

Hidden Serial Correlations in the Economic Sciences

Term Paper

by

Hailey D Nguyen

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1. Introduction

According to Oxford economist Kate Raworth, “Economics is the mother tongue of public policy; it dominates our decision-making for the future, guides multi-billion-dollar investments, and shapes our responses to climate change, inequality, and other environmental and social challenges that define our times.” Whether economists want this responsibility or not, their work carries significant weight over to the vast majority of the population.

In response to the increasing diversity of modern human institutions, contemporary economics has both benefitted from and been benefitting other disciplines such as psychology, biology, sociology, and more recently neuroscience. Additionally, Raworth recommends a collective goal in economics that balances between essential human needs and planetary boundaries. However, interdisciplinary approaches lean towards addressing variety, not diversity, which is distinctively more interactive and nuanced. Concerns have been raised by both insiders and outsiders of the economics profession on the lack of diversity of economists, specifically the under-representation of marginalized voices, mainly due to ethical and equity reasons. These concerns on social welfare are valid, but I believe they are not satisfactory as mechanisms for meaningful change.

This paper aims to leave aside ethical and equity concerns, rather focus on discussing potential issues and consequences of this oversampling effect in the economics profession using economics language. *As identities of modern humans are intersectional, leading to materials for our reasoning to include both baseline and intersectional tradeoffs, the oversampling of economists' few identities clusters results in hidden serial correlations with bias in error variances not accounted for, when findings got scaled up for public policy.* The flow of this paper is as followed: part 2 will discuss the

context for human's decision making process and my understanding of our materials for reasoning (2.1), specifically what we collectively have in common as the baseline materials for the reasoning process (2.2), and how that materials have digressed and become customized for each identity cluster thanks to intersectionality (2.3). With this mix of similarity and differences in sources for rationality, part 3 will investigate the mismatch in the share of identities clusters between policy advisory and policy beneficiary (3.1), and how it lead to hidden serial correlations which can hinder efficiency of problem solving for economists (3.2).

2. Materials for Reasoning: Baseline and Intersectional

2.1 Materials for Reasoning

As social scientists, Economists hold various views on what 'rational' human behavior entails. It might be benefits maximizing, it might be bounded, it might be prospected, it might be purely self-interest or mixed, and it might include stable preferences or not. So far, breakthroughs in behavioral economics, using psychological experimentation to develop theories about human decision making, have identified that our thinking is subject to insufficient knowledge, feedback, and processing capability. This process often involves uncertainty and is affected by the environment in which we make decisions. Most of our choices are not the result of careful deliberation, as we can even make a decision before it enters awareness (Soon et al., 2008). However, my concern is that behavioral economists are still framing the matter as we are not 'purely rational', as if there is an objective point of reference for rationality.

Framing the matter as rational versus non-rational, instead of the interaction in different ways of

ration, might make problem solving in Economics more frustrating than it should. This begs the question: is there a hard line between rational and non-rational behavior? If so, could a person alternate between these two states somehow? The persistence of behavioral puzzles, biases, fallacies and people's different views about them challenge the existence of a collective way to ration, or the 'right' way to ration. It is further complicated by the existing hidden costs and benefits (history of marginalizing/marginalized, social norms, emotions, and other hidden factors) that may affect the decision-making process. As a result, two agents or groups with similar sets of explicit costs and benefits may disagree on the 'right' decision because of the hidden costs and benefits affecting their decision-making process. Hence, it can be argued that there is no objective rationality, that humans won't collectively agree or disagree on one perception of reality on a given topic, including science.

Rational or non-rational, all humans engage in the process of reasoning, which collects and processes materials from the self and the environment to function. Table 1 illustrates my understanding of all possibilities from which these materials arise:

Table 1. Materials for Reasoning in Human

Materials for Reasoning: Costs and Benefits	ENDOGENOUS (the self)	EXOGENOUS (the environment)
IMPLICIT (hidden)	Subconscious (primitive and modern)	Intangible (e.g. norms, history, time)
EXPLICIT (revealed)	Conscious	Tangible (e.g. money, written contracts)

Note that this table lacks the interactions between materials, how each individual weights them when making decisions, and the ratio between collective materials to customized materials. This table aims to visualize the sources of one's utility functions, biases, risk and time preferences,

assumptions, heuristic rules of thumb and way of ration in general. When observe one's behavior, which is the outcomes of the reasoning process, only the explicitly exogenous materials are obvious to the external party. The remaining materials tend to be estimations, which are subject to standard errors.

