working hours can also be used as a source to infer the dispersion in these variables.

Utilising recent data from Australia on preferred working hours for single males (who are likely to have less variation in non-work responsibilities than other categories), and assigning a minimum value of ten hours (below this value it is reasonable to assume some form of barrier to greater workforce participation) and a maximum of 50 hours (increased equality would very likely remove the compulsion to work longer hours) yields a value of 0.167 for the Gini index; 0.045 for the Thiel-T index, and 0.057 for the mean log-deviation or Theil-L.[18]In comparison, the lowest reported level of observed inequality obtained from a search of the relevant literature is a figure of 0.11 for the Gini index, reported for urban China in 1978.[19]In this paper, I adopt a round value of 0.04 for the mean-log deviation of warranted income inequality. This is between the estimated value for urban China from 1978 and the estimate from Australian data on desired working hours, and is a very low level of inequality in comparison to observed levels for most countries. It should be noted that the choice of this value within reasonable ranges, for example a Gini index of between zero and 0.20 has only marginal effects on calculated relative distributional efficiency.

1.3 Estimating the Atkinson index from the Gini index

In this section, I outline a novel, statistically based method for estimating a consumption inequality based Atkinson index from the readily available Gini index of post-transfer incomes. No algebraic conversion exists, because of fundamental differences in the way that

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Engels," *American Philosophical Quarterly* 10, no. 3 (1973): 189-199; Adam Schaff, *A Philosophy of Man* (New York: Dell Publishing, 1963).

[16] Due to the decomposability of the generalised entropy class of inequality indexes, (one of which is utilised to estimate the Atkinson Index) this is a trivial process.

[17] They would be equivalent under an assumption of equal disutility of labour.

[18] Data source is: Yi-Ping Tseng and Mark Wooden, *Preferred vs Actual Working Hours*, Working Paper, Melbourne Institute Working Papers (The University of Melbourne, June 2005), http://melbourneinstitute.com/wp/wp2005n07.pdf.

[19]Jiwei Lou, "Comment on: Equity and Growth in Developing Countries: Old and New Perspectives on the Policy Issues," in *Income Distribution and High-Quality Growth*, ed. Vito Tanzi and Ke-young Chu (Cambridge Mass.: The MIT Press, 1998), 147-153.

information is encoded to produce the different indexes of inequality. In particular, the Atkinson index is *not* a monotonic transformation of the Gini index, and reversals in order are possible when comparing these metrics for a series of countries or regions.[20] Whilst this introduces a potentially serious and irresolvable problem in attempting to estimate the Atkinson index directly from the Gini, for moderate values of ε and typical income distributions, remarkably consistent and accurate estimations can be achieved in practice.

The estimation of the Atkinson index, even from accurate income distributions, is prone to inconsistency, as it depends on the value of ε chosen, and the treatment of very low or zero reported incomes.[21] These issues potentially introduce greater variability in results, even when utilising identical data, than the conversion method outlined here.

In order to convert the Gini index of income inequality into an Atkinson index of social welfare losses from consumption inequality, a chain of regressions have been run on a series of large and varied data sets compiled from a number of secondary sources. The order of transformation is shown below

$$Gini\ index\ \rightarrow Theil-t\ index\ \rightarrow Theil-l\ index$$

The Theil-l index, also known as the mean-log deviation (MLD) can then be utilised to estimate the Atkinson index using an algebraic transformation;[22]

$$A \approx 1 - e^{-T_L \cdot \varepsilon}$$

An additional step can be added at the start to transform income inequality to consumption inequality

$$Gini\ index\ (income) \rightarrow Gini\ index\ (consumption)$$

The reason for adopting this roundabout conversion method is that no large data set could be constructed with values for both the Gini index of income inequality, and an Atkinson index of social welfare losses from consumption inequality; however large data sets exist with estimates at either end of each link in the chain outlined above. These conversion processes are outlined in turn below.

[20]This is because the Gini index is especially sensitive to income levels at the middle of the income distribution, whereas the Atkinson index is very sensitive to income levels at the bottom of the income distribution.On this point, see Atkinson, *Social Justice and Public Policy*, 29.

[21] All incomes must be non-zero to compute the Atkinson index, and a small number of very small incomes can lead to very large values for A. In practice, a minimum level of income consistent with subsistence is imposed in order to produce consistent results. The choice of this income level can create large deviation in the estimate.

[22] On the relationship between the Theil-L and the Atkinson index, see Sen and Foster, *On Economic Equality*, 140–141; Francois Bourguignon, "Decomposable Income Inequality Measures," *Econometrica* 47 (1979): 913.

1.3.1 Converting post-transfer income inequality to consumption inequality

This conversion is conducted on the grounds that consumption, rather than income, determines utility outcomes.[23] Through the use of savings and credit, consumption can in theory be considerably smoothed over the life cycle and in response to income volatility.[24] If this is the case, then utilising income inequality to compute the Atkinson index may significantly overstate the social-welfare losses from inequality. Although some smoothing does occur, the magnitude of the adjustment is small. The data used to perform the estimation is presented in table 1.

In order to estimate the relationship between two indexes normalised to the range 0-1, a standard linear regression cannot be performed, as (meaningless) outputs of less than zero or more than one could result. To resolve this problem, a log de-normalisation transformation is applied to the Gini data:

$$D_G = \ln(\frac{1}{1-G})$$

Where D is the resultant de-normalised inequality measure. The relationship between these measures of inequality is then estimated utilising a basic equation;

[23] Although, when the elasticity of marginal utility from *income* is the input to an Atkinson type function, there is good reason to utilise income inequality as the input as well. In general, it is often difficult to discern whether the elasticity of marginal utility from income of consumption is being calculated by a particular estimation method. The transformation is conducted here largely in response to those that claim such a transformation greatly diminished the magnitude of welfare losses. For example, there is some debate on the nature of the relationship between consumption and income inequality in the United States. According to Krueger and Perri, consumption inequality is significantly lower than income inequality, and has not risen in line with income inequality since the 1980's. However, there is evidence that this has been a result of unsustainable use of credit to augment lower incomes. In addition, Aguir and Bills, (whose results I utilise) take issue with the CEX data utilised by Krueger and Perri to obtain their estimates, which they find to significant underestimate luxury consumption. Computing consumption from savings and income data and the CEX, they find a tighter correlation. I find that internationally, there is a close correlation, and it is difficult to see how consumption and income inequality could permanently diverge by a large margin, unless there is constantly diminishing inequality in lifetime income and offsetting rise in income volatility at the personal level. See Dirk Krueger and Fabrizio Perri, "Does Income Inequality Lead to Consumption Inequality? Evidence and Theory," *The Review of Economic Studies* 73, no. 1 (January 1, 2006): 163-193; Mark A. Aguiar and Mark Bils, *Has Consumption Inequality Mirrored Income Inequality?*, Working Paper, NBER Working Papers (National Bureau of Economic Research, February 2011); Johnson and Stephanie Shipp, "Trends in Inequality using Consumption-Expenditures: The U.S. from 1960 to 1993," *Review of Income and Wealth* 43, no. 2 (1997): 133-152.

[24] There is evidence that savings are capable of significantly smoothing consumption in the face of transitory income shocks, but not shocks to lifetime income or persistent unemployment. In particular, during recessions, personal credit can dry up, and consumption inequality tends to converge towards the level of income inequality, whilst the poor have difficult self-insuring as a result of credit constraints. See Richard Blundell, Luigi Pistaferri, and Ian Preston, "Consumption Inequality and Partial Insurance," *The American Economic Review* 98, no. 5 (December 1, 2008): 1887-1921; Richard Blundell, "From income to consumption: Understanding the transmission of inequality" (Institute for Research on Poverty, 2010),

$$D_{Gc} = a.G_{gi}$$

Where D_{Gc} is the denormalised Gini index of consumption inequality; $D_{Gc}$is the denormalisedGini index of post-transfer income inequality; and a is the constant to be estimated. The relationship between the Gini index of income inequality can then be expressed as;

$$G_c = 1 - e^{-a.\ln(\frac{1}{1-G_i})}$$

The regression results and statistics are given in table 2.

Table 1: Income and consumption inequality data

Source	Place	Scope	Observation pairs
Naseem (1973)	Pakistan	Rural	6
Naseem (1973)	Pakistan	Urban	6
Alauddin (1975)	Pakistan	Rural	6
Alauddin (1975)	Pakistan	Urban	6
Keane and Prasad (2002)	Poland	National	26
Harding and Greenwell (2002)	Australia	National	4
Bhalla (2002)	World	Global	5
Idrees (2002)	Pakistan	National and regional	16
Azfar (1973)	Pakistan	National	1
Gradin et. al. (2008)	Spain	National	11
Krueger et. al. (2010)	8 industrialised countries	National	8
Domeij and Floden (2009)	Sweden	National	2
Aguiar and Bils (2009)	USA	National	6
		Total:	**103**

Table 2: Regression statistics: Income and consumption inequality

a	0.9286		
De-normalised values (OLS)		Final results (OLS)	
R^2	0.996	R^2	0.997
F stat	25971	F stat	33257
T stat (.01)	161.16(2.63)	T stat(.01)	182.36(2.63)
P null	0	P null	0

1.3.2 Converting the Gini index to the Thieil-T index

The Atkinson index can be readily estimated from the Theil-l index, also known as the mean log-deviation (MLD); however this index is rarely calculated, in comparison to the Theil-T. Given that the Thiel-T and Theil-l share a common mathematical structure, under certain assumptions, for example an approximately log-normal distribution of income, they can be

shown to be almost identical in value.[25] I therefore utilise observation pairs for the Gini and Theil-T index as a first step towards a conversion to the Thiel-L index, in order to allow for a much expanded data set. The date used for this conversion is summarised in table 3.

Table 3: Income inequality data: Gini and Theil-T index

Source	Country/Region	No. of observation pairs
Chotikapanich et. al. 2009	Africa	34
	Asia	38
	EE and Central Asia	36
	Latin America	36
	Europe, NA and Oceania	46
	World	2
Lin et. al. (2008)	China	24
Ferranti et. al. (2003)	Latin America	51
Berry and Serieux (2002)	World	3
Sala-i-Martin (2002)	World	58
Bourguigona and Morisson(2002)	World	4
Dikhanov and Ward (2002)	World	4
Sala-I-Martin (2006)	World	31
Dowrick&Akmal(2005)	World	2
CEDLAS (2011)	Argentina	35
	Total:	**404**

A similar problem to that encountered when converting Gini indexes arises when conversion from the Gini to Theil is considered, however in this case the following conditions apply for large populations;

$$\lim_{G\to 0} 0\,,\ \lim_{G\to 1} \infty$$

The following equation satisfies these conditions and provides an accurate fit to the available data;

$$T_T = a\left(\mathrm{Ln}\frac{1}{1-G}\right)^b$$

Where T_T is Theil's T Index

Running the regression, two data sources (Berry and Serieux 2002, Ferranti et. al. 2003) appeared to overstate the Theil index in comparison to the other data sources by a consistent margin, and to display a significant Y intercept when one was allowed for.

[25] There is evidence that income distributions are approximate log-normal, see John Creedy, *Dynamics of Income Distribution* (Basil Blackwell, 1985); Frank A. Cowell, *Measuring Inequality*, vol. 2 (New York: Prentice Hall, 1995).

Therefore, 2 dummies were inserted for these data sets, removing the implicit Y intercept but retaining the curve and gradient data. The final equation for estimation is thus;

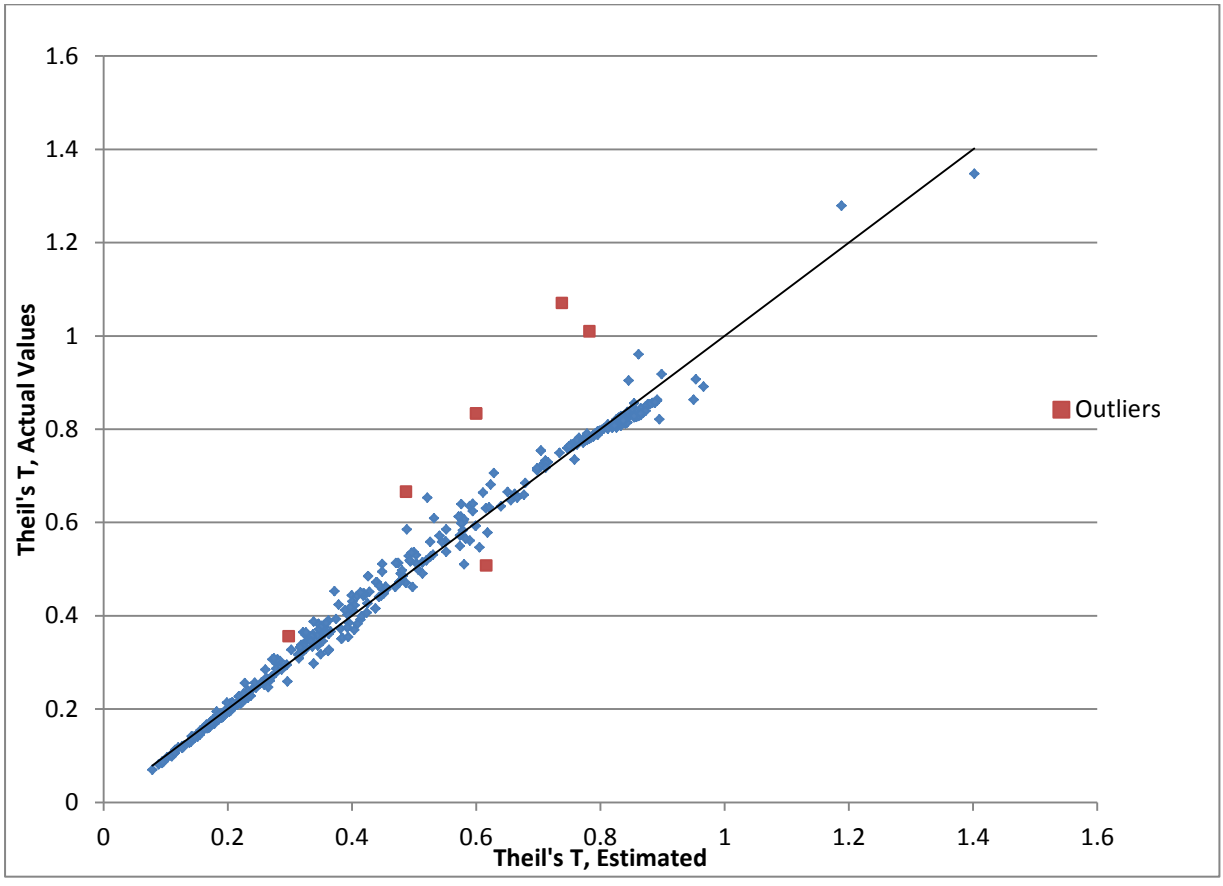
$$T = a\left(\ln\frac{1}{1-G}\right)^{b} + cB + dF$$

Where B and F are dummies for Berry and Serieux(2002), and Ferranti et. al. (2003) respectively. Further, 6 obvious outliers were removed from the data set. The final results of the estimation are presented in table 4 and figure 1.

Table 4 Regression statistics: $Gini \rightarrow Theil\ T$

Variable:	A	B	C	D
Value:	0.7695	1.55	0.1181	0.054
T statistic:	424	N.A	8.1431	14.5251
Null: 0%	R^2: .998	F:72613	Critical T (.01)=2.588	

Figure 1: Estimated vs actual values of Theil's T index



2.43 Converting the Theil-t to the Theil-L and the Atkins Index

The Theil-t and Theil-L are both special cases of the generalised entropy index;[26]

$$GE(\alpha) = \frac{1}{N\alpha(\alpha-1)}\sum_{i=1}^{N}\left[\left(\frac{yi}{\bar{y}}\right)^{\alpha} - 1\right], \quad \alpha \neq 0,1$$

Where yi is income for individual i, $\bar{y}$ is mean income, and α is a parameter that determines the sensitivity of the index to incomes at different ends of the income spectrum. For low value of α, the index is sensitive to incomes at the bottom of the income spectrum (increasing more rapidly as the incomes of the very poor approach zero). For higher values of α, the index becomes increasingly sensitive to incomes at the upper end of the spectrum (increasing more rapidly as the incomes of the very rich approach infinity)

For the Theil T index, α =1, for the Theil L index, α =0. Equations for these special cases are given below;

$$T_T = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{yi}{\bar{y}}.\ln\frac{yi}{\bar{y}}\right)$$

$$T_L = \frac{1}{N}\sum_{i=1}^{N}\left(\ln\frac{\bar{y}}{yi}\right)$$

Where T_T is the Theil-T index, and T_L is the Theil-L index, also known as the mean log-deviation (MLD).

The advantage of converting from T_T to T_L is that the normalised version of T_L is equivalent to the Atkins index for ε =1. For $\varepsilon \neq 1$ the following conversion can be utilised to produce a close approximation of the Atkins Index.[27]

$$A \approx 1 - e^{-T_L.\varepsilon}$$

Due to the commonalities in functional form between T_T and T_L, they become almost identical in value for income distributions that are approximately log-normal, which is somewhat typical.[28] In order to account for differences that result from skewness in typical distributions, the relationship between T_T and T_L can be estimated via standard OLS regression techniques. Although a smaller data sample is available for this regression as opposed to others in the chain, the commonality in functional form should provide added weight to the results. Data sources and regression statistics are given in table 5.

Table 5 Data sources and regression statistics -Theil T and Theil L indexes

[26]Sen and Foster, *On Economic Equality*, 140.
[27] For the relationship between the Theil-L and the Atkinson index, see Ibid., 140–141; Bourguignon, "Decomposable Income Inequality Measures," 913.
[28]Creedy, *Dynamics of Income Distribution*; Cowell, *Measuring Inequality*,2:.

Source	Place	Scope	Observation pairs
Shipp (1997)	U.S.	National	5
Sali-i-Martin (2002)	Global, across and within countries	Global	87
Regression statistics			
a:	1.04	Observations	92
R^2	0.9999	F statistic	87840
P null	0	T statistic (.01)	296.37(2.63)

Given this relationship, T_L can be estimated directly from the Gini index:

$$T_L = 0.7695 \times 1.04 \left(\text{Ln}\frac{1}{1-G}\right)^{1.55}$$

$$T_L = 0.8 \times \left(\text{Ln}\frac{1}{1-G}\right)^{1.55}$$

Combined with the transformation equation; $A \approx 1 - e^{-T_L \cdot \varepsilon}$, the Atkinson index can then be directly estimated from the Gini Index. The calculated relationship between the Gini and Atkinson indexes is shown graphically in figure 2

1.3.3 Checking estimates against secondary sources

Each step in the chain process outlined above has produced very strong results; however, it is still possible given the number of steps in the process that the overall results of this estimation method may be unsatisfactory. In order to guard against his possibility, the results have been checked against estimates for the Atkinson index in the secondary literature calculated from income shares. A standard linear OLS regression is used to check the results utilising the following equation to be estimated

$$A = a.A_e$$

Where A is the Atkinson measure calculated from an estimate of income shares, and A_e is the estimate derived from the Gini index. If the estimation method is accurate both a and the r^2 should be close to 1.

The results suggest that that the conversion in incredibly accurate for value of e between .5 and 1.5. Some inaccuracy exists for estimates utilising e=2 for Argentina, where the conversion equation under-estimates the Atkins measure by around 4 per cent.[29] Results are

[29]This inaccuracy is a result of the sensitivity of the Atkins measure at high values of e to low incomes; and therefore also to the incomes share at the lowest decide, and to variability in the treatment of very small, zero, or negative reported incomes. The problem of dealing with very low incomes affects all estimation techniques;

presented in table 6, showing separate regression statistics for e=.5, 1, and 1.5, and the less accurate estimates for Argentina when e=2. The results are shown graphically figure 3

Table 6 Data and regression statistics: conversion equation accuracy check

Source	Place	Scope	Observation pairs
Sali-i-Martin (2002)	World	Global aggregate	116
Francois &Rogas-Romagosa (2006)	many countries	National	50
Sali-i-Martin (2006)	World	Global aggregate	62
CEDLAS (2011)	Argentina	National & Regional	115
LIS (2011)	35 countries	National	70
Regression statistics: $\varepsilon = 0.5; 1; 1.5$			
a:	1.002	Observations	400
R^2	0.9989	F statistic	376772
P null	0	T statistic (.01)	613 (2.59)
Regression statistics: $\varepsilon = 2$			
a:	1.04	Observations	35
R^2	0.9982	F statistic	18626
P null	0	T statistic (.01)	136.47 (2.73)

Conclusion

This chapter outlined a method for estimating the Atkinson SWF from the ubiquitous Gini index. The method outlined in this chapter can enable researchers to readily adopt inequality adjusted income as an alternative or additional indicator of social welfare. The advantage of utilising this indicator over unadjusted per-capita income is that the former explicitly accounts for distributional efficiency in a transparent and non-ad-hoc manner. The method outlined in this chapter alongside the point estimate for ε of 1.5 obtained in chapter 2 is later employed to produce a series of estimates of the direct social welfare losses from inequality across time and place. These results are presented in appendix A, alongside estimates of total losses, inclusive of external and positional effects.

Figure 2 Gini-Atkinson index functions for selected values of ε

however variability in the skewness of the income distribution creates additional problems for the Gini-Atkinson conversion method outlined here. When the Atkins measure is estimated from the Gini index, a typical income distribution is assumed, and where the income share of the lowest decile is lower than in the typical distribution corresponding to a given Gini index, the estimation is biased downwards

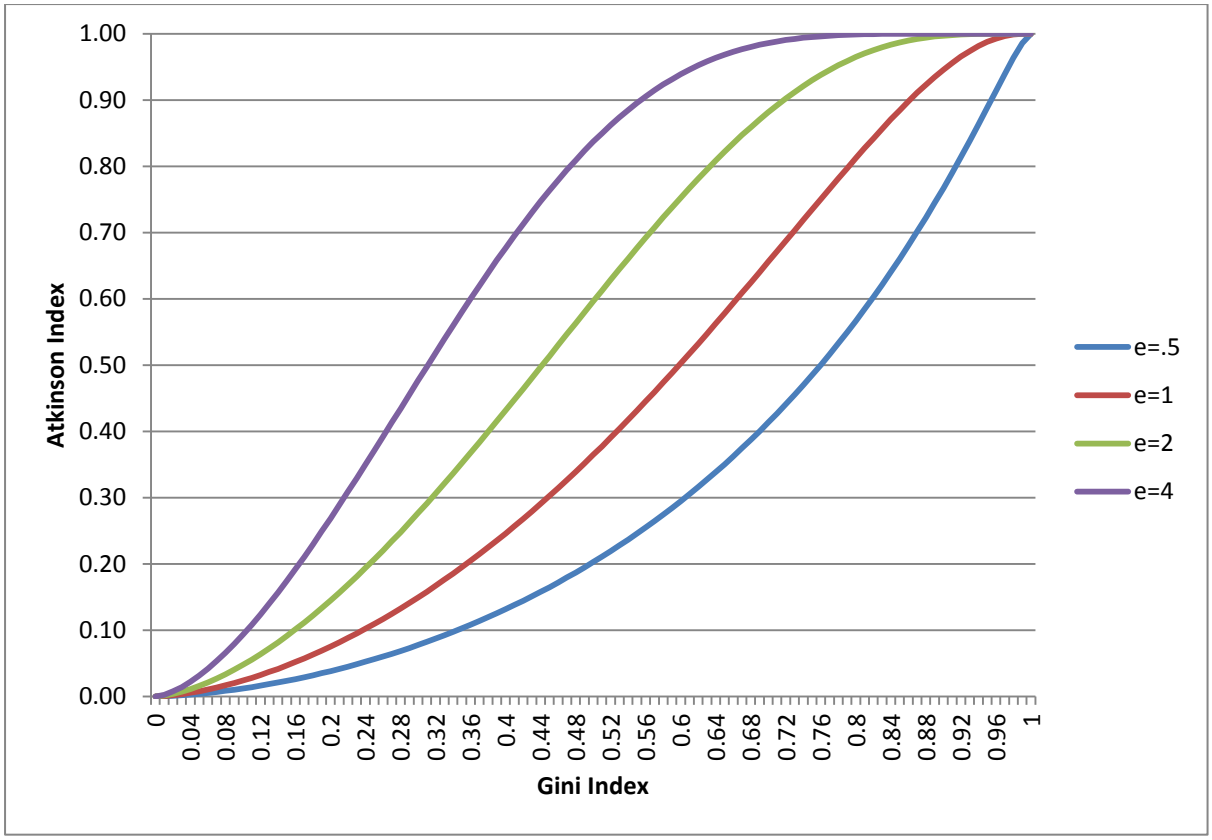
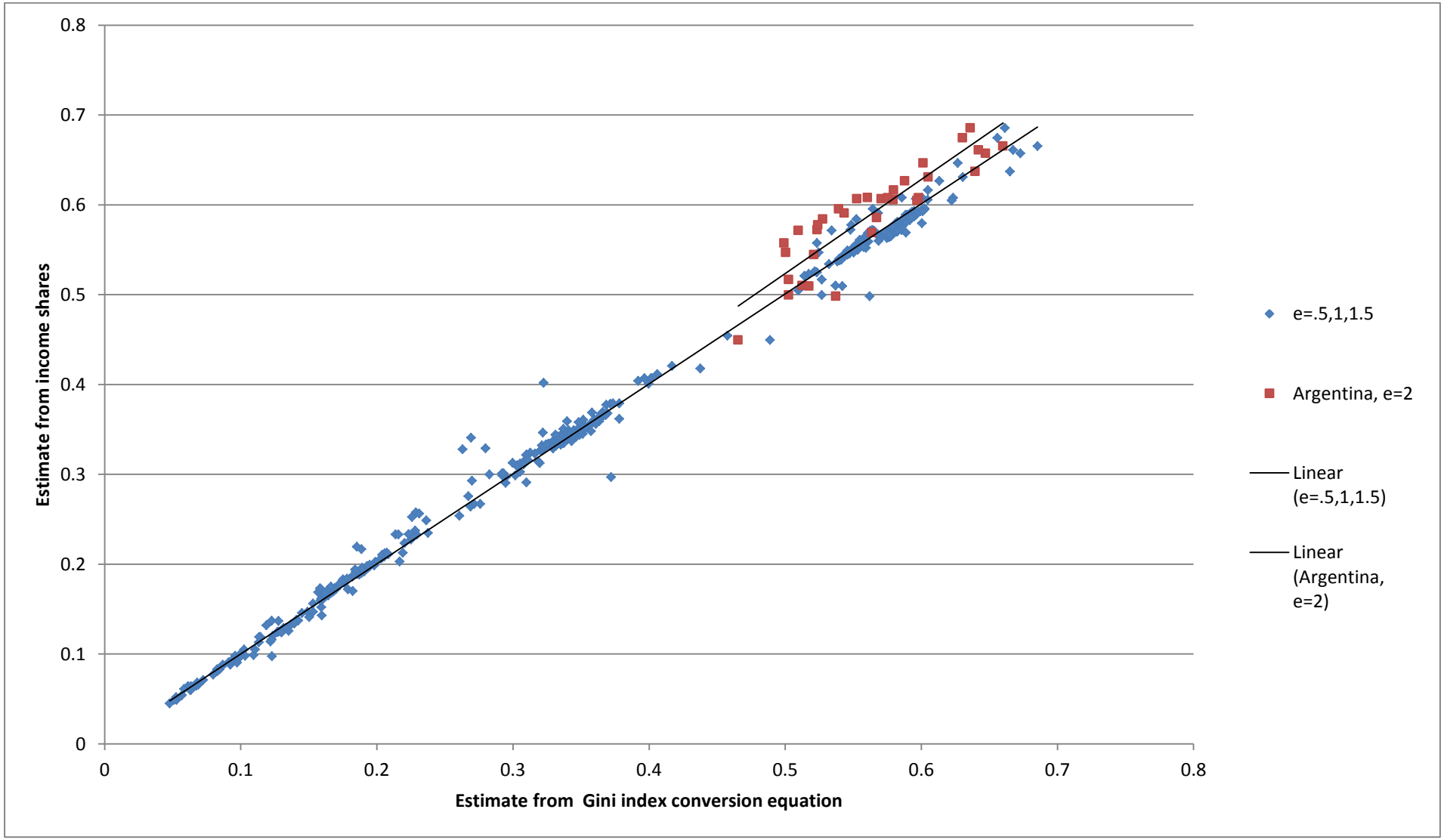

1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Atkinson Index
0
0.04
0.08
0.12
0.16
0.2
0.24
0.28
0.32
0.36
0.4
0.44
0.48
0.52
0.56
0.6
0.64
0.68
0.72
0.76
0.8
0.84
0.88
0.92
0.96
1
Gini Index
e=.5
e=1
e=2
e=4

Figure 3 Correlation of Atkinson index estimates – from Gini index and income shares



2 Review of estimates of the personal elasticity of marginal utility from income

Introduction

This chapter conducts a review of an extensive literature devoted to the estimation of the elasticity of marginal utility from income, with a view towards obtaining a suitable value for estimating the direct social-welfare losses from income inequality. A series of estimation methods, alongside the results obtained, are presented and discussed in turn. From this review, a value of 1.5 is obtained. As discussed in the conclusion, this is consistent with other literature reviews.

The elasticity of marginal utility from income can be estimated through direct surveys, and through a variety of econometric techniques focused on expenditure and savings behaviour under conditions of uncertainty or inter-temporally variant income. A very large number of studies have been conducted utilising these two classes of methods over the last 35 years, although the results are not always consistent or commensurable. It should be noted that only a subsection of a very large number of studies are suitable for estimating ε in the context of an individualistic interpretation of the Atkinson index-in which case a generalised personal utility function in a context of fixed reference incomes is being estimated. A number of studies have been excluded for consideration on two criteria; firstly, those that utilise ε as a subjective parameter of social preferences; secondly, those that estimate ε in the context of varying reference incomes.[30]

Regarding variable reference income, some studies have utilised a 'veil of ignorance' lottery where individuals are asked to rank various income distribution in which they are told to imagine they will be placed at random.[31] This approach is consistent with the established practice of deriving cardinal utility functions from preferences under uncertainty, but the existence of variable reference incomes means external and positional affects are also captured by the estimation method. In these studies the Pareto or monotonicity principle is

[30] For subjective estimates of the elasticity of marginal (social) income, see Michele Bernasconi, "How should income be divided? questionnaire evidence from the theory of 'Impartial preferences'," *Journal of Economics* 9 (December 1, 2002): 163-195-195; Jukka Pirtilla and Roope Uusitalo, *Leaky Bucket in the Real World: Estimating Inequality Aversion Using Survey Data* (CESIFO, June 2007), http://www.cesifo-group.de/portal/pls/portal/docs/1/1187588.PDF; Yoram Amiel, John Creedy, and Stan Hurn, "Measuring Attitudes Towards Inequality," *The Scandinavian Journal of Economics* 101, no. 1 (March 1, 1999): 83-96.

[31] F. Carlsson, G. Gupta, and O. Johansson-Stenman, "Choosing from behind a veil of ignorance in India," *Applied Economics Letters* 10, no. 13 (August 11, 2011): 825-827; Olof Johansson-Stenman, Fredrik Carlsson, and Dinky Daruvala, "Measuring Future Grandparents' Preferences for Equality and Relative Standing," *The Economic Journal* 112 (April 1, 2002): 362-383.

often violated, and the social marginal utility of income of those on higher incomes can be negative, which is inconsistent with the functional form of the standard Atkinson SWF.[32] These studies provide excellent information on the magnitude of external and total social-welfare losses from inequality, and are utilised to that end in Chapter 3.

2.1 Estimates of ε derived from surveyed and revealed risk aversion

The elasticity of marginal utility of income can be readily derived from estimates of personal risk aversion, obtained from surveys and indirect estimation methods. As demonstrated by von Neumann, Morgenstern, Arrow, and Pratt, under conditions of uncertainty (or inter-temporal variation in income), expected utility from income or consumption takes a cardinal form, and the marginal utility across income levels can be derived from the implicit or explicit utility weight individuals give to consumption or income at different possible income levels.[33] This approach, usually known as Expected Utility Theory (EUT), has been widely employed to study a variety of economic behaviours, and has, often as a by-product, produced a large number of estimates for ε.

Both surveyed and revealed preferences have been utilised by EUT to estimate Constant Relative Risk Aversion (CRRA) functions, which are conceptually and formally equivalent to the isoelastic utility function utilised by Atkinson.[34] In survey methods, respondents are asked to rank lotteries on future income, where the mean and dispersion across options vary.[35]Relative risk aversion functions can also be estimated from actual decisions in the context of options with varying risk and mean payoff. Estimates from these two methods are summarised in table 7.

[32] On violation of the Pareto principle, see Chew Soo Hong, "A Generalization of the Quasilinear Mean with Applications to the Measurement of Income Inequality and Decision Theory Resolving the Allais Paradox," *Econometrica* 51, no. 4 (July 1, 1983): 1065-1092; Bernasconi, "How should income be divided? questionnaire evidence from the theory of 'Impartial preferences'"; Yoram Amiel and Frank Cowell, "Monotonicity, dominance and the Pareto principle," *Economics Letters* 45, no. 4 (August 1994): 447-450.

[33] On this approach, see Kenneth J. Arrow, "Uncertainty and the Welfare Economics of Medical Care: Reply (The Implications of Transaction Costs and Adjustment Lags)," *The American Economic Review* 55, no. 1/2 (March 1, 1965): 154-158; John von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behaviour* (Princeton: Princeton University Press, 1944); Kenneth J. Arrow, *Aspects of Risk-Bearing* (Helsinki: Yrjo Hansson Foundation, 1965); John W. Pratt, "Risk Aversion in the Small and in the Large," *Econometrica* 32, no. 1/2 (January 1, 1964): 122-136.

[34]Atkinson, "On the measurement of inequality."

[35]Whilst several studies have employed this method, many also vary reference incomes, and are therefore unsuitable for the reasons explained above

Table 7 Estimates of ε derived from surveyed and revealed risk aversion

Table sources

Source	Data source/Method	Population/Indicator	e estimate
Survey results			
Biswanger (1980)	Survey & experiment, lottery	Semi-arid rural India	1.37*
Barsky (1995)	Survey on retirement income prospects, middle aged respondents	U.S., first income quintile	3.91
		Q2	4.23
		Q3	4.33
		Q4	4.33
		Q5	3.98
		mean of above	4.16
Guiso and Paiella 2001	Lottery type question on security payoff. Bank of Italy	Italy	4.80
Eisenhaur and Ventura (2011)	as above	Italy	7.18-8.59
Dohmen et. al. 2005	Hypothetical lottery	Representative Sample, Germany	~4.0
Revealed preferences			
Friedman (1973)	Health Insurance	U.S.	~10
Friend and Blume (1975)	Demand for risky assets	U.S.	2.0-3.1
Farber (1978)	Union negotiations	U.S. Mine Workers, 1948-1973	3.0-3.7
Szpiro (1986)	Property & Liability Insurance	U.S.	1.29-1.79
Rozenweig and Wolpin (1993)	Investment in risky assets: Livestock	Rural India	0.96*
Halek and Eisenhauer (2001)	Life insurance	U.S.	3.74
Azar (2007)	Demand for risky assets	U.S.	~1.0
Kreisner, Vicusi, and Ziliak (2010)	Avoidance of risk of death	U.S.	~1.44
Bombardini andTrebbi (2011)	Lottery type game show	Italy	~1.0

*model has been calibrated to adjust for credit constraints (including self-imposed quasi-constraints) or uncertainty aversion

The estimates derived from these methods tend to be both rather high in comparison to estimates derived from other methods, and highly inconsistent, and this variability can be attributed to a series of conceptual and econometric problems. For example, the high estimates for ε that are often obtained from revealed preferences can be partly attributed to habitual or myopic risk aversion.[36]When data consistent with these effects is utilised to estimate a Constant Relative Risk Aversion (CRRA) equation, especially in the context of low relative risk, unreasonably high estimates for ε are often obtained- in some instances

[36]Evidence from surveys and direct experiments suggest that some absolute risk aversion exists, due to myopia or habit formation, even in cases where potential losses are insignificant in comparison to life-savings or permanent income. On this point, see for example Pierre Chiappori and Monica Paiella, *Relative Risk Aversion Is Constant: Evidence from Panel Data*, Working Paper, Department of Economic Studies Working Papers (Naples: University of Naples, 2008), http://economia.uniparthenope.it/ise/sito/DP/DP_5_2008.pdf.

producing three to four digit estimates.[37]In these instances, there is an element of model misspecification- risk aversion is not consistent with the specified CRRA model. Additionally, when revealed preferences are utilised, there is also often an assumption made that perfect information exists in regards to the mean payoffs and probabilities associated with alternative options. In the absence of sufficient information required to assess various options, various heuristic devices, or social norms may be utilised to inform decisions on risk taking behaviour, introducing various biases and noise. In addition, there is likely to be a degree of 'uncertainty aversion' which compounds pure risk aversion.[38]

These potential problems have motivated strident attacks on the ability of EUT to model risk aversion.[39] However, it has been shown that in general mean risk aversion (defined as the percentage premium for the risky option) is small for small gambles, as predicted by EUT.[40] In addition, various methods have been devised for adjusting for myopic or habitual risk aversion, and for credit constraints. Both credit constraints and heuristic or habitual approaches to risk aversion ('firewalling' some savings or income from risky decisions) can be modelled by estimating the portion of lifetime income that is capable of or willing to be brought forward, in order to smooth consumption in response to negative income shocks. Studies that have made corrections of this nature, for example Biswanger (1980) and Rozenweig and Wolpin (1993) have produced lower and more realistic estimates for ε, as have those where large or transparent risks are involved, such as Kreisner, Vicusi, and Ziliak (2010) and Bombardini and Trebbi (2011).[41] These results can be treated with some degree of seriousness, as opposed to the much higher figures, which could be cautiously interpreted as setting an upper bound for ε. Finally, it should be noted that the low variance

[37] See Hans P. Biswanger, "Attitudes towards Risk: Experimental Measurement in Rural India," *American Journal of Agricultural Economics* 62 (August 1980), http://karlan.yale.edu/fieldexperiments/pdf/Binswanger_Attitudes%20Toward%20Risk_Experimental%20Measurement%20in%20Rural%20India.pdf; Hans P. Biswanger, *Attitudes Towards Risk: Implications for Economic and Psychological Theories of Behaviour under risk in an Experiment in Rural India*, Working Paper, Economic Growth Centre Discussion Papers (New Haven: Economic Growth Centre, 1978); Shlomo Benartzi and Richard H. Thaler, "Myopic Loss Aversion and the Equity Premium Puzzle," *The Quarterly Journal of Economics* 110, no. 1 (February 1, 1995): 73-92. The results obtained by Biswanger are not included because a CRRA equation was not utilised and hence the results are incommensurable.

[38] On uncertainty aversion, see P. Anand, "Analysis of Uncertainty as Opposed to Risk: An Experimental Approach," *Agricultural Economics* 4 (1990): 145-63; David Kelsey, "Maxmin Expected Utility and Weight of Evidence," *Oxford Economic Papers* 46, no. 3, New Series (July 1, 1994): 425-444; D. Ellsberg, "Risk, Ambiguity and the Savage Axioms," *Quarterly Journal of Economics* 75 (n.d.): 643-69.

[39]M. Rabin, "Risk Aversion and Expected-Utility: A Calibration Theorem," *Econometrica* 68 (2000): 1281-1292.

[40] Whilst some risk aversion can be observed in some instances for small risks, negative risk aversion can also be observed (i.e. gambling). See Ignacio Palacios-Huerta, Roberto Serrano, and Oscar Volji, "Rejecting Small Gambles Under Expected Utility," *Economics Letters* 91, no. 2, Economics Working Papers (2006): 250-259.

[41] In the latter case, the context of a game show is likely to reduce the effect of myopic/habitual risk aversion, as the situation is so different from normal life choices where habits or heuristics may be employed. On the other hand, the situation may select those with low risk aversion.

across income quintiles obtained by Barsky lends support to the practice of utilising a constant elasticity of marginal utility function in the Atkinson SWF.[42]

2.2 Estimates for ε derived from intertemporal consumption behaviour

The value of ε can also be derived from data on consumption and saving behaviour over the life-cycle. The basic approach relies on estimating a 'Euler equation', where expected utility is maximised over time, in the context of variable interest rates and income. In this approach, ε is calculated as the inverse of the elasticity of intertemporal substitution of consumption (EIS)- a measure of the level of indifference to the allocation of lifetime consumption over time (and hence income level).[43] When the EIS is high, consumers are unconcerned about smoothing consumption over the life cycle- they will therefore save more when interest rates rise in order to maximise mean lifetime income. In contrast, when the IES is below one, consumers are primarily concerned with smoothing consumption rather than maximising lifetime income, and the income effect of increases in interest rates will outweigh the incentive effect. When the EIS is unity, the income and incentive effects of interest rates balance each other, and interest rate changes should have no effect on savings behaviour.[44]

Despite some troubling econometric issues, some consistent results have been obtained by this method. Estimates for ε derived from intertemporal consumption patterns range from .32 to 4.24 for developed countries; however a significant proportion of reported estimates are within a moderately tight band around the mean of 1.58. Especially noteworthy are the results obtained by Ogaki, Ostry and Reinhart (1996), which range from 1.57 to 1.63 for developed countries. Estimates for high income countries are summarised in table 8.

In general, the application of EUT to model consumption behaviour is dependent on an assumption of near-perfect capital markets and rational agents; although corrections have been introduced in some instances to model credit constraints. When results are estimated for developing countries with rudimentary capital markets, estimates for ε are likely to be biased upwards. Such an effect can arguably be found in the results of Ogaki, Ostry and Reinhart for low and middle income countries, where high estimates are found for low

[42] Other studies have confirmed that relative risk aversion is largely invariant of income, see Neal Blue and Tweeten, "The estimation of marginal utility of income for application to agricultural policy analysis."

[43] The model generally relies on determining the degree of variation in consumption patterns that result from pure time preferences and variation in needs across the life cycle- this is equivalent to the consumption pattern that would be chosen when interest rates are zero and no credit constraints exist. Form this baseline, the effect of changes in the interest rate on consumption over time, and the EIS, can be estimated.

