TERRITORI APERTI

Specialization or diversification of local production systems. Size matters?

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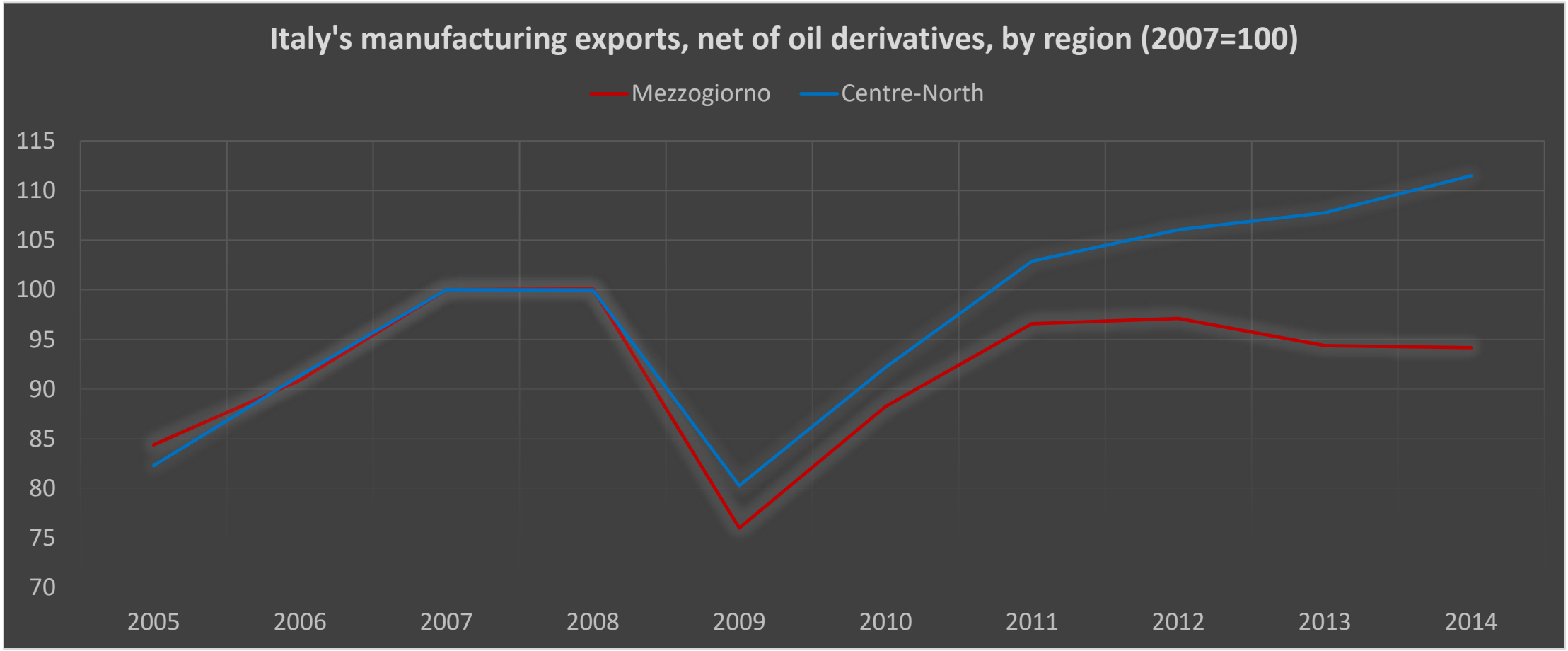
Outline

- Motivation: export resilience in Italian provinces during the global crisis
- The literature on the quality of specialization patterns
- Measuring export performance
- Concentration or diversification?
  - Statistical indicators
  - Econometric estimates
- Preliminary conclusions and next steps

