

Inward Investment, Knowledge
Transfers and Productivity:
What does the UK evidence reveal?

Nigel Pain

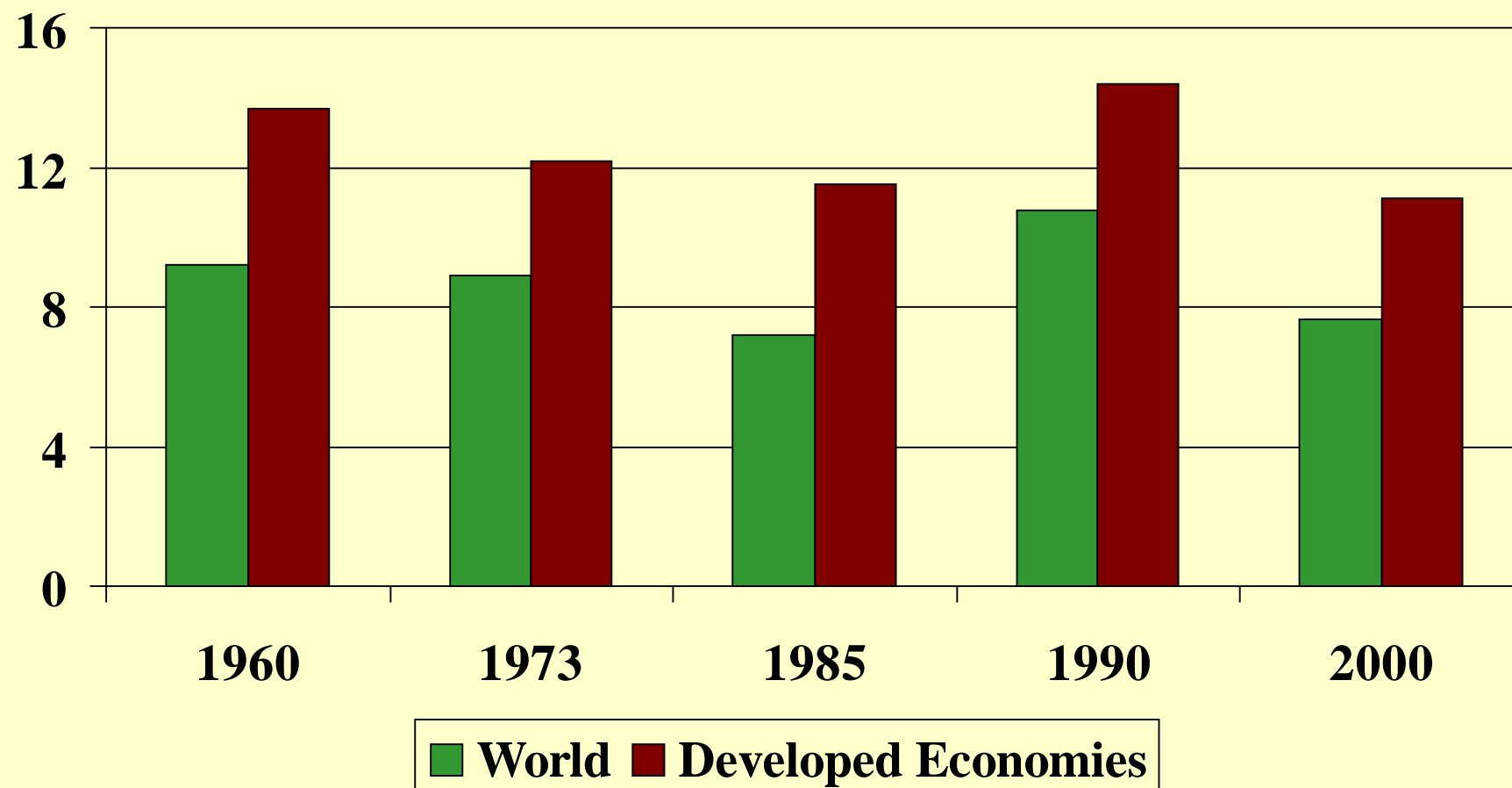
NIESR

September 2002

Outline

- One measure of inward investment - the global FDI stock- has risen by 8% p.a. in real terms since 1973.
- Most FDI takes place between developed economies, with firms from knowledge-intensive industries more likely to invest overseas.
- Does this knowledge benefit host economies such as the UK?
 - compositional and behavioural effects
 - focus on productivity, investment and R&D
- There is evidence of positive spillovers, but not necessarily in all industries or locations.