[44] Timothy J. Besley and Costas Meghir, *Tax Based Savings Incentives*, unpublished paper, World Bank Savings Project (World Bank, September 1998), http://siteresources.worldbank.org/INTMACRO/Resources/besley.pdf.

income countries, although some of this variation may be due to genuinely higher levels of risk aversion amongst low income earners.[45] These results and Reinhart are reproduced in table 9. These are some of the very few consistent and plausible results for developing countries.[46]

A series of econometric issues arise in the context of estimating the EIS, and a lively debate exists in regards to the most appropriate and fruitful modelling techniques.[47] In particular, criticism has been levied against estimates derived from the Euler equation on grounds that is susceptible to the often large errors in available consumption data, and that it requires (largely unavailable) long panels to obtain robust estimates.[48] These modelling issues may explain the considerable variation in results obtained by different studies. Some additional variation across and within studies can be explained by the consumption measure utilised.[49] The lower estimates obtained by Blundell et al. can also be explained by variation in model

[45] Evidence suggesting that the EIS increases with wealth can also be found in: Andrew Atkeson and Masao Ogaki, "Wealth-varying intertemporal elasticities of substitution: Evidence from panel and aggregate data," *Journal of Monetary Economics* 38, no. 3 (December 1996): 507-534. However, if the wealthy have greater access to capital markets, then this does not imply differing value of ε. On the effect of credit constraints on Euler equation type models, see: Fatih Guvenen, "Reconciling conflicting evidence on the elasticity of intertemporal substitution: A macroeconomic perspective," *Journal of Monetary Economics* 53, no. 7 (October 2006): 1451-1472.

[46] Other plausible results have been obtained for India in: Atkeson and Ogaki, "Wealth-varying intertemporal elasticities of substitution: Evidence from panel and aggregate data."

[47] Alan Sule and Martin Browning, *Estimating Intertemporal Allocation Parameters using Synthetic Residual Estimation* (Cambridge: Centre for Financial Analysis & Policy, Cambridge University, January 2008), http://www-cfap.jbs.cam.ac.uk/publications/downloads/wp32.pdf.

[48] On data error, see David E. Runkle, "Liquidity constraints and the permanent-income hypothesis : Evidence from panel data," *Journal of Monetary Economics* 27, no. 1 (February 1991): 73-98; J. G. Altonji and A. Siow, "Testing the Response of Consumption to Income Changeswith Noisy Panel Data," *Quarterly Journal of Economics* 102 (1987): 293-328; Matthew D. Shapiro, "The permanent income hypothesis and the real interest rate : Some evidence from panel data," *Economics Letters* 14, no. 1 (1984): 93-100. According to Carroll, these data issues make Euler Equation estimated utilising micro-data insufficiently robust- see C. Carroll, "Death to the Log-Linearized Consumption Euler Equation! (And Very Poor Health to the Second-Order Approximation)," *Advances in Macroeconomics* 1, no. 1 (2001), http://www.bepress.com/bejm/advances/vol1/iss1/art6/.Anatsio& Low have countered that a sufficiently long panel allows for robust estimates- see Orazio P. Attanasio and Hamish Low, "Estimating Euler equations," *Review of Economic Dynamics* 7, no. 2 (April 2004): 406-435.

[49] Studies that utilise non-durables as the consumption measure produce higher results than those that have utilised a broader measure. The lower value obtained by Fauvel & Samson contains a bias in the other direction, due to the exclusion of services. As services clearly are 'non-durable', their exclusion increase the weight of the durable component of the consumption measure. Unlike the exclusion of durable goods, there are no theoretical grounds for excluding services; however the problem of calculating price indexes for services may produce practical reasons for exclusion. Yvon Fauvel and Lucie Samson, "Intertemporal Substitution and Durable Goods: An Empirical Analysis," *The Canadian Journal of Economics / Revue canadienne d'Economique* 24, no. 1 (February 1, 1991): 192-205. The presumed rational for this narrow definition of consumption is that purchases of durable goods should be treated as a form of saving and investment

specification, in this case, by an ad-hoc attempt to control for interest rate volatility in the 1980's.[50]

Table 8 Estimates of ε from intertemporal consumption behaviour: High income countries

Source	Country	Data period	Consumption measure	E estimate (mean)	Notes
Weber (1970)	U.S.			2.72	Asset return + Consumption eq.
Boskin (1978)	U.S.	1926-1969 ex. 1941-46	total consumption	2.5-3.33 (2.91)	
Skinner (1985)	U.S.	1972-3		2.0-5.0	CES model
Muellbauer (1987)	U.K.	1968-72		0.77	
Attanasio and Weber (1989)	U.K.	1970-84	non-durables	1.46 0.51	CES model Consumption + asset eq.
Fauvel and Samson (1991)	Canada	1961-86	durables & nondurables	0.97 0.77	 Excluding services
Patterson and Pesaran (1992)	U.S. U.K.	1955-89 1955-89	Non-durables & Services	4.69 3.66	
Zulia (1993)	Canada France Germany Italy Japan U.K. U.S.	1960-92	total consumption	.79-2.41 (1.60) .98-3.57 (2.28) .66-3.37 (2.02) .75-2.42 (1.58) .51-1.10 (.80) .71-1.52 (1.11) .85-1.42 (1.13	Lower and upper results are from different model specifications.
Blundell et al. (1994)	UK	1970-86		1.18-1.39 (1.27) .32-1.04 (.52)	Standard model Dummy variable for interest rate spike in 1980's
Beaudry and Van-Wincoop (1996)	U.S.	1953-91 1978-91 1953-91 1978-91	non-durables	2.69 0.95 2.94 2.06	 Variable tax rates
Hamori (1996)	Japan	1955-93		2.1 1.04	Lowest income quintile Highest income quintile
Ogaki, Ostry and Reinhart (1996)	Ireland Singapore U.K. Italy France Switzerland U.S. Average developed	1968-92	traded & non traded	1.63 1.59 1.59 1.59 1.59 1.58 1.57 1.58	Stone-Geary consumption model, IES allowed to vary with wealth
		Average all studies		1.6	

[50]According to Evans this represents the introduction of a 'relatively crude dummy variable adjustment to an otherwise sophisticated empirical model'. David J. Evans, "The Elasticity of Marginal Utility of Consumption: Estimates for 20 OECD Countries," *Fiscal Studies* 26, no. 2 (2005): 203.

Table 9 Estimates by Ogaki, Ostry and Reinhart (1996) for low to upper middle income countries

Country	Data period	Consumption measure	E estimate	Notes
Burkina Fasa	1968-92	Traded & non-traded	4.05	Stone-Geary Consumption model, IES allowed to vary with wealth
India			2.98	
Togo			2.68	
Kenya			2.31	
Sudan			2.22	
Ten poorest countries			5.21	
Phillipines			1.84	
Morocco			1.83	
Peru			1.72	
Chile			1.69	
Lower-Middle income countries			1.74	
Argentina			1.7	
Brazil			1.67	
Portugal			1.66	
Malaysia			1.65	
Venezuela			1.62	
upper-middle income countries			1.65	

2.3 Estimating ε derived from consumer demand: The Fisher, Frisch and Fellner method

Another method for estimating ε, pioneered by Fisher, Frisch, and Fellner (FFF), relies on the demand for preference independent goods, which enables a direct estimation of ε from consumption data, utilising the following equation.[51]

$$\varepsilon = \frac{(1 - wy)}{p}$$

Where y is the income elasticity of demand, p is the compensated price elasticity of demand, and w is the budget share of the preference independent good utilised.[52]

The FFF model produces relatively consistent results; however its utilisation is not without controversy. Firstly, the method is dependent on relatively strict preference independence- the class of goods selected must be neither substitutes nor complements to other goods in the consumption bundle. Whilst this strict condition has been utilised to discredit the FFF

[51] I. Fisher, "A statistical method for measuring marginal utility," in *The Economic Essays Contributed in Honour of J. Bates* (London: Macmillan, 1927), 157-93; R. Frisch, *New Methods of Measuring Marginal Utility* (Tubinger: J. C. B. Morh, 1932); W. Fellner, "Operational utility: the theoretical background and a measurement," in *Ten Economic Studies in the Tradition of Irving Fisher*, ed. W. Fellner (New York: Wiley, 1967).

[52] Evans, "The Elasticity of Marginal Utility of Consumption: Estimates for 20 OECD Countries," 204.

method, the assumption of preference-independence has been found to be valid for broad aggregates, and for food.[53]

As with other estimation methods, the FFF approach is sensitive to model specification. The constant demand elasticity model (CEM) has been the default method for estimating y and p, however alternatives exist, including the almost ideal demand system (AIDS) and the quadratic almost ideal demand system (QAIDS).[54] Support for the constant elasticity assumption can be found in data from the UK, where the income elasticity of demand for food was found to be largely constant during 1979-2000.[55] Cointegration methods have been utilised to test the validity of the CEM and AIDS models, with both options outperforming each other in different cases.[56]

One novel approach for estimating ε with some similarities to the FFF model is also considered here. In this approach, pioneered by Raj Chetty, ε is calculated from the income side, utilising the ratio of the income elasticity of labour to the compensated wage elasticity.[57] Utilising a variety of secondary sources to obtain data on these variables, Chetty obtained results ranging from .15 to 1.78 (mean .71) for the basic model, and .30-2.25 (mean .97) for an upper bound adjustment for labour-consumption complementarity. However, no adjustment was made to account for barriers to employment, which may lead to a significant understatement of ε.[58] A summary of relevant results is given in table 10.

[53]For criticism of the FFF method, see Nicholas Herbert Stern, "Welfare weights and the elasticity of marginal utility of income," in *Proceedings of the Annual Conference of University Teachers of Economics*, ed. M. Artis and R. Norbay (Oxford: Blackwell, 1977); Angus Deaton and John Muellbauer, "An Almost Ideal Demand System," *The American Economic Review* 70, no. 3 (June 1, 1980): 312-326. On the credibility of the want-independence assumption for broad classes, see Fellner, "Operational utility: the theoretical background and a measurement"; David J. Evans and Haluk Sezer, "Social discount rates for member countries of the European Union" 32 (2005): 47-59; E. A. Selvanathan, "A cross-county analysis of consumption patterns" 25 (1993): 1245-59; E. A. Selvanathan, "A System-Wide analysis of international consumption patterns: advanced econometric series" (University of Western Australia, 1988).

[54]Jan Van Daal and Arnold H. Q. M. Merkies, "A Note on the Quadratic Expenditure Model," *Econometrica* 57, no. 6 (November 1, 1989): 1439-1443; Deaton and Muellbauer, "An Almost Ideal Demand System"; James Banks, Richard Blundell, and Arthur Lewbel, "Quadratic Engel Curves and Consumer Demand," *The Review of Economics and Statistics* 79, no. 4 (November 1, 1997): 527-539.

[55]MAFF (Ministry of Agriculture, Forestry, and Fisheries, UK), *The National Food Survey* (London: Office for National Statistics, 2001), 97–98.

[56] For studies where the CEM outperforms the AIDS model, see E. Kula, "Estimation of the social rate of interest for India," *Journal of Agricultural Economics* 55, no. 1 (2004): 199-217; Evans, Kula, and Sezer, "Regional welfare weights for the UK: England, Scotland, Wales and Northern Ireland." For the alternative case, see David J. Evans, "A social discount rate for France," *Applied Economics Letters* 11 (2004): 803-808.

[57]Raj Chetty, "A New Method of Estimating Risk Aversion," *The American Economic Review* 96, no. 5 (December 1, 2006): 1821-1834.

[58]Raj Chetty, *Consumption Commitments, Unemployment Durations, and Local Risk Aversions*, Working Paper (Massachusetts: National Bureau of Economic Research, 2004), http://www.nber.org/tmp/35654-w10211.pdf.

Table 10 Estimates for ε derived from the FFF method

Source	Model	Country	Data Period	e estimate
Kula (1984)	CEM	U.S.A	1954-76	1.89
	CEM	Canada	1954-76	1.56
Kula (1985)	CEM	UK	1954-77	0.71
Blundell (1988)	AIDS	UK	1970-84	1.97
Blundell et al. (1993)	Agreggate QUAIDS (GMM)	UK	1970-84	1.06
	Micro QUAIDS (OLS)	UK		1.06
	Micro QUAIDS (GMM)	UK		1.37
Blundell et al (1994)	Generalised AIDS/QUAIDS	UK		1.29
Banks et. al. (1997)	QUAIDS	UK	1970-86	1.07
Clements at. al. (2001)	Various	Various		2.41
Evans and Sezer (2002)	CEM	UK	1967-97	1.64
Evans (2004)	CEM	UK	1965-01	1.6
Evans (2004b)	AIDS	France	1970-01	1.33
Chetty (2006)	Supply of labour, meta-study	Various	Various	.71-.97
		Average all studies:		1.42

2.4 Estimates for ε derived from taxation progressivity: The equal absolute sacrifice model

Another method that has been employed to estimate ε is the equal absolute sacrifice taxation model. This method relies on an assumption that governments set their income tax rates in a manner that is designed to impose an equal absolute sacrifice of utility (EAS) on each citizen.[59] If this is the case, then estimates for ε can be derived in a rather straightforward manner from the progressivity of the income tax schedule. In the opinion of the author, this is not a very promising estimation method; however a discussion of the method and summary of results is provided in order to provide a complete survey.

It should be noted that the EAS model should not be interpreted as producing a 'subjective' estimate for ε, and should therefore not be immediately ruled out for consideration. No normative judgement need be made on the equal absolute sacrifice principle- one simply has to accept that the rule is faithfully (even if unconsciously) applied by governments that have an accurate picture of the utility functions of their citizens.[60] This assumption is, however, rather tenuous. Whilst some evidence exists that governments do adopt principles consistent with the equal sacrifice model, the significant variation in tax progressivity across

[59] H.P. Young, "Progressive taxation and the equal sacrifice principle," *Journal of Public Economics* 32 (1987): 203-12; D.F. Vitaliano, "The tax sacrifice rules under alternative definitions of progressivity," *Public Finance Quarterly* 5 (1977): 489-94.

[60] The equal absolute sacrifice principle is strongly anti-egalitarian in comparison to a utilitarian framework, and in keeping with the perspective of this paper, should be rejected on normative grounds.

time and place suggest that other principles are employed in setting taxation schedules.[61] In particular, it is plausible that governments would depart from the equal sacrifice principle in both utilitarian/egalitarian or elitist directions due to political pressure for more or less equal post-transfer income distributions. Even if the principle of equal absolute sacrifice can be shown to be robust, there is little reason to suggest that governments are able to correctly estimate a representative utility function, and then apply that information to produce a taxation schedule that even approximately reflects the actual variation in marginal utility across income levels. Although little weight should be given to the results obtained by the method, they are remarkably consistent with the results obtained by the life-cycle and FFF models. A summary of estimates derived from the equal absolute sacrifice model is given in table 11.

Table 11 Estimates of ε derived from taxation progressivity and the equal absolute sacrifice model

Source	Country	ε value (income tax)	ε value (income tax and social security
Stern (1977)	U.K.	1.97	
Cowell and Gardiner (1999)	U.K.	1.41	1.28
Evans (2004b)	France	1.33	
Evans (2005)	20 OECD countries	1.4	
Percoco (2006)	Italy		1.35
Lopez (2008)	Argentina	1.3	
	Bolivia	1.5	
	Brazil	1.8	
	Chile	1.3	
	Colombia	1.8	
	Honduras	1.1	
	Mexico	1.3	
	Nicaragua	1.4	
	Peru	1.9	
	Average Latin America	1.5	

[61] For recent discussions in defence of the equal sacrifice model, see David Evans and Haluk Sezer, "A time preference measure of the social discount rate for the UK," *Applied Economics* 34, no. 15 (August 3, 2011): 1925-1934; Evans, "The Elasticity of Marginal Utility of Consumption: Estimates for 20 OECD Countries"; Frank A. Cowell and Gardiner, K. A., *Welfare Weights*, Working Paper (London: Office of Fair Trading, 1999), http://www.oft.gov.uk/shared_oft/reports/consumer_protection/oft282.pdf.

2.5 Discussion of Results: Choosing a value of ε for discounting income in relation to direct losses from inequality

This chapter has outlined a series of methods for estimating ε. The most consistent and methodological sound estimates have arguable been derived from intertemporal consumption data, utilising the FFF or intertemporal consumption approaches. These methods have produced estimates which are concentrated in the range of between one and two, with a mean of 1.4 and 1.6 respectively. On these grounds a mid-point value of 1.5 is adopted for the calculations in this paper.

This adopted value is somewhat consistent with results produced from other surveys of the existing literature. For some time the British Treasure recommended the use of a value of 1.5 for cost-benefit analysis, although it has been later reduced to 1.0, on the grounds of evidence given in Peace and Ulph (1989), which itself recommends a value of 1.25.[62] In a series of papers which a times criticise this downward adjustment, Peter Evens has provided evidence suggesting that the Treasury adopt a value close to the previous value of 1.5.[63]

Earlier surveys have also produced estimates somewhat consistent with a value of 1.5. Surveying results obtained from studies of choices under uncertainty, Dasgupta (1998) obtained a best bet figure of around 2.0, or slightly higher, whilst Blanchard & Fischer (1989) report that results based on intertemporal choices suggest a value close to but somewhat higher than unity.[64]

The survey conducted here is to my knowledge the most extensive to date of the literature on the personal utility function. A large body of consistent evidence has been compiled and reviewed, sufficient to enable an estimate to be obtained with a degree of confidence.

[62]Evans, "The Elasticity of Marginal Utility of Consumption: Estimates for 20 OECD Countries"; Pearce, D. and Ulph, D., "A social discount rate for the United Kingdom," in *Economics and Environment: Essays on Ecological Economics and Sustainable Development*, ed. Pearce D. (Cheltnham: Edward Elgar, 1998), http://www.uea.ac.uk/env/cserge/pub/wp/gec/gec_1995_01.htm.

[63]David J. Evans, "The elevated status of the elasticity of marginal utility of consumption," *Applied Economics Letters* 11, no. 7 (2004): 443-447; David J. Evans and Haluk Sezer, "Social discount rates for six major countries," *Applied Economics Letters* 11, no. 9 (2004): 557-560; Evans, Kula, and Sezer, "Regional welfare weights for the UK: England, Scotland, Wales and Northern Ireland."

[64]O. Blanchard and S. Fischer, *Lectures on Macroeconomics* (Cambridge Mass.: The MIT Press, 1989).

3 Estimating the indirect and total costs of income inequality

Introduction

The role of reference incomes and social patterns of consumption in determining the relationship between personal consumption and satisfaction has been long known to political economy, with Smith, Marx, and Veblen focusing attention on the social nature of consumption.[65] According to Marx:

> "A house may be large or small; as long as the surrounding houses are equally small it satisfies all social demands for a dwelling. But if a palace arises beside the little house, the little house shrinks to a hovel … the dweller will feel more and more uncomfortable, dissatisfied and cramped within its four walls."[66]

More recently, the role of positional effects in determining health and welfare outcomes has been the subject of rapidly growing literature within and across the disciplines of economics, political economy, psychology, and epidemiology. This literature suggests that income inequality can impose large social-welfare costs in addition to those that can be attributed to the convexity of the relationship between income and various outcomes, including reduced health outcomes and life satisfaction. In this regard, these costs can be treated as a form of negative externality.

Section 3.1 of this chapter outlines the pathways through which these external effects operate. The second section is devoted to the estimation of the social-welfare costs that are imposed in a series of areas. Mechanisms through which external effects operate include;

- Direct positional income effects (the envy and snob effect)
- Secondary positional effects(induced positional good consumption)
- Primary psychosocial effects (neuroendocrine responses)
- Secondary psychosocial effects (increased high risk and anti-social behaviour)
- Corrosive effects on social cohesion and coordinative capacity
- Corrosive effects on democratic culture and institutions (the oligarch effect)

Operating through these and possibly other mechanisms, indirect negative effects of income inequality can be observed in the following areas;

[65] For examples and discussion of early works dealing with positional concerns, see T. Veblen, *The Theory of the Leisure Class* (New York: McMillan, 1899); Andrew B. Trigg, "Veblen, Bourdieu, and Conspicuous Consumption.," *Journal of Economic Issues (Association for Evolutionary Economics)* 35, no. 1 (March 2001): 99-115; Tibor Scitovsky, *The Joyless Economy: The psychology of human satisfaction*, 1976.
[66] Karl Marx, "Wage labour and capital" (Marxist Internet Archive, 1847), http://www.marxists.org/archive/marx/works/1847/wage-labour/index.htm.

- Health outcomes, including mental health
- Happiness and life satisfaction
- Transaction costs
- Costs from crime, including defensive costs
- Resolution of conflicts, and adoption of innovations and reforms, (including those that are Pareto or Kaldor-Hicks efficient)
- Environmental outcomes

Section 3.2 and 3.3 are devoted to estimates of the effect of income inequality on health outcomes and total welfare respectively. In these estimates, an Atkinson type SWF is estimated from micro and macro data. At the micro level, surveys utilising an income lottery, as discussed in Chapter 2 can be employed, except in this case reference incomes also vary. In these 'Haryanyi lotteries' positional income effects are uncovered, and some, but not all of the negative external effects of high incomes (the induced envy effect) can be calculated, alongside values of ε that can be utilised to calculate an approximation of total social welfare losses from inequality. Additionally, Atkinson SWF functions can be calculated via the correlation between mean income, inequality, and life satisfaction, and between mean healthcare expenditures, background income inequality, and life expectancy. In this case, the Atkinson index is utilised as an expenditure divisor, reducing the expected effects of health expenditures and mean income on health and experienced utility outcomes in monotonic proportion to inequality. Utilising an iterative process, a value for ε can be calculated that provides the best possible fit to the available data.

When values for ε obtained from these methods are higher than those obtained in the previous section where only direct effects were considered, this can be taken as evidence of significant external effects. This is the case, and significantly larger values for ε are obtained when the aggregated direct and indirect costs are estimated. These values are generally between two and four. It should be noted that several of these effects can also be seen as imposing negative effects on economic growth. Discussions of these effects are deferred to chapter 4.

3.1 Positional income effects and social-welfare

3.1.1 Direct positional income effects

It has long been known that people compare their level of consumption and income to others, and that when personal income is well below a social standard or some social reference point, various feelings of resentment, inadequacy, and envy are likely to result.[67] Crucially, however, the effects of income inequality on happiness and life satisfaction do not operate purely through psychological channels. Envy can be a rational counterpart to class-based discrimination, which is generally exacerbated or facilitated by income inequality.[68] Increases in reference incomes can impose negative, material impacts on those who cannot keep pace with reference levels of consumption. A series of pathways exist through which these losses can accrue;

- The price of goods which are supply-inelastic, for example land and housing in some cities, will tend to rise with mean incomes. Increased income inequality can reduce the real purchasing power of those on less than mean incomes in relation to these assets or goods, even when their absolute incomes rise.[69] The price rises of some of these good can be further inflated by inequality induced positional expenditures.[70]

- Due to positional discrimination, the level of personal consumption, in relation to socially determined reference levels, can determine one's ability to take advantage or certain opportunities or access non-market 'goods'. When levels of personal consumption are below certain standards, the ability to access education, socialise with peers, enter into relationships, and obtain certain forms of employment is restricted as a result of discrimination or positional screening.[71] This discrimination is much less pronounced in more equal societies, where the dispersion in ability to

[67]H. L. Carr and V. L. Vignoles, "Keeping up with the Joneses: Status projection as symbolic self-completion," *European Journal of Social Psychology* 41, no. 4 (June 2011); O. L. Braun, "Psychological antecedents of conspicuous consumption," *Journal of Economic Psychology* 10, no. 2 (June 1989); Andrew E. Clark and Andrew J. Oswald, "Satisfaction and comparison income," *Journal of Public Economics* 61, no. 3 (September 1996): 359-381.

[68]Robert H. Frank, *Luxury Fever* (New York: Free Press, 1999).

[69]According to Matlack et al, 'In tight housing markets, the poor do (absolutely) worse when the rich get richer'. See Janna L. Matlack and Jacob Vigdor, "Do rising tides lift all prices? Income inequality and housing affordability," *Journal of Housing Economics* 17, no. 3 (2008): 212-224.

[70]Rachel E. Dwyer, "The McMansionization of America? Income stratification and the standard of living in housing, 1960-2000," *Research in Social Stratification and Mobility* 27, no. 4 (December 2009): 285-300; Robert H. Frank, *Does Rising InequalityHarm the Middle Class*, Occasional Paper, School of Economics Occasional Papers (Hobart: University of Tasmania, 2004).

[71]Postlewaite Andrew, "The social basis of interdependent preferences," *European Economic Review* 42, no. 3-5 (May 31, 1998): 779-800; Harold L. Cole, George J. Mailath, and Andrew Postlewaite, "Social Norms, Savings Behavior, and Growth," *Journal of Political Economy* 100, no. 6 (December 1, 1992): 1092-1125; R Collins, *The Credential Society: An Historical Sociology of Education and Stratification* (New York: Academic Press, 1979).

purchase positional goods is restricted by the reduced dispersion in disposable income.[72]

In these instances, Pareto improvements in income distribution which involve small relative gains for the poor and large relative gains for the rich may actually reduce mean social-welfare.[73] As the incomes of the rich increase, so do social reference incomes, and without corresponding increases in income across the spectrum, the absolute level of social opportunity for large sections of society can decrease. As aspirations and abilities are not distributed in proportion to wealth, stratification reduces the mean or aggregate level of social opportunity.[74] If, as hypothesised by Veblen, reference patterns of consumption are set by the wealthy, the effect of increased income inequality on reference consumption patterns can be especially pronounced.[75]

3.1.2 Secondary positional effects: Increased positional consumption

When access to various forms of opportunity is determined by ones consumption of positional goods in relation to social standards, it can be a rational response for an individual to increase consumption of those goods, to, in effect, signal a higher position in the income ladder than is actually achieved.[76] Collectively such a response is irrational and self-defeating.[77] Therefore, inequality induced increases in positional goods consumption

[72] Amartya K. Sen, *Development as freedom* (New York: Knopf, 1999).

[73] See Hong, "A Generalization of the Quasilinear Mean with Applications to the Measurement of Income Inequality and Decision Theory Resolving the Allais Paradox"; Bernasconi, "How should income be divided? questionnaire evidence from the theory of 'Impartial preferences'"; Amiel and Cowell, "Monotonicity, dominance and the Pareto principle."

[74] In a stratified society, some on high incomes may be presented with and avail themselves of many opportunities that they have little desire or ability to make full advantage of, whereas many on low incomes will, through inequality induced discrimination, be denied access to similar opportunities that they may be capable of more fully appreciating and taking advantage of.

[75] There is some evidence this is the case, see Samuel Bowles and Y. Park, "Emulation, inequality, and work hours: Was Thorsten Veblen right?," *Economic Journal* 115, no. 507 (November 2005); Fredrik W. Andersson, "Is concern for relative consumption a function of relative consumption," *Journal of Socio-Economics* 37, no. 1 (February 2008): 353-364. On general emulation and positional nature of consumption, see Jessica L. Harringer, "Conspicuous consumption and inequality: Theory and evidence" (Phd Thesis, State University of New York, 2010); Chris Tsoukis, "Keeping up with the joneses, growth, and distribution," *Scottish Journal of Political Economy* 54, no. 4 (2007): 575-600.

[76] R. Layard, "Human Satisfactions and Public Policy," *The Economic Journal* 90, no. 360 (December 1, 1980): 737-750; Michael J. Boskin and Eytan Sheshinski, "Optimal Redistributive Taxation When Individual Welfare Depends upon Relative Income," *The Quarterly Journal of Economics* 92, no. 4 (November 1, 1978): 589 -601; Amartya K. Sen, "Poor, Relatively Speaking," *Oxford Economic Papers* 35, no. 2, New Series (July 1, 1983): 153-169; Robert H. Frank and Adam Seth Levine, "Expenditure Cascades" (January 2007), http://www.aeaweb.org/annual_mtg_papers/2007/0107_1300_0202.pdf; Harringer, "Conspicuous consumption and inequality: Theory and evidence"; Herbert Walther, *Competitive Conspicuous Consumption, Household Saving and Income Inequality*, Working Paper, Growth and Employment in Europe: Sustainability and Competitiveness (Vienna: Vienna University of Economics and Business Administation, 2004), http://epub.wu.ac.at/1116/1/document.pdf; Tsoukis, "Keeping up with the joneses, growth, and distribution"; Frank, *Luxury Fever*.

[77] For a generalisation of this idea, see Lester C. Thurow, *Zero Sum Society* (New York: Basic Books, 1980).

represents a pure welfare loss. Additionally, positional concerns can lead to excessive working hours, and attendant negative secondary effects, in an attempt to match reference incomes or consumption patterns.[78]

Positional consumption has also been associated with increased levels of indebtedness and reduced levels of personal and aggregate savings.[79] These effects may have negative effects in relation to the level and stability of economic growth. These potential growth effects are assessed in Chapter 4.

3.1.3 Direct and indirect psychosocial effects

In the last 15 to 20 years, a series of studies, following from the ground-breaking Whitehall-II study, have established a relationship between low social status and autonomy over life and workplace decisions, and a series of illnesses, in particular cardiovascular disease.[80] This relationship operates at least partly through the inducement of damaging stress and low-esteem related neuroendocrine responses, including elevated corticosteroid and fibrinogen levels.[81]

These effects can be significant, and crucially, cannot be significantly ameliorated through increasing absolute incomes, or, at least in wealthy countries, through increased healthcare expenditures.[82] In high income countries where the marginal effect of aggregate healthcare

[78]Bowles and Park, "Emulation, inequality, and work hours: Was Thorsten Veblen right?"; R. Boheim and M. P. Taylor, "Actual and Preferred Working Hours," *British Journal of Industrial Relations* 42, no. 1 (2004), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=513356; Linda A. Bell and Richard B. Freeman, "The incentive for working hard: explaining hours worked differences in the US and Germany," *Labour Economics* 8, no. 2 (May 2001): 181-202; Mark Pingle and Mike Mitchell, "What motivates positional concerns for income?," *Journal of Economic Psychology* 23, no. 1 (February 2002): 127-148; Jeremy Reynolds, "You Can't Always Get the Hours You Want: Mismatches between Actual and Preferred Work Hours in the U.S.," *Social Forces* 81, no. 4 (June 1, 2003): 1171-1199; Steffen Otterbach, "Mismatches Between Actual and Preferred Work Time: Empirical Evidence of Hours Constraints in 21 Countries," *Journal of Consumer Policy* 33, no. 2 (June 1, 2010): 143-161; Claudio Micheletto and Jospep Pijoan-Mas, "Inequality, Hours and Labor MarketParticipation", October 2008, http://www.cemfi.es/~michela/MichelacciPijoan2paper.pdf.

[79]Frank and Levine, "Expenditure Cascades"; Harringer, "Conspicuous consumption and inequality: Theory and evidence"; Tsoukis, "Keeping up with the joneses, growth, and distribution."

[80]Michael Marmot and Richard G Wilkinson, "Psychosocial and material pathways in the relation between income and health: a response to Lynch et al," *BMJ* 322, no. 7296 (May 19, 2001): 1233 -1236; Richard Wilkinson, *Unhealthy Societies: The afflictions of inequality* (London: Routledge, 1992); James A. Macinko, Leiyu Shi, and Barbara Starfield, "Wage inequality, the health system, and infant mortality in wealthy industrialized countries, 1970-1996," *Social Science & Medicine* 58, no. 2 (January 2004): 279-292.

[81]E Brunner et al., "Childhood social circumstances and psychosocial and behavioural factors as determinants of plasma fibrinogen," *Lancet* 347 (1996): 1008-1013; A. Melhem and S. Conzen, "Connecting Environmental Stress to Cancer Cell Biology Through the Neuroendocrine Response," in *Encyclopedia of Environmental Health* (Burlington: Elsevier, 2011), 822-827; B. S. McEwan, "Protective and damaging effects of stress mediators," *New England Journal of Medicine* 338 (1998): 171-179; C.D. Conrad, R.L. Wright, and K.J. McLaughlin, "Stress and Vulnerability to Brain Damage," in *Encyclopaedia of Neuroscience* (Oxford: Academic Press, 2009), 481-488.

[82] See Richard Wilkinson and Kate Pickett, *The Spirit Level: Why Equality is Better for Everyone* (New York: Penguin, 2009).

expenditures is low, the cost of these psychosocial effects, expressed in terms of the increase in healthcare expenditure that would be required to offset them, can be exceptionally large. I provide estimates of these costs in section 3.3 for a large combined dataset, however the estimated costs for a high income subsample cannot be computed as the negative effects of inequality completely overshadow and positive effect of expenditures.[83]

A series of secondary negative effects can also result from income inequality via increased high risk and anti-social behaviours, which impose health and other costs, both on those with low status, and on society as a whole.[84]

3.1.4 Corrosive effects on social cohesion, coordinative capacity, and democratic institutions

Income inequality is also associated with reduced social-cohesion, trust, and to the concentration of political power amongst those at the top of the income distribution.[85] These outcomes can impair the ability of society to respond to a series of health, social and environmental problems- especially when the response is likely to be costly; the benefits accrue to those with low incomes and political power, and the cost fall at least partly on those with high levels of income and political power.[86] When both income and political power are highly concentrated, the policy formation process can become indifferent to the welfare of those on low incomes, and highly sensitive to the desires, including myopic desires, of those on high incomes.[87] In this situation, policy responses which may have very

[83] There is likely to be an element of reverse causality in the macro data. One solution would be to utilise micro data to determine the relationship between expenditures and health outcomes. Introducing this data to an analysis of the type conducted here would be a fruitful line of future research.

[84] Wilkinson and Pickett, *The Spirit Level: Why Equality is Better for Everyone*. (Wilkinson + Pickett)

[85] Eric M. Ulsaner, *The Moral Foundations of Trust* (Cambridge: Cambridge University Press, 2007); Robert D. Putnam, *Bowling alone: The collapse and revival of American community* (New York: Simon & Schuster, 2000).

[86] On barriers to effective public health policy, see: R. Evans, *Death in Hamburg* (New York: Oxford University Press, 1987); I Kawachi et al., "Social capital, income inequality, and mortality.," *American Journal of Public Health* 87, no. 9 (September 1, 1997): 1491-1498; Yew-Kwang Ng and Jianguo Wang, "Relative income, aspiration, environmental quality, individual and political myopia : Why may the rat-race for material growth be welfare-reducing?," *Mathematical Social Sciences* 26, no. 1 (July 1993): 3-23.

[87] On the relationship between income inequality, power imbalances, and democratic responsiveness, see: Bartels, Larry, "Economic Inequality and Political Representation" (Princeton University, Research Program in Political Economy, August 2005); Martin Gilens, "Inequality and Democratic Responsiveness," *Public Opinion Quarterly* 69, no. 5 (Special Issue 2005): 778 -796; Jeffery A. Winters and Benjamin I. Page, "Oligarchy in the United States?," *Perspectives on Policy* 7, no. 4 (December 2009): 731-751; Dani Rodrik, "Participatory Politics, Social Cooperation, and Economic Stability," *The American Economic Review* 90, no. 2 (May 1, 2000): 140-144; Lawrence Jacobs and Desmond King, *The Unsustainable American State* (New York: Oxford University Press, 2009); Lawrence R. Jacobs and Benjamin I. Page, "Who Influences U.S. Foreign Policy," *American Political Science Review* 99, no. 1 (February 2005).

high cost effectiveness may be frustrated, whilst far-less cost effectiveness or even counterproductive polices are pursued.[88]

3.1.5 Inequality and transaction costs

Additional losses are likely to result through increased transaction costs. There are several mechanisms through which income inequality may increase transaction costs:

- The demand for particular classes of positional goods is likely to be highly responsive to advertising and marketing efforts. The psychological effects that come with social-stratification, including low-esteem and competitiveness, are likely to make advertising more effective. To the extent that inequality increases positional concerns and positional consumption, it may also induce increased expenditures on advertising.[89] This can take the form of increased expenditure on advertising designed to impart positionality to otherwise non-positional goods.[90]
- Reduced levels of trust and social cohesion are likely to lead to increased transaction costs. In situations of low social capital, contracts and litigation may be used as substitutes for moral codes and informal regulation via communities.[91]
- When income inequality is also associated with income volatility, a greater use of credit and forms of insurance is employed to smooth consumption. Various transaction cost are associated with an increased use of these instruments to smooth consumption.[92]
- Inequality and positional driven consumption rises at the bottom of the income ladder can lead to high, and often unsustainable borrowing by low income earners. This expansion in credit provision can impose standard transaction costs, as well as financial instability.[93]

The relationship between advertising expenditures and income inequality is demonstrated for 23 industrialised countries in figure 4.[94] Advertising expenditures are only a small proportion of total transaction costs, especially in developed economies, and if total costs have a similar inequality gradient to advertising expenditures, then large welfare losses

[88]Ng and Wang, "Relative income, aspiration, environmental quality, individual and political myopia : Why may the rat-race for material growth be welfare-reducing?".
[89]Wilkinson and Pickett, *The Spirit Level: Why Equality is Better for Everyone*.
[90]Steven Saywer, "Advertising as a proxy for inter-class emulation: A Veblenian analysis" (Phd Thesis, New School University, 2008).
[91]Samuel Bowles and Herbert Gintis, "Efficient Redistribution: New Rules for Markets, States and Communities," in *Recasting Egalitarianism*, ed. Erik Olin Wright (London: Verso, 1998), 3-75.
[92]There is evidence that in the United States this effect is significant, and transitory shocks account for a large part of the increase in income inequality since the 1980's. See Blundell, Pistaferri, and Preston, "Consumption Inequality and Partial Insurance."
[93]Fadhel Kaboub, Zdravka Todorova, and Luisa Fernandez, "Inequality-led Financial Instability," *International Journal of Political Economy* 39, no. 1 (Spring 2010): 3-27; Michael Kumhof and Romain Ranciere, "Leveraging Inequality," *Finance and Development* 47, no. 4 (December 2010): 28-31.
[94] Reproduced from data published in Wilkinson and Pickett, *The Spirit Level: Why Equality is Better for Everyone*. Original data sources are United Nations Development Report, "Human Development report", 2006; World Advertising Research Centre, "World Advertising Trends", 2002.

could result from induced transaction costs.[95]. For a sense of proportion, estimates for the size of transaction costs in the US are given in figure 5.

Figure 4 Income inequality and advertising expenditures

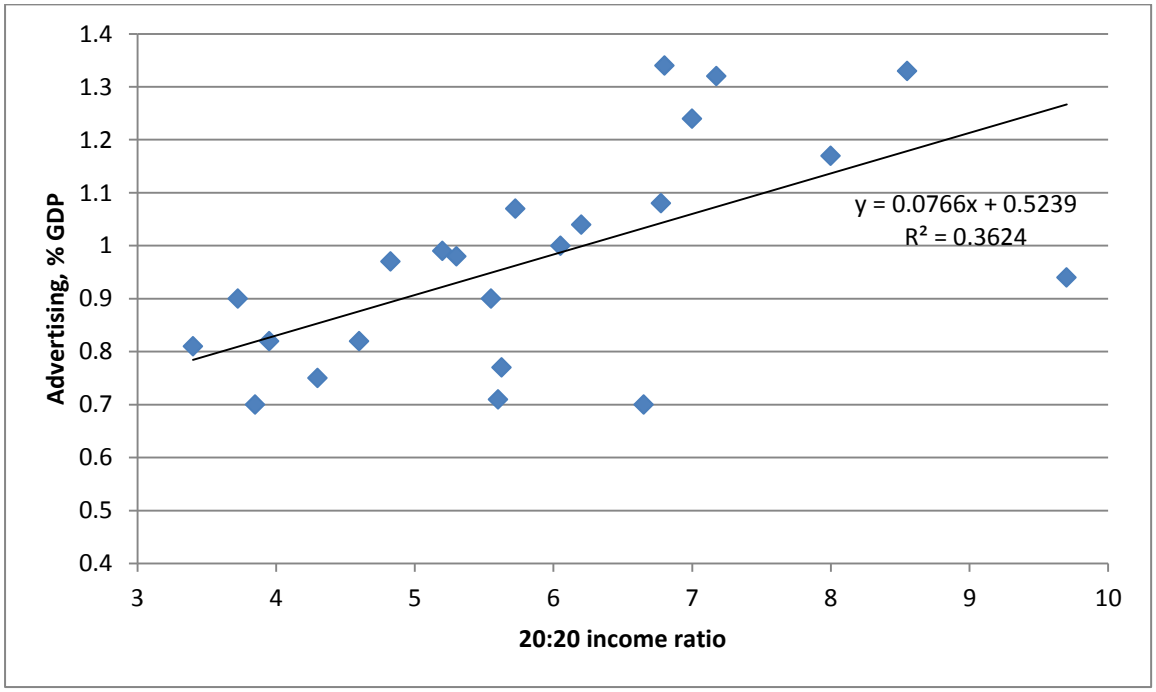
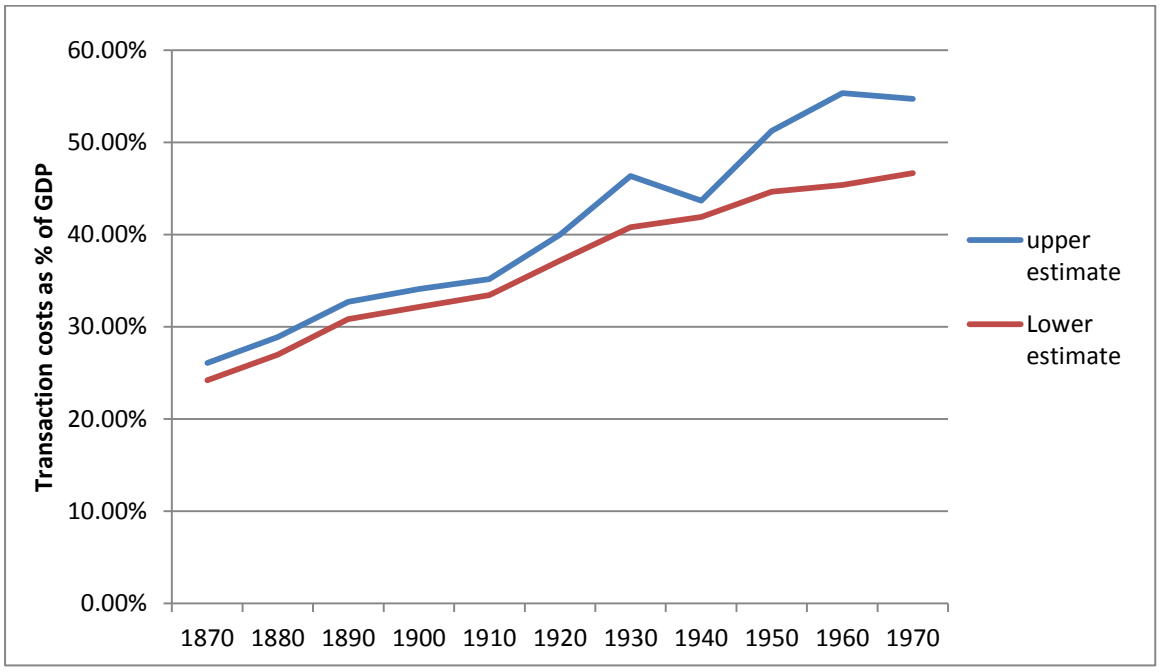


Figure 5 Estimate of transaction costs in the US economy by Wallis and North (1989)



[95] For an estimate of transaction costs in the united states, see John Joseph Wallis and Douglass C. North, "Measuring the Transaction Sector in the American Economy, 1870-1970," in *Long Term Factors in American Economic Growth*, ed. Stanley L. Engerman and Robert E. Gallman (Chicago: University of Chicago Press, 1989).

