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PROFILE

"Fair Shares" of the Economic Pie:
What Actually *Is* Fair, and Why? And What Does This Mean for Capitalist Theory?

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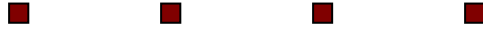
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"Fair Shares" of the Economic Pie:
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The conviction of the have-nots that they are unfairly taken advantage of by the haves has often been cited as a primary determinant of social and political upheaval throughout the ages. The names of Spartacus, Robespierre, Marx, and Mao come to mind when we recall cries for fairness and redistribution across history. This redistributive impulse is far from dead, and is now showing new signs of life worldwide.

A. Introduction

This **PROFILE** is one of the most ambitious we have ever published. It addresses what is becoming the most fundamental, if controversial, topic on front pages around the world: Distributive Justice. More specifically, what exactly do we mean by "Fair Shares" of the economic pie? Who owes how much to whom, and why? Should the tax schedule be "flat" or progressive? Which, and why?

At a practical level, the importance of this issue can be witnessed by the various "Occupy Wall Street" movements around the globe. Fair Shares is also central not only to the current US Presidential election, but indeed to elections worldwide. President Obama may well be re-elected because of a growing sense that the distribution of income and opportunity in the US has become unfair. France's new president François Hollande won his election precisely because of his populist redistributionist agenda. The eminent *Financial Times* columnist Gideon Rachman published an explosive op-ed piece on August 7th titled, "The Backlash Against the Rich Has Now Gone Global." He argued that an era of lower taxes and rising inequality is coming to an end throughout the West.

At a more philosophical level, great progress has been made in the past few decades in clarifying many of the thorny issues that have made the topic of Distributive Justice so difficult over the span of human history. Harvard Professor Michael Sandel has become *the* rock star of international academics largely because of his focus on this issue. Larry Summers move over! Students worldwide recognize the issue of social justice to be the most fundamental of all topics in the theory of political economy. They like being made to think about this topic and to argue about it. Older people on the other hand tend to sidestep the issue — Republicans and Democrats alike in the US. Indeed their views degenerate into political and moral clichés (e.g., "The Bush tax cuts were unfair.") Yet holding beliefs about such matters does not amount to possessing a proper theory of justice. For starters, no one has ever demonstrated that tax rates either before or after the Bush cuts were fair in any meaningful sense. Heaven help us if a person's stance on the Bush tax cut issue is supposed to be a proxy for his or her political philosophy!

Motivation and Summary of the Essay

The purpose of this essay is first to disentangle and clarify several different dimensions of the concept of Fair Shares and Distributive Justice. For example, when we talk about Fair Shares, are we invoking the norm of To Each According to his Relative Needs, or the norm of To Each According to his Relative Contribution? As Marx emphasized in his *Communist Manifesto* of 1848, both concepts are crucial — but irreconcilable. Our second goal is to *answer* the deep question as to what shares of the pie *are* fair in different contexts. In doing so, we demonstrate that a new consensus about Distributive Justice is becoming possible, one bridging the differences between flat-tax conservatives on the one hand, and redistributionist liberals on the other.

An ancillary goal of this essay is to demonstrate that conventional wisdom is wrong in asserting that questions about Fair Shares are altogether separate from the issue of economic efficiency in Capitalist free-market theory. As will be seen, the *ethical* ideal of fair distribution and the *economic* ideal of an efficient distribution are intertwined at a very deep level.

These arguments are part of a larger agenda, one set forth in the author's recent book *American Gridlock — Why the Right and Left are Both Wrong.* This broader agenda aims to demonstrate that today's polarizing prejudices of both the Left and Right are ill-founded, and that a broader consensus is possible, even in the extremely divisive issue of Fair Shares.

Section B just below reviews the distinction between the issue of Distributive Justice and other more familiar forms of justice. The present essay is restricted to the issue of Distributive Justice.

Section C identifies several different concepts of Fair Shares, and clarifies which concepts are appropriate in which contexts. For example, when should we invoke the norm of Relative Need versus the norm of Relative Contribution? And Why?

Section D reviews concepts of Distributive Justice in the *private sector* of the economy, whereas Section E clarifies issues of fairness in the *public sector*. A primary source of today's political gridlock over taxation of the rich stems from a failure to distinguish what is fair in the private versus public sector. The issues that arise here are extremely subtle.

Finally, Section F sets forth a comprehensive theory of Distributive Justice that reconciles and integrates the two most fundamental concepts of Distributive Justice. Karl Marx and virtually all subsequent philosophers believed that these two conflicting norms could not be reconciled.

B. Distributive Justice versus Other Forms of Justice

The subject of social justice as a whole is far broader in scope than the topic of Distributive Justice. To simplify matters, we can distinguish the issue of Fair Shares on the one hand and the issue of "basic human rights" on the other. Concepts of basic human rights go back to the beginning of civilization. What most such concepts have in common is a precept of interpersonal equality or symmetry. For example, we conceive of the role of a Constitution as protecting such basic human rights as gender equality (a man counts as much as a woman), racial equality (a black person is equal to a white person), voting equality (one and only one vote for each man and woman), trial by a jury of peers that are not biased, habeas corpus, freedom from arbitrary arrest, one set of laws applicable to all people, and so forth. Simple as these norms may seem, it has taken thousands of years to codify them in the modern constitutions of some three dozen democracies. Interestingly, once most people become aware of these basic interpersonal symmetries, they come to agree over time that these precepts are desirable.

