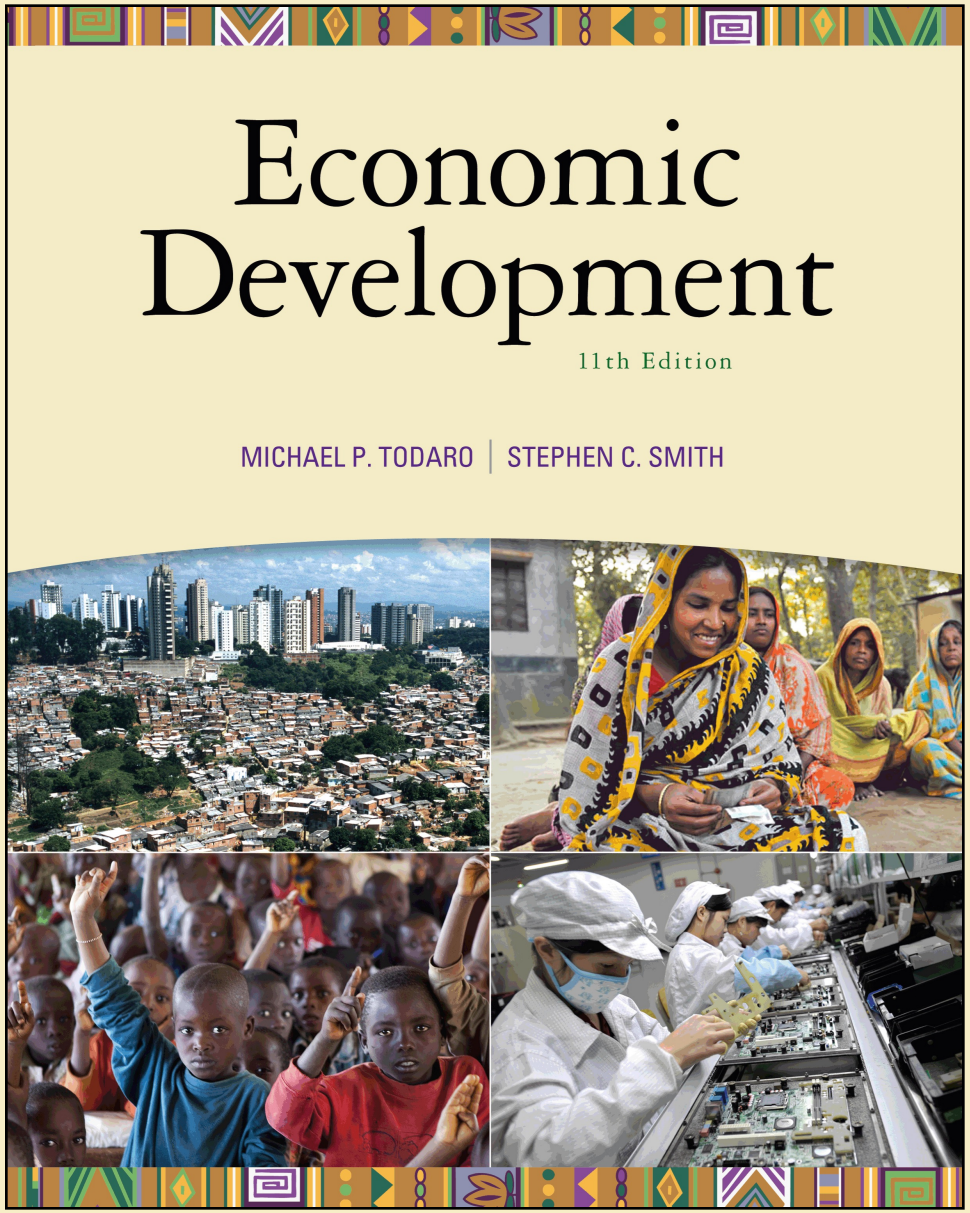
Chapter 4

Contemporary Models of Development and Underdevelopment



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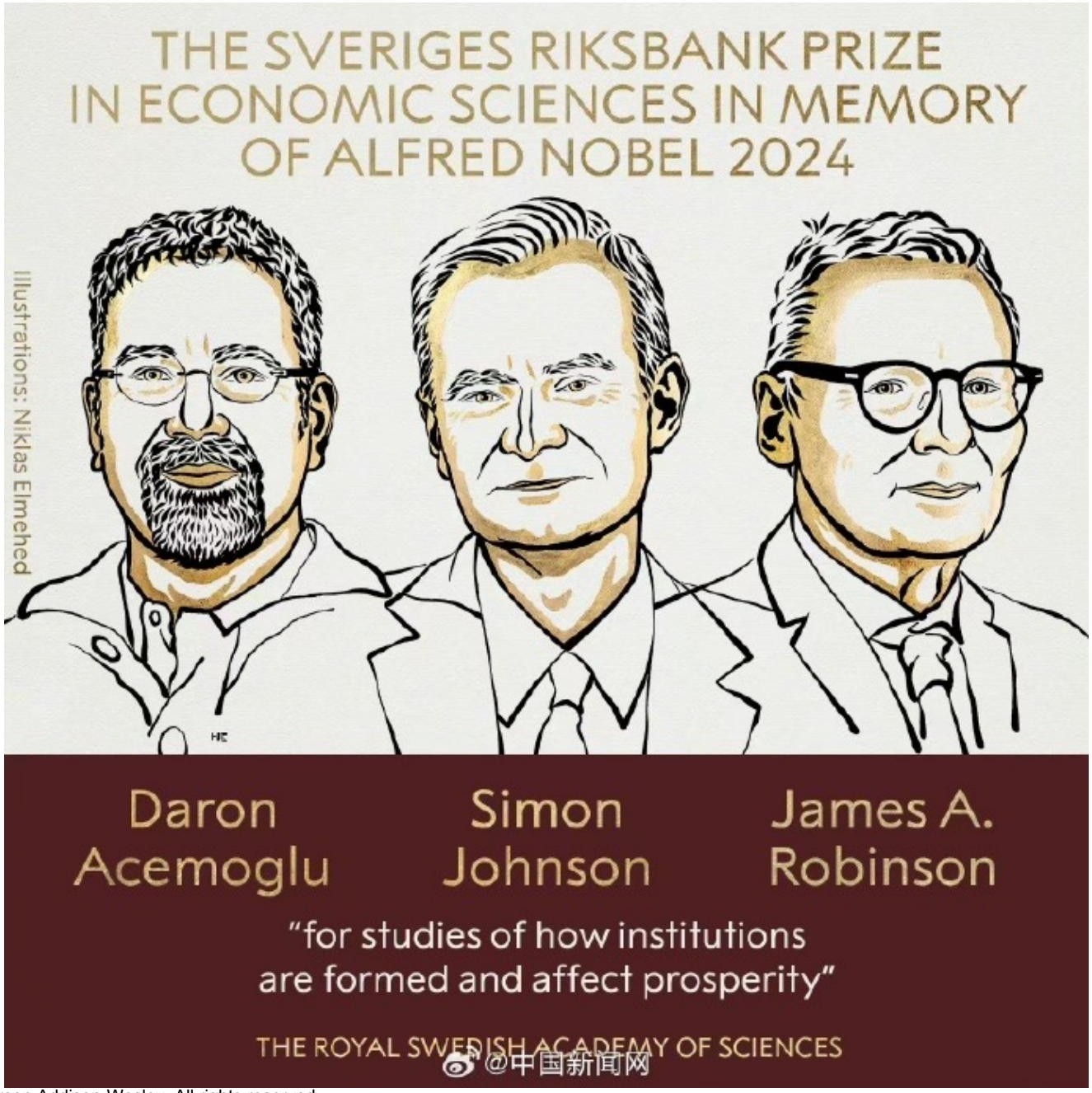


4.1 Underdevelopment as a Coordination Failure

- A newer school of thought on problems of economic development
- Coordination failures（协调失灵）occur when agents' inability to coordinate their actions leads to an outcome that makes all agents worse off.
- This can occur when actions are complementary（互补的）, i.e. actions taken by one agent reinforces（加强）incentives for others to take similar actions

