Development Economics

Alessandra Pelloni

Lectures II

April 2018

We will introduce some key ideas that can explain persistent underdevelopment

- Complementarities and coordination failures
- Big push
- Capital Market Imperfections and Inequality
- O'ring
- Growth diagnostics

But before that:
Early Theories of Economic Growth and Development

1950s and 1960s Theories of Economic Growth and Development

Scientific interest in development began following World War II. Economist had as a guide the experience of the Marshall Plan, under which massive amounts of U.S. financial and technical assistance enabled the war-torn countries of Europe to rebuild and modernize their economies in a matter of years as well as the lessons of economic history: after all modern industrial nations were once undeveloped agrarian societies.

Theorists of the 1950s and 1960s viewed the process of development as a series of successive stages of economic growth through which all countries must pass.

Rostow's Stages of Economic Growth model (1960)

According to the american economic historian the five basic stages in which all countries can be classified are: Traditional society (subsistence agriculture or hunting and gathering);Transitional society(more productive, commercial agriculture, urbanization, formation of national identities); Take-off(industrialization, technological breakthroughs).Mature stage (Diversification of the industrial base, Transport infrastructure); and society of mass consumption.

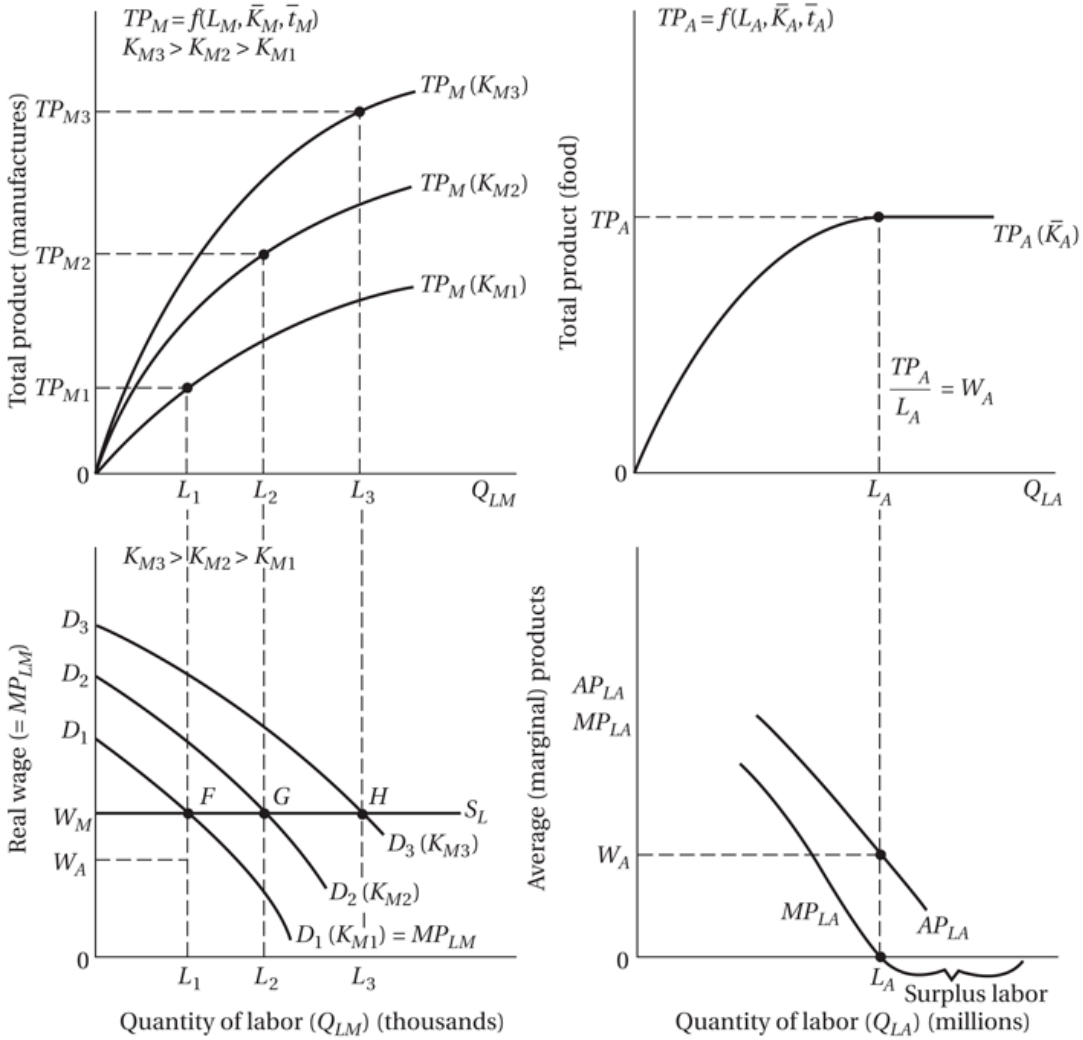
The Harrod Domar model

The right mixture of saving, investment, and foreign aid were then all that was necessary to enable developing nations to proceed along an economic growth path that had historically been followed by the more developed countries.
The economic mechanism by which more saving and investment leads to more growth can be described in terms of the so called Harrod-Domar growth model.
