# Abhijit Banerjee

Nancy Qian[*]

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## 1    Introduction

Abhijit Banerjee was born on February 21, 1961, in India, as the first of two children to two distinguished Indian economists, Dipak Banerjee (1930-2007) and Nimrala Banerjee (1936-2023). Banerjee had an academic career that can only be characterized as exceptional. At each step of school, he was admitted to the most selective program to which he applied. In 1978, he entered the Indian Statistical Institute in Kolkata, one of the best places to study mathematics in India. A few months later, he transferred to Presidency College, the highly reputed school where his father was the head of the Department of Economics. In 1981, he attended the competitive masters program at Jawaharlal Nehru University in New Dehli. In 1983, he became the first student from Jawaharlal Nehru University to be admitted into the economics Ph.D. program at Harvard University in Cambridge, Massachusetts.

His post-graduate career was no less spectacular. He obtained appointments at the most prestigious economics departments in the world. After his graduate studies, he was first appointed as an assistant professor at the Department of Economics at Princeton University (1988-1992), before moving back to Harvard in 1992, and then to the Massachusetts Institute of Technology (MIT) in 1993, where he has been a distinguished researcher and acclaimed teacher for the past thirty years. Along the way, he accumulated academia's most prestigious awards, such as the Guggenheim Fellowship in 2000 and the Nobel Memorial Prize in Economic Sciences in 2019.

In many ways, Banerjee's work reflect the environment in which he spent his youth. India in the 1960s, 70s and 80s was a country rich in history and culture, but plagued with poverty and inequality. According to the World Bank, per capita income in India, which is $2,090 (2015 USD) in 2022, was only $310 (2015 USD) in 1961, the year Banerjee was born. When he was in university in the 1980s, it hovered around $450 (2015 USD). For comparison, average per person U.S. income was $19,135 in 1961, around $34,000 in the mid 1980s, and $62,798 in 2022. Moreover, there was much inequality between the relatively wealthy and the very poor in India, and society was deeply divided by hard-to-erase delineations according to caste, religion and gender.

India's poverty and economic and social inequality shaped Banerjee's later work. Yet, his path to becoming a development economist was not as direct as one might imagine. His Nobel Biography acknowledged that many important decisions were made not because of a clear ex ante direction, but in avoidance things he disliked, or simply because he chanced upon an inspiring individual. In college, he studied math and later economics because his parents worried that he would not have a successful career as a writer or philosopher, which he preferred, and because he did not want to study physics, which his parents preferred. Despite his initial interests in Marxist economics and economic development, he changed course after being a research assistant for Jeffrey Sachs at Harvard because he lacked what he perceived as the relevant skills to be successful in those fields – computational skills for empirical analysis and social savvy to sway policymakers (Banerjee, 2019).

As Banerjee lost hope in becoming a development economist, he was drawn to theory by Dilip Abreu, Andreu Mas-Colell and Eric Maskin at Harvard and Oliver Hart at MIT. Then after establishing himself as a prominent applied theorist, he began to teach development economics only because Harvard needed him to fill a teaching vacancy. This was the beginning of his pivot back to development economics.

The transition was sped up at MIT, where amongst others, he met Michael Kremer and Esther Duflo. With them, Banerjee helped to lead the charge to re-energize and re-invent development economics as it is known today. At the time, theory was revered by the economics profession while empirical economics was on the side lines. Research of development economics, in particular, was often marginalized as "demography" (if it was about population or gender), "area studies" (if one emphasized the importance of understanding institutional or historical details), or "transitional economics" (if it was about a formerly socialist country). These three scholars, together with others such as Angus Deaton, Robert Townsend, Chris Udry, and many others, created modern

development economics. They promoted rigorous empirical analysis with micro data. In 2019, Banerjee, together with Esther Duflo and Michael Kremer, won the Nobel Prize for Economics.

