

Asian Growth and African Development

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Since World War II, integration with the world economy has arguably been the chief route from poverty to wealth. Japan initially exported cheap goods and later moved on to more technologically sophisticated products. When Japan became rich, Korea, Taiwan Province of China, Hong Kong SAR, and Singapore replaced Japan as low wage exporters, and when these countries moved on to more sophisticated products, Thailand and Malaysia filled their niche. More recently, China has become an important exporter of manufactured goods and India is increasingly moving into services exports.

No mainland sub-Saharan African country has experienced this type of transformation. Even countries that have undergone major economic reforms seem far from takeoff. Forecasts for Africa based on extrapolation of its historical experience tend to be bleak. We consider whether it is possible to construct a model, consistent with the data, which supports a more optimistic view.

Motivated by the Asian experience, the model assumes countries can potentially undergo rapid economic transformation only if they integrate into the world economy by producing non-traditional exports. For the purposes of constructing a long-run model of the world economy, we are agnostic on whether exports matter due to technological learning by doing spillovers, political economy considerations, or other factors. As each developing country transforms and becomes advanced, it further improves trade opportunities for the remaining developing countries. For example, if China becomes rich, a billion more people will live in countries that import toys and a billion fewer will live in countries that export them.

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Our approach is similar to that of Robert E. Lucas (2000) in that we assume that growth prospects improve with the state of the world economy, potentially generating accelerating world growth. However, unlike Lucas (2000), we allow for differential population growth between rich and poor countries. The steady-state proportion of the world population living in advanced countries depends on the rate at which developing countries transform into advanced ones and on the magnitude of population growth differentials between these two groups of countries. The economic transformation process will overcome the demographic trend, leading to a prosperous steady state, only if the initial share of world population is above a threshold. A simple calibration using historical data suggests that the long-run prospects for lagging developing regions may hinge on a race between economic growth in China and India and population growth in the lagging regions, particularly Africa. If the former “wins,” we may eventually observe accelerating global growth. This suggests some caution should be used when interpreting empirical studies on growth determinants, as these results may not be stable over time. Country characteristics that lead to poor performances today may well allow for rapid growth in the future if and when the world economy reaches a sufficiently advanced stage.

Our model also suggests a queuing effect, where the order in which countries are absorbed into the world economy is determined by the quality of their policies. Economic reforms in one country may potentially have a large impact on growth if they move the country to the front of the queue. But similar reforms in all countries may have a much smaller impact on world growth.

I. The Model

Consider a model with two production technologies: traditional and modern. Labor is the only input and is inelastically supplied. In the traditional technology, each unit of labor produces one unit of final consumption. The modern technology combines a simple intermediate input L and a complex intermediate input H to produce the consumption good. Trade allows these tasks to be performed in different countries. For

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example, the simple input could be stitching shoes and the complex input could be designing and marketing the shoes, or the simple input could be automobile assembly and the complicated input could be manufacturing automobile components.

There are many small countries of two types: advanced and developing. Only advanced countries can produce intermediate good H . Intermediate good L can be produced anywhere, but production in a developing country involves an additional cost of δ_c units of the final good. This can be thought of as a transport cost or as a cost caused by policy distortions. Thus:

$$\begin{aligned}
 Y_{\text{traditional}} &= n_{\text{traditional},c} \\
 Y_{\text{modern}} &= AH^\alpha L^{1-\alpha} \\
 H &= \begin{cases} n_{H,c} & \text{if } c \in \text{advanced} \\ 0 & \text{if } c \in \text{developing} \end{cases} \\
 L &= \begin{cases} n_{L,c} & \text{if } c \in \text{advanced} \\ n_{L,c} + \delta_c Y & \text{if } c \in \text{developing} \end{cases}
 \end{aligned}$$

where $A > 2(1 + \delta)$, $0 < \alpha < 1$, $n_{\text{traditional},c}$, $n_{H,c}$ and $n_{L,c}$ are the number of workers in country c engaged in the traditional production and the production of intermediate goods H and L respectively.