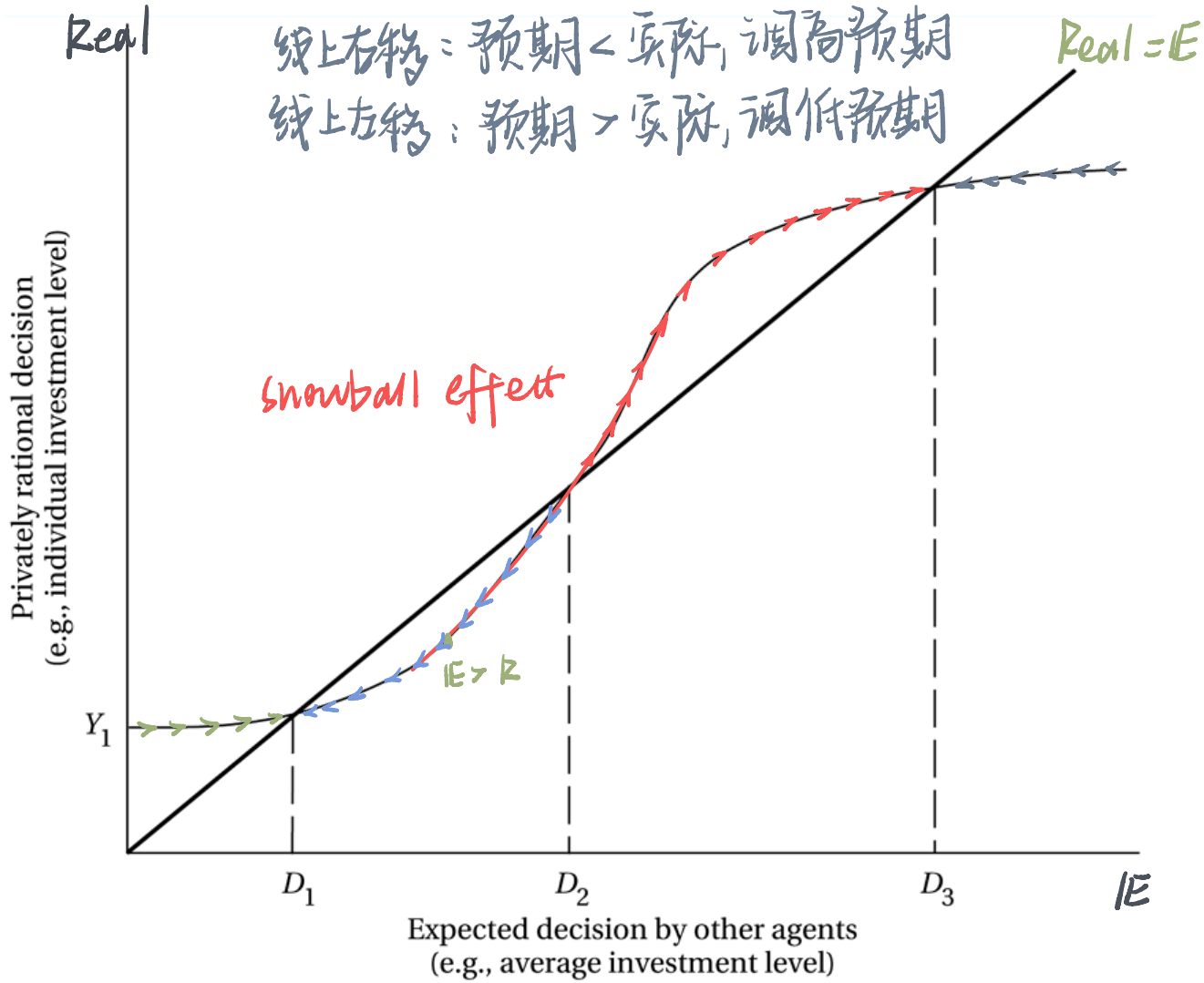
4.2 Multiple Equilibria: A Diagrammatic Approach

- Often, these models can be diagrammed by graphing an S-shaped function and the 45º line
- The basic idea is that the benefits an agent receives from taking an action depend positively on how many other agents are expected to take the action or on the extent of those actions.

- Typically, the S-shaped "privately rational decision function" first increases at an increasing rate and then at a decreasing rate.
- This shape reflects what is thought to be the typical nature of complementarities. 反映了互补的本质.
  - Some agents may take the complementary action (such as investing) even if others in the economy do not. 部分人始终投资
  - If only a few agents take the action, each agent may be isolated from the others, so spillovers may be minimal. Thus the curve does not rise quickly at first as more agents take the action. 均衡效应大于增长效应
  - But after enough invest, there may be a snowball effect, in which many agents begin to provide spillover benefits to neighboring agents, and the curve increases faster. 增长效应大于
  - After most potential investors have been positively affected and the most important gains have been realized, the rate of increase slows down. 边际效益递减，增长效应小于均衡

Figure 4.1 Multiple Equilibria

adjust expectation



- Suppose that firms expected no other firms to make investments, but some firms did anyway (implying a positive vertical intercept in the diagram).
- But then, seeing that some firms did make investments, firms would have to revise their expectations upward, matching their expectations to the level of investment they actually would see. But if firms now expected this higher level of investment, firms would want to invest even more.
- This process of adjustment of expectations would continue until the level of actual investment would just equal the level of expected investment.

- Equilibrium is found where the "privately rational decision function" crosses the 45-degree line, implying that the level of investment expected is equal to the level that all agents find best.
- Stable equilibria: D_1 & D_3
  - Function crosses the 45º line from above
  - If expectations were slightly changed to a little above or below these levels, firms would adjust their behavior in a way to bring us back to the original equilibrium.
- Unstable equilibria: D_2
  - Function crosses the 45º line from below
  - If a little less investment were expected, the equilibrium would be D_1, and if a little more, the equilibrium would move to D_3

- Economic development concerns coordinating decisions when one investment depends on other investments.
- All are better off with more investors or higher rates of investment, but the market may not get there without proper government policy.
- In general, when jointly profitable investments may not be made without coordination, multiple equilibria may exist in either a good or a bad situation.
- Many of the least developed countries are essentially caught in such circumstances.
  - sub-Saharan Africa

4.3 Starting Economic Development: The Big Push 大推进理论

- Sometimes market failures 市场失灵 lead to a need for public policy intervention 公共政策干预
  - Pecuniary externalities 货币外部性: A positive or negative spillover effect on an agent's costs or revenues.
  - e.g. an influx of city-dwellers buying second homes in a rural area can drive up house prices, making it difficult for young people in the area to buy a house.
- Coordination failures model: the "big push," pioneered by Paul Rosenstein-Rodan
- Pointed out several problems associated with initiating industrialization in a subsistence economy