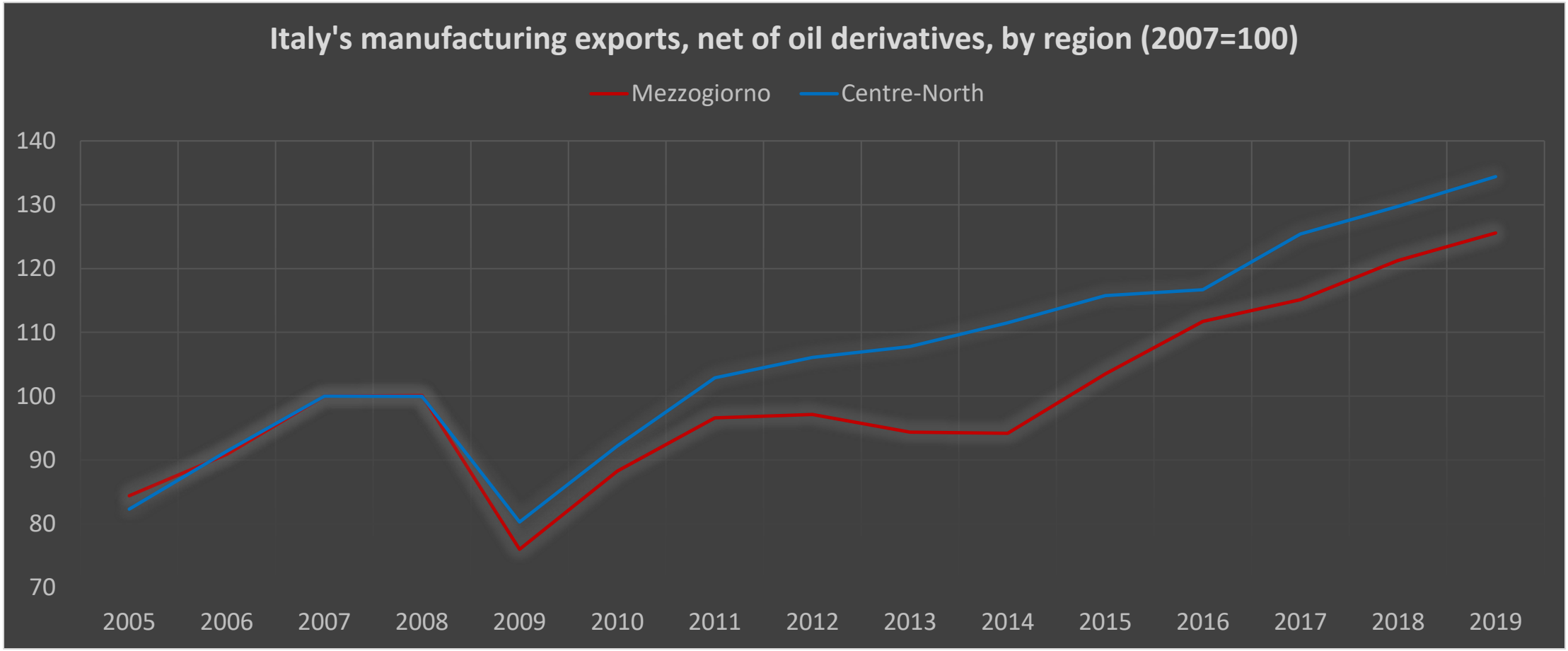
Export resilience in Italy during the global crisis

- Better understanding the relationship between international economic integration, risk and resilience at the local level
- Initial assumptions
  - Open local economies are exposed to higher risks of external shocks
  - Under certain conditions, international economic integration reinforces the resilience of local economies, by spreading knowledge and improving their productive structure
- The global crisis initiated in 2008 offers an important benchmark to assess the different resilience of local economies to a common external shock
- Export performance after the 2009 trade collapse can be used to gauge the dynamic resilience of open local economies

