The Global Firm
Lecture 3

OLI Framework of MNE Analysis & Friedman on Positive Economics (Part 2)

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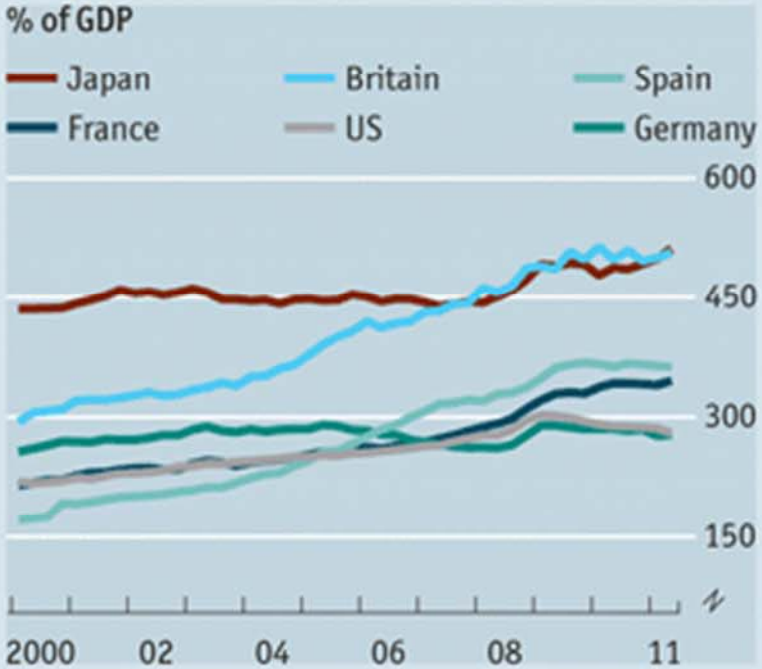
Big Picture