- Six assumptions for The Big Push Model

  (1) One factor of production: labor

  (2) Two sectors

  - Traditional sector (wage=1)
  - Modern sector (W>1)

  (3) Technology: N products

  - Tradition sector: 1 worker produces one unit of output
  - Modern sector: $L=F+cQ$ $(c<1)$ increasing return to scale, symmetry: same production function for producing any product

Labor ↑ Fixed cost ↓ → Quantity of products

规模经济

unit costs

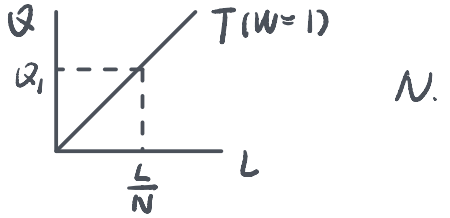
(4) Domestic demand: consumers spend an equal amount on each good Y/N

(5) International supply and demand: closed economy

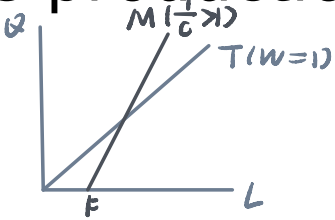
(6) Market structure

- Perfect competition with traditional firms operating price: 1, 1, 1, ...

- Limit pricing monopolist with a modern firm operating, also charges the same price and produces same quantity as tradition price: $\frac{1}{N}, \frac{1}{N}, \ldots, \frac{1}{N} = 1$



- Traditional producers:
  - Linear technique with slope 1, with each worker producing one unit of output;
  - Wage bill line lies coincident with the production line (start from the origin, slope=1)



- Modern firms:
  - Fixed costs F, after that linear technique with slope 1/c>1;
  - Wage bill line has slope W>1
- Price = 1, so revenue PQ can be read off the Q axis

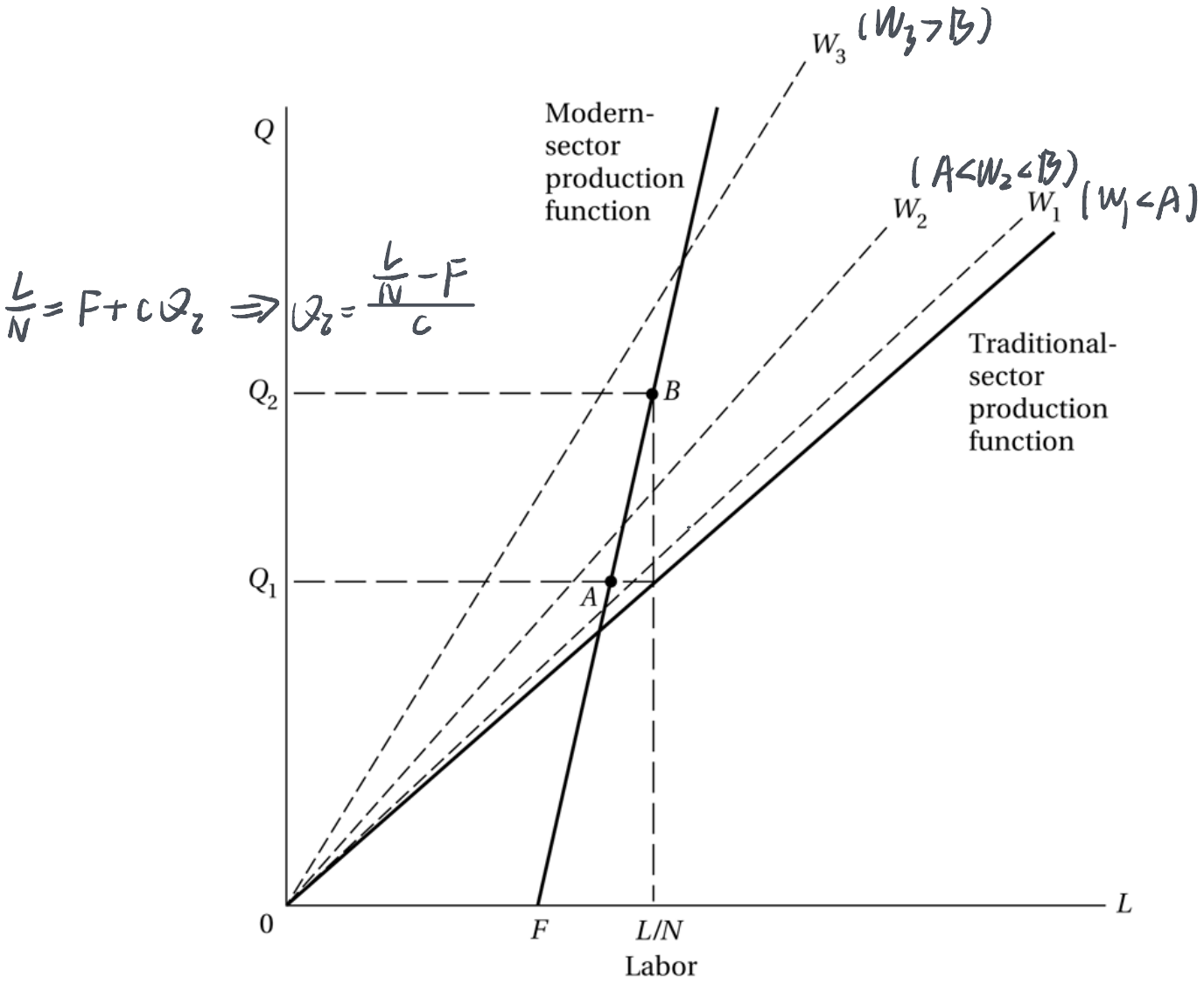
- Conditions for Multiple Equilibria
  - To begin, suppose that we have a traditional economy with no modern production in any market.
  - At point A, we see the output that the modern firm will produce if it enters, provided there are traditional firms operating in the rest of the economy. 剩余劳动力仍在传统产业.
  - Whether the modern firm enters depends, of course, on whether it is profitable to do so.