The next sections describe Banerjee's broad body of work. There are at least two recurring themes. One is to allow for complex human behavior. The second is the generosity in how Banerjee's studies view the poor. Poverty and bad economic outcomes do not necessarily imply that people are making bad decisions or simply too uneducated to take advantage of opportunities. Rather, his work illustrates how rational individuals can be undermined in their effort towards a better life by the failure of information transmission, markets and other factors. Banerjee's work can be viewed as two distinct phases – the first being in applied theory and the second being in development economics. The following discussion will show how the first body of work motivates the second and the second informs the first, and how the full body of work contributes to our understanding of economic development by interpreting empirical results and astute observation of the world with theory and challenging theory with the facts.

## 2    Banerjee at MIT

When Abhijit Banerjee moved to the Department of Economics at MIT in 1993, he was most well-known for his work in applied theory, and in particular, the model of herding behavior in Banerjee (1992). At MIT, he began several close personal and intellectual friendships that would influence his future work. One such person was Richard (Dick) Eckaus (1926-2022), a well-respected development economist. Eckaus was one of the very few faculty at top U.S. economics departments who strongly believed in the need to study economic development with data and the importance of a solid understanding of institutional details. This was at a time when the economics profession generally focused on "fundamental" market forces and held relatively little value for context-specific details that necessarily accompany the interpretation of empirical work. Eckaus encouraged Banerjee to combine his personal knowledge of India and economic insights to push forward our understanding of the process of economic development.

During 1993-1995, Thomas Piketty was an assistant professor at the department of economics at MIT. Amongst other works, Piketty challenged the "Kuznets curve". Kuznets argues that the rise in inequality observed during the rapid growth of the industrial era is due to an increase in productivity, and thus wages, in new sectors

such as manufacturing. As the economy grows and market forces reallocate labor from low productivity sectors such as agriculture to the high productivity ones, inequality will naturally decline (Kuznets, 1955). Piketty argues that the observed declines in inequality are usually driven by policy and/or exogenous forces rather than market forces. For example, Piketty (2003) uses historical data to document that in France, inequality declined because the two World Wars destroyed the capital held by the top one percent and that they were unable to accumulate the same degree of wealth afterwards because of the introduction of highly progressive taxes. This is important because if inequality declined only due to exogenous shocks like policy and conflict, then market forces alone may not reduce inequality at higher levels of income (Piketty, 2006).

Banerjee and Piketty wrote several papers together. Aghion et al. (1999) argues that capital market imperfections together with unequal access to capital can generate macro fluctuations. Banerjee and Piketty (2005) documents the rapid increase of the top 1% of incomes in India, which (Piketty and Qian, 2009) extends to a comparison of top income evolution of China and India during a period of high income growth in the two countries.

These papers and those described in the later discussions reconcile the Marxist economics that Banerjee had studied in his youth and the market-based frameworks in modern economics by carefully investigating the sources of failure in market economies.

MIT is also where Banerjee met Michael Kremer and Esther Duflo, with whom he formed two of the most important collaborations of his career. Michael Kremer was a growth theorist who was interested in using randomized control trials, which had long been popular in fields like medicine, to study questions in economic development. Esther Duflo first met Banerjee as his student. She was interested in economic development, and unlike Banerjee and Kremer, was empirically trained by the new generation of econometricians and labor economists promoting reduced form tools for causal interpretation such as Joshua Angrist. Angrist, together with Guido Imbens, was awarded the Nobel Memorial Prize in Economics in 2021 "for their methodological contributions to the analysis of causal relationships". Duflo thus became Banerjee's bridge between theoretically motivated questions and rigorous empirical analysis, and broadened the scope of their joint research to include topics such as the household and gender. These topics are important to the lives of the poor, but usually neglected by the traditional theories of economic growth that characterized economic development in the early 1990s.

At MIT, Banerjee created new courses for several new fields. He co-created a new Ph.D. sequence in development economics (which was co-taught with Harvard in its first years) with Michael Kremer, Esther Duflo, Sendhil Mullainathan and Philip Aghion, and a new undergraduate sequence in development economics at MIT with Esther Duflo. He also co-created MIT's first economics Ph.D. course on political economy with Daron Acemoglu.

