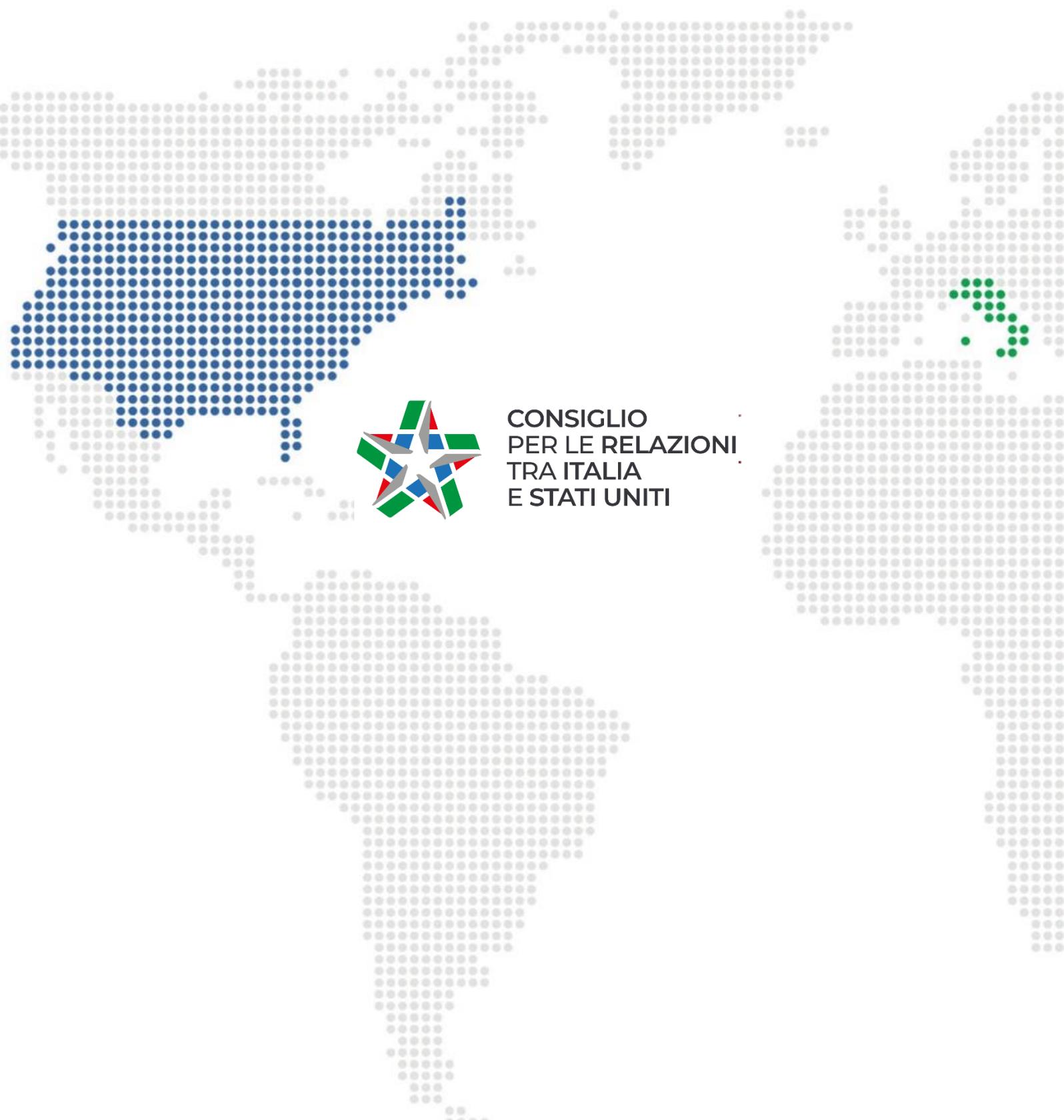


April 2021



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## The Big Picture – April, 2021

### “ECONOMICS MUST BUILD BACK BETTER, TOO”

Thoughtful economists have long been concerned by their profession’s hubristic tendencies, collective attachment to questionable models, and lack of openness to new and different voices. Will the combined effect of the global financial crisis, the anti-globalization backlash, and now COVID-19 finally prompt the discipline to demonstrate greater humility and embrace genuine diversity?

