

A Powerful, but Limited, Theory of Development

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I

Thisⁱ is a collection of essays by one of the finest theorists in economics, applying his mind to the historical sweep of the process of economic growth over the last two centuries. This process has led to unprecedented growth and prosperity in a set of countries, increasing divergence in their performance from a large set of other countries, and yet an amazing catch-up process in a small third set of countries. Robert Lucas wants to understand the 'mechanics' of these processes, set up abstract and sophisticated models of endogenous growth to capture them and throw light on the broad contours of the stylized facts that are now available to us. This is a meticulous and at the same time sweeping analysis, ambitious and yet full of scholarly modesty and an infectious sense of wonder at the large forces of economic history that affect the lives of vast masses of humanity.

Lucas starts the volume with his widely cited paper, "On the Mechanics of Economic Development", which puts endogenous human capital accumulation at the center stage of sustained growth in the currently advanced economiesⁱⁱ. The inexorable forces of diminishing returns that afflict physical capital accumulation in standard neo-classical growth theory are overcome by the social increasing returns brought about by human capital externalities, which lead to disproportionate advances for the economy as a whole from individual acts of private human capital investments. The advantages of agglomeration of human and physical capital, apart from inducing flows of such capital from poor to rich countries (that would be regarded as 'perverse' from the diminishing-returns-to-capital point of view), lead to the unequalizing spirals in inter-country economic performance.

Increasing returns are key to understanding the endogenous growth models of both Paul Romerⁱⁱⁱ and Lucas, but while Romer focuses on positive knowledge spillovers from one firm to another so that aggregate production has increasing returns in the stock of knowledge capital, Lucas emphasizes the spillovers from investment of a worker's time in learning, which improves the average skill level of the whole labor force. Learning models, of course, have a long tradition in economics. In Arrow's celebrated model^{iv} learning was a function of cumulated gross investment in physical capital. This was extended by Bardhan^v to the case where learning arising from cumulated experience in the process of producing a

good spilled over to the whole industry, and different industries with different learning possibilities gave rise to the case for infant-industry protection (either to an import-substitute or export industry). Krugman^{vi} took over from there and emphasized the self-reinforcing nature of initial specialization which results from the learning process, as an economy becomes better at producing the same thing; he also stressed how a deliberate policy intervention may be needed to pry the economy loose from an historical 'lock-in' with respect to specialization in a slower-growing sector. Such policy intervention is, of course, fraught with practical problems. As Lucas comments on his own model: "In the model 'picking winners' is easy. If only it were so in reality!" (p.51). Even if we knew the winner, trade economists point out that there are better ways of helping it than trade policy. Nevertheless, many development economists believe that the early stages of industrial transformation in East Asia were marked by some cases of successful infant-industry protection, just as there were many cases of failures of such policy all over the world (including in some sectors in East Asia).

In the chapter on "Making a Miracle" Lucas points our attention to an aspect of the learning process which had been ignored in the earlier literature. For learning, particularly in the sense of Lucas, i.e. on-the-job skill formation, to occur in an economy on a sustained basis, it is necessary that workers and managers continue to take on tasks that are new to them, so as to continue to move up the quality ladder in goods. As Lucas comments (p. 86), "a growth miracle sustained for a period of decades thus must involve the continual introduction of new goods, not merely continued learning on a fixed set of goods". Lucas here draws upon the open-economy models of Young^{vii} and Stokey^{viii}. Young's model, for example, endogenizes the movement of goods out of the learning sector into a mature sector where learning no longer occurs, and thus gives a plausible account of an evolving trade structure. In Stokey's model there is North-South trade based on vertical product differentiation and international differences in labor quality; learning is stimulated by the production of high-quality goods.

Lucas links learning-based growth with trade openness. Let us quote (p.94):

" Consider two small economies facing the same world prices and similarly endowed, like Korea and the Philippines in 1960. Suppose that Korea somehow shifts its workforce onto the production of goods not formerly produced there, and continues to do so, while the Philippines continues to produce its traditional goods. Then according to the learning spillover theory, Korean production will grow more rapidly. But in 1960, Korean and Philippine incomes were about the same, so the mix of goods their consumers demanded was about the same. For this scenario to be possible, Korea needed to open up a large difference between the mix of goods produced and the mix consumed, a difference that could widen over time. Thus a large volume of trade is essential to a learning-based growth episode".