In contrast to this consensus about fairness in the context of human rights, consider the absence of any such consensus about fairness as regards the distribution of wealth and income — and in how progressive an ideal tax system should be. Right-wing conservatives and "self-styled capitalists" tend to believe in a fairly flat-tax regime and in a minimal role for the state. Left-wing liberals believe in strongly progressive tax systems and in a larger role for the state. Today's polarization between these views is very strong indeed.

Interestingly, progress in understanding the simple symmetries defining basic human rights occurred over the past three thousand years. In contrast, the major advances in making sense of Distributive Justice only go back two centuries.[1] Why is this the case? The answer is that the

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[1] Some claim that the first comprehensive discussion of these issues dates back to Plato's *Republic* and Aristotle's *Politics,* some four hundred years before Christ.

kind of logic required to identify the symmetries of human rights is of a much lower order than the logic required to make sense of who should get what percentage of the economic pie. More specifically, it did not require any modern mathematics to establish such simple symmetries as one man/one vote, a black person is as good as a white person, etc. No math was needed to arrive at the non-quantitative answers required.

In contrast, a clarification of who should receive how much pie and who does owe how much to whom requires the use of modern game theory and decision theory, both branches of mathematics. These higher orders of logic make it possible to solve for what is *required* in theories of Distributive Justice: A determination that Jack should receive 38% of the pie, while Jill should receive 62%. There are no simple symmetries here, just as there are no such symmetries in determining how progressive a fair income tax schedule should be. Should the top rate be 75% or 30%? Equations must be solved, and these equations are embedded in theories less than a century old.

In all that follows, we are only going to discuss the topic of Distributive Justice, the more demanding and modern branch of the theory of Social Justice. The discussion will be free of any mathematics.

C. Different Concepts of Fair Shares and Their Relevant Contexts

When asked who should receive how much pie, most people invoke one of two fundamental ethical norms in framing their answer. First, the Relative Needs principle suggests that the shares of the pie should be allocated according to the relative neediness of the players — assuming this can be measured. Second, the Relative Contribution principle suggests that each player in the game should receive a payoff proportional to his or her contribution — assuming this can be measured.

These two principles have been listed here in order of their priority in political and moral theory. This point is an important one. Why is Relative Need listed first? Because no matter what the context, the players will always have differing degrees of need for whatever pie is at stake. Always. This is not true of the Relative Contribution principle since there are situations where none of the players have contributed anything to creating the pie at stake. For example, if Mother Teresa is given $1 million to distribute to good causes (e.g., patients in sick wards or farmers needing money to buy seeds for their crops), then Mother Teresa will allocate her $1 million "Manna from Heaven" in proportion to the Relative Neediness of the patients for medicine, and of the farmers for seeds.

We thus need to distinguish "Manna" from "non-Manna" contexts — Manna contexts being those in which Relative Needs is the appropriate norm. None of this is to downplay the importance of Relative Contribution in those non-Manna contexts where it is relevant. For

example, members of an athletic team who train hard and strive to win should be allocated their bonuses in proportion to their relative contributions. The best way to understand *why* this is true is to ask what would happen to the durability of the team's franchise were the players *not* rewarded in proportion to contribution! Much productive real-world activity would cease to function were the Relative Contribution norm not respected.

Incidentally, is it in fact possible to rigorously quantify the concepts of Relative Need and Relative Contribution in a broad class of sociological contexts — contexts including but far transcending that of classical economic markets? Happily, yes. The formula for allocation in accord with Relative Contribution was discovered by Peyton Young in 1988, and the formula for Relative Need was discovered by the present author in 2004. Each formula was shown to be *unique* in the sense of being uniquely consistent with a set of reasonable axioms. And each works in both market and non-market/political contexts.[2]

D. Distributive Justice in a Classical Economy's *Private* Sector

Any idealized competitive economy contains two distinct sectors: First, the Private Sector in which goods are produced and allocated efficiently, assuming that perfect competition (and certain other requirements) hold true; and second, the Public Sector in which so-called "Public Goods" such as the army and the courts of law are established and maintained, and in which non-market "externalities" such as pollution are regulated. Here in section D we show how concepts of Distributive Justice are deeply intertwined with concepts of market efficiency. Right-wing anti-redistributionists will find this discussion particularly interesting, if not upsetting. *For it turns out that true market efficiency requires an extensive redistribution of income for reasons that are highly counterintuitive.* Thus, if you pose as a free marketeer, you must also champion an appropriate redistribution of income, and hence, of wealth.

In discussing fairness in free-market economies, we first show how the norm of Relative Contribution is satisfied. This is very straightforward. The second section is not, and demonstrates how the norm of Relative Needs is satisfied *indirectly,* due to the role of luck in life and its impact on the risk-sharing activities of risk-averse agents.