2.2 Baseline Materials for Reasoning: Similarity in Rationality

Roughly 15,000 years ago, almost everyone lived in mobile foraging bands as hunter-gatherers until a radical transformation 5,000 years ago jumpstarted developments to the modern world, where humanity parted ways. This transformation was the emergence of the first city-states, but before this huge social transformation, Dow and Reed (2022) find parallel developments of human settlements all over the world. Therefore, it is intuitive to associate the baseline materials for human reasoning with periods before this radical transformation.

Since humans hunted and gathered for most of our 2 million years of evolutionary history, which is the majority of our life history, rationality is not fully endogenous to modern civilization. According to Robson and Kaplan (2006), ancient and modern foraging people exhibit remarkable similarities, especially in development and aging. Though economics as a discipline has only been around for 250 years, they suggest the economics of hunter-gatherer societies can help form a baseline frame for how evolution shaped economically relevant aspects of humans. In general, foraging societies are characterized by intelligence (learning), social organization (cooperation and sharing), and intergenerational transfers from adult to children. Economists under evolution lens have shed light on other primitive preferences such as utility, attitude to risks and time preference. Specifically, utility is hedonic so decision making is a conversation

between emotions and reasons in the brain (Damasio et al., 1994); we benefit from having utility functions inherited from ancestors (Robson, 2001), they adapt in real time to changing circumstances (Stauffer et al., 2014), and adaptive utility is ultimately evolutionarily optimal (Robson et al., 2022); we value the now more than the future, but individual exhibit much more patience when decisions are made collectively (Robson & Szentes, 2014); we are more risk-loving when there is high uncertainty to secure energy needs for survival (Real & Caraco, 1986); we are much more risk-averse when the risk is aggregate, compared to individual risk (Robson & Orr, 2021). I suppose these evolutionary foundation of preferences can influence all four sources of materials for reasoning in Table 1, but most strongly for implicitly endogenous materials.

Apart from having similarity in the inherited preferences from our hunter-gatherer ancestors, most regions of the world also went through similar developments before modernization, as mentioned above. Dow and Reed (2022) noticed these parallel development patterns, used economic logic and archeological evidence, in order to derive the six transitions that shaped the modern world. These transitions are sedentism, agriculture, inequality, warfare, cities, and states. As a result, they could act as humanity's baseline materials or context for reasoning, both explicitly and implicitly, across regions before global modernization.

2.3 Intersectional Materials for Reasoning: Diversity in Rationality

After the emergence of the first city-states, global human settlements branch out into numerous directions of development with increasing complexity, making the share of baseline materials for reasoning increasingly smaller among us. Life materials are hardly similar across groups of humans globally anymore, especially after we discover the power of specialization to improve

efficiency and standard of living. Modern human institutions are adding to the list of differences, these differences affect our materials for reasoning (views of self and the external), which then affect our reasonings and tradeoffs, then responses. Consider a classic example in the 1950s, students from two Ivy League schools were separately shown the same film of a previous controversial game between their football teams, but Dartmouth students noticed only half as many number of Dartmouth fouls as Princeton students (Hastorf & Cantril, 1954). Depending on their group ties, the students saw different realities, even when the football game wasn't live and shown months later.

