

# Knowledge Transfer and Intra-Firm Trade

Sotiris Blanas<sup>1</sup>   Adnan Seric<sup>2</sup>

<sup>1</sup>UCLouvain (IRES) and FNRS

<sup>2</sup>UNIDO

FIW - Conference International Economics

December 3, 2015

Vienna

# Motivation

- Foreign affiliates with intra-firm trade relatively few (Ramondo, Rappoport and Ruhl, 2015; Blanas and Seric, 2015)
- Firm boundaries facilitate the transfer of intangibles (Arrow, 1969; Teece, 1977; Atalay, Hortcacsu and Syverson, 2014)
  - Tacit knowledge → Incomplete contracts
  - Asymmetric information → Market failure (Ethier, 1986)
  - Risk of knowledge diffusion and expropriation → Need for knowledge internalisation (e.g. Apple Vs Samsung)
- Parent company as coordinator of local and global production
- Knowledge transfer for coordination purposes
- Coordination requirements relatively high under intra-firm trade
- Production of final output and the flow of knowledge and ideas

- Foreign affiliates without intra-firm trade:
  - With arm's length trade and/or local backward linkages
  - With no trade and no local backward linkages
- Foreign affiliates without intra-firm trade tend to have relatively low needs for coordination with their parent
- Differences in coordination requirements between foreign affiliates with and without intra-firm trade
- Differences in knowledge transferred to them from their parent?

# This paper

- Study the relationship between the existence and value share of a foreign affiliate's intra-firm trade and the knowledge transferred to it from its parent
- Sample of 1675 foreign affiliates with and without intra-firm trade in 19 countries in sub-Saharan Africa in 2009
- No causality, only correlations
- Novel empirical results and theoretical background
- Identification of differences in knowledge transfers to different types of foreign affiliates
- Better understanding of the coordination between the parent and different types of foreign affiliates

# Preview of findings

- Extensive and intensive margins of intra-firm trade positively associated with knowledge transfer from the parent in the form of:
  - Patents, trademarks, brand names
  - Technology and know-how
  - Assistance in access to finance, foreign supplier network, global markets
- Positive association weakens when foreign affiliate operates in a country of relatively high institutional quality
- More evidence on parental assistance in access to finance
  - Parent as a source of finance of working capital and fixed assets (extensive and intensive margin)

# Outline

- 1 Related literature
- 2 Theoretical background
- 3 Data and stylised facts
- 4 Econometric model & estimation strategy
- 5 Empirical results
- 6 Robustness checks
- 7 Concluding remarks and further research

# Outline

- 1 Related literature
- 2 Theoretical background
- 3 Data and stylised facts
- 4 Econometric model & estimation strategy
- 5 Empirical results
- 6 Robustness checks
- 7 Concluding remarks and further research

- Transfer of intangible assets easier within the boundaries of the firm (sample of domestic firms in the US) (Atalay et al., 2014)
- Theories of the firm (TCA and PRT)
- Tacit knowledge and incomplete contracts (Arrow, 1975; Teece, 1982; Keller, 2004)
- Market failure due to asymmetric information (Ethier, 1986)
- Risk of knowledge diffusion and expropriation and the need for knowledge internalisation (Antràs and Rossi-Hansberg, 2009)
- Firm as an institution for knowledge integration (Grant, 1996)
- “Technical dialogue” among production stages (Demsetz, 1988)
- Flow of ideas/knowledge within the firm and production (Simon, 1991)

# Outline

- 1 Related literature
- 2 Theoretical background**
- 3 Data and stylised facts
- 4 Econometric model & estimation strategy
- 5 Empirical results
- 6 Robustness checks
- 7 Concluding remarks and further research

# Theoretical background

- Yeaple (2005)'s concept: homogeneous firms choose among a set of technologies and become heterogeneous
- Firms decide over two modes of organisation of production before they set up a foreign affiliate
- With intra-firm trade (ift) Vs Without intra-firm trade (nift)
- Without intra-firm trade:
  - Arm's length trade and/or local backward linkages
  - No trade and no local backward linkages (fully autonomous)
- Each mode implies different coordination requirements (I) between the parent and the foreign affiliate
- Choice of a mode made simultaneously with choice of knowledge transfer (K) from the parent to the foreign affiliate
- $I_{ift} > I_{nift}$  implies  $K_{ift} > K_{nift}$