In this Big Picture, Harvard University’s **Dani Rodrik** thinks that while economists can be justifiably proud of the power of their statistical and analytical methods, they need to be more self-conscious about these tools’ limitations. In that regard, **Arvind Subramanian** and Johns Hopkins University’s **Devesh Kapur** show how growing use of one such tool – randomized controlled trials – is excluding not only ideas but also people, amplifying the Global South’s underrepresentation among development economists.

Harvard’s **Ricardo Hausmann**, meanwhile, explains why economists’ excessive methodological focus on rational individual decision-making puts the discipline at a huge disadvantage vis-à-vis the natural sciences. But New York University’s **Roman Frydman** and **Michael Goldberg** of the University of New Hampshire make the case that economists’ aspiration to the natural sciences’ predictive power has resulted in models that are regularly wide of the mark, because they assume that the future follows mechanistically from the past.

Finally, **Diane Coyle** of the University of Cambridge hopes that economists and policymakers will rediscover nature before the damage to the natural world – and thus to everybody’s standard of living – becomes irreparable.

For more than a century, the oil and gas industry has played a central role in almost every geopolitical development of consequence. Now that the fossil fuels’ days finally seem to be numbered, it is time to consider not just what will come next, but also what it will take to get there.

## “HOW ECONOMISTS AND NON-ECONOMISTS CAN GET ALONG”

(Project Syndicate – March 9, 2021)



**Dani Rodrik**, Professor of International Political Economy at Harvard University’s John F. Kennedy School of Government, is the author of *Straight Talk on Trade: Ideas for a Sane World Economy*.

*Understanding the advantages and limitations of economists’ methods clarifies the value they can add to analysis of non-economic questions. Equally important, it underscores how economists’ approach can complement but never replace alternative, often qualitative methods used in other scholarly disciplines.*

CAMBRIDGE – Economists have never been shy about taking on the big questions that disciplines such as history, sociology, or political science consider their own province. What have been slavery’s long-run implications for contemporary American society? Why do some communities exhibit higher levels of social trust than others? What explains the rise of right-wing populism in recent years?

In addressing these and many other non-economic issues, economists have gone well beyond their bread-and-butter preoccupation with supply and demand. This transgression of disciplinary boundaries is not always welcomed. Other scholars object (often correctly) that economists do not bother to familiarize themselves with existing work in relevant disciplines. They complain (again rightly) about an inhospitable academic culture. Replete with interruptions and aggressive questioning, economics seminars can seem to outsiders more akin to the Inquisition than a forum for colleagues to communicate results and probe new ideas.

Perhaps the most important source of tension, however, arises from the methods economists bring to their research. Economists rely on statistical tools to demonstrate that a particular underlying factor had a “causal” effect on the outcome of interest. Often misunderstood, this method can be the source of endless and unproductive conflict between economists and others.

Understanding the advantages (and limitations) of economists’ method clarifies the value they can add to analysis of non-economic questions. Equally important, it underscores how economists’ approach can complement but never replace alternative, often qualitative methods used in other scholarly disciplines.

It helps to begin with the idea of causality itself. In the sciences, we acquire knowledge about causation in one of two ways. Either we start from a cause and try to identify its effects. Or we start from the effect and try to ascertain its cause(s). The Columbia University statistician Andrew Gelman has called the first method “forward causal inference” (going from cause to possible effects) and the second “reverse causal inference” (going from effect to likely causes).

Economists are obsessed with the first of these approaches – forward causal inference. The most highly prized empirical research is that which demonstrates that an exogenous variation in some underlying cause X has a predictable and statistically significant effect on an outcome of interest Y.