Profit = $(Q_M - W_{1,2,3})$

(1) how much more efficient the modern sector is than the traditional sector

(2) how much higher wages are in the modern sector than in the traditional sector.

Figure 4.2 The Big Push



- Case 1: consider a wage bill line like W_1 passing below point A
  - Since revenues exceed costs, the modern firm will pay the fixed cost F and enter the market
  - If a modern firm finds it profitable to produce one good, the same incentives will be present for producing all goods, and the whole economy will industrialize through market forces alone; demand is now high enough that we end up at point B for each product.
  - A coordination failure need not always happen.
  - At B: $L/N=F+cQ_2$, $Q_2=(L/N-F)/c$

- Case 2: consider a wage bill line like W_3 passing above point B
  - Even if a modern producer entered in all product sectors, all of these firms would still lose money, so again the traditional technique would continue to be used.

- Case 3: consider a wage bill line like W_2 passing between points A and B
  - The firm would not enter if it were the only modern firm to do so in the economy because it would incur losses.
  - But if modern firms enter in each of the markets, then wages are increased to the modern wage in all markets, and income expands.
  - To prevent traditional firms from entering, modern firms cannot raise prices above 1.
  - The modern firm can now sell all of its expanded output (at point B), produced by using all of its available labor allocation (L/N).

- With prevailing wage W_2, point B is profitable after industrialization because it lies above the W_2 line.
- Workers are also at least as well off as when they worked in the traditional sector because they can afford to purchase an additional quantity of goods in proportion to their increased wage, and they have changed sectors voluntarily.
- All of the output is purchased because all of national income is spent on output; national income is equal to wages plus profits, the value of which is output of each product times the number of products N.

- To summarize:
- Whenever the wage bill line passes below point A, the market will lead the economy to modernize, and whenever it passes above A, it will not.
- The steeper (i.e., more efficient) the modern-sector production technique or the lower the fixed costs, the more likely it is that the wage bill will pass below the corresponding point A.
- If the line passes above B, it makes no sense to industrialize.

- Thus with a prevailing wage like W_2, there are two equilibria:
  - Industrialized B: One in which producers with modern techniques enter in all markets, and profits, wages, and output are higher than before;
  - Without industrialized: One in which no modern producer enters, and wages and output remain lower.
- The equilibrium with higher output is better, but the market will not get there because of a coordination failure.
- There is a role for policy in starting economic development.

- A big push may also be necessary when there are:
  - *Intertemporal跨期 effects*: investment must be undertaken in the current period to get a more efficient production process in the next period
  - *Urbanization effects*: need a big push to urbanization to achieve industrialization
  - *Infrastructure effects*: one product sector's industrialization increases infrastructure services used by other product sectors
  - *Training effects*: underinvestment in training facilities because workers may be enticed away with higher wages offered by rival firms

Why the Problem Cannot be Solved by a Super-Entrepreneur

- Why can't one agent solve the coordination failure problems by capturing all the rent?
- Super Entrepreneur?
  - Capital market failures 资本市场失灵
  - Cost of monitoring managers- Asymmetric Information 信息不对称(one party to a potential transaction has more information than another) 代理成本
  - Communication failures 沟通成本
  - Limits to knowledge 知识限制
  - Lack of any empirical evidence that would suggest this is possible

In a Nutshell: Big Push Mechanisms

- Firms adopting increasing-returns-to-scale technologies are having the following effects:
  - Raising total demand TD↑
  - Reducing fixed costs of later entrants future FC↓
  - Redistributing demand to later periods when other industrializing firms sell
  - Shifting demand toward manufacturing goods (usually produced in urban areas) 分散了需求
  - Help defray分摊 costs of essential infrastructure (a similar mechanism can hold when there are costs of training, and other shared intermediate inputs) 分担成本
- Each of these has external beneficial effects on other industrializing firms. 正外部性