Each period, developing countries become advanced with probability p times the share of their population in modern production. This is not internalized by producers nor workers. We assume population growth in advanced countries, γ_A , is less than that in developing countries, γ_D , as has been the case empirically since the early 20th Century. Each period, advanced countries allow immigration from developing countries equivalent to a proportion i of the advanced countries population.

I. A Evolution of the World Population

Modern sector firms hire developing country workers until the marginal revenue product equals their wage (one if the outside option is the traditional sector) plus the transaction cost. In a competitive equilibrium, advanced countries will only demand L from a developing country once all the developing countries with lower transaction costs

have already joined the modern sector. Depending on how large these differences in cost are, the modern sector may never reach the highest cost countries. We focus on a favorable scenario for lagging developing regions, where the difference in transaction costs across countries are small: $\delta_c \approx \delta \quad \forall c$. We later discuss an alternative and less favorable scenario. Developing country modern sector employment is therefore $N_{DM} = \min((A(1-\alpha)/(1+\delta))^{1/\alpha} N_A, N_D)$, where N_A and N_D denote the advanced and developing countries' population. We consider the case where the initial N_A is not sufficient to absorb all N_D into the global economy, so:

$$\begin{aligned}\frac{\dot{N}_A}{N_A} &= \gamma_A + p(A(1-\alpha)/(1+\delta))^{1/\alpha} + i, \\ \frac{\dot{N}_D}{N_D} &= \gamma_D - \left(p(A(1-\alpha)/(1+\delta))^{1/\alpha} + i\right) \frac{N_A}{N_D}.\end{aligned}$$

This implies that if:

$$(1) \quad \frac{N_A}{N_D} \leq \frac{\gamma_D - \gamma_A}{p(A(1-\alpha)/(1+\delta))^{1/\alpha} + i} - 1,$$

then $\dot{N}_A/N_A < \dot{N}_D/N_D$ and the proportion of the world population in advanced countries declines indefinitely, converging to zero. If population growth rates are similar in advanced and developing countries, N_A/N_D will increase over time. If not, the N_A/N_D ratio will only increase if it's starting value is above a threshold equal to the right-hand-side of (1). If that is the case, the transformation and migration processes dominate the opposing demographic trend.

Once all N_D workers are in the modern sector, wages in developing countries are no longer pinned down by traditional sector productivity and will grow with N_A/N_D . Depending on parameter values, N_A/N_D will either grow without bounds or converge to a steady-state ratio.²

The model implies that differences in transaction costs between countries have strong implications for which developing countries will integrate into the global economy first. Even when the differences are arbitrarily small, the ordinal rank of these costs will

place countries in a “development queue.” An individual country benefits from policy improvements that reduce its transaction costs, if that moves it to the front of the queue. However, this comes at the expense of other developing countries. The limited ability of advanced economies to absorb the labor in the developing world means that policy improvements have smaller impacts on world growth than on individual country growth. That is, individual country growth can be driven by ordinal improvements while world growth depends on the actual magnitude of the improvements. This can help explain growth failing to pick-up in the developing world as a whole despite significant improvements in policy over the last decades (as documented in William R. Easterly 2001). The model also suggests a non-linear impact of policy reform, with growth potentially responding dramatically if the reforms move a country to the front of the queue but not otherwise. African countries may have limited opportunities for integration over the short- and medium-term if they are (and remain) behind Asian countries on this development queue.

If transaction cost differences across countries are significant, the process of global integration will slow down as it reaches increasingly more costly developing countries. In the extreme case in which a subset of countries have policies bad enough that the resulting transaction cost is $\delta_c > A\alpha^\alpha(1-\alpha)^{(1-\alpha)} - 1$, these countries will never be integrated into the global economy, because the advanced economies would rather produce L themselves than transact with these countries. If that is the case, in the absence of migration, the share of the world population living in these countries would grow indefinitely since $\delta_D > \delta_A$. However, migration from these countries to advanced ones can compensate for the natural population growth differential if N_A / N_D is sufficiently high. Provided $N_A / N_D > \gamma_D / (\gamma_A + i)$, the global economy will still converge to widespread prosperity.