In the natural sciences, causal effects are measured using lab experiments that can isolate the consequences of variations in physical conditions on the effect of interest. Economists sometimes mimic this method through randomized social experiments. For example, households might be randomly assigned to a cash grant program – with some receiving the extra income and others not – to discover the consequences of additional income.

More often than not, history and social life do not permit lab-like conditions that allow the effects of changes in the human condition to be precisely ascertained and measured. Economists resort to imaginative statistical techniques instead.

For example, they might document a statistical association between an exogenous factor such as rainfall and the incidence of civil conflict, allowing them to infer that changes in income levels (due to fluctuations in agricultural output) are a cause of civil wars. Note the key piece of ingenuity here: because civil wars cannot influence weather patterns, the correlation between the two must be due to one-way causality in the other direction.

Well-done research in this style can be a beautiful thing to behold and a significant accomplishment – as reliable a causal assertion as is possible in the social sciences. Yet it might leave a historian or a political scientist cold.

This is because the economists’ method does not yield an answer to the question “what causes civil conflict” (the reverse causal inference question). It merely provides evidence on one of the causes (income fluctuations), which may not even be one of the more important factors. Worse, because economists are trained only in the forward-induction approach, they often present their research as if the partial answer is in fact the more comprehensive one, further raising the ire of scholars from other disciplines.

There are other sleights of hand that cause economists problems. In their quest for statistical “identification” of a causal effect, economists often have to resort to techniques that answer either a narrower or a somewhat different version of the question that motivated the research.

Results from randomized social experiments carried out in particular regions of, say, India or Kenya may not apply to other regions or countries. A research design exploiting variation across space may not yield the correct answer to a question that is essentially about changes over time: what happens when a region is hit with a bad harvest. The particular exogenous shock used in the research may not be representative; for example, income shortfalls not caused by water scarcity can have different effects on conflict than rainfall-related shocks.

So, economists’ research can rarely substitute for more complete works of synthesis, which consider a multitude of causes, weigh likely effects, and address spatial and temporal variation of causal mechanisms. Work of this kind is more likely to be undertaken by historians and non-quantitatively oriented social scientists.

Judgment necessarily plays a larger role in this kind of research, which in turn leaves greater room for dispute about the validity of the conclusions. And no synthesis can produce a complete list of the causes, even if one could gauge their relative significance.

Nevertheless, such work is essential. Economists would not even know where to start without the work of historians, ethnographers, and other social scientists who provide rich narratives of phenomena and hypothesize about possible causes, but do not claim causal certainty.

Economists can be justifiably proud of the power of their statistical and analytical methods. But they need to be more self-conscious about these tools’ limitations. Ultimately, our understanding of the social world is enriched by both styles of research. Economists and other scholars should embrace the diversity of their approaches instead of dismissing or taking umbrage at work done in adjacent disciplines.

## “THE ABSENT VOICES OF DEVELOPMENT ECONOMICS”

(Project Syndicate – March 26, 2021)



**Arvind Subramanian**, former chief economic adviser to the government of India, is the author of *Eclipse: Living in the Shadow of China’s Economic Dominance*

**Devesh Kapur**, Professor of South Asian Studies at Johns Hopkins University’s Paul H. Nitze School of Advanced International Studies, is the co-author of *The World Bank: Its First Half Century*

*Development economics focuses on improving the well-being of billions of people in low-income countries, but the Global South is severely underrepresented in the field. A small number of rich-country institutions dominate, and their growing use of randomized controlled trials in research is entrenching the imbalance.*

NEW DELHI – The lack of representation of marginalized groups in the corridors of power – political, financial, and cultural – is a growing source of global concern. Knowledge confers power, so who creates it matters. As the Nobel laureate economist Paul Samuelson famously said, “I don’t care who writes a nation’s laws...if I can write its textbooks.”

Development economics focuses on improving the well-being of billions of people in low-income countries, but the Global South is severely underrepresented in the field. Unfortunately, a small number of rich-country institutions have appropriated it, with serious consequences. And the problem appears to be getting worse.

