



# The Global Firm

## Lecture 4

### Determinants of FDI Structure

Paul Deng  
Feb. 21, 2012

# Big Picture

The Global Distribution of Gross Domestic Product (GDP) in 2040, by Grouping of Nations

Grouping	Population (in millions)	Percent of total	GDP in billions of \$ (PPP)	Percent of total
United States	392	5	41,944	14
European Union (EU 15)	376	4	15,040	5
India	1,522	17	36,528	12
China	1,455	17	123,675	40
Japan	108	1	5,292	2
6 South East Asian Countries (SE6)	516	6	35,604	12
Subtotals	4,369	50	258,083	85
Rest of the World	4,332	50	49,774	16
World	8,701	100	307,857	101*

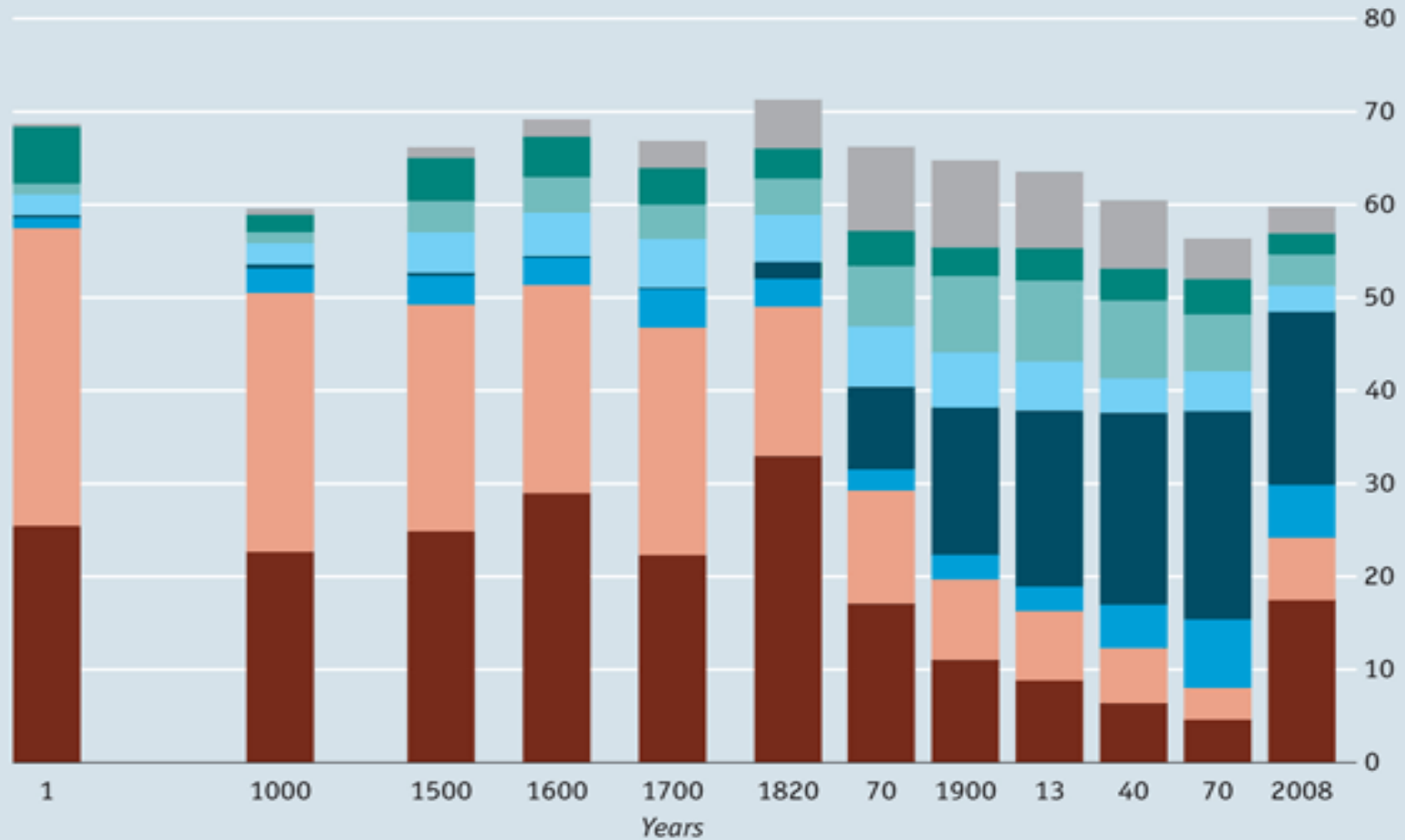
Note: GDP in U.S. dollars of 2000.