Among the layers of differences in materials for reasoning, each individual lies at the intersection of multiple identity-defining clusters, customizing their own intersectional materials for reasonings. Modern human institutions are increasingly adding to the layers and clusters of differences, some are explicit such as geography, nationality, gender, education, language, while some are rather implicit like social norms, cultures, ideologies, sexualities. I will refer to these as identities clusters, instead of demographic clusters because materials for sense of identity are more than just demographic segmentation. As a result, outcomes of reasoning from different clusters vary under similar explicitly exogenous settings, as implicit materials are hidden. Consider a single layer such as geographic regions with clusters of countries. In economics, ultimatum game is classic experiment to investigate human bargaining behavior, where the proposer offers a share of the sum and the responder either can accept this share, or reject and both people walk away empty-handed. A meta-analysis of 37 papers with 75 results from ultimatum game experiments by Oosterbeek and colleagues (2004) find differences in behavior of responders (and not of proposers) across geographical regions. Asian responders have

significantly higher rejection rates than responders in the US, and responders in the western part of the US have lower rejection rates than responders in the eastern part of the US. Surprisingly, they found no relation between subjects' behavior and countries' scores on trust and competition scales, or per capita income and income inequality. In order to conceptualize the nuances of differences in identity, Crenshaw (1989) proposed intersectional theory, providing a lens to illustrate the complex and unique experiences of discrimination and privilege of modern people (Figure 1). She suggests that marginalized and marginalizing groups clusters tends to perceive different set of implicit costs and benefits, on top of explicit tradeoffs, due to this intersectionality of identity.

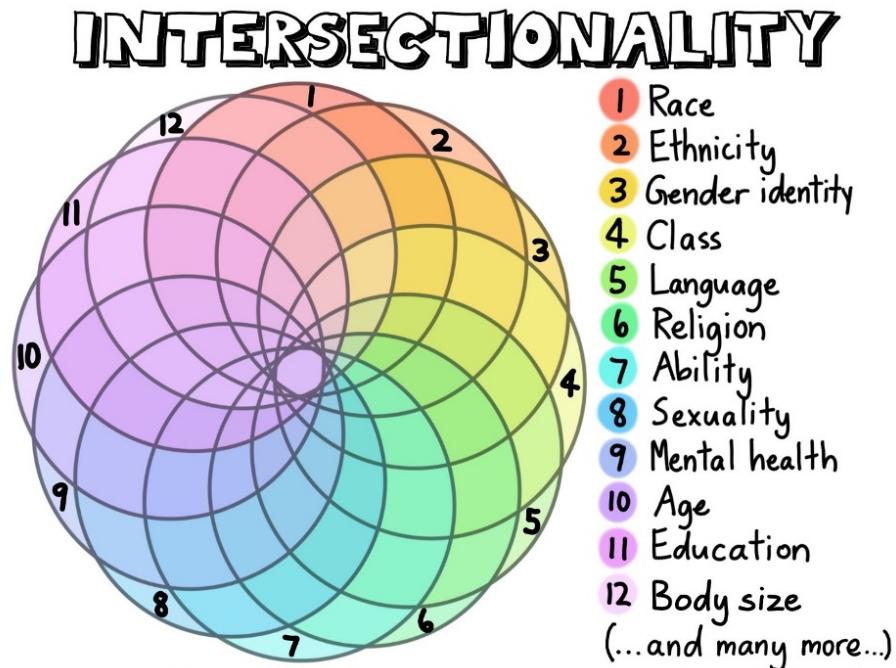


Figure 1. Intersectionality. Source: <https://sylviaduckworth.com>

Diversity in rationality, not variety in rationality, emphasizes the interactive nature in human ways of rations across numerous identities clusters. As Hershock (2014) wrote in the book

Valuing Diversity, variety simply means factual coexistence and usually given, whereas “diversity when fully realized, is a means-to and has the meaning-of both valuing and adding value to a shared situation through enhancing the significance of differences”. Since we can only observe others' outcomes of rationalization and occasionally their explicit materials, we tends to fill in others' implicit materials with our own materials. This obviously, lead to mismatch in standard errors. Nobel laureates Theodore W. Schultz actually wrote about this "mistakes by economists: [development] economics has suffered from several intellectual mistakes. Models developed for this purpose were widely acclaimed until it became evident that they were at best intellectual curiosities. The reaction of some economists was to turn to cultural and social explanations for the alleged poor economic performance of low income countries". Applying the best responses of one cluster onto another cluster could results in underestimation or overestimation of standard error, especially in implicit costs and benefits.