Consider the *Journal of Development Economics*, a leading outlet for research papers in the field. Neither the journal’s editor nor any of its ten co-editors are based in a developing country. Just two of its 69 associate editors are, with Africa and Asia completely unrepresented.

Then there is the World Bank’s prestigious Annual Bank Conference on Development Economics (ABCDE). The 2019 event celebrated the 75th anniversary of the Bretton Woods conference that established the World Bank and the International Monetary Fund, but none of the 77 participants were from an institution located in a developing country. And our analysis of the ABCDE’s three-decade history shows that just 7% of those authoring conference papers have been from developing-world institutions.

The long-standing problem of underrepresentation is being amplified by the growing use of randomized controlled trials (RCTs) to test the effectiveness of specific poverty-reduction interventions in low-income countries. Although the RCT movement deserves immense credit for highlighting the need for evidentiary rigor in development economics, it has had exclusionary consequences.

By virtue of their well-deserved academic reputations, RCT-oriented economists now work at the world’s most prestigious universities and research institutions and serve on the editorial boards of top economics journals. This crucial gatekeeping role gives them agenda-setting power. Two decades ago, for example, there were virtually no RCT-based papers in development economics; in 2020, according to our analysis, they accounted for about 40% of the articles in the leading journals.

And exclusion characterizes the RCT movement itself. At the Abdul Latif Jameel Poverty Action Lab (J-PAL), the most influential global center for development-related RCT research, about 5% of the nearly 225 affiliated professors are based in developing countries, with no representation from institutions in East Asia. Moreover, conducting RCTs is expensive, which means that poverty-reduction research – and funding for it – is increasingly concentrated in the richest universities (J-PAL was established at MIT).

Indeed, the cost of carrying out RCTs can run into millions of dollars per paper, making it difficult for developing-country researchers to study their own countries without genuflecting to wealthy institutions’ academic orthodoxies. If these researchers cannot do RCT-based studies, they have little chance of getting published in leading journals, and risk being consigned to second-class status. Even on a generous interpretation of authorship, our analysis suggests that developing-country institutions accounted for less than 10% of RCT-based papers in the top six economics journals in 2020.

A subtler cost concerns prioritization of research. There is an inherent power imbalance between relatively weak developing-country governments and reputationally and financially powerful researchers, as well as tension between what policymakers in lower-income economies consider important and what academics deem worthy of publication in top journals. These factors surely privilege research that yields high private returns to

researchers based in rich countries but meager public returns to developing-country decision-makers.

True, scholars from developing countries in these elite institutions make important contributions to development economics. But the incentives and priorities of the institutional cultures they inhabit play a powerful role.

The final cost relates to the type of knowledge that is ignored. Several highly successful economies – including South Korea, Taiwan, China, Vietnam, Mauritius, and Botswana – did not rely on RCTs to change their destinies and lift their large populations out of poverty. Yet, academics from these countries generally do not sit on the editorial boards of major journals or participate prominently in development economists’ conferences and seminars – an omission that is particularly telling in the case of China, with its historically unprecedented economic transformation. It is as if these countries’ development successes have no lessons to offer.

To preempt the Global North’s monopoly of knowledge creation in development economics requires, first, recognizing that the Global South has ceded dominance as much as the North’s elite institutions have appropriated it. Many developing countries have severely undermined their own universities and knowledge-production systems both through lack of funding and political interference, with the latter being especially pernicious in the social sciences. Unless they remedy this, they will continue to suffer the consequences of the global imbalance.

We also must heed the novelist Kazuo Ishiguro’s 2017 Nobel lecture, in which he urged a broadening of “our common literary world to include many more voices from beyond our comfort zones of the elite first-world cultures.” That means searching “more energetically to discover the gems from what remain today unknown literary cultures, whether the writers live in far-away countries or within our own communities,” while taking “great care not to set too narrowly or conservatively our definitions of what constitutes good literature.”