The climb is easier than the descent

Total debt

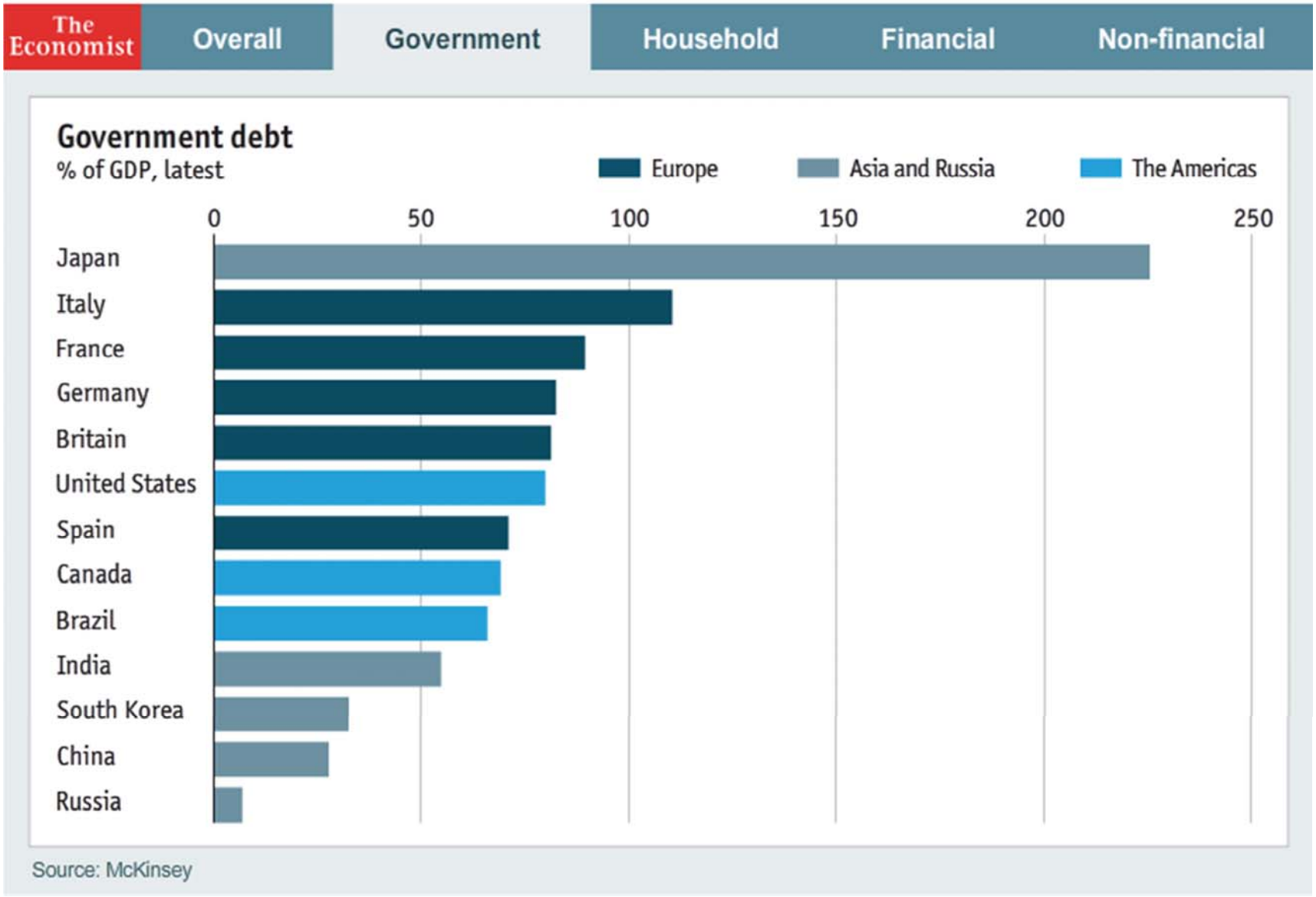


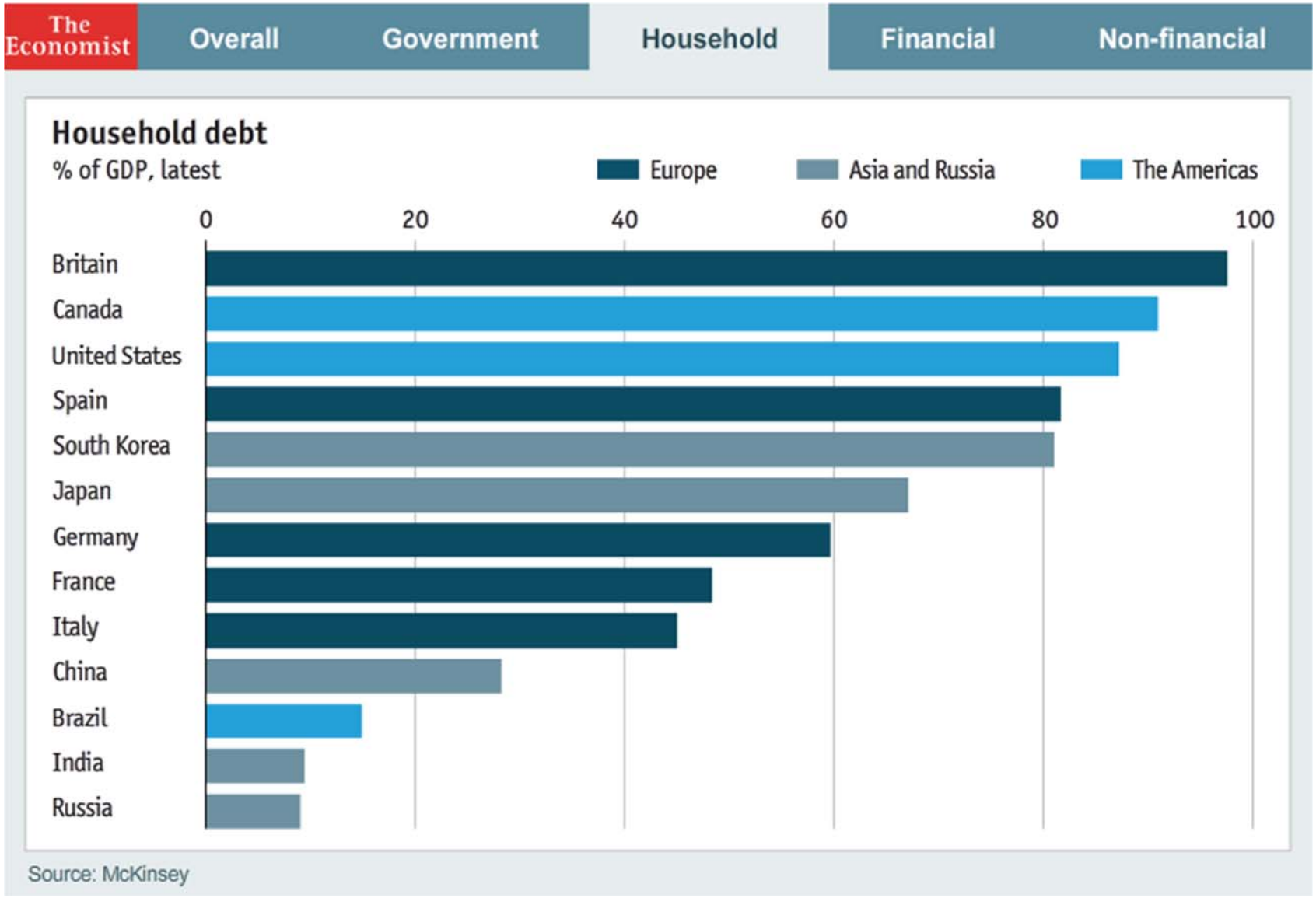
Sources: McKinsey Global Institute

Change, % of GDP

	2000-2008	2008-Q2 2011
Japan	36.5	38.9
France	88.8	35.4
Spain	145.2	25.6
Britain	177.2	20.3
Canada	38.5	17.0
Italy	67.8	11.5*
Germany	7.2	1.2
South Korea	91.4	-15.5
United States	75.2	-16.1