In a nutshell: $S=sY$ and $K=kY$ with s (savings ratio) and k (capital-output ratio) since in equilibrium $I=dK=S$ then $dY/Y=dK/K=sY/(Yk)=s/k$. So growth will be higher the higher is the savings ratio and the lower the capital-output ratio.

Unfortunately more saving and investment is a necessary but not a sufficient condition for accelerated rates of growth. The Marshall Plan had worked for Europe because the European countries receiving aid possessed the necessary structural, institutional, and attitudinal conditions (e.g., well-integrated commodity and money markets, highly developed transport facilities, a well-trained and educated workforce, the motivation to succeed, an efficient government bureaucracy etc.). So development also needs overcoming these differences.

The Lewis Model of Structural Change

It was recognized that development requires not just accelerated capital formation but the structural transformation of a primarily subsistence economy. This was formulated by Nobel laureate W. Arthur Lewis in the mid-1950 and became the general theory of development in the 1960s and early 1970s.
The economy consists of two sectors: a traditional, rural sector with zero marginal labor productivity (from which surplus labor can be withdrawn without any loss of output)—and a high-productivity modern sector into which labor is gradually transferred. The speed of the transfer is determined by the rate of capital accumulation in the modern sector. Capitalists reinvest all their profits. Wages in the urban industrial sector is constant (the supply curve of labor to the modern sector is perfectly elastic due to surplus labor). This process of modern-sector expansion continues until all surplus rural labor is absorbed. This is known as the "Lewis turning point." Then the labor supply curve becomes positively sloped.