3.1.5.1 Estimates of the relationship between income inequality and size of the financial sector

In this section, I present estimates for the relationship between the size of the finance, insurance, and real estate sector (FIRE) and income inequality in the United States. The method of estimation is a basic OLS linear regression with the Gini index of income inequality as the main explanatory variable, alongside the year and a dummy to account for the rapid growth in FIRE between 1948 and 1956. This dummy value is equal to 1956 minus the date (negative values set to zero). [96] Regression statistics are given in table 12, and time series results are shown graphically in figure 6.

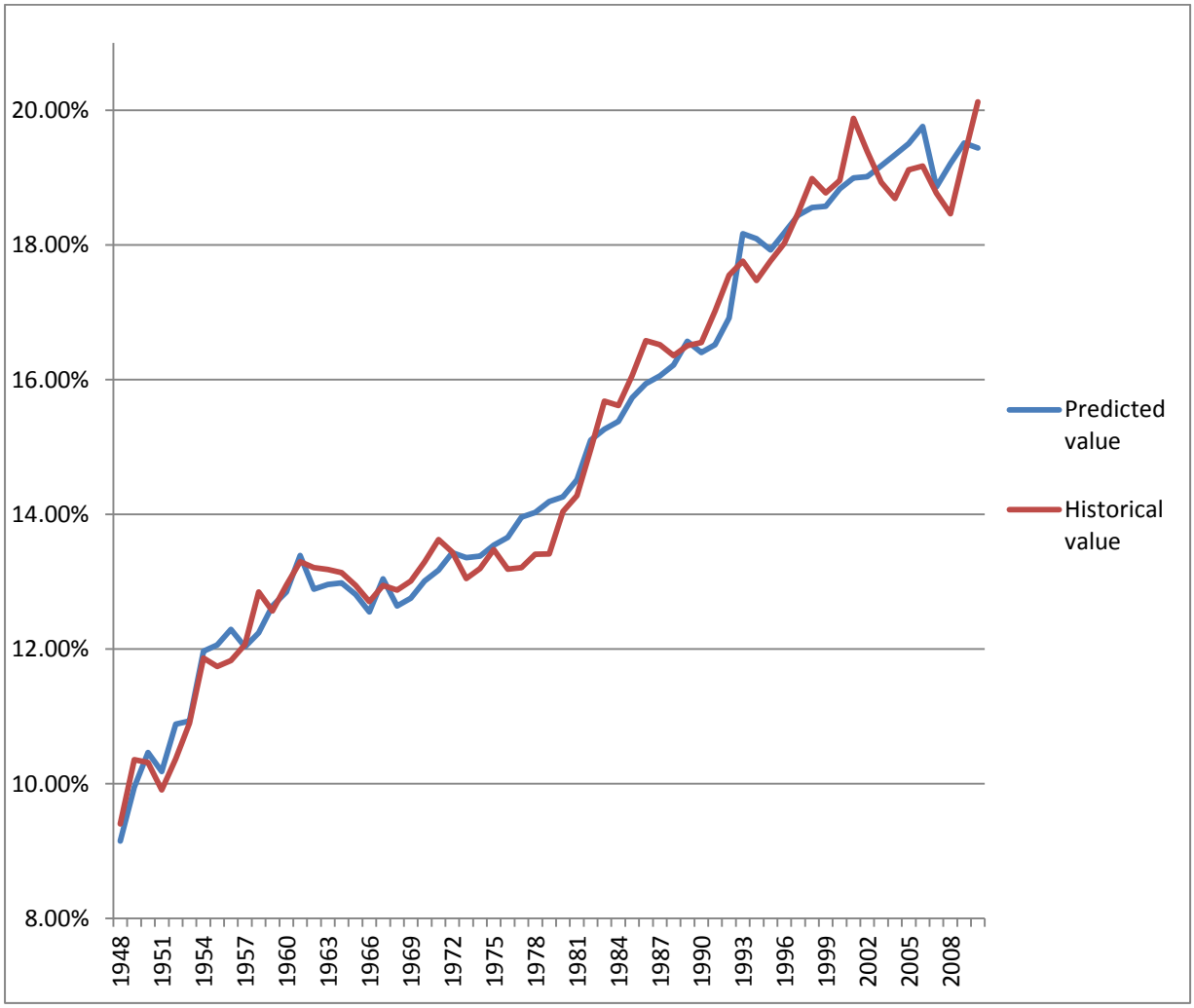
These results suggest a close relationship between inequality and development of the FIRE sector in the US. Although some reverse causality is likely, on theoretical grounds there is reason to suggest that inequality can induce extra expenditures on financial services, as a means to smooth or insure consumption in the context of income volatility and uncertainty. These additional, inequality induced transaction costs represent a deduction from the funds available for actual consumption, and hence represent an additional external welfare loss.

Table 12 Regression statistics, income inequality and FIRE sector size, US 1948-2010

Variable	Gini Index	Date (year)	Pre 1956	Y intercept
Coefficient	0.472093	0.000681	-0.004020	-1.378450
T stat	11.47	7.90	-8.65	-8.81
R^2	F stat	Critical T (.01)	P null	Observations
0.9822	1011.36	2.67	6.1 * 10^-44	63

[96] Time series data for the Gini index was obtained from the US Bureau of Census, and FIRE sector size from the Bureau of Economic Analysis NIPA tables 6.1B, 6.1C, 6.18. Due to changes in the NIPA data classification, there is some inconsistency across the time series, and a basic splicing method was utilised, with the later values adjusted to correlate with the earlier series at the switching point. This was achieved by multiplying the latter series (1998-2010) by 1.086.

Figure 6 Predicted and historical values, FIRE sector as percentage of GNI, US 1948-2010



3.1.6 Inequality and environmental impacts

Inequality can be associated with environmental degradation via two mechanisms:

- As outlined above, inequality is associated with a reduction in social solidarity, trust, and the corrosion of democratic institutions and coordinative capacity. In these instances, negative external effects of production and consumption are less likely to be addressed, either via moral codes or policy. When income inequality is associated with the concentration of political power, environmental policies which benefit the majority but impose costs on a wealthy minority may be politically unviable.
- In more unequal societies, a higher level of mean income is required to obtain the same level of mean utility. If a given level of mean utility is a policy target, perhaps imposed by democratic institutions or social pressures, a greater emphasis must be placed on growth 'at all cost' in order to reach the welfare target in a more unequal

society. Inequality induced positional concerns can drive such political demands for ever increasing capabilities to engage in positional consumption.[97]

When there are very strong environmental constraints to growth, welfare maximisation will be dependent on reducing inequality and maximising distributional efficiency.

3.1.7 Positional effects in low-income countries and across nations: do reference incomes negatively affect the welfare of the global poor?

Positional income effects are arguably more pronounced in wealthy countries. In order to investigate the likely effects of inequality on social welfare in developing countries, or at the international level, the relationship between income level and positional income effects must be known. In particular, the modelling of positional related losses in low income countries will result in biased estimates if relationships obtained from data relevant to wealthy countries, where positional concerns are strong, is applied to discount income in countries where positional concerns are weaker.

For analysis of welfare outcomes in low-income countries or globally, another important question is the strength of global positional effects. Do global mean incomes, or patterns of consumption in wealthy countries impact on the welfare effect of consumption in low-income counties? [98] If such an effect is present, then low income countries will over-consume in an attempt to emulate consumption patterns in high-income countries, possibly reducing both savings rates (and possibly growth) and distributional efficiency, and hence welfare outcomes. In recent years, a number of empirical studies have begun to address these questions. The findings of these studies are summarised in table 12.

Although the results from these studies are mixed, some basic generalisations from the results can be obtained in combination with some basic theoretical inferences. These insights can be summarised as:

- When people are very poor, absolute income level is the major determinant of welfare levels
- Reference incomes can have a major negative effect on welfare in developing countries, where incomes are above very low levels.
- There is evidence that positional effects increase with both personal and mean population income level

[97] Ng and Wang, "Relative income, aspiration, environmental quality, individual and political myopia : Why may the rat-race for material growth be welfare-reducing?".

[98] For an early argument in favour of such an effect, see R. Nurske, *Problems of Capital Formation in Underdeveloped Countries* (Oxford: Basil Blackwell, 1953). See also Jeffrey James, "Positional goods, conspicuous consumption and the international demonstration effect reconsidered," *World Development* 15, no. 4 (April 1987): 449-462.

These finding suggest that positional externalities will be present in developing countries; however they may be weaker than those in higher income countries. This has implications for the discounting of income in low-income countries. In this case, numerical estimates of positional effects derived from high income countries should be treated as upper bound estimates for developing countries. This approach is suggested for interpreting the results presented in appendix A.

Table 13 Review of empirical studies on positional and reference income effects on welfare in developing countries

Paper	Context	Finding
Ravalllin and Lokshin (2005)	Malawi	Relative income concerns exist among upper income groups
Bloch et. al. (2005)	India	The poor spend large amounts on weddings in order to signal status, leading to large welfare losses
Solnick, Hong, and Hemenway (2007)	China	Positional concerns in China and U.S. are of equal intensity
Kingdon and Knight (2007)	South Africa	Income level of distant neighbours and other racial groups reduces experienced utility. Effect rises with personal income level.
Bookwalter and Dalenberg (2009)	South Africa	Reference income effect set by parent's level, not community. Positive and negative effects of local reference incomes tend to balance.
Guillen-Royo (2008)	Peru	Reference income level negatively affects wellbeing
Knight et. al. (2009)	China	Reference incomes a major determinant of happiness
Knight and Gunatiliaka (2010)	China	Rural residents who migrate to urban regions are less happy than absolutely poorer rural residents who remain in poor regions.
Corrazini et al. (2011)	8 countries	Strength of positional concerns is positively related to counties mean income level
Corazinni et al.(March 2011)	8 countries	Major relative income effect in low income countries that strengthens with country mean income level
Brown et al. (2010)	rural China	High expenditures on positional goods, including by very poor. Large welfare losses from positional expenditures, including funerals, weddings, and gifts
Linssen et al. (2011)	rural India	Major negative observed welfare effects from positional consumption by rural poor who forgo basic goods consumption to match positional consumption patterns set by wealthier neighbours
Akay et. al. (2011)	very low income groups in Ethiopia	No positional effects amongst the very poor
van Kempen (2011)	Bolivia	Poor consumers will pay a premium for the status signalling effects embodied in brand name goods

3.2 Estimating the relationship between income inequality and social-welfare

In this section, the Atkinson SWF is applied to estimate the effect of income inequality on health outcomes, and to total utility, when measured through revealed preferences or indexes of happiness and life satisfaction. These estimation methods produce values for ε that incorporate external as well as direct effects of inequality. In this instance, ε is utilised as a general inequality aversion parameter which imperfectly reflects the elasticity of *social* utility from income.[99]

3.2.1 Inequality and health outcomes

In this section, a value for ε is derived to discount health expenditures due to direct and indirect losses induced by background income inequality. Existing estimates for direct losses suggest a value of around unity, which is considerably less than the value of 3.6 that I obtain from a large cross sectional analysis. This suggests that losses from positional and external effects outlined in section 3.2 can be very large. I estimate the unweighted average of total inequality induced losses across a dataset of 137 countries to to be equivalent to 52 % of healthcare expenditures.[100]

3.2.1.1 Inequality and the individual income effects on health outcomes

Income inequality directly reduces the effect of increases in mean income and health expenditures on mean health outcomes, due to the convexity of the expenditure-outcome relationship. Put simply, there is a declining marginal effect of increases in healthcare expenditures at the personal, and country level. In the same way that inequality reduces mean inequality in the context of declining marginal utility at the personal level, it also reduces mean health outcomes in the context of declining marginal health improvements from income and healthcare expenditures. The first two chapters of this thesis showed how this effect could be modelled through the use of the Atkinson index, and that a suitable

[99] It is an imperfect representation because the standard Atkinson SWF cannot return a negative marginal utility of income, although the aggregate effect of such positional externality derived losses can be imperfectly but accurately modelled by a suitably high value of ε. When such an approach is applied, the resulting estimation process is somewhat less sensitive to high incomes than is actually the case. An adjusted Atkinson type function can be utilised to properly model high income earners with negative marginal social utility from income, see Fredrik Carlsson, Dinky Daruvala, and Olof Johansson-Stenman, "Are People Inequality-Averse, or Just Risk-Averse?," *Economica* 72, no. 287 (2005): 375-396; Carlsson, Gupta, and Johansson-Stenman, "Choosing from behind a veil of ignorance in India."

[100] See results in appendix A.

value for e was around 1.5. Evidence suggests that for health care expenditures, the equivalent figure is close to 1- the ubiquitous logarithmic function.[101]

Although significant, the individual income effect generally cannot explain the total observed negative effects of income inequality on health outcomes.[102] I find that the total observed effect of inequality is best modelled by utilising a much higher ε value of 3.6 to discount healthcare expenditures due to total income inequality. This result is similar to the conclusions of Wolfson et al. (1999), which finds that only a small fraction of the observed negative effect of inequality on health outcomes across U.S states could be attributed to the individual income effect.[103] It is also consistent with a large body of evidence and literature which provides independent evidence for large relative income effects.[104]

3.2.1.2 Estimating aggregate effects of income inequality on health outcomes

A two-step process is adopted to estimate the impact of inequality on life expectancy, which is utilised as a proxy for general health outcomes. Firstly, the statistical significance of the inequality effect is confirmed with a standard OLS regression. Secondly, an Atkinson index is employed as an expenditure divisor to model the effect of inequality, and an appropriate value for e is obtained for discounting health expenditures. The following equation is estimated;

$$L = \ln(1 - A_{\varepsilon}).\mathrm{E} + \mathrm{b}$$

Where L is life expectancy, E is per-capita real (PPP adjusted) expenditure on healthcare, b is the Y intercept, and $A_{\varepsilon}$is an Atkinson index computed from the Gini index and an inequality aversion parameter (to be estimated), ε. This function therefore models life expectancy as

[101] For papers providing evidence of a convex relationship, see R. Ecob and G. Davey-Smith, "Income and health: what is the nature of the relationship?," *Social Science & Medicine* 48 (1999); E. Backlund, P. D. Sorlie, and N. J. Johnson, "The shape of the relationship between income and mortality in the United States. Evidence from the National Longitudinal Mortality Study.," *Annals of Epidemiology* 6, no. 1 (1996): 12-22; John W. Lynch and George A. Kaplan, "Understanding How Inequality in the Distribution of Income Affects Health," *Journal of Health Psychology* 2, no. 3 (July 1, 1997): 297 -314.

[102] However, a small number of papers have found it can explain all or most of the negative effect of income inequality on health outcomes. See Hugh Gravelle, "How much of the relation between population mortality and unequal distribution of income is a statistical artefact?," *BMJ* 316, no. 7128 (January 31, 1998): 382 -385; Kevin Fiscella and Peter Franks, "Poverty or income inequality as predictor of mortality: longitudinal cohort study," *BMJ* 314, no. 7096 (June 14, 1997): 1724.

[103]Michael Wolfson et al., "Relation between income inequality and mortality: empirical demonstration," *BMJ (British Medical Journal)* 319, no. 7215 (October 9, 1999): 953 -957. Evidence for effects beyond the personal income effect can also be found in; Mah-Jabeen Soobader and Felicia B. LeClere, "Aggregation and the measurement of income inequality: effects on morbidity," *Social Science & Medicine* 48, no. 6 (March 1999): 733-744; M. C. Daly et al., "Macro-to-micro links in the relation between income inequality and mortality," *Milbank Quarterly* 76, no. 3 (1998); Robert S. Kahn et al., "State income inequality, household income, and maternal mental and physical health: cross sectional national survey," *BMJ* 321, no. 7272 (November 25, 2000): 1311 -1315.

[104] For a brief outline, see Marmot and Wilkinson, "Psychosocial and material pathways in the relation between income and health: a response to Lynch et al."

the natural logarithm of health expenditures, discounted utilising the Atkinson method due to losses induced from background income inequality. This function is not readily estimable through traditional OLS regression methods, and an iterative process is instead adopted. In this approach, the regression is run for a series of values of ε. In each case, the R^2 is recorded, and the $\boldsymbol{\varepsilon}$ value that produces the best fit is returned as the estimated value. [105]

Unlike other studies, no controls are added for other determinates of welfare outcomes, including corruption, democracy, political violence etc., as these have been shown to be positively correlated with income inequality.[106] In this case, their inclusion would downwardly bias the estimate of losses. Unfortunately, the introduction of these confounding variables is a common feature of other related studies.

Values for L, E and the Gini index of income inequality were obtained for 141 countries. World Bank data was utilised for health expenditures and life expectancy, and an average of UN and CIA estimates were utilised for the Gini index. In a few cases both UN and CIA estimates for the Gini index were unavailable, and in these cases a suitable figure was obtained from the secondary literature. As in other studies utilising large global datasets, dummies were adopted for the ex-communist countries and for Sub-Saharan Africa.[107] The initial OLS regression results for the full sample are shown in table14.

Table 14 OLS statistical significance check: Gini index and life expectancy

Variable	Gini Index	Log expenditure	sub-Sahara dummy	Ex-comm dummy	Y intercept
Coefficient	-20.04	3.27	-12.78	-3.79	59.79
T stat	-5.36	11.74	-14.02	-4.43	21.97
R^2	F stat	Critical T (.01)	P null	Observations	
0.88	258.10	2.61	2.6 * 10^-33	137.00	

The iterative process adopted relies not on estimating the general shape of the income-outcome function across countries, which is given, but on minimising deviations from this general function that are induced by variations in inequality across countries. This is advantageous, because the concavity of the expenditure-life expectancy function across countries is different to the function being estimated, which captures the positional and

[105] Utilising the T value for adjusted income yields equivalent results.

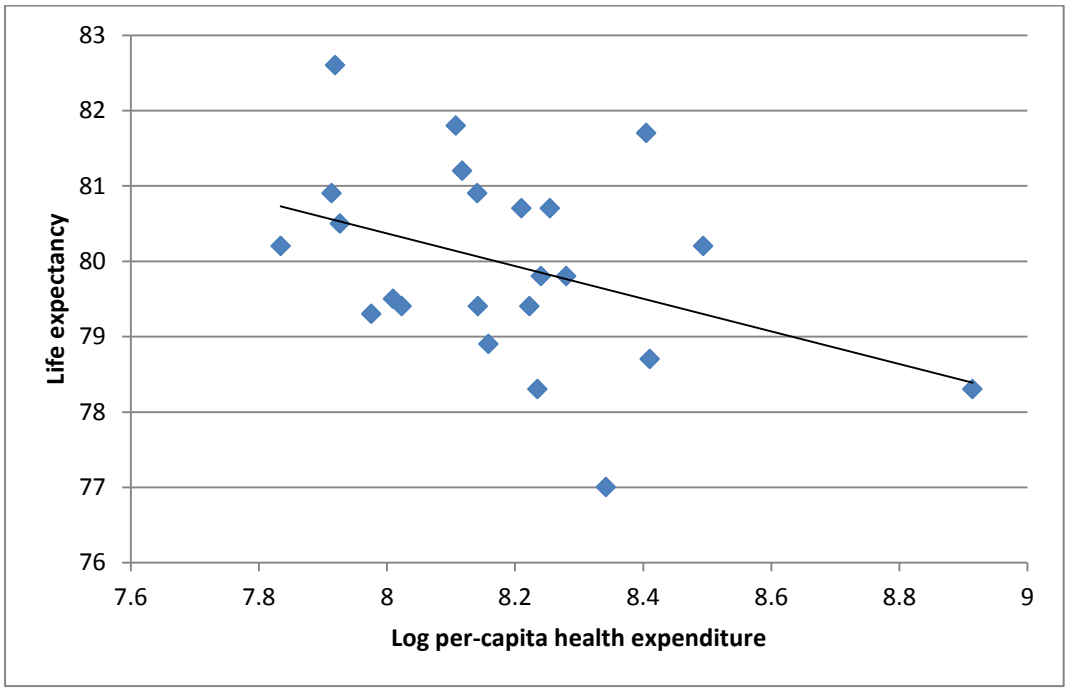
[106] See for example Alberto Alesina and Roberto Perotti, "Income distribution, political instability, and investment," *European Economic Review* 40, no. 6 (June 1996): 1203-1228; Y. Vanieris and D. Gupta, "Income Distribution and Sociopolitical Instability as Determinants of Savings: A Cross-Sectional Model," *Journal of Political Economy* 94 (1986): 873-83; Philip Keefer and Stephen Knack, "Polarisation, Politics and Property Rights: Links between Inequality and Growth," *Public Choice* 111, no. 1 (1996): 127-154.

[107] These dummies are highly significant. Other regional dummies including Latin America and North Africa were tested, but were found to be insignificant and were hence not adopted.

external effects of background inequality (which likely operate within, but not across countries).[108] It is hypothesised that high inequality will lead to underperformance in health outcomes, in comparison to more equal countries with similar unadjusted incomes. As the inequality aversion parameter increases, the predicted outcomes for these countries will be reduced, and vice versa, improving the R^2.

One potential problem with this approach is that the functional form adopted must fit the data well. When there is a poor fit, and in cases where inequality varies across income levels, adjustments to the inequality aversion parameter can lead to improved fit, not by correcting for individual deviations from the local average, but by shifting this average back towards the line of best fit. Such a possibility of spurious results exist in regards to the data set utilised here, where increased expenditures cease to have an observed positive effect on life expectancy beyond $2500, as shown in Figure 7.[109]

Figure 7 Life expectancy and per-capita health expenditures for high expenditure countries (expenditure >$2500)



In order to account for this non-linearity, a separate regression was run for a dataset with the over $2500 expenditure countries excised. In this data set, a very good general fit is observed. However, the result was found to be almost identical to that obtained from the

[108] Reference incomes are deemed to be set by regional or national, as opposed to global, consumption patterns.

[109] This non linearity could bias the estimate downwards, as lower values for ε would reduce the estimated life expectancy of wealthy countries and hence spuriously 'fix' the under-prediction 'problem', as inequality is on average lower at high incomes.

full dataset.[110] Therefore, the results from the full dataset are presented here with some confidence. Regression results are given in Table 14, for both the obtained value of e=3.6 and the poorer fitting results without any inequality adjustment ($\varepsilon = 0$). Figures 8 and 9 display scatters for the correlation between estimates and actual life expectancy values for both ε = 3.6 and ε = 0 respectively. In these scatters, the considerable improvement in fit that results from utilising the obtained ε value of 3.6 is clearly demonstrated.

Table 15- Regression statistics: ε estimate, full dataset

$\boldsymbol{\varepsilon = 3.6}$				
Variable	log of Atkinson adjusted income	Sub-Sahara dummy	Ex-Comm dummy	Y intercept
Coefficient	3.36	-12.67	-3.70	54.91
T stat	15.73	-14.38	-4.69	44.40
R^2	Critical T (.01)	P null	Observations	F Statistic
0.89	2.62	0.00	141	365.31
$\boldsymbol{\varepsilon = 0}$				
Coefficient	3.74	-13.18	-2.32	48.78
T stat	12.89	-13.24	-2.61	24.92
R^2	Critical T (.01)	P null	Observations	F Statistic
0.86	2.62	0.00	141	278.52

3.2.2 Estimating the relationship between income inequality and total utility utilising the Harsanyi lottery and reported life satisfaction

In this section, estimates for ε are obtained for total utility from personal income. Two methods are utilised for this estimation. Firstly, results from 'Harsanyi lotteries' are surveyed. In these survey based experiments, respondents are asked to rank various possible income distributions, which they are asked to imagine themselves of a family member being placed at random. This 'veil of ignorance' approach captures positional affects, as reference incomes vary across the different options. Secondly, I present results from a series of cross country regressions which produce estimates for ε from data on reported life satisfaction and happiness.

[110] A value of 3.575 was found for the restricted dataset, in comparison to 3.6 for the full dataset. A figure of larger than 100 was found for countries with health expenditures over $2500, suggesting inequality completely overshadows any income effect at this expenditures level.

Figure 8 Predicted and actual life expectancy, $\varepsilon = 0$

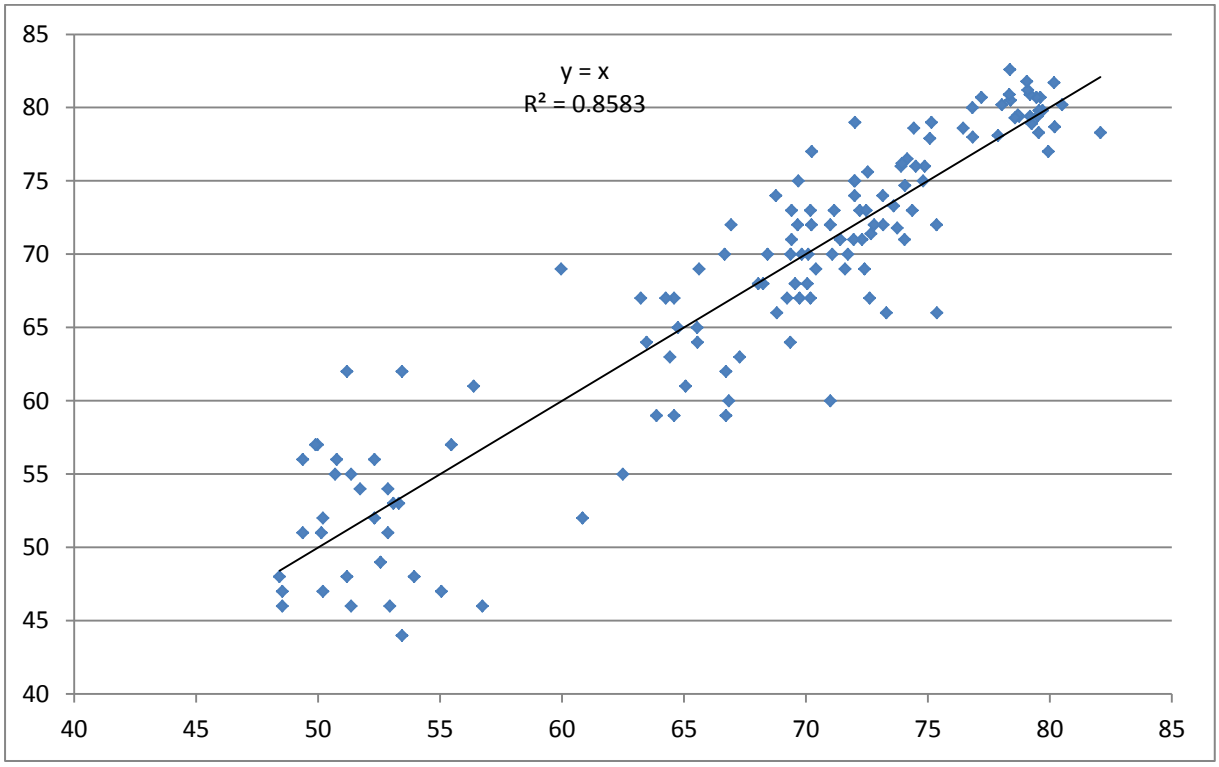
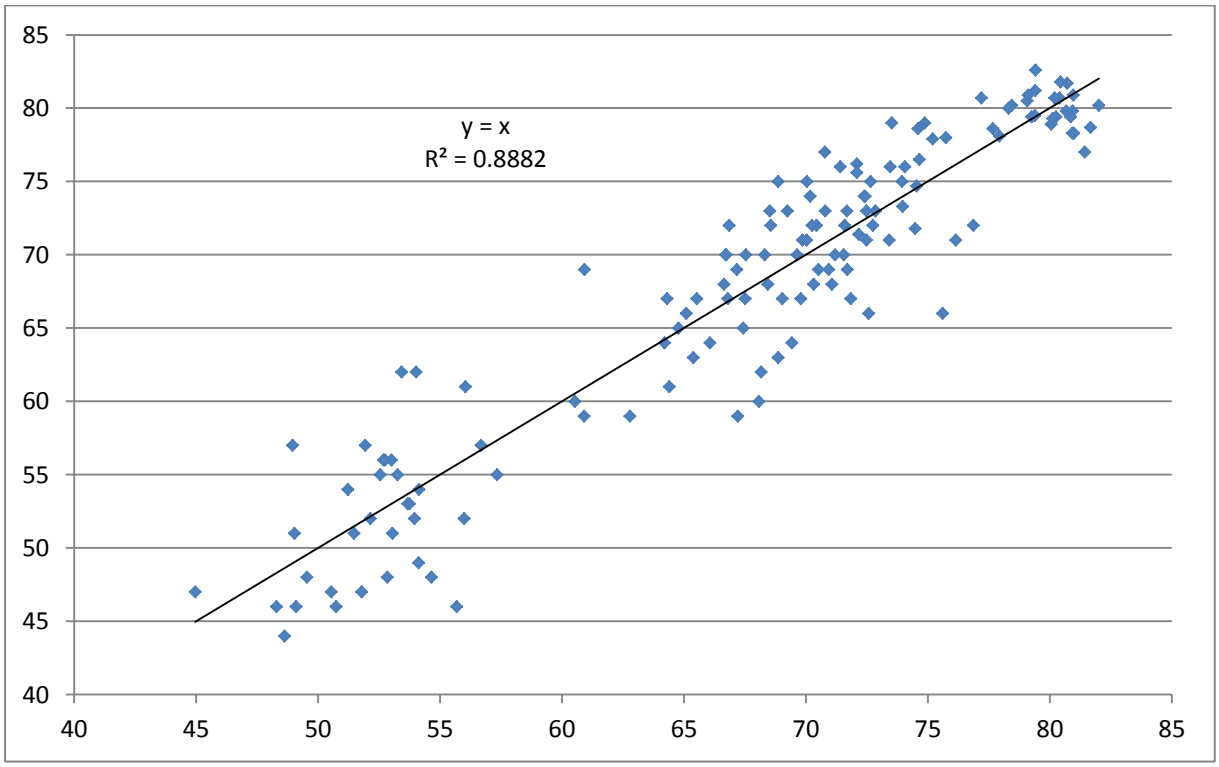


Figure 9 Predicted and actual life expectancy, $\varepsilon = 3.6$



3.2.2.1 Estimates for ε from Harsanyi Lotteries

The Harsanyi lottery is an application of the veil of ignorance thought experiment, which enables the explicit extension of the von Neumann-Morgenstern approach of deriving cardinal utility from preferences under uncertainty to the problem of interpersonal comparison.[111] According to Harsanyi:

> Value judgements concerning social welfare are a special case of judgments of preference, inasmuch as they are nonegoistic impersonal judgements of preferences . . . Now, a value judgement on the distribution of income would show the required impersonality to the highest degree if the person who made the judgement had to choose a particular income distribution in complete ignorance . . . of his own relative position . . . This choice in that hypothetical case would be a clear instance of 'choice involving risk'.[112]

For Harsanyi, the 'ethical preferences' revealed by such an experiment would reflect a utilitarian social-welfare function.[113]Crucially, the estimates obtained in such experiments capture inequality aversion motivated by positional concerns and, implicitly, negative external effects from living in a more unequal society. As stated by Hong (1986), when options similar to those presented in Harsanyi Lotteries exist, 'a rational individual may choose society A over society B fearing the high likelihood of having to envy the millionaires in society B' [114]. Only a few known studies have employed this method to produce estimates of ε, and these have employed a similar design.[115] Results from Harsanyi Lottery type studies are given in table 14.

Table 16 Estimates for ε from Harsanyi Lotteries

Source	Demographic	Indicator	ε estimate
Johansson-Stenman (2002)	Swedish University Students	Mean	3
Carlsson et. al. (2003)	Indian University Students	Mean	3.38
Carlsson et. al. (2005)	Swedish University Students	Mean	2.65
Pirtila and Uusitalo (2007)	Representative sample, 3000 Finns	Median	>3.0

[111]B. G. Dahlby, "Interpreting inequality measures in a Harsanyi framework," *Theory and Decision* 22, no. 3 (1987): 187-202.
[112]John C. Harsanyi, "Cadinal Utility in Welfare Economics and in the Thoery of Risk-Taking," *Journal of Political Economy* 63 (1953): 434–5.Quoted in Ibid.
[113]John C. Harsanyi, "Cardinal Welfare, Individualistic Ethics, and Interpersonal Comparisons of Utility," *Journal of Political Economy* 63, no. 4 (1955): 309-321. For a recent formalisation of the concept, see Simon Grant et al., "Generalized Utilitarianism and Harsanyi's Impartial Observer Theorem," *Econometrica* 78, no. 6 (2010): 1939-1971.
[114]Hong, "A Generalization of the Quasilinear Mean with Applications to the Measurement of Income Inequality and Decision Theory Resolving the Allais Paradox."
[115]A common method is to ask respondents to make a series of pairwise decisions between two income distributions, into which they are asked to imagine a hypothetical grandchild of theirs will be placed at random.

Harsanyi Lotteries and related methods can also be utilised to produce independent measures of inequality aversion, and measures of negative positional effects. For example, Carlssonet. al. (2005) finds that persons are often significantly inequality averse in the sense that they will choose to be individually poorer in order to live in a more equal society. Such a result is consistent with the respondent taking into account likely negative external effects. In Johansson-Stenman (2002) and Carlsson et. al. (2005), the marginal social utility from consumption, including induced external envy effects is estimated across the income spectrum. According to Johansson-Stenman (2002):

> Even with quite conservative parameters of relative risk aversion and positionality, the marginal social utility of income becomes negative above certain non-extreme income levels. At these income levels, it may then seem rational to increase taxes even if no one else would benefit in terms of increased consumption. Hence, taking money from the very rich and throwing (it) into the sea would be welfare improving, if no indirect effects would occur.[116]

Such a finding is also consistent with the series of positional based external effects outlined in section 3.2. [117]

3.2.2.2 Estimating ε from reported life satisfaction

In this section, I apply the method utilised in section 3.2.1 to estimate a value of ε for discounting total income in reference to its correlation with reported life satisfaction. The use of life satisfaction as the metric of utility is an operationalisation of Kahneman's concept of 'experienced utility'.[118] This approach has the advantage of in theory better reflecting actual outcomes, as opposed to often myopic preferences.[119]However, the approach adopted is prone to the myriad of problems associated with utilising self-reported metrics, which can be influenced by cultural and reference effects. In particular, it is possible that inequality is associated with a culture of exaggerating personal capabilities and 'achievements'.[120] If life satisfaction is seen by as related to life achievements, these effects will downwardly bias estimates of the negative effect of inequality.

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[116]Johansson-Stenman, Carlsson, and Daruvala, "Measuring Future Grandparents' Preferences for Equality and Relative Standing," 381.

[117] See also Amiel and Cowell, "Monotonicity, dominance and the Pareto principle."

[118] See for example Daniel Kahneman, Peter P. Wakker, and Rakesh Sarin, "Back to Bentham? Explorations of Experienced Utility," *The Quarterly Journal of Economics* 112, no. 2 (May 1, 1997): 375-405; Daniel Kahneman and Alan B. Krueger, "Developments in the Measurement of Subjective Well-Being," *The Journal of Economic Perspectives* 20, no. 1 (January 1, 2006): 3-24; Daniel Kahneman and Robert Sugden, "Experienced Utility as a Standard of Policy Evaluation," *Environmental and Resource Economics* 32, no. 1 (March 2005): 161-181.

[119]This is advantageous, because it is possible that preferences for equality that are driven by positional concerns are partially myopic. Such an effect would appear to be minor or not present if strong negative effects of inequality on experienced utility are also established

[120] See Wilkinson and Pickett, *The Spirit Level: Why Equality is Better for Everyone*.

The results from this set of regressions are not as strong as those relating to health outcomes, suggesting some of these confounding effects may be present. However, for countries with a GNI per-capita in excess of $15 000, I find a very high value of 4.2 for ε. This is consistent with other studies that have found evidence to support significant effects of income inequality on life satisfaction or happiness.[121]

Data for these regressions is similar to the dataset utilised for the health outcomes regressions, however in this case an index of reported life satisfaction has replaced life expectancy, and World Bank data for 2008 GNI per-capita (PPP) has replaced health care expenditures.

As in the health outcome analysis, initial investigation consisted of a standard OLS regression with regional dummies, to establish the statistical significance of income inequality as an explanatory variable. For the full data set, the T-stat for the Gini index is only significant at the 10% level. A second regression run on a dataset restricted to high-income countries with GNI per-capita larger than $15,000 per annum is significant at 1%. Results are shown in tables 17 and 18 respectively. Estimates for ε were then derived utilising the method outlined in section 3.33.Regression results for the point estimate for ε and for ε=0 are given for both the full and restricted dataset are given in tables 19 and 20. Results are shown graphically in figures 10 and 11.

Table 17 Statistical significance check: Gini index and reported life satisfaction- full dataset

Variable	Gini Index	Log GNI	Latin America dummy	Ex-Comm dummy	East Asia High income	Y intercept
Coefficient	-1.54	0.57	0.58	-1.43	-1.13	1.79
T stat	-1.79	9.73	2.76	-7.90	-2.06	2.44
R^2	F stat	Critical T (.1)	P null	Observations		
0.59	37.28	1.66	3.4*10^-4	137		

[121] See for example: Monica Hanssen, "Is equality a determinant of well-being? A cross-national analysis of income inequality and self-reported life satisfaction" (Master's Thesis, Georgetown University, 2011); Paolo Verme, "Life Satisfaction and Income Inequality," *Review of Income and Wealth* 57, no. 1 (2011): 111-127; Chau-kiu Cheung and Kwan-kwok Leung, "Ways by which Comparable Income Affects Life Satisfaction in Hong Kong," *Social Indicators Research* 87, no. 1 (May 1, 2008): 169-187-187; Guglielmo Maria Caporale et al., "Income and happiness across Europe: Do reference values matter?," *Journal of Economic Psychology* 30, no. 1 (February 2009): 42-51; Takashi Oshio and Miki Kobayashi, "Income inequality, perceived happiness, and self-rated health: Evidence from nationwide surveys in Japan," *Social Science & Medicine* 70, no. 9 (May 2010): 1358-1366; Alberto Alesina, Rafael Di Tella, and Robert MacCulloch, "Inequality and happiness: are Europeans and Americans different?," *Journal of Public Economics* 88, no. 9-10 (August 2004): 2009-2042; Carola Gruen and Stephan Klasen, "Growth, inequality, and welfare: comparisons across space and time," *Oxford Economic Papers* 60, no. 2 (April 1, 2008): 212 -236; Takashi Oshio and Miki Kobayashi, "Area-Level Income Inequality and Individual Happiness: Evidence from Japan," *Journal of Happiness Studies* 12, no. 4 (September 2010): 633-649. A relationship between equality an happiness or life satisfaction holds up when equality results from redistributive polices, see Alexander Pacek and Benjamin Radcliff, "Assessing the Welfare State: The Politics of Happiness," *Perspectives on Politics* 6, no. 2 (2008): 267-277; Radcliff, "Politics, Markets, and Life Satisfaction: The Political Economy of Human Happiness."

