REGIONALISM, PRODUCTIVITY AND INNOVATION

ADB CONFERENCE ON RETHINKING GLOBALISATION

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Motivation: Regionalism as a choice

- Does regional integration influence growth such as labour productivity and innovation activity even at times of 'de-globalization'?
- What effects, if any, are associated with different channels of integration (e.g. trade, finance, infrastructure...)?
- Does using geography or economic-political regional grouping yield different results?

Identify determinants using PF approach

Model: $$Y_{jt} = AC_{jt}^{\alpha}L_{jt}^{\beta}\left(\sum_r K_{rjt}^{\gamma_r}\right)e^{b_{j0}+\delta G_{jt}+\lambda t+\varepsilon_{jt}}$$

C_{jt} and L_{jt} are the national input of physical capital and labour, respectively,

$K_{rjt}^{\gamma_r}$ represents the level of productive knowledge available to the country via activity r, including knowledge-enhancing activities like R&D expenditures, international cooperation and exchanges of ideas through migration and short-term labour movements, FDI-related technology transfers, and international trade in goods and services, among others: some activities can be related back to initiatives aimed at strengthening regional integration such as closer institutional links for technology transfers or collaboration on environmental matters.

γ_r is the proportional increase in productive knowledge resulting from the r^{th} activity (r = 1, 2, …).

e captures other productivity drivers, including an initial country-specific level of value added b_{j0}, a country-specific set of initiatives G_{jt} strengthening regional integration but only indirectly affecting productivity (e.g. joint supervision on financial transfers), a deterministic time trend λt representing the exogenous growth of the global technological frontier (λ being the rate of disembodied technical change) and an idiosyncratic error term ε_{jt}.

Empirics: country level

Transforming the equation in logarithmic form, and rearranging it to measure output per employee yields:

$$\ln\left(\frac{Y}{E}\right)_{jt} = constant + \alpha \ln\left(\frac{C}{E}\right)_{jt} + \gamma_1 \ln\left(\frac{K_1}{E}\right)_{jt} + (\alpha + \beta + \gamma_1 - 1)\ln(E)_{jt} + \gamma_3 \ln\left(\frac{X+M}{GDP}\right)_{jt} +$$

$$+ \gamma_4 \ln\left(\frac{FDI}{GDP}\right)_{jt} + \gamma_5 \ln\left(\frac{BV}{Pop}\right)_{jt} + \gamma_{reg} K_{reg} + b_{j0} + \delta G_{jt} + \lambda t + \varepsilon_{jt}$$

where: j (country) = 1-172; t (time) = 2006-2021; $_{reg}$ = regional integration directly influencing labour productivity; ln = natural logarithm;

Productivity = labour productivity (Output, Y, over total Employment, E),

Controls: physical capital stock (C) per employee, the R&D stock (K, for knowledge) per employee, the trade, foreign direct investments, and mobility intensity (i.e. import plus export over GDP, foreign direct investments over GDP, and volume of air travelers over population)

Focus on: γ_{reg} (direct influence: trade and financial agreements, infrastructure investment, people's movements, technology connectivity) and δ (indirect influence: institutional agreements, co-location of firms in same value chain, environmental agreements)

Nesting firm-level innovation decisions

- Aggregate output produced by $i = 1....M_i$ firms in economy j at time t
- Each firm's demand for s, a generic production factor, to produce output Z^i is: $c_S^i(A^i, W)Z^i$ where c_S^i is the unit requirement of generic factor s for firm i, which depends on the vector of factor augmenting technologies A^i and the vector of domestic factor prices W
- In equilibrium demand for s = supply → $S_j = \sum_{i=1}^{M_j} c_S^i\,(A^i, W)Z^i$
- Regional integration modelled as a set of actions that can raise S_j, and hence as $dS_j \geq 0$
- Trace the domestic partial equilibrium response to $dS_j \geq 0$ by total differentiation:

$$dS_j = \sum_{i=1}^{M_j} Z^i c_{SA^i}^i\, dA^i + \sum_{i=1}^{M_j} c_S^i\, dZ^i + \sum_{i=1}^{M_j} Z^i c_{SW}^i\, dW$$

- $c_{SA^i}^i$ is the response of firm i's unit requirement of factor s with respect to that firm's production technologies A^i, and c_{SW}^i is a vector of cross-price derivatives of the unit requirement of factor s with respect to domestic factor prices