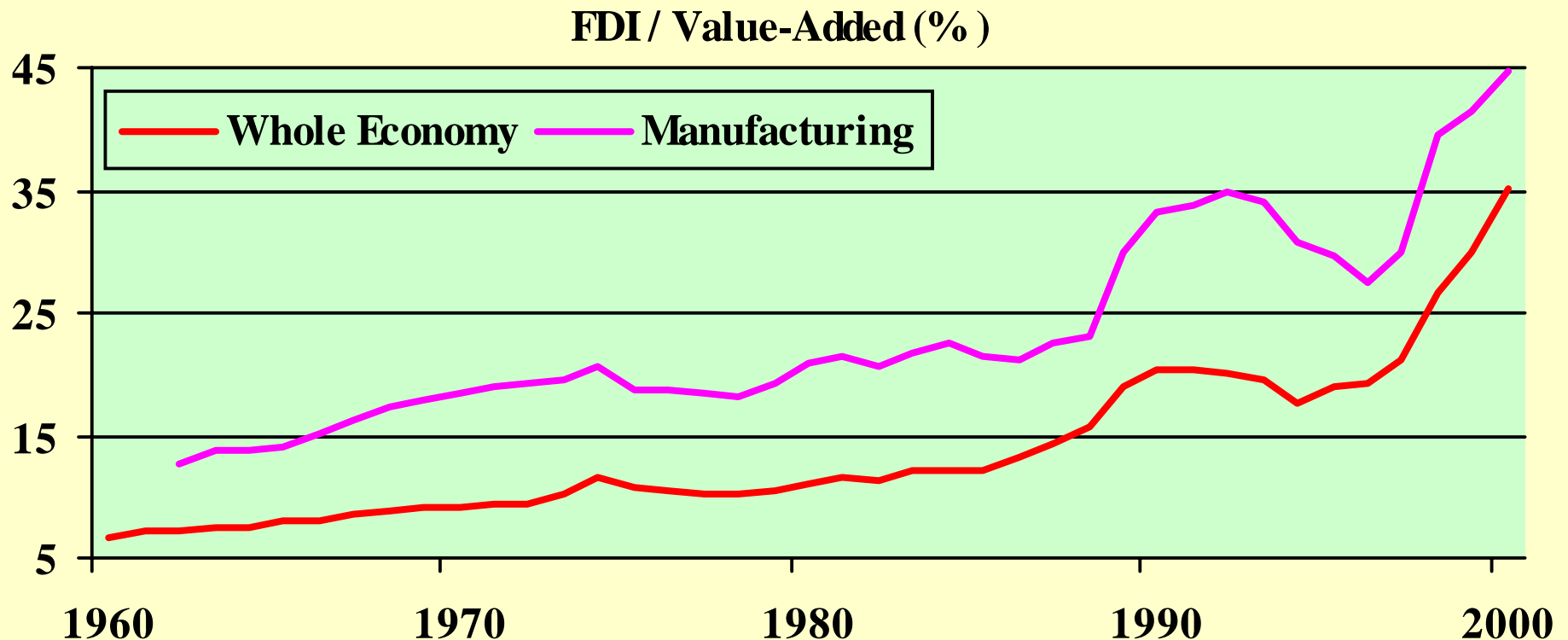
UK Share of Total Inward FDI Stock (%)