Table 18 Statistical significance check: Gini index and reported life satisfaction-High income countries

Variable	Gini Index	Log GNI	Ex-Comm dummy	East Asia High income	Y intercept
Coefficient	-5.47	1.05	-1.25	-1.17	-1.83
T stat	-3.84	2.98	-4.84	-2.06	-0.48
R^2	F stat	Critical T (.01)	P null	Observations	
0.59	37.28	2.74	5.4*10^-4	35	

Table 19 Regression statistics- Health outcomes and income inequality, full sample

$\boldsymbol{\varepsilon = 1.1}$					
Variable	log of Atkinson Adjusted GNI	Latin America Dummy	Ex-Comm dummy	East Asia High income	Y intercept
Coefficient	0.59	0.53	-1.40	-1.11	1.22
T stat	11.76	2.71	-8.01	-2.03	0.42
R^2	Critical T (.01)	P null	Observations	F statistic	
0.5840	2.61	2.01*10^-4	137.00	46.32	
$\boldsymbol{\varepsilon = 0}$					
Coefficient	0.62	0.44	-1.34	-1.06	0.77
T stat	11.57	2.22	-7.64	-1.93	1.65
R^2	Critical T (.01)	P null	Observations	F Statistic	
0.5772	2.61	2.1*10^-4	141.00	45.05	

Table 20 Regression statistics- Health outcomes and income inequality, high-income countries

$\boldsymbol{\varepsilon = 4.2}$				
Variable	log of Atkinson adjusted GNI	Ex-Comm dummy	East Asia High income	Y intercept
Coefficient	1.11	-1.22	-1.19	-3.38
T stat	5.68	-6.29	-3.70	-1.78
R^2	Critical T (.01)	P null	Observations	F statistic
0.83	2.74	3.3*10^-4	37.00	55.14
$\boldsymbol{\varepsilon = 0}$				
Coefficient	1.36	-1.06	-1.06	-6.87
T stat	3.40	-3.56	-2.75	-1.64
R^2	Critical T (.01)	P null	Observations	F Statistic
0.75	2.74	6.7*10^-4	37.00	34.59

Figure 10 Estimated vs actual life satisfaction: high-income dataset $\varepsilon = 0$

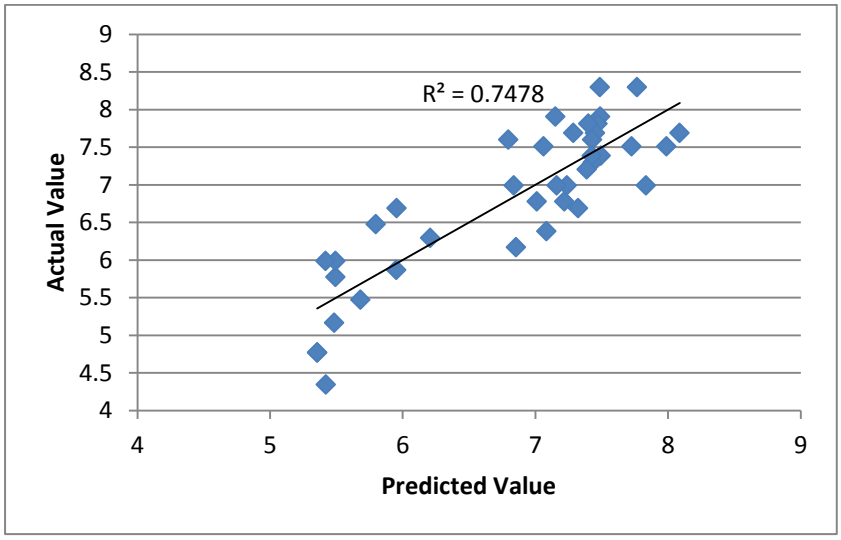
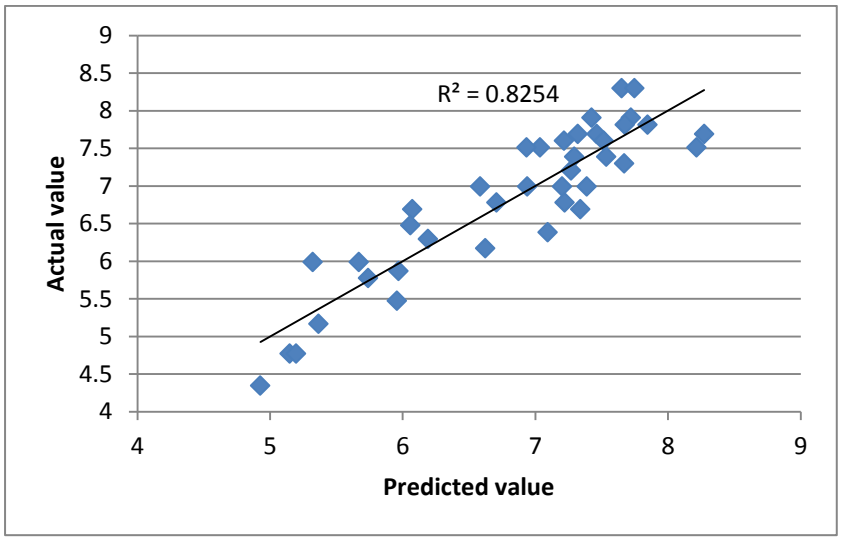


Figure 11 Estimated vs actual like satisfaction: high–income dataset, $\varepsilon = 4.2$



3.2.2.3 Choosing an estimate for ε to discount income due to total inequality effects

With the exception of the full period estimate derived from reported life satisfaction, the results obtained or surveyed in this section have been relatively consistent, ranging from 2.65 to 4.2. Given the potential problems associated with utilising self-reported life satisfaction, and the somewhat inconsistent results obtained, more weight is given here to the results obtained from Haryanyi lotteries. From these results, I adopt a value of 3.0 as a conservative estimate for ε. Given the fact that the results obtained from Harsanyi lotteries do not capture all possible positional effects, this result should be treated as a lower bound. However, due to the sensitivity of the Atkinson index at high values of ε and the small number of studies surveyed, a conservative approach to discounting income in relation to

total losses from inequality is adopted. The design and running of Harsanyi-lottery studies capturing the total-losses from inequality (in which respondents are asked to explicitly take into account all external effects) across varied demographics, is a precondition for more accurate estimates of ε.[122]

3.3 Calculating inequality discounted GNI per-capita

In this section, I utilise the estimates for ε obtained in the previous sections to compute a table of inequality adjusted GNI for a series of countries. For each country, a Thiel-L or MLD index of unwarranted consumption inequality is estimated from the Gini index. From this index, inequality discounted health expenditures and total GNI can be calculated. Firstly, estimates are calculated to remove direct losses from inequality. In this calculation, health expenditures are discounted utilising an Atkinson index with ε =1, whilst remaining expenditure is discounted utilising the value of 1.5 obtained in Chapter 2. Secondly, total losses are calculated. In this estimation, a value of ε = 3.6, obtained in section 3.2.1 is utilised to discount health expenditures. A value of 3.0, taken as a consensus value from the methods and results outlined in section 3.2.2, is utilised to discount the non-health portion of GNI. Total and Inequality adjusted expenditure, alongside the absolute and relative magnitude of losses is given in table 26 for 137 countries, located in the appendix A. In this table, the results are ranked by inequality adjusted GNI per capita.

It should be noted that a decision has been taken to discount the portion of income devoted to savings and investment utilising values of ε of 1.5 and 3 for direct and indirect losses respectively. This is defensible on the grounds that future income streams from these investments are likely to be distributed in a manner similar to the current distribution of income. The same decision has been made for non-health government consumption. Technically, many services provided by governments are pure public goods, for example roads and environmental protection. Given the positional concerns outlined above, there is a strong argument for increased provision of public goods, especially if this is funded through highly progressive taxation, on the grounds that there is likely to be less inequality induced losses to distributional efficiency from these expenditures.[123] However, there is also evidence that increased inequality is associated with increased expenditures devoted to

[122] One option in this regard is to ask respondents to choose between societies with different income profiles, life expectancies, murder rates, incidences of mental illness etc.

[123] Michael J. Boskin and Eytan Sheshinski, "Optimal Redistributive Taxation When Individual Welfare Depends Upon Relative Income," *The Quarterly Journal of Economics* 92, no. 4 (November 1, 1978): 589-601; Y. K. Ng, "Relative-income effects and the appropriate level of public expenditure," *Oxford Economic Papers* 39, no. 2 (June 1987): 293-300; Richard B. Howarth, "Status effects and environmental externalities," *Ecological Economics* 16, no. 1 (January 1996): 25-34; Olof Johansson-Stenman, Fredrik Carlsson, and Dinky Daruvala, "Measuring Future Grandparents' Preferences for Equality and Relative Standing," *The Economic Journal* 112 (April 1, 2002): 362-383; Lester C. Thurow, "The Income Distribution as a Pure Public Good," *The Quarterly Journal of Economics* 85, no. 2 (May 1, 1971): 327 -336; Robert H. Frank, "The frame of reference as a public good," *Economic Journal* 107, no. 4 (November 1997): 1832-1847.

offsetting social problems associated with inequality, whilst education expenditures are likely to be less effective in more unequal settings.[124] This may mean that high public expenditures may be a sign of more problems to address, rather than more thoroughgoing attempts to address a given level of social problems. Additionally, the personal utility of some classes of public goods is largely determined by personal income- roads are of no use if one cannot afford a car, and the enforcement of property rights is of little value to those with almost no property. In the absence of any developed method for discounting government expenditures, I adopt a second best method of discounting these expenditures as if they were personal income.

It is worth noting that the value utilised to discount income in relation to total, including positional losses has been derived from a small number of empirical studies that have mostly utilised data obtained from developed countries with the results obtained by Carlsson et. al. (2003) from surveys of Indian students being a notable exception. As discussed in section 3.1.7, there is some evidence that positional effects decline with country level income, but still remain large and significant. Therefore, for the poorer countries in this sample, the total welfare losses computed should be treated as an upper bound, with the direct losses forming the lower bound of the estimate. Unfortunately, without a larger number of relevant empirical studies, it is impossible to estimate the income gradient of positional effects.

The egalitarian implications of these results are readily apparent. The direct social welfare losses from inequality are generally large and significant, with an unweighted average of 28% of GNI. Total losses are on average equivalent to a massive 48% of GNI. Significantly, large changes in rank are observed when countries are ranked by unadjusted and adjusted GNI. For example, Sweden, in third place in terms of adjusted income, is well ahead of the significantly richer Singapore, in twentieth place. Kyrgystan, with a GNI per capita of $2,190 outranks South Africa with a much larger GNI per-capita of $10,010.

Conclusion

This chapter has outlined a series of mechanism through which inequality can indirectly lead to reduced health and welfare outcomes. Utilising a variety of estimation methods, suitable values of ε for discounting health expenditures and personal income have been obtained. The final results for aggregate social welfare losses are on average very large, and comprise the greater portion of GNI in many countries. This suggests that social-welfare maximising policy should be strongly egalitarian, unless strong negative growth effects are associated with progressive redistribution.

[124]Wilkinson and Pickett, *The Spirit Level: Why Equality is Better for Everyone*.

4 The growth-equality trade off and economic policy

Introduction

Despite the potentially very large social-welfare gains that can be achieved through reductions in income inequality, the question of growth and the possibility of an inequality-growth trade-off is still important. Modest growth effects, compound over time, can lead to large variations in mean income and hence income based or determined measures of social-welfare. Even if it is accepted that in high income countries increased mean income levels cease to have any major effect on welfare outcomes, a large proportion of the world's population live in countries where this income level is yet to be achieved.[125] In addition, growth may itself be equality promoting, to the extent that it reduces unemployment and increases the volume of funds available for egalitarian social policies.[126] Furthermore, egalitarian political strategies and polices may be politically contingent on maintaining a suitably high level of economic growth – in order to provide a growing stream of income capable of satisfying a series of powerful political agents and the population in general. Rapid growth enables the real incomes of low income earners to be raised significantly, without necessitating politically difficult absolute reductions in the real incomes of other section of society. Even in contexts where growth is seen as an unimportant or unviable aim (for example due to environmental constraints), there are good reasons to ensure that policy maintains or increases labour productivity, implying a certain degree of capital intensity and hence investment. For these reasons, the strongly egalitarian result derived in the previous chapters must be combined with an analysis of the likely or potential dynamic effects of egalitarian reform.

Given the previously established strong social welfare promoting effects of income equality, social-welfare maximising policy should have a strong preference for egalitarian outcomes, unless there are significant and strong negative impacts on economic growth. If no negative growth effects from equality exist at any inequality level, then social welfare maximising distributional policy is a simple problem of reducing inequality to the level associated with marginal utility equalisation. When equality is associated with negative growth effects at relevant levels of inequality, the ideal level of inequality will exist at a point where further

[125] The argument that growth is unimportant in high income countries is put in the following works: Clive Hamilton, *Growth Fetish* (Sydney: Allen & Unwin, 2003); Clive Hamilton and Richard Denniss, *Affluenza: When Too Much is Never Enough* (Sydney: Allen & Unwin, 2005).

[126] Jih Y. Chang and Rati Ram, "Level of Development, Rate of Economic Growth, and Income Inequality," *Economic Development and Cultural Change* 48, no. 4 (July 1, 2000): 787-799.

increases in equality induce negative growth effects that just outweigh further welfare gains from distributional efficiency.[127]

Economic theory suggests a series of channels through which both positive and negative growth effects can result from decreases in income inequality. Whilst this ambiguity leads to a general theoretical indeterminacy, different theoretical approaches provide a series of empirically testable hypothesis, enabling econometric clarification of the main theoretical postulates. Furthermore, many of the theorised channels leading to positive of negative growth outcomes are hypothesised or found to be non-linear or situation dependent. These theoretical and empirical insights together provide a basis for assessing the likely growth impact of egalitarian redistribution in different situations. In general, these analyses lead to a view of a non-linear growth-equality relationship, with growth being maximised at moderate levels of inequality. In this case, the welfare maximising level of inequality will lie somewhere between the level associated with growth maximisation, and that associated with distributional efficiency maximisation. Using this bracketing procedure, the long–run welfare optimum Gini index is likely to lie between 0.15 and 0.35, although the exact range and figure will be determined by policy and structural variables, and may be not very far from the level associated with distributional efficiency maximisation.

Crucially, the growth-equality relationship is open to modification via economic policy and structural reform. In the context of both positive and negative partial effects from equality on growth, superior outcomes can be obtained via reforms which maximise the positive effects of equality and mitigate and suppress the negative effects. In particular, high equality and high growth can be simultaneously achieved if equality can be made consistent with high levels of profitability, savings and physical capital accumulation. This outcome can be achieved by two types of reforms. Firstly, increases in wage and asset equality can reduce equality, without negatively impacting on aggregate profitability. Secondly, reforms aimed at increasing the rate of profit-reinvestment can increase the volume of productive investment at a given level of aggregate profitability. In this regard, structural changes associated with ‘neoliberalism’ and ‘financialisation’ can be seen to have negatively impacted on the terms of the growth-equality trade-off, lowering the rate of profit reinvestment, and asset and wage equality. In this context, it is possible that egalitarian shifts in income distribution, particularly those driven by generalised wage explosions, will lead to modest distributional efficiency gains and potentially large negative growth impacts, unless these egalitarian shifts are accompanied by reforms of the nature outlined above. In this case, welfare maximising policy should be seen as comprising a complementary package of both equality and investment promoting structural reforms.

[127] This problem can be seen as equivalent to the Ramsey model of an optimal savings rate, except in this case, inequality is equivalent to the savings rate - it reduces welfare statically, but has a positive dynamic effect through increasing growth mean incomes.

This chapter is divided into three sections. The first section assesses the growth-equality relationship from a supply side analysis. Firstly, endogenous growth theory is employed to analyse the determinants of growth. Various mechanisms hypothesised by the theoretical literature of leading to positive and negative equality-growth relationships are then outlined, alongside relevant empirical evidence. From this analysis, a likely non-linear effect of inequality on both human and physical capital accumulation is deemed to be likely. However, at common levels of inequality, equality promotes human capital accumulation and has a negative or indeterminate effect on physical capital accumulation. This provides a basis for systematising the equality-growth and equality-welfare relationship and clarifying the relevant trade-off parameters.

The second section analyses the growth-equality trade-off from the standpoint of post-Keynesian demand theory. In this approach, increases in profit share can have indeterminate effects on aggregate demand. Although evidence suggests that aggregate demand can be wage-led, this is unlikely to be the case over the long-run, especially in open and credit-constrained economies. Furthermore, macroeconomic interventions can, subject to long-run financing constraints, impose near optimal levels of economic activity at any plausible functional distribution. Therefore, the optimal functional distribution is determined in the long-run by supply-side considerations. The resolution of demand side problems and constraints in the context of a flexible functional distribution is dependent on the capacity of government to determine the rate of aggregate investment. This implies a significant degree of government economic intervention, which is congruent with the pro-investment policy options discussed in the section three.

The third section specifically addresses the structural and policy determinates of the equality-growth relationship, by way of comparative economic analysis. Both the level of wage and asset inequality and the rate of profit reinvestment are found to be highly variable across countries. In particular, in their high growth phases, Korea, Japan and Taiwan were characterised by very high rates of profit reinvestment, high levels of asset equality, and hence a combination of very rapid growth rates and somewhat egalitarian outcomes, leading to very rapid increases in welfare levels. In contrast, those economies characterised by reliance on equity markets to coordinate investment funding have lower rates of profit reinvestment. This variability in structural performance is underlined by original empirical research on the profit-investment relationship in both China and the United States. I find that, in comparison to the United States, only a small proportion of China's exceptionally high rate of investment can be attributed to high rates of return to capital, and the greater portion should be attributed to an investment promoting economic structure. Additionally, investment is less sensitive to the rate of return in China than in the United States. This variability in structural performance suggests that structural reform can vary by large degrees the parameters of the growth-equality trade-off and lead to very large welfare gains. In general terms, the central task of welfare maximising redistributive policy is in enacting a shift in expenditures from social-welfare diminishing luxury and positional

consumption towards productive investment and/or consumption with a high marginal social utility. This can be obtained at the firm level by increasing the rate of profit retention and reinvestment.

4.1 Inequality and growth – theory and evidence

In the last 15 years, a large body of literature has been produced devoted to theoretical and empirical analysis of the growth-equality relationship. This section reviews this evidence, and proceeds to present a stylised systematisation of the equality-growth-welfare relationship. In this systematisation, equality has contradictory effects on human and physical capital accumulation at levels of inequality near the welfare optimum (low levels of inequality). A negative relationship between equality and physical capital accumulation is hypothesised to operate as a counterpart to a positive relationship between inequality, profitability, and physical capital accumulation. A key result of this section is that shifting the parameters of this equality-capital accumulation trade-off is the key to simultaneously achieving high growth and equality. The role of demand constraints in affecting this trade-off are then assessed in section 4.2. The policy options available for simultaneously maximising equality and physical capital accumulation are discussed in section 4.3.

4.1.1 Endogenous growth theory, factor inputs, and the equality-growth trade-off

One of the major questions within growth theory is the comparative role of exogenous and endogenous factors in long-run growth. A related question concerns the comparative role of producible (physical and human capital, technology, infrastructure) and non-producible (land, environmental inputs, unskilled labour) factor inputs, and the residual which can be attributed to none of these inputs (total factor productivity). There are a large number of competing growth models proposed in the literature, which include or omit various factors, and impose various functional constraints. Without taking a position on these debates it is possible to present a generalised growth equation which is capable of capturing the key insights of endogenous growth theory.

I propose the following semi-endogenous growth theory model, in order to help clarify the growth-equality trade off problem. I proceed from a basic augmented Solow-Swan growth model:

$$Y = PK^{a}C^{b}H^{c}L^{d}E^{e}$$

Where P is TFP, K is ordinary physical capital, C is public goods and infrastructure, H is human capital, L is unskilled labour, E is environmental inputs, and a, b, c, d and e are the

relevant factor shares.[128] When there are no direct scale effects, $a + b + c + d + e = 1$, and hence sustained growth (as opposed to level) effects from variability in factor accumulation rates is only possible when $d + e \leq 0$. As this is unlikely, output growth will converge towards the rate of TPF growth as per the Solow-Swan model, although likely at a slower pace and with greater effect of broad investment on the equilibrium output level. It should be noted that the possibility of positive spill-over effects or, conversely monopoly rents means that the relevant factor shares cannot be computed from marginal or average private returns, and must instead be derived from macro-level econometric studies. These studies suggest that total factor accumulation can explain a large share of economic growth, and hence modifications to the rate of factor accumulation can lead to relatively sustained increases in the rate of economic expansion.

Some of these spill-over effects are likely to be non-linear, and hence cannot be captured simply by a factor share exponent such as a, b, c etc. In this case they can enter as explanatory variables into an endogenous or semi-endogenous total factor productivity equation.

I suggest that TFP can be modelled as a semi-endogenous variable. I propose the following formalisation:

$$P = F(1 - e^{-T/F})$$

Where F is the productivity frontier and T is a measure of emulative (reverse engineering) or embodied technology. F is a function of pure and high-level applied research, and is largely determined at an international level (somewhat exogenously for the purposes of this study).[129] T can be formalised as follows;

$$T = f(r, e, o, c, s, m)$$

Where r is expenditures on applied or emulative research and development, and e is embodied technology (a spill-over effect from investment that is somewhat proportional to expenditures on new or advanced capital goods). The other terms are variables that determine the efficiency of expenditures on research and embodied technology; o is a measure of intellectual openness and information sharing; c is a measure of concentration and coordination of research efforts; s is a measure of scale effects; and m is a measure of management and institutional proficiency and efficiency.

One additional option is to nest functions of this type. For example, firms may converge towards a national industry best practice, in proportion to their own investments in new

[128] In this case, total labour input is a combination of L and H. In this case, a relatively small but skilled labour force can substitute for a larger, less skilled labour force.

[129] For a similar approach to modelling productivity growth, see Wu Yanrui, "Is China's economic growth sustainable? A productivity analysis," *China Economic Review* 11, no. 3 (Winter 2000): 278-296.

machinery and efforts devoted to assimilating national best practices. The same approach can be applied to regions and localities.[130]

In this model, sustained growth is possible provided there are sufficiently large shares to producible factors and/or strong spill-over effects on productivity, and the economy is sufficiently far away from the theoretical productivity frontier. Given the variability in productivity within regions and sectors across and within even highly developed economies, this theoretical productivity frontier is likely to be some distance from average levels of productivity even in developed countries. There is therefore likely to be sustained growth effects from policies that affect the rate of factor accumulation, with this effect diminishing but not disappearing altogether in the wealthy countries. This theoretical outcome is consistent with international growth empirics, where the primary finding is one of conditional convergence- poorer countries tend to catch up with the richer countries, but generally only on the condition of achieving sustained human and physical capital accumulation. At the same time, wealthy countries such as Singapore which have maintained high rates of physical capital accumulation, and developed good infrastructure and a highly skilled workforce, have maintained high labour productivity growth rates. Alternatively, where capital accumulation has slowed, such as Japan and the United States, so too has labour productivity growth.

The growth function outlined above has not been calibrated to actual data. Instead, the formalisation has been presented in order to clarify some key concepts in growth theory, which are consistent with some 'stylised facts' obtained by the comparative growth literature. These stylised facts, which are remarkable consistent with classical economic concepts, are listed below:

- Factor inputs are the primary forces in economic growth. Internationally, there is a very strong correlation between the pace of growth and capital accumulation, defined narrowly in terms of physical capital, or broadly to include human capital.[131]
- Strongly diminishing returns to physical capital are the exception, rather than the rule of growth experiences. Only within a few, mostly autarkic centrally-planned economies, has high investment levels coincided with low growth and rapidly rising capital-output ratios.[132]

[130] In this case, at each level of nesting, a term equal to the local productivity frontier divided by the average level of productivity must be inserted.

[131] Andrew Glyn, "Does aggregate profitability really matter?," *Cambridge Journal of Economics* 21, no. 5 (1997): 593 -619.

[132] Econometric analysis of the economies of the USSR and Warsaw Pact countries have produced exceptionally low estimates of the elasticity of substitution between capital and labour. See Martin Weitzman, "Soviet Postwar Economic Growth and Capital-Labour Substitution," *The American Economic Review* 60 (1970); Robert S. Whitesell, "The Influence of Central Planning on the Economic Slowdown in the Soviet Union and Eastern Europe: A Comparative Production Function Analysis," *Economica* 52, no. 206, New Series (May 1985): 235-244; Robert C. Allen, *From Farm to Factory, A Reinterpretation of the Soviet Industrial Revolution* (Princeton: Princeton University Press, 2003). My own calculations find that the incremental capital-output ratio (ICOR) rose from around 4.0 in 1950-60 to an astonishingly high figure of 25 in 1985-90. There is no reason to believe, as has been suggested by Paul Krugman, that this type of exceptionally poor productivity

- Economies of scale and the division of labour are major factors in productivity growth. Duplication of research efforts and capital expenditures, and a proliferation of inefficiently small capital units or firms, or industries are barriers to productivity growth.[133]In small national economies and in high technology goods, autarkic industrial development is largely incompatible with productivity growth.

In light of these stylised facts, promoting growth seems to be a rather simple problem of maintaining a sufficient degree of openness to trade and technological diffusion, obtaining sufficient concentration in order to realise economies of scale, and maintaining high rates of physical and human capital accumulation. The question in terms of analysing the possibility of a growth-equality trade-off is whether equality is consistent with these objectives. Arguably this is the case, and the basic solution in terms of pro-growth egalitarian policy is to redistribute resources from luxury and positional consumption, which may have a negative marginal social utility, to productive investments. Additionally, some variants of egalitarian economic policy may be able to address inequality and private ownership induced coordination and principal-agent problems, which may lead to additional gains in terms of productivity.[134]

4.1.1.1 The role of fixed investment in economic growth

Exogenous growth theory has attributed to capital accumulation a minor role in determining long term growth outcomes. This is partly a result of an assumption that factors shares in national output reflect the relative marginal productivity of these factors. One of the major insights of endogenous growth theory is that this assumption is potentially invalid. In particular, capital accumulation is hypothesised to be associated with a series of positive spill-over effects, including 'learning by doing' productivity effects, and economies of scale.[135] In this case, the factor share of fixed capital cannot be determined by the share of profits in national income, but instead must be directly derived from the empirical association between capital accumulation and either output or labour productivity growth, both over time and across countries.

Empirical studies have primarily centred on the relationship between the capital/labour ratio and labour productivity. Utilising the basic correlation between capital accumulation

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outcome is likely to reoccur in open, market economies with high factor input growth- for example China. On Krugmans hypothesis of low factor productivity limiting east Asian growth, see Paul Krugman, "The Myth of Asia's Miracle," *Foreign Affairs* 73, no. 6 (1994): 62-89.

[133] On duplication in research, see Manuel A. Gomez, "Duplication externalities in an endogenous growth model with physical capital, human capital, and R&D," *Economic Modelling* 28, no. 1-2 (January): 181-187.

[134]Bowles and Gintis, "Efficient Redistribution: New Rules for Markets, States and Communities."

[135]Paul M. Romer, "Increasing Returns and Long-Run Growth," *Journal of Political Economy* 94, no. 5 (October 1, 1986): 1002-1037; Kenneth J. Arrow, "The Economic Implications of Learning by Doing," *The Review of Economic Studies* 29, no. 3 (June 1, 1962): 155-173.

and labour productivity suggest a figure for the share of capital as high as 0.7.[136] When country and time specific effects are incorporated, lower figures between .35 and .5 are obtained, obviously varying by location.[137] These results are consistent with significant external effects from capital accumulation.

In addition, investment may play a role in promoting growth via its role in effective demand, and via complementarities with labour. In situations of significant unemployment, increased capital accumulation can be associated with capital broadening, and an increase in human-capital utilisation.[138] Even in situations of high employment, increased capital accumulation in a context of physical-human capital complementarily can produce additional investments in skills, or human capital deepening, via an induced labour market skill premium.[139]

This analysis suggests that egalitarian reforms which suppress the rate of capital accumulation can have large negative effects on economic growth. The relationship between equality and capital accumulation is therefore a key parameter of the equality-growth-welfare relationship.

4.1.1.2 A note on long-run total factor productivity and inequality in duel-economies

Due to limitations of space, and the difficulties of TFP measurement[140], little attention is given to the empirical relationship between inequality, redistributive polices, and total-factor productivity in this thesis. It is only noted that there is likely to be no major negative effects of equality on TFP, especially within market economies. For example, the Soviet

[136]Edward N. Wolff, "Capital Formation and Productivity Convergence Over the Long Term," *The American Economic Review* 81, no. 3 (June 1, 1991): 565-579; Peter K. Clark, "Capital Formation and the Recent Productivity Slowdown," *The Journal of Finance* 33, no. 3 (June 1, 1978): 965-975; Andrew Glyn et al., "The Rise and Fall of the Golden Age," in *The Golden Age of Capitalism. Reinterpreting the Postwar Experience*, ed. S. Marglin and J. Schor (Oxford: Oxford University Press, 1990); S. Englander and A. Mittelstadt, "Total factor productivity: macroecenomic and structural aspects of the slowdown," *OECD Economic Studies* 10 (1988): 7-56; Paul M. Romer, "Crazy explanations for the productivity slowdown," in *NBER Macroeconomic Annual*, ed. S. Fischer (NBER, 1987); Assar Lindbeck, "The Recent Slowdown of Productivity Growth," *The Economic Journal* 93, no. 369 (March 1, 1983): 13-34.

[137]S. Englander and A. Gurney, "Medium-term determinants of OECD productivity," *OECD Economic Studies* 22 (1994): 49-110; N Oulton and G Young, "How high is the social rate of return to investment?," *Oxford Review of Economic Policy* 12, no. 2 (June 1, 1996): 48 -69; Robert S. Chirinko, Steven M. Fazzario, and Andrew P. Meyer, *That Elusive Elasticity: A Long-Panel Approach to Estimating the Capital-Labor Substitution Elasticity*, Working Paper, CESifo Working Paper Series (CESifo Group Munich, 2004), http://ideas.repec.org/p/ces/ceswps/_1240.html.

[138]Robert Rowthorn, "Capital Formation and Unemployment," *Oxford Review of Economic Policy* 11, no. 1 (March 20, 1995): 26 -39.

[139]Enrique Lopez-Bazo and Rosina Moreno, "Does human capital stimulate investment in physical capital?: Evidence from a cost system framework," *Economic Modelling* 25, no. 6 (November 2008): 1295-1305.

[140] In particular, the TFP estimate is sensitive to the factor shares utilised. As discussed above, these cannot be computed simply from the shares in national accounts, due to the likely presence of large external effects. Unfortunately, TFP estimates derived from endogenous growth models with explicit accounting for external effects are still very rare.

Union had very low levels of TFP growth in the 1970's and 1980's- however this can be attributed to its autarkic centrally planned economy, rather than low levels of inequality. The Nordic economies demonstrate that central planning is not a prerequisite for achieving low levels of inequality.

One important insight can be derived from the growth model outlined above in relation to duel economies- defined by a large variation in physical and human capital intensity and labour productivity across regions or sectors. In this case, the existence of a national or international productivity frontier will limit growth as the advanced sector pushes up against this frontier. Long-run growth will then be dependent on addressing the structural inequality in labour productivity, as unlike in the advanced sector growth in the backward region is not limited by proximity to the productivity frontier.

Crucially, although the potential for long-run productivity growth in the backward region may be large, this does not necessarily imply a high rate or return to capital in the immediate context - a certain level of coordinated investment in human capital and infrastructure, which may have low or negative rates of private return over long time periods, may be a precondition for unlocking the productivity possibilities in these backward regions. Where political power is concentrated in the wealthy region or sector, or there is a general opposition to taxation and public expenditures on infrastructure, such major investments with long (or external) payoffs are unlikely to be undertaken. Such a situation may result from, and would reinforce high levels of income inequality. In contrast, a coordinated response of pre-emptive investment in broad capital may lead to a reduced regional (and personal) income disparity and an increase in potential long-run productivity growth.[141] This insight could also be applied to class and ethnically stratified societies, where the 'backward' sector is not a region, but a sector of society which is locked in a pattern of poverty and low human capital accumulation.

4.1.1.3 A note on sustainable growth and environmental inputs and outputs

Traditional growth accounting does not factor the accumulation or degradation of non-marketised natural resources into measures of output.[142] This is a major oversight, and a

[141]Stanislaw Wellisz, "Dual Economies, Disguised Unemployment and the Unlimited Supply of Labour," *Economica* 35, no. 137, New Series (February 1968): 22-51; P. N. Rosenstein-Rodan, "Problems of Industrialisation of Eastern and South-Eastern Europe," *The Economic Journal* 53, no. 210/211 (September 1943): 202-211; Kevin M. Murphy, Andrei Shleifer, and Robert W. Vishny, "Industrialization and the Big Push," *The Journal of Political Economy* 97, no. 5 (October 1989): 1003-1026; Antonio Ciccone and Kiminori Matsuyama, "Start-up costs and pecuniary externalities as barriers to economic development," *Journal of Development Economics* 49, no. 1 (April 1996): 33-59; Rodrik, Dani, "Coordination failures and government policy: A model with applications to East Asia and Eastern Europe," *Journal of International Economics* 40, no. 1-2 (1996): 1-22.

[142] Clive Hamilton, "Measuring Changes in Economic Welfare: The Genuine Progress Indicator for Australia," in *Measuring Progress: Is life getting Better?*, ed. Richard Eckersley (Canberra: CSIRO, 1998).

major question arises as to whether growth, as traditionally understood, should be a policy goal in the context of already unsustainable demands being placed on the environment.

The growth model outlined above can suggest some possible ways forward. If environmental inputs, E are taken to include damaging or unsustainable use of existing resources, then reducing degradation implies a reduction in the flows of services from E- i.e. a lower 'capacity utilisation' of the environmental capital stock. Ordinarily, this would reduce output, but the existence of reproducible inputs in the production function means that other inputs can substitute. For example, renewable energy is generally more capital intensive and less carbon intensive than traditional energy sources. Skilled labour may be a complement to these new technologies. Achieving growth and a reduction in environmental inputs can be simultaneously achieved, if investment in green technologies is greatly expanded. However, this implies a large increase in the rate of aggregate investment and savings.

This insight suggests that the problems of achieving sustainable growth and growth in general are generally similar from a macroeconomic perspective. Policies which increase inputs of physical and human capital are virtuous in both cases. These factor inputs can be utilised to increase output in general or alternatively to substitute for environmental inputs. The ideal mix of expansion and substitution will depend on the costs attributed to the utilisation of the relevant environmental inputs, the returns to capital in various deployments, and the marginal utility of consumption function.

4.1.2 The equality-growth relationship and economic theory

Classical and early Keynesian and post-Keynesian economic theory largely assumed the existence of a positive relationship between income inequality and economic growth. [143] In these approaches, redistribution from workers to capitalists; and from the poor to the wealthy, would increase rates of saving and investment, due to the higher propensity to save and/or invest of firms and wealthy households. [144] In the last twenty years, the classical idea of a positive link between inequality and economic growth has come under sustained

[143] N. Kaldor, "A model of economic growth," *Economic Journal* 57 (1957): 591-624; Luigi L. Pasinetti, "Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth," *The Review of Economic Studies* 29, no. 4 (October 1, 1962): 267-279.

[144] See for example R. F. Kahn, "Exercises in the analysis of growth," *Oxford Economic Papers* 11 (1959): 143-56; Kaldor, "A model of economic growth"; Luigi L. Pasinetti, "The rate of profit and income distribution in relation to the rate of economic growth," *Review of Economic Studies* 29 (1962): 267-79; Luigi L. Pasinetti, "Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth," *The Review of Economic Studies* 29, no. 4 (October 1, 1962): 267-279; D. Ricardo, "Principles of political economy and taxation," in *Works and correspondence of David Ricardo*, ed. Pierro Sraffa, vol. 1 (Cambridge: Cambridge University Press, 1951). Zou Heng-fu, "'The spirit of capitalism' and long-run growth," *European Journal of Political Economy* 10, no. 2 (July 1994): 279-293; Yulei Lou, William T. Smith, and Heng-Fu Zou, "The Spirit of Capitalism, Precautionary Savings, and Consumption." *Journal of Money, Credit & Banking (Wiley-Blackwell)* 41, no. 2/3 (March 2009): 543-554.

empirical and theoretical challenge. Theoretical modifications or challenges to the classical theory of distribution and growth can be divided into a series of categories:

- **Theories of demand-led growth:** In this approach, workers' wages and consumption enters the growth equation from two sides; negatively as a deduction from profits (when profitability is variable in the investment function), and positively as a component of aggregate demand. In certain conditions, it can be shown that increases in wage share can positively or negatively impact on the rate of growth , at least in the short-run and in demand constrained economies. This approach is dealt with in detail in section 4.2

- **Theories of endogenous growth and human capital accumulation:** In this approach, human capital (skills) is a major input to the supply side equation. As the poor are credit constrained and decreasing returns to education exist at the individual level, increased income inequality reduces the rate of human capital accumulation. If human and physical capitals are complementary, this can also lead to constraints on physical capital accumulation.[145]

- **New theories of saving:** According to the permanent income hypothesis, savings rates are determined by variations in income and desired consumption over the life cycle, and to income volatility, risk perception, and forms of insurance against income and expenditure shocks. According to the 'expenditure cascade' model, increased income inequality can increase positional consumption. In addition, as outlined in chapter 3, inequality can be associated with reduced levels of trust and social cohesion, which may reduce the ability of governments to fully fund expenditures via taxation. These approaches cast doubt on any presumed positive relationship between income inequality and aggregate savings. [146]

- **Political economy models:** In this approach, increased inequality leads to political instability and demands for populist redistribution. These political-economic effects can lead to a negative relationship between inequality and physical capital accumulation, via increase in the risk premium on investment, increased borrowing cost and credit constraints, and/or via politically induced dysfunctional economic policies. Additionally, increased inequality can be associated with the concentration of political power, and an increased ability of the wealthy to pursue rent-seeking behaviour and/or block efficiency increasing economic policies. [147]

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[145]Roberto Perotti, "Income distribution and investment," *European Economic Review* 38, no. 3-4 (April 1994): 827-835.

[146]D. M. Maki and M. G. Palumbo, *Disentangling the wealth effect: a cohort analysis ofhousehold saving in the 1990s*, Discussion Paper, Finance and Economics Discussion Series (Board of Governors of the Federal Reserve System (U.S.), 2001), http://www.federalreserve.gov/pubs/feds/2001/200121/200121pap.pdf.

[147]Alesina and Perotti, "Income distribution, political instability, and investment"; Roberto Perotti, "Growth, income distribution, and democracy: What the data say," *Journal of Economic Growth* 1, no. 2 (June 1, 1996): 149-187-187; Alberto Alesina and Dani Rodrik, "Distributive Politics and Economic Growth," *The Quarterly Journal of Economics* 109, no. 2 (May 1, 1994): 465-490; Torsten Persson and Guido Tabellini, "Is Inequality Harmful for Growth?," *The American Economic Review* 84, no. 3 (June 1, 1994): 600-621. On the relationship between trust, social capital, and development see Jacob Dearmon and Kevin Grier, "Trust and development," *Journal of Economic Behavior & Organization* 71, no. 2 (August 2009): 210-220; Jacob Dearmon and Robin Grier, "Trust and the accumulation of physical and human capital," *European Journal of Political Economy* 27, no. 3 (September 2011): 507-519; Hirokazu Ishise and Yasuyuki Sawada, "Aggregate returns to social capital: Estimates based on the augmented augmented-Solow model," *Journal of Macroeconomics* 31, no. 3 (September 2009): 376-393.

At the level of economic theory, no forgone conclusion can be obtained in regards to the exact relationship between equality and growth. The assessment of the growth-equality relationship then becomes largely an empirical question. However, not all questions are resolvable by empirical examination, because these examinations are limited by the available data and breadth of economic experiences. Not all policy options and distributions have been extensively deployed or have existed, and therefore no generalised view of the growth-equality relationship can be obtained. In particular, the strongly egalitarian result obtained in chapters 3 suggests that the range of potentially welfare maximising income distribution is likely to be quite low, and therefore the primary concern here is the growth-equality relationship at low levels of income inequality, where negative effects can be expected from further egalitarian redistributions at the level of theory- even if no large dataset of countries with very low levels of inequality exist that enables the empirical testing of this hypothesis.

Theoretical views on the growth-equality relationship are summarised in table 21. Space constraints preclude a detailed discussion of these theoretical channels, and the reader is referred to the relevant footnotes for works outlining these mechanisms.

4.1.3 A stylised systematisation of the distribution-growth welfare relationship

Before proceeding to a discussion of the relevant empirical evidence, I present here a stylised systematisation of the equality-growth-welfare problem, which captures the key empirically supported insights of the theoretical literature. In this system, there is a positive relationship between profit-share and both investment and inequality, and a non-linear but generally negative relationship between inequality and human capital accumulation, which becomes positive at some point (where further equality sufficiently diminishes the accumulation of indivisible high level skills via incentive effects- e.g. 'brain drains' and/or funding constraints).[148] Combined with the distributional efficiency function obtained in previous chapters, this system enables a solution to be found in regards to the optimum functional distribution. It can readily be seen that modification of the component functions can shift both the level of the optimal welfare outcome, and the optimum functional distribution at which this optimum occurs. In particular, shift upwards in the investment-profitability relationship, and downwards in the inequality profitability relationship, can modify greatly the relationship between inequality, the functional distribution of income, and fixed capital investment. These insight help enable an investigation of the relevant

[148]Park Jungsoo, "Dispersion of human capital and economic growth," *Journal of Macroeconomics* 28, no. 3 (September 2006): 520-539; Oded Galor and Moav, Omer, *From Physical to Human Capital Accumulation: Inequality in the Process of Development*, Working Paper (Brown University, February 11, 2002), http://www.cepr.org/pubs/new-dps/dplist.asp?dpno=2307; Andres Rodriguez-Pose and Vassilis Tselios, "Inequalities in income and education and regional economic growth in western Europe," *The Annals of Regional Science* 44, no. 2 (2010): 349-375; Amparo Castelló and Rafael Doménech, "Human Capital Inequality and Economic Growth: Some New Evidence," *The Economic Journal* 112, no. 478 (March 1, 2002): C187-C200.

policy objectives and problems, as well as a guide to analysing and designing empirical studies.

The remainder of this thesis will concentrate heavily on investigating the determinants of the profit-share –investment share relationship. However, the profitability-inequality relationship is also critical to determining the growth-equality relationship. This relationship is generally up-sloping. When profit share is zero, the distribution of income will be simply be determined by the inequality of non-capital income. As profit share increases towards 100 per cent of income, the degree of total income inequality will approach the level of asset inequality (assuming returns on capital are homogenous), which is in all countries is significantly higher than the level of non-capital income inequality. However, redistribution of assets or the income streams from assets could flatten this relationship appreciably. If assets or asset income were to be redistributed on an egalitarian basis, then increases in profit share would have no negative impact on income distribution. This type of radical redistribution could take the form of various types of employee ownership schemes- in this case capital-labour conflict would also be significantly attenuated.