In total, while at MIT and Harvard, Banerjee was the primary or secondary advisor of over seventy Ph.D. theses of students from over fifteen countries. His former students include several of the first cohort of leading development economists, such as Esther Duflo, Maitreesh Ghatak, Dean Karlan, Eliana La Ferrara, Jishnu Das, Asim Khwaja, Stuti Khemani and Chris Spohr. They also include students in a larger number of other fields, such as theory, macroeconomics, economic history and political economy.

Banerjee's popularity as an advisor is driven by his broad interests and toolkits, and a skill for drawing insight from seemingly disparate or superficial observations. In celebration of Banerjee's 50th birthday, his former student and distinguished development economist, Kaivan Munshi, credited Banerjee for "teaching me how to think".

# 3    The Theory of Information

The early work of Abhijit Banerjee was greatly influenced by Dilip Abreu, Andreu Mas-Colell, Oliver Hart and Eric Maskin, who taught Game Theory, General Equilibrium and Contract Theory at Harvard and MIT (which allowed Harvard students to take their classes). These courses teach students how to crystalize abstract ideas and to use theory to shed light on practical problems. In addition to providing instruction in the classroom, Andreu Mas-Colell and later Eric Maskin encouraged Banerjee to become an applied theorist and formalize his many ideas. Following their advice, Banerjee wrote a Ph.D. thesis in applied theory.

Banerjee's first high impact contribution studied the mechanics of social learning, i.e. how information sharing frictions affect the way in which dispersed information gets aggregated in informal economic systems. In a series of studies, Banerjee clarifies circumstances in which the process of social learning aggregates information well and achieve the so-called wisdom of crowds, and circumstances in which information aggregation may fail. In the latter scenario, many agents, who in principle jointly hold much information, may choose suboptimal actions based on the information of a few.

While there may be many different possibilities for why this is, Banerjee highlights the role of two features in the way that information is communicated. One feature is that information is usually not communicated in full. For example, it is much easier to observe whether someone is entering a restaurant than to observe how much they like it afterwards. For other patrons, it is much easier to observe what someone else in the restaurant orders than to observe if she is ill from food poisoning afterwards. The second feature is that each person does not communicate information to everyone else in society at the same time. It is common to talk to one's friends or read user restaurant reviews on Yelp sequentially, and one rarely has the luxury or time of talking to everyone or reading all the restaurant reviews online before deciding which restaurant to go to. Banerjee's work formalizes various contexts where imperfect information and a very specific geometry for transmission can make it difficult for people to come to the correct information.

His first major contribution in this area considers a setting where a person can observe another's investment, but cannot observe the returns to that investment. Based on this, she must decide whether to invest. Earlier studies about the diffusion of information assumed that the probability of choosing to invest or not invest was decided exogenously (e.g., Shiller, 2008). In his job market paper, Banerjee (1993) allows for strategic behavior and derives the decision rule that is optimal for the decision. The model considers that some investors face high cost of investing, while others face low costs of investing. Low cost investors always invest. But high cost investors only invest if they hear the rumor before some finite time since it started. This is because the more people invest, the faster the rumor will spread. Thus, if an investor hears about the rumor late, then she thinks that not many people invested initially, which will dissuade her from investing.

After his Ph.D., Banerjee was appointed as an assistant professor at the Department of Economics at Princeton. Banerjee lived in Manhattan and commuted between Penn Station and Princeton Junction using the train. While waiting on the Amtrak platform, he observed that the lines for boarding the train would often be in the wrong place, and it would usually start with one person standing in the wrong place and other people following the first person. Building on his work on rumors, he formalized why these correlated errors regularly occurred in what became his first well-known paper, "A Simple Model of Herd Behavior" (Banerjee, 1992). Herding is a simple model that produces the insight that it is not necessarily irrational to follow others against one's own inclinations, and this may lead to poor social outcomes.