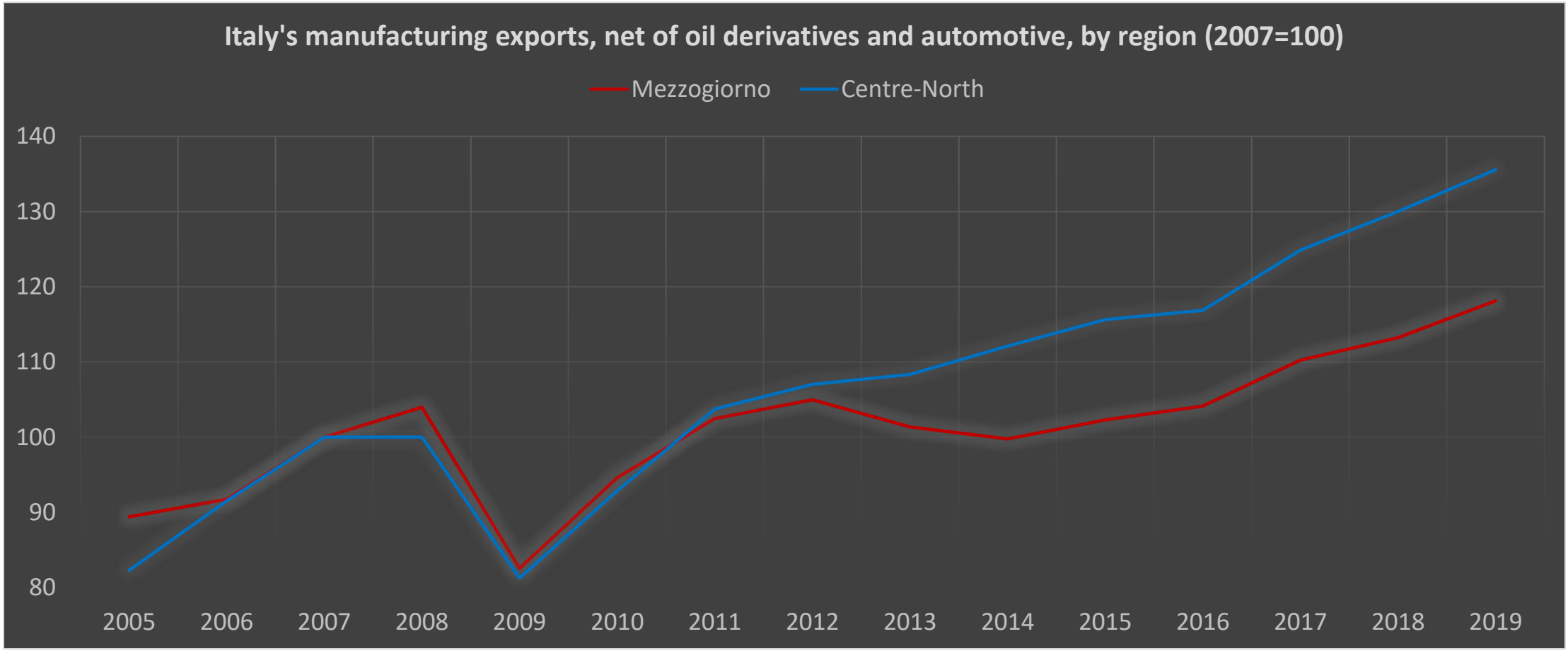
Export resilience in Italy during the global crisis



Convergence resumed in 2015-16…



…but mostly as a result of the upsurge in automotive exports from a couple of plants in the Mezzogiorno



Research questions

- Understanding why the resilience to the global crisis has been so different across local economies in Italy
- Exploring the linkages between the quality of international specialization and export performance after the crisis
  - Controlling export performance for composition effects (constant-market-shares analysis)
  - Exploring the linkages between the diversification of comparative advantages and export competitive performance

Measuring export performance

A NUMBERS GAME

	Italian exports		*World exports*		*Market shares*	
	Period 1	***Period 2***	***Period 1***	***Period 2***	***Period 1***	***Period 2***
Sector A	4	9	40	80	10,0	
Sector B	8	9	40	44		
Total	12	18	80	124		

CMS analysis

- *Constant-market-shares (CMS) analysis* is a particular application to international trade of a more general statistical decomposition technique, aimed at measuring the contribution of ‘structural factors’ (composition effects) to the growth of an aggregate variable (Memedovic and Iapadre, 2010)
- In regional economics this technique is known as *shift-and-share analysis*.
- CMS analysis can usefully be integrated into an econometric model of trade flows, where it helps improve the specification of the dependent variable by filtering out composition effects.