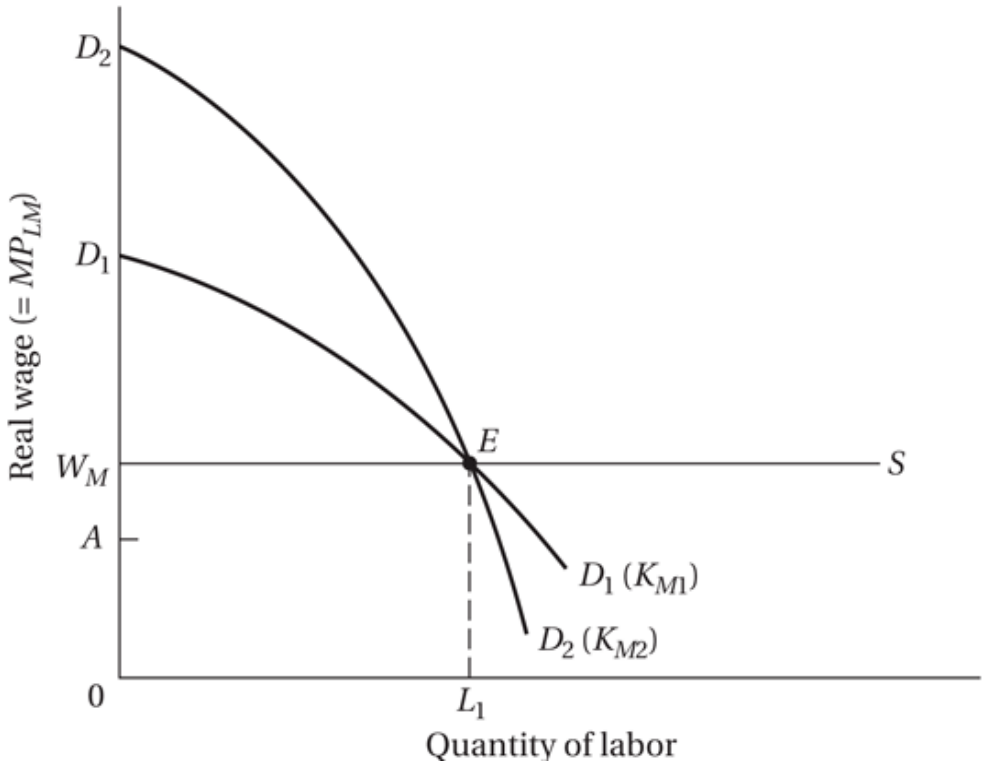


(a) Modern (industrial) sector

(b) Traditional (agricultural) sector

Limits of the Lewis Model

Employment creation in the modern sector is increasing in capital accumulation. This will not happen with labor saving investment. Then all the extra income goes to the owners of capital.



Moreover:

- The existence of close to unlimited surplus labor in agriculture and of constant urban wages are not observed. Urban wages tend to rise substantially over time, both in absolute terms and relative to average rural incomes, even in the presence of rising levels of open modern-sector unemployment **(urban surpus labor)** and low or zero marginal productivity in agriculture.
- Also, in contrast to the East Asian experience, none of the recent growth accelerations in Latin America, Africa, or South Asia was driven by rapid industrialization.

Recent growth accelerations were based on either rapid within-sector labor productivity growth (Latin America) or growth-increasing structural change (Africa), but rarely both at the same time.

Coordination failure and the importance of complementarities I

Complementarity

An action taken by one agent that increases the incentives for other agents to take similar or related actions. Leading example is investments whose return depends on other investments being made by other agents.

Coordination failure

A coordination failure is situation in which agents' inability to coordinate their choices leads to an outcome (equilibrium) in which all agents worse off, compared to an alternative situation that is also an equilibrium (prisoner's dilemma).

Coordination failure and the importance of complementarities II

Assume an economy has two possible states :

- Only agriculture
- Railways, coal, steel and engineers (plus some agriculture)

Consider undertaking separate investments:
Railway alone – who will pay for it?
Coal alone: how to transport it?
Steel alone: who will use it?
Only engineering school – no jobs for them
These investments are complementary: All of them are needed, at once!
Almost literally true in a closed economy, in an open economy, partly true
All this affects development policy, at least when the aim is to industrialize and develop. Coordination is required.

Multiple Equilibria From Aggregate Demand Externalities and the Big Push I

N sectors, in each sector i either

- modern technology (IRS) $L_i = F + cQ_i, c < 1$, or $Q_i = (L_i - F)/c$ Monopolistic Competition
- *or* traditional technology (CRS), $L_i = Q_i$. Perfect Competition. Demand in each sector is $P_iQ_i = \sum P_jQ_j/N=Y/N$. Elasticity of demand=-1
  Under both regimes W=1(for simplicity) and P_i=1. Monopoly price cannot go above 1 because of competition by traditional firms.

Multiple Equilibria From Aggregate Demand Externalities and the Big Push II

- **Scenario A : Big Push**
  $\pi_i = Q_i(1-c) - F$ can be positive only if Q_i is big enough. If all firms modernize then $L_i = L/N$ and $Q_i = (L/N - F)/c$. Let us assume that this level of demand is sufficient to guarantee positive profits $\pi_i = (L/N - F)(1-c)/c - F > 0$.
  Modernization happens.
- **Scenario B : (No) business as usual**

Suppose all firms but firm i choose traditional technology: then $Q_i = L/N$, but then $\pi_i = L/N(1-c) - F < 0 < (L/N - F)(1-c)/c - F$.
Modernization in isolation is not possible.

Multiple Equilibria From Aggregate Demand Externalities and the Big Push III

Interpretation :
Equilibrium with TT as a "development trap" where due to a coordination failure economy remains in "underdevelopment"
Equilibrium with MT corresponding to "industrialization": societies that can *coordinate* will industrialize. Can the government do it?

Further Coordination Failures:

1) Intertemporal effects. Problem made worse if F is to be paid in advance.
2)Urbanization effects. Historically one needs urbanization to achieve industrialization.
3)Infrastructure effects. Infrastructures, such as roads, railroads, and ports, are not tradable by definition; When one product sector industrializes, it increases the size of the market for the use of infrastructure. But the building of the infrastructure, if other coordination problems, is not sufficient for industrialisation.
4) Under-training effects. a) Entrepreneurs know workers they train may go to rival firms. b) Workers do not know whether firms will make investments requiring the skills they acquire. To solve this problem not openness to trade but free mobility of labor is useful: however$\longrightarrow$ brain drain.