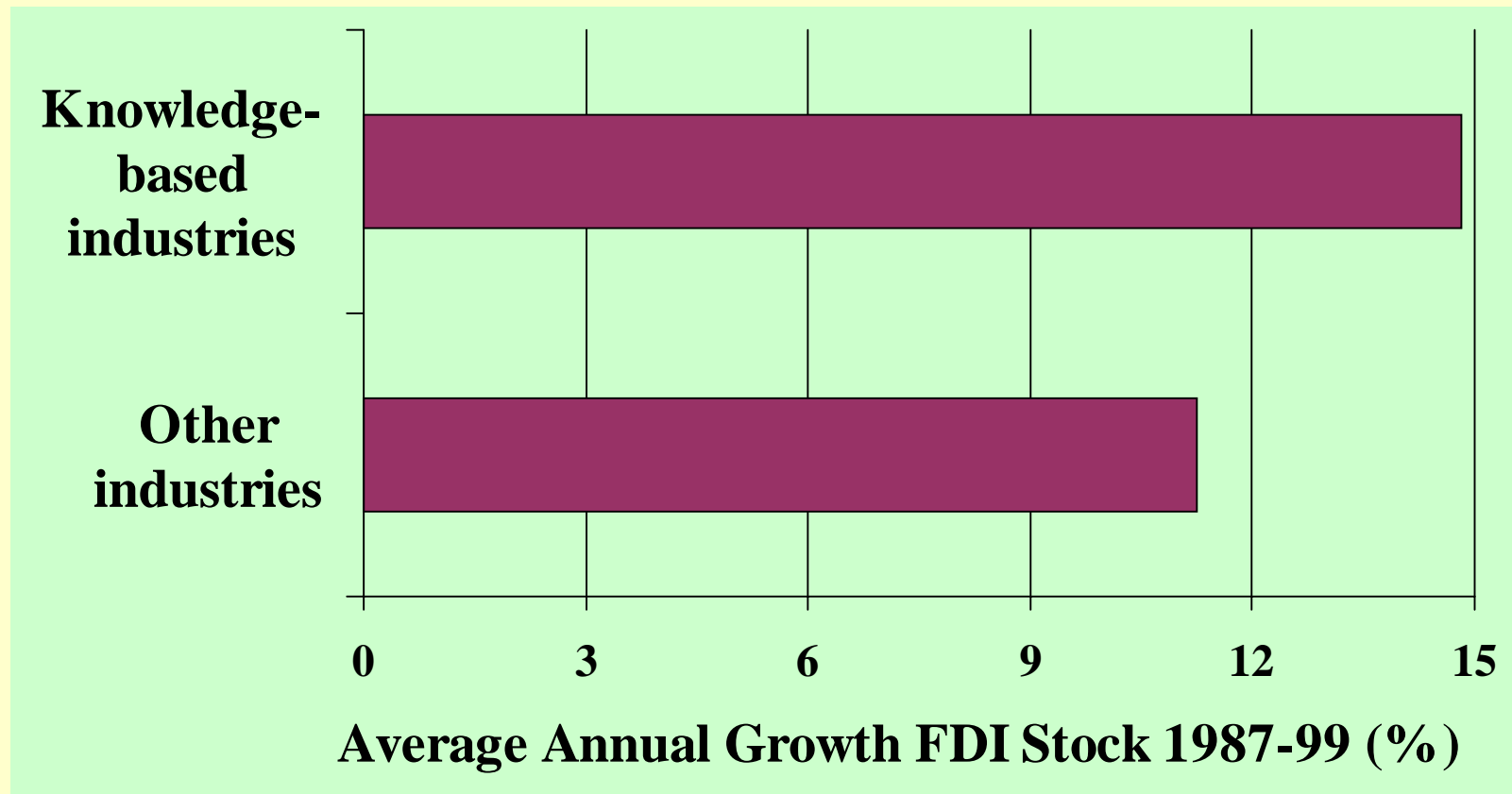
UK GDP is about $3\frac{1}{4}\%$ of world GDP and $5\frac{1}{4}\%$ of OECD GDP

Inward Investment in UK

- Inward FDI stock risen from 6½% of GDP in 1960 to 35% by 2000:
 - UK largest host in EU (partly oil); 1/3 of FDI from US
 - US-owned firms produce 7% of UK GDP



FDI in the UK has risen more rapidly in knowledge based industries (45% of 1999 stock).



Knowledge-based industries: chemicals, electronics, transport equipment, financial services, communications

The Sources of Growth

- Economic growth comes from two sources:
 - an increase in the quantity and quality of inputs (labour, human and physical capital)
 - an increase in the efficiency with which inputs are combined (total factor productivity [TFP])
- TFP will include:
 - technical progress and the accumulation of knowledge
 - improvements in organisational efficiency (product market competition)
 - economies of scale
- Inward investment can raise fixed capital and the supply of skilled labour directly and affect TFP.