The Contribution Principle: In an idealized competitive economy, each worker will be paid a wage equal to what he contributed to the enterprise for which he works. His wage will equal his "marginal product," or contribution to his firm, as has been known for many decades. The proof

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[2] See "Individual Contribution and Just Compensation" by H. P. Young, appearing in *The Shapley Value*, ed. Alvin Roth, Cambridge University Press, 1988. Also see "To Each According to His Need — An Axiomatic Characterization" by H. W. Brock, appearing in *Assets, Beliefs and Equilibria in Economic Dynamics*, eds. C. D. Aliprantis, K. J. Arrow, P. Hammond et al., Springer Verlag, 2004.

that this will happen is simple: A company that pays its workers a wage exceeding their contribution will be driven out of business because it will incur losses under perfect competition. A firm that pays workers less than their contribution will be unable to retain employees. Every manager of a business knows the importance of respecting the Contribution Principle. If an employee is underpaid relative to his contribution, say to corporate sales, he will know it all too well. If an employee is overpaid, everyone else will know it, and the issue of compensation will rankle and cause morale problems.

The reader might wonder whether the Contribution Principle is satisfied in *nonmarket* contexts, for example, in those multi-lateral bargaining games characteristic of politics. The answer is yes, and we refer you to a footnote.[3]

Luck-Based Redistribution and its Relation to Relative Neediness: On the surface, there would appear to be no link whatsoever between the economic ideal of market efficiency and the ethical norm of allocation in proportion to needs. But this is in fact not the case. Understanding why is both fascinating and demanding.

In classical market economics prior to 1953, the concept of uncertainty about the future did not enter into the analysis of those conditions required for product and labor markets to be efficient (e.g., the condition of perfect competition). All agents were assumed to know the truth about all future events, and hence the "location" of all future supply and demand curves, and hence, prices. In 1953, the Stanford economist Kenneth Arrow extended micro-economics in a manner permitting all agents to be uncertain about future states of the world.

It turned out that in order for market efficiency to continue to hold true under conditions of uncertainty, a whole new set of markets were required: hedging markets, in which so-called "Arrow securities" were traded. More specifically, in order for market efficiency to exist, each agent is permitted to and indeed is *required* to take out a contract (Arrow security) hedging himself against every and any future uncertainty. Moreover, it is rational for each agent to do so providing that he is risk averse which virtually everybody is. [A risk-neutral agent will not insure against anything, but will rather self-insure.][4]

Regrettably, while most of us are able to hedge against such risks as our house burning down, or expenditures for poor health, some 95% of the risks we confront *cannot be hedged* at all.

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[3] In non-market political contexts, the first problem that arises as regards Relative Contribution is that "correct market wage rates" cannot be defined, for there is no market. Thus the Contribution Principle discussed just above cannot be invoked. The good news is that, when politics is modeled within game theory as bargaining in accord with the Nash-Harsanyi theory, then it turns out that a much more general version of the contribution principle is always satisfied. For each player in a bargaining game receives a payoff in strict proportion to his relative contribution — properly defined as the generalized Shapley Value of the game. This was first proven by the Nobel laureate John Harsanyi in 1963, and is one of the marvels of modern social science.

[4] Professor Steve Ross at Yale would prove in 1973 that Arrow securities are mathematically equivalent to options, under an appropriate interpretation.

This is known as the problem of *incomplete markets*. Problems of adverse selection, moral hazards, and problematic cost structures make the existence of such hedging markets impractical as is well-known in the insurance literature.

What does any of this have to do with the concepts of fair distribution of income and wealth? Everything, as it turns out. Most every hedging contract amounts to a redistribution from the person who, in his own eyes, is "lucky" to a person who is unlucky. If my house does not burn down, then I, the lucky one, reimburse you, the unlucky one, through my insurance premium should your house burn down. Clearly, the greater the number of such luck-based contracts, the greater the amount of net redistribution from the lucky to the unlucky.

In this context, what the incomplete market problem does is dramatically *reduce* the extensive redistribution from the lucky to the unlucky that is, in fact, logically *required* in order for economic efficiency to exist. In this regard, today's concept of a "winner take all" economy is often a "lucky keep all" economy. The resulting distribution of income and wealth is thus much more *unequal* than it would be under a regime with optimal risk-sharing.

> *What can be done to remedy this situation, and to restore the "efficient" distribution of income and wealth logically implied by the capitalist ideal of a complete market system in which all risks can be hedged? This problem was first examined by this author in his 1975 doctoral thesis. I proposed that a progressive income tax could serve as a <u>proxy</u> for the redistribution implied by those myriad hedging contracts that do not, in fact, exist.*

The validity of this argument requires an assumption that people with higher levels of wealth and income have been luckier than others during their lifetimes. While this is not always the case, it is usually true. As the late Australian news-media magnate Kerry Packer memorably put it to the author, "If you've ever met anyone who thinks he deserves his success, you know you've met a real jerk." Amen.

The Oprah Winfrey Book Club Lottery

The logic of luck-based redistribution is so compelling that I want to give a concrete example that really brings it home. Suppose you and I are both accomplished writers of exactly the same age and reputation. We have both sold about the same number of books, but neither of us makes much of an income because we write "serious" books. Now suppose a random event occurs: Oprah Winfrey opens up her book club. We both now face an equal chance that she might notice one of our next books when they are published, read the book, and recommend it strongly to her audience. If I am the lucky one, then my income will soar by $5,000,000 (from $75,000 to $5,075,000), and vice versa for you if you are the lucky one.

What might we do to improve our welfare confronting this new possibility? Suppose that we are both risk averse, indeed equally risk averse. Then the Nash bargaining solution to this game between us will be to draw up an insurance contract, whereby we split the extra $5,000,000 payoff *equally* should one of us luck out. Understand that this contract is motivated solely by our mutual self-interest, and not because of our beliefs about "fairness."