# Outline

- 1 Related literature
- 2 Theoretical background
- 3 Data and stylised facts**
- 4 Econometric model & estimation strategy
- 5 Empirical results
- 6 Robustness checks
- 7 Concluding remarks and further research

- Data source: UNIDO Africa Investor Survey 2010
- Information on 2403 foreign affiliates in 19 countries in sub-Saharan Africa in 2009
- Sectors: Agriculture (ISIC: 1 - 5), Mining (ISIC: 10 - 14), Manufacturing (ISIC: 15 - 39), Electricity, gas and water supply (ISIC: 40), Construction (ISIC: 45), Services (ISIC: 50 - 90)
- Location of parents: high-income, low/middle-income other than SSA, SSA countries
- Currency exchange rates from WB World Development Indicators

- Information on intra-firm trade and local procurement
- Drop 728 firms with no response on both intra-firm imports and exports
- Proxies for transfer of *tacit* knowledge from the parent
- Measures of importance of parental assistance received in:
  - the use of patents, trademarks, brand names
  - technology and know-how
  - quality upgrading of staff
  - access to finance, foreign supplier network, global markets
- Scale: 0-5
- Overall measure of parental assistance: average of six measures

# Outline

- 1 Related literature
- 2 Theoretical background
- 3 Data and stylised facts
- 4 Econometric model & estimation strategy**
- 5 Empirical results
- 6 Robustness checks
- 7 Concluding remarks and further research

# Econometric model & estimation strategy

- For firm  $z$  in country  $c$  and industry  $j$ , whose parent company is located in country  $p$ , we estimate the following ordered probit model:

$$K = \alpha + \beta_1 * fchar_{zcjp} + \beta_2 * D_{ift,zcjp} \\ + \beta_c * D_c + \beta_j * D_j + \beta_p * D_p + \epsilon_{zcjp}$$

- $K$ : proxies for knowledge transfer with values 0-5
- $D_{ift,zcjp}$ : dummy equal to 1 if firm  $z$  has intra-firm trade (imports, exports, or both)
- $fchar$ : skill intensity, capital intensity, total number of employees, wage per employee, labour productivity, input intensity, dummy for training
- $D_c$ : host-country dummies,  $D_j$ : industry dummies,  $D_p$ : parent-location dummies

# Outline

- 1 Related literature
- 2 Theoretical background
- 3 Data and stylised facts
- 4 Econometric model & estimation strategy
- 5 Empirical results**
- 6 Robustness checks
- 7 Concluding remarks and further research

# Knowledge Transfer and Intra-Firm Trade

**Table:** Knowledge transfer and the extensive margin of intra-firm trade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. var:	<i>UsePat</i>	<i>TechTrans</i>	<i>QualWork</i>	<i>AccFin</i>	<i>ForSuppNet</i>	<i>GIMarketAcc</i>	<i>assParOv</i>
<i>D<sub>ift</sub></i>	0.0409***	0.0214***	-0.0168	0.00478	0.0195***	0.0217***	0.0215***
	[0.0075]	[0.0063]	[0.013]	[0.0033]	[0.0067]	[0.0058]	[0.0054]
Obs	1331	1333	1335	1335	1335	1330	1338
<i>Pseudo – R<sup>2</sup></i>	0.074	0.078	0.063	0.061	0.052	0.061	0.040
<i>Log – likelihood</i>	-2032.8	-1822.8	-1942.6	-1854.5	-1917.2	-2067.6	-3879.4