Foreign Firms and Productivity

- Theory and empirics both stress the positive links between firm-specific knowledge-based assets and the decision to invest abroad.
- Technologies, ideas, skills, working practices & information transferred across national borders.
- These could have compositional and behavioural effects on host economies:
 - average characteristics of foreign firms differ to those of domestic firms (*compositional*)
 - ‘spillovers’ from the presence of foreign firms affect the performance of domestic firms (*behavioural*)

Spillovers from Inward Investment

- Spillovers may be intra-industry or inter-industry
 - intra: demonstration, competition, worker mobility
 - inter: demonstration, worker mobility, supplier upgrading
- These may affect productivity directly (technical efficiency) or indirectly (competition, investment, R&D, exporting).
- Spillovers may be region-specific.
- Spillovers may be negative as well as positive.
- Reasons for spillovers and mechanisms by which they take place are unclear (*also true other models*).

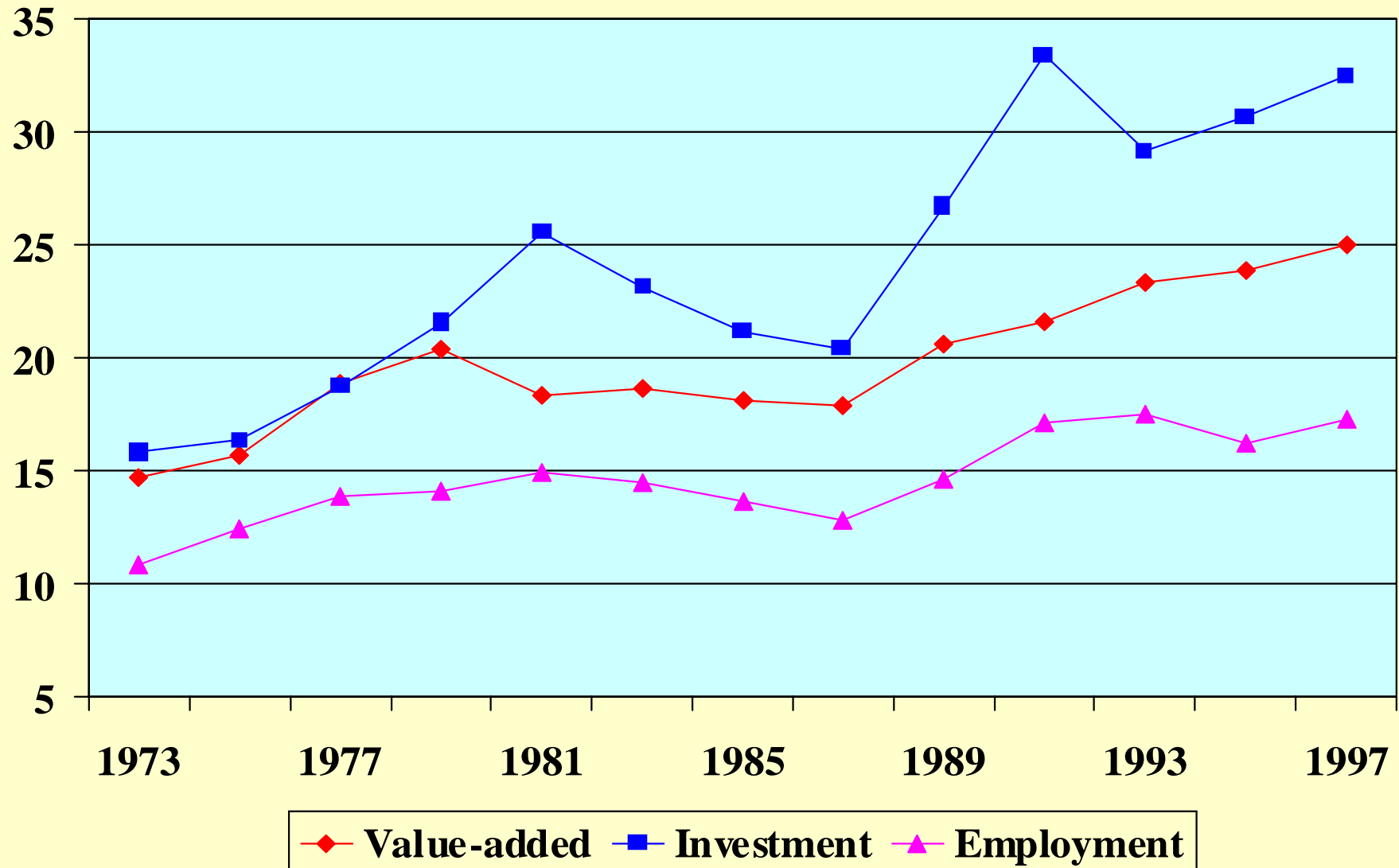
Modelling Spillovers

- How to measure the available stock of foreign ‘knowledge’?
 - industry share of foreign firms is a good measure of competition over time, but it is not a good indicator of changes in the level of technologies over time
 - the level of foreign output/efficiency may be better
- Knowledge can be transferred independently of the level of FDI or the share of foreign firms.
 - the existence of a single firm may be sufficient.
- Data poor for non-manufacturing sectors.