\*Total equals more than 100 percent due to rounding.

## A history of world GDP

Percentage of total, 1990 \$ at PPP\*

China India Japan US France Germany Italy Britain

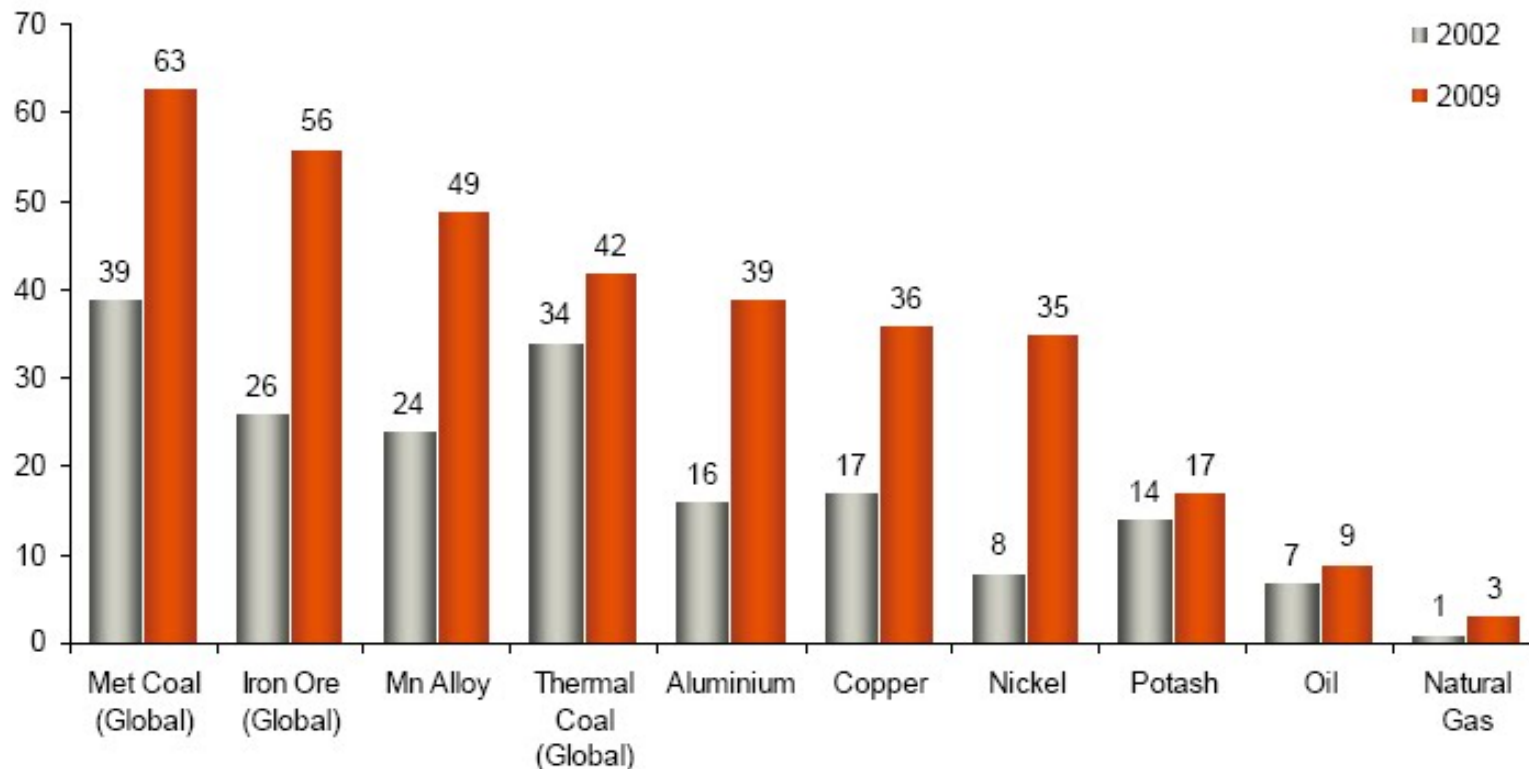


Sources: Angus Maddison, University of Groningen; *The Economist*

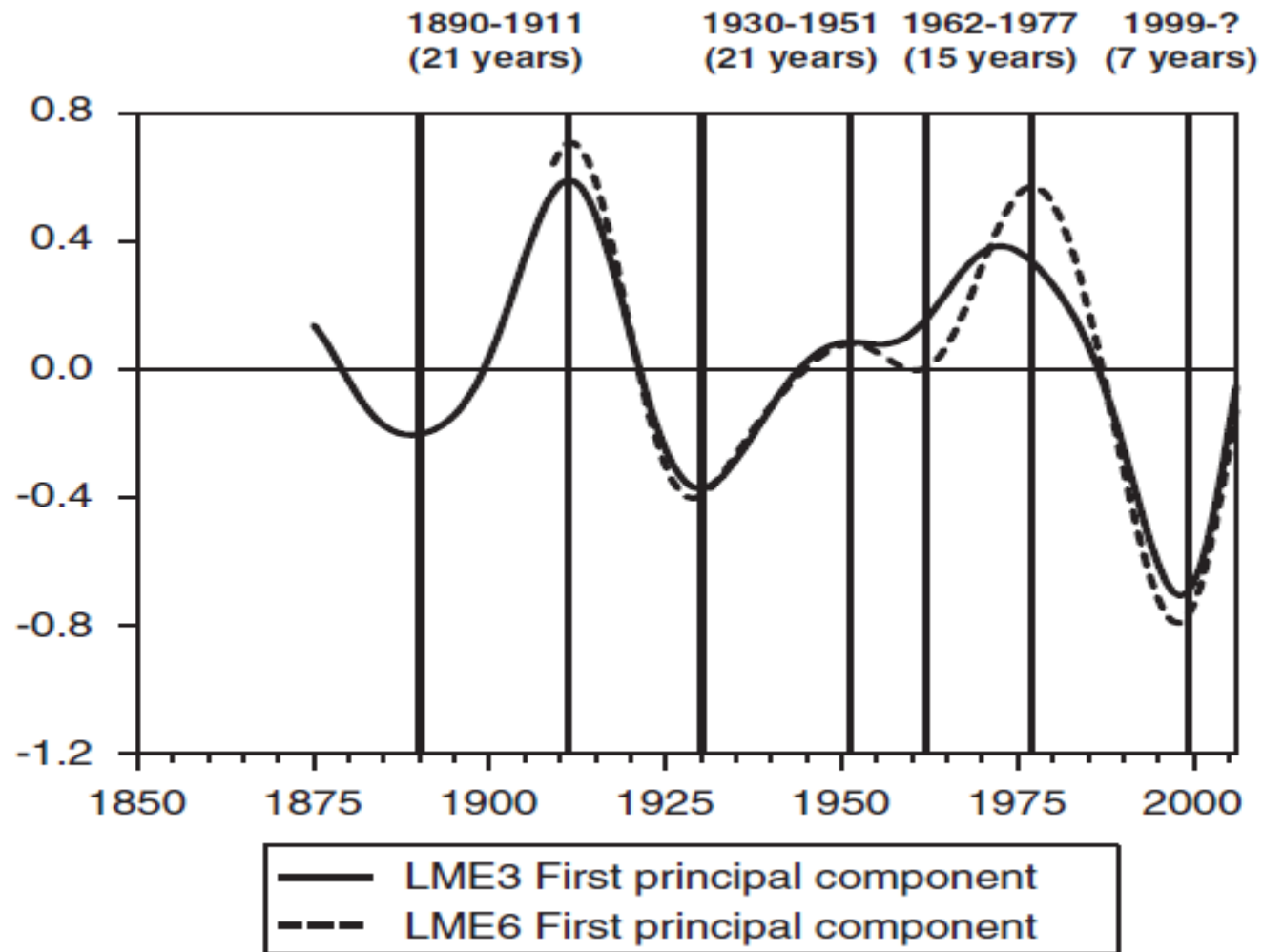
\*Purchasing-power parity

# China and World's Commodities

China's share of global demand by commodity (%)



# Commodity Super Cycles





## A bit theoretical background first...

- **Horizontal FDI (or HFDI)** is mostly motivated by gaining market access in a host country.
- **Vertical FDI (or VFDI)** is mostly incentivised by factor cost considerations, such as cheap labor or strategic resources. The feature of VFDI is its integration of different stages of production in different countries often based on factor cost.
- “The third type”: knowledge-capital based FDI
  - theorized by James Markusen
  - featuring a mixture of the two motives above (Yeaple’s paper is an example).



