

My Research Summary - Lakshmi K. Raut

A. Current Research

My research interests are in Public Policies, Applied Economic Theory, and Applied Econometrics - focusing on Disability, Early Childhood Investment, and Income Redistribution policies. The basic economic question that shaped my research since childhood and more formal research since my Ph.D. work is, what explain observed high levels of income inequality and low rates of social mobility in many economies. To that end, I focused on the role of individual or parental investment in human development in determining the aggregate outcomes on social mobility, income inequality, and economic growth. Apart from this main interest, I have also worked in Economic Theory, and Mathematical Economics, and in R&D, and Exports behaviors of Indian private firms using firm level data.

Currently at the Social Security Administration (SSA), I am working on three research projects:

- (1) Pathways to disability using the Health and Retirement Survey (HRS) dataset.
- (2) Effects of early interventions on life cycle earnings, health and disability outcomes (jointly with Professor James Heckman).
- (3) Improving prediction of frauds in the Social Security Disability (DI) program using techniques from the Machine Learning Literature.

In the past several years at SSA, I used Administrative data to analyze the patterns of entitlements into and the patterns of exits from the DI program, and the effects of business cycles, DI policy changes and demographic shifts on the observed entitlements and exits patterns. I will continue doing this research at SSA either directly or through a research consortium (e.g., with University of Michigan or NBER) when I take up an outside job.

For the past several years, I have analyzed the NLSY dataset to study the effects of preschool investment on school and labor market outcomes and the effect of providing free preschool to disadvantaged children on income inequality, educational and social mobility. Much of this project is in collaboration with the Nobel Laureate Economist Professor James Heckman. In our joint project we estimated a structural dynamic programming model to examine the long-term intergenerational effects of a subsidized early childhood investments program for the disadvantaged families, see our 2016 *J. Econometrics* paper. I plan to carry out this line of research if my new job accommodates it.

Recently I have completed a research paper, “Education and Economic Growth: A Comparative Study of China and India,” (forthcoming in a conference volume). I plan to extend this work in collaboration with Professor T.N. Srinivasan to compare the roles of globalization and education on economic growth of China and India. With other researchers, I will also examine the effects of various early childhood interventions, especially at the preschool level, on school and labor market outcomes of the poor in India collecting data from a village in Rajasthan, India.

I have been working on a book—An Introduction to Differential Geometry with Applications in Economics and Optimizations— about 40 percent completed. I have in mind to write others in Human Development drawing from Neuroscience, Psychology and Economics literature.

I have also worked in the past with Professor T.N. Srinivasan and Professor Marc Nerlove on population growth and economic development issues, with Professor Kazuo Nishimura on optimal growth issues and with Professor Koichi Hamada on ageing issues. I have also worked with other researchers on various issues (see my resume for details).

I have a solid background in economic theory and econometrics, and in analyzing large datasets using SAS, Cran R, C++, Java and SQL databases. For the past few years, I used C++ and Java to implement two large-scale economic and econometrics models: (1) A computable stochastic overlapping generations model to evaluate social security policies. (2) An econometric structural discrete dynamic programming (DDP) model to study the long-term intergenerational effects of preschool investments using the NLSY dataset.

In the rest of this document, I describe the details of my research.

B. Details of my past research by areas

1. Fertility choices and Economic Development

How do income redistribution policies such as tax-transfers from high income to low income households within a generation, or tax transfers from future to present generation through a pay-as-you-go social security system, and various education policies affect parental investment in children and in turn affect the course of income distribution, social mobility, income and population growth rates over time?

- I used an overlapping generations general equilibrium framework to endogenize savings, fertility, and investment in human capital of children at the household level and then generate observable patterns of income distribution, social mobility, population growth and income growth in many countries. The key issues were to study the determinants of higher fertility levels, lower investment in human capital of children and lower savings rate of low-income families, and the restrictions imposed by these endogenous choices on equilibrium dynamics and long-run behavior of income distribution, social mobility and growth in income. This research program began with an essay of my Ph.D. dissertation (see the Journal of Development Economics, 1990 paper for details).

I have extended it in several directions since then.