Further problems/issues of Coordination Failures:(low level equilibrium traps)

- Why not a super entrepreneur, who coordinates the whole? Capital market failures, agency costs/asymmetric information, communication failures, limits to knowledge explains why such a figure has never been observed!
- Aggregate demand externalities are important as sources of persistence in all market economies (see recent financial crisis!)

Further problems/issues of Coordination Failures:(low level equilibrium traps)

1) Tecniques with IRS tend to become entrenched even when no longer best practice.
2) Behaviour and norms - You can have equilibria where most people resist corruption, and so corruption is rare; and you can have equilibria where few resist corruption, and corruption is common. How move from a bad to a good equilibrium?
Traditional norms (ie have as many children as possible) may not be functional to a modern society but they are embedded in religion and are therefore very difficult to change without state intervention.
3) Linkages : One government policy for solving coordination problems is to focus on key industries. The implementation could be through public enterprises or incentives for multinational firms as Asian Tigers since late sixties.

Inequality, Credit Market Imperfections and Human Capital

The traditional view has been that inequality may enhance growth one reason being that the rich save more than the poor. However, this is not necessarily true.
The poor may not be able to obtain loans (for instance to become entrepreneurs) because (by def) they lack collateral. Similarly they may not be able to obtain loans to finance otherwise very productive schooling. Families can be trapped in poverty from generation to generation; however, if schooling could somehow be achieved, they could escape from this poverty trap.

- Distribution of income and the organization of financial markets affect human capital investments.
- Show the possibility of multiple steady states, and more substantive questions related to the role of inequality and credit markets in the process of development.
- Focus on human capital investments, but inequality and credit market problems influences also occupational choices and other aspects of the

Simplified Galor Zeira

- Continuum 1 of dynasties.
- Each individual lives for two periods, childhood and adulthood, and gets an offspring in his adulthood.
- Consumption only at the end of adulthood.
- Preferences:

$$(1-\delta)\log c_i(t) + \delta \log e_i(t)$$

  where c is consumption at the end of the individual's life, and e is the educational spending on the offspring
- Budget constraint:

$$c_i(t) + e_i(t) \leq w_i(t),$$

- Preferences here have the "warm glow" type altruism: parents do not care about utility of their offspring, but about what they bequeath (education).

Simplified Galor Zeira II

- Each individual choose the spending on education that maximizes its own utility

$$e_i(t) = \delta w_i(t)$$

- Labor market is competitive, wage income is a linear function of individual's human capital:

$$w_i(t) = Ah_i(t)$$

Simplified Galor Zeira III

- Implies "saving rate": $e_i(t) = \delta A h_i(t)$.
- Human capital of the offspring of individual i of generation t:

$$h_i(t+1) = \begin{cases} e_i(t)^{\gamma} & \text{if } e_i(t) \geq 1 \\ \bar{h} & \text{if } e_i(t) < 1 \end{cases}, \gamma \in (0,1) \text{ and } \bar{h} \in (0,1).$$

- Key feature to generate multiple equilibria or multiple steady states: a *nonconvexity* in the technology of human capital accumulation. Threshold values in education not unrealistic "sheepskin effect".
- One unappealing feature (not crucial for results): parents derive utility from educational spending so spend even when useless to children $e_i(t) < 1$.
- Assume that $\delta A > 1 > \delta A \bar{h}$.
- Dynasty that starts with $h_i(0) < (\delta A)^{-1}$ will never reach a human capital level greater than $\bar{h}$.
  - implies that $e_i(0) = \delta A h_i(0) < 1$, so the offspring will have $h_i(1) = \bar{h}$. Repeating this argument, we have $h_i(t) = \bar{h}$ for all t.