Constant-market-share analysis of export performance of Italian provinces

- Splitting the change in aggregate export market shares into three components:
  - *Competitiveness effect (CE)*: export performance, net of composition effects, reflecting *ex post* the role of relative prices and other competitiveness factors
  - *Structure effect (SE)*: measuring how *changes* in the composition of export demand interact with the exporting economy's specialization pattern
  - *Adaptation effect (AE)*: measuring how *changes* in the exporting economy's specialization pattern interact with *changes* in the composition of export demand

Constant-market-share analysis of export performance of Italian provinces

- The decomposition formula:
- $S^t - S^0 = CE + SE + AE \quad = \sum_k (s_k^t - s_k^0) w_k^0 + \sum_k (w_k^t - w_k^0) s_k^0 + \sum_k (w_k^t - w_k^0)(s_k^t - s_k^0)$
- where:
  - *S:* province *i*'s market share of total Italian exports;
  - s_k*:* province *i*'s market share of Italian exports in sector *k;*
  - w_k*:* sector *k*'s weight on Italian exports;

The quality of specialization: concentration or diversification?

Concentration and polarization

- If the structure of a local economy relies heavily on a limited number of products, this concentration can increase its vulnerability to external shocks.
- The debate on international monetary integration (Kenen, 1969): the costs of monetary integration, as highlighted by the theory of optimum currency areas, are lower for countries characterised by a more diversified export structure, because this reduces the probability of an adverse asymmetric shock and dampens its impact.

Measuring the concentration of local specialization patterns

- Number of comparative advantage sectors of province *i* (n_i), relative to the total number of sectors (m):

  $RCAN_i = n_i/m$

- Herfindahl-Hirschmann concentration index (*Hi*):

  $Hi = \sqrt{\sum_k \left(x_{ik} / \sum_k x_{ik} \right)^2}$

  - This index is dependent on the number of products considered in the distribution More precisely, *Hi* is equal to 1/n when all the *n* products have the same weight in terms of export value, reaching a maximum level of 1 if exports are concentrated in only one product.
  - So, we prefer its normalised version, which is as follows:

    $NH_i = (H_i - 1/n)/(1 - 1/n)$

    $0 \leq NH \leq 1$

Measuring the concentration of local specialization patterns

- Problems of concentration indicators
  - Both variants of the Herfindahl-Hirschmann index are based on a comparison between the actual distribution of data and an abstract benchmark of equi-distribution across the statistical units of observation.
  - This benchmark can be reasonable, when the index is applied to individual families or firms, but may be questioned when the index is used to study the concentration of a distribution across statistical units that are inherently different in terms of size, such as sectors or partner countries.

Export dissimilarity

- An alternative approach, which does not refer to the equi-distribution benchmark, is based on the linkage between the concepts of concentration and specialization. Local economies tend to concentrate their productive resources in their sectors of comparative advantage, so that their export structure tends to differentiate from the average of other localities (an alternative interpretation of Kenen's criterion)
- A simple way to measure the dissimilarity of export structures across provinces is offered by the Finger-Kreinin index (FK_i), which is as follows:

$$FK_i = \tfrac{1}{2} \Sigma_k \left| (x_{ik} / x_{i.}) - [(x_{.k} - x_{ik}) / (x_{..} - x_{i.})] \right|$$

$$0 \leq FK_i \leq 1$$

Related and unrelated variety

- Underlying idea: innovation and growth can be favoured by technological and cognitive externalities among sectors (so-called Jacobs externalities).
- So, other things being equal, an economy characterized by a relatively large presence of *related* sectors grows more rapidly than a strongly specialised economy, as well as than a diversified economy, which however is oriented towards reciprocally *unrelated* sectors.
- This concept is difficult to operationalize:
  - Assessing linkages among sectors would require detailed information about their production functions
  - Even the use of input-output tables would not be enough to ascertain the presence of cognitive spillovers, which often go beyond supply-and-use linkages