In figure 11, the relationship between growth and inequality is derived from a system of six functions. These functions include:

1. The profitability-investment/capital stock function
2. The functional-personal inequality function
3. The inequality-human capital accumulation function
4. The factor input-output equation (standard growth equation)
5. The inequality-distributional efficiency relationship
6. The distributional efficiency-welfare efficiency relationship

Of these, function 5 is derived in chapters 1-3, and 6 is by definition a basic linear function, derived from the identity W=YE = Y(1-A) where A is the Atkinson index. Function 4 is a reduced form version of a standard growth equation, and this case the relevant parameters are the factor shares and spill-over effects of human and physical capital.[149] The analysis therefore turns to analyse the determinants functions 1-3. These will jointly determine the shape of the inequality-welfare relationship, and hence the level of the welfare optimum and income distribution associated with this optimum. In subsequent sections, I will show that these functions are highly variable and open to modification via policy, enabling large

[149] In this system, an increased share of human capital will increase the level of equality associated with growth maximisation. If development is characterised by increased demand for high-skill workers, then excess inequality can be a major drag to growth at higher levels of development. See Oded Galor and Moav, Omer, "From Physical to Human Capital Accumulation: Inequality and theProcess of Development," *Review of Economic Studies* 71 (2004): 1001-1026; Dustin Chambers and Alan Krause, "Is the relationship between inequality and growth affected by physical and human capital accumulation?," *Journal of Economic Inequality* 8, no. 2 (2003), http://www.springerlink.com.ezproxy2.library.usyd.edu.au/content/a42348w7r384690t/; Michael Bleaney and Akira Nishiyama, "Income inequality and growth--does the relationship vary with the income level?," *Economics Letters* 84, no. 3 (September 2004): 349-355.

welfare gains to be attained by well-designed structural reform which shifts the key parameters of the system outlined above.

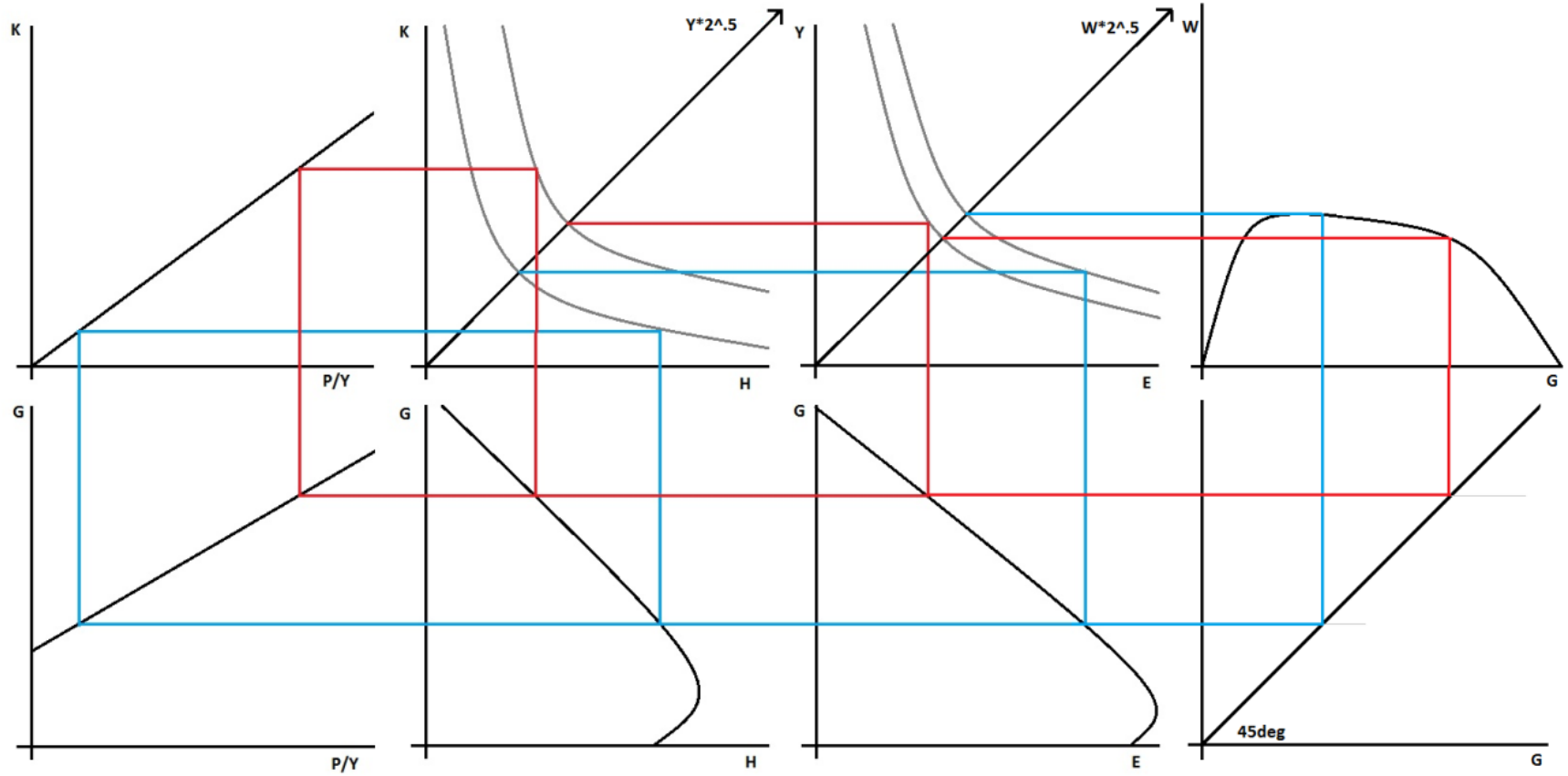
Table 21 Theorised mechanisms determining the growth-equality relationship

Positive effects	Negative effects
Physical capital accumulation	
Increased aggregate demand level and stability via increased worker consumption expenditures	Redistributive policy increases government consumption and tax burden on capital
Reduced political instability, and trust, reducing risk premiums ,transaction costs, coordination problems, and populist dysfunctional economic policy responses	Positive relationship between profits and inequality, due to generally high asset inequality
Poor are credit constrained and declining return to capital exist at individual level	Poor are credit constrained and scale effects to capital exist at individual level
Human-physical capital complementarity and positive equality human-capital relationship	
Savings	
Reduced positional consumption	Marginal propensity to save increases with income level
Reduced wealth effect	Bequests are luxury items, and/or wealth is a positional good
Increased social capital raises ability to tax citizens, driving upwards government saving	Higher propensity to save out of capital income, esp. by corporate sector
Rich will engage in luxury consumption rather than save if investment prospects are risky due to instability	
human capital formation	
Declining returns to scale from human capital at the personal level[150]	Indivisibilities in high-level human capital accumulation
Reduction of budget/credit constraints, (including high interest rates) on poor	Reduced skill premium
Increased direct provision and subsidisation of education associated with income equality[151]	Physical-human capital complementarity and negative equality physical-capital accumulation relationship
Increased social mobility	Inequality reduces life expectancy and working life, reducing lifetime returns to education
Reduced material and psychosocial barriers to learning	
The poor invest relatively more in education, and less in financial assets	

[150]Chambers and Krause, "Is the relationship between inequality and growth affected by physical and human capital accumulation?"; Galor and Moav, Omer, *From Physical to Human Capital Accumulation: Inequality in the Process of Development*; Oded Galor and Daniel Tsiddon, "The Distribution of Human Capital and Economic Growth," *Journal of Economic Growth* 2, no. 1 (1997): 93-124.

[151]Zvi Eckstein and Itzhak Zilcha, "The effects of compulsory schooling on growth, income distribution and welfare," *Journal of Public Economics* 54, no. 3 (July 1994): 339-359.

Figure 12 Stylised systematisation of the profitability-equality-growth-welfare relationship in the static frame



Summary of this table: K=capital stock at T=x, G= income inequality; Y= output per capita; E is welfare-income efficiency, defined as, $E = W/\bar{Y} = \frac{C}{Y}(1 - A)$; and W = social-welfare. Red lines represent a high profit, high inequality, high growth, low welfare outcome. Blue lines represent a welfare optimal low profit, low inequality, moderate growth, high welfare outcome. Modification to the relevant functions will modify the level of the welfare optimum and the level of inequality associated with this optimum, and these solutions are therefore presented for illustrative purposes only.

It should be noted that the system presented in figure 19 is in a static frame, in order to sidestep the problems associated with intertemporal optimisation, which can become incredibly complex if not irresolvable in the context of non-convergent growth. In this case, the level of K and the investment rate are treated as linear or monotonic functions of one another, in which case K can be treated as the equilibrium capital stock, or alternatively, as capital stock at time X in non-equilibrium growth situations. In the context of convergent (equilibrium) growth, the intertemporal optimisation problem could be solved by the augmentation of this model with a Ramsey-Cass-Koopmans type optimisation solution.

It should be noted that the W/Y term is not simply (1-A), as not all income is consumed. Only the consumption portion of national income is welfare increasing, and thus the welfare term will be given by $\frac{W}{Y} = \frac{C}{Y}(1 - A)$, where $\frac{C}{Y}$ is the consumption share of national income, and (1-A) is the distributional efficiency of consumption, as derived in chapters 1-3. Thus, inequality that promotes growth can only be long-run welfare increasing if the existing level of investment is below the Ramsey-Cass-Koopmans optimum, in which case increases in consumption inequality and reduced distributional efficiency is the price that society pays in order to raise investment towards this level. This implies that the non-capitalist sector must systemically under-invest (perhaps due to a high pure time preference rate), or that the social return to investment is much higher than the private rate of return for the non-wealthy sector. These are plausible but challengeable assumptions, which suggest that there may be some gains from resources being concentrated in the hands of a capitalist class whose propensity to save and invest is sufficiently high that redistribution towards them pulls the social rate of savings and investment upwards towards the long-run social-optimum. When the marginal rate of saving and investment by the high income or capitalist sector is very high, greater increases in the rate of investment can be 'purchased' at a lower social cost of consumption inequality and distributional inefficiency. When the marginal rate of saving of the wealthy is very low, or is below the marginal rate of saving of other sectors such as the government sector, then there is no utilitarian justification for inequality being above the level associated with distributional efficiency maximisation.

In this model, human and physical capital complementarity has not been explicitly modelled. Where complementarity is strong, and there is a sufficiently strong negative relationship between human capital accumulation and income inequality, the relationship between inequality and physical capital accumulation can turn negative, especially in the long-run. This can be driven via feedback effects on profitability- in the context of strong complementarity, there will be strongly diminishing returns to physical capital when physical accumulation is not matched by complementary increases in skilled labour.[152]

[152] Lopez-Bazo and Moreno, "Does human capital stimulate investment in physical capital?: Evidence from a cost system framework"; Robert E. Lucas, "On the mechanics of economic development," *Journal of Monetary Economics* 22, no. 1 (July 1988): 3-42; Jung Mo Kang, "An estimation of growth model for South Korea using human capital," *Journal of Asian Economics* 17, no. 5 (November 2006): 852-866; Sharmistha Self and Richard

4.1.4 The equality-growth relationship: Evidence from empirical studies

In light of the complex nature of the functional distribution-equality-growth relationship, care must be taken in analysing the results obtained from both cross country and panel estimates of the effect of income inequality on economic growth. In particular, the correlation between growth and the personal income distribution will depend on the time scale, on context, and the reason for the shift in income distribution. For example, when inequality increases due to increased profitability, and hence increases in capital income (which is generally more highly concentrated than labour income), the likely effect on short to mid-term growth is likely to be positive, as investment increases. However, the long-run effect is indeterminate, as over time, increases in inequality could be associated with reductions in human capital accumulation, or political instability (both of these effects are likely to operate on long time horizons). In contrast, downward shifts in the inequality/profit function would likely have modest growth effects in either direction in the short run, but positive effects in the long run (increasing human capital accumulation via reduced inequality, and possibly also physical capital (via reduced instability and human-physical capital complementarity).

From a policy design perspective, it is imperative to known the nature of these exact relationships that drive the overall equality-growth relationship. Ideally, for this purpose, empirical studies should utilise controls on the functional distribution. In this case, the effect of modifications to the level of wage and asset inequality can be separated from the profitability effect. In particular, modification to the functional distribution driven by exogenous shocks should be controlled for. Knowing, for example, that increases in export prices simultaneously increases capital income, inequality, investment, and growth tells us little about the effect of asset redistribution, or egalitarian wages policy, especially is these are designed in order to have little or no negative effect on profit-share. When they do, it might be better to model this effect via a dedicated investment function. Investment functions for both the United States and China are estimated in section 4.3.3. Unfortunately, the necessary data is, to my knowledge, not available to enable a cross sectional study of growth and personal income inequality, with relevant controls on the functional distribution to be conducted. In this case, one second best solution would be to concentrate on studies with a long time horizon, in particular true cross sectional studies. Unfortunately, a large number of recent studies have been panel studies which only capture relatively short-run effects. A summary of empirical studies is given in tables 22 to 24.

The results of the previous theoretical discussion, and the empirical studies presented here could be interpreted as indicating a generally negative, but non-linear inequality-growth

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Grabowski, "Education and long-run development in Japan," *Journal of Asian Economics* 14, no. 4 (August 2003): 565-580; CHI Wei, "The role of human capital in China's economic development: Review and new evidence," *China Economic Review* 19, no. 3 (September 2008): 421-436.

relationship, with inequality having a potentially positive effect on short run growth, with this relationship tending to be negative in the long-run. Furthermore, as indicated by Chen (2003), there is likely to be a generally negative long-run relationship between inequality and growth that may turn positive at low inequality levels, if redistributive policy begins to diminish physical investment via significant reductions in post-tax profitability.

The turning point for this potential non-linearity can be utilised to bracket the welfare optimal level of inequality. According to the estimates of Chen (2003), the inequality-growth relationship turns positive below a Gini index of approximately 0.35, although his exact estimate is somewhat dubious given the small number of samples with inequality below this level.[153] If this is the case, then this inequality level should be treated as the absolute upper bound to the long-run welfare maximising level of income inequality, with the lower bound having been roughly calculated in section 1.2.1 at approximately Gini=0.15. Unfortunately, there are very few examples of countries or regions, excluding the formerly planned economies with inequality levels well below 0.35, with the Nordic countries being the obvious exceptions. In this case, it is very difficult to determine the exact magnitude of any negative long-run effects of inequality on growth at these bracketed levels of inequality via empirical analysis. Rather than rely on empirical estimates, a more fruitful method may be to isolate the likely theoretical mechanisms by which growth could be severely curtailed. The most likely channel for this outcome within a market (even if heavily regulated) economy is via possible negative impacts of redistribution on post-tax profitability, and hence physical investment.[154] Provided that high levels of investment are maintained, on theoretical and empirical grounds, there is likely to be no *necessary* negative effect on growth even at very low inequality levels. Where inequality is high, both growth and redistributive efficiency may be improved by reductions in the level of inequality, leading to very large welfare gains.

One potential qualification to this result is in regards to human capital inequality, where excessive human capital equality may slow growth if there is then an oversupply of mid-level skills and under-supply of high-level skills. However, such a potential problem can easily be averted via the government providing free, heavily subsidised or cost-deferred access to education in the relevant area of skills shortage. Such a policy would also, if sufficiently expensive, tend to reduce the skill wage premium, leading to positive effects on income equality.[155]

[153] See also Eiji Yamamura and Shin Inyong, *Effects of Income Inequality on Growth through Efficiency Improvement and Capital Accumulation*, Working Paper, MPRA working papers (MPRA, 2008), http://mpra.ub.uni-muenchen.de/10220/.

[154] On the assumption that there is positive relationship between profitability and investment

[155] Such an effect would, however, be balanced by the increased numbers of high skill workers created by the policy.

Table 22 Studies indicating a negative effect of income or asset inequality on growth

Paper	Method	Dataset	Finding
Easterly + Rebello (1993)	panel & x-section	cross country	Public expenditures on infrastructure promote growth, no negative effects of egalitarian redistribution or taxation
Persson & Tabelini (1994)	panel & x-section	cross country	Negative effect in democracies
Perotti (1994,1996)	Various	cross country	Negative effect, via instability and reduced human and physical capital accumulation, no evidence of negative effects from redistribution
Deininger & Squire (1998)	cross-section	cross country	Negative effect of asset inequality
Chang & Ram (2000)	non-standard model	cross country	Growth and equality mutually reinforcing
Easterly (2001)	panel model	cross country	Negative effect of reduction in middle-class size
Alesina and Rodrik (2004)	cross-section	cross country	Negative effect of income and land inequality
Hsing (2005)	panel model	U.S	Negative effect on inequality increases
Malinen (2009)	panel cointegration	cross country	Negative effect in high and middle income countries
Alfranca & Miguel-Angel (2009)	panel & X section	cross country	Positive effect of egalitarian distribution and public expenditures
Chambers & Krause (2009)	panel model	cross country	Negative effect on growth in less educated countries via reduced human capital accumulation. Effect is stronger as physical capital level increases.
Herzer & Volmer (2010)	panel cointegration	cross country	Strong negative effect, in total and across categories (democracy, dictatorship, developed, developing)

Table 23 Empirical studies on the human-capital inequality-growth relationship

Study	Method	Dataset	Finding
Jungsoo (2006)	panel model	cross country	Increasing dispersion in human capital, controlled for level, is associated with increased growth rate
Rodrigues-Pose & Tselios (2008)	panel model	W. Europe	Positive effect of human-capital inequality increases,
Castello & Domenich (2008)	panel model	cross country	Robust negative effect of human-capital inequality on fixed capital investment and growth
Castelló-Climent (2010)	panel model	cross country	Negative effect, except in high income countries

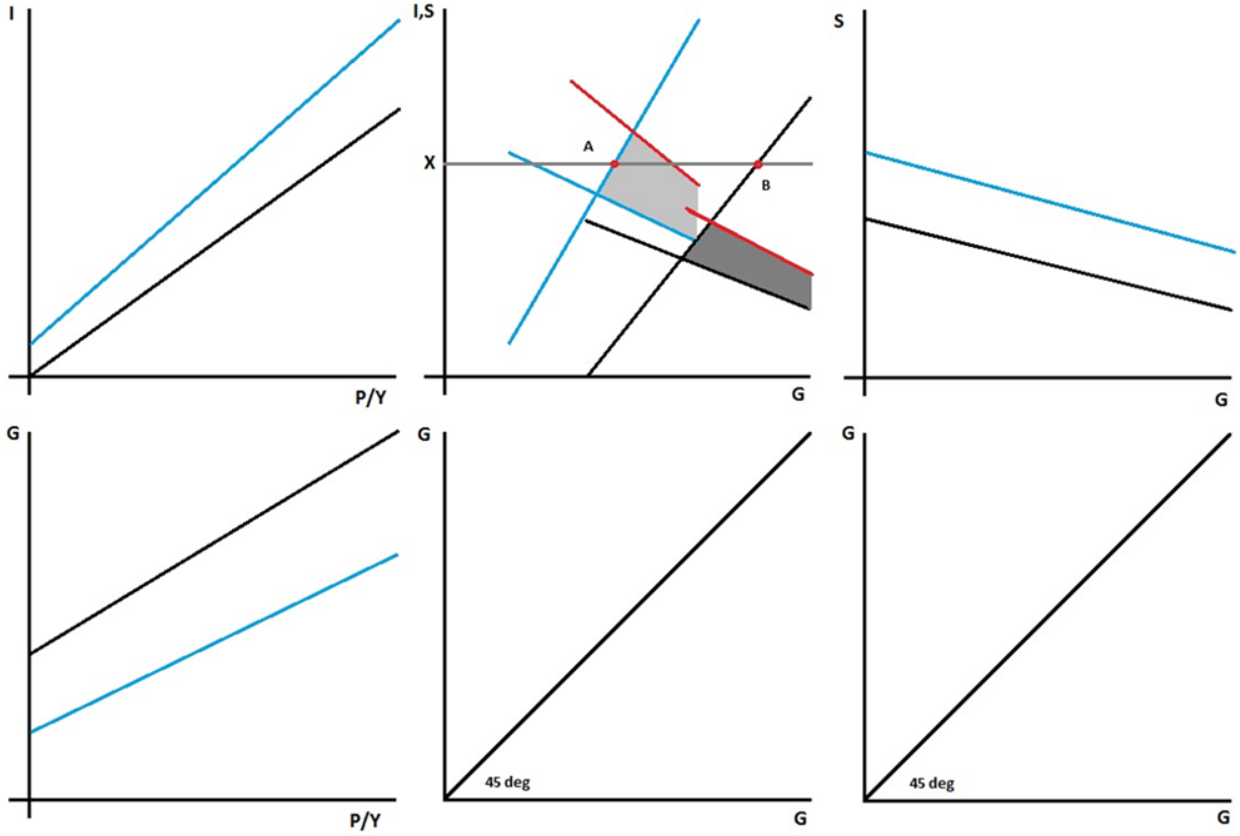
Table 24 Studies indicating a positive, non-linear, or inconclusive income inequality-growth relationship

Study	Method	Dataset	Finding
Studies indicating non-linear effects			
Castelló-Climent (2010)	panel model	cross country	Negative effect in low to middle income countries, neutral or positive in high income countries
Barro (2000)	panel model	cross country	Weakly negative in poor countries, weakly positive in rich countries
Chen (2003)	cross-section	cross country	Inverted U relationship, mid-level inequality is best for growth
Voitchovsky (2005)	panel model	cross country	Negative effect from inequality at bottom of distribution, positive to top of distribution
Studies indicating positive effects			
Rodrigues-Pose & Tselios	panel model	W. Europe	Positive effect of inequality increases
Forbes (2000)	panel model	cross country	Positive short to mid-run effect
Studies finding inconclusive effect			
Panizza (2002)	panel model	U.S	Non-robust weak negative effect

4.1.5 The distribution of income, savings constraints, and credit-crisis

This model presented in figure 11 can be augmented by the incorporation of a distributional and policy determined savings constraint. If the relationship between inequality and investment is more strongly positive (or less negative) than the inequality-aggregate saving relationship, then increased inequality will decrease the external balance. When capital inflows are limited, the savings function will then exert a downward limit of varying flexibility or rigidity to investment, depending on the strength of the international credit constraint. In the context of such a constraint, increased inequality would be associated with unsustainable investment increases that would be eventually limited by credit squeezes or crisis. This possible appendage to the model is illustrated in figure 13, where the analysis is extended to analyse differing economic structures.

Figure 13 Stylised systematisation of savings constrained growth with functional distribution determined investment and personal distribution determined savings



In figure 12, growth that is driven by increased capital share is savings constrained, as savings do not rise in line with investment, as they are independently (and negatively) determined by the level of personal inequality.[156] This could be the result if consumption is strongly driven by the wealth effect; inequality induced positional consumption; or by inequality induced opposition to taxation (driving government dissaving). In this model, two systems are presented; a standard system shown in black, and an 'egalitarian developmentalist' (ED) solution shown in blue, which is characterised by a higher investment/profit-share function (driven by investment policy), a lower inequality/profitability function (associated with egalitarian wage and asset distributions) and a higher savings/inequality function (driven by savings promoting policy). In the ED solution, the rate of investment is driven upwards for a given functional distribution, as is the rate of savings and income equality, in comparison to the standard solution. This outcome is analogous to the developmental path of Korea, Taiwan, and Japan in their rapid, state-capitalist growth phases. In the system represented in figure 12, investment can exceed savings, but only by a defined margin. This upper limit of capital inflows is shown by

[156] The negative nature of this relationship is not necessary for the general outcomes illustrated here to eventuate, the use of a sharply negative relationship is only to aid in creating a clear, stylised illustration.

the two lines in red, signifying the long run credit constraint, which is a multiple of the domestic savings rate. This constraint can determine the nature (stable or unstable) and level of growth. Consider that a target for investment, X, is set. In this case, the ED system is driven to point A, in which case a modest but sustainable volume of capital inflows is induced. In comparison, the 'normal' system is driven to point B, which is well above the long-run credit constraint. In this case, attempting to maintain investment at level X will eventually lead to a credit crisis, and a subsequent deleverage and reduction in growth rates.

This system can be used to model or explain a series of sustainable and unsustainable growth experiences. For example, the path followed by Taiwan, Korea, and Japan during their rapid growth phase is analogous to the ED solution shown in blue and point A. The growth experience in these countries was characterised by high rates of investment in physical capital, low levels of inequality, and high rate of human capital accumulation and savings.[157] In contrast, the initially rapid but eventually unsustainable rapid growth experiences that occurred in many countries of Latin America and Africa during the 1970's and early 1980's can be likened to point B- characterised by high profits and physical investment, but also high inequality, low to moderate savings, human capital constraints, and reliance on external debt.[158] In a similar fashion, countries such as the United States, Greece, Spain and Ireland could be seen as being or having been at one stage at points B, during the period from the turn of the century or before, till at least 2007. In these countries, shifts in the post-tax functional distribution from labour to capital arguably drove growth of varying rapidity (ranging from rapid in Ireland to modest in the U.S), but without corresponding pro-saving polices, and with consumption driven strongly by the wealth effect and possibly by inequality induced positional consumption, these modest levels of investment could only be financed by large and unsustainable capital inflows.[159] In the case of the United States, these inflows have come to account for essentially all of net investment.[160] Without the reduced credit constraint that is imparted by world currency status, it is unlikely that growth and investment would have been significantly slower in the Unites States throughout the 2000's.

[157]Anthony Elson, "The Economic Growth of East Asia and Latin America in Comparative Perspective: Lessons for development policy," *World Economics* 7, no. 2 (June 2006); Ajit Singh, "Savings, investment and the corporation in the East Asian miracle," *Journal of Development Studies* 34, no. 6 (September 25, 2011): 112-137; Jong-Il You, "Income Distribution and Growth in East Asia.," *Journal of Development Studies* 34, no. 6 (1998): 37; United Nations Conference on Trade and Development, "Income distribution, capital accumulation, and growth: A more equal distribution of income can enhance growth," *Challenge*, March 1998; Jong-Il You, "Income Distribution and Growth in East Asia.," *Journal of Development Studies* 34, no. 6 (1998): 37.

[158] Elson, "The Economic Growth of East Asia and Latin America in Comparative Perspective: Lessons for development policy."

[159] On induced positional consumption, see Frank and Levine, "Expenditure Cascades"; Walther, *Competitive Conspicuous Consumption, Household Saving and Income Inequality*; Harringer, "Conspicuous consumption and inequality: Theory and evidence."

[160] Net aggregate savings for 2009 and 2010 were negative. See NIPA table 5.1 and figure 19 of this work.

4.1.6 Inequality and aggregate savings: empirical evidence

Classical theoretical accounts of the inequality-savings relationship have presented strong arguments for a positive relationship, based on the higher propensity of the wealthy to save, and a higher propensity to save out of capital income. These propositions are generally supported by the available empirical evidence.[161] However, this does not necessarily imply a positive relationship between inequality and aggregate savings. This is because inequality induced positional consumption would tend to reduce the rate of personal savings at all income levels, even as savings continued to rise with income across the distribution. This effect may impact on corporate savings too, if shareholders utilise their power to increase dividend payments in an attempt to maximise positional consumption. Furthermore, if reduced trust and increase political power of the wealthy limits the ability of government to levy taxes, or induces spending on 'middle class welfare' then inequality can be associated with increased government dissaving. This effect will be augmented if inequality leads to increase in expenditures on healthcare, prisons, etc. as a result of inequality induced health and social problems.

If consumption is driven by the wealth effect, increases in capital share, inclusive of capital gains can be associated with increased inequality and reduced personal savings. These effects are likely to operate with differing intensity in different places, and therefore the entire story on savings and inequality cannot be deduced directly from large cross sectional studies. Existing studies present a mixed picture, with no conclusive evidence of a positive inequality effect. A summary of empirical studies is given in table 25.

[161] See K. Gupta, "Personal savings in developing nations: Further evidence," *Economic Record* 46 (1970): 243-9; H. Houthakker, "An international comparison of personal savings," *Bulletin of the international statistical institute* 38 (1961): 55-69; A. C. Kelly and J. Williamson, "Household savings behaviours in developing countries: the Indonesian case," *Economic Development and Cultural Change* 16, no. 3; J. Williamson, "Personal savings in developing nations: An intertemporal cross-section from Asia," *Economic Record* 44 (1968): 194-202; Karen E. Dynan, Jonathan Skinner, and Stephen P. Zeldes, "Do the Rich Save More?," *The Journal of Political Economy* 112, no. 2 (April 2004): 397-444; P. Menchik and M. David, "Income Distribution, Lifestime Savings, and Bequests," *American Economic Review* 73 (1983): 672-90; Yiannis P. Venieris and Dipak K. Gupta, "Income Distribution and Sociopolitical Instability as Determinants of Savings: A Cross-Sectional Model," *Journal of Political Economy* 94, no. 4 (1986): 873-883.

Table 25 Inequality and savings: summary of empirical studies

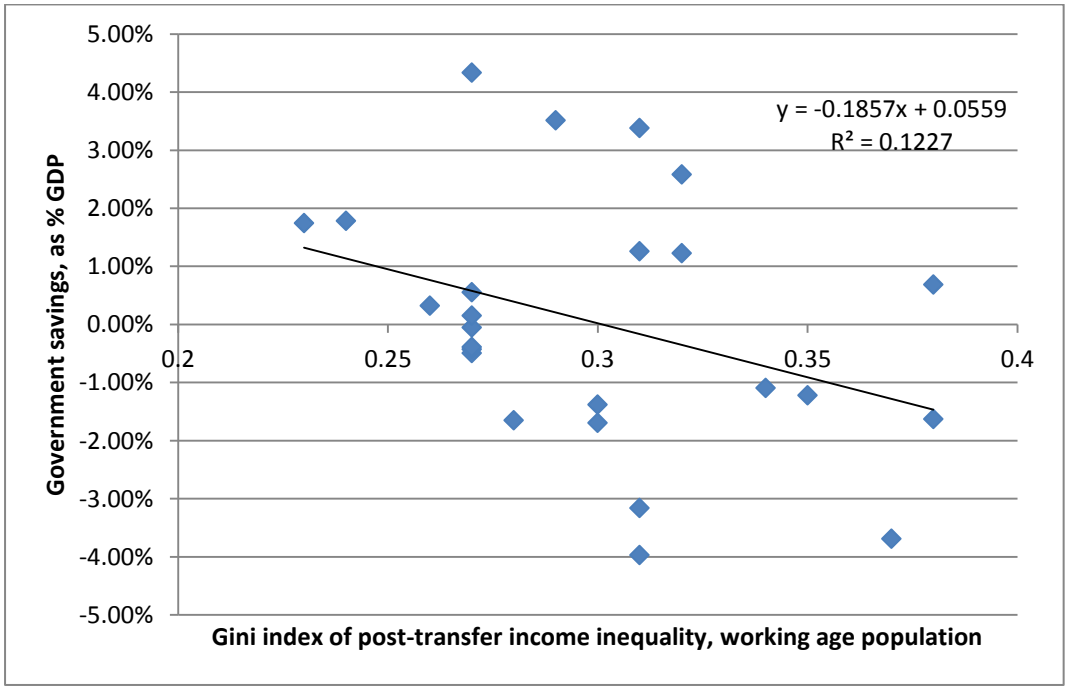
Paper	Dataset	Finding (effect of income inequality)
Cross section studies		
Della Vale and Oguchi (1976)	industrialised & developing	some positive effect in OECD
Musgrove (1980)	industrialised & developing	no effect
Lim (1980)	developing countries	some positive effects in some subsamples
Sahota (1993)	65 countries	positive but non-robust effect
Cook (1993)	49 LDC's	positive effect
Hong (1995)	68 industrialised and developing countries	positive effect of top 20% share in GNI
Edwards (1995)	developing + OECD countries	positive but non-robust effect
Schmidt-Hebbel and Servern (1999)	large and varied cross-county dataset	no effect
Leigh and Posso (2009)	11 developed countries	no effect of top 10% and 1% income share
Time series studies		
Blinder (1975)	US	negative insignificant effect of inequality
Cook (1995)	developing countries	positive effect
Schmidt-Hebbel and Servern (1999)	large dataset of industrialised & developing	no effect
Smith (2001)	cross country dataset	positive effect
Li and Zhou (2004)	cross country dataset	weak negative effect on private savings
Harringer (2010)	US	Inequality increases conspicuous consumption
Malinen (2011)	Panel cointegration, nine developed economies	Inequality and consumption are non-stationary, inequality increases savings in Central Europe and Nordic Countries, inconclusive effect in Anglo-Saxon countries

In addition to these estimates, I present original empirical work on the relationship between income inequality and government and aggregate savings, the external balance, and growth for OECD countries, utilising a cross section of inequality circa 2005 and the average macroeconomic variables over the period 2000-2010.[162] These estimates are presented in figures 14 to 18. These results, although not all highly significant, suggest that the level of inequality exerts a negative effect on savings and growth in this sample, with no non-linear effects present. In particular, the negative growth relationship appears to be highly linked to the negative external balance relationship. Countries with relatively high inequality have tended to have negative external balances, higher debt levels, and have consequently been relatively more affected by the GFC than more equal countries. As shown in figure 18, there is no relationship between inequality and the rate of private investment.

[162] Data is from AMECO, the countries in the sample are; Turkey; Poland; Slovak Republic; Hungary; Czech Republic; Korea; Portugal; Greece; Spain; France; Italy; Japan; Finland; Germany; UK; Belgium; Sweden; Australia; Canada; Ireland; Austria; Denmark; Iceland; Netherlands; Switzerland; US; Norway; Luxembourg

Figure 14 Inequality and external balances, Cross section of 29 OECD countries, balances adjusted to remove income level effect

Figure 15 Inequality and government savings, Cross section of 27 OECD countries, savings adjusted to remove income level effect, excluding outliers[163]



[163] Korea and Norway have been excluded. They have exceptionally high rates of government savings, and low to modest inequality. Their inclusion increases the measured negative effect of inequality.

Figure 16 Inequality and aggregate savings, Cross section of 29 OECD countries, savings rate adjusted to remove income level effect

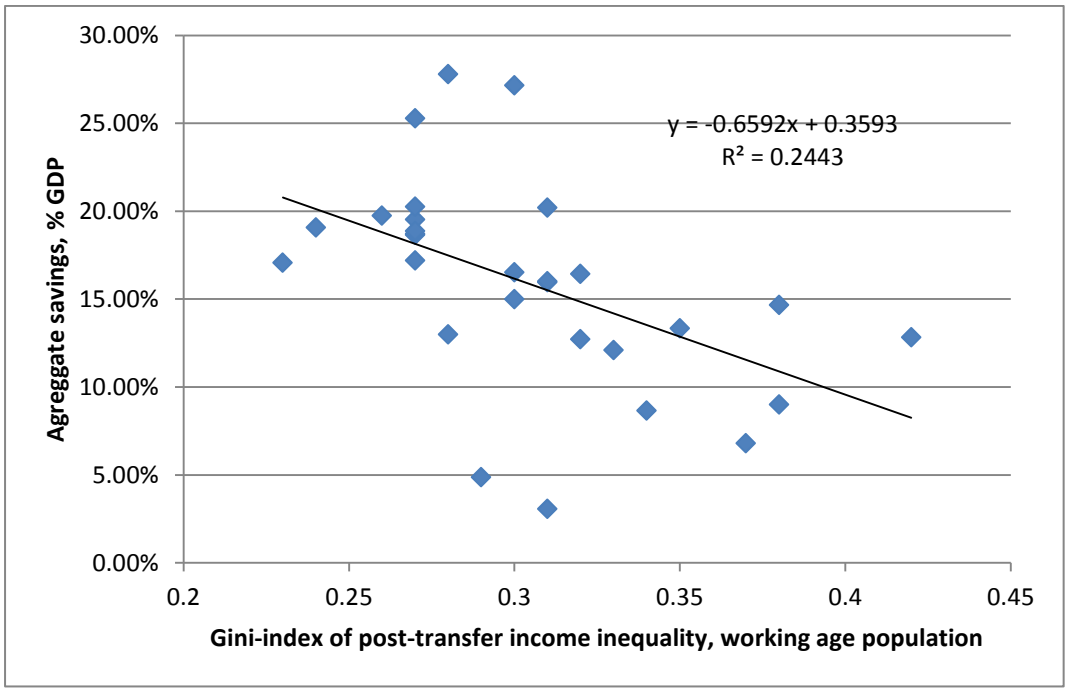


Figure 17 Inequality and per-capita growth, cross section of 29 OECD countries, growth rate adjusted to remove income level effect[164]

[164] The income level effect is non-linear, and a control is incorporated to model the high growth rates of low and very high income countries in this sample. In this case, additional controls are added with control values equal to the extent to which country income is below PPP Euro 15,000 or above PPP Euro 26,000.

Figure 18 Inequality and private fixed investment, cross section of 25 OECD countries, investment rate adjusted to remove income level effect.[165]

4.1.6.1 Inequality and savings: Time series evidence from the United States

The cross sectional results presented above can be augmented by an investigation of the relationship between income inequality and savings across time in the United States. The basic approach adopted here is to investigate the correlation between inequality and both government, personal, corporate, and aggregative savings as a percentage of GNI, with controls on time to remove long-run trends unrelated to the explanatory variable.[166] Graphical demonstrations of the model accuracy are given graphically in figures 19-21, and regression statistics in tables 25-27.

These results show a strong negative relationship between inequality and aggregate savings. Decomposition of this relationship shows that this is entirely driven by an even stronger negative relationship between income inequality and personal savings, which is partially offset by a positive but not highly significant relationship between inequality and government savings. There is no relationship between inequality and business savings rates. These results are consistent with personal savings being strongly driven by relative income effects, with consumption patterns being set by top income earners.

[165] Due to missing data, the following countries are removed from the sample; Turkey; Korea; Japan; New Zealand.

[166] Savings Data is from BEA NIPA tables, Gini index is from the US Bureau of Census.