# Knowledge Transfer and Intra-Firm Trade

**Table:** Knowledge transfer and the extensive margins of intra-firm trade, arm's length trade and local backward linkages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. var:	<i>UsePat</i>	<i>TechTrans</i>	<i>QualWork</i>	<i>AccFin</i>	<i>ForSuppNet</i>	<i>GIMarketAcc</i>	<i>assParOv</i>
<i>D<sub>ift</sub></i>	0.0753*** [0.026]	0.00950 [0.023]	0.0201 [0.047]	0.00603 [0.011]	0.0361* [0.021]	0.0318 [0.023]	0.0374* [0.019]
<i>D<sub>alt</sub></i>	0.0349 [0.025]	-0.0132 [0.023]	0.0326 [0.047]	0.000845 [0.011]	0.0200 [0.020]	0.0106 [0.023]	0.0162 [0.019]
<i>D<sub>noTradeLBL</sub></i>	0.0367 [0.027]	-0.00448 [0.025]	0.0709 [0.050]	0.00411 [0.011]	-0.00451 [0.023]	0.00732 [0.025]	0.0162 [0.020]
Obs	1331	1333	1335	1335	1335	1330	1338
<i>Pseudo – R<sup>2</sup></i>	0.074	0.078	0.064	0.061	0.053	0.061	0.041
<i>Log – likelihood</i>	-2031.9	-1822.2	-1940.5	-1854.3	-1913.9	-2067.4	-3879.1

# Knowledge Transfer and Intra-Firm Trade

**Table:** Knowledge transfer and the intensive margin of intra-firm imports and exports

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. var:	<i>UsePat</i>	<i>TechTrans</i>	<i>QualWork</i>	<i>AccFin</i>	<i>ForSuppNet</i>	<i>GIMarketAcc</i>	<i>assParOv</i>
ifimToInp	0.0762***	0.0513***	-0.0240	0.0136*	0.0475***	0.0297***	0.0406***
	[0.015]	[0.013]	[0.025]	[0.0070]	[0.014]	[0.011]	[0.011]
Obs	1327	1329	1331	1331	1331	1326	1334
Pseudo – R <sup>2</sup>	0.073	0.079	0.063	0.062	0.053	0.060	0.040
Log – likelihood	-2029.0	-1814.8	-1936.0	-1845.9	-1909.0	-2064.1	-3867.6
Panel B	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. var:	<i>UsePat</i>	<i>TechTrans</i>	<i>QualWork</i>	<i>AccFin</i>	<i>ForSuppNet</i>	<i>GIMarketAcc</i>	<i>assParOv</i>
ifexToExp	0.0741***	0.0452**	-0.0428	0.00408	0.0286*	0.0161	0.0348***
	[0.023]	[0.018]	[0.049]	[0.0059]	[0.016]	[0.0100]	[0.013]
Obs	540	540	540	540	540	541	542
Pseudo – R <sup>2</sup>	0.14	0.15	0.13	0.13	0.12	0.12	0.082
Log – likelihood	-749.2	-688.8	-739.1	-670.2	-712.2	-744.1	-1482.5

# The role of institutional quality

**Table:** Knowledge transfer and the extensive margin of intra-firm trade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. var:	<i>UsePat</i>	<i>TechTrans</i>	<i>QualWork</i>	<i>AccFin</i>	<i>ForSuppNet</i>	<i>GIMarketAcc</i>	<i>assParOv</i>
$D_{ift}$	0.0653*** [0.016]	0.0415*** [0.013]	-0.0231 [0.027]	0.0209*** [0.0078]	0.0273** [0.014]	0.0302*** [0.011]	0.0387*** [0.011]
$D_{HIQ}$	0.0218 [0.035]	-0.00201 [0.031]	-0.0540 [0.056]	0.0566** [0.024]	0.0127 [0.041]	0.00651 [0.028]	0.0224 [0.027]
$D_{ift\_HIQ}$	-0.0326* [0.018]	-0.0266* [0.014]	0.00843 [0.030]	-0.0217** [0.0086]	-0.0104 [0.015]	-0.0113 [0.013]	-0.0230* [0.012]
Obs	1331	1333	1335	1335	1335	1330	1338
Pseudo – $R^2$	0.075	0.079	0.063	0.063	0.052	0.061	0.041
Log – likelihood	-2030.7	-1820.7	-1942.5	-1849.3	-1916.9	-2067.1	-3877.4