To understand the logic, consider three people, Alice, Ben and Ceren, who will take the Amtrak from Penn Station to Princeton Junction. They arrive at the station sequentially and each make the decision of whether to wait by escalator A or B until they are let down to the platform. Before arriving, all three people believe that A has a 51% chance of being closer to the train and B has a 49% chance of being closer than A. But as they walk to Penn station, they observe construction workers walking out of the various exits in a way that signals to the three approaching commuters that some of the usual walkways may be closed due to construction, which changes the distance to the platform. But the signals of how the distances to each platform is affected varies across the three individuals.

The construction workers signal to Alice that A is closer today and signals to Ben and Ceren that B is closer. If Alice enters the station first, she will go to A. When Ben enters, he will see Alice and think that she got a signal that A is closer, and this will cancel his signal that B is closer (because Ben gives equal weights to his own signal and A's signal). Because of the slightly higher prior for A, he will go to A despite his own signal for B. When Ceren enters, the same thing happens. Ben and Ceren are behaving rationally, but the result is that everyone is waiting by A despite the fact that in the aggregate, more people received a signal that B was closer than A.

Several of Banerjee's later papers will build upon these early studies. They and the contemporaneous work of Bikhchandani et al. (1998) added to studies in information theory that helped to set the stage for the literature on networks and social learning that will be discussed in Section 6. The insights of these papers will also become the background of many of Banerjee's empirical investigations. The notion that sub-optimal economic outcomes are due to some external (though perhaps endogenous) constraints instead of an individual's inability to make good decisions underpins most of Banerjee's studies in economic development.

Even in these early years, Banerjee wrote papers about economic development. These were lesser known, but nevertheless important for understanding the intellectual evolution of his work. In particular, Banerjee and Spagat (1988) and Banerjee and Spagat (1991) attempts to understand why the centrally planned Soviet economy, which was poised to rival the U.S. economy in the 1960s, ultimately failed by the 1980s. It had been observed that the Soviet economy was plagued by supply shortages. Banerjee and Spagat (1988) theorizes that it was the interaction of supply disruptions and growing complexity that reduced productivity growth, where the authors assume that centrally planned economies achieve the same level of input reliability as a market economy, but

at a higher cost. Banerjee and Spagat (1991) shows that the supply volatility in the Soviet Union can be a result of the central planner having imperfect information about the performance of bureaucrats combined with the fact that bureaucrats in this system are not incentivized to satisfy consumers.

# 4    Economic Growth

Traditionally, most studies of long-run economic development are conducted within macro economic frameworks or by economic historians. They typically focus on early industrializing nations in Europe and North America and try to understand how the production possibility frontier expands. The most important growth models since the 1980s are models of endogenous growth, pioneered by macro-economists Robert Lucas and Paul Romer. Many other economists such as Robert Barro, Oded Galor, Philippe Aghion, Peter Howitt, and slightly later, Daron Acemoglu, Chad Jones and Pete Klenow contributed to this literature. Economic historians, using a different toolkit – combining theory with a large body of narrative and quantitative evidence – argued that growth was a result of institutions that encourage economic activity (North, 1989) and/or an outcome of institutions and culture (Mokyr, 1992).

Yet, during the second half of the 20th century, many of the most notable economic events occurred in countries that did not industrialize early and were not on the production possibility frontier. In addition to the stagnation of the Soviet economy, which surprised some observers, the period between the 1950s to the mid 1990s was characterized by the rapid industrialization and income growth of several Asian economies: Japan, South Korea, Singapore, Taiwan and Hong Kong. This contrasted sharply with the persistent poverty in countries such as India and China, which had not yet begun their famous economic rises. These events motivated a body of studies about economic growth about why some countries were able to reach the production possibility frontier while others were not.