Substitute “development economics” for “literature,” and Ishiguro’s injunction yields a constructive agenda of corrective action for intellectuals in the Global North. It also suggests that diversity and broader representation are the best safeguards against intellectual narrowness resulting from elite capture.

## “THE INDIVIDUAL FAILINGS OF ECONOMICS”

(Project Syndicate – March 31, 2021)



**Ricardo Hausmann**, former minister of planning of Venezuela and former chief economist at the Inter-American Development Bank, is a professor at Harvard's John F. Kennedy School of Government and Director of the Harvard Growth Lab.

*In recent decades, economics has gone from defining itself as a set of questions to defining itself as a set of methods, all based on individuals making decisions. By doing so, it has undermined its own ability to make progress.*

CAMBRIDGE – Economics could advance enormously if it relaxed one of its most precious assumptions: methodological individualism, or the idea that any explanation needs to be related to individuals making sensible decisions. This requirement puts the discipline at a huge disadvantage vis-à-vis the natural sciences, because it prevents progress in understanding the relationship between the micro and the macro.

Physics explains all behavior by assuming some fundamental laws at the (very) micro level. Quarks give rise to protons and neutrons, which, together with electrons, generate atoms, in turn giving rise to molecules and macro-molecules such as DNA, genes, and proteins. These produce cells, multicellular beings, and whole ecosystems that live on a planet that rotates around the sun. In theory, one should be able to explain all of this by going back to the fundamental laws of particle physics. In practice, this is not only impossible but also unnecessary, facilitating progress.

We know about all of these levels because scientists looked into them and described them in as much detail as possible, enabling other scientists to explain them in terms of lower-level determinants. Each layer can somehow be related to the layer below, all the way back to quarks and electrons.

Whereas going back one step is not easy, but often doable, going forward even one step is hard. We can work out the amino acid sequence of a protein from the gene that codes for it, but we still are unable to establish what three-dimensional shape the protein will take, which is fundamental to determining its function.

Making things even harder is a phenomenon known as emergence, whereby a next-level property does not exist at the previous step. Diamonds and graphene have very different properties, for example, but are chemically identical. Neurons give rise to consciousness, but only at the level of millions of networked neurons; we would never have guessed it by looking inside the neuron.

Contrast this with economics today. Methodological individualism requires that all phenomena ultimately be explained in terms of individuals making decisions they have sound reasons to make. Studying regularities in aggregate data - typical of macroeconomics before the 1970s - is thus uninteresting if these cannot be grounded in rational individual behavior.

As the Nobel laureate economist Robert Lucas argues, governments could not trust these regularities to be stable if they based policies on them, because individuals would respond to those measures in ways that would undermine the regularities. The data might suggest a trade-off between inflation and unemployment, but if governments tried to "buy" less unemployment through a bit more inflation, people would change their inflation expectations in ways that would make the whole exercise futile.

The economics profession thus developed models with strong micro foundations, centered on individuals making rational decisions and responding to well-understood incentives. To make progress while abiding by these requirements, economists had to simplify or dumb down the layers of interaction between the individual and the aggregate outcomes they were trying to explain. One common way to do this is to assume that all individuals are identical, or that they are heterogeneous in predictable ways. But requiring all economic explanations to be based on individual behavior is like attempting to explain global warming with quantum physics.

Fortunately, this methodological approach is crumbling. At the micro level, behavioral economics has dented belief in the assumption of individual rationality. In a series of papers, Harvard's Xavier Gabaix has shown that all the basic tenets of both micro and macroeconomics change a lot if we assume that there are limits to agents' rationality. Likewise, Gabaix's Harvard colleague Joseph Henrich argues that the way people make decisions is not universal, but rather depends on a society's culture.

More to our point is the issue of going from decision-making individuals to the aggregate level. The extremely talented late Harvard economist Emmanuel Farhi, working with UCLA's David Baqaee, showed that we need to consider the (unexplained) input-output structure of production in order to understand macroeconomic fluctuations: we cannot just derive it from individual representative agents.