II. A Simple Calibration

We calibrate the model using population and GDP data from Angus Maddison (2003) for 1820—2001 and population and international migration data and projections

² See Marcos D. Chamon and Michael R. Kremer (2006) for details.

from the United Nations (U.N.) Population Division for 1950—2050. We classify economies as developing or advanced based on whether their GDP per capita, measured in 1990 International Geary-Khamis dollar terms, was higher than one third of that of the leading country, defined as the United Kingdom for 1820—1900, and the United States afterwards. Since the model assumes one-way transitions from developing to advanced status, we focus only on economies that permanently cross that threshold (exceptions are made for temporary declines). See Chamon and Kremer (2006) for details.

Figure 1 shows the relative population in the advanced world, N_A / N_D , increased throughout the 19th century because population growth in advanced countries exceeded that in developing countries. In the early 20th century, population growth began declining in advanced countries and increased substantially in developing ones. Following this demographic reversal, N_A / N_D gradually declined through the 20th Century, with blips when large countries transitioned from developing to advanced economy status (notably Japan in 1932). Note that N_A / N_D declined despite a substantial increase in the number of advanced economies.

We estimate $p(A(1 - \alpha)/(1 + \delta))^{1/\alpha}$, the arrival rate of transition from developing to advanced economy status, as 0.40% over the last 50 years. This is the average ratio of the population in the economies that became advanced in a given year to the total advanced economy population. During 2000—05, natural population growth rates were 0.29% in advanced economies and 1.38% in developing ones, and net migration into advanced economies was 0.31% of their population. The U.N. Population Division projects natural population growth rates to continue to decline in both advanced and developing countries, with their gap narrowing but remaining substantial. Natural population growth in Africa is projected to remain substantially above the developing world's average (Figure 2).

Under the parameter values above, N_A / N_D would be below the critical threshold and the proportion of the world population living in developing countries would grow indefinitely, just as it has grown since the early 20th century when modern medicine reached the poor world. Under the demographic changes projected by the U.N., the world will eventually converge to prosperity but the process would be extremely slow. No

substantial improvements would take place within a century. As shown in Figure 3, the long-run dynamics could substantially improve through halving natural population growth disparities, doubling immigration or doubling the transformation rate. The transformation rate could potentially change due to improvements in communication and transportation or policy improvements.

The model and this calibration exercise have considered the world economy as a large collection of small countries, whose evolution can be approximated by a smooth and deterministic process. In practice, the transformation of large countries could move sizable shares of the world population from poverty to prosperity, adding stochasticity to the world economy. Figure 3 also shows the effect of China and of China and India instantaneously becoming advanced economies. This leads to a large acceleration in the rate at which other economies develop. Thus, even if China and India are at the front of the development queue, that could actually benefit other developing countries in the long-run provided these giants transform sufficiently rapidly.

III. Conclusion

A model in which development comes through non-traditional exports suggests that the prospects for economic transformation in developing countries depend on the amount of labor that can be absorbed by the advanced economies. Africa's non-traditional export opportunities may remain limited as long as labor remains "cheap" in China and India. But once China and India develop, there will be a very strong demand for the labor in the remaining developing countries, potentially leading to accelerating growth over time. The model also suggests that the development of these two large countries could help other developing countries in the short- and medium-term through terms of trade effects.

Our results suggest one should be careful when extrapolating the existing empirical evidence on economic growth into the future. Over short horizons, these results are likely to exaggerate the developing world-wide benefits of policy improvements, as some of the observed growth may come at the expense of other developing countries if the queuing effects described are at play. Over longer horizons, these empirical results