A topic of particular interest regarded the value of "big-push" policies, which was partly motivated by the state-led industrial policies of the high-growth Asian countries. Most of the studies in this area focused on using theory to understand the role of a particular mechanism for growth. The models often have multiple sectors where for exogenous reasons, some are assumed to be high productivity for and others are assumed to have lower productivity. In this vein, Banerjee and Andrew Newman,

who met as students at Harvard, wrote a series of papers that highlighted the role of imperfect capital markets and the importance of initial wealth inequality. In one paper, the authors showed that imperfect capital markets and unequal wealth can affect occupational choice (Banerjee and Newman, 1993). In this model, people have limited access to credit and occupations that require initial investment such as an apprenticeship or a job that, in turn, require higher education, are only accessible to those who are wealthy enough to afford it. Those who cannot afford the investment will work for the rich. Occupation, in turn, influences savings and wealth accumulation. An implication of this model is that economies that are very unequal to begin with can end up with low wages and low employment, while economies that are equal to begin with can end up with high wages and high employment.

In another paper, the authors show that initial wealth inequality and imperfect capital markets can affect the share of the economy that moves from unproductive traditional sectors into productive modern ones (Banerjee and Newman, 1998). The authors consider a world where a worker can chose to stay in a traditional unproductive sector in their home villages or move to the productive new sector in city factories. A key difference, motivated by the authors' observation of developing countries, is that the worker (and his family) are well known in his home village and live in close proximity to lenders. This means that lenders can more easily monitor someone working in the home village than someone who moves to the city.

It follows that the workers most likely to move to the productive urban sector are the wealthiest and most productive because they do not need to borrow to move, and the poorest and least productive because they are too poor to obtain a loan no matter what. An interesting implication of this model is that the equilibrium movement into the productive sector as determined by market forces can be lower than the socially optimal rate. The credit market works when the traditional sector is large, which it usually is for poor countries, because lenders can monitor borrowers. The price of loans, i.e., the interest rate, will be relatively high compared to if the credit market did not work as well. The high interest rate will, in turn, reduce the number of workers who can afford to the city.

Amongst other insights, these studies formalize the view that the initial distribution of wealth determining whether a dynamic capitalist economy can emerge. The results and works such as Murphy et al. (1989) argued that pecuniary spillovers and the structure of consumer demand play a central role, and motivate government intervention and big push policies. For example, the optimal movement to productive urban sectors

can be achieved by a government that forces relocation (Banerjee and Newman, 1998). Similarly, subsidized loans for investment in human or physical capital for the poor can allow them to choose productive occupations (Banerjee and Newman, 1993). By clarifying the conditions under which large-scale government intervention can increase aggregate income, they help make coherent the decades-long debate about the advantages and disadvantages of large-scale and possibly coercive government interventions.

Another perceived feature of poor countries that motivated big-push policies was the belief in the presence of poverty trap. This is an old idea that the poor cannot escape poverty because of some non-convexity in the production function. Dasgupta and Ray (1986) provides a very influential treatment of this idea in modern development economics. They use a simple model to show that a poverty trap will emerge if the relationship between calorie intake and productivity is S-shaped. For very, very poor individuals, who are too weak to be very productive, giving them a little more money so that they can buy a little but more food will result in a very small gain in productivity. They will still be tool poor to do much work and will stay trapped in poverty. However, giving them a larger amount of money so that they can buy a large quantity of food will allow them to be much more productive because the marginal returns to additional food is increasing in the amount of food consumed for low levels of food, and they will escape the poverty trap. Banerjee and Newman (1994) shows that a poverty trap can also emerge via the credit market. They intuit that the poor are less likely to repay a loan because they have less to lose from being punished. After all, what can a lender take away from someone who has nothing? It follows that the poor are less likely to obtain credit and thus likely to stay poor. In both cases, and indeed in all poverty trap models, the initial distribution is very important because wealth (or any other income that does not come from your personal labor or investment) determines whether you are in the trap to begin with. Thus, poverty traps motivate redistribution from the rich to the poor and large-scale subsidies to the poor.