Foreign Firms Share Of Manufacturing (% p.a.)

	<u>1973-79</u>	<u>1981-89</u>	<u>1990-97</u>
Value-added	17.4	18.5	23.9
Investment	18.1	22.2	30.9
Employment	12.8	13.8	17.4
Operatives	12.0	12.8	16.0
Non-operatives	15.2	16.4	19.9

Foreign Firms Share of UK Manufacturing (%)



Foreign Firms In UK and France (% share of manufacturing)

		<u>1973/4</u>	<u>1987</u>	<u>1997</u>
Output	UK	14.7	17.9	25.0
	France	22.2	25.2	34.4
Labour	UK	10.8	12.8	17.3
	France	17.5	21.6	29.2
Investment	UK	15.8	20.4	32.5
	France	21.8	25.6	35.3

Firm-Level Evidence For The UK

- The measured labour productivity advantage of foreign firms partly reflects size and scale, capital inputs and the industry mix
- Controlling for these, firm-specific assets give a foreign labour productivity advantage of 5-15%.
- The measured advantages are largest for US firms:
 - 1997, foreign labour productivity in manufacturing 60% above UK firms (89% US, 26% JP, 21% EU)
 - broadly comparable to cross-country differentials in manufacturing productivity (1996 advantages: US 71%, JP 47%, FR 30%, GE 26%)
- The key factor may be multinationality.

Productivity Spillovers: Endogenous Technical Progress

- CES production function:

$$Q = \gamma \left[s (K)^{-\rho} + (1 - s) (L e^{\lambda t})^{-\rho} \right]^{-(v/\rho)} \quad [1]$$

- Log-linear ‘desired’ labour demand:

$$\ln(L^*) = \frac{1 + \sigma(v-1)}{v} \ln(Q) - \sigma \ln\left(\frac{w}{p}\right) - (1 - \sigma)\lambda t + k \quad [2]$$

- Technical progress:

$$\lambda t = \lambda_t TIME + \lambda_f \ln(FDI) + \lambda_m \ln(M) + \lambda_r \ln(R\&D) \quad [3]$$

- Allowing for adjustment costs:

$$\Delta \ln(L_t) = \beta_0 + \beta_1 \Delta \ln(Q_t) + \beta_2 \ln(L_{t-1} / L_{t-1}^*) + \varepsilon_t \quad [4]$$

This model is estimated for domestic firms only.

Manufacturing: (Hubert & Pain, 2001)

- Using a data set for UK-owned firms in 15 manufacturing industries for 1983-92:
 - Intra-industry and inter-industry effects from foreign firms value-added are both significant and of a similar magnitude.
 - A 1% rise in foreign firms output (1990 prices) in all sectors will raise technical progress by 0.5-0.6%.
 - Results robust to the inclusion of imports and R&D.
 - US firms have a larger effect and EU firms a statistically smaller effect than others.
 - Similar results obtained using FDI stocks.