*To Q1 2011


The Economist
Overall
Government
Household
Financial
Non-financial
Government debt
% of GDP, latest
Europe
Asia and Russia
The Americas
0
50
100
150
200
250
Japan
Italy
France
Germany
Britain
United States
Spain
Canada
Brazil
India
South Korea
China
Russia
Source: McKinsey


The Economist
Overall
Government
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Household debt
% of GDP, latest
Europe
Asia and Russia
The Americas
0
20
40
60
80
100
Britain
Canada
United States
Spain
South Korea
Japan
Germany
France
Italy
China
Brazil
India
Russia
Source: McKinsey

Household debt

As a percentage of GDP

	Levels				Changes[2]		
	1980	1990	2000	2010[1]	1980–90	1990–2000	2000–10
United States	52	64	74	95	12	10	21
Japan	60	82	87	82	22	5	–5
Germany	59	61	73	64	2	13	–9
United Kingdom	37	73	75	106	36	2	31
France	27	46	47	69	18	2	22
Italy	6	21	30	53	15	9	23
Canada	56	63	67	94	7	4	27
Australia	42	46	74	113	5	27	39
Austria	41	41	47	57	0	6	10
Belgium	35	38	41	56	3	3	15
Denmark			95	152			57
Finland	29	48	35	67	19	–14	33
Greece	8	9	20	65	1	11	45
Netherlands	43	49	87	130	6	38	43
Norway			64	94			31
Portugal	15	23	75	106	7	52	31
Spain	24	41	54	91	17	13	37
Sweden	53	61	51	87	8	–10	36
Total of above							
Median	39	47	65	94	8	8	31
Weighted average[3]	46	60	69	90	14	9	18
Simple average	37	48	61	93	11	11	27
G7	43	59	65	87	16	6	16
Other advanced	32	39	58	97	7	14	34
Memo: Std deviation	*17*	*20*	*21*	*28*			

[1] Some figures refer to 2009. [2] In percentage points of GDP. [3] Based on 2005 GDP and PPP exchange rates.

Sources: OECD; national data, authors' estimates.

Today’s plan

- Introduction to OLI framework
- Ethier (QJE, 1986)
- Continue on positive economics

Introduction to OLI Framework

- What is OLI?
  - **O**wnership
  - **L**ocation
  - **I**nternalization

- A basic theoretical framework, proposed by John Dunning, to explain
  - the incentives for MNEs to go overseas
  - the organizational forms of MNEs
  - MNE's location choices
  - decision choice between FDI and its alternatives, such as international trade, licensing and outsourcing

Introduction to OLI Framework

- Before we get into the advantages of being a MNE, let's understand two basics:

  1. FDI vs. portfolio capital investment
     - Portfolio investment seeks higher returns to capital
     - MNE is often formed to take advantage of specific business opportunities, rather than secondary benefits of interest rate differential, or investment returns

  2. The disadvantages of being a MNE vs. domestic firm
     - Communication and transportation costs
     - Language and cultural differences
     - Adaptation costs to different regulations, government procedures,etc.
     - Additional risks: exchange rate, political stability, degree of property rights protection

     ➔ Because of these **inherent disadvantages**, it's natural to assume that MNEs must be more productive (or they must enjoy some special advantage) over their domestic counterparts.

Introduction to OLI Framework

- According to Dunning (1977, 1981), for a firm to become multinational, it must enjoy or attempts to get access to the following:
  - Ownership advantage --- product, design, patent, trade secret and resources --- link this to Hart's property rights approach
  - Location advantage --- cheap input factors, transport cost, trade barriers
  - Internalization advantage --- the additional benefits from establishing a foreign subsidiary vs. joint venture, licensing, etc.

Introduction to OLI Framework

- Dunning's theory so far assumed away government intervention. In the case of an interventionlist government, a less productive doemstic firm may, however, become multinational, if it gets:
  - Special government (or bank) financing
  - Various subsidies, such as R&D, preferred tax rates.

  → A recent example: China's State-Owned Enterprises (or SOEs) investing abroad (see Zilibotti et al., AER, 2011).

Ethier (1986), A theory based on OLI framework

- A model that explains and predicts the emergence of MNE due to internalization advantage
- In other words, this model aims to **endogenize** ”internalization” --- **the ”I” in OLI framework**
- This is a general equilibrium (eqm for short) model
  - *Manufacturing eqm* in three stages of production: research, upstream production, and downstream production, i.e., a vertical integrated firm
  - *Labor market eqm* between two countries through a traded good (wheat in the paper)

Ethier (1986), A theory based on OLI framework

- The core idea of the model
  - The uncertainty in research outcome and the complexity of technology itself produce uncertainty in the valuation between home and foreign producer (in downstream operation).
  - This problem is further exacerbated by information asymmetry. To save transaction costs (such as large flow of information exchange and potential underbid for technology), domestic firms have every incentive to internalize the foreign operation, essentially becoming multinational.
  - The model emphaized the importance of information exchange. In contrast, Hart's property rights theory of firm emphasizes the uncertainties related to "residual rights control".

