Related Industrial Diversification as an Economic Development Strategy

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Plan

Theoretical concepts

Related variety
Related diversification
Economic complexity

Policy considerations

Not obvious
A new framework
Variety, specialisation and growth

Related variety

Variety can be related or unrelated

Entropy decomposition theorem

Unrelated variety absorbs random shocks
Hypothesis: unrelated variety -> less unemployment

Related variety enhances inter-industry spillovers
Hypothesis: related variety -> more employment

Related variety (cont.)

Most studies find positive effect of related variety on employment growth.

Some studies find negative effect of unrelated variety on unemployment growth.

Related-variety effect may be specific to knowledge-intensive sectors only.

Limitation of entropy measure

Most studies find strong positive effect of relatedness on the probability of diversification. GDP, liberal-market institutions, social capital as moderating factors. Migration and MNOs enhance unrelated diversification. Methodological challenges remain.
Economic Complexity

2010

From: Tacchella (2012) *Scientific Reports* 723
Economic Complexity (cont.)

If you accept that complex products are rare, then we observe that complex products are produced by economies with high variety.

Some associate the variety of an economy with the complexity of an economy.

However, variety and complexity should not be conflated: variety refers to the number of products in an economy while complexity refers to the division-of-labour in production.

‘The Hump’ can then be explained by rich countries losing simple products.

Policy

But:

Lack of competitiveness of related industries

Lack of additionality of related-industry policy

Strong assumption wrt ability to produce complex products

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A new framework with two policies (work in progress):

- **Specific policy**: leads to unrelated diversification increasing variety (industrial policy, technology policy)
- **Generic policy**: raises ability $c^*$ to produce complex products increasing complexity (science, innovation-system)

Assumption: Related diversification occurs without policy, but only into products with $c < c^*$

Key logic: return to generic policy increases with variety

Implication: early-stage policy should increase variety through specific policy, later-stage policy should raise complexity through generic policy
Innovation policy

Mission-oriented (Mazzucato)
- technology-base industrial policy
- works mainly for large countries/regions
- politically legitimate
- risky but potentially high additionality
- lobby-sensitive

Relatedness (Foray/Boschma)
- supply-led exploitation of related variety
- applies to any region, esp. rural and ‘lagging’ ones
- economically legitimate (evolutionary)
- not risky but low additionality
- lobby-sensitive

Unrelatedness (Frenken)
- making the unrelated related
- applies to any region, esp. urban and ‘advanced’ ones
- potential breakthrough leading to unique niche
- market failure: support risky entrepreneurship (incubator example)
- societal challenge: temporary innovation system (vision zero example)
- regulatory: “Innovation principle” (sharing economy example)
The scrabble metaphor

- Products are words
- Capabilities are letters
- Letters make up words
- The letters available in a country determine:
  - Which words a country can spell (product variety)
  - The average length of words (product sophistication)
- Countries develop by acquiring letters one by one allowing them, over time, to produce more products and more sophisticated products
The model (2)

- Given $n$ capabilities (letters), there are $2^n$ possible products (words).
- The average product length is $\frac{n}{2}$.

Assuming average product length is a proxy of $GDP_{pc}$, we have:

$$\log d \propto GDP_{pc}$$
The model (3)

- The probability that a component is used in a product \( \rho \in (0, 1) \)
- Then probability that \( s \) components make up a viable product \( \rho^s \)
- Number of possible sets of size \( s \) out of \( n \) components
  \[
  \binom{n}{s} = \frac{n!}{s!(n-s)!}
  \]
- The expected **product variety** made with \( n \) components
  \[
  d(n) = \sum_{s=0}^{n} \binom{n}{s} \rho^s = (1 + \rho)^n
  \]
- Taking logs
  \[
  \log(d) \propto n
  \]
- **Average product sophistication** is total length over all products
  \[
  \bar{s}(n) = \frac{\sum_{s=0}^{n} s \binom{n}{s} \rho^s}{(1+\rho)^n} = \frac{\rho}{1+\rho} n
  \]
Diversification and average product length

Assuming average product length is a proxy of \( GDP_{pc} \), we have:

\[
\log d \propto GDP_{pc}
\]
**Loss of variety**

- Contrary to what Hausmann & Hidalgo (2011) assume, countries do not make **all** products they can. They tend to lose simple products (short words) as they develop and increase their GDP per capita.

- \( r \) defines the range of product lengths a country makes: \( 0 \leq r \leq n \)

- Total number of products given \( r \):
  \[
  d(n|r) = \sum_{s=n-r}^{n} \binom{n}{s} \rho^s
  \]

- Average product length given \( r \):
  \[
  \bar{s}(n|r) = \frac{\sum_{s=n-r}^{n} s \binom{n}{s} \rho^s}{\sum_{s=n-r}^{n} \binom{n}{s} \rho^s}
  \]