Given such a contract, our two incomes will remain equal should either or both of our books get endorsed by Oprah. *No "winner takes all" inequality arises.* But if we do not contract away the risk involved because we cannot draw up this mutually advantageous contract for whatever reason, one of us will walk away with a bonanza, leaving nothing for the other. In this context, a progressive income tax would then help rectify the lopsided distribution of income resulting from a lack of insurance—*insurance required if economic efficiency is to result.* The tax would have the effect of "restoring" the distribution of income that true capitalism would have generated.

The moral here will be highly disconcerting for many self-styled conservatives and other devotees of capitalism who are doubtless unaware of Arrow's 1953 result. If you really believe in the free market and worship at the high altar of market efficiency, then you had better rethink your position on Distributive Justice, and on the progressivity of the tax schedule in particular. What you have hopefully learned is that capitalism not only implies an efficient allocation of goods and services, but also an efficient allocation of risk as well. I find it remarkable that this argument has never been exploited by self-styled liberals concerned about inequality.

One important point here is that there is nothing Left-wing or Right-wing about the logic I have set forth. Redistribution occurs because of acts between consenting adults wishing to pool and hedge their risks. As a result, today's shouting match between those on both sides of the redistribution issue needs to be much less shrill than it is.

Thus far, we have shown how the capitalist concept of market efficiency in the presence of uncertainty logically requires a redistribution of income by the government given the absence of complete markets. We have said nothing about the relationship of this argument to the concept of Relative Needs. Such a link is not needed for the concept of luck-based redistribution that was introduced. Yet, a link exists. Quite surprisingly, it turns out that the concept of "relative neediness" and "relative risk aversion" are one and the same. Moreover, the more risk averse an agent is, the more needy he is. Only in the extreme special case where all agents are completely risk neutral will there be no luck-based redistribution, and will the concept of relative neediness be vacuous and irrelevant. But we all *are* risk averse to different degrees, so this special case is uninteresting. As a result, there will ideally be lots of redistribution required for economic efficiency.[5]

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[5] These three observations about risk aversion were proven by the author in his 2004 paper cited above.

To sum up, in the presence of uncertainty, textbook free markets will reward workers in proportion to their Relative Contribution. Yet, they will not reward workers in proportion to their Relative Need. The latter concept merely enters *indirectly* insofar as the existence of relative neediness (equivalently, relative risk aversion) between agents logically implies the need for extensive luck-based redistribution, assuming that hedging markets are incomplete. The greater the number of missing hedging markets, the greater must be the redistribution from lucky to unlucky, if the "correct" distribution of income implied by the norm of efficiency is to be achieved.

E. Distributive Justice in a Classical Economy's *Public* Sector

Understanding Fair Shares within the public sector of the economy is much more demanding than in the private sector. The reason is that the government must produce and pay for so-called public goods. In their purest form, such goods have two properties. First, their existence benefits virtually all citizens. Second, no individual firms or people have an incentive to provide such goods on their own. Thus, government is obliged to provide these goods, the most salient examples of which are national defense, the courts of law, environmental safety, etc. By extension, government must pay for all these goods by imposing taxes upon the citizenry. And there is the rub: *For in discussing Distributive Justice in the public sector, we necessarily confront the controversial issue of who should pay how much for the cost of government.* Should the tax structure be flat, mildly progressive, or very progressive?

The answer to this question should not be based upon prejudice as it usually is, but ideally on a deduction from first principles. We shall now derive an answer based upon recent advances in game theory and decision theory. To anticipate, the answer is that a progressive tax structure is optimal, where the degree of progressivity depends upon the Relative Needs of the citizens. To use a concept introduced above, the Relative Needs norm dominates the relevant logic here, not the Relative Contribution principle. This is because the ability to select a fair tax system and thereby to obtain public goods (e.g., sleeping safely at night) is in effect "Manna from Heaven." No one is contributing more than anyone else when a tax schedule is adopted. Of course, *after* some schedule is put into effect, then the real world contributions that we all make to our various enterprises will differ among us, and in this case, the Relative Contribution norm should apply in determining the pretax income paid to each agent.

To restate this argument in the manner of political philosophers, consider a two-stage decision problem. In Stage 1, the "Basic Institutions" of society are chosen at a Constitutional Convention where all representatives are assumed to contribute equally to the enterprise at hand. They will agree upon principles of optimal taxation as well as an optimal legal system, etc. There is no differential contribution by different members, thus, decisions will be predicated upon the relative neediness of participants in the real-world Stage 2 game. In the second game, we all hustle between 8 a.m. and 5 p.m. to perform our best at our jobs. Pretax wages in this

case should reflect the norm of Relative Contribution. In Section F just below, we sketch a model that formally integrates Stages 1 and 2 as defined above. Thus, we will integrate the rival concepts of Relative Need and Relative Contribution within a single political and moral theory of Distributive Justice.

Caveat: For brevity we restrict the analysis to cases of "pure" public goods, such as the provision of national defense or a fair system of taxation. We ignore "mixed" public goods, such as a particular turnpike where issues of *relative usership* arise. For example, if the turnpike is needed by most everyone, but you use it ten times more often than I do, then you should be charged a user fee much greater than mine. We shall ignore such cases.