Ethier (1986), A theory based on OLI framework

Basic setup in manufacturing eqm, ME:

Two countries: home and foreign;

Two goods: M: manufactured good, and W: wheat.

Three stages of production: research, upstream production and downstream production.

Research R, determines how cheap (captured by productivity parameter, a: higher a indicates lower productivity) M-good can be produced in upstream production with the same quality, Q. Q is an index of quality - the bigger the Q, the higher the quality. Q takes two values, Q and Q_1, and Q<Q_1.

With uncertainty in research output, we could have two research outcomes, a_L or a_H, with $a_L < a_H$. p(R) is the probability that a=a_L , and it follows that p'>0 and p"<0.

Ethier (1986), A theory based on OLI framework

Basic setup in manufacturing eqm, ME:

In upstream production, labor, L, is the only input, and the variable cost of production for product with quality Q, is just aQw, where w denotes the wage in term of wheat production - think of output of upstream production as capital (or intermediate) good.

If we denote cost of production as C, $\frac{\partial C}{\partial a} < 0$, $\frac{\partial C}{\partial Q} > 0$.

In downstream production, q units of labor is required to produce one unit of product (of any quality level Q) - think of output from downstream stage as final (or consumer) good.

Note again: The firm is modeled as a vertical-integrated firm.

Ethier (1986), A theory based on OLI framework

Derivation of results in manufacturing eqm, or ME:

For a chosen level of Q, we have average, a, that follows

p(R)a_L+[1 − $p(R)$]a_H;

w is domestic wage; w* is foreign wage, consider the case when w<w*,

Then domestic manufacturing firm's profit max equation is:

p(R)Q_L(1-a_Lw) + [1-p(R)]Q_H(1-a_Hw) - (wR + qw^0) . . . (1)

(q is labor required for downstream production, and $w^0 = \mu w + (1 - \mu)w*$),

Take first order condition (or FOC) w/ respect to R , we have,

p'(R)Q_L(1-a_Lw) - p'(R)Q_H(1-a_Hw) - w = 0 . . . (1b)

For the upstream production to be profitable, we must have 1-aw>0, or w<(1/a).

Ethier (1986), A theory based on OLI framework

Derivation of results in manufacturing eqm, or ME:

Since a could take two values, a_L or a_H, we could have the following three scenarios:

(i) $w>(1/a_L)>(1/a_H)$ → firm loses money, no production;

(ii) $w<(1/a_H)<(1/a_L)$ → firm earns money, for both research outcomes, and the optimal research effort R_1 is determined by MC=MB.

From equation (1b), we have,

$w = p'(R)Q_L(1-a_L w) - p'(R)Q_H(1-a_H w)$,

since at eqm, $Q_L=Q_H=Q_1$ $(Q<Q_1)$,

$\rightarrow w = p'(R_1)Q_1[(1-a_L w) - (1-a_H w)]$

$\rightarrow p'(R_1) = 1/[Q_1(a_H - a_L)]$, ... (2)

which says the probability of investing in greater research effort R_1 is not determined by the wage, w; rather, it's determined by the technology dispersion $(a_H - a_L)$: the higher the dispersion, the less likely to invest in greater research effort, R_1.

Ethier (1986), A theory based on OLI framework

Derivation of results in manufacturing eqm, or ME:

(iii) $(1/a_L) > w > (1/a_H)$ →only product with $Q_L = Q_1$ will be produced, and $Q_H = 0$. The optimal research effort R_2 is the solution to:

$$w = p'(R_2) Q_L (1 - a_L w)$$

$$\rightarrow p'(R_2) = w / [Q_L (1 - a_L w)] \quad \ldots (3)$$

Unlike (2), research effort R_2 is related to wage →when w increases, probablity of putting in greater effort R_2 increases even more. (But is this greater effort verifiable by others?)

In addition, R_2 must satisfy (for downstream production to be profitable),

$$p(R_2) Q_1 (1 - a_L w) - (w R_2 + q w^0) \geq 0 \quad \ldots (4)$$

⇒Compare (ii) and (iii), under (ii), R_1 is not related to wage, while under (iii), R_2 is connected to wage. This major difference is at the very center of the role of multinationals in Ethier's model.

Ethier (1986), A theory based on OLI framework

Derivation of results in manufacturing eqm, or ME:

Now let's solve the equation in both in (ii) and (iii), and get an expresson of w in term of w*.