Simplified Galor Zeira IV

- Dynasty that starts with $h_i(0) \in \left((\delta A)^{-1}, h^*\right)$.
  - $\left(h_i(1) = (\delta A h_i(0))^{\gamma} > 1\right.$, so gradually accumulate more and more and ultimately reach "steady state" $h^* = (\delta A h^*)^{\gamma}$ or

$$h^* = (\delta A)^{\frac{\gamma}{1-\gamma}} > 1.$$

- If $h_i(0) > h^*$: decumulate human capital
- Two steady-state levels of human capital for individuals, $\bar{h}$ and $h^* > \bar{h}$: dynasties with $h_i(0) < (\delta A)^{-1}$ will tend to $\bar{h}$, while those with $h_i(0) > (\delta A)^{-1}$ will tend to h^*.
- Simple dynamics:
  - Human capital of a single individual contains all information for dynamics of entire economy.
  - Reason is no prices determined in equilbrium.
  - No general equilibrium interactions.

Simplified Galor Zeira V

- Key implication: poverty traps due to the nonconvexities created by the credit market problems.
- Contrast two identical economies, but starting out with different distributions of income.
- Consider economy with two groups starting at income levels h_1 and $h_2 > h_1$ such that $(\delta A)^{-1} < h_2$.
- If inequality (poverty) is high so that $h_1 < (\delta A)^{-1}$, a significant fraction of the population will never accumulate much human capital.
- If inequality is limited, $h_1 > (\delta A)^{-1}$, all agents will accumulate human capital, eventually reaching h^*.

Simplified Galor Zeira VI

- Parallel between the multiplicity of steady states here and the multiple equilibria in Big Push model, but also differences
  - Multiple equilibria in a static model: nothing determines which equilibrium the economy will be in. Can at best appeal to "*expectations*," or informally to the role of "*history,*" but this is misleading. Static model, so discussion of an economy "that has been in the low equilibrium for a while" is not meaningful.Even if the model were turned to a dynamic one by repeating it, history of being in one equilibrium will have no effect on multiple equilibria at the next instant.
  - Thus models with multiple equilibria have indeterminacy that are both theoretically awkward and empirically difficult to map to reality.
  - Multiple steady states avoids these thorny issues: equilibrium is *unique*, initial conditions determine where the dynamical system will end up
  - No issue of indeterminacy or expectations, and multiple steady states can be useful for thinking of development traps.

Simplified Galor Zeira VII

- Distribution of income affects which individuals will invest and influences the long-run income level.
- Sometimes interpreted as implying that an unequal distribution of income will lead to lower output (and growth).
- But not a general result and no specific predictions about relationship between inequality and growth.
- E.g., now starting with $h_1 < h_2 < (\delta A)^{-1}$, neither group will accumulate.Redistributing from 1 to 2 so that $h_2 > (\delta A)^{-1}$ would increase human capital accumulation but worsen inequality!

General feature: in models with nonconvexities, *no unambiguous general* results about whether greater inequality is good or bad for accumulation and growth. Empirically growth and inequality negatively related.

Michael Kremer's (1993) O-Ring Theory

Basic insight: modern production (economy) requires many activities(sectors) be done well together: a form of strong complementarity.
A small faulty part caused the Challenger shuttle to explode in 1986.
Crucial difference from standard efficiency unit formulation of labor skill: cannot substitute quantity for quality within a single production chain.
Inside a firm n tasks to produce an output/implement a production process. Order tasks by level of skill q (assume between 0 and 1)
q either a kind of a quality index or the probability of completing the task successfully
The production function: multiply tasks (assume independence of probabilities)

Also: labor markets are competitive, and workers supply labor inelastically. We then have positive assortative matching: workers with high skills will work together, because they will then be more productive. This can be seen easily if we imagine a four-person economy. Suppose that this economy has two high-skill q_H workers and two low-skill q_L workers. Total output will always be higher under a matching scheme. Comes from math rule that given sum, product is higher if numbers are closer.

Assume six workers: 3 with q=0.4 and three with q=0.8 in two firms
Assume one worker in each firm trained (25% increase in q of one worker)
Firm 1: y= (0.4)(0.4)(0.4) = 0.064 -> (0.4)(0.4)(0.5) = 0.080
Firm 2: y= (0.8)(0.8)(0.8) = 0.512 -> (0.8)(0.8)(1.0) = 0.640
Point value increase much higher in firm 2: Virtuous circle .. Consistent with competitive equilibrium
The more you upgrade the better it pays (wages increase at an increasing rate)

More general case: n (exogenous can be endogenized) workers

$$y = Bn\Pi_{i=1}^{n} q_i$$

Define B as the output per worker if all tasks are performed perfectly. In this case, total output would be nB.