Towards a Fair Income Tax Schedule: Due to its simplicity, many people believe in a "flat tax." For the wealthy, of course, the appeal of greater simplicity is joined by the lure of lower tax rates than under a progressive system. Regrettably, for all of its simplicity, the concept of a flat tax is highly problematic. To begin with, what do we mean by flat? Flat tax champions, such as Steve Forbes of *Forbes Magazine* would define a flat tax as a schedule consisting of equal tax rates for everyone (e.g., 18% of everyone's income). But wait — why not opt for a *truly* flat tax whereby each of the **N** income-earning citizens is charged an equal dollar income tax of **X/N**, where **X** represents the total dollar cost of government. For example, every taxpayer might be taxed $21,000 annually. Much as self-styled conservatives might like such a scheme, it is clearly preposterous since it is not feasible. It would condemn some 18 million taxpayers to starvation or else a career in robbery.

But what is wrong with a flat *percentage* tax (e.g., the flat percentage tax of 18% cited above)? This scheme is perfectly feasible. *But is it fair?* It has long been recognized that the "ability to pay" a flat tax of say, 18% was much lower for people with low incomes than for people with high incomes. For example, if you earn $15,000 you can barely afford to buy basic necessities for your family. This being true, it would be extremely painful for you to fork over 18% of that income. This would not be true for a person making $1 million a year. It has thus been considered morally preferable to tax people in a progressive manner.

This simplistic argument can be countered by the claim: "Your argument is flimsy and merely represents your own subjective view of 'fairness.'" This is true. However, the basic point here has been significantly deepened during the past two hundred years by Anglo-American philosophers. First, the British Utilitarians proposed that government should select all policies including tax schedules based on the rule, "Always act so as to maximize the Greatest Good for the Greatest Number." *They also demonstrated the important fact that a progressive tax was required to maximize the Greatest Good*. A flat tax cannot do so. Even more fundamentally, the Nobel laureate John Harsanyi demonstrated in 1955 that only the Utilitarian criterion of maximizing the Greatest Good (maximizing the sum of the citizens' utilities, in modern parlance) is logically consistent with a family of axioms of societal rationality. He subsequently

argued that maximizing the Greatest Good is also consistent with allocation on the basis of Relative Need.

Lastly, the present author showed in his 2004 paper that the Utilitarian criterion of maximizing the Greatest Good is *not* in fact fully consistent with the concept of Relative Need, a concept Harsanyi could never quantify. The author defined the concept of Relative Need formally and quantitatively, and introduced a new criterion of the Greatest Good from a new set of axioms that is fully consistent with the concept of allocation according to Relative Needs. [We maximize a particular weighted sum of the utilities, not an unweighted sum.] We can thus determine which of infinitely many progressive tax schemes is "best" by optimizing this new criterion of the Greatest Good.

Thus, over time, there has been a dramatic deepening of the source of support for a progressive income tax that is consistent with citizens' ability to pay — where ability to pay reflects the relative neediness of the different citizens for the economic pie at stake. Accordingly, it is much harder than it used to be to reject the use of Relative Need in determining an optimal tax code. Of course, the objection can be raised that the choice of Relative Need as the fundamental criterion here is still subjective and arbitrary. We would rebut by arguing that this is *not* arbitrary since the situation at hand is a Manna problem, and thus requires a solution based upon Relative Need — the only relevant criterion in Manna contexts.

F. A Unified Theory of Distributive Justice

– Integrating Relative Contribution and Relative Need –

For the 1992 *Handbook of Game Theory*, one of a number of volumes comprising the *Handbook of Economics* edited by Kenneth Arrow and Michael Intriligator, John Harsanyi was asked to write the chapter on the subject of moral theory, with a particular focus on Distributive Justice. His mission was to show how the advent of decision theory and game theory had impacted moral philosophy, and had made possible several overarching new theories of social justice. Harsanyi was chosen to do so because he was the only game theorist who was also a moral philosopher and had made fundamental contributions to the theory of Utilitarianism, as was noted above.

In his *Handbook* essay, Harsanyi reviewed and contrasted three quite different theories of justice: Utilitarianism, John Rawls' celebrated theory, and a third quite formal theory that I developed in the late 1970s upon completing my Ph.D. dissertation at Princeton. Since this third theory was developed after the other two theories, I was able to clarify several problems with

the earlier arguments, as well as to extend moral theory in a new direction. My principal goal was to show how the twin distributive concepts of Relative Needs and Relative Contribution could be reconciled and unified — with each applying contexts where it was appropriate. This had never before been attempted.[6]

In this final section of the essay, I first provide an intuitive example of how the two fundamental ethical norms can be integrated. I conclude by sketching graphically the formal theory that makes this synthesis possible, and that I developed in the late 1970s. The issues here are utterly fundamental, very relevant today, and intrinsically interesting.

An Intuitive Example: The Princeton Philosophy Department

Suppose Princeton's eminent Department of Philosophy must choose between two excellent professors in awarding tenure: Susan Stentley and Tom Smith. Both have done excellent work, but Susan is thought to have a very slight edge professionally. But there is a complication. Tom is the more affable and popular colleague, *and* has an expensive illness, as a result of which he would benefit much more than Susan from the added income and job security that the tenured position would make possible. That is to say, he is much more needy than Susan. Which candidate will Princeton choose? Which *should* it choose?