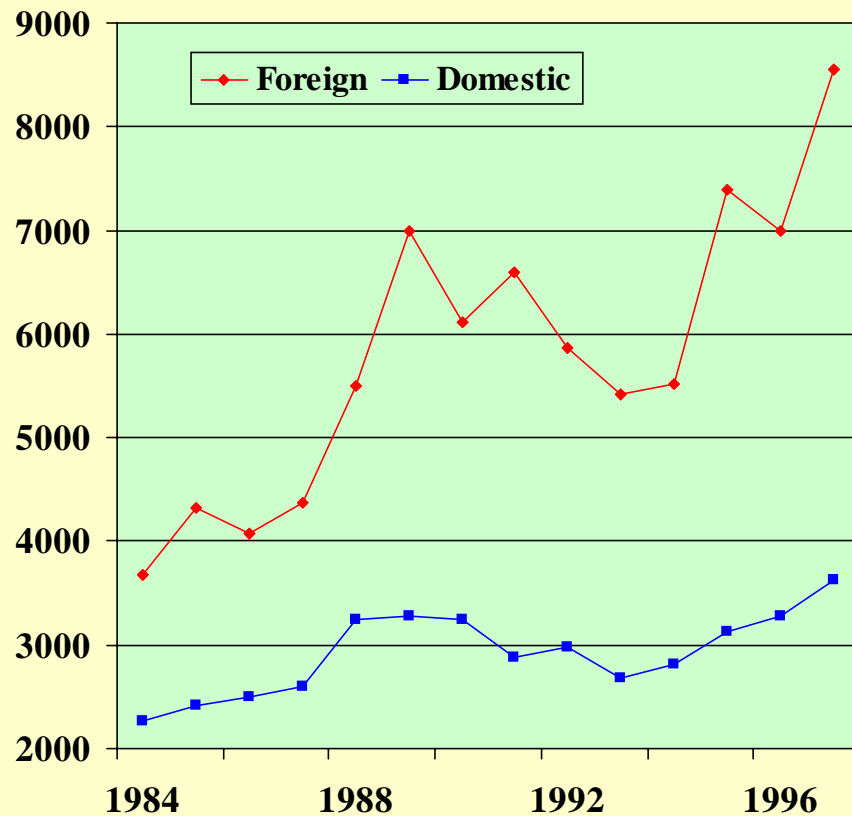
Non-Manufacturing: Hubert/Pain (2000)

- Using a data set for all firms in 3 service sectors: distribution, transport/communications and business services and for 1972-1996:
 - A 10% in the inward FDI stock (1990 prices) raises technical progress by 1.35%. Technical progress also has exogenous trend component worth 1.9% p.a.
 - Equivalent parameters for manufacturing 3.2% (FDI) and 2.9% per annum.
- Combining the compositional and behavioural effects for 1972-96:
 - inward FDI accounts for up to one-third of output growth in these sectors (66% of GDP)

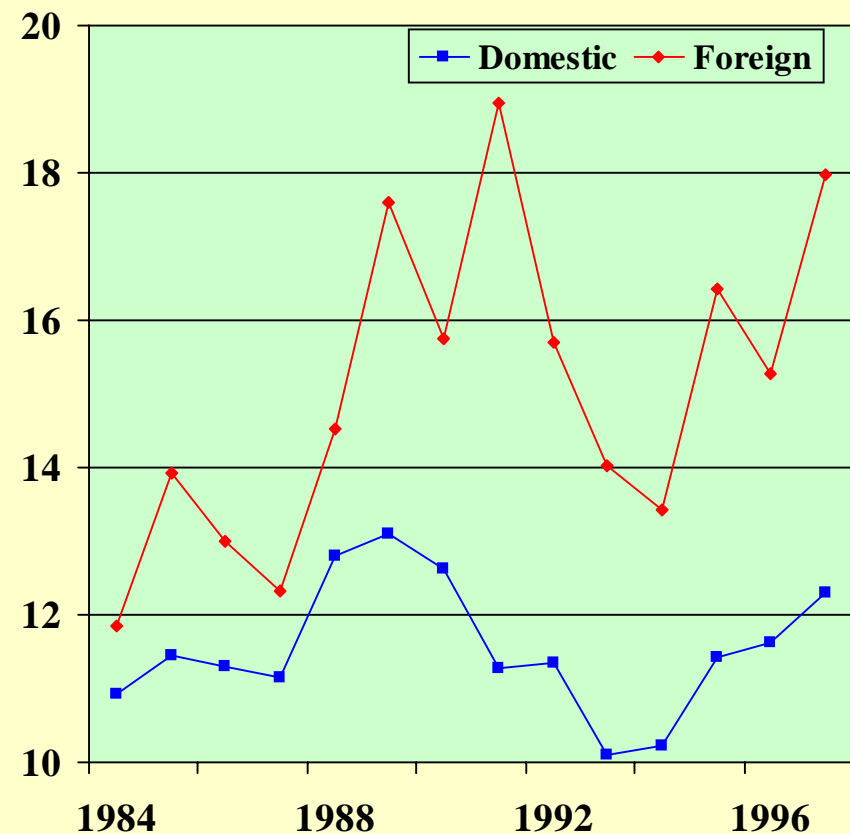
Fixed Capital Formation in the UK

Foreign-firms have helped to raise the capital intensity of manufacturing production in the UK
(3 digit data 1984-1997, 90 industries)

Investment per worker (£,1995)



Investment Intensity (%)