While this suggests why autarchic policies that derive their rationale from learning by doing may be limited by the (usually small) size of the domestic market, which allows only bounded

learning possibilities, this can also be construed as an argument for mercantilist policies of export subsidies in favor of goods with larger learning potential. More importantly, Lucas here does not draw our attention to the fact (briefly noted by him a few pages back) that in the North-South trade models of Stokey and Young, where in the quality spectrum of goods North is at the high end and South is at the low end, free trade speeds up human capital accumulation, and thus growth, in the North (as it reallocates resources to more high-learning, high-quality goods) but slows it down in the South (which is driven by trade to reallocate resources to low-learning, low-quality goods). Of course, southern consumers may still benefit from free trade, depending on the trade-off between static gains from trade and dynamic losses.

One limitation of the Stokey-Young story is the presumption that all imports substitute for domestic production. But, as Henry Wan has pointed out to me, when imported inputs are complementary with domestic production, there may be a lot of scope for learning in the assembly and processing of new imported industrial inputs, and this may give the opportunity to continuously upgrade domestic skills, as may have happened in East Asian industrialization. This possibility can be accounted for in Romer-type models of expansion in the range of specialized inputs.

II

While both the 'Mechanics' and the 'Miracle' papers by Lucas are widely known and cited, nearly half of this book is taken up by a long chapter on the Industrial Revolution, which formed the text of his hitherto unpublished Kuznets Lecture, and may be less widely known. Here Lucas is grafting a model of demographic transition on the lines of Becker, Murphy and Tamura (BMT)^{ix} into his endogenous growth model. Until recently much of endogenous growth theory ignored endogenous population growth. Lucas poses the problem in starkly simple terms. Upto about 1800 human history has seen many spurts of significant technological changes, but by and large as population growth responded positively to the resultant increase in per capita income, the Malthusian model could explain the reversion to the relatively stagnant equilibrium with low growth rates and low dispersion in inter-country per capita income.^x To Malthus writing at the end of the 18th century and looking back, what the classical economists called the 'iron law of wages' (in this respect all the classical economists were Malthusians, as Lucas suggests) broadly fitted the long-term pattern of growth.^{xi} Then over the last two centuries came the unprecedented boost in per capita income growth in today's industrially advanced countries (Lucas defines this boost, when sustained, as the Industrial Revolution), which was not offset by any commensurate population growth, and in fact over the two centuries population growth rates in these countries have declined. Lucas uses a link between the increase in rate of return to human capital accumulation (largely due to technological

changes) and the demographic transition to model and explain this turn-around and its persistence. This in turn led to a large divergence in the per capita incomes of these countries and those in the laggard countries.

The BMT model showed how a small displacement from an initial position of income stagnation can induce an economy to shift from 'quantity' of children to 'quality' (drawing upon the old Beckerian idea of quantity-quality trade-off in demography), to shift onto an equilibrium path with reduced fertility and sustained income growth. Lucas recasts Malthusian fertility theory 'as a matter of conscious choice, not biology', and formulates the quantity-quality trade-off in terms of dynastic preferences of a household (i.e. in terms of its own consumption, the number of children it has, and the lifetime utility that each child will enjoy). His use of these dynastic preferences set in a variety of different social arrangements (for example, a hunter-gatherer society, an economy of small farmers, a two-class economy), and application of equilibrium reasoning to show how the interaction of individual and social forces determines fertility, production, and population display some of the most elegant theoretical exercises available in the literature on demography and growth. His models also clearly show the mutation of the theory from its classical origins, as in the last model of the book where he has both land per capita (which is missing in the model of BMT) and the level of human capital as state variables, and traces the dynamic path of demographic and industrial transition away from the classical equilibrium.