4.4 Further Problems of Multiple Equilibria

- Inefficient Advantages of Incumbency 现存低效优势
  - Existing firm has low costs due to increasing return to scale.
  - Thus firm with the old technique has an advantage over any rivals.
- Behavior and Norms 行为和规范
  - Your choice of partner may determine much.
  - We cannot rely on good organisations to prevail in competition if the rules of the game tend to reward the bad organisations. (coordination failure)

4.4 Further Problems of Multiple Equilibria (Con't)

- Linkages
  - One strategy for solving coordination problems is to focus government policy on encouraging the development of industries with key backward or forward linkages. 可传导到上下游
  - As a start to overcoming a coordination failure and generating positive feedback.
- Inequality, Multiple Equilibria, and Growth
  - Too high a degree of equality could compromise growth, poverty trap (a bad equilibrium involving a vicious circle in which poverty and underdevelopment lead to more poverty and underdevelopment)

4.5 Michael Kremer's O-Ring Theory of Economic Development O环模型

- Provide important insights into low-level equilibrium traps by Michael Kremer
- The model name is taken from the 1986 *Challenger* disaster, in which the failure of one small, inexpensive part caused the space shuttle to explode.
- It explains not only the existence of poverty traps but also the reasons that countries caught in such traps may have such exceptionally low incomes compared with high-income countries.

Michael Kremer

https://economics.uchicago.edu/directory/michael-kremer

Ph.D., Harvard University, 1992.
University Professor in Economics and the College and the Harris School of Public Policy (at Chicago since 2020);
Co-recipient of the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel, 2019.

Model Set Up

- The O-Ring Model
  - Production is modeled with strong complementarities 互补性 among inputs
- Suppose a production process is broken down into n tasks, which we order strictly by level of skill q required, $0 \leq q \leq 1$.
- The higher the skill, the higher the probability that the task will be "successfully completed".
- Assumptions:
  - Firms are risk-neutral
  - labor markets are competitive
  - workers supply labor inelastically

- The production function assumed is a simple one: Output is given by multiplying the *q* values of each of the *n* tasks together, in turn multiplied by a term *B*, that depends on the characteristics of the firm and is generally larger with a larger number of tasks.
- Suppose also that each firm hires only two workers. Then the O-ring production function looks like this:

$$BF(q_i q_j) = q_i q_j$$

Let B=1 to simplify the model

完整 $BF(q_i q_j) = B\, q_i q_j$

- One of the most prominent features of this type of production function is *positive assortative matching* (正向匹配).
  - Workers with high skills will work together and workers with low skills will work together.
  - You will be more productive when working with a more productive person.
- Imagine a four-person economy.

$$q_H^2 + q_L^2 > 2q_H q_L$$

- The firms with high-skill workers would pay more to get other high-skill workers or upgrade skills among existing workers.

- Suppose 6 workers: three have q = 0.4 and are grouped together in equilibrium, while the other three have q = 0.8.
- Now suppose that the *q* of one of the workers in the first firm rises from 0.4 to 0.5 (perhaps due to training). Similarly, suppose the *q* of one worker in the second firm rises from 0.8 to 1.0.
- In each case, we have a 25% increase in the quality of one worker, leading to a 25% increase in output quality. But starting from a higher level of quality, that 25% clearly translates into a much larger point increase.

- In the example, the first firm goes from (0.4)(0.4)(0.4) = 0.064 to (0.4)(0.4)(0.5) = 0.080; this is a difference of 0.080 - 0.064, which is a point change of 0.016; and 0.016/0.064 = 0.25, which is a 25% increase.
- For the second firm, we move from (0.8)(0.8)(0.8) = 0.512 to (0.8)(0.8)(1.0) = 0.640; the change in this case is 0.128, which is again 25%.
- However, the point value of the increase is much greater—eight times greater—for a doubled point-value investment (0.2 in the second firm versus 0.1 in the first firm).

- Implications of strong complementarities for economic development and the distribution of income across countries
  - Firms tend to employ workers with similar skills for their various tasks.
  - Workers performing the same task earn higher wages in a high-skill firm than in a low-skill firm.
  - 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.
  - When those around you have higher average skills, you have a greater incentive to acquire more skills.

- One can get caught in economywide low-production-quality traps. There could thus be a case for an industrial policy to encourage quality upgrading. This could be relevant for a country trying to escape the middle-income trap 中等收入陷阱.
- O-ring effects magnify the impact of local production bottlenecks瓶颈 because such bottlenecks have a multiplicative倍数的 effect on other production.
- Bottlenecks also reduce the incentive for workers to invest in skills by lowering the expected return to these skills.