Accounting For Changes in Investment

- Aggregate changes in investment intensity stem from:
 - changing investment intensity in each industry ('within' effects)
 - changes in the share of industries in total output/demand ('between' effects)
- These can be calculated separately for foreign and UK-owned firms.
- This decomposition can be done for investment intensity (I/Y) and investment per worker (I/L)

- If foreign and domestic firms behaved in a similar manner, foreign firms should account for 20-25% of aggregate changes in I/Y or I/L:
 - accounting decompositions for 1984-97 show foreign firms account for 84% of \uparrow in I/Y and 48% of \uparrow in I/L
 - majority of effects are due to changes ‘within’ industries and nationalities rather than ‘between’ them
- The aggregate change in investment intensity was more than accounted for by changes in 6 out of 21 two-digit industries
 - largest effects in motor vehicles, chemicals and radio/TV/communications
 - some industries with negative effects

Accounting For Changes In Investment Intensity (11.11% 1984, 13.74% 1997)

	Average Annual Change (%)	'Between' contribution		'Within' contribution	
		Foreign	Domestic	Foreign	Domestic
1984-97	1.65 %	0.66 %	-0.41 %	0.72 %	0.68 %

Decomposition of 'between industry' changes in investment intensity

	'Between' contribution	Ownership		Upgrading	
		Foreign	Domestic	Foreign	Domestic
1984-97	0.25 %	0.50 %	-0.39 %	0.16 %	-0.02 %

The aggregate change in investment intensity is more than accounted for by changes in 6 out of 21 two-digit industries

Two-Digit Industries Contribution to Average Annual Changes in Investment Intensity (%pts)

All Nationalities (Total Change 1.65% per annum)

Gains			Losses		
Industry	Contribution	Output Rank	Industry	Contribution	Output Rank
Motor Vehicles	0.616	6	Non-Met Min Prods	-0.157	15
Chemicals	0.420	2	Precision Instruments	-0.125	11
Radio/TV/Comms	0.313	12	Fuels	-0.068	20
Publishing	0.235	4	Food and Drink	-0.060	1
Rubber/Plastics	0.200	8	Textiles	-0.053	17
Furniture/Jewellery/Other	0.153	16	Clothing	-0.042	13
%of Total Change	117.1%		%of Total Change	-30.6%	

Can UK firms learn from foreign firms?

$$\Delta \left[\frac{I}{Y} \right]_{Di,t} = \alpha_i + \left[\beta + \gamma \text{FSHARE}_{i,t-1} \right] \left[\left(\frac{I}{Y} \right)_{Fi} - \left(\frac{I}{Y} \right)_{Di} \right]_{t-1} + \sum \lambda_t T_t$$

- Do domestic firms try to close the investment gap?
- What is the effect of foreign competition measured by the market share of foreign-owned firms?
- Preliminary work suggests there may be significant positive spillovers from intra-industry demonstration effects (β and γ both significant) :
 - a gap of +1% pt between I/Y in foreign and UK firms, will raise I/Y for UK firms by 0.12% pts if foreign share of industry is 10% and 0.2% pts if share 30%.