First, in (ii), when $w < (1/a_H)$, the zero profit condition is:

$Q_1 - wQ_1[p(R_1)a_L + (1 - p(R_1))a_H] - (wR_1 + qw^0) = 0,$

Now, let's plug in $w^0 = \mu w + (1-\mu)w*$,where μ is the fraction of consumption (of one unit of good produced) at home; 1-μ is the foreign share of consumption. Then we have,

$w(Q_1(p(R_1)a_L + (1 - p(R_1))a_H) + R_1 + q\mu) = Q_1 - q(1-\mu)w*$

$\rightarrow w = \frac{Q_1 - q(1-\mu)}{Q_1(p(R_1)a_L + (1-p(R_1))a_H) + R_1 + q\mu} w*$

$\rightarrow w = a_1 - b_1 w* \quad \ldots (4a)$

$\left(\text{where } a = \frac{Q_1}{Q_1(p(R_1)a_L + (1-p(R_1))a_H) + R_1 + q\mu}, \text{ and } b_1 = \frac{q(1-\mu)}{Q_1(p(R_1)a_L + (1-p(R_1))a_H) + R_1 + q\mu}\right)$

Equation (4a) is shown as the straigt line, BC, in Figure I. (Remember, R_1 is unrelated to w)

Ethier (1986), A theory based on OLI framework

Derivation of results in manufacturing eqm, or ME:

Second, in (iii), when $(1/a_L) > \mathrm{w} > (1/a_H)$.

Since we allow free entry, equation (4) must become equality, i.e.,

$\mathrm{p}(R_2)Q_1(1\text{-}a_L\mathrm{w}) - (\mathrm{w}R_2 + \mathrm{q}w^0) = 0,$

plug in expression of $w^0 = \mu w + (1-\mu)w*$, we have,

$\mathrm{p}(R_2)Q_1 - [\mathrm{p}(R_2)a_L + R_2 + \mathrm{q}\mu]\mathrm{w} = \mathrm{q}(1\text{-}\mu)\mathrm{w}^*$

$\rightarrow \mathrm{w} = \frac{p(R_2)Q_1}{p(R_2)a_L+R_2+q\mu} - \frac{q(1-\mu)}{p(R_2)a_L+R_2+q\mu}\mathrm{w}^*$

$\rightarrow \mathrm{w} = a_2 - b_2\mathrm{w}^* \qquad \ldots \ (4\mathrm{b})$

$\left(\text{where } a_2 = \frac{p(R_2)Q_1}{p(R_2)a_L+R_2+q\mu}, \text{ and } b_2 = \frac{q(1-\mu)}{p(R_2)a_L+R_2+q\mu}, \right)$

Combining results in (4b) and (3), when $\mathrm{w} > (1/a_H)$, ME curve becomes steeper in Figure I, i.e., the part above point B and below the 45° line.

Ethier (1986), A theory based on OLI framework

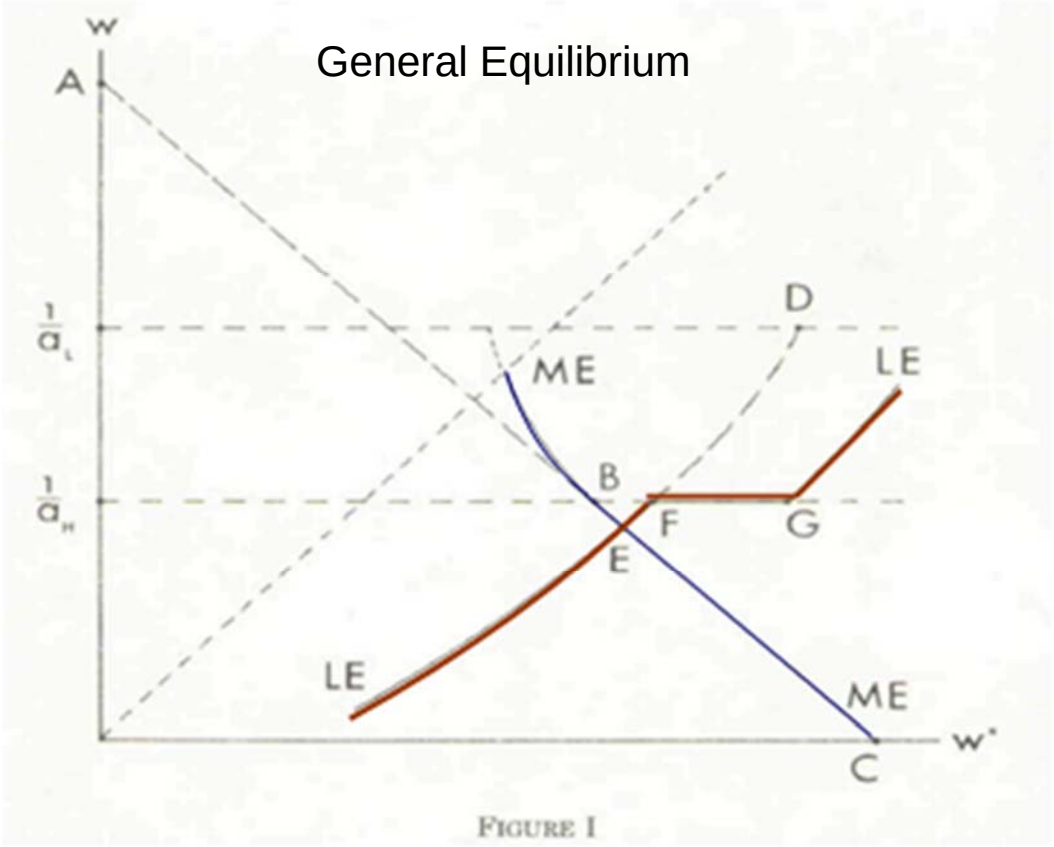


FIGURE I

I will skip the derivation of labor market equilibrium, or LE. For details, please refer to p. 817-18 in Ethier's paper.