# 5    Revolutionizing Development Economics

By the mid 1990s, Abhijit Banerjee was a well-established applied theorist and development economist. And it was at this time that his work began a gradual, but fast-paced, transformation from entirely theory to become increasingly more empirical. In many ways, the empirical shift was motivated by his early theory work, which together with

the literature on economic growth that had exploded in the previous decade, had failed to come to a consensus about the drivers of growth. A key limitation was the lack of variation in cross-country regressions, which was the main method for validating and motivating theories (Barro, 1989; Easterly and Levine, 1997; Mankiw et al., 1992). There are many more potential drivers of growth than there are countries in the world. Moreover, the empirical results usually did not have causal interpretations because the factors are mostly endogenous. Empirical associations can reflect reverse causality. For example, growth can increase educational attainment, but higher average educational attainment can also increase growth. Both will result in a positive association between growth and educational attainment. There is also the problem of joint determination. The positive association between growth and educational attainment can be an outcome of a third omitted factor such as good economic policy.

The development accounting literature was similarly constrained by data and endogeneity. The best measures of physical capital and human capital at the time could only account for one-third of the variation in world income, and the residual, which is usually interpreted as "technology" can any number of things including political institutions an outcome or human capital (e.g., Lagakos et al., 2018). The various factors of growth can be outcomes of growth, or be jointly determined with growth by other omitted factors.

Some empirical facts were simply hard to explain with existing growth theories. Banerjee and Duflo (2005) provide an example of this problem by documenting that within-country heterogeneity in the returns to the same factor was far larger than the cross-country heterogeneity.

The 1990s was also when econometricians such as Joshua Angrist, Guido Imbens and Jerry Hausman introduced a new set of reduced form tools for causal identification, and they and labor economists such as David Card, Larry Katz and the Allen Krueger demonstrated the usefulness of applying these tools to questions that were central to the applied fields. "Natural" experiments exploited variation caused by plausibly exogenous policy or historical "shocks" to X to identify the causal effect of X on Y. Randomized experiments were those in which the econometrician randomly assigns X to identify the causal effects of X on Y. These methods quickly spread to applied fields other than labor. In development economics, this was led by Banerjee, Esther Duflo and Michael Kremer, who started their first experiments in the mid 1990s (e.g., Banerjee et al., 2007; Miguel and Kremer, 2004). Banerjee's first field experiment studied how an additional randomly assigned teacher affected test scores in Udaipur in 1997 (Banerjee

et al., 2004).

The availability of these new tools allowed Banerjee to systematically explore the validity of the drivers of development with empirical evidence. He did this with colleagues at MIT and other schools, as well as his students. These papers systematically examined the roles of credit constraints (e.g., Banerjee and Duflo, 2014), education (e.g., Banerjee et al., 2007), behavioral economics (e.g., Banerjee et al., 2022), health (e.g., Banerjee et al., 2021a), fertility (Banerjee et al., n.d.), policing (Banerjee et al., 2019b), land tenure systems (Banerjee and Iyer, 2005), transportation infrastructure (Banerjee et al., 2020a), service delivery (e.g., Banerjee et al., 2018), misallocation (Banerjee and Duflo, 2005) and many other possible drivers of development.

Banerjee and Esther Duflo further motivated and energized the field by describing the contributions of the new generation of empirical development studies in addressing the concerns of the poor in their book, *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty* (Banerjee and Duflo, 2012).

While the new empirical development studies aim to fill the knowledge gap left by earlier cross-country growth regressions, it is important to recognize that they are also conceptually quite different from earlier growth studies. Economic growth studies directly asked: what is the effect of a broadly defined object, human capital, on another broadly defined object, such as the economic growth of a country. This is motivated by growth models, where aggregate growth or income is a function of human capital, physical capital and some residual.

This new generation of studies, because they acknowledge that X can be endogenous, will examine both what drives X and how X affects the economic outcome of interest. The newer studies will also usually break down the variables into subcomponents that researchers are able to measure consistently and which are relevant to the context being studied. For example, the years of educational attainment is a good measure of human capital in a developed or middle income economy, but would not make sense for a very poor economy where few children complete primary school. In that context, school attendance, literacy, or height-for-age may be more appropriate. Similarly, economic growth can be reflected by individual wages, or employment status, or something else that is positively associated with economic well being (and thus conceptually aggregates to some notion of aggregate income or growth).

