

Romer and Nordhaus's Nobel Winning Contributions

ALEX M THOMAS

The contributions of Paul Romer and William Nordhaus to both economic theory and policy are critically assessed here. By undertaking a brief history of economic thinking prior to their pioneering work, it validates the Nobel award. However, it is argued that the Nobel Prize has mostly been awarded to work that employs neoclassical, or more accurately, marginalist assumptions. On the policy front, it is suggested that India should formulate its economic policies by drawing inspiration from some of the work by Samuel Bowles and Mariana Mazzucato alongside that of Romer and Nordhaus.

The author wishes to thank Niranjana Rajadhyaksha, Bhavya Sinha, Limakumba Walling, and especially, Arjun Jayadev for helpful comments.

This article is a revised version of his talk delivered at the First Annual Bengaluru Central University Distinguished Nobel Lecture Series on 16 November 2018.

Alex M Thomas (alex.thomas@apu.edu.in) teaches economics at Azim Premji University, Bengaluru.

The contributions of the Nobel laureates in economic sciences are better understood when seen against the backdrop of larger changes the discipline of economics has undergone. Mainstream economics has transitioned from a “science of wealth” to a “science of choice,” the major representatives of the former are Adam Smith, David Ricardo, and Karl Marx and that of the latter are William Stanley Jevons, Alfred Marshall, and Paul Samuelson. This transition has been accompanied by a move from methodological holism to methodological individualism. In other words, the basic unit of analysis has shifted from a social class to an individual. Another important characteristic of the work of Jevons, Marshall, and Samuelson is the adoption of the marginalist approach—the use of counterfactual concepts such as marginal utility, marginal revenue, and marginal cost—in the determination of value and income distribution. The work of both Paul Romer and William Nordhaus employs the marginalist approach.

Intellectual Context

In 1936, Keynes published *The General Theory of Employment, Interest, and Money*. His key argument was that it is aggregate demand which determines the equilibrium level of output and employment in the short run (when productive capacity is given) and the central policy implication was that if private investment is not forthcoming, then the government must intervene so as to increase equilibrium output and employment. Roy Harrod extended Keynes's principle of effective demand to the long run, that is, to questions relating to economic growth. Harrod's work highlighted the difficulty of attaining stable growth with full employment due to insufficient entrepreneurial expectations, much like Keynes. By introducing the

marginalist notion of perfect substitutability of labour and capital alongside the assumption that all saving is automatically invested, Robert Solow arrived at a conclusion opposite to that of Harrod: in the long run, the economy can attain stable growth with full employment. Solow was awarded the Nobel Prize for his contributions to growth theory. And thus, the dismal or gloomy conclusions of Keynes and Harrod were overthrown by the “optimistic, harmonious, self-equilibrating” (Jones 1975: 97) growth model of Solow.

Besides the work of Solow, the study of economic growth and climate change owes much to the contributions by Frank Ramsey and Irving Fisher. In 1928, Ramsey raised the question of how much the nation should save today for future enjoyment so as to maximise total enjoyment across generations. This is the key question for optimal growth theories. It is here that the question of intergenerational equity—how much the present generation values the enjoyment of the future generation—becomes important. Around the same time, Fisher, the author of *The Rate of Interest* (1907) and *The Theory of Interest* (1930), argued that the “interest rate [is] like any other price” (Weitzman 2007: 706) and therefore, determined by forces of demand and supply. More precisely, according to marginalist economists such as Ramsey and Fisher, the equilibrium rate of interest in a competitive economy is equal to the marginal product of capital. By 1960, the following ideas were well-entrenched in the mainstream marginalist economics tradition. First, (exogenous) technological progress generates stable growth in an economy assumed to be at full employment. Second, the rate of interest is like any other commodity price, which is the outcome of the interaction of demand (for capital) and supply (of capital).

Contributions

The Royal Swedish Academy of Sciences awarded the 2018 prize in economic sciences to Romer and Nordhaus for “integrating technology and nature into economics.” By “economics,” it is meant

marginalist economics and not Classical, Marxian, or Keynesian economics.