Related and unrelated variety

- A widely used indicator is based on the concept of entropy (Theil, 1972), and has been applied to the study of specialization patterns by Frenken et al. (2007).
- The driving idea is that Jacobs externalities emerge more easily among related productions *within* each sector, rather than *between* different and unrelated sectors.
- So, unrelated variety is measured by the Theil entropy index between different sectors (*k*):

$$UV = \Sigma_k \, w_k \, log_2(1/w_k)$$

- Related variety is measured by a similar index computed between different products (*p*) within each sector, and its aggregate measure for each economy is given by the weighted average of the sector indicators:

$$RV = \Sigma_k \, w_k \, V_k$$

  - where: $V_k = \Sigma_p \, w_{pk} \, log_2(1/w_{pk})$

$$w_{pk} = x_{ip}/x_{ik}$$

$$w_k = x_{ik}/x_{i.}$$

Related and unrelated variety

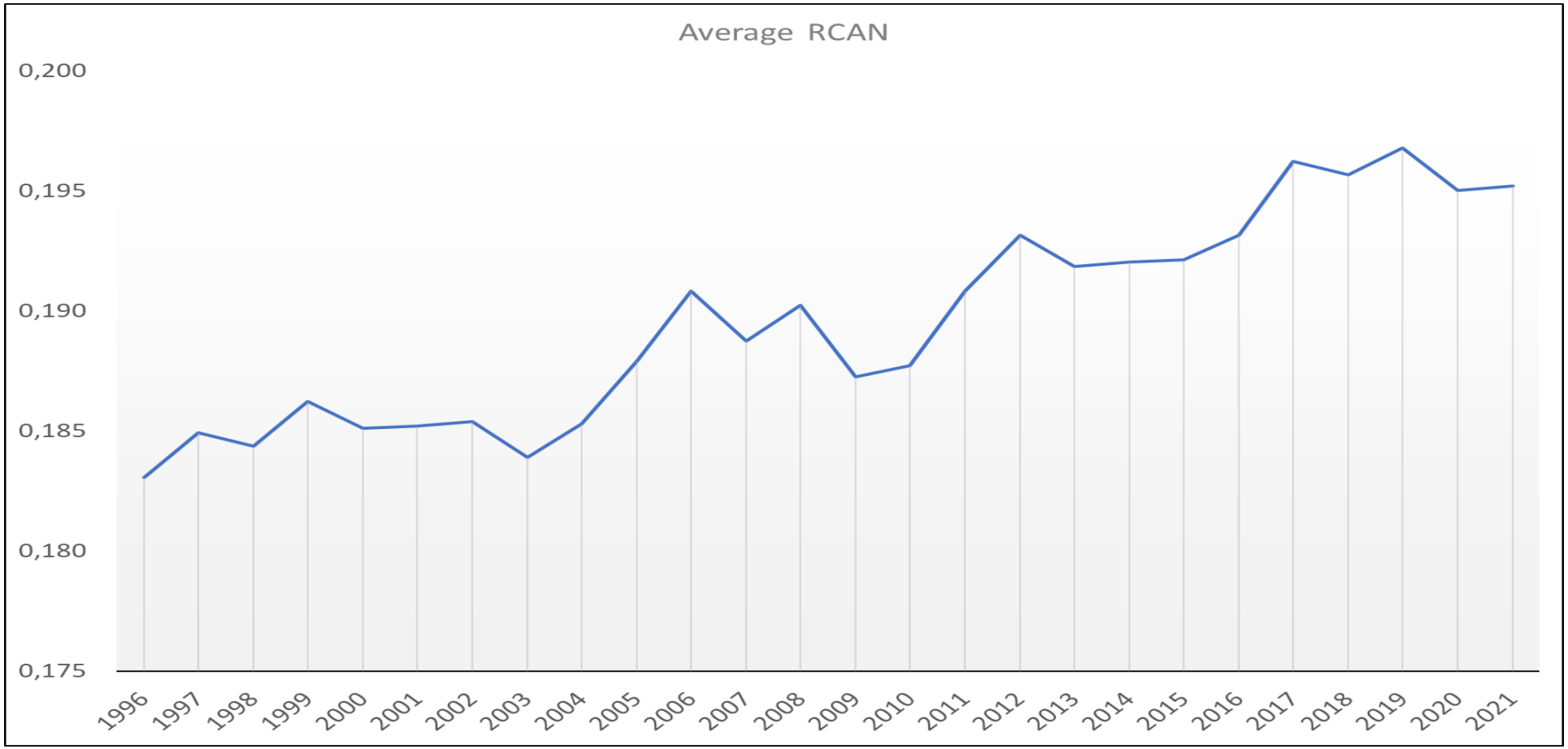
- The properties of the Theil entropy index ensure that total variety across products is equal to the sum of related and unrelated variety.
- The heuristic power of these indices is strongly affected by the quality of the available statistical classification, and particularly by the reliability of the distinction between products and sectors.
- Leaving this problem aside, it should be stressed that, by construction, the entropy index is a measure of diversification. So, it is an inverse function of the degree of concentration and its maximum corresponds to the case in which all the statistical units (products or sectors) have the same weight (equi-distribution).
- The equi-distribution benchmark appears as unreasonable when the size of the statistical units of observation is intrinsically different.