Similarly, Harvard's Pol Antràs (with co-authors) has recently been reconstructing the theory of international trade by assuming that the world is organized through global value chains instead of standard markets. This apparently minor assumption makes huge differences both in theory and in terms of trade-policy implications. We are barely starting to understand what it means in practice, because, up to now, we had not bothered to collect the requisite firm-to-firm data.

Seen from this perspective, the neoclassical theory of economic growth looks quaint. Its main contribution, in the words of the Nobel laureate economist Paul Romer, is to show how hard it is to ground long-term growth in theory. Alas, neoclassical theory has been next to useless for any practical purpose, mainly because it blatantly disregards the meso-structures that exist between individuals and aggregate economic outcomes.

Fortunately, some researchers have tried to uncover these meso-structures, using big data with network science and other techniques. For example, they have identified complex structures of skill complementarities and patterns of relatedness within and across industries, technology classes, and scientific areas.

These studies show that meso-structures matter for how cities and countries grow, and how technologies develop. Given the current orthodoxy, these papers have been unpublished in economics journals, because they cannot show how these structures are linked to individuals making decisions under constraints. But they have been published in prestigious scientific journals such as *Nature* and *Science*, as well as in the *Journal of Urban Economics* and *Research Policy*. As a result, other researchers can ask questions about how these meso-structures arise from, say, individual decision-making.

In recent decades, economics has gone from defining itself by the questions it asks to defining itself by the methods it uses. By restricting its approach to methodological individualism, it has undermined its own progress.

## **“DID CAPITALISM FAIL?”** (Project Syndicate – September 13, 2013)



**Roman Frydman**, Professor of Economics at New York University, is the co-author of *Imperfect Knowledge Economics and Beyond Mechanical Markets*.

**Michael D. Goldberg** is Professor of Economics at the University of New Hampshire. He is the co-author of *Imperfect Knowledge Economics and Beyond Mechanical Markets*.

*Regulators, bankers, and rating agencies bear much of the blame for the 2008 crisis. But the near-meltdown was not so much a failure of capitalism as it was a failure of contemporary economic models' understanding of the role and functioning of financial markets - and, more broadly, instability - in capitalist economies.*

NEW YORK - Until six days before Lehman Brothers collapsed five years ago, the ratings agency Standard & Poor's maintained the firm's investment-grade rating of "A." Moody's waited even longer, downgrading Lehman one business day before it collapsed. How could reputable ratings agencies - and investment banks - misjudge things so badly?

Regulators, bankers, and ratings agencies bear much of the blame for the crisis. But the near-meltdown was not so much a failure of capitalism as it was a failure of contemporary economic models' understanding of the role and functioning of financial markets - and, more broadly, instability - in capitalist economies.

These models provided the supposedly scientific underpinning for policy decisions and financial innovations that made the worst crisis since the Great Depression much more likely, if not inevitable. After Lehman's collapse, former Federal Reserve Chairman Alan Greenspan testified before the US Congress that he had "found a flaw" in the ideology that self-interest would protect society from the financial system's excesses. But the damage had already been done.

That belief can be traced to prevailing economic theory concerning the causes of asset-price instability - a theory that accounts for risk and asset-price fluctuations as if the future followed mechanically from the past. Contemporary economists' mechanical models imply that self-interested market participants would not bid housing and other asset prices to clearly excessive levels in the run-up to the crisis. Consequently, such excessive fluctuations have been viewed as a symptom of market participants' irrationality.

This flawed assumption - that self-interested decisions can be adequately portrayed with mechanical rules - underpinned the creation of synthetic financial instruments and legitimized, on supposedly scientific grounds, their marketing to pension funds and other financial institutions around the world. Remarkably, emerging economies with relatively less developed financial markets escaped many of the more egregious consequences of such innovations.

Contemporary economists' reliance on mechanical rules to understand - and influence - economic outcomes extends to macroeconomic policy as well, and often draws on an authority, John Maynard Keynes, who would have rejected their approach. Keynes understood early on the fallacy of applying such mechanical rules. "We have involved ourselves in a colossal muddle," he warned, "having blundered in the control of a delicate machine, the working of which we do not understand."