The new micro studies also differed from earlier studies in how they humanized the field. The macro models and cross-country regressions were about aggregates instead of individual people, creating little space for compassion. The new field of economic

development was very different. The use of micro data shifted the focus onto specific communities and individuals, and from these data emerged specific details of the lives of the poor – what one ate, when one starved, how much one slept, who she married, how many children she had, whether she was beaten, how long a child was allowed to attend school before she needed to work or marry to support her family. The data and the in-country field work necessitated by data collection and learning about the institutional and cultural details needed for designing and interpreting studies reshaped the relationship between economic researchers and the environments they studied. It gave the new generation of scholars a very different and much more personal view of economic development. The people who lived behind the math became vivid subjects of interest and sympathy.

In the early 2000s, Banerjee conveyed this spirit in the relatively new Ph.D. development economics course at Harvard-MIT. His first lecture motivated the subject of development economics without the typical mathematical equations, but instead by talking about the life of a very poor Bengali man named Abu, as recorded by anthropologists (Hartmann and Boyce, 1983). Abu used his savings to buy a seed to plant a jackfruit tree with the hope that in several years, when the tree matured, it would bear fruit and become a source of income for him and his family. Within a few years, the adults of the household fell ill and could not work as much, and at the same time, the jackfruit tree died. Abu was poorer than before and there was no obvious way to make money or improve the health of those who labored, since one was needed for other. Abu's plight motivates development economics by illustrating the challenges of poverty, as well as the importance of markets for credit and insurance.

In the 1990s and 2000s, most of Banerjee's empirical studies consisted of natural experiments. Afterwards, they were mostly randomized experiments, which are remarkably useful for studying interventions that have direct pertinence to the lives of the poor. Due to the efforts of Banerjee and others, RCTs have become the gold standard of causal identification in development economics.

However, RCTs must be implemented thoughtfully for seveal reasons. First, like natural experiments, RCTS usually do not produce results that directly answer the central questions of development economics: why some economies are rich/growth, while others are not; why some people are productive/rich, while others are not. The second is that they are expensive to run, often costing hundreds of thousands of dollars.

The difficulty in mapping experimental results to aggregate outcome is mainly due to concerns about not capturing general equilibrium effects and the lack of external

validity. To capture general equilibrium effects, studies such as Miguel and Kremer (2004) estimate spillovers by identifying individuals who can be indirectly affected but is not assigned to treatment. In their case, this is children who live near those assigned to receive de-worming pills. However, it is not always possible to identify the group that would be indirectly affected by spillovers. Other studies have addressed this by randomizing over large units such as provinces (e.g., Banerjee et al., 2018). But this can significantly increase the financial and logistic costs of the experiment.

Addressing external validity is a daunting task. There are two approaches. The first is to simply repeat the same experiment in different settings. This is in some sense, conceptually very clean. But it is not always feasible. Another approach is to use theory and common sense to bridge the gap. But this can be unsatisfying especially if the question and context is new and a chicken-or-the-egg situation presents itself – if a new theory needs to be validated by the empirical results, then how can theory be used to interpret the empirical results. In practice, development economists will do both. They will extrapolate generalizable insights by piecing together the results accumulating from many randomized and non-randomized studies, including the many (and unfortunately under-published) null results, into a coherent and plausible explanation of the drivers of economic development.

All these considerations raise the question of when development economists should choose to randomize and when they should opt for other study designs. Studies such as Banerjee et al. (2017) and Banerjee et al. (2020b) have begun to make progress on this issue.

Experiments are expensive. And some of the solutions to the main challenges of RCTs – repeating experiments and conducting experiments at larger scale – require more money and cooperation for organizations and governments. To help reduce the logistic and financial costs, Banerjee, Duflo and Sendhil Mullainathan founded the Abdul Latif Jameel Poverty Action Lab (J-Pal), which help researchers find funding and logistical support for field experiments. This and other organizations that emerged such as Innovation for Poverty Action, CEGA, and more recently, the Global Innovation Fund, have helped to increase access to field experiments for young researchers. As of 2020, J-Pal counts over 1,000 completed or ongoing randomized evaluations worldwide.