3. Hidden Serial Correlations: Status Quo and Implications

3.1 Policy Advisory versus Policy Beneficiary

Given that economics literature heavily influenced public policy globally, the diversity of policy beneficiary are currently not proportionately reflected in the diversity of policy advisory, indicating gaps for understanding beneficiary's ways of ration. Policy beneficiary is the stakeholders for outcomes of public policy, which are people globally. Figure 2 provides a visualization of this diversity in identities clusters if the world only has 100 people, or 100 policy benefitors. On the other side, policy advisory includes both practitioners, those who actively applying economics literature for policy making, and academics who are adding to the literature.

In general, the status quo is that the economics profession includes disproportionately few women and members of historically underrepresented racial and ethnic minority groups, relative both to the overall population and to other academic disciplines (Bayer & Rouse, 2016). Only 30% of PhD economists in the US federal government and 23% of economics faculty in academia are women (Wessel et al., 2022). There is also evidence on the lack of socioeconomic diversity in economics PhDs (Stansbury & Schultz, 2022). The literature on this topic has mostly focused on demographic disparities in developed nations, but economics literature have further impacts than that. Economics concepts are taught and widely applied all over world across identities clusters, so it might be worth it to look at the disparities between leading academics and the population.



Figure 2. The World as 100 People with 2016 data from 100people.org.
Source: jackhagley.com

In order to investigate and visualize the disparities between leading academics and the population, I assigned Nobel laureates in the economic sciences as leading academics since it is awarded for economists with greatest contributions to the field. By 2022, the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel has been awarded to 92 laureates (The Nobel Prize, n.d.). By 2016, the world population totalled roughly 7.5 billion people (100people.org). As the work of Nobel laureates echoed, I assume that the mismatch in year has negligible effects. Further, laureates Arthur Lewis holds 2 nationalities, but given his birthplace is Saint Lucia, I'll assign him in North America. All units are percentage of group population.