## Further analysis on the tradeoff of going global

We have previously discussed the inherent disadvantages of going global and the potential advantages under OLI framework. Now, here is something new:

### ■ For HFDI

- Costs: scale of economies foregone
  - HFDI involves duplication of the same physical assets, wasteful and it foregoes the benefits of economies of scale.
  - But we need to differentiate between
    - Plant vs. Firm - level scale economy (see the example on next slide)
    - Tangible vs. Intangible assets – plant-level scale economy matters less for intangible assets
- Benefits: market access and competition, saving of trade related costs, and bypass of trade barriers

# Two types of scale of economies

Table 2.1. Average firm and plant level size of US manufacturing firms, 1987.

	Plant size (A)	Firm size (B)	Plants per firm (ratio B/A)
Chemicals	132	1120	9.1
Transport equipment	663	4190	6.7
Food, beverages and tobacco	157	832	5.5
Paper, printing and publishing	125	610	5
Rubber and plastic	130	507	4
Electrical equipment	293	1123	3.8
Textiles	279	1056	3.8
Furniture	182	659	3.7
Machinery	172	615	3.7
Apparel	175	526	3
Miscellaneous manufactures	120	264	2.2
Leather	178	340	1.9
All industries	177	852	5

→ The higher the firm/plant size ratio, the more likely the firm will go global

→ In other words, the gain of economies of scale on a firm level outweighs the cost of foregone economies of scale at plant level!!!

Note: Size is measured by average number of employees. The sample only includes multi-unit firms, defined as firms with plants in at least two different locations.

Source: Elaborations on the US Bureau of Census Company Statistics found in Kim, S. (1998), The rise of multiunit firms in U.S. manufacturing, NBER WP 6425.





## Further analysis on the tradeoff of going global

- **For HFDI**

- Costs: scale of economies foregone
- Benefits: market access and competition, saving of trade related costs, and bypass of trade barriers

- **For VFDI**

- Costs: economies of integration foregone
  - It's cheaper to integrate productions in proximate places. This is the main argument for agglomeration after all— easy access to suppliers (remember GM and Fisher Body?), or easy access to the pool of skilled-labor (think of Silicon Valley).
- Benefits: cheaper factor cost
  - So for firms to have incentives to engage in VFDI, the cost of disintegration must be smaller than the gains from cheaper factor cost.

# Empirical implications

If we were to conduct empirical analysis, what are our priori expectations regarding the sign of coefficient?

**Table 2.3. Determinants of FDI: theoretical predictions**

<i>Determinants relate to</i>	<i>Determinants</i>	<i>Prediction by type of investment</i>	
		<i>Horizontal</i>	<i>Vertical</i>
<b>Types of firms/industries</b>			
	Firm level scale economies	+	+
	Plant level scale economies	-	?
	Product specific trade costs	+	-
	Costs to disintegrate stages of production	-	-
	Difference in factor intensity between stages of production	?	+
<b>Types of countries</b>			
	Trade costs (distance, trade barriers etc)	+	-
	Market size	+	?
	Factor cost differentials	?	+



## Yeaple (2003), skill endowments and US OFDI structure

- A clean, well structured empirical paper – good benchmark for your own empirical research
- The central research question asked by Yeaple is,  
    ***”What determines the US outward FDI?”***
- He considered two sets of factors:
  - Market access factors
  - Comparative advantage factors
- The novelty of this paper is its construction of comparative advantage factors – what Yeaple called the *”chain of comparative advantage”*



## Yeaple (2003) – Data for the empirical test

- A frequently used database of US MNEs from Bureau of Economic Analysis (or BEA) – a database you could use for your term paper, available on BEA website
- Including all the affiliates majority-owned by the US MNEs
- Based on a survey in 1994 (a bit old), covering US foreign affiliates in 39 countries and in 50 manufacturing industries (note: multi-year surveys are available, as in Hansen & Slaughter, 2001)
- The data is aggregated into the industry level (note: not the firm level data).