In 2019, Banerjee, together with Esther Duflo and Michael Kremer, won the Sveriges Riksbank Prize in Economic Sciences in memory of Alfred Nobel. They were recognized "for their experimental approach to alleviating global poverty". See Olken (2020) for a discussion about the collective contributions of these three scholars.

# 6 The Economics of Networks

Part of the field of information economics, in which Banerjee made his first major contributions, evolved over time into the field of networks. The economics of networks focuses on how the structure of networks influences the way that society and economies function, which has been a question of long-standing interest in many disciplines. In the past twenty years, the proliferation of technologies such as the internet and social media, and societal-level shocks such as the COVID19 pandemic have increased the salience and the importance of networks. Economists, such as Matthew Jackson, have unified the modeling of networks from disciplines such as sociology, economics physics, mathematics an computer science to create the modern economics of networks (Jackson, 2010).

The economics of networks is closely related to the earlier works from the 1990s. Banerjee (1992); Bikhchandani et al. (1998), for example, showed that the coarseness of the information that is transmitted and the geometry of the social network can undermine people's ability of ending up with correct information. The Banerjee (1992) model of herding behavior is in essence a study a highly stylized network. The modern economics literature on networks has much richer and complex networks. But this also opens up many more questions that require empirical validation.

The tight identification and real-world setting of field experiments are attractive for studying these networks because experimenters can systematically manipulate information delivery to pinpoint the many aspects of actual social networks. For example, Banerjee et al. (2019a) examines whether villagers are aware of who is in their network, and in particular of the centrality of the network, by randomly assigning the recipient of information about an immunization campaign. In some villages, the information was given to central individuals who are nominated by their community. In other villages, the information was given to randomly selected individuals from the village. The authors found that average immunization rates were 22% higher for the former villages afterwards. They use these results to theorize about how social networks become salient to the community members.

Banerjee's recent studies on networks is one example of how his earlier work on the theory of information and later work in development economics and randomized experiments have converged. In various settings, Banerjee and co-authors, use experiments and non-experimental methods to systematically piece together how social networks work (Banerjee et al., 2013; Alatas et al., 2016; Banerjee et al., 2024, 2021b).

# 7　Conclusion

Banerjee began his career as an applied theorist studying information diffusion and over time, became one of the scholars who revolutionized empirical development economics. In the profession of economics, such a dramatic transformation and breadth of interest and skill sets are unusual.

His evolution reveals the deep and personal connection between social scientists and the society within which they live. Banerjee grew up in a society where everyday life was determined by economic poverty and inequality. This motivated him to study social justice in his youth. Because of practical constraints, he abandoned it to pursue economics. But when the opportunity presented itself, he returned to his first interests in a slightly varying form and applied the tools of an economist to study poverty.

Banerjee's career also reflects the role of fortune, which favored him. His desire to address the gaps of growth theory coincided with the emergence of modern reduced form empirical economics at MIT. Over the course of his studies and work, he met numerous mentors, colleagues and students, the most important of which is Esther Duflo, who was first his student, then his colleague, and nearly twenty years later, his spouse. His personal fortunes have been mixed. His eldest son, Kabir (Sasha) Banerjee, passed away at only 26 years of age. Banerjee's continued work reflects his commitment to scholarship, the support from Esther, their two children, and the resilience of Sasha's mother, his ex-wife Arundhati Banerjee. Abhijit Banerjee, Esther Duflo and Michael Kremer donated their prize money from the 2019 Nobel Prize, which was matched by Andrew Weiss, to create the Kabir Banerjee Fellowship. The Weiss Fund sponsors Kabir Banerjee Fellows in predoctoral positions at leading institutions to increase representation of researchers from low and lower-middle income countries in development economics.

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