Lucas contrasts theories of exogenous technological change which imply that higher growth should be associated with higher fertility ('people prefer to bring more children, not fewer, into a world that offers them a more prosperous life') with theories of endogenous growth where higher growth in response to an increase in return to human investment can imply that higher growth is associated with lower fertility ('a family that wants to take advantage of an increase in the return to investment in knowledge does so, in part, by reducing the number of children so as to devote more time and resources to each child'). So the latter type of growth is consistent with demographic transition. Lucas hastens to add that the demographic transition does not follow from human capital accumulation by a privileged class or subset of people. Let us quote (p.160):

"Such accumulation has taken place for centuries, inducing technical change, improved living standards, and increase in population, but ultimately leading to a return to the living standards of earlier ages. The new element that must have been involved in the demographic transition was an increase in the return to human capital accumulation that affected everyone, and hence every family's fertility choices. The industrial revolution required a change in the way people viewed the possibilities for the lives of their children that was widespread enough to reduce fertility across economic classes, affecting propertied and propertyless people alike".

This, of course, underlines the importance of public policies for expanding access to educational and vocational training opportunities for the masses, when credit market imperfections and

other constraints limit the horizons for the propertyless, an issue which Lucas does not pursue. Wealth constraints may not merely limit utilization of educational opportunities (since future labor earnings cannot be used as collaterals for education loans), but may also make it difficult to translate the same educational achievements into occupational outcomes. For models of low occupational mobility traps, see Banerjee and Newman^{xii} and for the changing impact of wealth distribution on social mobility over different stages of development, see Aghion and Bolton^{xiii}. There are also some theoretical models^{xiv} in the literature exploring the income or wealth distribution dynamics with endogenous fertility.

In the literature there have been attempts to integrate fertility transition and growth theory, alternative to the quantity-quality trade-off mechanism used by Lucas. For example, the relation between development and higher wages of women, raising the opportunity cost of child-rearing has been used by Galor and Weil^{xv}; the changing value of children as parental investment has been used by Ehrlich and Lui^{xvi} and Raut and Srinivasan^{xvii}. A variant of the quantity-quality trade-off has been used in a model of demographic evolution by Galor and Weil^{xviii}, where a 'disequilibrium' brought about by technological change raises the rate of return to human capital and thus induces the substitution of quality for quantity.

Lucas concentrates on the fertility transition and does not consider the equally important forces driven by mortality declines in the last two hundred years. These declines were caused both directly by higher incomes (and better nutrition) and large strides in medical technology and public health. In the last century these strides meant that mortality started declining in less developed countries at much lower levels of per capita income than was the case historically in Europe. In most countries (with the notable exceptions of US and France) mortality decline has preceded that in fertility. These and other factors have resulted in a relatively rapid demographic transition (by historical standards) in many less developed countries. As Lee^{xix} notes, there has been a rapid global convergence in fertility and mortality among countries in the last 50 years, although important differences remain; this demographic convergence is in marked contrast to the divergence in per capita income between less and more developed countries in the same period.

The mechanism of mortality decline may be complementary to the links between human capital accumulation and fertility transition that Lucas focuses on. A larger expected life span directly affects the rate of return to human investment by increasing the horizon over which such investment pays off. For a model on this line see Kalemli-Ozcan, Ryder and Weil^{xx}. Meltzer^{xxi} has shown that mortality decline in Mexico from 1920 to 1965 has resulted in a 9.2 per cent increase in the rate of return, which in turn implied a 20 per cent increase in the enrollment rates. Also the usual fertility choice models, as in Lucas, do not have uncertainty with respect to life chance. If there is uncertainty about the number of surviving children, there may be a precautionary demand for children, and with a general improvement in medical technology this

may induce parents to move along the quantity-quality frontier.
See Kalemli-Ozcan^{xxii}.

III

Lucas ends the book with a remarkable statement (pp 174-75):

"The legacy of economic growth that we have inherited from the industrial revolution is an irreversible gain to humanity, of a magnitude that is still unknown. It is becoming increasingly clear, I think, that the legacy of inequality, the concomitant of this gain, is a historical transient"

(By inequality he means inter-country inequality). In an earlier chapter, on the basis of a numerical simulation of a technology diffusion model, he carries out some broad quantitative exercises in prediction which back that statement. He predicts (p.106) "that sooner or later everyone will join the industrial revolution, that economies will grow at the rate common to the wealthiest economies, and that percentage differences in income levels will disappear (which is to say, return to their pre-industrial levels)", i.e. to a difference of more like a factor of two or so (compared to a factor of 20 or more now, as it is between rich and very poor countries even in purchasing power parity terms). He then adds (with a bit of relish, and probably a wink):

"If you are reading this in the year 2100, I ask you: Who else told you what the macroeconomics of your century would look like, in advance, with such accuracy and economy?"