## Yeaple (2003) – Estimation equation

$$FDI_{ij} = \beta_1 T_{ij} + \beta_2 SE_i + \beta_3 MKT SIZE_j + \beta_4 UC_{ij} + \beta_5 CTR_j + \varepsilon_{ij}$$

Subscript *i* indexes industries, and *j* indexes countries.

Yeaple's main hypothesis is that US OFDI (proxied by 3 different measures of affiliate sales) is determined by a list of market access factors (including trade cost  $T_{ij}$ , scale economy,  $SE_i$ , and market size,  $MKT SIZE_j$ ), and a list of comparative advantage factors (to be discussed), plus a list of country-specific control variables,  $CTR_j$ , such as corporate tax rate.

Again, the construction of  $UC_{ij}$  (unit cost), which gauges comparative advantage, is the most novel part of this paper.



## Yeaple (2003) – Estimation equation

$$FDI_{ij} = \beta_1 T_{ij} + \beta_2 SE_i + \beta_3 MKT SIZE_j + \beta_4 UC_{ij} + \beta_5 CTR_j + \varepsilon_{ij}$$

$UC_{ij}$  is a vector of variables that reflect a host country (j)'s unit cost of production by industry, i. The unit cost of production is one way of to capture comparative advantage.

Normally, developed countries are with relative abundance in skilled labor, so these countries enjoy comparative advantage in industries with higher skilled-labor intensity;

Similarly, developing countries are with relative abundance in unskilled labor, so these countries enjoy comparative advantage in industries with lower skilled-labor intensity.

Since unit cost is not observable in the data, it is hypothesized to take the following expression:

$$\beta_4 UC_{ij} = \beta_6 HC_j + \beta_7 HC_j \times SK_i + \beta_8 SK_i$$

$HC_j$  is the relative human capital abundance of host country j,

$SK_i$  is the skilled-labor intensity of industry i.

## Yeaple (2003) – Priori expectations

$$\beta_4 UC_{ij} = \beta_6 HC_j + \beta_7 HC_j \times SK_i + \beta_8 SK_i$$

$HC_j$  is the relative human capital abundance of host contry j,

$SK_i$  is the skilled-labor intensity of industry i.

**What signs should we be expecting for  $\beta_6$ ,  $\beta_7$ , and  $\beta_8$ ?**

If we were to expect FDI's mostly happen because firms invest in host countries with similar endowment in human capital (Ethier, 1986), then  $\beta_6$  should take a positive sign; but if we were to expect most US firms invest abroad due to factor cost considerations, then  $\beta_6$  should take a negative sign (see Markusen-Helpman, the comparative advantage story). In short, theories predict  $\beta_6$  could be either positive or negative - so we temporarily put a “?” on  $\beta_6$ .

Similar argument can be made to  $\beta_8$  - it could be either positive or negative.

However, if we were to believe Yeaple's story that comparative advantage dominate, then both  $HC_j$  and  $SK_i$  should take negative signs as US firms would want to invest in those host countries /industries where both measures are relatively low.



## Yeaple (2003) – Priori expectations

$$\beta_4 UC_{ij} = \beta_6 HC_j + \beta_7 HC_j \times SK_i + \beta_8 SK_i$$

**What sign should we be expecting for  $\beta_6$ ,  $\beta_7$ , and  $\beta_8$ ?**

The most interesting part of the regression is the interaction term,  $HC_j \times SK_i$  - that's what Yeaple called "*chain of comparative advantage*".

The interpretation of this interaction term is tricky.

The sign of  $\beta_7$  should tell us a story of how the US MNEs decide which industry ( $SK_i$ ) to invest for a host country with a given human capital endowment,  $HC_j$ .