Romer extended Solow's work by introducing technological progress as an endogenous variable, explicitly showing that technological progress is created by "purposeful activities in the marketplace" (Royal Swedish Academy of Sciences 2018: 2). In Solow, technological progress was exogenous to the growth model, which invited the scorn of Joan Robinson who termed it "manna from heaven, given to us by God and the engineers." Romer demonstrated that "ideas" have positive externalities which the "free" market is unable to compensate for and consequently the market underproduces "ideas" or research and development (R&D).

Nordhaus, like Romer, also extended the Solow growth model so as to account for global warming. He showed that global warming has negative externalities, which the "free" market is unable to account for and consequently, the market overproduces Carbon dioxide (CO₂) emissions. Nordhaus introduced energy as an input alongside the conventional inputs—labour and capital—in the Solow model. Through this approach, Nordhaus "pioneered the development of integrated assessment models (IAMs)," which consist of three interacting models reflecting the chemistry of global CO₂ emissions, the physics of the effects of CO₂, and the economic impacts of climate change policies on the economy and its CO₂ emissions (Royal Swedish Academy of Sciences 2018: 5).

The work of Nordhaus is an exercise in optimal growth with environmental protection as an important constraint. It is in this context that the work of Ramsey and Fisher becomes important. Once the key objectives and constraints are fixed, the computer simulation undertakes a massive optimisation exercise. It is here that the choice of the discount rate plays a significant role. In other words, as Weitzman (2007: 707) writes, this is a

gigantic macroeconomic cost-benefit exercise trading off less present consumption from greenhouse gas abatement for more future consumption from mitigating the bad effects a century hence of global warming.

Policy Implications

Now that their key ideas have been outlined, what are their popular policy

implications? Since the market underproduces ideas, as Romer demonstrated, the policy suggestion via R&D subsidies and patents is to create an additional market for ideas, as it were. And since Nordhaus demonstrated that the market overproduces CO₂, the policy recommendations are carbon taxes and carbon credits. The idea that polluters must pay, it must be noted, was already advanced by A C Pigou in the 1920s. In short, both their popular policy prescriptions can be seen as attempts at internalising the externalities—both positive and negative—through the market mechanism. And in this manner, the optimism of the Solow growth model was restored through the work of Romer and Nordhaus. The optimism of mainstream economics arises from the comforting view that economic progress happens automatically via market mechanisms which are enabled by a small government.

Romer recommends monetary incentives for R&D production through "well-designed government interventions such as R&D subsidies and patent regulation" (Royal Swedish Academy of Sciences 2018: 4). The "price" of the subsidy or patent is decided by some economic cost-benefit accounting which will generate an "optimum" price. That is, the

patent laws should strike the right balance between the motivation to create new ideas, by giving some monopoly rights to developers, and the ability of others to use them, by limiting these rights in time and space. (Royal Swedish Academy of Sciences 2018: 4)

In her recent book *The Value of Everything* (2018), Mariana Mazzucato offers us a template to innovatively rethink the crucial role played by the government in the production of basic R&D by underscoring its historic contribution to value and outlining its immense future potential. In this conception, the government is an active producer and not just an enabler. Thus, Mazzucato's approach together with Romer's helps us envision the creation of good public enterprises alongside private ones to produce R&D.

Nordhaus's research suggests that

the most efficient remedy for the problems caused by greenhouse gas emissions would be a global scheme of carbon taxes that are uniformly imposed on all countries. (Royal Swedish Academy of Sciences 2018: 6)

Alternatively, if the emission limits are set low, the same result can be achieved by a "global emission trading system" or carbon credits, and in our parlance, a market for CO₂ emissions. Yet again, the solution has been found within the market mechanism, properly designed by the government, or more accurately, by mainstream economists.