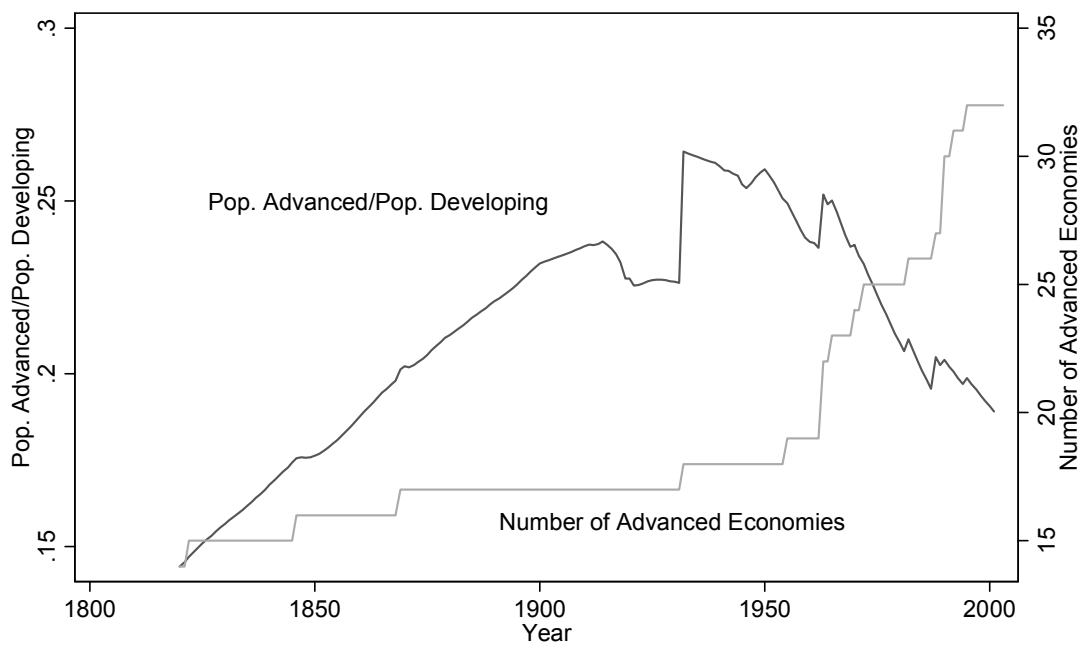
are likely to be over-pessimistic, as country characteristics that lead to low growth today may allow for high growth if and when the global economy reaches a sufficiently advanced stage.

The old conventional wisdom was that population growth in developing countries was a major problem. The new conventional wisdom is that population growth is rapidly declining and hence not an obstacle to development. Our results highlight the importance of *relative* population growth between rich and poor countries. Because population growth has been declining in the rich world along with the poor world, this population growth gap is relatively persistent. It's worth noting that in our model, population growth in developing countries will create negative externalities on other countries, while population growth and open immigration policies in advanced countries will create positive externalities for the rest of the world. The model suggests that the future of the world economy may well be decided by a race between Asian economic growth and African population growth.

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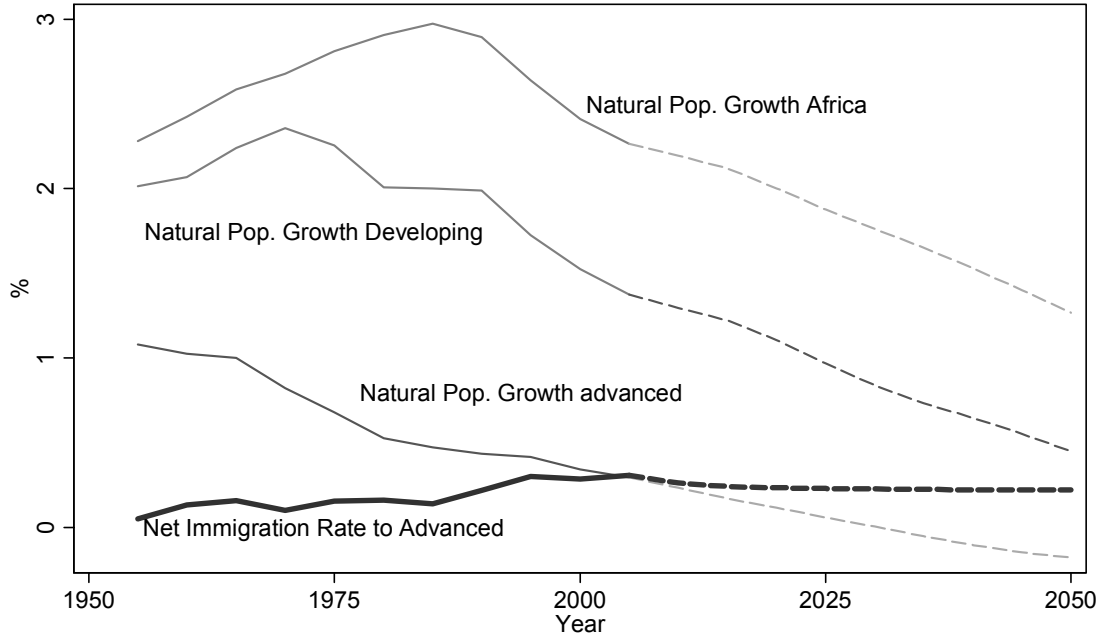
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Figure 1: Ratio of World Population in Advanced and Developing Economies and Number of Advanced Economies.