Empirics: firms' level

$$Innov_{ijt} = a_0 + X_{ijt}a_1 + K_{jt}a_2 + R_{jt}a_3 + \ j_j + t_t + \varepsilon_{ijt}$$

Innov is a binary indicator of innovation activity for firm i in country j at time t,

X_{ijt} is a vector of firm-specific characteristics affecting innovation activity (investment in R&D, holding international patents, firm size),

K_{jt} is a vector of country-level characteristics influencing innovation activity (international trade, labour mobility, capital inflows), and

R_{jt} is a set of regional integration indicators

j and *t* represent vectors of country and year fixed effects; ε_{ijt} is a vector of unobserved characteristics

Data

- Productivity (labour): ILO data at country level for 2012-2022
- Regional integration: ADB ARCII database: 8 indicators for 2006-2021 (in log)
- Innovation: WB Enterprise Survey for 2011-2019
- Controls: WB Indicators database for period up to 2021

- 2 working samples:
  - Country-level sample: panel of ~60 countries for 2012-2021
  - Firm-level sample: pooled cross section of ~ 55,000 firms in 67 countries for 2012-2019

Baseline results (panel)

Regional integration matters.....

...but also connectivity short-term!

Ln productivity/employee	I	II
RD/employee	-.121*	-.257
	(.072)	(.160)
GFCF/employee	.480***	.655**
	(.119)	(.313)
Ln employment	-.521***	-.373***
	(.177)	(.131)
Gross trade/GDP	-.006	-.062
	(.041)	(.042)
Net FDI/GDP	.006	.010*
	(.005)	(.005)
Air transport/population	1.46***	.955**
	(.351)	(.415)
Year	.019***	.016***
	(.001)	(.003)
ARCII indicators		
Ln trade and investments		-.021**
		(.010)
Ln money and finance		-.062***
		(.023)
Ln value chain		.130**
		(.062)
Ln infrastructure		.306***
		(.085)
Ln people		-.243***
		(.082)
Ln institutional arrangements		-.032
		(.281)
Ln technology		.056**
		(.026)
Ln environmental cooperation		-.159
		(.193)
Constant	-19.98***	-15.92***
	(4.58)	(4.38)
Country FE	Yes	Yes
Year FE	Yes	Yes
F-stat	21.27	21.94
R^2 within	.4492	.5510
R^2 between	.0574	.0520
R^2 overall	.0474	.0255
N	560	469

Baseline results (cross-section)

- Standard innovation determinants have expected sign and magnitude
- Regional integration matters:
  - +ve influence from co-location of supply chain, investment in infrastructure and technology, and peoples' movements;
  - -ve influence from trade and monetary integration as well as institutional agreements (data include EU)!

Probability to innovate	Innovation (pooled)	Product Innovation	Process Innovation
RD (firm)	.300***	.313***	.313***
	(.004)	(.005)	(.005)
Firm size	.031***	.022***	.031***
	(.001)	(.002)	(.002)
Firm has int'l certification	.044***	.050***	.041***
	(.005)	(.005)	(.005)
GDP growth	.023***	.019***	.021***
	(.005)	(.005)	(.005)
Gross trade/GDP	.0001	.0001	.0001
	(.0001)	(.0001)	(.0001)
Net FDI/GDP	.0006	.0006	-.0002
	(.0004)	(.0006)	(.0006)
Air transport/population	1.01	-.935	6.05*
	(3.03)	(3.40)	(3.53)
ARCII indicators			
Ln trade and investments	-.182***	-.175***	-.127***
	(.026)	(.028)	(.029)
Ln money and finance	-.129***	-.095**	.020
	(.040)	(.045)	(.046)
Ln value chain	.270	.345*	.700***
	(.194)	(.213)	(.218)
Ln infrastructure	.963***	1.099***	.731***
	(.136)	(.158)	(.061)
Ln people	.681***	.479***	.359**
	(.152)	(.163)	(.172)
Ln institut. arrangements	-.638***	-.343***	-.462***
	(.096)	(.092)	(.094)
Ln technology	.056**	.077***	-.010
	(.026)	(.029)	(.029)
Ln environ. cooperation	-.538	-1.24**	-1.81***
	(.488)	(.504)	(.519)
Constant	.160	-.379	-1.60**
	(.531)	(.689)	(.072)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Adj R^2	.2419	.2183	.2446
N	54,653	54,503	54,221

Why sign of some indicators is negative?