Another key policy question which draws on the work of Nordhaus is: how much of current gross domestic product (GDP) to devote to climate change? It is well known within the economic community that the answer is highly sensitive to the discount rate chosen. If we value the future generations' enjoyment as much as ours, the discount rate is zero implying that we need to devote a large share of GDP for climate change (that is, we reduce our present consumption of goods and services). And if we discount or value less the future generations' enjoyment relative to our, the discount rate is high and therefore, we devote less of our GDP to climate change (that is, we increase our present consumption of goods and services). Mainstream economists such as Nordhaus believe that our (current society's) preference for future consumption is captured by the interest rate. They treat the interest rate as a price which equilibrates their (time) preference for the future with that of the present.

Let us compare the environmental economics of Nordhaus with that of Nicholas Stern, a mainstream economist who is non-orthodox in his choice of the discount rate. The discount rate was close to zero in the *Stern Review*. In his review of Stern, Martin Weitzman, another mainstream environmental economist, criticises Stern's choice of such a low discount rate because it is based on the

a priori philosophical principle of treating all generations equally—irrespective of preferences for present over future utility that people seem to exhibit in their everyday savings and investment behaviour (Weitzman 2007: 707).

In other words, according to mainstream economists such as Nordhaus and Weitzman, the choice of the discount rate has to be based on strictly economic factors (leaving aside for now the problems

with interest rate understood as time preference). For them, the social preference (the aggregate of all individual preferences) has already been identified and quantified in the saving–investment market, the results of which are embedded in the interest rate. And once again, we see that it is the market mechanism which has been tasked with the political job of aggregating preferences even when there is a strong ethical dimension. And moreover, Kenneth Arrow’s work in the 1950s already highlighted the impossibility of aggregating individual preferences into a social preference.

India urgently requires an environmental policy which is sufficiently decentralised both in its creation and implementation, wherein the environmental costs are not disproportionately falling on the poor. On the Environmental Performance Index, India has slipped to 155 (out of a total of 178 countries) in 2014. According to Avay Shukla (2018), the estimated cost of environmental degradation is 3.5% of India’s GDP in addition to the thousands of deaths every year. The dilution of the Environment (Protection) Act, 1986, the Forest (Conservation) Act, 1980, the Wildlife Protection Act, 1972 and the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 in the recent years has led to a greater exploitation of natural resources. In addition to increased resources being devoted to floods and extreme temperatures, they must also be allocated for studying and reducing slow environmental damage (for a latter example, see Kumar-Rao 2015). And a good environmental policy requires the joint efforts and representation of locals, ecologists, anthropologists, sociologists, and economists.

Criticisms

The criticisms against any work can be classified as internal or external to its field. Thus, the criticisms advanced by economists against the work of Romer and Nordhaus fall under the heads of “criticisms internal to neoclassical economics” and “criticisms external to neoclassical economics but internal to economics.” And, criticisms from other disciplines can be labelled as “criticisms external to economics.”

Within mainstream economics, there are debates about what is the correct interest rate to select from the multiple interest rates prevailing—on government bonds, short-term commercial bank deposits, long-term commercial bank deposits, corporate bonds, and so on. It is also recognised that there are strong irreversibilities associated with ecological damage. There is also discussion on how to integrate improbable events with catastrophic consequences into the IAMs. That is, should we devote a part of current GDP for “catastrophe insurance,” to use Weitzman’s phrase?

Some heterodox economists, following the work of Keynes, argue that the rate of interest, in general, is not an outcome of time preference but of liquidity preference, the preference for currency and bank deposits over safe non-liquid assets such as government bonds. Another group of heterodox economists posit that the interest rate is set by monetary institutions and is not an equilibrium variable arising solely from the interactions of economic variables (for a concise account, see Bank of England 2014).

Another criticism that is levelled at long-run models of growth, and by extension at IAMs, is that they cannot integrate fundamental uncertainty. Indeed, a model ceases to exist if fundamental uncertainty is incorporated. Romer’s growth model, much like Solow’s, is a supply-side growth model wherein the possibility of aggregate demand insufficiency is ruled out by construction (Thomas 2015). And, consequently, supply-side growth policies do not prioritise ways to revive aggregate demand, which, in the demand-led growth theory framework, generates higher output and employment.

