

Does Hierarchy Drive Income Inequality?

Blair Fix

Project Synopsis

Income inequality has, over the last 4 decades, increased dramatically in the United States and Canada [1–5]. It is a concerning trend. Not only is inequality objectionable ethically, it also seems to be corrosive to human welfare. As inequality grows, human well-being worsens [6–8]. But while the extent and effects of inequality are well-studied, the *cause(s)* of growing inequality remains poorly understood. My research attempts to address this deficiency.

I propose that *hierarchy* — the rank ordering of individuals within a chain of command — is central to how humans distribute resources [9]. The idea is that individuals within a hierarchy tend to use their power to accumulate resources. The result is that income tends to grow with hierarchical rank.

I have assembled a variety of evidence that confirms (at static points in time) this hierarchy-income hypothesis [10–13]. My post-doctoral research will attempt to extend the evidence to understand how hierarchy relates to the *growth* of inequality. I propose that the recent growth of top incomes (in the United States and Canada) has been caused by a hierarchical redistribution of income. The idea is that income has been taken from those at the bottom of the corporate hierarchy and given to those at the top.

To investigate this hypothesis, I will extend a large-scale numerical model developed during my PhD studies [14]. This model is the first (to my knowledge) to rigorously connect the distribution of income at the macro-level to the fine-scale, hierarchical structure of firms. I have previously found that this model accurately predicts key features of the US distribution of income [11, 13]. In my post-doctoral research, I will extend the model to study income *redistribution* — changes in income distribution over time.

By studying how growing income inequality (in the US and Canada) relates to the hierarchical structure within firms, I hope to illuminate new ways to combat inequality.

Project Description

Overall Goals

The goal of my post-doctoral research is to investigate how income redistribution relates to the hierarchical structure of firms. This research is driven by the following research question and specific aims:

- **Research Question:** How does the recent growth of macro-level income inequality (in the United States and Canada) relate to the fine-scale, hierarchical structure of firms?
- **Aim 1:** Extend a large-scale computational model (developed during my PhD) to simulate how the redistribution of income relates to the hierarchical structure of US and Canadian firms. (Months: 0–4)
- **Aim 2:** Test this model against the available empirical evidence in the United States and Canada. (Months: 5–8)
- **Aim 3:** Use the model to infer if/how a hierarchical redistribution of income has driven the growth of inequality. (Months: 9–12)
- **Aim 4:** Use the model (in tandem with empirical evidence) to study potential policy for reducing inequality. (Months: 13–24. This is proposed research for a second year of postdoctoral study, if the position is renewed.)

Research Background

“Man is born free,” Jean-Jacques Rousseau famously proclaimed, and yet “he is everywhere in chains” [15]. Since these words were written (in 1755), they have haunted generations of social scientists. In nearly all modern societies, we live with systemic income inequality. Why?

One idea (dating back at least to John Locke [16]) is that income inequalities stem from differences in *productivity*. Those who earn more income, the theory contends, do so because they are more productive. In the 19th century, Francis Galton proposed that these productivity differences are genetically inherited [17]. Modern human capital theory, in contrast, argues that productivity differences are acquired through training [18–21]. Regardless of the source of ability, ‘productivist’ theories argue that income differences stem from differences in productivity.

A problem with this approach is that it is inconsistent with the facts of personal income distribution. In most societies, the distribution of income is highly skewed, with a few individuals earning hundreds (sometimes thousands) of times more than the average [22–28]. Yet when workers’ productivity is measured independently of income, such extreme differences are absent [29, 30]. If individuals’ productivity is relatively equally distributed, how can it explain the extremes of income inequality? Furthermore, why does the distribution of income *change* with

time? Does growing inequality mean that top earners are becoming more productive? Some researchers think so [31,32]. Other social scientists (myself included) are skeptical.

The primary alternative to the ‘productivist’ approach is the idea that income differences stem from inequalities in our *social relations* [33–50]. Individuals with power, the thinking goes, tend to use it to accumulate resources. Given humanity’s evolutionary heritage, I find this social theory of income more plausible than the ‘productivist’ approach. Virtually all social mammals form dominance hierarchies [51–56], within which higher social status allows greater access to resources, particularly sexual mates [57–62]. Unsurprisingly, humans seem to exhibit similar behavior [63–67].

If income inequality does stem from asymmetries in our social relations, then the main task of inequality research should be to understand and model these relations. With that in mind, my research seeks to understand how income relates to rank within *employment hierarchies* — the chain of command inside firms and governments.

The relation between hierarchical rank and income was first modeled by Herbert Simon in 1957 [68]. Simon sought to explain a surprising fact: CEO pay grows with firm size [69]. This pay trend, Simon showed, could result from the hierarchical organization within firms. If individual income grows with hierarchical rank, then the pay of the top-ranked employee would be proportional to the firm’s size. A few years later, H.F. Lydall [70] demonstrated that the same model of hierarchy could explain a ubiquitous feature of income — the power-law distribution of top incomes [22–28].

Despite its promise, this hierarchy model of income distribution has received little attention. One reason is that the model clashes with the dominant view (in economics) that income stems from productivity [71,72]. As Simon put it, “only an improbable coincidence would bring about equality between salaries determined by [hierarchical rank] . . . and salaries determined by the marginal productivity mechanism” [68].