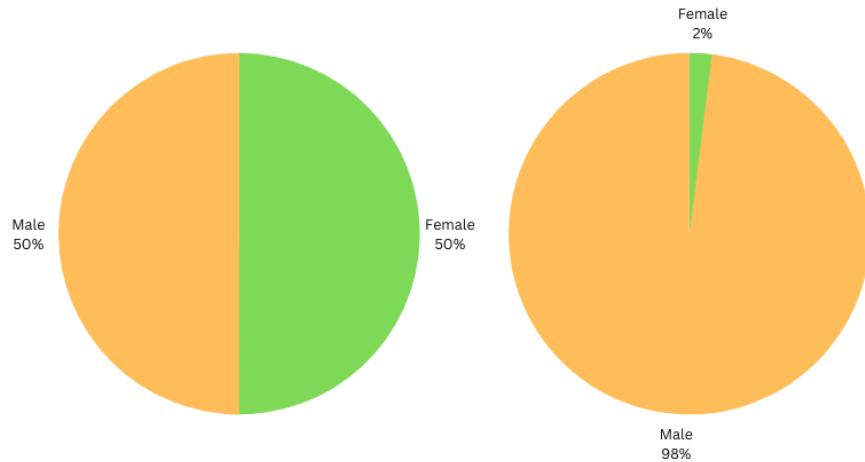


Chart 1. Gender: World vs Nobel laureates

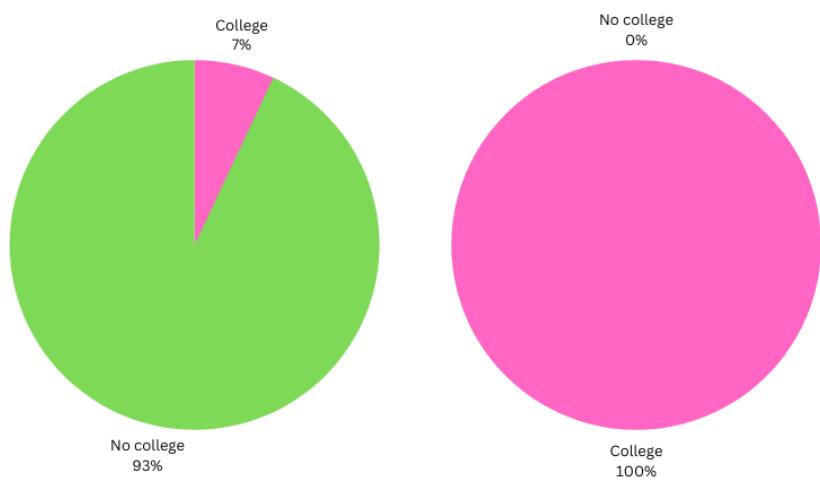


Chart 2. College education: World vs Nobel laureates

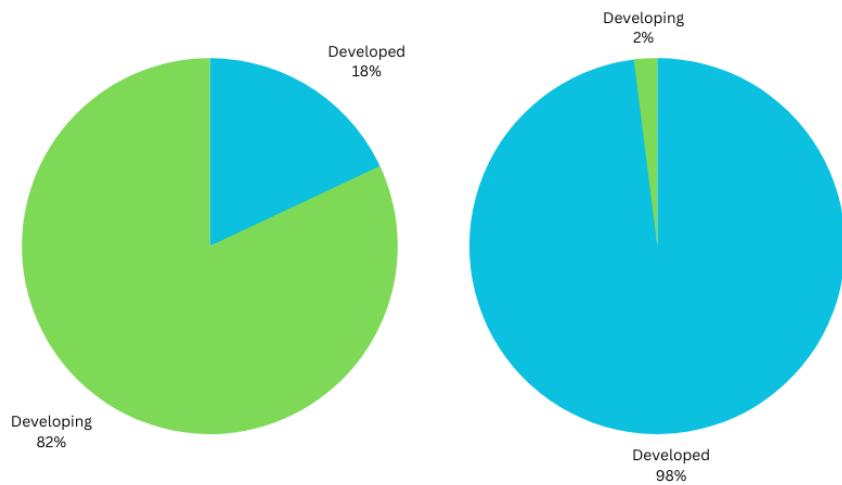


Chart 3. Economic development: World vs Nobel laureates

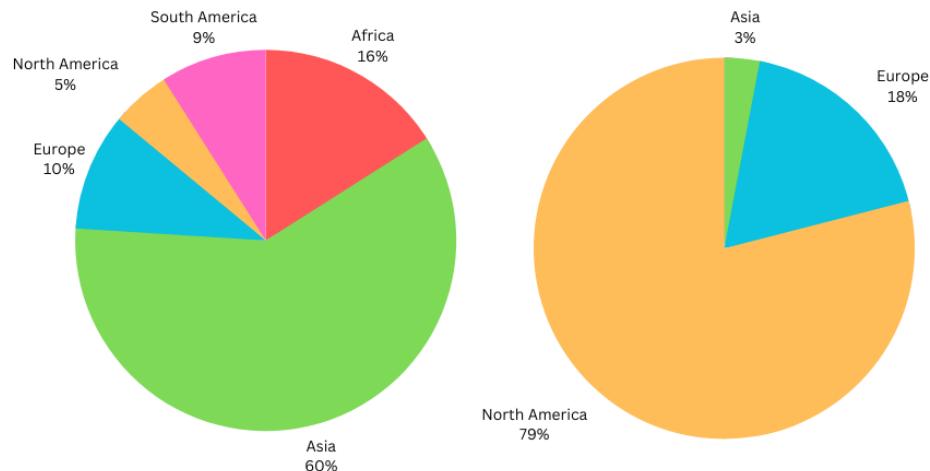


Chart 4. Geography: World vs Nobel laureates

Chart 1 to 4 illustrate the disparities between the world and economics Nobel laureates in four basic identities clusters: gender, college education, economic development, and geography. It is evident that the economic sciences are oversampling from certain identities clusters, at least in the case of leading academics.