- I have extended the basic framework of my JDE 1990 paper to model population density-induced technological change and analyzed the dynamics of the resulting endogenous growth model (see the 1994 Economic Theory joint paper with T.N. Srinivasan). In this research, I assumed a life-cycle utility function and modeled the motive for saving, having children, and investing in children's human capital as old-age pension, assuming transfers from adult children to old parents are determined exogenously by social norms.
- In the paper "Learning to Perfect Manipulation...", I endogenized intergenerational transfers by incorporating two-sided altruistic utility functions in the above overlapping generations framework. I have shown that two-sided altruism brings about strategic behavior, and I have argued that the notion of subgame perfection is the appropriate equilibrium concept that captures this strategic behavior. In this paper, I also introduce the concept of local learning equilibrium, which can be computed and is shown to converge to a subgame perfect equilibrium. This approach allows one to study the properties of subgame perfect equilibrium, and provides an alternative explanation for the existence of social security programs.

- To test models of intergenerational transfers, I have used the Indonesian Family Life Survey Data set (see, "Parental Human Capital Investment and Old-age Transfers from Children: Loan contract or Reciprocity ?," (with Lien Tran) 2000 conference volume, and "Parental Human Capital Investment and Old-age transfers from Children: Is it a loan contract or reciprocity for Indonesian Families?," (jointly with Lien H. Tran) 2005 Journal of Development Economics).

2. Ageing, Disability and Health

- The Social Security Disability (SSDI) program pools disability health risks of the US workers. I used a computable stochastic overlapping generations model to examine the value of the SSDI program to the US workers, and the effect of the program on reducing poverty and improving living standards of the disabled population.
- When a household member loses job due to onset of disability, what is the cost to the household? In a joint paper with Manoranjan Pal and Premananda Bharati, we measure the cost in terms of loss in the 'conversion handicap' adjusted per capita household consumption and using the Indian National Sample Survey (NSS) data, we estimate the cost for Indian households.
- Infectious diseases are main obstacles to development of many poor countries. Three important such diseases are AIDS, malaria and tuberculosis. Important determinants of the spread of an infectious disease are individual behaviors regarding relevant preventive care, curative care, and the degree of awareness about the consequences of these diseases and the available prevention methods. Such knowledge about a disease and the prevalence rate of the disease determine the demand for preventive care and curative care. Both in turn determine the timing of drug-resistance, and composition of the productive healthy people in the labor force, and hence the growth rate of income. I studied these issues as part of a World Bank project. (For details, please refer to my paper, Economic Epidemiology of Malaria).
- Recent aging problems in OECD countries are the result of their high life expectancy and low fertility. The developing countries, on the other hand, have low life expectancy and high fertility rates. Given this demographic mismatch, OECD countries and developing countries can all benefit from the foreign capital flows from OECD countries to developing countries and from the immigration of labor from developing countries to OECD countries. Could this help to overcome the aging crisis in OECD countries and the speed of development in developing countries? I investigated this as part of a project with Economic and Social Research Institute, Cabinet Office, Government of Japan. Part of this research is in collaboration with Professor Koichi Hamada at Yale University. (See "Immigration or Foreign Investment to Cope with Aging Crises of an Aging Open Economy", and (2) "Aging and Care in an open economy", (jointly with Koichi Hamada).
- In the absence of publicly provided social security system, parents depend on children for old-age support. Using an overlapping generations framework with two-sided altruism, I address the following issues:
 - How does the absence of publicly provided social security program affect fertility rate, the level of investment in children's education and the amount of old-age resource transfers from children to parents? (For details, see "Learned Convention and Subgame Perfect Equilibrium in an Overlapping Generations Model with Two-Sided Altruism").

- Does absence of publicly provided social security program affect the investment in human capital of children and the level of old-age support that the parent can obtain? Could the investment in human capital of children and old-age care be left to the privatized family decisions or do we need social programs? The answer depends on the mechanism of intergenerational transfers. I examine these issues empirically using the Indonesian Family Life Survey data, jointly with Lien Tran. (See, “Parental Human Capital Investment and Old-age transfers from Children: Is it a loan contract or reciprocity for Indonesian Families?” (jointly with Lien H. Tran) Journal of Development Economics, August 2005).