While a Ph.D. student at Princeton, I posed these questions to several department members. The answer I received from every professor I asked—and most had *very* liberal views—was that the department should pick Susan. "Our primary responsibility is to hold this department to the very highest academic standards possible." In my theory, this ostensibly heartless reply will be morally acceptable *provided* that the basic institutions of society fund the cost of Tom's illness. That is to say, the Princeton philosophers focus on the quality of their department and its reputation, and Relative Contribution fairness prevails.

How Right-wing this may sound! Yet, it is not. For they make their choice of Susan knowing that Tom's most basic needs have been dealt with "elsewhere," via the choice of the basic institutions of society — a choice problem resolved by appealing to the norm of Relative Contribution. To restate this, the choice of Susan for tenure occurred in a Non-Manna context where the issue of Relative Contribution existed, and mattered to the university. The choice of basic institutions occurred in a Manna situation, at some hypothetical Constitutional Convention where Relative Needs prevailed due to the "primacy principle" introduced above.

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[6] See, for example, "A New Theory of Social Justice Based upon the Mathematical Theory of Games" by H.W. Brock, appearing in *Game Theory and Social Science,* Ed. P. Ordeshook, New York University Press, New York 1978.

What follows is a sketch of the highly analytical theory showing how to model all these issues, and to solve mathematically for precise answers to questions of Distributive Justice such as fair tax rates — at least in principle. This final discussion is optional reading intended for those SED clients interested in foundational issues.

## An Integrated Theory - A More Formal Discussion

A "Supergame" in game theory is just a game whose payoffs are permission to play a second-stage game, a third-stage game, etc. These later-stage games are known as subgames. In Figure 1, the topic of Distributive Justice is modeled as a two-stage Supergame, a modern version of the classical theory of the "Social Contract" as in the theories of Hobbes, Rousseau, and Locke. In the Stage 1 game on the left, members of society select some "best" constitution setting forth the basic laws under which they will live — including a tax regime. This constitutional choice will then constrain behavior in the Stage 2 game — that real-world game wherein people secure jobs, compete, and do what is best for themselves and their careers. But in doing so, they are subject to the laws of the constitution selected in the Stage 1 game. The black rays within each Stage 2 regime indicate the set of all real-world strategies ("life plans") from which members of society will choose their best strategies during their real-life Stage 2 problem.

To sum up, the choice of a constitution in Stage 1 will determine which regime (box) is encountered in the Stage 2 game of real life. "Solving" such a Supergame requires that we first solve for all citizens' optimal strategies and payoffs within each of the Stage 2 regimes. Remember, there will be as many such regimes as there are possible constitutions, including tax schedules. Second, knowing these various possible regime-specific payoffs, we then determine which of these regimes would be selected as "best" in the Stage 1 problem of constitutional choice. Note the important requirement of "backwards induction" logic here: To solve the Stage 1 problem, it is first necessary to solve all the possible Stage 2 regime problems.

Appearing on the far right of the figure are the "payoffs" to everyone from doing what is best for himself or herself subject to the provisos of the constitution adopted. The capitalized letter P underlined is just shorthand for the fact that P is a payoff vector consisting of n different payoffs when there are n people involved, with one payoff specified for each person. Thus $P = (P_1, P_2, P_3, \ldots P_n)$. These payoffs represent the time-discounted utilities of each of the n players, assuming each plays his optimal strategy. The dotted line at the bottom leading to a "null regime" with payoff d represents what happens if the citizens fail to agree on any constitution at all. The resulting null game represents a non-cooperative game whose payoff d can be thought of as the payoff from a Hobbesian world devoid of laws and basic institutions — in effect a political free-for-all of the kind witnessed in recent times in Somalia.

The capitalized initials **RN** and **RC** at the top of the graph indicate that the norm of Relative Need is to be used in arbitrating the Stage 1 game, whereas Relative Contribution is the

appropriate norm for the Stage 2 game. It is assumed the payoffs **_P_** from all regimes with constitutions are high enough to permit all players to end up better off than they would be with payoff **_d_** in the null regime. This is not a restrictive assumption since all Stage 2 games are "cooperative games" in which side payments can be made from winners to any losers. The gains from cooperation of all those who benefit from the adoption of a constitution will far exceed any losses to losers, so that the latter can be compensated via side payments.