Competitive firms face a wage schedule w(q) and price of one. They solve:
$\max_{\{q_i\}} \pi = Bn\Pi_{i=1}^{n} q_i - \sum_{i=1}^{n} w(q_i)$,
FOCS: $dy/dq_i = Bn\Pi_{j\neq i}^{n-} q_j = w'(q_i)$,for all i.
Also: $d^2y/(dq_j dq_i) = Bn\Pi_{k\neq j\neq i}^{n} q_k > 0$
A worker's productivity increases in the skill of workers he is matched with. Hence, firms with high q workers in the first n-1 tasks place the highest value on having high-skill workers in the nth task, so they bid the most for these workers. Hence, all workers employed by any single first have the same q.

Search for equilibria can be restricted to those allocations of workers to firms in which all workers employed by any single firm have the same q. Given this positive assortative matching, the first order condition can be written as
$dw/dq = q^{n-1}nB$. By integrating we get: $\mathrm{w}(q) = \int_0^q t^{n-1}nBdt + C$ or $\mathrm{w}(q) = q^n B + C$
Clearly $\mathrm{w}(0)$
$= 0$ so $\mathrm{w}(q) = q^n B$,and total wage bill $nq^n B$
so $\pi = Bn\Pi_{i=1}^n q_i - \sum_{i=1}^n w\left(q_i\right) = 0$
Hence, profits are zero for all firms . Firms indifferent regarding the skill level of their workers as long as their labor force is of homogeneous skill.

Remarks

O-ring production function provides a mechanism through which small differences in worker skill create large differences in productivity and wages:

1) It therefore helps to explain enormous wage and productivity differentials between rich and poor countries.

Because wages increase in q at an increasing rate, wages will be more than proportionally higher in developed countries than would be predicted from standard measures of skill.

2)When those around you have higher average skills, you have a greater incentive to acquire more

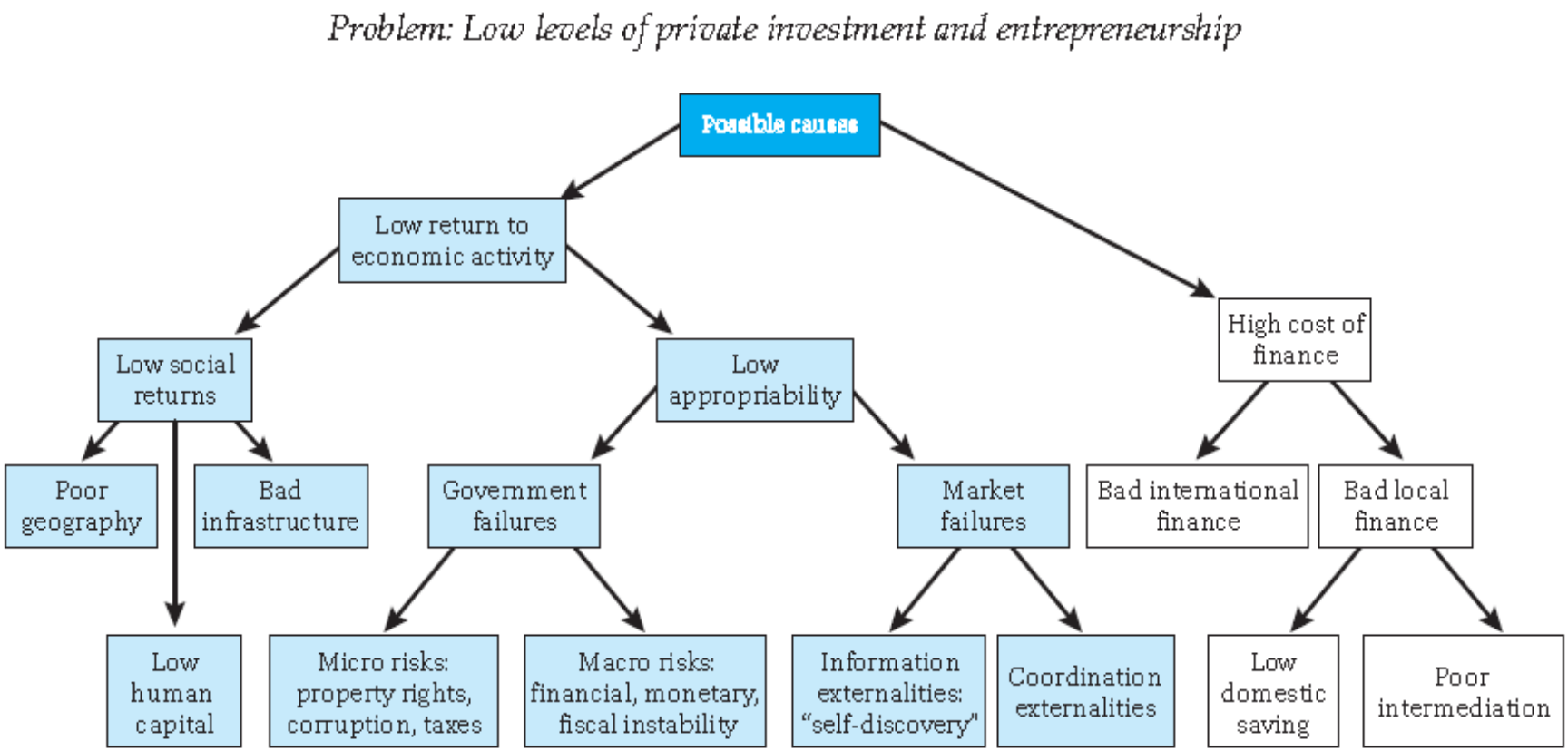
skills. This type of complementarity should by now be a familiar condition in which multiple equilibria can emerge.