This is quite a challenge to development economists, particularly those with a pessimist bent, who are preoccupied with the enormity of the barriers to development facing many poor countries today.

Lucas relies on mechanisms of international diffusion of human capital not fully specified in his main theoretical models; the presumption is that innovations (in ideas, institutions, and policies) spill over across countries ("like acid rain or volcanic ash"). As Grossman and Helpman^{xxiii} emphasize, the literature on endogenous growth and trade is fundamentally divided by the alternative presumptions about the scope of knowledge spillovers: "the traditional forces of comparative advantage dominate long-run outcomes whenever knowledge spillovers are global in scope. In contrast, when knowledge spillovers are confined to a single country or region, the vagaries of history can influence the trade patterns even in the long run." The reality, of course, lies somewhere in between. Those who emphasize limited international diffusion are pointing to many hard problems and constraints on receiving and adapting international blueprints that poor countries face and will face for a considerable length of time

(even ignoring the tight control of the international conglomerates on the ability of others to do adaptive research, and monopoly licensing fees and other imperfections in technology markets that limit the diffusion of proprietary knowledge and hinder a move toward international best practice).

Lucas very briefly refers to the 'barriers to growth' pointed out by Parente and Prescott^{xxiv}. The latter have identified the main reason for low total factor productivity in less developed countries as the regulatory barriers imposed by their governments to adopting internationally available technology and the opposition from influential special-interest groups like labor unions. These are, of course, important obstacles. But as Pack^{xxv} points out, much of the effective use of technology is not codified, but implicit or tacit, and cannot be purchased or transplanted from abroad. Domestic efforts to adapt and assimilate are critical and costly, and in this government investment in market-supporting infrastructure and in research and training and extension are quite important. Much therefore depends on the nature of the state and other institutions. Not to speak of the numerous cases of non-performing or failed states, even take one of the widely acclaimed cases of Chile, where the program of economic liberalization was much more thorough than in South Korea and Taiwan (the latter in the initial decades of industrial growth had a much more protective regime and gave more monopoly rights to domestic firms), and yet, as Pack points out, the productivity performance in the latter was better than in Chile. There is now a fairly large literature^{xxvi}, using firm-level panel data on productivity and entry and exit of firms, which shows that some countries have liberalized both their international trade regime and domestic regulations, but have not realized high TFP growth rates or levels, in the absence of a set of institutions constituting a national innovation system that facilitates appropriate training and technology absorption. As for unions, in recent history there has not been a high degree of protection of union rights in Chile or the Philippines, and yet TFP levels are not particularly high.

Lucas notes in passing (p.173):

"One non-European nation after another has followed Japan into rapid income growth, and no one can see anything but unstable domestic politics and mercantilist trade policies that keep the rest from doing so".

Even ignoring the fact that some economists have actually described the trade policies of the 'miracle' economies of South Korea and Taiwan in the initial two decades of industrial transformation as semi-mercantilist (after all, mercantilists of history used to encourage exports to maximize the country's acquisition of gold), referring to 'unstable' domestic politics is too easy, and ultimately dismissive, a way of putting a whole range of formidable political-economy constraints on development under the carpet. In most poor countries there are massive costs of collective action in building new economic institutions and political coalitions, and in breaking the deadlock of incumbent interests threatened by new technologies.^{xxvii} As Acemoglu^{xxviii} puts it, there may not be any political Coase Theorem here, whereby politicians and powerful social groups could make a deal with the rest of society to give up some of their control on existing

institutions that are inefficient, and allow others to choose policies and institutions which bring about improvements in productivity, and then redistribute part of the gains to the former. Such deals have severe commitment problems; those in power cannot credibly commit to not using this power in the process, and others cannot credibly commit to redistribute once the formerly powerful really give up their power for the sake of bringing about the new institutions.