Figure 19 Predicted and historical values, aggregate net savings, US 1947-2010

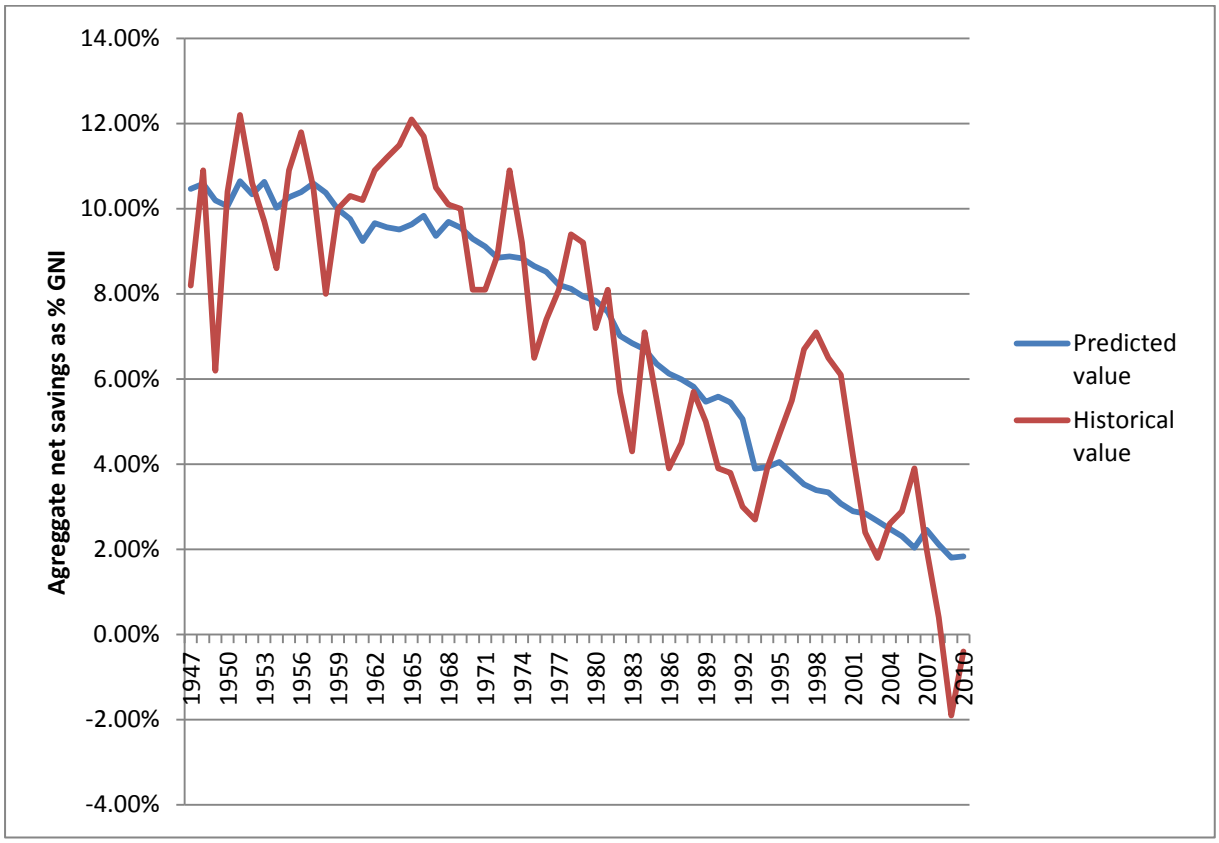


Figure 20 Predicted and historical values, net personal savings, US 1947-2010

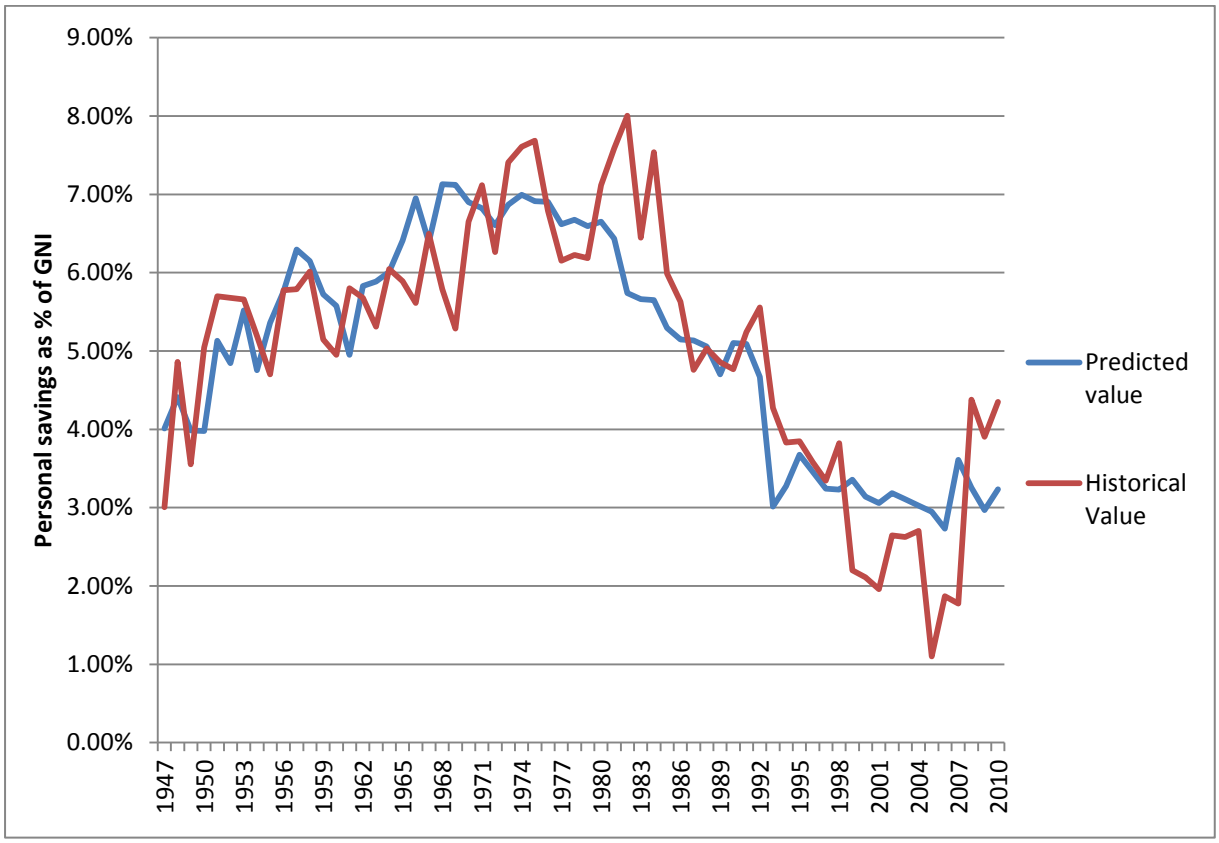


Figure 21 Predicted and historical values, gross government savings, US 1947-2010

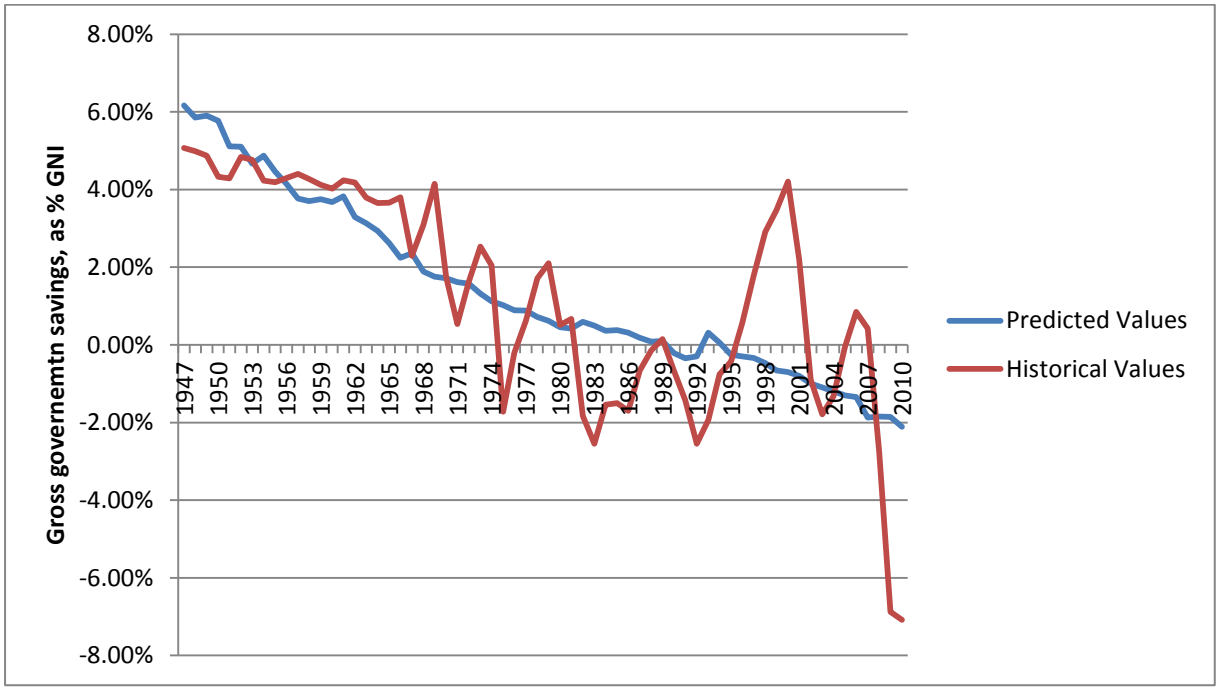


Table 26 Regression statistics, savings and inequality, US 1947-2010

Aggregate net savings			
	Gini	Year	Y intercept
Coefficient	-0.42619	-0.00094	2.08841
T-Stat	-3.37140	-4.28291	5.33038
F stat	R^2	P value	Critical T (.01)
99.31250	0.76505	6.53*10^-20	2.65886
Household net savings			
	Gini	Year	Y intercept
Coefficient	-0.68496	0.00057	-0.81671
T-Stat	-10.57654	5.10901	-4.06897
F stat	R^2	P value	Critical T (.01)
83.82152	0.73321	3.15*10^-18	2.65886
Government gross savings			
	Gini	Year	Y intercept
Coefficient	0.30847	-0.00163	3.11515
T-Stat	2.12753	-6.49045	6.93225
F stat	R^2	P value	Critical T (.01)
42.25326	0.58077	3.05*10^-12	2.65886
Business savings			
	Gini	Year	Y intercept
Coefficient	0.012	-0.00126	0.33477
T-Stat	0.2222	-1.58	1.8853
F stat	R^2	P value	Critical T (.01)
3.54	0.104	0.05451	2.65886

4.2 The functional distribution of income, demand constraints, growth, and investment

Within classical, Marxist, and neoclassical growth theory, there is a direct inverse relationship between wage share and profitability. However, once variability in aggregate demand and capacity utilisation is considered, as in neo-Marxist, Keynesian and Post-Keynesian analysis, the effect of changes in the function distribution of income can become indeterminate.[167] It is therefore necessary to consider the extent to which positive demand side effects of wages can offset the negative effect on profit-share. If the net effect of wage-share on aggregate demand is neutral or positive at all relevant distributions of income, then no short-run growth-equity trade-off could exist via profit-squeeze effects.

Although wage-led economic growth is possible and empirically observed, it is not clear that a wage-led regime is desirable or stable in the long-run. In particular, the simultaneous achievement of a stable and flexible functional distribution and high capacity utilisation can only be achieved within the context of demand and supply functions having similar relationships to the functional distribution. Furthermore, wage-led regimes can result from barriers to profit-reinvestment, such as monopolistic industrial structures. Therefore, the possible approach of achieving the nullification of the growth-equity trade-off via a shift towards wage-led demand regimes can at best be an imperfect long-run policy response.

Positive demand effects from increases in wage share result when the marginal consumption from wages is larger than marginal investment from profits, which can then lead to an increase in the average and marginal rate of capacity utilisation. Increased wage share can then positively affect investment through two channels:

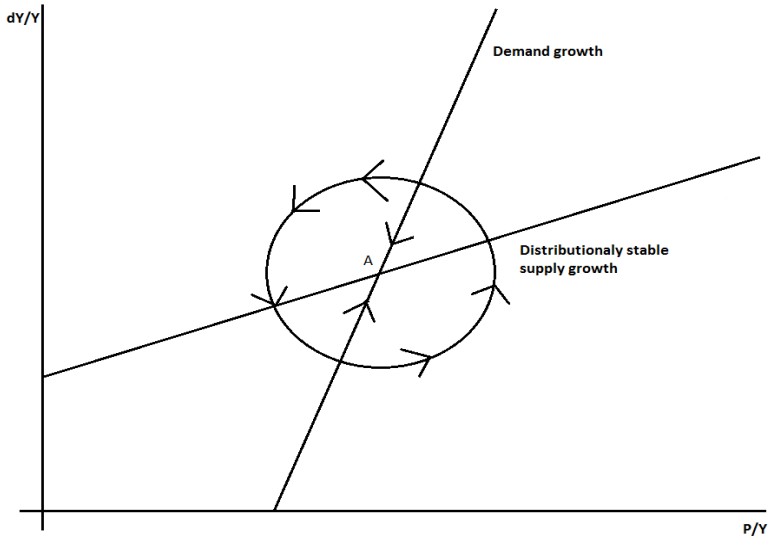
- The accelerator effect: As capacity utilisation goes beyond 'optimal' levels, investment is induced in order to reduce capacity constraints. Firms that do not increase capacity in situations of generalised capacity constraint will lose market share.[168]
- The profitability effect of increased capacity utilisation: Increased capacity utilisation increases the rate of return on capital by decreasing the capital-output ratio. When increased utilisation is driven by wage-led aggregate demand, this effect can offset the effects of rising wages on profit share and hence the rate of return to capital. In this case, the negative effect on wage-share on the rate of reinvestment via inducement effects can be offset or reversed.

[167] See S. Marglin and Amit Bhaduri, "Profit squeeze and Keynesian theory," in *The Golden Age of Capitalism. Reinterpreting the Postwar Experience* (Oxford: Clarendon Press, 1990); Amit Bhaduri and S. Marglin, "Unemployment and the real wage: the economic basis for contesting politicalideologies," *Cambridge Journal of Economics* 14 (1990): 375-93.

[168] See J Steindl, *Maturity and Stagnation in American Capitalism* (London, 1953).

Before considering the possibility of wage-led demand regimes, it is useful to consider the classical profit led Goodwin model. In this model, aggregate demand is profit led, as investment is sensitive to profit-share. Additionally, the rate of real wage increase is determined by the tightness of the labour market, i.e. by demand conditions. In this case, a stable equilibrium is possible, as are distributional cycles in the context of short-run positive feedback effects and inertia. In the classical cyclical model, high profits induce high levels of investment, which then create tight-labour market conditions, above productivity wage increases, and falling profit-share. This eventually leads to a breakdown in accumulation and a sharp fall in AD, and a consequent profit share restoring rise in the reserve army of labour. This cycle is demonstrated graphically in figure 18, alongside the equilibrium point, A, that would obtain in the absence of inertia and/or demand being wage-led in the short-run.

Figure 22 Standard Goodwin profit-led distributional cycle



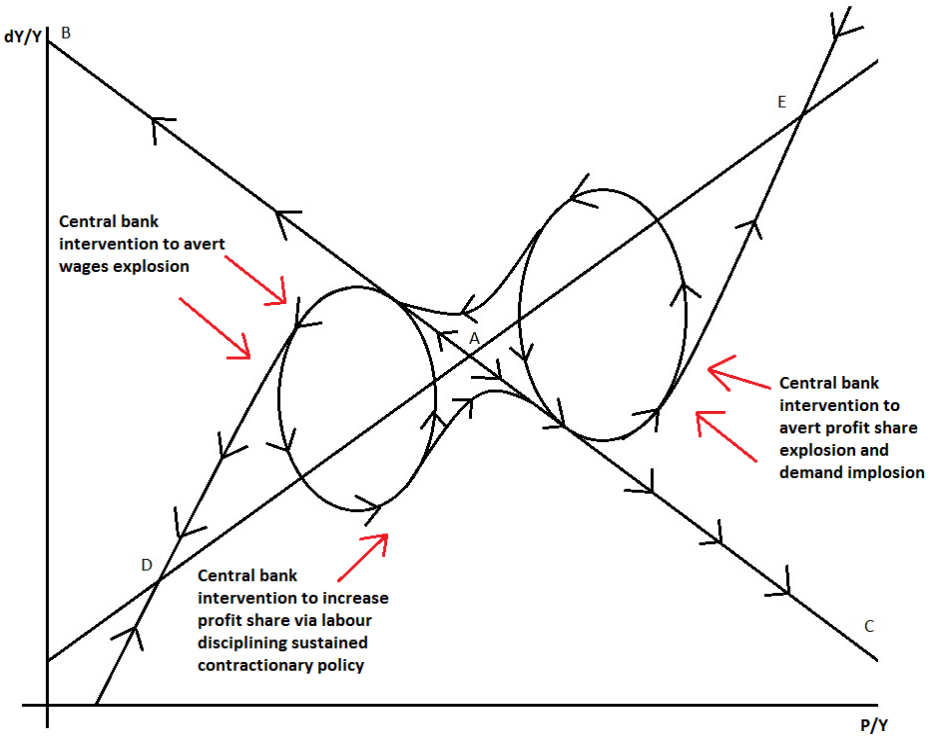
In comparison to the profit-led demand regime, a wage-led regime is capable of extreme instability, and is prone to explosive wages and demand growth, or alternatively, to implosive wage and demand, on the condition that wage-share is demand driven.[169] In this case, when demand growth exceeds the rate of distributional stable supply growth, wage share increases, leading to an increased gap between demand and supply and an explosive positive feedback process. The opposite case obtains in the situation where demand is initially below that required to maintain distributional stability. In these cases, a negative feedback needs to be introduced via macroeconomic intervention- when wage growth is explosive, the entire demand function needs to be brought downward via contractionary policy till demand is below the distributional stable supply function, in which case wage

[169] In the opposite case where profit share is demand driven, a stable cycle similar to the Goodwin model will result except the cycle will be in reverse. In this case, wage share driven demand will lead to an increase in profit share, and hence a correcting fall in demand.

share decreases. A relaxing of this contractionary policy leads to another wage explosion cycle, or, if the policy response overshoots past point A, to a wage share and demand collapse. The opposite response is necessary to forestall an implosive scenario; the demand schedule needs to be driven up such that demand and wage share increase in response to a move towards explosive profit share expansion and demand implosion. These dynamics are illustrated in figure 23.

In regards to the relationship between the functional distribution of income and AD, this indeterminacy at the level of theory can be resolved through empirical investigation. In certain economies, it can be shown that AD is either wage or profit led. A summary of the findings of this literature is given in table 22.

Figure 23 Profit led distribution cycles driven by macroeconomic policy or international credit constraints in otherwise unstable demand-led economies



In this figure, the line passing through D and E is a distribution stable supply growth function, the line passing through B and C is demand growth. The equilibrium point A is knife-edge unstable, and without policy intervention, the economy will explode towards point B, or implode towards point C. In this case, stability can be imposed by modifying by policy the demand curve to slope downwards (via contractionary policy) to create an equilibrium D, or upwards (via expansionary policy) to create the stable equilibrium E. Especially strong corrective policy can instead drive the economy back towards A, but the instability of this knife-edge will lead either to a resumption of the previous cycle, or a shift towards the opposite cycle. In this case, policy imposed Goodwin cycles can result from attempts to impose stability in an otherwise unstable system. Alternatively, in a credit constrained economy, the cycle can be driven by credit constraints- as the economy heads towards point B, the external balance becomes sharply negative, and credit inflows are necessary to sustain demand expansion. A credit squeeze will then substitute for CB contractionary policy in driving the cycle rightwards, with deleveraging driving a sustained move rightwards.

Table 22

Source	Country	Period	Finding, ex. trade	Finding, inc. trade	Notes
Weiskopf (1979)	USA	1948-78		p	Goodwin cycles uncovered
Bowles and Boyer (1995)	France		w	P	
	Germany		w	p	
	Italy		w	p	
	UK		w	w,n	
	USA		w	w,n	
Gordon (1995)	USA			P	
Stockhammer and Onoran (2004)	USA	1966-97		n	
	UK	1970-97		n	
	France	1972-97		n	
Onoran&Stockhammer (2005)	South Korea			n	
	Turkey			n	
Nastepad (2006)	Netherlands	1960-00		w, n	
Barbosa-Filho and Taylor (2006)	USA	1948–02		p	
Proaño, Flaschel, Ernst and Semmler (2006)	USA	1955-04		p	
	Euro area	1955-04		p	
Naastepad and Seervas (2006/7)	France	1960-00		w	
	Germany			w	
	Italy			w	
	Netherlands			w	
	Spain			w	
	UK			w	
	Japan			p	
	USA			p	
Ederer&Stockhammer (2007)	Austria	1960-05	w	p	
Flaschel, Tavani, Taylor and Teuber (2007)	USA	1955-04		p	g
Hein & Vogel 2007	France	1960-05	w	w	
	Germany		w	w	
	UK		w	w	
	USA		w	w	
	Austria		w	p	
	Netherlands		p	p	
Flaschel, Kauermann and Teuber (2008)	USA	1955-04		p	g
Ederer&Stockhammer (2008)	France		w	p	
Stockhammer, Onoran and Ederer (2009)	Euro Area	1960-06		w	
Stockhammer and Stehrer (2009)	Germany	1970-07		w	
	Finland			w	
	France			w	
	Japan			w	
	lux			w	
	Netherlands			w	
	Sweden			w	
	Canada			w	
	Australia			p	
	UK			p	
	Ireland			p	
	USA			p	
Diallo et al (2011)	USA	1955-06		p	g

Glossary: p=profit led, w= wage led, n = weak or insignificant result, g= goodwin cycle model

These results suggest that both wage and profit-led economic structures are possible. However, it should be noted that not all studies properly test the hypothesised negative relationship between economic activity and wage-share implied by the Goodwin (reserve-army of labour) model of profit-led distributional cycles.[170] This problem is addressed in a number of papers where explicit cyclical models have been employed, which have uncovered evidence of short and long-period profit-led Goodwin type distributive cycles in the United States.[171]

Whilst economies can be empirically classified in terms of the likely effect of changes in AD as a result of modifications to the functional distribution of income, the nature of the relationship between functional distributions is arguably determined by economic structure and policy.[172] This opens the possibility of modifying the distribution-growth relationship via policy interventions. In terms of welfare maximisation, a wage-led structure is potentially advantageous, because in this context no growth-equality trade-off problem would exist- both growth and equality could be promoted by policies designed to increase wages for low to middle income earners at the expense of capital- at least in the short-run. However, from a policy design perspective, no general preference for a wage-led structure can be given. This is because a wage-led structure is arguably less conducive to productivity increases than profit led structures. In order for an economy to be wage led, it must be sufficiently closed that increases in domestic consumption lead in large proportion to increases in AD. In addition, the economy must be sufficiently uncompetitive (or closed to external trade) across broad categories of goods that increases in profitability are not associated with large increases in export opportunities. This degree of relative autarky can be associated with low productivity, especially in small economies where a closed, diversified economy is inconsistent with efficient industry size and the realisation of economies of scale. Alternatively, in open wage-led economies, demand is likely to be highly correlated with imports and trade deficits. In this case, long periods of wage led demand growth are unsustainable if credit constraints limit the size of the deficit.

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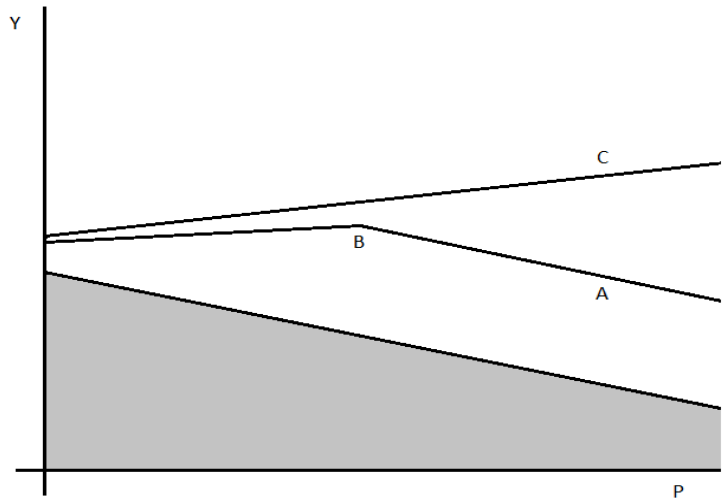
[170]R. M. Goodwin, "A Growth Cycle," in *Socialism, Capitalism and Economic Growth*, ed. C. H. Feinstein (Cambridge: Cambridge University Press, 1967).

[171]Mamadou Bobo Diallo et al., "Reconsidering the Dynamic Interaction between Real Wages andMacroeconomic Activity," *Research in World Economy* 2, no. 1 (April 2011), http://www.sciedu.ca/journal/index.php/rwe/article/viewFile/193/82.

[172] Structural determinants of the wage or profit led nature of an economy include the degree of exposure to international competition, the manner in which investment is financed, and various policy determinates of the investment function. See Lance Taylor, *Income Distribution, Inflation, and Growth* (Cambridge Mass.: MIT Press, 1991); Robert Blecker, "International Competition, Income Distribution, and Economic Growth," *Cambridge Journal of Economics* 14 (1989): 375-393; Stephanie Seguino, "The investment function revisited: disciplining capital in South Korea.," *Journal of Post Keynesian Economics* 22, no. 2 (Winter 1999): 313; Stephanie Seguino, "Wages, Income Distribution and Gender in south Korean Growth" (Ph.D. dissertation, American University, 1994); Steven M. Fazzario, "Keynsian Theories of Investment and Finance: Neo, Post, and New," in *Financial Conditions and Macroeconomic Performance*, ed. Steven M. Fazzario and Dimitri Papadimitriou (New York: M.E. Sharp, 1992); Jenny Corbett and Tim Jenkinson, "The Financing of Industry, 1970–1989: An International Comparison," *Journal of the Japanese and International Economies* 10, no. 1 (March 1996): 71-96; Steven M. Fazzario and Tracy Mott, "The Investment Theories of Kalecki and Keynes: An Empirical Study of Firm Data," *Journal of Post Keynesian Economics* 9, no. 2 (July 1986): 171-187.

Furthermore, even in economies where AD is wage-led, investment still tends to be profit led, with Japan and Korea during the 1980's being notable exceptions uncovered by one econometric study.[173] Additionally, an economy can be wage-led due to having a very low rate of marginal investment out of marginal profits, for example, due to a monopolistic industrial structure or strong liquidity preferences, both of which can limit investment even when the marginal rate of return to capital is high. In this case policies designed to increase investment by increasing the gradient of the profit-investment function, or 'unkinking' the investment function would also shift the economy towards a profit-led structure.[174] This possibility is demonstrated graphically in figure 21.

Figure 24 Kinked and linear investment-profitability functions and aggregate demand



In this figure, P is profit-share, and y is aggregate demand. The grey shaded portion is consumption, which is a positive function of wages, and hence a negative function of profit-share. Stacked on top of consumption is the investment potion of demand. In the baseline, kinked, scenario, the investment function increases with profit share till point B, where additional profits are no longer absorbed by investment. In this case, aggregate demand is weakly profit-led as profits increase to the inflexion point B, whereupon further increases in profit share reduce consumption but have no effect on investment, producing a wage-led demand function. In this case, when an economy is at point A, it is in a classic position of Kaleckian stagnation, with profit share being 'too high'. One solution would be to increase wages and bring the economy back to point B, however, this may still be associated with low investment and productivity growth. Alternatively, addressing the structural limits to investment, and 'unkinking' the investment function could enable an outcome such as C. Such a shift would also result in AD being profit led.

In addition to the productivity issues outlined above, both wage and profit-led economies suffer from the problem that for AD increases to be desirable, there is an implication that AD is in general sub-optimal.[175] Ideally, via active AD management, optimal levels of AD can

[173]V. Bhaskar and Andrew Glyn, "Investment and Profitability: The Evidence from the Advanced Capitalist Countries," in *Macroecenomic Policy After the Conservative Era: Research on Investment, Savings, and Finance*, ed. Gerald Epstein and Herbert Gintis (Cambridge: Cambridge University Press, 1995); Seguino, "The investment function revisited: disciplining capital in South Korea."

[174]A similar outcome could result from various policies designed to increase the personal savings-rate.

[175]For example, in a wage-led economy, wage rises can only be seen in a positive light from a policy perspective if AD is sub-optimal. If, on the contrary, AD is near an ideal level, wage rises would push AD beyond the optimal level, and a (long-run) equity-growth trade-off problem would re-emerge. Such a problem

be imposed at any plausible functional distribution. In such a situation of policy imposed high capacity utilisation, growth is determined solely by the supply side.[176]

The following principles of demand and investment management can be applied to maximise growth and welfare in the context of AD being (in the absence of correcting policy) distributional determined:

- The level of investment should be stabilised around the level necessary to ensure optimal levels of capacity utilisation, subject to distributional and price stability considerations.

- The marginal rate of investment out of net profits should ideally be stabilised at a level close to unity. In this case, shifts in the distribution from wages to capital automatically lead to a corresponding increase in the investment portion of demand- offsetting any reduction in workers consumption. Furthermore, a high rate of reinvestment maximises the rise in investment, and minimises the rise in rentier income, luxury consumption and consumption inequality associated with an increase in profit share.

- In economies that are ordinarily (passively) wage-led, increases in profit share should be accompanied by an increasingly expansionary macroeconomic policy, and/or direct government investment. There may be scope to finance government investment from increased taxation of 'surplus profits' (the portion of profits that is not privately reinvested). The converse applies to ordinarily profit-led economies, where decreases in profit-share should be accompanied by similar investment inducing or demand augmenting polices, and counter-cyclical lending to the enterprise sector.

- In the context of successful and unconstrained demand management, the optimal functional distribution becomes a problem of intertemporal optimisation of consumption, complicated by the impact of changes to the functional distribution on consumption inequality and hence distributional efficiency. If higher growth is sought, then investment should be increased by reducing consumption, ideally at the upper end of the income distribution, where the marginal social utility of consumption can be near zero or even negative.[177]

Achieving these outcomes is by no means uncomplicated or even readily and universally feasible. However, crucially, the capacity of governments to undertake such Keynesian rebalancing is arguably determined by 'supply side' fundamentals, in particular, the financial

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could also emerge in the context of initially sub-optimal level of AD, in the context of strongly wage led economies where large increases in wages are considered.

[176] There are limits to this approach- If distributional changes are extreme, then the capital stock will not be able to adjust quickly enough to changes in demand for capital and wage goods, and supply bottlenecks and/or unused capacity will result. The range of permissible distributions consistent with high utilisation will depend on the ability to use trade to modify the relationship between investment and consumption, and capital goods and wage good production.

[177] Olof Johansson-Stenman, Fredrik Carlsson, and Dinky Daruvala, "Measuring Future Grandparents' Preferences for Equality and Relative Standing," *The Economic Journal* 112 (April 1, 2002): 362-383.

capacity of government. In order for government to be a significant counter-cyclical investor, it must in normal periods be a significant saver.[178]

Given combined supply and demand side constraints, the optimal profit-demand function will be that which ensures an optimal level of excess capacity associated with functional stability, enabling a stable Ramsey-Cass-Koopmans optimal functional distribution. In this case, the post-policy profit-share -demand growth curve will closely follow the supply growth curve. In an ideal policy framework, with a stable and high rate of profit reinvestment, the profit-supply growth function will be sharply up-sloping, and so must be the demand function in order to achieve stable capacity utilisation rates.

In economies that are in a classic Kaleckian stagnation, where output is constrained by the profit share being 'too high' an obvious short-run solution is to implement egalitarian policies which decrease profit share and raise AD. This is, however, only a second best long-run solution, because it this case the functional distribution and growth ceiling is inflexibly determined by the point of intersection of the demand and supply schedules.

4.3 Economic policy and structure, and the parameters of the growth-equality relationship

4.3.1 The policy determinants of the investment function

In general, terms, there is evidence for a positive profit-investment relationship. However, there is reason to expect there to be significant policy and structure determined variation in the average and marginal rate of investment out of profits, both across place and time. The following variables are hypothesised to affect the shape and level of the investment function:

- The extent to which investment is 'socialised'. Presumably, state directed investment is likely to be less susceptible to changes in the rate of return to capital. Furthermore, there is likely to be an increased accounting of positive external effects in 'socialised' investment decisions, raising the general investment rate.
- The degree of capital mobility. When capital is highly mobile, private investment is likely to be highly sensitive to the local rate of return.[179] Additionally, when capital mobility is

[178] This does not imply budget surpluses, but rather revenue that exceeds consumption.
[179] Jong-Il You, "Capital-Labor Relations and Economic Development" (Harvard University, 1991).

low, the rate of savings and investment is highly correlated, and policies designed to increase the rate of savings therefore also tend to raise the rate of investment.[180]

- The nature of firm ownership and management. According to Post-Keynesian theories of the firm under financialisation, increased shareholder power can create a compulsion to disperse profits as dividends, rather than retain profits for reinvestment. In contrast, managers with secure tenure, who are judged by their long-term performance, are more likely to commit to investments with a long pay-off.[181]

- The nature of firm financing. When firms are dependent on retained profits, reduced profit share can curtail profits via reducing firm funds. This is not the case when reliable and affordable external finance is available. Likewise, market financing such as equity and corporate bonds may be more sensitive to firm profitability than bank credit, especially when banks are state owned or regulated in order to be explicitly counter-cyclical in their lending patterns.[182]

- The degree of risk perception, and mechanisms for risk sharing. Volatility in key determinants of firm profitability, combined with limited abilities to spread or insure against risk can lead to large risk premiums being attached to productive investment. This concept can be applied to industrial relations, where wage volatility and an absence of coordinated bargaining can inhibit investment. When wage rises are linked to productivity or profitability, the risk of supply and demand shock driven profit squeezes is attenuated. Additionally, when the state is a large investor, and especially in the context of insufficient demand, it is somewhat self-insured across its investment portfolio. Even if a large proportion of government investments have a low or negative

[180] This is the canonical Feldstein-Horioka hypothesis. See M. Feldstein and C. Horioka, "Domestic Savings and International Capital Flows," *Economic Journal* 90 (1980): 314-29; Nicholas Apergis and Chris Tsoumas, "A survey of the Feldstein-Horioka puzzle: What has been done and where we stand," *Research in Economics* 63, no. 2 (June 2009): 64-76; Soyoung Kim, Sunghyun H. Kim, and Yunjong Wang, "Saving, investment and international capital mobility in East Asia," *Japan and the World Economy* 19, no. 2 (March 2007): 279-291; Cheng Li, "Savings, investment, and capital mobility within China," *China Economic Review* 21, no. 1 (March 2010): 14-23.

[181] Engelbert Stockhammer, "Financialisation and the slowdown of accumulation," *Cambridge Journal of Economics* 28, no. 5 (2004): 719-741; Engelbert Stockhammer, "Shareholder value orientation and the investment-profit puzzle," *Journal of Post Keynesian Economics* 28, no. 2 (2006), p193-215; Engelbert Stockhammer, *Neoliberalism, Income Distribution and the Causes of the Crisis*, Discussion Paper (Research on Money and Finance, 2010); A. Bhide, "The hidden costs of stock market liquidity" 34, no. 1 (1993): 31-51; Thomas Dallery, "Post-Keynesian Theories of the Firm under Financialization," *Review of Radical Political Economics* 41, no. 4 (December 1, 2009): 492 -515; Eckhard Hein, "Shareholder Value Orientation, Distribution And Growth-Short- And Medium-Run Effects In A Kaleckian Model," *Metroeconomica* 61, no. 2 (2009): 302-332; W. Lazonick and M. O'Sullivan, "Maximising shareholder value: A new ideology for corporate governance," *Economy and Society* 29, no. 1 (2000); Till Van Treeck, "Reconsidering the Investment–Profit Nexus in Finance-Led Economies: An ARDL-Based Approach.," *Metroeconomica* 59, no. 3 (July 2008): 371-404.

[182] Andrew Henley and Euclid Tsakalotos, "Corporatism, profit squeeze and investment," *Cambridge Journal of Economics* 15, no. 4 (December 1, 1991): 425 -450.

return, these are likely to be balanced by positive returns in other areas, and the positive tax receipts that result from the multiplier and consumer surplus effect.[183]

- The effectiveness and credibility of counter-cyclical macroeconomic policy. When stable and growing demand is demonstrated over some time, and is explicitly guaranteed or promoted by policy, the perception of the risk of severe demand shocks is likely to be reduced.

These variables can be deployed to explain comparative growth. For example, in their periods of rapid growth, Taiwan, Korea, and Japan employed industrial policies that would be classified as pro-investment in terms of the variables mentioned above. The same variables can be employed to partially explain the rapid growth within China, where economic policy is explicitly designed to increase and stabilise investment, in order to drive capital deepening.[184] In addition, there is evidence that within western industrialised countries, various forms of corporatism is associated with a reduced dependence of investment on short and long--run profitability. This may explain why the social-democratic European countries have been able to maintain acceptable growth levels even when various potentially profitability reducing redistributive policies have been employed. In particular, these countries appeared to be less affected by profit-squeezes in the period 1972-85, in comparison to more liberal-market economies such as the United-States and Britain. Figure 25 reproduces data contained in Henley and Tsakalotos (1991), showing the varying sensitivity of investment to reductions in profitability during 1954-86.[185]

The degree to which the relationship between growth and equity is determined by industrial policy is well demonstrated by the experience of Korean and Taiwanese industrialisation. In both Korea and Taiwan, growth and industrialisation was associated with relatively egalitarian outcomes, and there is evidence that industrial and investment policy designed to promote and stabilise investment was responsible for this outcome.[186] According to Seguino (1999):

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[183] Considering trade between the government and private sector, a negative shock to the government sector terms of trade via-a-vis the private sector will tend to reduce government sector revenue, but increase private sector profits and hence taxation income. When the marginal rate of corporate taxation is sufficiently high, the whole national capital stock can essentially become part of the government investment portfolio. In the opposite case of a large rise in the government sector terms of trade, there is a case for reducing prices on government output purchased by the private sector, consistent with maximising the social return to investment (inclusive of the consumer surplus). When the consumer is the private sector, a large proportion of any losses in government revenue will be recovered from increased taxes on private sector profits.

[184] Dic Lo, "China's Quest for an Alternative to Neo-liberalism: Market Reform, Economic Growth, and Labor," *The Kyoto Economic Review* 76 (2007): 193-210.

[185] Categories are; pluralism: Australia, Canada, New Zealand, US; weak corporatism: Italy, Spain, UK; medium corporatism: Belgium, Denmark, Finland, Germany, Ireland, Switzerland; strong corporatism: Austria, Netherlands; Norway; Sweden; concertation without labour: France, Japan

[186] See Dennis L. Chinn, "Distributional Equality and Economic Growth: The Case of Taiwan," *Economic Development and Cultural Change* 26, no. 1 (October 1, 1977): 65-79; Dennis L. Chinn, "Review: Growth, Equity, and Gini Coefficients: The Case of Taiwan," *Economic Development and Cultural Change* 30, no. 4 (July

> the argument is not that profitability does not matter, but simply that the policy environment can alter the relationship between profits and investment, in some cases in salutary ways- salutary, that is, insofar as the relationship between growth and equity is concerned . . .Macro models show that, in open economies with liberalised capital flows, when a more equitable distribution of income is attempted, firms respond at times hyper-sensitively to diminutions in profitability, thereby threatening the stability of the system and economic growth . . . In spite of South Korea's semi-openness to trade in which wages can have a potentially strong negative effect on aggregate demand via the effect on export demand, wage growth that exceeds productivity growth does not appear to bring down the system. Rather, firms are corralled by the state's complex set of policies and institutional arrangements to respond to higher wages with productivity advances.[187]

A similar argument is put in the 1997 United Nations Conference on Trade and Development, Trade and Development Report:

> The relationship between inequality and accumulation is greatly influenced by the extent to which profits are saved and invested. An examination of sources of capital accumulation show that corporate profits are often the principal source of investment in industry, while the contribution of voluntary household saving to productive investment is relatively small. However, the extent to which profits are saved and reinvested varies considerably among countries. It is argued that high retention and reinvestment of profits foster accumulation and growth at minimal inequality in terms of personal income distribution. What distinguished East Asian newly industrialised economies (NIEs) from other developing countries is not so much an exceptionally high rate of household saving [as hypothesised to rise with inequality in traditional accounts] as a considerably higher propensity of corporations to save and invest profits.[188]

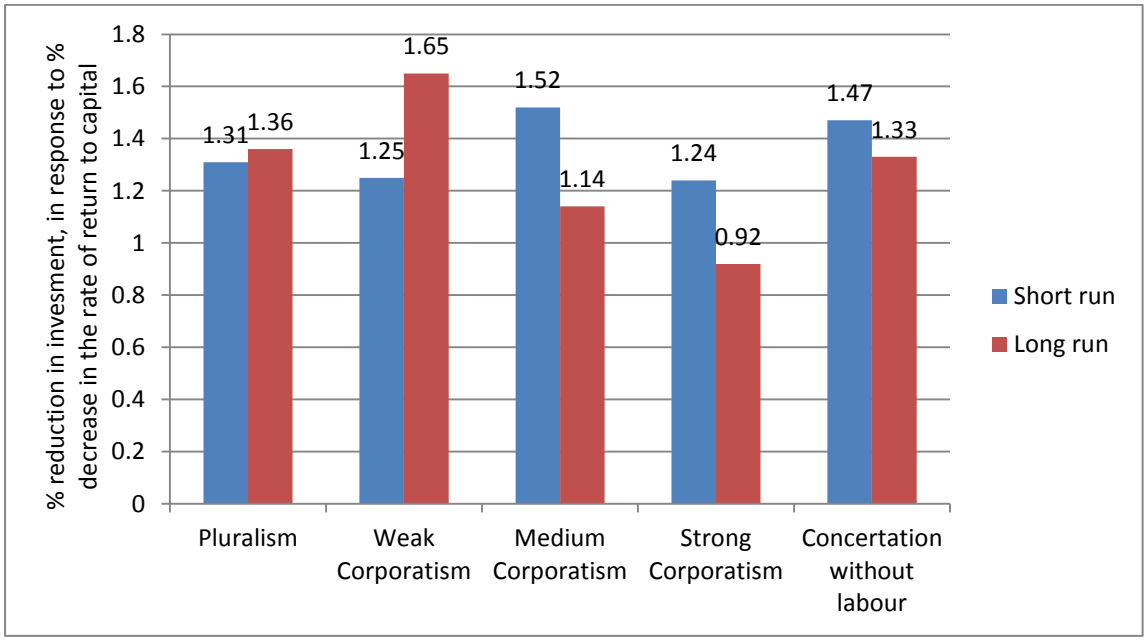
From a welfare-maximising policy standpoint, variability in the profit-investment relationship enables policy interventions to raise appreciably the level of investment for a given level of profit share. Furthermore, asset redistribution and egalitarian wages and transfer policy can reduce the level of inequality associated with a given functional distribution. Thus, high levels of investment can be achieved at very-low levels of personal inequality. This scope for policy intervention enables any possible negative equality-growth relationship operating via the physical investment channel to be attenuated or nullified even at very low levels of inequality, and suggests that the welfare optimum level of inequality is likely to be very close to the level associated with distributional efficiency.

1, 1982): 871-886; John Fei, Gustav Ranis, and Shirley W. Y. Kuo, *Growth With Equity: The Taiwan Case* (World Bank Research Publication, 1980).

[187] Seguino, "The investment function revisited: disciplining capital in South Korea."

[188] Excerpted in United Nations Conference on Trade and Development, "Income distribution, capital accumulation, and growth.," *Challenge* 41, no. 2 (March 1998): 61.

Figure 25 Profit elasticity of investment by labour/industrial policy regime, 1954-86



4.3.2 Financialisation, corporate financing and control, and the profitability-investment function

One major determinant of the profit-reinvestment rate is the nature of firm financing and control. Put simply, the financial sector and equity markets can act either to bolster corporate investment via net inflows of financial capital, or alternatively as a parasitic institution which draws funds out of the corporate sector, via dividends and interest payments. A series of papers have argued that reliance on equity markets and high levels of shareholder power reduce the firm reinvestment rate, and increase the share of post-tax profits that are paid out as dividends.[189] This effect can be exacerbated by highly dispersed share ownership, where the inability to properly monitor firms leads to the dividend rate being utilised as a default proxy for firm performance. In this case, there is a powerful incentive for managers concerned with share valuation to raise the dividend rate, even if this is at the expense of forgone investment in high value projects.[190]This effect will be especially strong if these

[189] See for example M. Aglietta and R. Breton, "Financial Systems, corporate control and capital accumulation," *Economy and Society* 30, no. 4 (2001): 433-466; Bhide Amar, "The hidden costs of stock market liquidity," *Journal of Financial Economics* 34, no. 1 (August 1993): 31-51; Clévenot, M., Y. Guy, and J. Mazier, "Investment and the rate of profit in a financial context: The French case," *Investment and the rate of profit in a financial context: The French case* 24, no. 6 (2010): 693-714; Dallery, "Post-Keynesian Theories of the Firm under Financialization"; Hein, "Shareholder Value Orientation, Distribution And Growth-Short- And Medium-Run Effects In A Kaleckian Model"; Lazonick and O'Sullivan, "Maximising shareholder value: A new ideology for corporate governance"; Engelbert Stockhammer, "Financialisation and the slowdown of accumulation," *Cambridge Journal of Economics* 28, no. 5 (2004): 719 -741; Stockhammer, "Shareholder value orientation and the investment-profit puzzle"; OECD, "Shareholder value and the market in corporate control in OECD counties," *Financial Market Trends*, 1998.

[190] Amar, "The hidden costs of stock market liquidity."

projects have a payoff horizon longer than the likely management tenure. Additionally, high levels of shareholder power and diversified holdings increase the risk of hostile takeovers, which has been shown to increase the risk premium on corporate lending.[191] Conversely, a strong bank-firm relationship can improve corporate governance and lower financing costs.[192]

A negative relationship between the degree of market firm financing and the profit reinvestment rate can be observed in cross country comparisons. Such a comparison is given for 12 mostly emerging countries in figures 26 and 27.[193] Additionally, a long term reduction in the firm reinvestment rate and corresponding increase in the rate of dividend dispersion can be observed in the US, where the role of equity markets has been especially pronounced.[194] The onset of a rapid rise in the dividend disbursement rate appears around the early 1980's, coinciding with the election of Reagan, which might be considered a turning point in the transition towards a neoliberal or financialised economic structure in the US.[195] These dynamics are illustrated in figures 28-30.