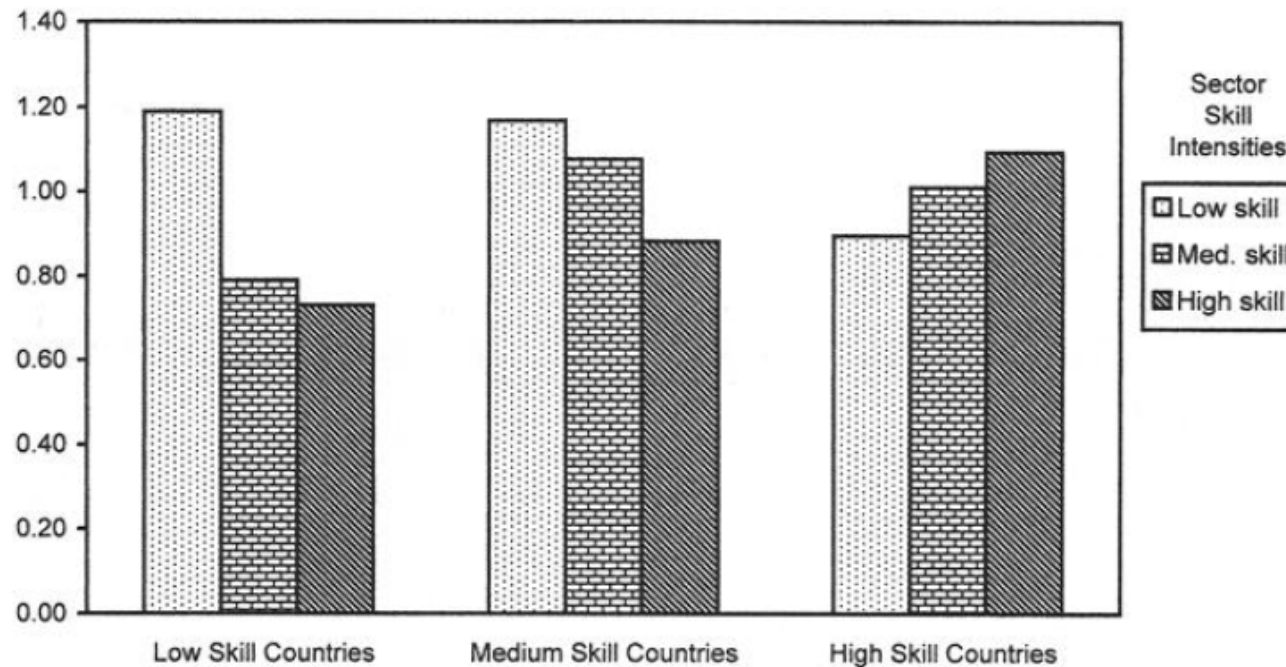
A positive sign of  $\beta_7$  combined with a negative sign of  $\beta_6$ , i.e., when  $\beta_6 < 0$  and  $\beta_7 > 0$ , would indicate skilled-labor-abundant countries tend to receive less FDI than skilled-labor scarce countries in the least skilled-labor-intensive industries, and more FDI in the most skilled-labor-intensive industries (see the graph from the actual data on next slide...)

Similar interpretation would apply when  $\beta_8 < 0$  and  $\beta_7 > 0$ .



# Chains of comparative advantage

FIGURE 1.—REVEALED COMPARATIVE ADVANTAGE INDICES FOR COUNTRIES GROUPED BY SKILL ENDOWMENTS AND INDUSTRIES GROUPED BY SKILL INTENSITY



# Empirical results

TABLE 1.—THE DETERMINANTS OF THE LEVEL OF TOTAL AFFILIATE SALES

Variable	(1)	(2)	(3)	(4)
<i>FREIGHT</i>	-0.60 (0.35)	0.00 (0.16)		-0.49 (0.33)
<i>TARIFF</i>	0.45 (0.18)	0.40 (0.23)		0.56 (0.19)
<i>PSCALE</i>	-1.07 (0.72)			-1.05 (0.72)
<i>CSCALE</i>	0.60 (0.55)			0.77 (0.53)
<i>MKTSIZE</i>	1.79 (0.11)			1.82 (0.11)
<i>CLOSEFDI</i>	-1.92 (0.30)		-2.25 (0.26)	-2.02 (0.31)
<i>TAX</i>	-0.99 (0.25)		0.65 (0.21)	-1.07 (0.25)
<i>HC</i>	-30.79 (6.22)		-25.64 (5.95)	
<i>HC</i> × <i>SK</i>	6.73 (1.35)	6.93 (1.23)	6.51 (1.29)	
<i>SK</i>	-15.42 (3.04)		-14.98 (2.77)	
<i>N</i>	1,930	1,930	1,930	1,930
<i>R-square</i>	0.255		0.093	0.239

Please refer to the paper for detailed discussions. Regression Table 3 is also worth digesting.