Both Romer and Nordhaus appear to be strong believers in the power of the market mechanism to influence individual and collective behaviour. In 1759, Adam Smith ably dealt with the importance of moral sentiments such as duty, prudence, sympathy, and virtue for a society in *The Theory of Moral Sentiments*. By embracing similar themes, Samuel Bowles’s *The Moral Economy* (2016) challenges the dominant tendency to achieve social goals by altering monetary incentives and argues in favour of

non-monetary incentives to achieve our societal goals.

Other social scientists and ecologists argue that the choice of the discount rate cannot be entirely left to economics and economists, and that it should be arrived at through a politically democratic process. Ecologists criticise economic models for their inability to incorporate non-compensatory losses. For instance, the loss of biodiversity from losing a lake in Bengaluru cannot be compensated by creating a similar lake in Thiruvananthapuram.

Conclusions

Today, economics is characterised by a pluralism of approaches and methods, of which neoclassical (or marginalist) economics is the dominant approach. The Nobel Prize in Economic Sciences has been awarded primarily to those contributing significantly to neoclassical economics. Given the intellectual status of neoclassical economics in the 1960s, as seen through the Keynes–Harrod–Solow and Ramsey–Fisher contributions, the award of the Nobel Prize to both Romer and Nordhaus is perhaps justified. However, it must be noted that those who reform and expand the horizons of neoclassical economics via “criticisms internal to neoclassical economics” such as Amartya Sen, Joseph Stiglitz, and Paul Krugman have also received the Nobel Prize.

In a way, the integration of knowledge and nature into economics was already carried out by Adam Smith and David Ricardo respectively, through their discussion of division of labour and diminishing returns to land in the context of economic growth. And those working in their tradition—classical economics—have developed these views considerably after its revival by Piero Sraffa in the 1960s, often in conjunction with the ideas of Keynes and Kalecki.

Finally, our aspiration for a good life for all must be supported with an intellectual admixture of historical understanding, competing economic ideas, alternative policy prescriptions, and decentralised politics. And as students and teachers of economics in India, we have the difficult task of engaging not only with mainstream and non-mainstream approaches to economics but also with the contributions

by Indian economists. Thus, it would be worthwhile for our students to learn about the contributions of B R Ambedkar, Krishna Bharadwaj, P R Brahmananda, K N Raj, Kanta Ranadive, to name a few, to economic theory and policy.

REFERENCES

- Bank of England (2014): "Money Creation in the Modern Economy," *Quarterly Bulletin*, Q1, pp 14–27.
- Bowles, Samuel (2016): *The Moral Economy: Why Good Incentives are No Substitute for Good Citizens*, New Haven: Yale University Press.
- Jones, Hywel G (1975): *An Introduction to Modern Theories of Economic Growth*, London: Nelson.
- Kumar-Rao, Arati (2015): "Disappearing Hilsa," <http://peepli.org/stories/disappearing-hilsa/>, last accessed on 9 December 2018.
- Mazzucato, Mariana (2018): *The Value of Everything: Making and Taking in the Global Economy*, London: Allen Lane.
- Ramsey, Frank (1928): "A Mathematical Theory of Saving," *Economic Journal*, Vol 38, No 152, pp 543–59.
- Romer, Paul (1994): "The Origins of Endogenous Growth," *Journal of Economic Perspectives*, Vol 8, No 1, pp 3–22.
- Royal Swedish Academy of Sciences (2018): "The Prize in Economic Sciences 2018: Popular Science Background," <https://www.nobelprize.org/uploads/2018/10/popular-economicsciencesprize2018.pdf>, last accessed 9 December 2018.
- Shukla, Avay (2018): "The Pushback against Mass Tourism," *New Indian Express*, <http://www.newindianexpress.com/opinions/2018/sep/18/the-pushback-against-mass-tourism-1873372.html>, last accessed 9 December 2018.
- Thomas, Alex M (2015): "Economic Survey 2014–15: Growth Policy and Theory," *Economic & Political Weekly*, Vol 50, No 32, pp 62–65.
- Weitzman, Martin L (2007): "A Review of *The Stern Review on the Economics of Climate Change*," *Journal of Economic Literature*, Vol 48, pp 703–24.