Figure 1: Modeling the Constitutional Choice Problem
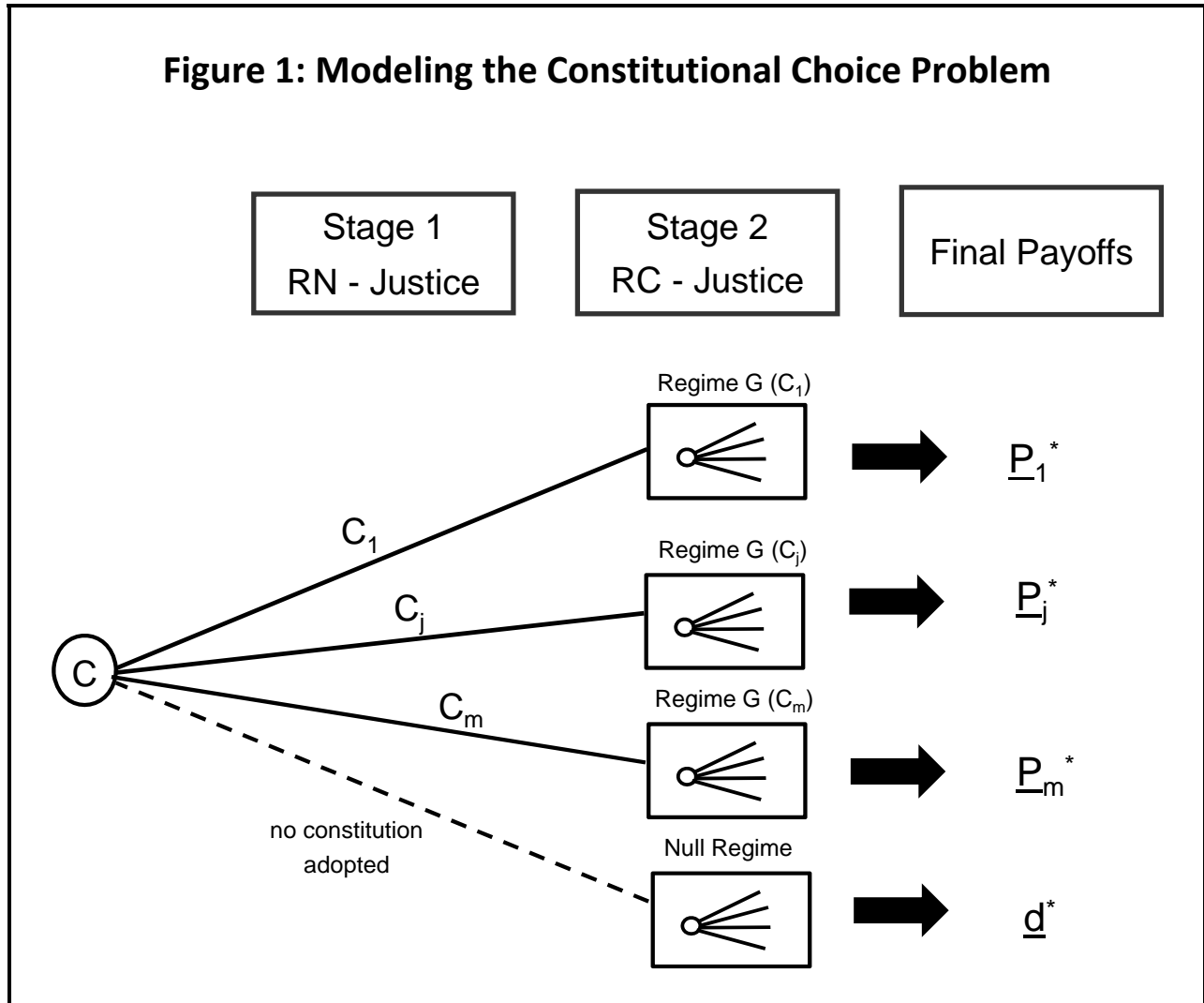
Following in the footsteps of classical Social Contract Theory, all three theories of justice that Harsanyi reviews adopt a two-stage structure like the one in our figure, but my own was the first to utilize formal game theory as well as the concept of a Supergame. For a real world example of this kind of social choice problem, consider the Constitutional Convention of 1787 when the US Constitution was hammered out in the summer heat of Philadelphia. Once

adopted, its provisions would constrain behavior throughout society by setting out just what kinds of laws, tax rates, and penalties could be enacted.

How to Solve the Supergame: This final point is necessarily quite technical, and assumes knowledge of game theory. The Stage 1 game is solved as follows. It is modeled as an *n*-person pure bargaining game, where *n* indexes the citizens (or their representatives).[7] The payoff space is the convex hull of the payoffs *P* awarded by the *m* possible constitutions (i.e., the *m* payoff vectors appearing on the far right of the figure). The solution to this bargaining game is arrived at in the standard manner by determining which constitution (or randomizations thereof) maximizes the generalized Nash product of its utility payoffs over and above the disagreement payoff *d*.

In bargaining over the various provisions of a constitution, many issues are noncontroversial and lack any zero-sum aspects. Unanimous decisions will often be reached on issues like one man/one vote, trial by a jury of peers, etc. The way in which the US Bill of Rights was adopted is often cited as an example here. As there is no zero-sum dimension to many such issues, no issue of *Distributive* Justice arises.

But this is not the case when selecting an optimal schedule of tax rates that, when implemented, will permit a financing of the cost of government. Here the problem is zero-sum in nature to the extent that, the more tax I pay, the less tax you pay. Which tax schedule is "optimal" in the sense of satisfying the Stage 1 norm of Relative Needs? And how can this be determined? Here is the answer: Let the citizens (or their representatives) bargain over the different possible sets of tax schedules — each citizen knowing how adoption of a given schedule will impact his/her taxes. They will end up with a bargaining compromise.

The Nash-Harsanyi theory of bargaining permits us to solve for the particular compromise tax schedule that is the rational bargaining equilibrium of this game. The ethical problem here is that, in bargaining, Might Makes Right, and the resulting compromise will reflect the relative power of each player in bargaining. In particular, less risk-averse players will "bargain down" more risk-averse players in arriving at a compromise in bargaining. As John Harsanyi first pointed out, power is inversely proportional to risk aversion.[8]

As a result, the bargaining compromise of the selection of tax rates will reflect the *power* (and in particular, the relative risk aversion) of players, and it will not be in any way consistent with allocation of the tax burden in proportion to Relative Needs. *Or will it?* I showed in my 2004 paper that the concepts of relative risk aversion and relative neediness are one and the same,

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[7] The game is "pure" in that no coalitions possessing threat power are permitted to play. For these were shown by the author to be morally inadmissible in a Relative Needs context.