3) Firms coexist while hiring different qualities of workers and producing different quality goods. But workers are presumably better off with a higher q and w. A whole country can get caught in economywide low-production-quality traps. There could thus be a case for an industrial policy to encourage quality upgrading, as some East Asian countries have undertaken in the past.

4) O-ring effects magnify the impact of local production bottlenecks because such bottlenecks can have a multiplicative effect on other productions. Trade can help to avoid some bottlenecks so trade barriers can hurt development. Economies closed to trade, such as India or China before the 1980s, have not fared as well as the four Asian Tigers that took advantage of foreign inputs.
5) Efficiency wages are important (effect of shirking can be disastrous with type of production function).
6) Explains why firm size and wages are positively correlated within and across countries. When skill is scarce, a firm is less likely to choose a technique with higher value but complicated production technology with many tasks, because the costs of doing any one of those tasks poorly are magnified.

The idea of "one size fits all" policy for economic development is now generally recognized as a myth. A key problem is to identify the different constraints each country faces. If a developing nation experiences a low level of private investment and growth, what steps should it take? Ricardo Hausmann, Dani Rodrik, and Andrés Velasco (HRV) propose a growth diagnostics decision tree framework to guide its action

FIGURE 4.3 Hausmann-Rodrik-Velasco Growth Diagnostics Decision Tree



Source: Ricardo Hausmann, Dani Rodrik, and Andrés Velasco, "Getting the diagnosis right," *Finance and Development* 43 (2006), available at http://www.inf.org/external/pubs/ft/fandd/2006/03/hausmann.htm. Used with permission.

At the first stage, countries are divided between those with low returns and those with high costs of finance. Low returns may be due to a) 1a)geography (tropical pests, mountains and other physical barriers, distance to world markets, and landlocked status), 2a)illiteracy or innumeracy or 3a) to insufficient infrastructure(roads, bridges, railroads, ports, telecommunications). b) Or may be due to an appropriability problem due to 1b) government or 2b)market failures (we have given an example with big push model). 1b) can take the form of a micro-risk (weakness of rule of law, corruption, confiscatory taxation) or a macro-risk (macroeconomic stability).

As to the high cost of finance. Here the problem may be 1) bad international finance—inadequate access to foreign sources of capital or problems with debt; or 2) bad local finance, low domestic saving, or poor intermediation owing to an inadequate or overregulated banking system.
In sum, one size does not fit all in development policy. Strategies focusing on market liberalization and opening up the economy can be most effective when social returns are high and the most serious obstacle to private appropriation is government-imposed excessive taxes and restrictions. Finally, strategies focusing on education and industrial policies can be most effective when private returns are low not because of what a government does (errors of commission) but because of what a government does not do (errors of omission).
Ricardo Hausmann, Dani Rodrik, and Andrés Velasco, "Growth diagnostics," in One Economics, Many Recipes: Globalization, Institutions, and Economic Growth, by Dani Rodrik (Princeton, N.J.: Princeton University Press, 2007), The World Bank offers a set of growth diagnostics exercises at http://web.worldbank.org/.