4.6 Economic Development as Self-Discovery 自我探索

- Hausmann and Rodrik: A Problem of Information
- Not enough to say developing countries should produce "labor intensive products," because there are thousands of them
- Industrial policy may help to identify true direct and indirect domestic costs of potential products to specialize in, by:
  - Encouraging exploration in first stage
  - Encouraging movement out of inefficient sectors and into more efficient sectors in the second stage

信息外部性

4.6 Economic Development as Self-Discovery

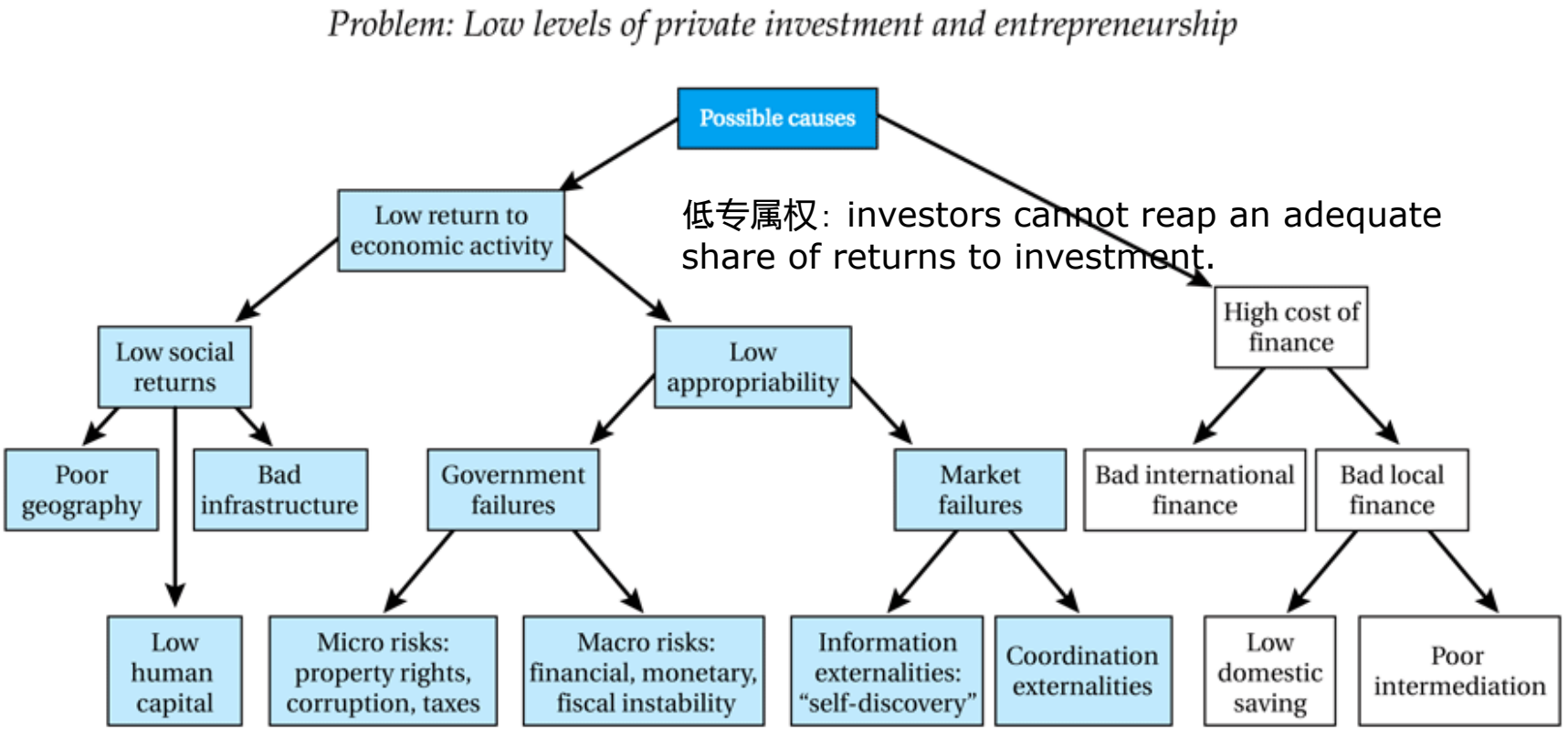
- Three building blocks of the theory; and case examples of their reasonableness in practice:
  - Uncertainty about products can produce efficiently (evidence: India's success in information technology was unexpected; reasons for Bangladesh's efficiency in hats vs Pakistan's in bedsheets is not clear)
  - Need for local adaptation适应 (evidence: seen in cases such as shipbuilding in South Korea)
  - Imitation can be rapid (e.g. the spread of cut flower 鲜切花 exporting in Colombia)

模仿

4.7 The Hausmann-Rodrik-Velasco Growth Diagnostics 增长诊断学 Framework

- Focus on a country's most binding constraints 绑定约束 on economic growth
- No "one size fits all" in development policy
- Requires careful research to determine the most likely binding constraint
- Adopted by the Inter-American Development Bank (IDB) and the World Bank

Figure 4.3 Hausmann-Rodrik-Velasco Growth Diagnostics Decision Tree 决策树



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.