In *The General Theory of Employment, Interest, and Money*, Keynes sought to provide the missing rationale for relying on expansionary fiscal policy to steer advanced capitalist economies out of the Great Depression. But, following World War II, his successors developed a much more ambitious agenda. Instead of pursuing measures to counter excessive fluctuations in economic activity, such as the deep contraction of the 1930's, so-called stabilization policies focused on measures that aimed to maintain full employment. The "New Keynesian" models underpinning these policies assumed that an economy's "true" potential - and thus the so-called output gap that expansionary policy is supposed to fill to attain full employment - can be precisely measured.

But, to put it bluntly, the belief that an economist can fully specify in advance how aggregate outcomes – and thus the potential level of economic activity – unfold over time is bogus. The projections implied by the Fed’s macro-econometric model concerning the timing and effects of the 2008 economic stimulus on unemployment, which have been notoriously wide of the mark, are a case in point.

Yet the mainstream of the economics profession insists that such mechanistic models retain validity. Nobel laureate economist Paul Krugman, for example, claims that “a back-of-the-envelope calculation” on the basis of “textbook macroeconomics” indicates that the \$800 billion US fiscal stimulus in 2009 should have been three times bigger.

Clearly, we need a new textbook. The question is not whether fiscal stimulus helped, or whether a larger stimulus would have helped more, but whether policymakers should rely on any model that assumes that the future follows mechanically from the past. For example, the housing-market collapse that left millions of US homeowners underwater is not part of textbook models, but it made precise calculations of fiscal stimulus based on them impossible. The public should be highly suspicious of claims that such models provide any scientific basis for economic policy.

But to renounce what Friedrich von Hayek called economists’ “pretense of exact knowledge” is not to abandon the possibility that economic theory can inform policymaking. Indeed, recognizing ever-imperfect knowledge on the part of economists, policymakers, and market participants has important implications for our understanding of financial instability and the state’s role in mitigating it.

Asset-price swings arise not because market participants are irrational, but because they are attempting to cope with their ever-imperfect knowledge of the future stream of profits from alternative investment projects. Market instability is thus integral to how capitalist economies allocate their savings. Given this, policymakers should intervene not because they have superior knowledge about asset values (in fact, no one does), but because profit-seeking market participants do not internalize the huge social costs associated with excessive upswings and downswings in prices.

It is such excessive fluctuations, not deviations from some fanciful “true” value – whether of assets or of the unemployment rate – that Keynes believed policymakers should seek to mitigate. Unlike their successors, Keynes and Hayek understood that imperfect knowledge and non-routine change mean that policy rules, together with the variables underlying them, gain and lose relevance at times that no one can anticipate.

That view appears to have returned to policymaking in Keynes’s homeland. As Mervyn King, the former governor of the Bank of England, put it, “Our understanding of the economy is incomplete and constantly evolving....To describe monetary policy in terms of a constant rule derived from a known model of the economy is to ignore this process of learning.” His successor, Mark Carney, has come to embody this view, eschewing fixed policy rules in favor of the constrained discretion implied by guidance ranges for key indicators.

Rather than trying to hit precise numerical targets, whether for inflation or unemployment, policymaking in this mode attempts to dampen excessive fluctuations. It thus responds to actual problems, not to theories and rules (which these problems may have rendered obsolete). If we are honest about the causes of the 2008 crisis – and serious about avoiding its recurrence – we must accept what economic analysis cannot deliver in order to benefit from what it can.

## “RESTORING NATURE TO ECONOMICS”

(Project Syndicate – February 10, 2021)



**Diane Coyle**, Professor of Public Policy at the University of Cambridge, is the author, most recently, of *Markets, State, and People: Economics for Public Policy*.