[8] Power is also determined by the coalitional strength and the potency of the threat strategies of the players, but these two aspects of power are deemed morally inadmissible in the setting of Constitutional choice. Why risk aversion is admissible is about to become clear.

both mathematically and conceptually. Thus, if the outcome of some bargaining game awards *one-third* of the pie at stake to player 1 and *two-thirds* to player 2, the *reason* is that player 1 is twice as needy for pie, or equivalently he is twice as risk averse as 2. He thus gets bargained down to accept a share of pie half as large as that of player 2 (one third is half as much pie as two thirds). Only when both are equally needy (equally risk averse) will each get the same share of the pie, in this case 50% each.

What then is the *ethically* fair tax schedule consistent with Relative Needs in this Manna context? It is that unique tax schedule that is the "reverse mirror image" of the one arrived at via bargaining. In the pie example, player 2 will now get half as much pie as player 1 precisely because player 2 is half as needy (half as risk averse).

Quantifying the Warren Buffet Rule: To illustrate this point in a context more relevant than that of a pie division, consider the alleged unfairness of today's tax structure. While this structure is ostensibly progressive, it is actually regressive in many cases once myriad loopholes are accounted for.

For simplicity, consider today's marginal tax rate of 15% on select billionaires (e.g., Buffet) and 30% on normal people (e.g., Buffet's receptionist) to have been the result of a two-party bargaining game between the rich and the poor. In effect, the party of the rich and well-connected utilized its power to bargain down the party of the poor and more needy to accept 30% marginal tax rates versus its own *effective* rate of 15%. [Might Makes Right.] Then the ethically fair effective tax schedule will be 15% for the poor, and 30% for the rich, according to our logic whereby the bargaining outcome must be inverted for the sake of fairness.

More formally, to determine the ethically fair allocation of the tax burden consistent with **n** citizens' Relative Needs, first solve for the **n**-vector **Z*** of tax rates that would be arrived at via Nash-Harsanyi bargaining. Next solve for the vector **Y*** of tax rates that is the *generalized harmonic mean* of this vector. This is the precise mathematical meaning of a vector that is the "reverse mirror image" of another vector. The resulting harmonic mean **Y*** will then represent the fair tax schedule consistent with Relative Neediness, as is proven in my 2004 paper.

Relative Contribution in the Stage 2 Games: How is the norm of allocation in accord with Relative Contribution to be satisfied in the real-world regimes of the Stage 2 problems? The good news here is that, whether arrived at via decentralized trading in free markets or else via outright political bargaining, the outcomes in each regime will *automatically* satisfy the correct characterization of Relative Contribution identified by Peyton Young in his 1988 paper cited above. This is because the allocations generated both in competitive market trading and in the political arena represent generalized Shapley Values of the relevant trading and bargaining games, and consistency with the Shapley Value of a game is precisely the requirement that the Relative Contribution principle be satisfied in both economics and politics.

It is in this manner that the solution of our Supergame can in principle be computed, and that both fundamental norms of Distributive Justice can be satisfied within a single coherent theory. *Pace*, Karl Marx! For the readers who have persevered to this point, I hope you now share the sense of wonderment that I always felt in realizing that new mathematical ways of thinking only seventy years old have made it possible to formalize matters ethical in precisely the manner that earlier mathematical advances made it possible to formalize matters physical in centuries gone by. This represents the great triumph for mankind that the mathematical genius Carl F. Gauss fervently hoped for two hundred years ago, but felt to be impossible:

> *There are problems to whose solution I would attach an infinitely greater importance than to those of mathematics, for example, touching ethics, or our relation with God, or concerning our destiny and our future; but their solution lies wholly beyond us and completely outside the province of science.*

Gauss has been proven wrong. And he would doubtless be quite amazed that it was mathematics that would lead to the solution of *ostensibly* non-mathematical problems such as the nature of Fair Shares.

G. Conclusion

The purpose of this essay has been to disentangle the diverse and seemingly contradictory concepts underlying the subject of Distributive Justice.

Three fundamental justifications for a redistribution of income from rich to poor have emerged. First, there is luck-based redistribution, a concept probably unfamiliar to most readers, but once that is extremely compelling. Recall that the requirement of luck-based redistribution is based upon concepts that are economic — not ethical — in nature, in particular the concept of "economic efficiency."

Second, there is the concept of distribution according to Relative Contribution. It was seen that this norm is usually satisfied automatically — with no one being aware of it — both in free market economic contexts, as well as in political bargaining. This result of John Harsanyi is truly remarkable. Third and last, there is distribution according to Relative Need. The appropriate context for this purely ethical dimension of the problem of fair shares lies in convocations where the basic institutions of society (e.g., fair tax rates) are selected, such as in Constitutional Conventions.

Above and beyond disentangling these basic aspects of Distributive Justice, we have sketched a model whereby all these concepts can be formally integrated in a compelling manner, and from which quantitative answers to questions about Fair Shares can in principle be determined.