A central issue of development economics is the persistence of dysfunctional institutions over long periods of time^{xxxix}. In particular the history of underdevelopment is littered with cases of formidable institutional impediments appearing as strategic outcomes of distributive conflicts. Acemoglu and Robinson^{xxx} develop a theory where incumbent elites may want to block the introduction of new and efficient technologies because this will reduce their future political power; they give the example from 19th-century history when in Russia and Austria-Hungary the monarchy and aristocracy controlled the political system but feared replacement, and so they blocked the establishment of institutions that would have facilitated industrialization. These replacement threats are, of course, often driven by extreme inequality in society. In explaining the divergent development paths in North and South America since the early colonial times, Engerman and Sokoloff^{xxxi} have provided a great deal of evidence of how in societies with high inequality at the outset of colonization institutions evolved in ways that restricted to a narrow elite access to political power and opportunities for economic advancement. Initial unequal conditions had long lingering effects, and through their influence on public policies (in distribution of public land and other natural resources, the right to secret ballot, primary education, etc.) tended to perpetuate those institutions and policies that atrophied development. In the context of endogenous growth theory attempts have been made to introduce the idea of vested interests of incumbents (opposed to those of innovators), showing why some societies adopt new technologies more rapidly than others; see Krusell and Ríos-Rull^{xxxii} and Aghion and Howitt^{xxxiii}.

Lucas suggests (p.96): "If we know what an economic miracle is, we ought to be able to *make* one". Earlier in the same chapter (p.72) he says:

"But simply advising a society to 'follow the Korean model' is a little like advising an aspiring basketball player to 'follow the Michael Jordan model'. To make use of someone else's successful performance at any task, one needs to be able to break this performance down into its component parts so that one can see what each part contributes to the whole, which aspects of this performance are imitable and, of these, which are worth imitating. One needs, in short, a theory."

Lucas, however, deliberately limits himself to a rather narrow technocratic explanation of growth or lack of it. In the Korea-Philippines comparison of the 'Miracle' paper, he concentrates on a theory of how Korea in its learning process could reallocate its workforce to increasingly sophisticated goods, helped by its export-oriented policies, but ignores less easily quantifiable aspects of the nature of political coalitions in Korea compared to the Philippines, land reform in Korea and the overhang of prior

oligarchic land institutions in the Philippines, a relatively more equal wealth distribution in Korea, etc. It is also interesting to study how in the more recent East Asian miracle of China a prior egalitarian wealth distribution may have helped the economy to withstand some of the stresses and strains of the massive dislocations of fast economic growth somewhat better than, say, the more unequal economies of Latin America.

For the sake of parsimony and abstraction Lucas defines growth only in terms of per capita income. Of course, in the integration of growth and demographic transition one needs to consider a whole vector of variables not all closely correlated with per capita income. Just as the diffusion of the industrial revolution is sometimes blocked by a whole array of political and institutional impediments, the historical relationship between population and technology is quite complex, depending on particular kinds of social interaction and coordination networks in different societies, the state of public health facilities and environmental resources, different types of feedback loops in the economy and society, and cultural norms (just to give one example, his model of dynastic preference assumes that parents provide the same level of lifetime utility for all children, which may or may not be valid depending on culture-specific norms about inheritance, gender relations, and family hierarchy).

It is also arguable that the big historical divergence in the pattern of inter-country performance since 1800 that Lucas tries to explain through the interaction of human capital accumulation and fertility transition may have had other important historical and geographical factors working on it. For example, Pomeranz^{xxxiv} claims that part of the story of divergence between Europe and China (comparing particularly the two most advanced regions in both, England and Yangzi delta) could be that after reaching comparable levels of development around the 18th century, Europe could expand its land frontier to the areas of new settlement and get raw materials and new technology from these areas and colonies, whereas China got 'involuted' by its land constraint, and this happened long before the demographic transition in much of Europe got started. Other historians have challenged the Pomeranz hypothesis. Brenner and Isett^{xxxv} point out, quite convincingly, that already in the early modern period (1500 to 1750) there were divergences between the two areas in agrarian property systems and institutions, and therefore in constraints and opportunities, and thus they were already on different trajectories by 1800. The English agrarian economy, for example, had already ceased to be dominated by peasants and lords, and had come to be operated by direct producers, in contrast to the Chinese economy. But again this is an institutional story of historical divergence, which is different from the story of fertility transition away from the Malthusian equilibrium.

Lucas refers to the story of intergenerational mobility in V.S. Naipaul's marvelous novel, *A House for Mr. Biswas*, and concludes (p.18):

"In a successfully developing society, new options continually present themselves and everyone sees examples of people who have responded creatively to them...The people who respond to the new

possibilities that development creates are also the ones who make sustained development possible. Their decisions to take risks and obtain new skills make new possibilities available for those around them. Their decisions to have fewer children and to try to prepare those children to exploit the opportunities of the modern world increase the fraction of people in the next generation who can contribute to the invention of new ways of doing things."