*Human economic activity makes extensive use of the ecosystem services nature provides, but these barely feature in measurements of GDP. It is vital to restore nature to economic analysis and policy before the damage to the natural world – and thus to everybody’s standard of living – becomes irreparable.*

CAMBRIDGE - "This land is your land," sang the American folk singer Woody Guthrie, listing the redwood forests, wheat fields, and golden valleys of the United States. Guthrie was making a moral claim that everyone should be able to share in the riches of the land. But his song also highlights the economic truth that the use of natural resources affects everyone. In particular, if we deplete or irreversibly degrade them, the economic consequences affect all of us and future generations.

Human economic activity makes extensive use of the ecosystem services nature provides. Classical economists such as Adam Smith and David Ricardo, who wrote at a time when agriculture accounted for a much greater share of the economy than it does today, were well aware that human activity occurred within the natural world and relied on nature's bounty. They always included land in their analyses. But modern economics has largely excluded nature from definitions and measurements of the economy.

Today, of course, the risks posed by climate change are attracting more attention, including from investors. But many other aspects of nature's role in economic activity have been overlooked until now.

For example, the money farmers earn from selling their crops counts toward GDP, but there is no accounting for the services of the bees that pollinate the crops, or for the quality of the soil - that is, until the bees die or the soil loses its fertility, causing yields to fall. Nor do conventional economic statistics incorporate the services provided by clean air, or the negative impact of pollution. But the link between COVID-19 mortality and respiratory disease has made the latter cost clear, even seen through the very narrow lens of reduced human capital and future earnings.

A recent landmark independent review of the economics of biodiversity, commissioned by the UK Treasury and carried out by my Cambridge colleague Partha Dasgupta, makes a powerful case for restoring nature to economic analysis. Dasgupta argues that we should regard a country's natural assets as no less a part of its productive capital than assets like broadband, bridges, or the skills base.

The job of economic policymakers should thus be to manage a country's entire portfolio of assets in order to deliver a positive return for society. This means taking into account the depreciation of individual assets, including important species and ecosystems, and the complementarities between them.

Under such a framework, a government taking a long-term portfolio approach might decide not to build flood defenses from costly, energy-intensive, and unsightly concrete, and instead make a lower-cost investment in tree planting upstream and wetland preservation downstream. Likewise, farmers are well aware of the loss of biodiversity and the depletion of bee populations, but perhaps less aware of the negative consequences such as poorer soil quality and less productive crops, which result in greater dependence on chemical fertilizers and more dead bees, in an accelerating downward spiral. The encroachment of human activity on wilder natural areas is also contributing to the spread of zoonotic diseases like Ebola and COVID-19, at huge cost to societies, economies, and governments.

There is some hope that economic analysis and policy will rediscover nature before the damage to the services we get from it - and thus to everybody's standard of living - becomes irreparable. Now that investors have understood the risks that climate change poses to their returns, they will find it easier to see the importance of biodiversity or clean oceans and air as well. Significantly, it was the UK's hardheaded treasury, and not the cuddly Department for Environment, Food & Rural Affairs, that commissioned the Dasgupta Review. But compiling the statistics needed to capture nature's services to the economy will be crucial.

This is a work in progress. The United Nations has defined standards for the measurement of natural capital. And the ongoing process of revising the definitions used to measure GDP and other economic statistics is an opportunity to bring ecosystem services inside the so-called "production boundary" that separates what is counted as the economy from everything else.

The pandemic is driving home many lessons, including the old but important one that money is a poor measure of value. "Essential workers" from hospital porters to delivery drivers are often among the lowest paid. Anyone currently supervising school lessons at home or doing extra cooking during lockdowns will have a fresh appreciation of the value of unpaid work in the home. And the value people place on access to a public park has jumped since March 2020. Similarly, because much of the value we get from nature currently is not measured, much less paid for, economists ignore it.

That is no longer sustainable (an often-used word with profound implications, because what is not sustainable can never be sustained). Humanity's relationship with nature will inevitably change in the coming years, and economic policymakers must influence how it changes. Ignorance is no defense.

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