3. Education

- How do various education policies and labor market practices affect individual choices and the course of income distribution, social mobility and income growth over time? I use an overlapping generations general equilibrium model featuring education signaling, job-matching and pre-school investment to study these issues. (For details, see Signaling Equilibrium, Intergenerational Social Mobility and Long-Run Growth, 2005, Work in Progress).
- Which of the skills that are acquired from investment in preschool and family background are important for success in school and labor market? To attain higher social mobility and growth, should a nation invest more on preschool early childhood development programs or subsidize education of disadvantaged children? These questions are relevant for both developing and developed countries. We use NLSY to address these issues. (See my 2016 Journal of Econometrics paper in collaboration with Professor James Heckman, and my own 2003 unpublished paper, “*Long Term Effects of Preschool: Evidence from NLSY*”).
- It has been generally found that children of homeowners perform better in school outcomes. It could be because homeownership is a proxy for neighborhood, school quality, or that homeownership have direct effects on child development. Using PSID child supplement dataset in collaboration with Lisa Mohanty I explore these issues. See
- When there are choices of many school qualities and parents are liquidity constrained in their choices of the quality of school for their children, it can generate non-convexity leading to intergenerational poverty trap in equilibrium models. Jointly with Professor Kazuo Nishimura, we study this issue theoretically in a growth model (see our 2006 Review of Development Economics paper).

4. R&D, Exports of Indian Firms and other research on Development

- I have also conducted other empirical research to find evidence for the R&D spillover hypothesis in the endogenous growth literature. More specifically, for private firms in India, I estimated the effects of the firms’ own private R&D investment on their productivity directly as a result of increase in own firm-specific knowledge capital, and indirectly as a result of increase in the industry level general knowledge capital. (See the paper in J. Development Economics, 1995). I also estimated how market structure and firm size influence R&D investment decisions and export performance (see, Indian Economic Review, 1988, and the working paper “Exports, Technology Import, R&D and Productivity Growth of Indian Private

Firms" 1993 for details). Furthermore, using cross-country panel data, I have examined the relative role of human capital and of international trade in cross-country growth experiences (with Andrew Levin, Economic Development and Cultural Change, 1997). Similarly, using cross-country data, I analyzed the determinants of savings behavior in less developed countries (with Arvind Virmani, The World Bank Economic Review, 1989).

- I have collected firm level data on Indian private firms. Using this data set, I analyzed the determinants of exports and R&D behaviors of these firms and how various liberalization policies influenced these behaviors. For details, please see the papers in my resume.

5. Economic Theory

A part of my research has been in economic theory. I extended the notion of impatience/myopia for preference ordering from discrete commodity space (ℓ_∞) to more general space (L_∞) admitting continuous time and uncountable number of states of nature and proved the necessity of such impatience for the existence of competitive equilibrium and optimal growth (see the article in Journal of Economic Theory, 1986). In the article in Economic Theory 2004, I extend the Samuelsonian overlapping generations general equilibrium framework to encompass a variety of altruistic preferences by recasting it into a Lindahl equilibrium framework. I show that the First and the Second Welfare theorems hold for Lindahl equilibrium with respect to the Malinvaud optimality criterion but not with respect to the Pareto optimality criterion. I then provide a complete characterization of Pareto optimal allocations is provided using the Lindahl equilibrium prices. See my article Economic Theory, April 2006.

Random order approach to Shapley value of games in coalition forms provides an important fairness principle in Social Choice Theory, and the Shapley value of games with non-atomic set of players has played an important role in characterizing fair cost allocations in Airlines and Telecommunications industries. Aumann and Shapley proved an Impossibility Theorem stating that the Random Order Approach cannot be extended to non-atomic games. I argued that this impossibility is due to their focus on larger space of games and larger set of orders. By restricting the set of orders and the space of games that includes the economically important ones, I proved a possibility theorem. (See my J. of Mathematical Economics, 1997 Fields Institute Communications, American Mathematical Society, 1999 for details).