This is indeed the heart-warming growth process of a 'successfully developing society' which Lucas builds an aggregative model of. But for many poor countries this does not give enough clue about how to reach there, how to overcome the various political and institutional constraints on the way-- the latter has become the preoccupation of a whole army of development economists, me included. At one point (p.31) Lucas talks about 'growth' and 'development' as distinct fields, "with growth theory defined as those aspects of economic growth we have some understanding of, and development defined as those we don't".

It is our good fortune that a towering figure in our profession like Robert Lucas has taken time off his fundamental contributions to rational expectations and macroeconomic theory and decided to work in the last two decades to refurbish growth theory so elegantly ("I did not look forward to the prospect of spending the latter half of my career trying to hang on to what I had done in the first half", he says modestly). But for those of us who work in the murkier waters, trying to probe the institutional atrophy that is called underdevelopment, we need more light to illuminate our way.

ⁱ Robert E. Lucas, Jr., *Lectures on Economic Growth* (Cambridge: Harvard University Press, 2002).

ⁱⁱ Aghion and Howitt distinguish between what they call the Lucas approach where growth is primarily driven by the accumulation of human capital and what they call the Nelson-Phelps approach where growth

is driven by the stock of human capital; see P. Aghion and P. Howitt, *Endogenous Growth Theory* (Cambridge:MIT Press, 1998).

ⁱⁱⁱ P. Romer, "Increasing Returns and Long-Run Growth", *Journal of Political Economy*, 94(1986): 1002-37; P. Romer, "Endogenous Technological Change", *Journal of Political Economy*, 98(1990): S71-S102.

^{iv} K.J. Arrow, "The Economic Implications of Learning by Doing", *Review of Economic Studies*, 29(1962): 155-73.

^v P. Bardhan, *Economic Growth, Development, and Foreign Trade: A Study in Pure Theory* (New York: Wiley-Interscience, 1970); P. Bardhan, "On Optimum Subsidy to A Learning Industry: An Aspect of the Theory of Infant Industry Protection", *International Economic Review*, 12 (1971): 54-70.

^{vi} P. Krugman, "The Narrow Moving Band, the Dutch Disease, and the Competitive Consequences of Mrs. Thatcher: Notes on Trade in the Presence of Dynamic Scale Economies", 27(1987):41-55.

^{vii} A. Young, "Learning by Doing and the Effects of International Trade", *Quarterly Journal of Economics*, 106(1991):369-406.

^{viii} N. L. Stokey, "The Volume and Composition of Trade between Rich and Poor Countries", *Review of Economic Studies*, 58(1991):63-80.

^{ix} G. S. Becker, K. M. Murphy, and R. Tamura, "Human Capital, Fertility, and Economic Growth," *Journal of Political Economy*, 98(1990): S12-S37.

^x In Europe, Maddison estimates that GDP per capita hardly grew between 500 and 1500; see A. Maddison, *Phases of Capitalist Development* (New York: Oxford University Press, 1982). In England, Lee estimates that the real wage was roughly the same in 1800 as it was in 1300; see R. D. Lee, "A Historical Perspective on Economic Aspects of the Population Explosion: The Case of Preindustrial England", in R. A. Easterlin (ed.), *Population and Economic Change in Developing Countries* (Chicago: University of Chicago Press, 1980): 517-66. In China, Chao suggests that the real wage at the end of the 18th century may even have been lower than that at the beginning of the first century; see K. Chao, *Man and Land in Chinese History: An Economic Analysis* (Stanford: Stanford University Press, 1986). In China for many centuries the per acre agriculture yields were higher than in most parts of the world, but mainly population adjusted and there was what China scholars call 'involutionary growth', without much difference in standards of living in China compared to other countries.

^{xi} The only country which seems to have come out of the Malthusian equilibrium long before 1800 is the Netherlands in the 17th century.

^{xii} A. V. Banerjee and A. Newman "Occupational Choice and the Process of Development", *Journal of Political Economy*, 101(1993):274-98.