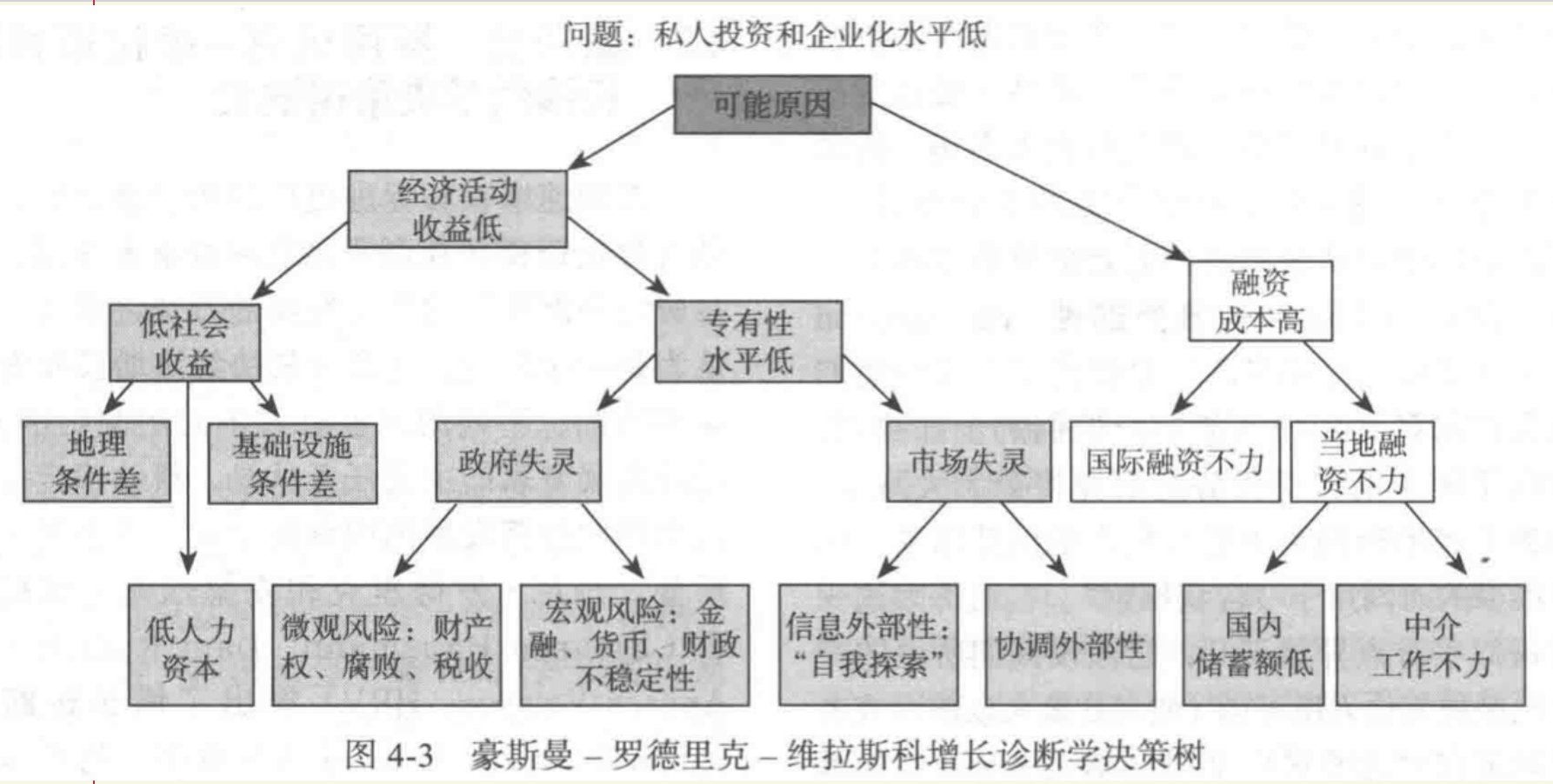
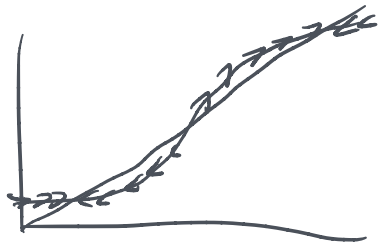


图 4-3　豪斯曼 – 罗德里克 – 维拉斯科增长诊断学决策树

4.8 Conclusions

- The deeper point is that people keep doing inefficient things because it is rational to keep doing them.
- This leads to a fundamental problem of coordination failure.
- Government policy and aid will be necessary to overcome the resulting vicious circles of underdevelopment.

- *Exercise:* Show in a diagram an S-curve and a 45-degree line. Are all three points of intersection stable equilibrium points? Explain. A_1, A_3 is stable, But A_2 is not.



- 阅读材料
  - 《发展经济学》，郭熙保等著，第四章第三节《中国经济增长及其动力因素》

- The S-curve is used to illustrate
  - (a) the typical path taken by the current account over time.
  - (b) economic fluctuations in the economy.
  - (c) the typical growth path of a developing economy.
  - (d) the existence of multiple equilibria.

- The O-ring theory places emphasis on
  - (a) education of the labor force.
  - (b) skill complementarities.
  - (c) purchases of machinery and equipment by firms.
  - (d) none of the above.