- Currently: same t as dependent variable, but leads and lags are likely important
- 'Endogenise' leads (F) and lags (L) (early days):

  Re-estimate model with controls and 1 indicator at a time, and up to 5L and 5F;

  Choose L and F based on likelihood

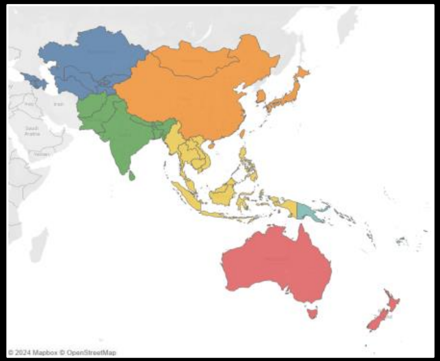
  Re-estimate model with controls and indicators adjusted by L and F ;

  Check stability of estimates by varying again L and F one indicator at the time
- Preliminary results: trade (L4), finance (F2), value chain (L, t), infrastructure (L3), people (F3),institutions (F4), technology (L, t), environment (F3)
- Negative signs replaced by +ve and either statistically significant or no different from zero

Spatial or economic reference also matters (R^2)

ADB ARCII produces two sets of regional integration indices to measure integration with respect to:

- Geographic groups: ie country *i* 'integrates' with Europe, Asia, Africa....



- Economic/political groups: ie country *i* 'integrates' with ASEAN, CAREC, ...

→ Use both in analysis
→ Only Asia has intra-regions

Geography vs. Economic groups

Economic groups: sign and significance of relations in line with literature (better fit in economic groups)

Connectivity from short-term visits matters for productivity

Indicators point to some significant relations but often different from those arising from geography-based analyses

Ln productivity/employee	Asia Geography	Asia Economic
RD/employee	-.823	-1.56
	(1.14)	(1.87)
GFCF/employee	9.15	10.45**
	(5.61)	(5.04)
Ln employment	-1.21**	-.758***
	(.424)	(.228)
Gross trade/GDP	.035	.073
	(.066)	(.084)
Net FDI/GDP	-.129	.025
	(.193)	(.118)
Air transport/population	4.56*	7.36***
	(2.56)	(1.68)
Year	.036***	.032***
	(.007)	(.007)
ARCII indicators		
Ln trade and investments	-.073**	-.007
	(.029)	(.013)
Ln money and finance	-.112***	-.024
	(.033)	(.022)
Ln value chain	.095	.014
	(.095)	(.108)
Ln infrastructure	.053	.131
	(.193)	(.140)
Ln people	-.148**	-.118***
	(.070)	(.019)
Ln institutional arrangements	-.294	-.398*
	(.343)	(.211)
Ln technology	.012	.031
	(.071)	(.096)
Ln environmental cooperation	-.045	-.031
	(.273)	(.141)
Constant	-44.31***	-42.68***
	(12.70)	(13.43)
Country FE	Yes	Yes
Year FE	Yes	Yes
F-stat	22.40	103.73
R^2 within	.8222	.8343
R^2 between	.0119	.0340
R^2 overall	.0147	.0606
N	102	184

Regionalism?

If global is ‘no more’ then what?

- Keep up short-term connectivity (e.g. work/business/academic visits), as:

  knowledge is not only disembodied but embodied in people (innovation literature)

  Consistently observed in:

  China rise in academic productivity (1)

  Primary data (airport surveys) (2)

  Innovation at sectoral level in OECD (3), Africa (4), Australia (5)… …

  ~50% of effect of R&D investment (6)

  9/11: drop in international students in US but no drop in productivity

Some preliminary conclusions

- Regional integration matters for labour productivity and innovation
- Effect is generally positive (must account for L and F in decisions to integrate)
- Space matters but economic/political choices matter more
- Less global and regional integration will likely reduce labour productivity and innovation activity BUT openness to short-term exchanges of embodied knowledge works in opposite direction
- RCI data enhance understanding of drivers of innovation capabilities by:
    - *complementing national and regional strategies*
    - *identifying common regional priorities and sectors*

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