# The role of institutional quality

**Table:** Knowledge transfer and the intensive margin of intra-firm imports

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. var:	<i>UsePat</i>	<i>TechTrans</i>	<i>QualWork</i>	<i>AccFin</i>	<i>ForSuppNet</i>	<i>GIMarketAcc</i>	<i>assParOv</i>
<i>ifimToInp</i>	0.111*** [0.029]	0.0827*** [0.023]	-0.0724 [0.047]	0.0220* [0.013]	0.0653*** [0.025]	0.0390* [0.020]	0.0546*** [0.018]
<i>D<sub>HIQ</sub></i>	0.0197 [0.034]	-0.00282 [0.030]	-0.0621 [0.056]	0.0514** [0.023]	0.0138 [0.041]	0.00428 [0.028]	0.0180 [0.026]
<i>ifimToInp_HIQ</i>	-0.0506 [0.033]	-0.0448* [0.026]	0.0697 [0.055]	-0.0120 [0.014]	-0.0255 [0.029]	-0.0134 [0.024]	-0.0203 [0.022]
Obs	1327	1329	1331	1331	1331	1326	1334
<i>Pseudo – R<sup>2</sup></i>	0.074	0.080	0.063	0.062	0.053	0.060	0.040
<i>Log – likelihood</i>	-2026.6	-1813.2	-1935.1	-1845.5	-1908.5	-2063.9	-3867.1

# Outline

- 1 Related literature
- 2 Theoretical background
- 3 Data and stylised facts
- 4 Econometric model & estimation strategy
- 5 Empirical results
- 6 Robustness checks**
- 7 Concluding remarks and further research

# Robustness checks

- Inflow of intangible assets to total employment and total sales
- Dummies for importance of parental assistance
- Dummies for intra-firm imports, exports, both as dep var with cutoffs (25%, 50%, 75%)
- Control for knowledge creation
- Control for transfer pricing
- Control for mode of acquisition of capital goods
- Control for risk of knowledge expropriation
- Control for years since set-up of the firm (i.e., firm age)
- Add dummies for firm age
- Add dummies for mode of investment

# Robustness checks

- Restrict sample to firms in manufacturing
- Restrict sample to MOFAs
- Restrict sample to MOFAs in manufacturing
- Alternative functional forms (logistic, linear probability model)
- Dummies for parent location (HI, non-SSA LMI, SSA)
- Dummies for pairs of host countries and industries
- Dummies for pairs of parent locations and industries
- Dummies for pairs of host countries and parent locations
- Economic geography variables (geographical distance, contiguity, common language, colonial ties)
- Add dummies for company type (wholly-owned, joint venture, individual foreign investor)
- Assistance provided to individual foreign investors from other associate companies in the business group

# Outline

- 1 Related literature
- 2 Theoretical background
- 3 Data and stylised facts
- 4 Econometric model & estimation strategy
- 5 Empirical results
- 6 Robustness checks
- 7 Concluding remarks and further research**

# Concluding remarks

- Extensive and intensive margins of a foreign affiliate's intra-firm trade positively associated with:
- Knowledge transferred from the parent in the form of:
  - Patents, trademarks, brand names
  - Technology and know-how
  - Access to finance, to foreign supplier network and to global markets
- Positive association weakens when foreign affiliate operates in a country of relatively high institutional quality
- Extensive margin of intra-firm trade and access to finance
  - Parent as a source of finance of working capital and fixed assets (extensive and intensive margin)

# Suggestions for further research

- Interpretation of results based on Antràs and Helpman (2004)
- Differences in knowledge transfer explained by differences in the coordination efficiency of the production network to which each type of foreign affiliate belongs
- Time dimension to study causality
- Blanas and Seric project 3 (in progress):
- Concerns of top managers in the parent over knowledge expropriation from managers in the foreign affiliate
- Differences in decision making power between the two firm types?