This analysis suggests that reform of the financial system designed to encourage bank lending, suppress equity markets, and reduce the dividend disbursement shift upward the investment-profitability function. Specifically, upward pressure on the reinvestment rate could be achieved by legislative limits on, and higher taxation of dividends, investment tax credits, and low interest loans linked to investment and output targets.

[191]Sudheer Chava, Dmitry Livdan, and Amiyatosh Purnanandam, "Do Shareholder Rights Affect the Cost of Bank Loans?," *Review of Financial Studies* 22, no. 8 (2009): 2973 -3004.
[192]Nishant Dass and Massimo Massa, "The Impact of a Strong Bank-Firm Relationship on the Borrowing Firm," *Review of Financial Studies* 24, no. 4 (April 1, 2011): 1204 -1260.
[193] Data is from Cornelia Staritz, "Financial structure, investment, and economic development a flow of funds analysis of emerging countries" (Ph.D. dissertation, New School University, 2008). Countries are: South Africa, South Korea, India, China, Mexico, Chile, Venezuela, Tunisia, Germany, US
[194] Data is from BEA NIPA tables.
[195] For a comprehensive study of neoliberalism, see Gérard Duménil and Dominique Lévy, *The Crisis of Neoliberalism* (New York: Harvard University Press, 2011).

Figure 26 Market financing and the firm investment rate

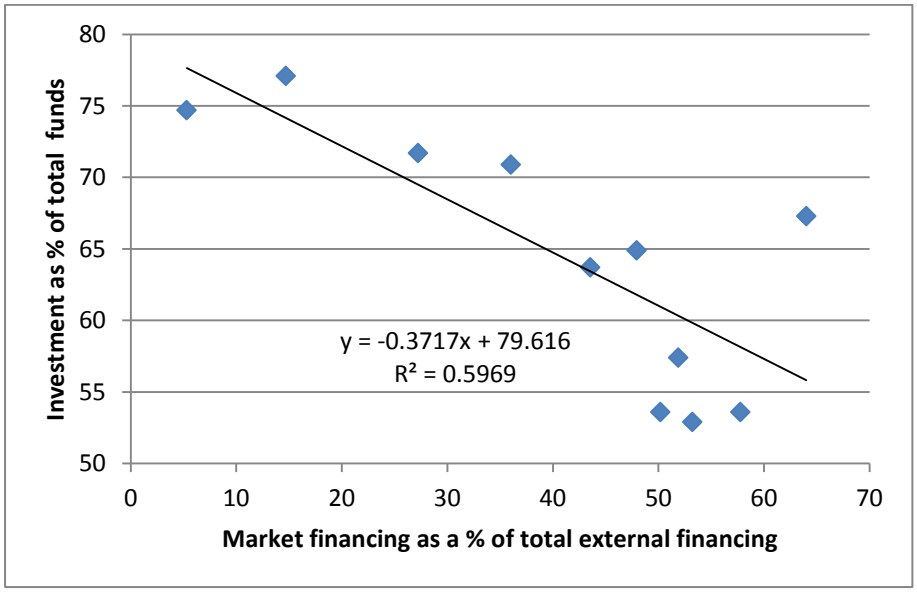


Figure 27 Bank and capital-transfer financing and the firm investment rate

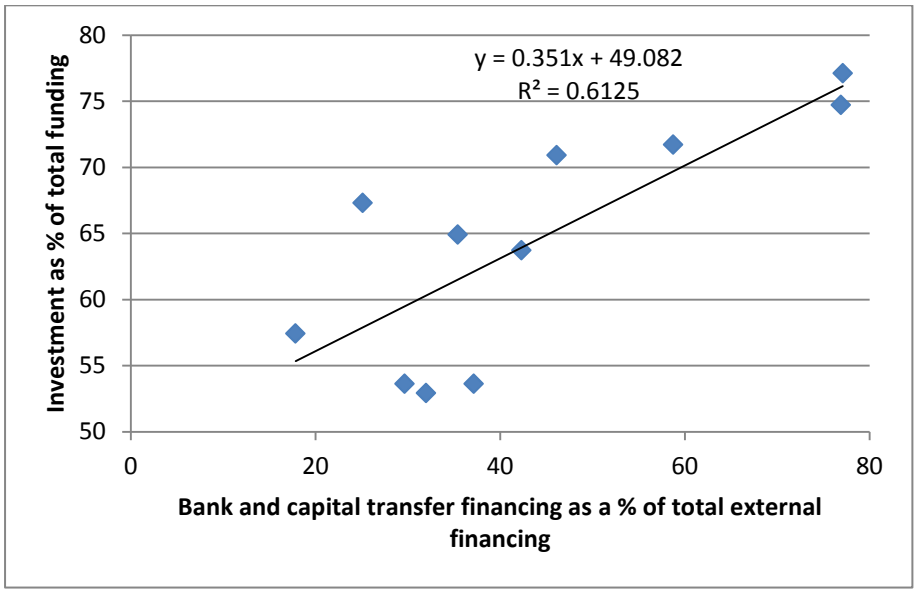


Figure 28 Corporate dividends as a percentage of GDP, US 1947-2011

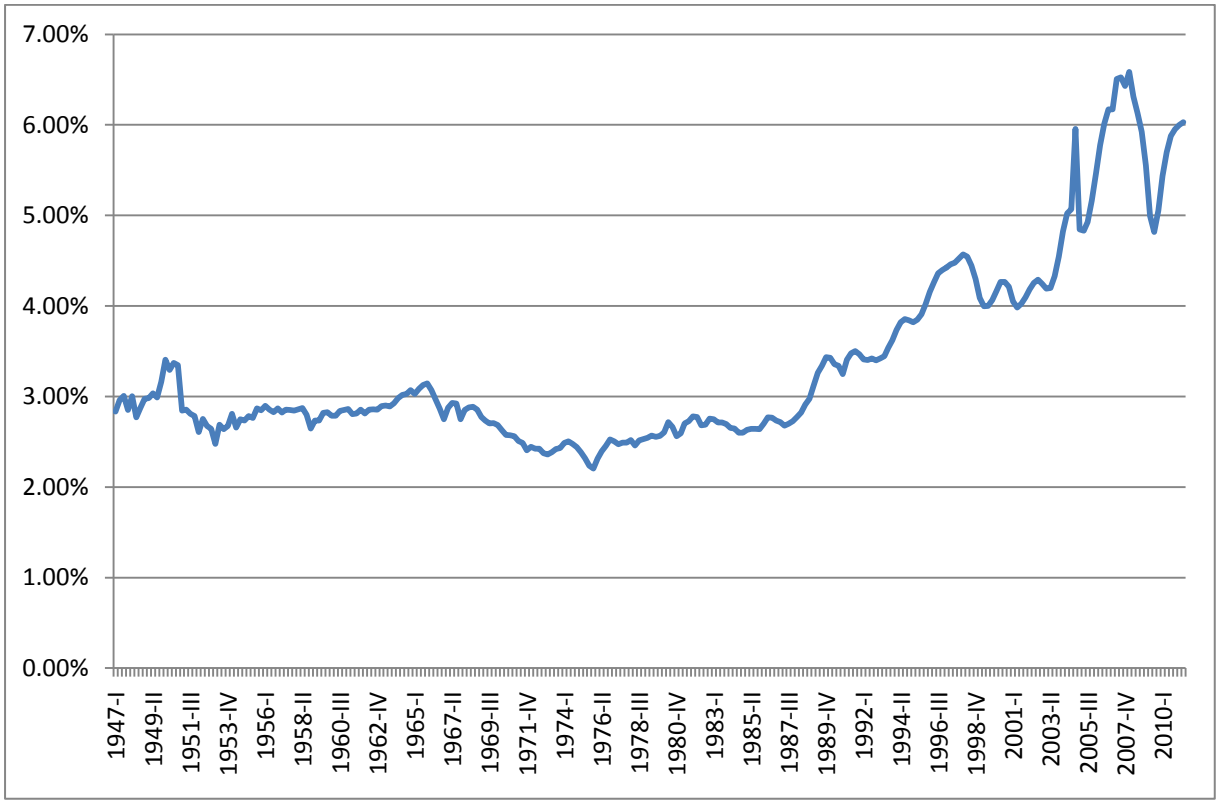


Figure 29 Corporate dividends as a percentage of post-tax profits, United States 1947-2011 (without inventory and capital consumption adjustment)

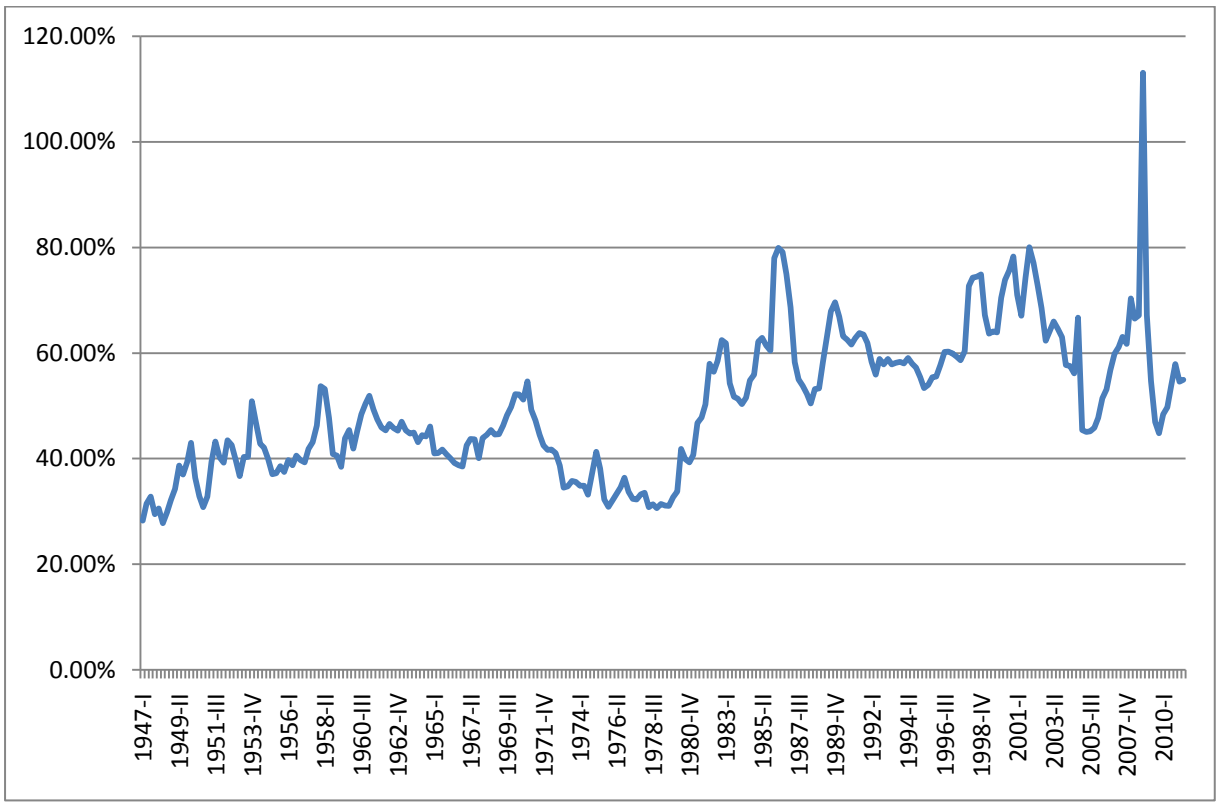
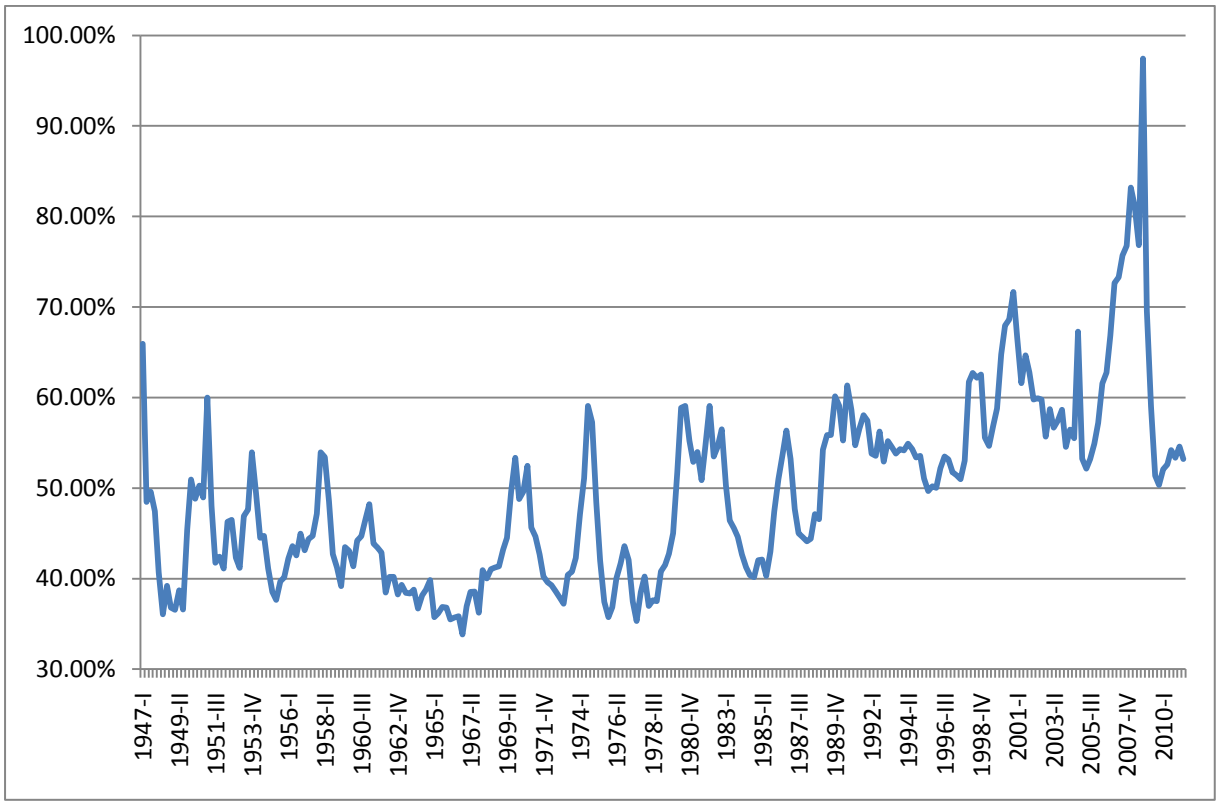


Figure 30 Corporate dividends as a percentage of post-tax profits, United States 1947-2011 (with inventory and capital consumption adjustment)



4.3.3 The profitability-investment function in the United States and China

In this section, I conduct an empirical investigation of the relationship between profitability and investment. Investment functions are estimated for both the Chinese and US national economies. This analysis reveals significant, structurally determined variation in investment functions across space and time.

Only a small proportion of the exceptionally high rate of physical capital accumulation in China can be attributed to the high rate of return, in comparison to the United States. The residual could be seen as an indicator of the strength of pro-investment and investment stabilising policies.

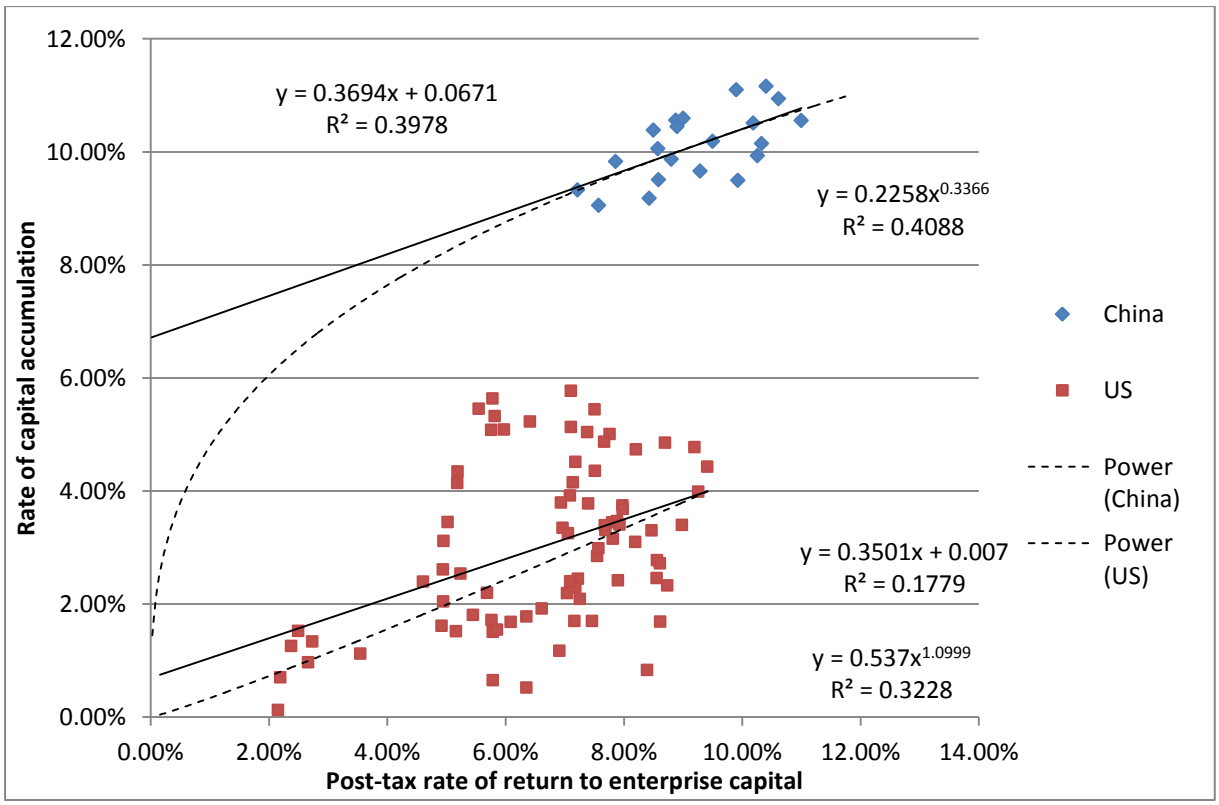
4.3.3.1 Data, estimation methods, and results

Data for China is obtained in Bai et al (2006). The authors kindly shared their updated estimates of the provincial capital stock and rate of return. Date for the United States was obtained from the BEA NIPA tables. For the time series estimates, a basic model of investment was constructed whereby the long-run (7 year moving average) rate of corporate investment is correlated to the long -run post-tax corporate rate of return (7 year moving average, 1 year lag). Additionally, a short run relationship was estimated via

estimating the correlation of the deviation from the long run trends, again with a 1 year lag on the investment data. The estimate obtained by utilising both the short and mid-run relationships, for both the United State and China is shown in figures 31-35.[196] The residual for the US model is shown in Figure 36, showing a clear inverted U relationship.

The cross section result reported for China was obtained by taking a cross section of the average pre-tax (the post-tax rate is unavailable) rate of return to capital and rate of accumulation at the provincial level, over the period 1978 to 2007. Additionally this analysis was run as a rolling cross section of annual data; the results of this analysis are shown in figure 37. The lack of data on post-tax returns at the provincial level precludes direct comparison of the investment level for a given rate of return at the Chine provincial level vis-a-vis the US national economy, but the sensitivity of investment can be calculated via the estimation of a power function. Utilising the power estimates of the long-run investment functions, estimates for the long run elasticity of investment with respect to profitability are obtained. These results are compared to the estimate for the United States obtained by Henley &Tsakalotos (1991) in figure 38.

Figure 31 long-run profitability-capital accumulation relationship in China and the United States, (correlation of 7 year moving averages)



[196] In the estimate derived from aggregated regional data, a linear decaying dummy variable for the period in the post-Tiananmen protests was utilised.

Figure 32 Chinese investment function: Cross section of Chinese provinces, 1978-05

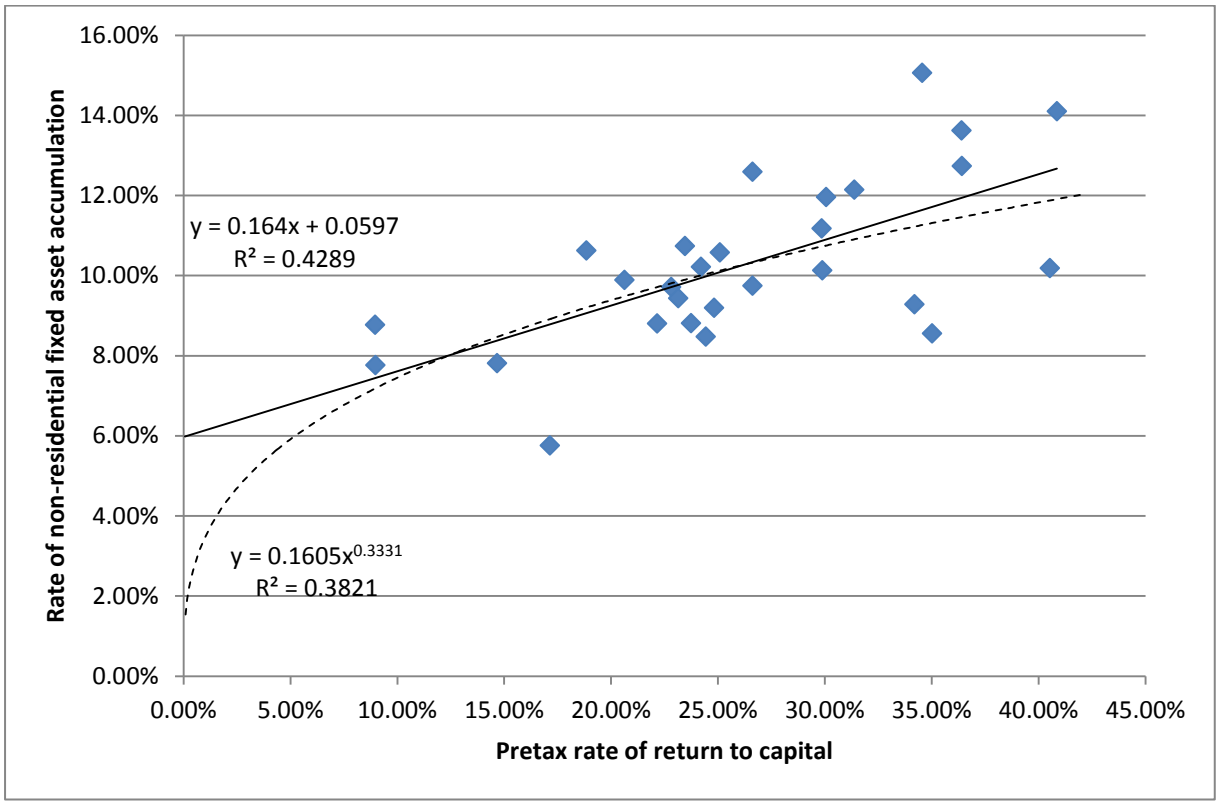


Figure 33 Predicted and actual rate of non-residential fixed capital accumulation, Chinese national economy

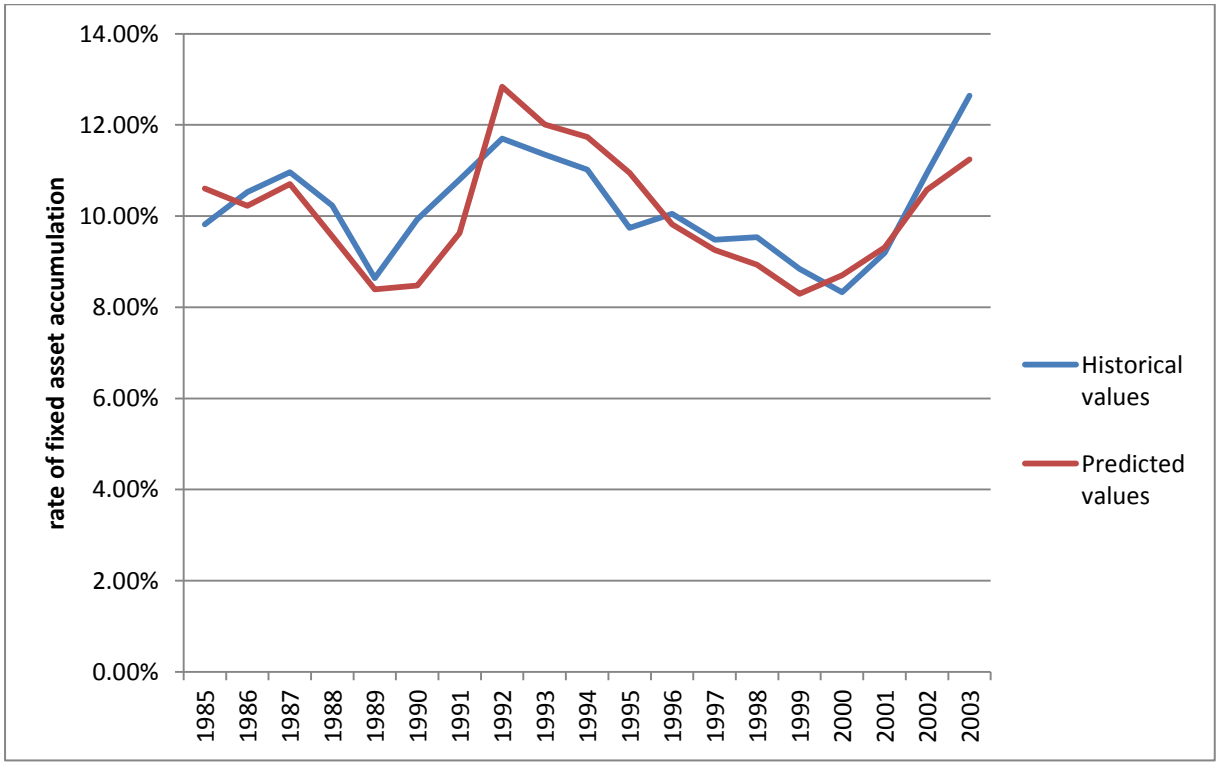


Figure 34 Predicted and actual rate of corporate capital accumulation, US, 1929-2009

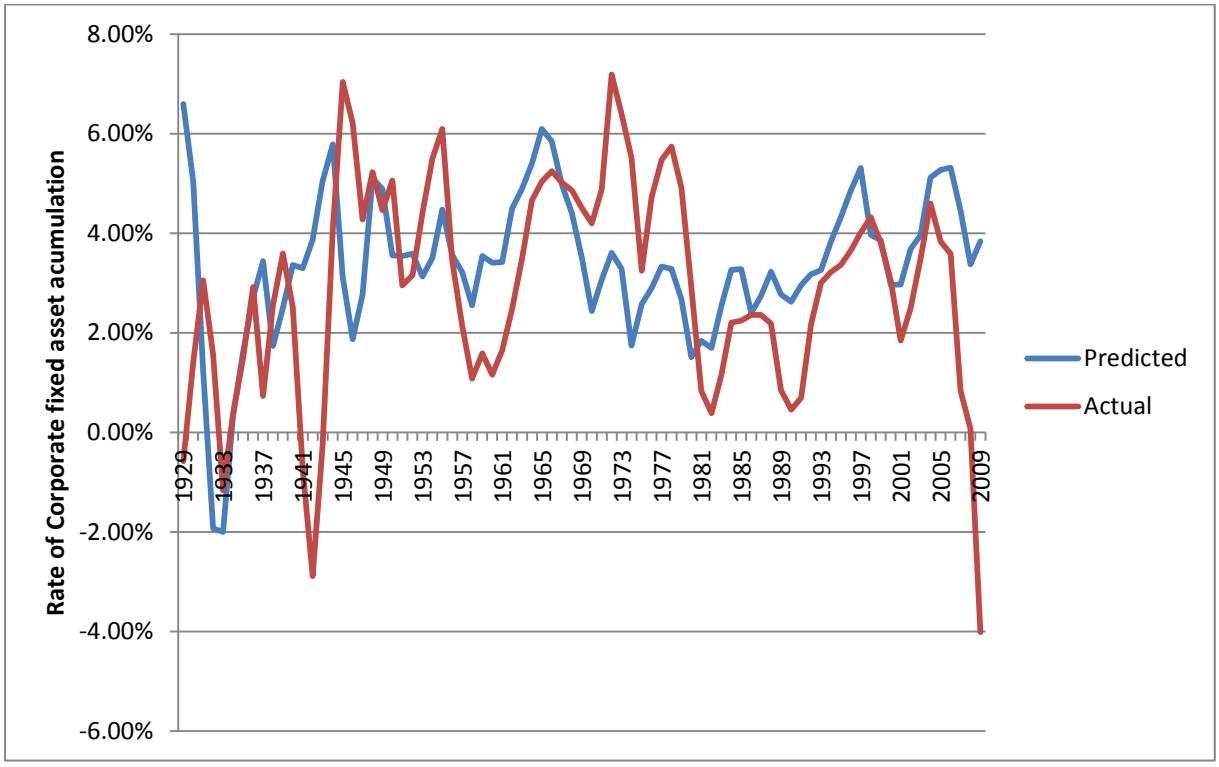


Figure 35 Predicted and actual rate of capital accumulation in Chinese national economy, from aggregated provincial estimates

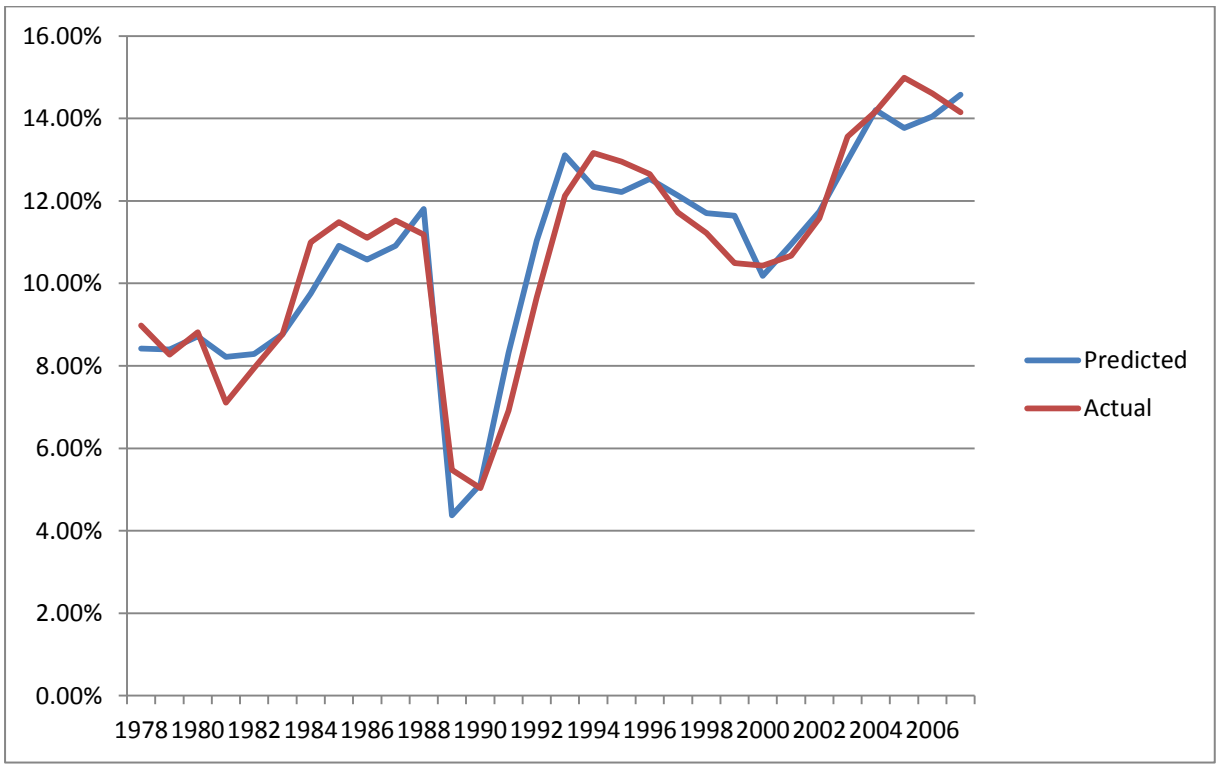


Figure 36 Residual rate of capital accumulation: US 1929-2009

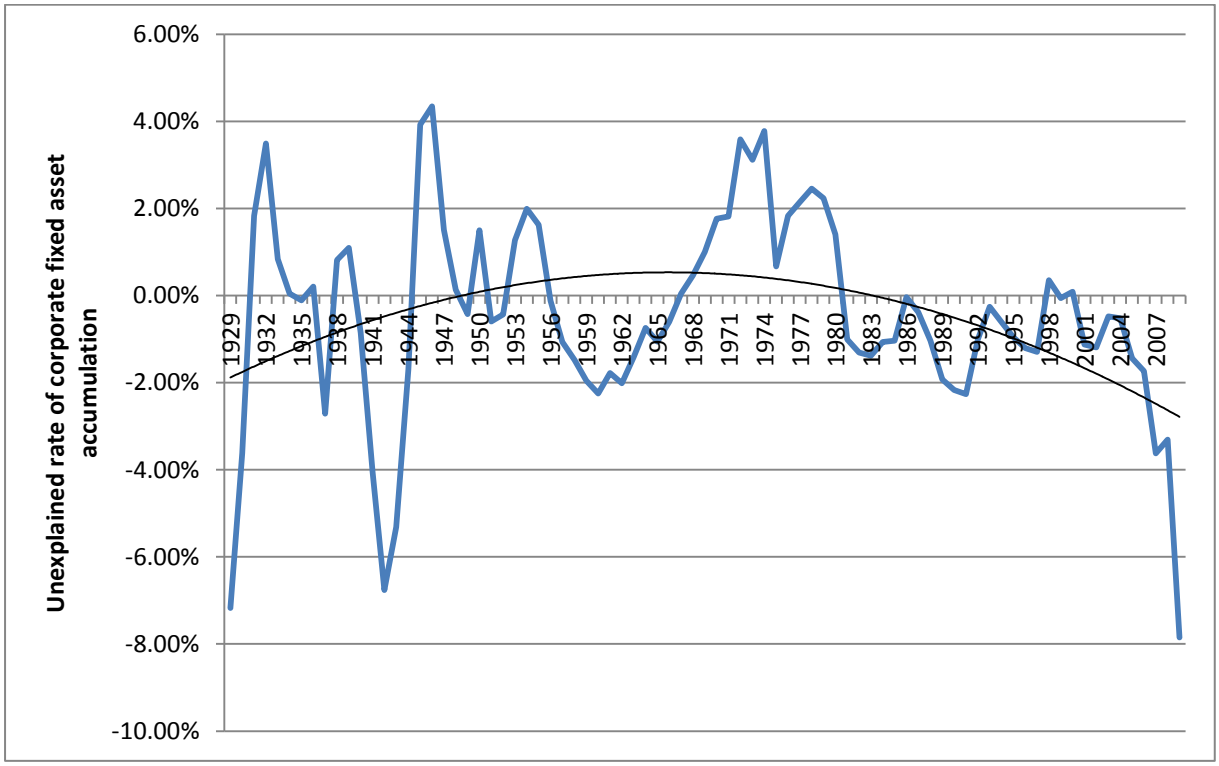


Figure 37 Chinese investment function, 1978-07: rolling provincial cross-sections, linear estimate

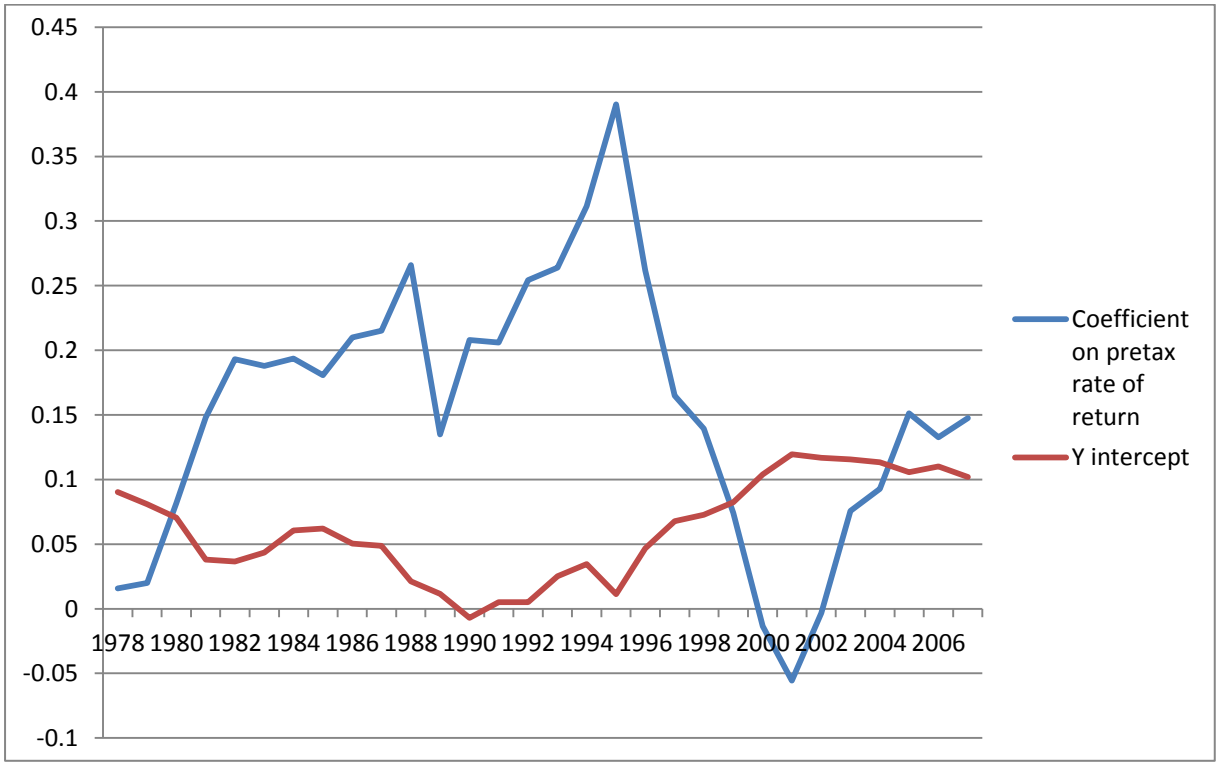
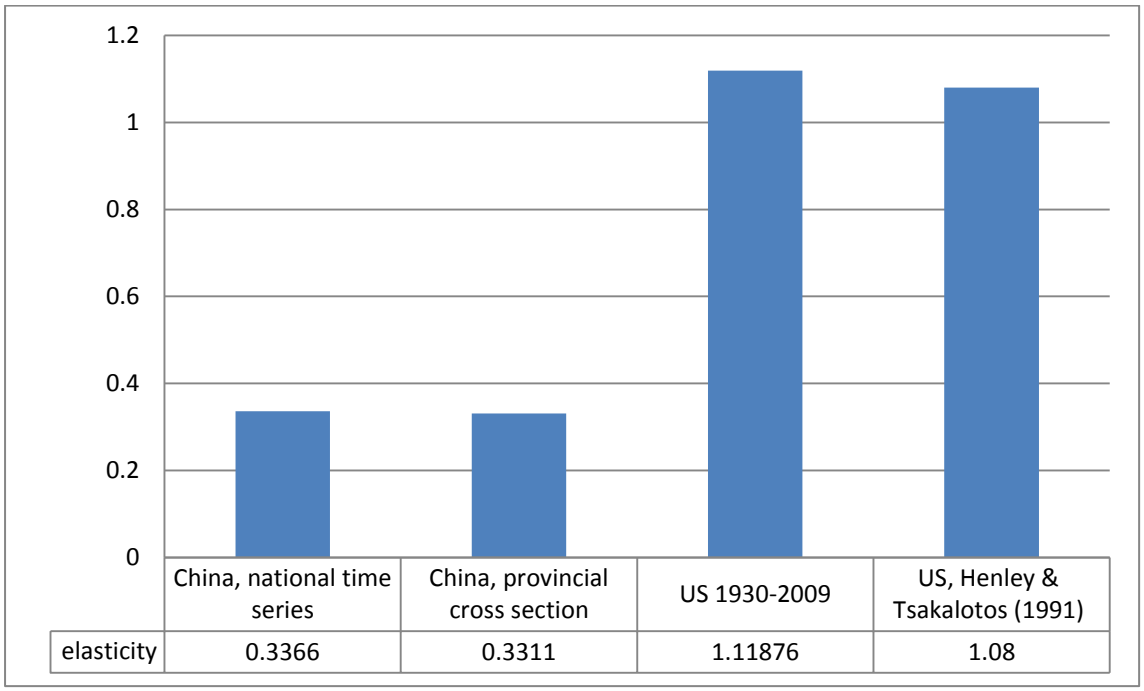


Figure 38 Estimates of the profit elasticity of investment, U.S and China



4.3.3.2 Discussion of results

Compared to the United States, China has a much higher rate of fixed capital investment that cannot fully be explained by the somewhat higher post-tax rate of return to capital. Additionally, the sensitivity of investment to profitability in China is very low in comparison to both the Unites States and other western economies, as shown by a far lower profit elasticity of investment in comparison to estimates for both the Unites States, and other countries, as presented in figures 32 and 19.

This variability in the investment function can plausibly be attributed to structural and policy factors. In particular, there are a series of factors which can plausibly explain both the high and stable level of investment in China

- State owned enterprises (SOE) have access to cheap and unconstrained credit and are not expected to pay dividends to the state.[197] They are therefore able to retain and reinvest a large proportion of their profits, and augment these with net capital

[197] Between 1994 and 2008 there was no requirement to pay dividends, see John Knight and Sai Ding, *Why Does China Invest so Much?*, Department of Economics Discussion Paper Series (Oxford: University of Oxford, 2009), http://www.economics.ox.ac.uk/Research/wp/pdf/paper441.pdf.

inflows from the financial sector. Additionally, a key explicit or implicit KPI for SOE managers is firm expansion.[198]

- The constraints of shareholder power discussed previously are not nearly as strong in China, where equity markets are not integral to firm financing and control, even within the private sector.
- Capital mobility within China is rather low, so provided that the provincial or national savings rate is high, so too will be investment, even if the rate of return is lower than in other regions or time periods. This capital immobility lowers the gradient of the profitability-investment function, and may also raise the general level of investment and savings by more strongly incentivising savings at the provincial government level.[199]
- The state acts as a large counter-cyclical investor, and as a result the Chinese economy has successfully weathered a series of major crisis, including the East-Asian financial crisis, the dot-com crash, and the GFC. Investors in China can therefore plausibly expect the risk of major profit depressing demand shocks to be slim.[200]
- The high level of national saving, and effective government control of the credit expansion rate, ensures that both the economy as a whole, and especially large firms are not credit constrained, either due to savings constraints or uncontrolled private credit tightening.[201]

That a still largely state-directed economy has a stable rate of capital accumulation is not a great surprise; however a major question is the extent to which this virtue can be retained in the face of an increased role for the market in the Chinese economy. In this regard, it is useful to examine the results presented in figure 31. This figure shows that from 1978 till 1995, the sensitivity of investment to profitability was increasing, as shown by an increased coefficient on the pre-tax rate of return. However, from 1995 onwards this sensitivity diminished, and in years around 2000 the coefficient on the rate of return became negative.