Related and unrelated variety

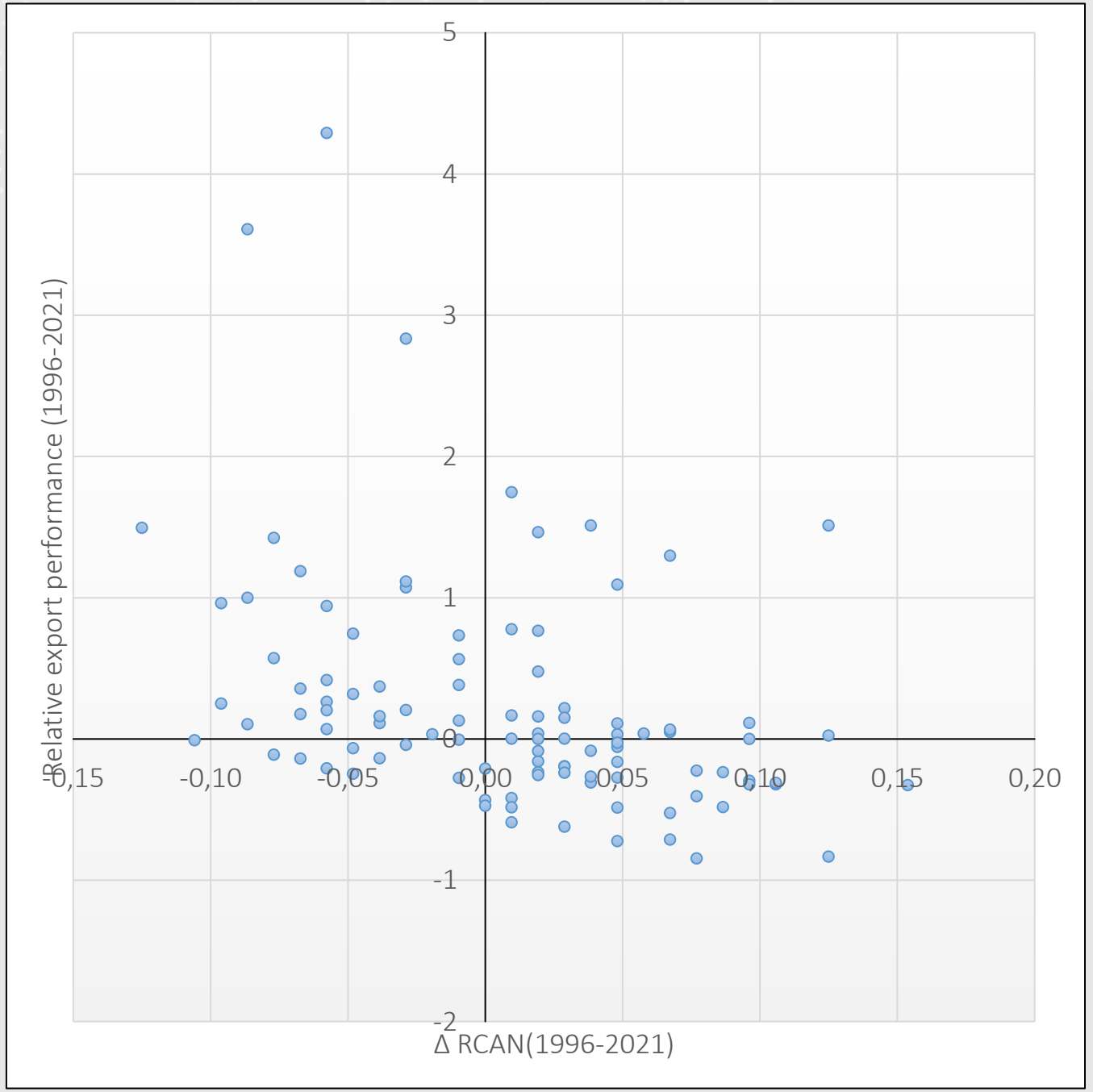
- A possible solution could be, even in this case, a comparison between each province's export distribution and their average.
- If a province's within-sector entropy is higher than the national average, this gap can be used to detect and measure related variety. So, our relative measures of related and unrelated variety are as follows:
- $RUV_i = (UV_i - UV^*)/(UV_i + UV^*)$
- $RRV_i = (RV_i - RV^*)/(RV_i + RV^*)$
- where the * refers to the arithmetic mean of the two indicators across provinces.