# Empirical results

To recap, the empirical test confirmed the following:

- Higher tariff tends to increase FDI – this confirms the theory that FDI is an indirect way to bypass trade barriers, such as tariff.
- Host country's **market size** is a big positive contributing factor for more FDI.
- Higher corporate tax rates work against FDI inflow into the host country.
- Last but not least, "chain of comparative advantage" factors worked as expected.

# Horizontal vs. Vertical

TABLE 2.—THE DETERMINANTS OF AFFILIATE SALES TO THE HOST COUNTRY AND TO THE UNITED STATES

Variable	(1) <i>LAS</i>	(2) <i>XAS</i>
<i>FREIGHT</i>	-1.29 (0.22)	-3.67 (0.29)
<i>TARIFF</i>	0.68 (0.21)	-0.13 (0.28)
<i>PSCALE</i>	-1.16 (0.37)	0.28 (0.49)
<i>CSCALE</i>	0.85 (0.20)	0.38 (0.27)
<i>MKTSIZE</i>	3.13 (0.15)	4.62 (0.23)
<i>CLOSEFDI</i>	-5.41 (0.47)	-6.49 (0.66)
<i>TAX</i>	-1.40 (0.46)	-2.78 (0.62)
<i>HC</i>	-50.58 (10.02)	-58.00 (13.47)
<i>HC</i> × <i>SK</i>	11.08 (2.19)	12.55 (2.93)
<i>SK</i>	-24.99 (4.58)	-25.98 (6.17)
<i>N</i>	1,930	1,930
Log likel.	-4460	-3032

Constant suppressed. All variables except *CLOSEFDI* are in logs.

# Export vs. FDI

Dependent variable:  
EXSH

TABLE 3.—THE DETERMINANTS OF THE COMPOSITION OF  
INTERNATIONAL COMMERCE

Variable	(1)	(2)	(3)	(4)
<i>FREIGHT</i>	-0.27 (0.07)	-0.13 (0.04)		-0.30 (0.07)
<i>TARIFF</i>	-0.10 (0.04)	-0.02 (0.06)		-0.18 (0.06)
<i>PSCALE</i>	0.34 (0.17)			0.33 (0.20)
<i>CSCALE</i>	-0.15 (0.13)			-0.26 (0.17)
<i>MKTSIZE</i>	-0.27 (0.02)			-0.26 (0.02)
<i>CLOSEFDI</i>	0.56 (0.09)		0.51 (0.06)	0.61 (0.10)
<i>TAX</i>	0.01 (0.04)		-0.25 (0.04)	0.02 (0.05)
<i>HC</i>	6.32 (1.53)		2.45 (0.87)	
<i>HC × SK</i>	-1.31 (0.33)	-0.82 (0.28)	-0.58 (0.19)	
<i>SK</i>	3.93 (0.78)		2.12 (0.46)	
<i>N</i>	1,930	1930	1930	1930
<i>R-square</i>	0.223		0.135	0.149

Constant suppressed. Standard errors in parentheses are heteroskedasticity-consistent and allow for clustering by industry. All variables except *CLOSEFDI* are in logs.



# Some further thoughts

- A detailed read of Yeaple's paper, especially the results in Table 1, shows that market access factors contributed a lot more than comparative advantage factors in US' OFDIs --- Market size alone explains about 15% of US FDI outflow variation (see Yeaple, p.731).
- The relative importance of market access factors indicates most US OFDIs were horizontal-FDIs.
- This is partly due to the data used for the empirical test, which is around early 1990s. More recent data have tended to show much more important contribution of factor costs. In other words, VFDI has become more common (see Hanson & Slaughter, 2001, our reading next week).
- So far, we have discussed the choice between HFDI and VFDI as if they must appear separately. However, if a country can offer MNEs benefits in both market access and cheap factor inputs, it's not surprising to find both HFDIs and VFDIs co-exist in one country (China is an example).



## Next time...

Read Hanson & Slaughter, 2001, “Expansion Strategies of US Multinational Firms”, NBER, w8433.

Reminder: for easier access to the reading list and course update, use the course website at: [http://www.pauldeng.com/teaching/global\\_firm](http://www.pauldeng.com/teaching/global_firm)