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[198] Gary H. Jefferson and Inderjit Sing, "Structure, authority, and incentives in China's industry," in *Enterprise Reform in China: Ownership, Transition and Performance* (Washington DC: World Bank and Oxford University Press, 1999), 43-64; James Reidel, Jin Jing, and Jian Gao, *How China Grows: Investment, Finance, and Reform* (Princeton: Princeton University Press, 2007); Heng-Fu Zou, "Socialist economic growth and political investment cycles," *European Journal of Political Economy* 7 (1991): 141-57.

[199] Li, "Savings, investment, and capital mobility within China"; Kim, Kim, and Wang, "Saving, investment and international capital mobility in East Asia." According to Li this immobility represents a misallocation of resources, however, increased mobility may lower the overall rate of savings and investment, increase volatility, and widen regional inequalities. As discussed in section 4.1.1.2 investments with low immediate returns in backward areas may well be rational from a long-run growth perspective- especially when, as in China, even 'low' social rates of return are likely to be well above the rate of interest on securities or yield on treasury bonds. Applying welfare weights to investment in poorer regions would further increase the calculated payoff. As shown in figure 28, the pre-tax rate of return is above 20% in most provinces.

[200] Adam McKissack and Jessica Xu, *Chinese Macroeconomic Management Through the Crisis and Beyond*, Working Paper, Treasury Working Papers (Canberra: Department of Treasury (Australia), 2011), http://www.treasury.gov.au/documents/2097/PDF/Tsy_WorkingPaper_11_1.pdf; Lo, "China's Quest for an Alternative to Neo-liberalism: Market Reform, Economic Growth, and Labor."

[201] Knight and Ding, *Why Does China Invest so Much?*; Gregory C. Chow, "Capital Formation and Economic Growth in China," *The Quarterly Journal of Economics* 108, no. 3 (1993): 809-842.

From this point the coefficient has risen, but in 2007, the Y intercept, or rate of accumulation associated with a rate of return of zero in a linear estimation, was close to 10 percent, higher than the value for 1978. Although data is unavailable beyond 2007, it is reasonable to conclude that the Chinese post GFC stimulus package, which contained large investments in infrastructure, has pushed higher the investment residual.

This outcome can be explained by a resurgent role of the state in setting a high target for capital deepening and policies such as the 'Go West' investment program designed to increase investment in low income western and central provinces.[202] In short, the process of market reforms in China has not lead to an increased sensitivity of investment to profitability. This suggests that modification to the investment function is possible in market economies, although state regulation and intervention on the scale, (although not necessarily form) of that existing in China, or for that matter employed in Korea, Japan or Taiwan in their state-capital high growth phases, may be necessary to achieve a similar investment –profitability function. It also suggest that in China, and other economies that adopt a similarly 'socialised' investment regime, wage rises, or increased government consumption on social services that are funded via capital taxation will not lead to sharp diminution in the rate of fixed capital accumulation via profit squeeze effects. Thus, although China's level of inequality is high and rising, its structure of accumulation makes egalitarian redistribution economically viable.

The role of economic structure in determining the rate of capital accumulation is also illustrated by the results presented in figure 29. In this case, the positive impact of economic regulation can be seen in the existence of a positive residual in the US investment function in the period 1944 to 1980, which might be characterised as an era of modestly regulated capitalism. Aside from the period 1992-2000, roughly coinciding with both the Clinton presidency and the IT investment boom, there has been a general decline in the investment residual since 1980, with the indicator in free fall since 2004. This decline in the residual would be consistent with some variants of financialisation theory, which predict a reduced profit retention and reinvestment rate, as outlined in section 4.3.2.

Conclusion

This chapter has assessed the equality-growth relationship from the standpoint of designing welfare maximising economic policy and structural reform. Due to the variability of the functions which determine the equality-growth relationship and a lack of countries which have had very-low levels of inequality, the inequality –growth relationship cannot be fully determined from empirical studies. However, existing empirical studies, alongside

[202] Lo, "China's Quest for an Alternative to Neo-liberalism: Market Reform, Economic Growth, and Labor."

theoretical insights, suggest that inequality is not associated with strong negative growth effects at common levels of inequality. On the contrary, equality may be growth promoting at moderate to high levels of inequality. Once the growth-equality relationship is decomposed, a very positive assessment of the likelihood of achieving a simultaneous increase in equality and growth is obtained. In particular, reforms which increase asset and wage equality, promote human capital formation, especially at the bottom of the income distribution, but do not negatively impact on profit-share and hence physical capital accumulation via the profitability-investment link are likely to unambiguously lead to increased labour productivity and growth. Furthermore, modifications to the investment-profitability function, which raise and stabilise the level of investment can both improve the efficiency and regularity with which profits lead to investment and growth, and help mitigate any potential negative growth effects, operating via egalitarian policy induced profit squeezes. Comparative analysis of the profitability-investment relationship in China and the US suggest that this function is highly variable, and that large increases in the rate of investment can be achieved for a given rate of return to capital, via investment promoting structural reform. This analysis suggest that very large welfare increases can be achieved by reforms which simultaneously increase income inequality and growth, by achieving an increase in physical and human capital formation at the expense of consumption at the upper end of the income distribution.

5 Summary of findings and suggested avenues for further research

5.1 Summary of findings and policy implications

In a famous 1994 paper critical of the East-Asian growth strategy, arguably defined by growth driven by large factor inputs and unexceptional productivity growth, Paul Krugman claimed that the 'East-Asian miracle' was no more than a story of deferred consumption on a mass scale:

> 'The newly industrializing countries of the Pacific Rim have received a reward for their extraordinary mobilization of resources that is no more than what the most boringly conventional economic theory would lead us to expect. If there is a secret to Asian growth, it is simply deferred gratification, the willingness to sacrifice current satisfaction for future gain.'[203]

Such a conclusion stems from approaching the intertemporal optimisation problem from the perspective of a representative agent model. Once the distribution of income and

[203] Krugman, "The Myth of Asia's Miracle."

consumption enters the analysis, East-Asian growth once again appears as a miracle of sorts. In this context, what matter alongside the aggregate rate of savings and consumption is whose consumption is decreased in order to fund factor accumulation, and who benefits from the growth process. When the sacrifices of forgone consumption are concentrated at the upper end of the income spectrum, and the benefits from growth widely spread, the opportunity costs of investment in terms of the welfare losses can be minimised, and the future welfare gains from growth maximised. What differentiated Korea, Taiwan and Japan from most of Africa and Latin America in their high growth phases was not lower absolute levels of consumption at the bottom and middle of the income spectrum, but a much lower level of rentier income and luxury consumption- which may have a near zero or negative marginal social utility and therefore represent no social opportunity cost at all.[204] This example very clearly outlines the need to incorporate distributional efficiency considerations into welfare calculations.

Chapters 1-3 of this thesis have outlined a method for calculating the relationship between distributional efficiency and income inequality. Although the accuracy of these calculations are limited by the available empirical evidence, the conservative estimates presented here suggest that inequality can greatly reduce the welfare outcomes for a given level of mean income. This finding has incredibly egalitarian implications- the unweighted average of total welfare losses from inequality is calculated to be equivalent to 47% of GNI. In the absence of a strong negative equality –growth relationship, this result would suggest that welfare maximisation requires a dramatic reduction in income inequality, with the potential gains to such egalitarian reform being in rough proportion to the existing level of inequality.

Chapter 4 assessed the theoretical and empirical evidence on the nature of the equality-growth relationship. On theoretical grounds, there are likely to be contradictory and non-linear effects from modifications to the personal distribution of income. Crucially, the likely effects are greatly modifiable by policy design. When inequality is reduced via asset redistribution, and egalitarian wage and taxation polices which do not reduce profit share, no negative growth effect is likely. When profit share and the return to capital is reduced, investment promoting reforms that shift upwards the investment-profitability relationship can offset any likely reduction in physical capital accumulation. A combined egalitarian and investment promoting structural reform package could simultaneously increase distributional efficiency and growth, leading to large welfare gains.

Combined, this analysis suggests that the welfare optimal post-transfer income distribution is a relatively low level, likely between a Gini index of 0.15 and 0.25. Complementary investment promoting and stabilising polices and asset redistribution can drive both the

[204] Johansson-Stenman, Carlsson, and Daruvala, "Measuring Future Grandparents' Preferences for Equality and Relative Standing." On luxury consumption as a barrier to development, see these classic works: P. Baran, *The poltical economy of growth* (Harmonsworth: Penguin, 1957); N. Kaldor, "Economic Problems in Chile," in *Essays on Economic Policy* (London: Duckworth, 1964); L. Reynolds, *Economic development in the third world* (New Haven: Yale University Press, 1986).

level of the welfare optimum higher, and reduce the level of inequality associated with this optimum, by reducing the strength of any possible link between inequality and investment. With no political constraints to policy implementation, there is likely to be no necessary strong growth-equality trade off at any relevant equality level, and the long-run welfare optimum is likely to be close to the level associated with distributional efficiency maximisation. Furthermore, the presence of environmental constraints will tend to lower further the level of inequality associated with the welfare optimum, and reduce the distance from the level of inequality associated with distributional efficiency maximisation, as any inequality induced reduction in distributional efficiency will require a greater level of output and resource throughput to achieve the same welfare level.

5.2 Suggested areas of further research

This thesis has drawn on a large body of literature, and augmented the finding of this literature with some novel estimation methods and original empirical work. However, it cannot be considered to be more than a very preliminary pilot study. Rather than concentrate on a particular issue relevant to income distribution and welfare outcomes, this thesis has sketched a broad framework for incorporating distributional concerns into welfare calculations, and demonstrated that the key questions raised by such an endeavour are capable of being fruitfully addressed by theoretical and empirical analysis. Although the answers given here are incomplete, there is little doubt that targeted empirical and theoretical investigations can fill in the gaps. These gaps are large, and a number of suggestions are presented for research which could help provide more satisfactory and precise answer to some relevant questions.

5.2.1 Suggested areas for further empirical analysis

The following are suggested as important avenues for future empirical research:

- Harsanyi lottery type estimates of inequality and risk aversion, with explicit accounting for external effects, including crime, poor health etc. These external effects can be bundled with the distribution or entered as a separate variable.
- Harsanyi lottery type studies in developing countries or cross country studies with countries with differing income levels, which would allow the income gradient of positional effects to be ascertained.
- Empirical studies on the growth equality relationship, with controls on the functional distribution of income and/or rate or return to capital.

- Cross country estimates of investment functions, preferably with controls on rates of capacity utilisation, the real interest rate, and possibly including variables such as the form of firm financing.
- Cross country estimates of the relationship between inequality and income level, and various measures of transaction costs, including advertising, financial and retail sector size etc.
- The incorporation of environmental inputs and externalities into growth measures, and estimation of the magnitude of any inequality-environmental degradation relationship. Ideally, the cost of environmental degradation should be subtracted from GDP in welfare calculations and cross country comparisons of economic performance.

5.2.2 Suggested areas for further theoretical analysis

The following are suggested as important targets for future theoretical analysis

- Derivation of an inequality augmented Ramsey-Cass-Koopmans model of intertemporal optimisation. Utilising the method outlined in chapters 1-3, distributional efficiency losses can be calculated, and then treated as a form of 'investment' that needs to pay a return in terms of greater growth. Theoretically, it should be possible to calculate the 'rate of return to inequality' when a negative growth-equality relationship exists, and this can be incorporated into a standard time preference model in which welfare is maximised over an infinite horizon.
- Construction of a flow-of funds type growth model, where distribution affects the rate of human and physical capital accumulation, and where physical-human capital complementarity and savings constraints (ideally including international credit flows) are explicitly modelled.

Appendix A

Table 27 Inequality adjusted GNI per capita and direct and indirect inequality induced welfare losses for 137 countries

Country	G-I	G-C	$GNI	$H	MLD	A 1	A 1.5	A 3	A 3.6	DAI$	DAH$	TAI$	TAH$	DA$	TA$	DL$	TL$	DL	TL
Luxembourg	0.26	0.24	$59,580	$4,494	0.07	0.07	0.10	0.19	0.22	$49,523	$4,186	$44,521	$3,487	$53,709	$48,008	$5,871	$11,572	10%	19%
Norway	0.25	0.24	$55,410	$4,885	0.07	0.06	0.09	0.18	0.21	$45,736	$4,571	$41,400	$3,852	$50,306	$45,252	$5,104	$10,158	9%	18%
Sweden	0.24	0.22	$37,810	$3,432	0.06	0.05	0.08	0.15	0.18	$31,603	$3,245	$29,051	$2,808	$34,847	$31,859	$2,963	$5,951	8%	16%
Switzerland	0.34	0.32	$47,090	$4,469	0.14	0.13	0.19	0.34	0.39	$34,561	$3,886	$28,026	$2,712	$38,448	$30,738	$8,642	$16,352	18%	35%
Denmark	0.27	0.25	$38,310	$3,770	0.08	0.07	0.11	0.21	0.24	$30,742	$3,488	$27,363	$2,856	$34,231	$30,219	$4,079	$8,091	11%	21%
Austria	0.28	0.26	$38,400	$3,792	0.08	0.08	0.12	0.22	0.26	$30,543	$3,489	$26,955	$2,816	$34,032	$29,771	$4,368	$8,629	11%	22%
Germany	0.28	0.26	$36,840	$3,724	0.08	0.08	0.12	0.22	0.26	$29,190	$3,424	$25,730	$2,757	$32,614	$28,487	$4,226	$8,353	11%	23%
Finland	0.27	0.25	$35,910	$2,910	0.08	0.07	0.11	0.21	0.24	$29,372	$2,693	$26,142	$2,205	$32,064	$28,347	$3,846	$7,563	11%	21%
Belgium	0.31	0.29	$36,640	$3,437	0.11	0.10	0.15	0.28	0.32	$28,203	$3,082	$23,956	$2,329	$31,285	$26,285	$5,355	$10,355	15%	28%
Netherlands	0.31	0.29	$36,690	$3,944	0.11	0.11	0.16	0.29	0.33	$27,662	$3,524	$23,367	$2,638	$31,186	$26,005	$5,504	$10,685	15%	29%
Canada	0.32	0.30	$37,280	$3,844	0.13	0.12	0.17	0.32	0.36	$27,667	$3,388	$22,893	$2,448	$31,055	$25,341	$6,225	$11,939	17%	32%
Australia	0.36	0.34	$38,510	$3,353	0.17	0.15	0.22	0.39	0.45	$27,435	$2,842	$21,409	$1,856	$30,277	$23,265	$8,233	$15,245	21%	40%
Japan	0.31	0.29	$32,880	$2,750	0.12	0.11	0.16	0.29	0.34	$25,328	$2,449	$21,291	$1,818	$27,777	$23,109	$5,103	$9,771	16%	30%
Iceland	0.28	0.26	$29,950	$3,320	0.09	0.08	0.12	0.23	0.27	$23,371	$3,044	$20,511	$2,433	$26,415	$22,944	$3,535	$7,006	12%	23%
France	0.33	0.31	$33,940	$3,679	0.13	0.12	0.18	0.32	0.37	$24,912	$3,231	$20,508	$2,314	$28,143	$22,821	$5,797	$11,119	17%	33%
Cyprus	0.29	0.27	$30,160	$1,825	0.10	0.09	0.13	0.25	0.29	$24,553	$1,659	$21,277	$1,297	$26,212	$22,574	$3,948	$7,586	13%	25%
Ireland	0.33	0.31	$33,030	$3,494	0.13	0.12	0.17	0.32	0.37	$24,386	$3,075	$20,134	$2,213	$27,461	$22,347	$5,569	$10,683	17%	32%
U.K.	0.35	0.33	$35,620	$3,051	0.15	0.14	0.21	0.37	0.42	$25,877	$2,617	$20,560	$1,763	$28,494	$22,323	$7,126	$13,297	20%	37%
U.S.	0.43	0.41	$45,640	$7,437	0.25	0.22	0.31	0.53	0.59	$26,231	$5,788	$18,011	$3,036	$32,020	$21,047	$13,620	$24,593	30%	54%
Singapore	0.45	0.43	$49,430	$1,833	0.29	0.25	0.35	0.58	0.64	$30,999	$1,377	$20,189	$660	$32,376	$20,848	$17,054	$28,582	35%	58%
Spain	0.33	0.31	$31,480	$2,735	0.14	0.13	0.18	0.34	0.39	$23,434	$2,387	$19,104	$1,681	$25,821	$20,785	$5,659	$10,695	18%	34%
Italy	0.34	0.32	$31,910	$2,771	0.14	0.13	0.19	0.35	0.40	$23,520	$2,402	$18,984	$1,663	$25,922	$20,647	$5,988	$11,263	19%	35%
Slovenia	0.28	0.27	$26,980	$2,129	0.09	0.09	0.13	0.24	0.28	$21,701	$1,945	$18,950	$1,541	$23,646	$20,491	$3,334	$6,489	12%	24%
Czech Republic	0.26	0.24	$24,050	$1,661	0.07	0.07	0.10	0.19	0.22	$20,198	$1,551	$18,221	$1,299	$21,748	$19,520	$2,302	$4,530	10%	19%
South Korea	0.32	0.30	$27,250	$1,651	0.12	0.11	0.16	0.30	0.34	$21,443	$1,467	$17,962	$1,082	$22,910	$19,044	$4,340	$8,206	16%	30%
Greece	0.34	0.32	$28,500	$3,010	0.14	0.13	0.19	0.34	0.39	$20,670	$2,617	$16,761	$1,826	$23,287	$18,588	$5,213	$9,912	18%	35%
Malta	0.26	0.24	$23,070	$4,197	0.07	0.07	0.10	0.19	0.22	$16,967	$3,909	$15,253	$3,256	$20,876	$18,510	$2,194	$4,560	10%	20%
Slovakia	0.26	0.24	$22,110	$1,619	0.07	0.07	0.10	0.19	0.22	$18,443	$1,509	$16,599	$1,260	$19,952	$17,859	$2,158	$4,251	10%	19%
New Zealand	0.36	0.34	$28,050	$2,525	0.17	0.15	0.22	0.39	0.45	$19,885	$2,138	$15,491	$1,393	$22,023	$16,884	$6,027	$11,166	21%	40%

Country	G-I	G-C	$GNI	$H	MLD	A 1	A 1.5	A 3	A 3.6	DAI$	DAH$	TAI$	TAH$	DA$	TA$	DL$	TL$	DL	TL
Hungary	0.27	0.26	$19,260	$1,433	0.08	0.08	0.12	0.22	0.26	$15,753	$1,319	$13,919	$1,067	$17,072	$14,986	$2,188	$4,274	11%	22%
Israel	0.39	0.37	$27,010	$2,012	0.20	0.18	0.26	0.45	0.51	$18,471	$1,644	$13,648	$978	$20,115	$14,626	$6,895	$12,384	26%	46%
Croatia	0.29	0.27	$19,240	$1,553	0.10	0.09	0.13	0.25	0.29	$15,327	$1,412	$13,281	$1,104	$16,738	$14,385	$2,502	$4,855	13%	25%
Portugal	0.39	0.36	$24,050	$2,419	0.19	0.18	0.25	0.44	0.50	$16,189	$1,994	$12,117	$1,213	$18,183	$13,329	$5,867	$10,721	24%	45%
Trinidad	0.39	0.37	$23,760	$1,237	0.20	0.18	0.26	0.45	0.51	$16,734	$1,015	$12,433	$609	$17,749	$13,043	$6,011	$10,717	25%	45%
Estonia	0.35	0.33	$19,120	$1,113	0.15	0.14	0.20	0.37	0.42	$14,330	$956	$11,403	$646	$15,286	$12,049	$3,834	$7,071	20%	37%
Poland	0.35	0.33	$18,200	$1,078	0.15	0.14	0.20	0.36	0.42	$13,669	$928	$10,913	$630	$14,597	$11,543	$3,603	$6,657	20%	37%
Lithuania	0.36	0.34	$17,380	$1,318	0.16	0.15	0.22	0.39	0.44	$12,555	$1,118	$9,813	$733	$13,673	$10,546	$3,707	$6,834	21%	39%
Latvia	0.37	0.35	$17,400	$1,100	0.17	0.16	0.23	0.41	0.46	$12,559	$925	$9,677	$591	$13,484	$10,268	$3,916	$7,132	23%	41%
Romania	0.32	0.30	$14,480	$840	0.12	0.11	0.16	0.30	0.34	$11,426	$746	$9,571	$551	$12,172	$10,121	$2,308	$4,359	16%	30%
Bulgaria	0.30	0.28	$13,290	$986	0.10	0.10	0.14	0.26	0.30	$10,592	$892	$9,119	$690	$11,485	$9,809	$1,805	$3,481	14%	26%
Belarus	0.29	0.27	$12,880	$730	0.09	0.09	0.13	0.25	0.28	$10,556	$665	$9,171	$522	$11,220	$9,693	$1,660	$3,187	13%	25%
Russia	0.41	0.39	$18,260	$1,038	0.23	0.20	0.29	0.49	0.55	$12,269	$828	$8,741	$463	$13,097	$9,203	$5,163	$9,057	28%	50%
Turkey	0.37	0.35	$13,480	$798	0.17	0.16	0.23	0.41	0.46	$9,780	$671	$7,542	$430	$10,451	$7,972	$3,029	$5,508	22%	41%
Uzbekistan	0.37	0.35	$12,800	$134	0.17	0.16	0.23	0.41	0.46	$9,768	$113	$7,533	$72	$9,880	$7,605	$2,920	$5,195	23%	41%
Kazakhstan	0.31	0.29	$10,160	$554	0.12	0.11	0.16	0.30	0.34	$8,064	$493	$6,769	$365	$8,557	$7,134	$1,603	$3,026	16%	30%
Mauritius	0.39	0.37	$13,020	$681	0.20	0.18	0.26	0.45	0.51	$9,151	$558	$6,786	$334	$9,709	$7,120	$3,311	$5,900	25%	45%
Bosnia	0.26	0.25	$8,830	$929	0.07	0.07	0.10	0.20	0.23	$7,087	$864	$6,356	$717	$7,951	$7,073	$879	$1,757	10%	20%
Chile	0.40	0.38	$13,260	$959	0.21	0.19	0.27	0.47	0.53	$8,987	$778	$6,566	$454	$9,765	$7,020	$3,495	$6,240	26%	47%
Albania	0.29	0.27	$8,260	$582	0.09	0.09	0.13	0.25	0.29	$6,662	$529	$5,780	$415	$7,191	$6,195	$1,069	$2,065	13%	25%
Macedonia	0.39	0.37	$11,000	$503	0.20	0.18	0.26	0.45	0.51	$7,785	$412	$5,773	$247	$8,197	$6,020	$2,803	$4,980	25%	45%
Argentina	0.45	0.43	$14,030	$1,062	0.28	0.25	0.35	0.57	0.64	$8,484	$800	$5,551	$386	$9,285	$5,937	$4,745	$8,093	34%	58%
Azerbaijan	0.37	0.34	$8,980	$561	0.17	0.16	0.22	0.40	0.46	$6,526	$473	$5,058	$306	$6,999	$5,364	$1,981	$3,616	22%	40%
Uganda	0.46	0.43	$12,800	$115	0.29	0.25	0.35	0.58	0.65	$8,185	$86	$5,282	$40	$8,271	$5,322	$4,529	$7,478	35%	58%
Uruguay	0.46	0.44	$12,800	$979	0.30	0.26	0.36	0.59	0.66	$7,548	$726	$4,819	$336	$8,274	$5,155	$4,526	$7,645	35%	60%
Iran	0.44	0.41	$11,420	$685	0.26	0.23	0.33	0.55	0.61	$7,238	$527	$4,880	$268	$7,765	$5,148	$3,655	$6,272	32%	55%
Malaysia	0.48	0.45	$13,650	$621	0.32	0.28	0.38	0.62	0.69	$8,021	$449	$4,938	$195	$8,471	$5,134	$5,179	$8,516	38%	62%
Venezuela	0.45	0.43	$12,170	$683	0.29	0.25	0.35	0.57	0.64	$7,490	$514	$4,884	$246	$8,003	$5,130	$4,167	$7,040	34%	58%
Algeria	0.35	0.33	$8,130	$544	0.16	0.14	0.21	0.37	0.43	$5,998	$465	$4,743	$311	$6,463	$5,053	$1,667	$3,077	21%	38%

Country	G-I	G-C	$GNI	$H	MLD	A 1	A 1.5	A 3	A 3.6	DAI$	DAH$	TAI$	TAH$	DA$	TA$	DL$	TL$	DL	TL
Mexico	0.50	0.47	$14,200	$842	0.36	0.30	0.42	0.66	0.73	$7,758	$586	$4,505	$230	$8,343	$4,736	$5,857	$9,464	41%	67%
Colombia	0.40	0.38	$8,680	$569	0.21	0.19	0.27	0.47	0.53	$5,926	$462	$4,329	$269	$6,387	$4,599	$2,293	$4,081	26%	47%
Tunisia	0.40	0.38	$7,800	$501	0.21	0.19	0.27	0.47	0.53	$5,317	$406	$3,874	$236	$5,723	$4,109	$2,077	$3,691	27%	47%
Costa Rica	0.48	0.46	$10,870	$1,165	0.34	0.29	0.40	0.64	0.70	$5,855	$832	$3,533	$349	$6,687	$3,882	$4,183	$6,988	38%	64%
Egypt	0.34	0.32	$5,790	$261	0.15	0.14	0.20	0.36	0.41	$4,435	$225	$3,557	$154	$4,660	$3,712	$1,130	$2,078	20%	36%
Thailand	0.43	0.40	$7,650	$328	0.25	0.22	0.31	0.52	0.58	$5,070	$257	$3,510	$137	$5,327	$3,647	$2,323	$4,003	30%	52%
China	0.40	0.38	$6,860	$309	0.21	0.19	0.27	0.47	0.53	$4,786	$251	$3,497	$146	$5,037	$3,643	$1,823	$3,217	27%	47%
Dominican Rep	0.45	0.43	$8,080	$465	0.28	0.24	0.34	0.57	0.63	$4,999	$351	$3,282	$171	$5,350	$3,453	$2,730	$4,627	34%	57%
Turkmenistan	0.41	0.39	$6,580	$146	0.22	0.20	0.28	0.49	0.55	$4,611	$117	$3,304	$66	$4,728	$3,370	$1,852	$3,210	28%	49%
Armenia	0.35	0.33	$5,370	$224	0.16	0.15	0.21	0.38	0.43	$4,062	$191	$3,207	$127	$4,254	$3,334	$1,116	$2,036	21%	38%
Tajikistan	0.33	0.31	$4,780	$95	0.13	0.12	0.18	0.32	0.37	$3,857	$83	$3,175	$60	$3,940	$3,235	$840	$1,545	18%	32%
Jordan	0.39	0.37	$5,700	$496	0.20	0.18	0.26	0.46	0.51	$3,842	$405	$2,836	$241	$4,247	$3,076	$1,453	$2,624	25%	46%
Jamaica	0.46	0.43	$7,420	$1,231	0.29	0.25	0.35	0.58	0.64	$4,012	$922	$2,601	$438	$4,934	$3,039	$2,486	$4,381	34%	59%
Panama	0.56	0.53	$12,240	$1,081	0.47	0.38	0.51	0.76	0.82	$5,479	$673	$2,690	$198	$6,152	$2,889	$6,088	$9,351	50%	76%
Brazil	0.53	0.50	$10,140	$943	0.42	0.34	0.47	0.72	0.78	$4,895	$619	$2,606	$210	$5,515	$2,816	$4,625	$7,324	46%	72%
Ecuador	0.51	0.49	$8,870	$503	0.39	0.32	0.44	0.69	0.75	$4,694	$342	$2,633	$127	$5,036	$2,760	$3,834	$6,110	43%	69%
Peru	0.51	0.49	$8,300	$400	0.39	0.32	0.44	0.69	0.75	$4,420	$272	$2,472	$100	$4,691	$2,573	$3,609	$5,727	43%	69%
Mongolia	0.33	0.31	$3,680	$166	0.13	0.12	0.18	0.32	0.37	$2,888	$146	$2,374	$104	$3,034	$2,478	$646	$1,202	18%	33%
Georgia	0.41	0.38	$4,690	$499	0.22	0.20	0.28	0.48	0.54	$3,015	$401	$2,169	$228	$3,416	$2,397	$1,274	$2,293	27%	49%
Indonesia	0.37	0.35	$4,030	$91	0.17	0.16	0.23	0.41	0.46	$3,035	$76	$2,339	$49	$3,112	$2,387	$918	$1,643	23%	41%
Morocco	0.40	0.38	$4,380	$251	0.21	0.19	0.27	0.47	0.54	$2,994	$203	$2,171	$117	$3,196	$2,287	$1,184	$2,093	27%	48%
El Salvador	0.50	0.47	$6,390	$427	0.36	0.30	0.42	0.66	0.72	$3,486	$299	$2,038	$119	$3,785	$2,157	$2,605	$4,233	41%	66%
Ukraine	0.30	0.28	$2,850	$445	0.10	0.10	0.14	0.26	0.30	$2,069	$403	$1,780	$311	$2,472	$2,091	$378	$759	13%	27%
Sri Lanka	0.45	0.42	$4,690	$193	0.28	0.24	0.34	0.56	0.63	$2,976	$147	$1,969	$72	$3,122	$2,041	$1,568	$2,649	33%	56%
Moldova	0.33	0.31	$3,020	$341	0.13	0.13	0.18	0.33	0.38	$2,189	$298	$1,789	$211	$2,487	$1,999	$533	$1,021	18%	34%
Timor-lest	0.38	0.36	$3,500	$126	0.19	0.17	0.24	0.43	0.49	$2,548	$104	$1,924	$65	$2,653	$1,989	$847	$1,511	24%	43%
Samoa	0.43	0.41	$4,250	$312	0.25	0.22	0.31	0.53	0.59	$2,698	$242	$1,849	$127	$2,941	$1,975	$1,309	$2,275	31%	54%
India	0.37	0.35	$3,260	$122	0.17	0.16	0.23	0.41	0.46	$2,420	$103	$1,866	$66	$2,523	$1,932	$737	$1,328	23%	41%
Bhutan	0.47	0.44	$4,930	$274	0.31	0.27	0.37	0.60	0.67	$2,927	$201	$1,840	$91	$3,128	$1,931	$1,802	$2,999	37%	61%

Country	G-I	G-C	$GNI	$H	MLD	A 1	A 1.5	A 3	A 3.6	DAI$	DAH$	TAI$	TAH$	DA$	TA$	DL$	TL$	DL	TL
Botswana	0.62	0.59	$13,160	$1,341	0.63	0.47	0.61	0.85	0.90	$4,590	$714	$1,782	$141	$5,303	$1,923	$7,857	$11,237	60%	85%
Pakistan	0.31	0.29	$2,670	$63	0.11	0.10	0.15	0.28	0.32	$2,211	$56	$1,876	$43	$2,268	$1,918	$402	$752	15%	28%
Vietnam	0.36	0.34	$2,780	$211	0.16	0.15	0.21	0.38	0.44	$2,018	$180	$1,585	$119	$2,198	$1,704	$582	$1,076	21%	39%
Kyrgyzstan	0.30	0.28	$2,190	$123	0.11	0.10	0.15	0.27	0.32	$1,761	$111	$1,499	$84	$1,871	$1,583	$319	$607	15%	28%
Philippines	0.45	0.43	$3,670	$129	0.28	0.25	0.35	0.57	0.64	$2,314	$97	$1,512	$47	$2,411	$1,559	$1,259	$2,111	34%	58%
Guyana	0.43	0.41	$3,330	$247	0.25	0.22	0.32	0.53	0.60	$2,103	$191	$1,435	$99	$2,295	$1,534	$1,035	$1,796	31%	54%
South Africa	0.61	0.59	$10,010	$862	0.62	0.46	0.61	0.84	0.89	$3,605	$463	$1,421	$94	$4,069	$1,514	$5,941	$8,496	59%	85%
Swaziland	0.50	0.48	$4,450	$287	0.37	0.31	0.43	0.67	0.73	$2,385	$198	$1,366	$76	$2,583	$1,442	$1,867	$3,008	42%	68%
Yemen	0.36	0.33	$2,330	$142	0.16	0.15	0.21	0.38	0.43	$1,723	$121	$1,357	$80	$1,844	$1,437	$486	$893	21%	38%
Laos	0.35	0.33	$2,210	$89	0.15	0.14	0.20	0.36	0.41	$1,696	$77	$1,356	$52	$1,773	$1,408	$437	$802	20%	36%
Congo Rep	0.44	0.42	$3,020	$108	0.27	0.24	0.34	0.56	0.62	$1,935	$82	$1,286	$41	$2,018	$1,327	$1,002	$1,693	33%	56%
Paraguay	0.53	0.51	$4,410	$281	0.43	0.35	0.47	0.72	0.78	$2,181	$184	$1,152	$61	$2,365	$1,214	$2,045	$3,196	46%	72%
Guatemala	0.54	0.52	$4,560	$308	0.45	0.36	0.49	0.74	0.80	$2,164	$196	$1,101	$62	$2,360	$1,163	$2,200	$3,397	48%	75%
Cave Verde	0.51	0.48	$3,550	$174	0.37	0.31	0.43	0.67	0.74	$1,929	$120	$1,102	$46	$2,048	$1,148	$1,502	$2,402	42%	68%
Mauritania	0.39	0.37	$1,950	$47	0.20	0.18	0.26	0.45	0.51	$1,411	$39	$1,047	$23	$1,450	$1,070	$500	$880	26%	45%
Angola	0.59	0.56	$5,430	$183	0.55	0.42	0.56	0.81	0.86	$2,310	$106	$1,017	$26	$2,416	$1,043	$3,014	$4,387	56%	81%
Bangladesh	0.33	0.31	$1,540	$48	0.14	0.13	0.18	0.33	0.38	$1,217	$42	$993	$30	$1,259	$1,023	$281	$517	18%	34%
Cameroon	0.45	0.42	$2,180	$119	0.28	0.24	0.34	0.56	0.63	$1,364	$90	$902	$44	$1,454	$947	$726	$1,233	33%	57%
Nigeria	0.44	0.41	$2,090	$136	0.26	0.23	0.33	0.54	0.61	$1,319	$105	$890	$53	$1,424	$943	$666	$1,147	32%	55%
Nicaragua	0.48	0.45	$2,530	$251	0.33	0.28	0.39	0.62	0.69	$1,400	$181	$860	$79	$1,581	$938	$949	$1,592	38%	63%
Honduras	0.55	0.52	$3,690	$248	0.45	0.36	0.49	0.74	0.80	$1,743	$158	$883	$49	$1,901	$932	$1,789	$2,758	48%	75%
Cambodia	0.42	0.40	$1,920	$122	0.24	0.22	0.31	0.52	0.58	$1,249	$96	$867	$51	$1,345	$919	$575	$1,001	30%	52%
Senegal	0.41	0.39	$1,800	$102	0.23	0.20	0.29	0.50	0.56	$1,205	$81	$855	$45	$1,286	$900	$514	$900	29%	50%
Benin	0.37	0.34	$1,490	$65	0.17	0.16	0.22	0.40	0.46	$1,105	$55	$856	$35	$1,159	$892	$331	$598	22%	40%
Bolivia	0.58	0.56	$4,430	$213	0.54	0.42	0.55	0.80	0.85	$1,884	$124	$842	$31	$2,009	$873	$2,421	$3,557	55%	80%
Tanzania	0.35	0.33	$1,360	$57	0.15	0.14	0.20	0.36	0.41	$1,042	$49	$833	$33	$1,091	$867	$269	$493	20%	36%
Ghana	0.40	0.38	$1,530	$204	0.21	0.19	0.27	0.47	0.53	$963	$165	$700	$95	$1,128	$795	$402	$735	26%	48%
Kenya	0.43	0.40	$1,560	$68	0.25	0.22	0.31	0.52	0.58	$1,033	$53	$715	$28	$1,086	$744	$474	$816	30%	52%
PNG	0.51	0.48	$2,280	$57	0.38	0.32	0.44	0.68	0.74	$1,256	$39	$710	$15	$1,295	$724	$985	$1,556	43%	68%

Country	G-I	G-C	$GNI	$H	MLD	A 1	A 1.5	A 3	A 3.6	DAI$	DAH$	TAI$	TAH$	DA$	TA$	DL$	TL$	DL	TL
Ethiopia	0.30	0.28	$930	$40	0.10	0.10	0.14	0.27	0.31	$761	$36	$651	$28	$797	$678	$133	$252	14%	27%
Burkina Faso	0.40	0.37	$1,160	$88	0.21	0.19	0.27	0.46	0.52	$788	$72	$579	$42	$859	$621	$301	$539	26%	46%
Chad	0.40	0.38	$1,160	$94	0.21	0.19	0.27	0.47	0.53	$779	$76	$569	$44	$855	$613	$305	$547	26%	47%
Mali	0.40	0.38	$990	$65	0.21	0.19	0.27	0.47	0.53	$672	$53	$488	$30	$724	$518	$266	$472	27%	48%
Guinea	0.38	0.36	$920	$58	0.19	0.17	0.25	0.44	0.50	$647	$48	$485	$29	$695	$515	$225	$405	24%	44%
Nepal	0.47	0.45	$1,170	$69	0.32	0.27	0.38	0.61	0.68	$685	$50	$427	$22	$736	$449	$434	$721	37%	62%
Malawi	0.39	0.37	$820	$50	0.20	0.18	0.26	0.45	0.51	$571	$41	$423	$25	$612	$448	$208	$372	25%	45%
Rwanda	0.47	0.44	$1,120	$102	0.31	0.27	0.37	0.60	0.67	$640	$75	$402	$34	$715	$436	$405	$684	36%	61%
Gambia, The	0.50	0.48	$1,260	$75	0.37	0.31	0.42	0.67	0.73	$683	$52	$393	$20	$735	$413	$525	$847	42%	67%
Zambia	0.51	0.48	$1,300	$68	0.38	0.32	0.43	0.68	0.74	$698	$47	$395	$18	$745	$413	$555	$887	43%	68%
Guinea Bissau	0.47	0.45	$1,050	$32	0.31	0.27	0.37	0.61	0.67	$637	$23	$398	$10	$660	$409	$390	$641	37%	61%
Madagascar	0.48	0.45	$980	$261	0.32	0.27	0.38	0.62	0.68	$444	$189	$275	$83	$634	$357	$346	$623	35%	64%
Mozambique	0.47	0.45	$870	$50	0.32	0.27	0.38	0.61	0.68	$509	$36	$316	$16	$546	$332	$324	$538	37%	62%
Namibia	0.73	0.70	$6,340	$384	1.02	0.64	0.78	0.95	0.97	$1,290	$139	$280	$10	$1,429	$290	$4,911	$6,050	77%	95%
Lesotho	0.63	0.60	$2,040	$119	0.67	0.49	0.64	0.87	0.91	$700	$61	$255	$11	$761	$266	$1,279	$1,774	63%	87%
Niger	0.51	0.48	$660	$40	0.37	0.31	0.43	0.67	0.74	$354	$28	$202	$11	$382	$213	$278	$447	42%	68%
Haiti	0.59	0.57	$1,150	$69	0.57	0.43	0.57	0.82	0.87	$463	$39	$198	$9	$502	$207	$648	$943	56%	82%
Burundi	0.42	0.40	$390	$49	0.24	0.22	0.31	0.52	0.58	$237	$38	$164	$21	$275	$185	$115	$205	29%	53%
Congo Dem	0.44	0.42	$300	$31	0.27	0.24	0.34	0.56	0.62	$179	$24	$119	$12	$202	$131	$98	$169	33%	56%
Central African Republic	0.61	0.59	$750	$32	0.62	0.46	0.60	0.84	0.89	$284	$17	$112	$4	$301	$116	$449	$634	60%	85%
Sierra Leone	0.63	0.60	$800	$104	0.66	0.49	0.63	0.86	0.91	$257	$54	$95	$10	$311	$105	$489	$695	61%	87%
Unweighted average	0.40	0.38	$12,956	$1,051	0.24	0.20	0.28	0.47	0.52	$9,299	$897	$7,427	$622	$10,196	$8,048	$2,759	$4,907	28%	47%

Glossary for table 20

G-I	Gini Index of income Inequality
G-C	Gini Index of consumption Inequality
$GNI	GNI per capita, $2005 PPP adjusted
$H	Health expenditures, $2005 PPP adjusted
MLD	Mean Log Deviation of unwarranted income inequality
A 1	Atkinson Index, ε =1
A 1.5	Atkinson index,$\varepsilon = 1.5$
A 3	Atkinson index, $\varepsilon = 3$
A 3.57	Atkinson Index, $\varepsilon = 3.6$
DAI$	Non-health expenditures, adjusted for direct inequality losses
DAH$	Health expenditures, adjusted for direct inequality losses
TAI$	Non-health expenditures, adjusted for total inequality losses
TAH$	Health expenditures, adjusted for total inequality losses
DA$	Total income, adjusted for direct losses
TA$	Total income, adjusted for total losses
DL$	Direct losses, in $2005 PPP
TL$	Total Losses, in $2005 PPP
DL	Direct losses, as % GNI
TL	Total Losses, as % GNI

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