To understand why there is a flat segment, FG, in LE schedule (the step-like shape), also refer to the details on p. 818.

Ethier (1986), A theory based on OLI framework

- In the previous slides, we maximize firm's profits as if they are one single firm
- So essentially, the ME schedule shows the relationship between w and w* when the domestic firm chooses to internalize all its operations
- Now let's compare the results under arm's length contract

Ethier (1986), A theory based on OLI framework

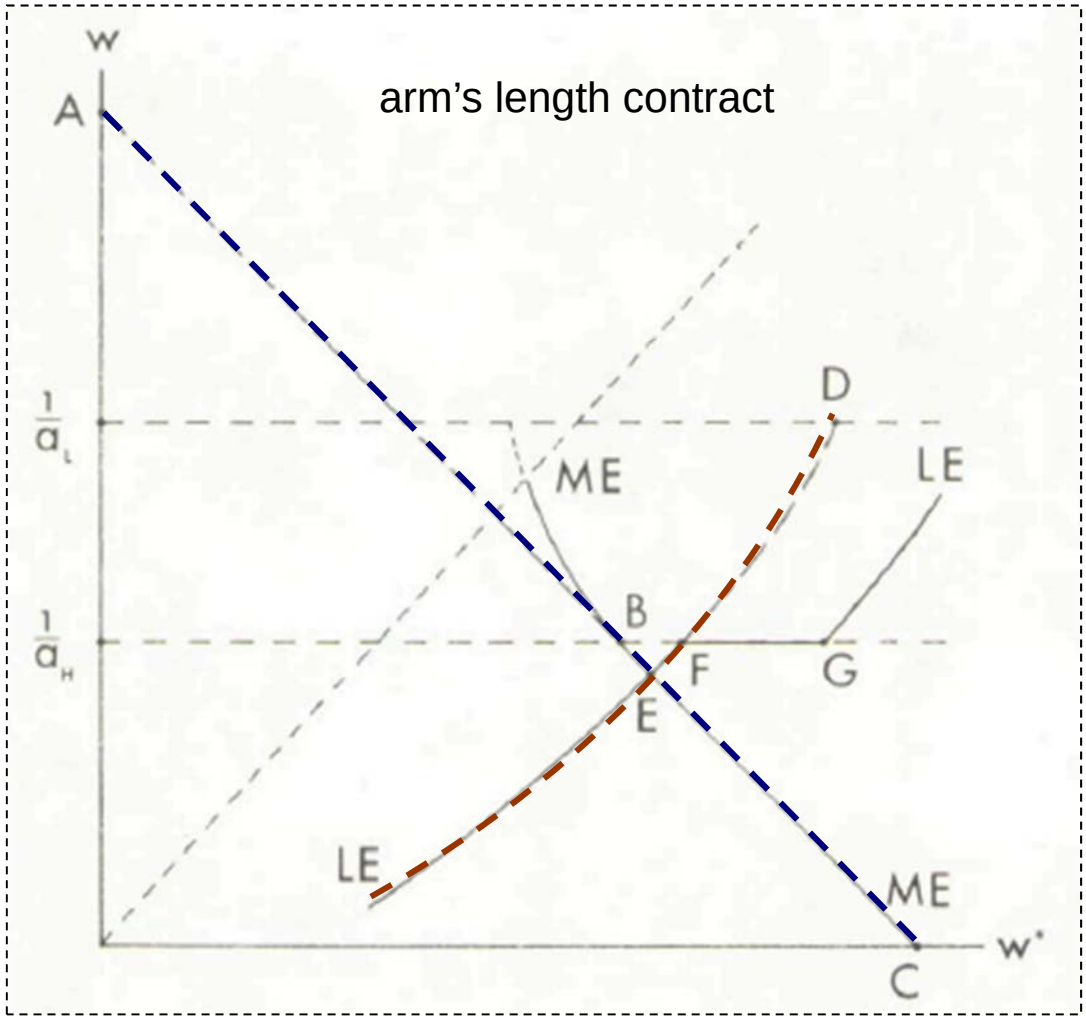
Firm's incentives to go multinational:

Arm's length vs. multinational

- **arm's length transaction** refers to the contract between two independent firms. In this paper, for example, arm's length contract can be signed between research-upstream firm in home country and downstream firm in foreign country.
- **internalization** in Ethier's context refers to the vertical integreation between a research-upstream domestic firm and a downstream foreign firm.
- note that the initial sectoral specialization is determined by relative factor intensities. In the case $w<w^*$, foreign country specializes in wheat production and home country specializes in mfg. As w gradually rises relative to w^*, home mfg firm starts to shift more of its (3-stage mfg) activities to foreign country (see p.827 for detailed discussions).

Let's denote arm's length equilibrium as A, and multinational equilibrium as M.