Another challenge is that data on the structure of firm hierarchies is scarce. In the last few decades, however, researchers have begun to quantify this hierarchical structure and its relation to individuals’ income [73–88]. Although this data is still limited, when used in tandem with a model, it is sufficient to start exploring how firm hierarchies affect the distribution (and redistribution) of income.

Methods

My PhD thesis — entitled *Economics from the Top Down: Does Hierarchy Unify Economic Theory?* — examined how seemingly disparate phenomena such as energy consumption and income inequality can be tied to hierarchical organization [14]. As part of this research, I developed a large-scale numerical model of how hierarchical rank relates to income [89]. The first of its kind (to my knowledge), this

model extrapolates the available case studies of firm hierarchy to simulate the hierarchical structure of an entire society. The model consists of a population of firms, each of which is hierarchically organized. Inside each firm, individual income is a (partial) function of hierarchical rank.

I have so far used this model to study the income effects of hierarchy at static points in time. The model suggests that hierarchy may play a key role in shaping the power-law distribution of top incomes [11]. The model also suggests that hierarchical rank (within firms) may be the strongest determinant of personal income [12]. More recently, I have found that hierarchical rank strongly relates to the class-based (i.e. capitalist-vs-labor) composition of income [13].

A key next step is to study how hierarchy within firms relates to income *redistribution*. Over the last 4 decades, income inequality in Canada and the United States has grown steadily, with the steepest gains going to top earners [5, 90]. As part of this income redistribution, we know that CEO pay has increased dramatically [91–93]. But other than for top-ranked executives, we understand little about how pay practices within firm hierarchies have changed. A key challenge is that evidence relating income to hierarchical rank remains scarce.

A feasible way to solve this problem is to use my numerical model of hierarchy to draw inferences from the available empirical data. My first step will be to model the path-breaking data recently released by Song et al. [94]. The first study of its kind, Song et al. used Social Security data to study how the growth of US income inequality relates to the pay structure between and within firms. They find that the growth of top incomes can be attributed mostly to growing inequality *within* firms. Importantly, their data is resolved down to individual employees — a key piece of information that, in combination with my numerical model, can be used to infer the effect that hierarchy has on the redistribution of income.

I hypothesize that over the last 40 years, US and Canadian firms have systematically redistributed income from the bottom to the top of their hierarchies. To test this hypothesis, I will first ‘tune’ my hierarchy model to reproduce macro-level trends in inequality (i.e. the growth of the Gini index and top 1% income share). This ‘tuning’ consists of constraining a single parameter — the rate at which individual income increases with hierarchical rank.

I will then use the model to hindcast trends (provided by Song et al.) in individual-level pay within firms. This modelling effort represents the first attempt to mathematically connect macro-level trends in inequality to remuneration trends within firm hierarchies. If successful, it will create a new tool for studying inequality.

After first working with US data, I will attempt to generalize the method to study the hierarchical redistribution of income in Canada. The Canadian *Workplace and Employee Survey* details income by occupation. Using methods developed by Wright [50], I will use occupation as a proxy for hierarchical rank within firms. I will then use my numerical model to test if/how income has been redistributed

within the hierarchies of Canadian firms.

Finally, if my postdoctoral research is extended for a second year, I will explore how different policies affect the pay structure within firm hierarchies. Evidence suggests that government oversight tends to reduce CEO pay [95, 96]. We know little, however, about how such policy affects income *redistribution* within firms. I hope to shed light on this issue.

Research Alignment

My research builds on and extends the pioneering work of my proposed supervisor, Jonathan Nitzan, and his collaborator Shimshon Bichler. Together they have developed path-breaking techniques for studying the power underpinnings of capitalism [42, 97–104]. To date, most of this work has been done at the macro level, using national statistics. My research on hierarchy provides a new dimension to Nitzan and Bichler’s study of power. It opens a much-needed link between the analysis of power and inequality at the societal level, and the fine-scale, hierarchical structure of this power within firms.

More broadly, York University is an ideal place to pursue this postdoctoral research. I will make ample use of York’s subscriptions to statistical databases, including Compustat, Execucomp, and Global Financial Data. And I look forward to using York’s Open Access Fund to publish my postdoctoral research in open-access journals. While at York, I hope also to foster a collaboration with Kean Birch and his postdoctoral colleague Troy Cochrane, who are studying the concept of rentiership in modern capitalism (SSHRC Insight Grant “From entrepreneurship to rentiership: The changing dynamics of innovation in technoscientific capitalism”) [105].

Finally, my research on the link between hierarchy and inequality aligns with York’s priority for ‘Living Well Together’. It also fits synergistically with the university’s sustainable-development goals for ‘no poverty’ and ‘peace, justice, and strong institutions’.

Research Significance

Although hierarchical organization is ubiquitous, we know little about how it relates to income inequality. If, as I hypothesize, hierarchy is a major driver of inequality, then it is imperative that we understand the mechanisms at work. My postdoctoral research represents the first attempt to rigorously connect macro-level inequality to the fine-scale, hierarchical structure of firms. My hope is that this research will open a new window for studying how inequality relates to remuneration policies within firms. And ultimately, my goal is to use this understanding to develop policy tools that can ameliorate income inequality and its accompanying toxic social effects.

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