^{xiii} P. Aghion and P. Bolton, "A Trickle-Down Theory of Growth and Development with Debt Overhang", *Review of Economic Studies*, 64(1997): 151-72.

^{xiv} For example, Kremer and Chen have a model where combining three assumptions, (a) higher wages reduce fertility, (b) children of the unskilled are more likely to be unskilled, and (c) skilled and unskilled workers are complements in production, they show that there are multiplier effects of improving educational opportunities for even small numbers of children of unskilled workers that could lead to large changes in the skill distribution in subsequent generations; see M. Kremer and D. Chen, "Income-Distribution Dynamics with Endogenous Fertility", *American Economic Review*, 89(1999):155-60.

^{xv} O. Galor and D. N. Weil, "The Gender Gap, Fertility, and Growth", *American Economic Review*, 86(1996):374-87.

^{xvi} I. Ehrlich and F. T. Lui, "Intergenerational Trade, Longevity, and Economic Growth", *Journal of Political Economy*, 99(1991):1029-59.

^{xvii} L. K. Raut and T. N. Srinivasan, "Dynamics of Endogenous Growth", *Economic Theory*, 4(1994):777-90.

^{xviii} O. Galor and D. N. Weil, "Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond", *American Economic Review*, 90(2000): 806-28.

^{xix} R. D. Lee, "The Demographic Transition: Three Centuries of Fundamental Change", *Journal of Economic Perspectives*, 17(2003), forthcoming.

^{xx} S. Kalemli-Ozcan, H. E. Ryder, and D. N. Weil, "Mortality Decline, Human Capital Investment, and Economic Growth", *Journal of Development Economics*, 62(2000): 1-24.

^{xxi} D. Meltzer, *Mortality Decline, the Demographic Transition and Economic Growth*, Ph. D. Dissertation, University of Chicago, 1992.

^{xxii} S. Kalemli-Ozcan, "A Stochastic Model of Mortality, Fertility, and Human Capital Investment", *Journal of Development Economics*, 70(2003):103-18.

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- ^{xxiii} G. Grossman and E. Helpman, "Technology and Trade", in G. Grossman and K. Rogoff (eds.), *Handbook of International Economics*, vol. 3 (Amsterdam: Elsevier, 1995): 1307.
- ^{xxiv} S. L. Parente and E. C. Prescott, *Barriers to Riches* (Cambridge: MIT Press, 2000).
- ^{xxv} H. Pack, review of S. L. Parente and E. C. Prescott, op. cit., in *Journal of Development Economics*, 70(2003): 243-47.
- ^{xxvi} See, for example, M. J. Roberts and J. R. Tybout, *Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity, and Market Structure*, (New York: Oxford University Press, 1996).
- ^{xxvii} In a forthcoming book, *Scarcity, Conflicts and Cooperation: Essays in Institutional and Political Economy of Development*, I have analyzed some of these issues.
- ^{xxviii} D. Acemoglu, "Why Not A Political Coase Theorem? Social Conflict, Commitment and Politics", Unpublished, Cambridge, Mass., 2002.
- ^{xxix} See P. Bardhan, "Distributive Conflicts, Collective Action, and Institutional Economics", in G.M. Meier and J. E. Stiglitz (eds.), *Frontiers of Development Economics: The Future in Perspective* (New York: Oxford University Press, 2001).
- ^{xxx} D. Acemoglu and J. A. Robinson, "Economic Backwardness in Political Perspective", NBER Working Paper no.8831, 2002.
- ^{xxxi} S. L. Engerman and K. L. Sokoloff, "Factor Endowments, Inequality, and Paths of Development among New World Economies", NBER Working Paper no.9259, 2002
- ^{xxxii} P. Krusell and J.-V. Ríos-Rull, "Vested Interests in a Positive Theory of Stagnation and Growth", *Review of Economic Studies*, 63(1996):301-29.
- ^{xxxiii} Aghion and Howitt, *op.cit.*, Chapter 9, section 3.
- ^{xxxiv} K. Pomeranz, *The Great Divergence: China, Europe, and the Making of the Modern World Economy* (Princeton: Princeton University Press, 2000).
- ^{xxxv} R. Brenner and C. Isett, "England's Divergence from China's Yangzi Delta: Property Relations, Microeconomics, and Pattern of Development", *Journal of Asian Studies* 61(2002):609-62