3.2 Hidden Serial Correlations in Economics

Economics, specifically practitioners and academics, is being oversampled from certain identity clusters, which results in hidden serial correlations in findings and the literature. As mentioned in the second part of this essay, four sources of materials for reasoning can come from baseline (collective) materials and intersectional materials, which are customized to each identity cluster. In econometrics, the clustering idea is that errors are likely to be correlated within clusters, but uncorrelated across clusters (see Figure 3). If Economics knowledge is being oversampled from certain identity clusters, it is being oversampled from the intersectional materials of those clusters and then generalized as baseline materials. In my opinion, this overestimation of knowledge transitivity across clusters is best described by a concept in econometrics, serial correlation. Serial correlation occurs in time-series studies when the errors associated with a given time period carry over into future time periods, and this significant issue relies on standard error correction methods such as robust or clustered standard errors. Clustered standard errors, with clusters defined by factors such as geography, are widespread in empirical research in economics and many other disciplines. However, a recent study by Abadie and colleagues (2022) find that there is even bias in this approach, as “when the number of clusters in the sample is a non-negligible fraction of the number of clusters in the population, conventional cluster standard errors can be severely inflated”. Therefore, there exists hidden serial correlations in contemporary economics.

When Economic findings are scaled up to treat other identity clusters in public policy, hidden serial correlations not only make the error variance smaller than the true variance, but they also hinder efficient problem solving. It is important to clarify that serial correlation will not affect the

unbiasedness or consistency of estimators, but it does affect their efficiency. When hidden serial correlations are left unaddressed, standard errors will be smaller than the true standard errors, leading to unreliable hypothesis testing, and eventually leads to an overestimation of fitness and t-statistics will actually appear to be more significant than they really are. It is especially concerning when one thinks about the nature of economic literature, or any literature, is the accumulation over time. Apart from causing noise in true variance of standard errors, hidden serial correlations also bring noise to problem solving in public policy, potentially deviating from ‘true’ problems and solutions for a specific groups cluster. In other word, the range for the diversity of research topics, tradeoffs, questions and solutions will be more limiting.

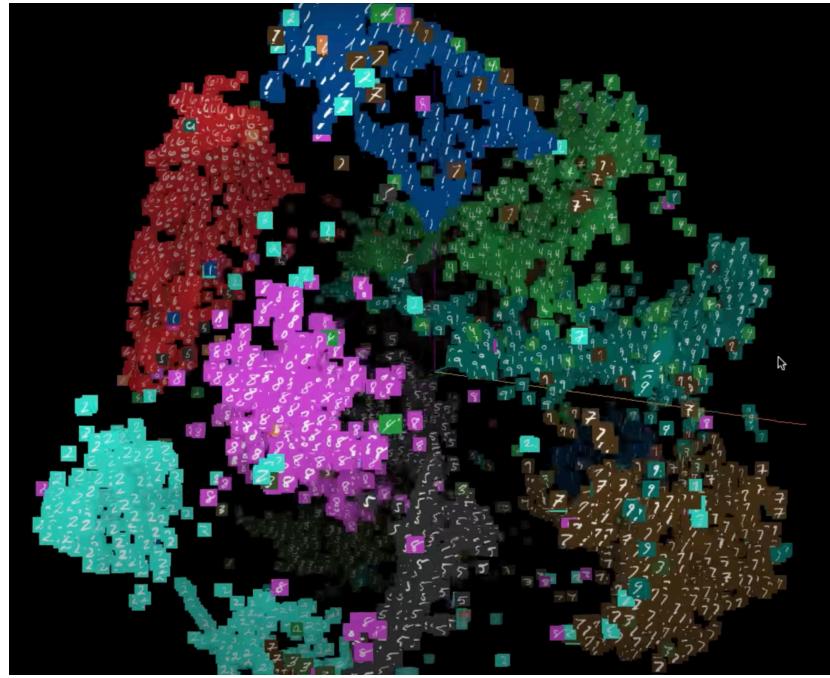


Figure 3. Visualization of groups clusters.
Source: Google Developers on Youtube.

4. Conclusion

This essay argue that because humans' materials or sources for the reasoning process are influenced both by baseline and intersectional materials, tradeoffs between costs and benefits are interactive and nuanced. The oversampling of economists' few identities clusters results in hidden serial correlations with bias in error variances not accounted for, when findings got scaled up for public policy. Under increasing complexity of modern human institutions, economics would be more efficient and applicable if its practitioners and academics integrate ways of ration from more diversed clusters of human identities in order to reveal the hidden errors.

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