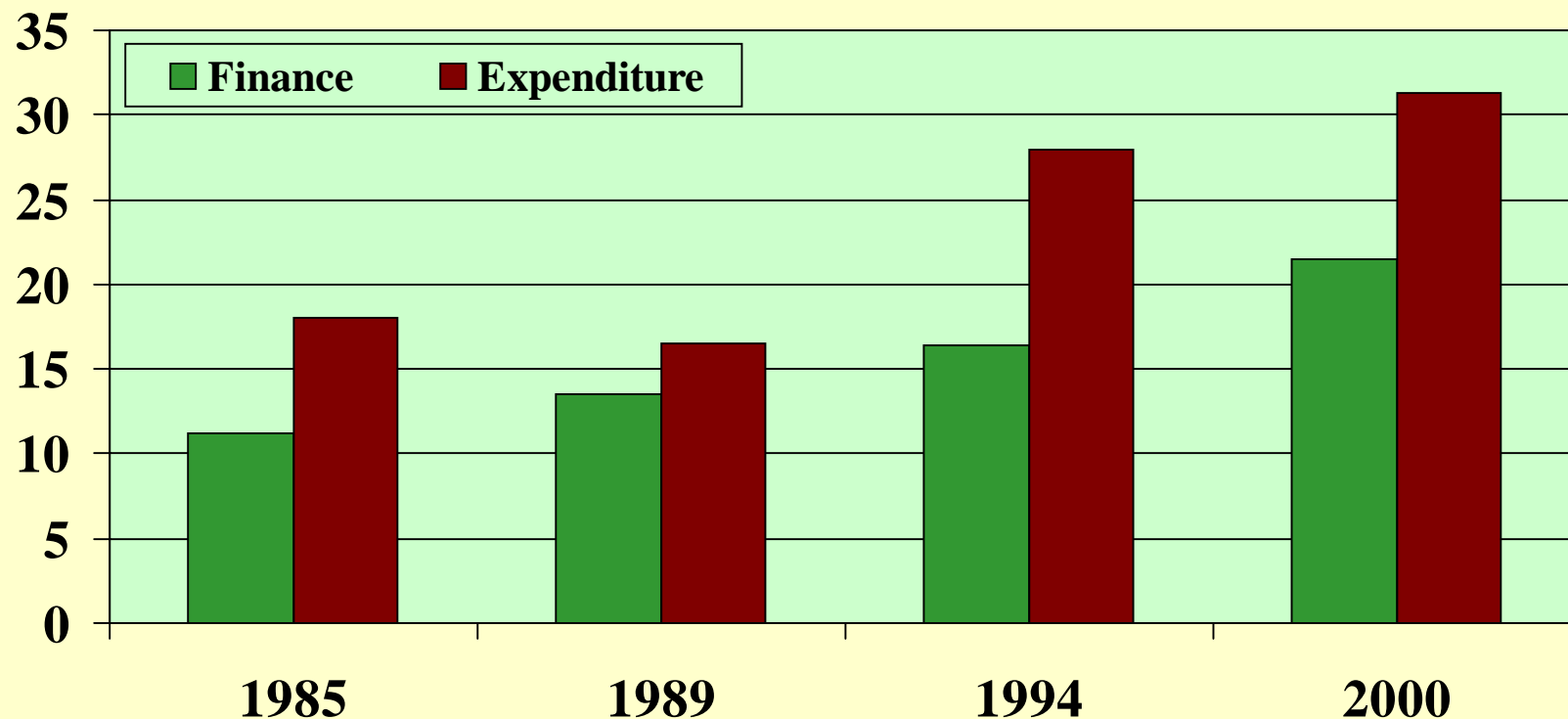
Some Next Steps

- Are there inter-industry effects?
- Are effects common to all industries?
- Why can foreign firms operate in UK with higher capital-labour ratios? (Management skills, finance?)
 - Not just a multinationality (size) effect. Evidence for France shows that on average foreign firms are more investment intensive than French ones, but UK firms are not.

		1984	1987	1991	1994	1997
	FRANCE					
Investment - intensity (%)	French firms	11.1	13.0	14.7	11.4	12.9
	Foreign firms	11.5	13.3	15.8	12.4	13.4
	UK firms	9.8	13.1	12.0	11.3	10.8

R&D

- Key driver of long-run growth but little work on determinants (especially at macro level)
- Growing proportion of UK BERD financed and undertaken by foreign firms:



R&D (con.)

- A key question is whether foreign firms simply takeover R&D previously done by UK firms, or expand the total level of R&D.
- Empirical evidence of the determinants of UK industry R&D expenditures suggests that R&D intensity and the growth of R&D are higher in those industries with a higher foreign share of R&D:
 - a rise of 1% pt in the foreign share in (t-1) raises the growth of R&D in (t) by 0.5% and the long-run level of R&D by 0.8%.
 - controls for profitability (+), import penetration (+), output growth (+), government finance (+) and real interest rates (-).

Summary

- Inward investment is one source of technical progress in at least some industries and regions.
- Inward investment brings ideas that can be applied across industries. Imports bring new technologies (and competition) that are industry-specific.
- Inward investment is not the only factor driving productivity growth but it is an important one.
- But many questions remain to be answered about the ways in which spillovers (and other forms of productivity catch-up) occur.

- Little is known about the factors that govern the size and distribution of spillovers.
 - Are spillovers generic to all investors (innovation in large firms)?
 - How important are inter-industry spillovers and how are they transmitted?
 - How important is labour mobility?
 - How important are competitive markets?
 - Is the assimilation of new technologies and ideas dependent on workforce skills?
 - Does the mode, sector and region of entry matter?