Ethier (1986), A theory based on OLI framework



➔ The intersection of the two dotted lines is the **general eqm under arm's length contract**.

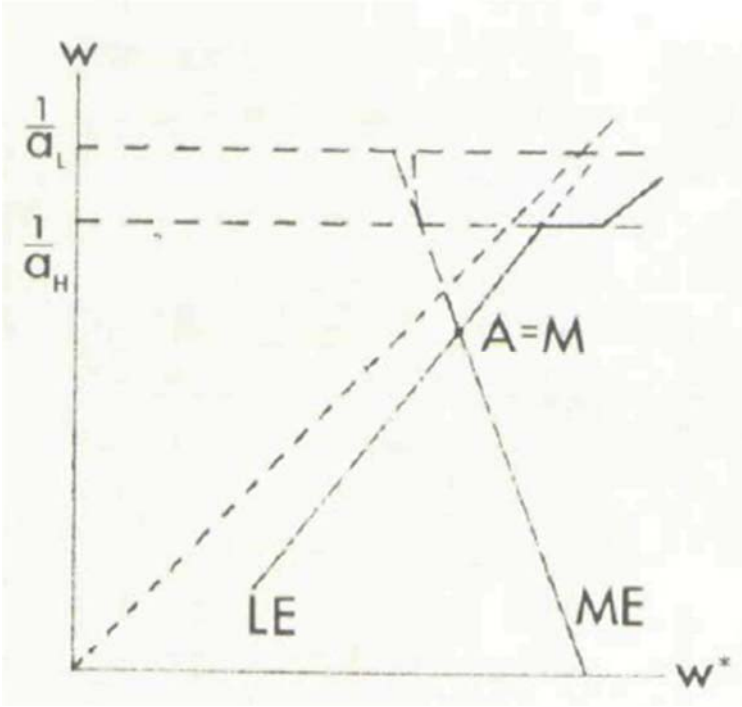
The contract must be designed in a way that calls for state-invariant quality. In other words, arm's length contract is best when the product in question is simple to value and the quality does not depend upon state variables – link this to eqn (2).

Since there is no uncetainty (assuming contract covers everything – a brave assumption), ME thus has no curved segment, and LE has no flat segment. (refer to p. 823 for details).

Ethier (1986), A theory based on OLI framework

Firm's incentives to go multinational:

First, when w $< (1/a_H)$, and when technology dispersion, $a_H - a_L$, is small, arm's length eqm and multinational eqm are the same, or $A = M$ (refer to p.823 for detailed derivations). This is shown in the graph below:



Ethier (1986), A theory based on OLI framework

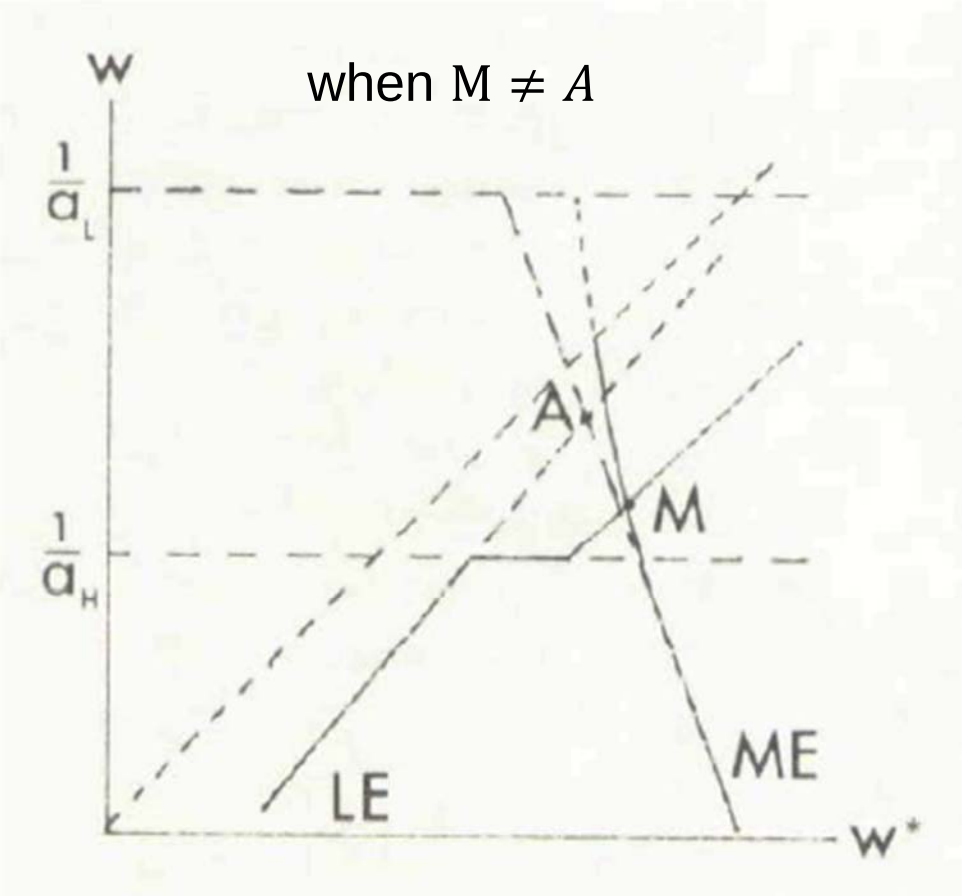
Firm's incentives to go multinational:

When $(1/a_H) < w < (1/a_L)$, A≠M, and multinational eqm, M, tends to dominate arm's length eqm, A. This is because,

- it's hard to verify home firm's actual research efforts (R) due to information asymmetry between home and foreign firms. If the two firms were to rely on arm's length contract, such as licensing, foreign firm would have no way of knowing how much to pay for the research (or the license). So the optimal response for foreign firm is to under-bid.
- it's also hard to verify the quality of products (intermidiate goods) produced by upstream operation due to multivariate nature of quality.
- well, because of information asymmetry, home firm always has incentives to cheat.

So when information asymmetry prevents verification of research effort a, and quality of products Q, to save transaction costs and get a fair valuation of its technology, research-upstream firm often chooses to internalize the downstream operation.

Ethier (1986), A theory based on OLI framework



One possibility of M domimnation A is shown in the graph on the left, where $1/a_H<w<1/a_{L.}$ and the technology dispersion is quite big.

The optimal choice is M over A, as shown in equation (3).

Note when M dominates A, w* at M is greater than w* at A. This is because at M, the presence of multinational firm moves foreign labor into manufacturing sector, marginal labor productivity in the wheat production sector thus improves, w* naturally rises.

Some further thoughts on Ethier (1986)

- Ethier's model predicts multinational activities take place between countries where relative factor intensity (such as labor/land or labor/capital) is similar (see again on p.827).

- This is generally in line with what we observe --- direct investments in industries that require high skills and more knowledge capital are mostly concentrated among developed countries, which are similar in factor intensity.

- But because there is only one wage rate across different sectors in the model, the theory failed to capture the fact that some direct investments happen simply because there are dissimilarities in factor intensity (see Markusen-Helpman's model in Ethier's reference list).

Some further thoughts on Ethier (1986)

- Lately, we even observe that investments in knowledge capital can happen when factor intensity significantly differs ---case in example: MNE's establishment of R&D centers in China and India, where human capital is as productive, but much cheaper.

Potential empirical test on Ethier (1986)

- To test Ethier's core idea on the relation between uncertainty of research outcome and incentives to internalize, one possibility is to look at whether FDI is partly driven by industry's skill intensity.

- Skill intensity could be measured by share of research workers relative to total number of workers in an industry, or could be measured by share of R&D investments relative to industry's total value-added.

- This test could be done both for a single country, such as the U.S. or for a group of countries, such as OECD countries.

Friedman on positive economics (Part 2)

- Last time, we have discussed
  - What is positive economics (vs. normative economics)?
  - Economic theory and its assumptions
    - Friedman's famous conclusion: *"The more significant the theory, the more unrealistic the assumptions."* --- However, the reverse may not be true.

- Today, we'll discuss what is a good theory, and how economic theories should be ultimately judged.

What is a good theory

- According to Milton Friedman, the ultimate goal of a positive science is the development of theory or “hypothesis” that yields valid and meaningful predictions about phenomena (not yet observed).
- Viewed as a body of substantive hypotheses, theory is to **be judged by its predictive power** for the class of phenomena which it is intended to “explain”.
- The prediction power is compared on a relative basis. If the existing theories all have relatively poor prediction power, then the best theory is the one that offers **better prediction power than all its available alternatives.**
- For alternative theories that have equal prediction power, **the simplest and least costly one, in terms of how expensive to test the theory,** should be the best theory.
- Friedman even argues that we should ditch the theory that is known to yield better predictions *but only at greater cost* (see his example of testing the gravity equation on p.11)

What is a good theory

- The “predictions” by which the validity of a hypothesis is tested need not be about phenomena that have not yet occurred (i.e., future events). They may be about phenomena that have occurred, but observations on which have not yet been made or are not known to the person making the prediction.
  - e.g. in-sampe and out-of-sample test of financial models

- However, a theory cannot be expected to work in every situation and all the time. As situation and time changes, a good theory then may become less good now. But again it may be still the best theory relative to all the available alternatives.

What is a good theory

- To illustrate the point that good theory may not be the all-around theory that is capable of explaining everything, let's see an example,
  - Downward sloping demand curve and upward supply curve are both very good theories in economics
  - But sometimes we observe upward demand curve, such as Giffen good, and downward supply curve, such as fire sale of financial asset during financial crisis.
  - But can we say the law of demand and supply is not a good theory??

What is a good theory

In summary, economists judge a theory (or hypothesis, or model) by its **prediction power.**

Other important criterion for a good theory:

- Parsimonicity or simplicity
- Cost to conduct empirical test of the theory
- Generalization - “explain much by little”!

Next time…

- Read Yeaple (REST, 2003)