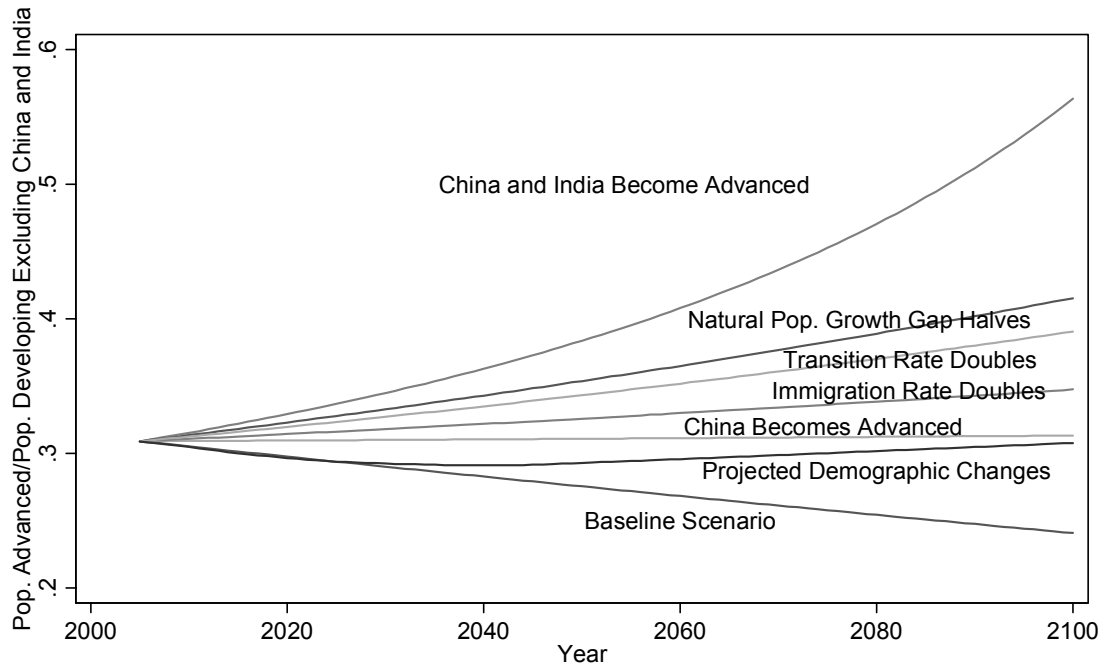
Notes: Data from Maddison (2003). Missing observations log-linearly interpolated.

Figure 2: Natural Population Growth and Net Migration from 1950 to 2005 and Projections for 2005 to 2050.



Notes: Data from the United Nations Population Division. Plot indicates average migration rate and the (geometric) average growth rate over the 5 year period ending in that year. Solid lines indicate actual values and dashed lines indicate projections.

Figure 3: Evolution of the Ratio of World Population in Advanced and Developing Economies, Excluding China and India:



Notes: The baseline scenario corresponds to the parameter values as of 2000—2005, and the historical rate of transition from 1952—2001.