Descriptive analysis

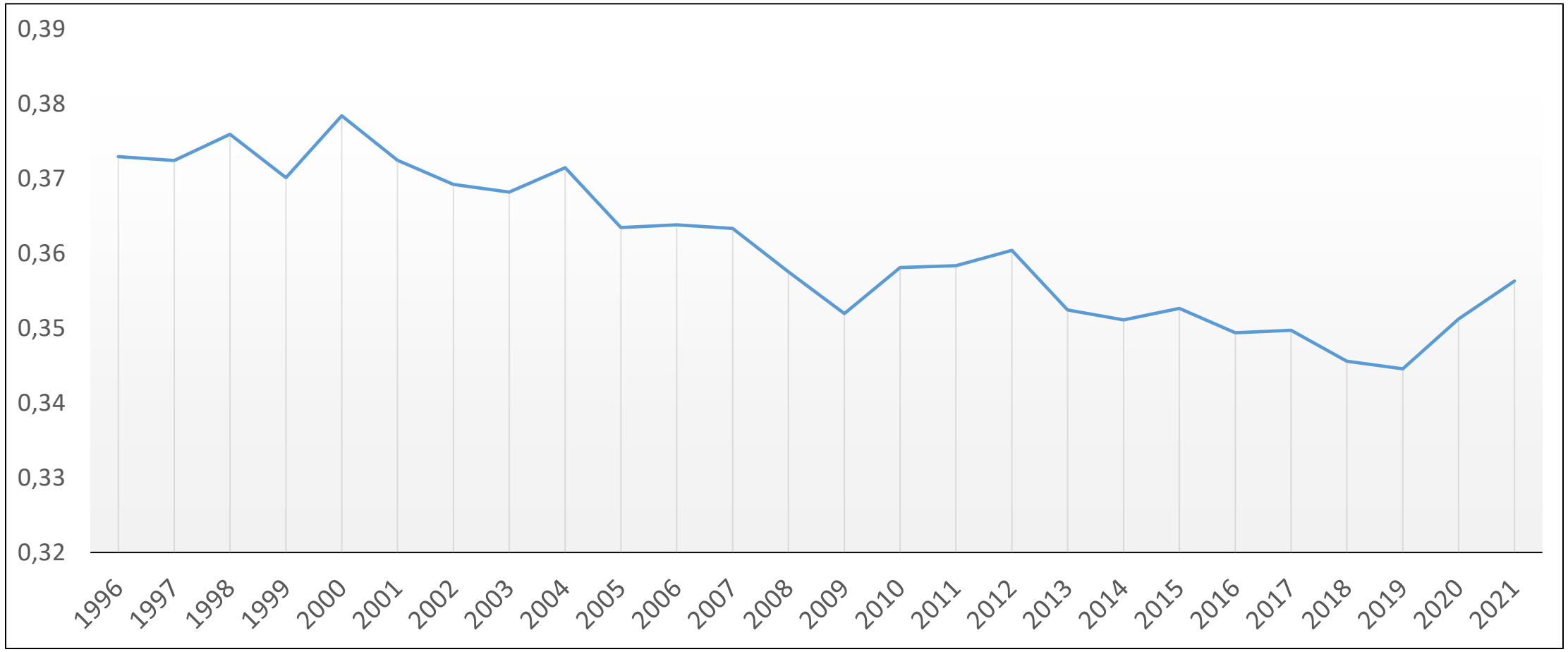
Relative number of comparative advantage sectors (average of Italian provinces)



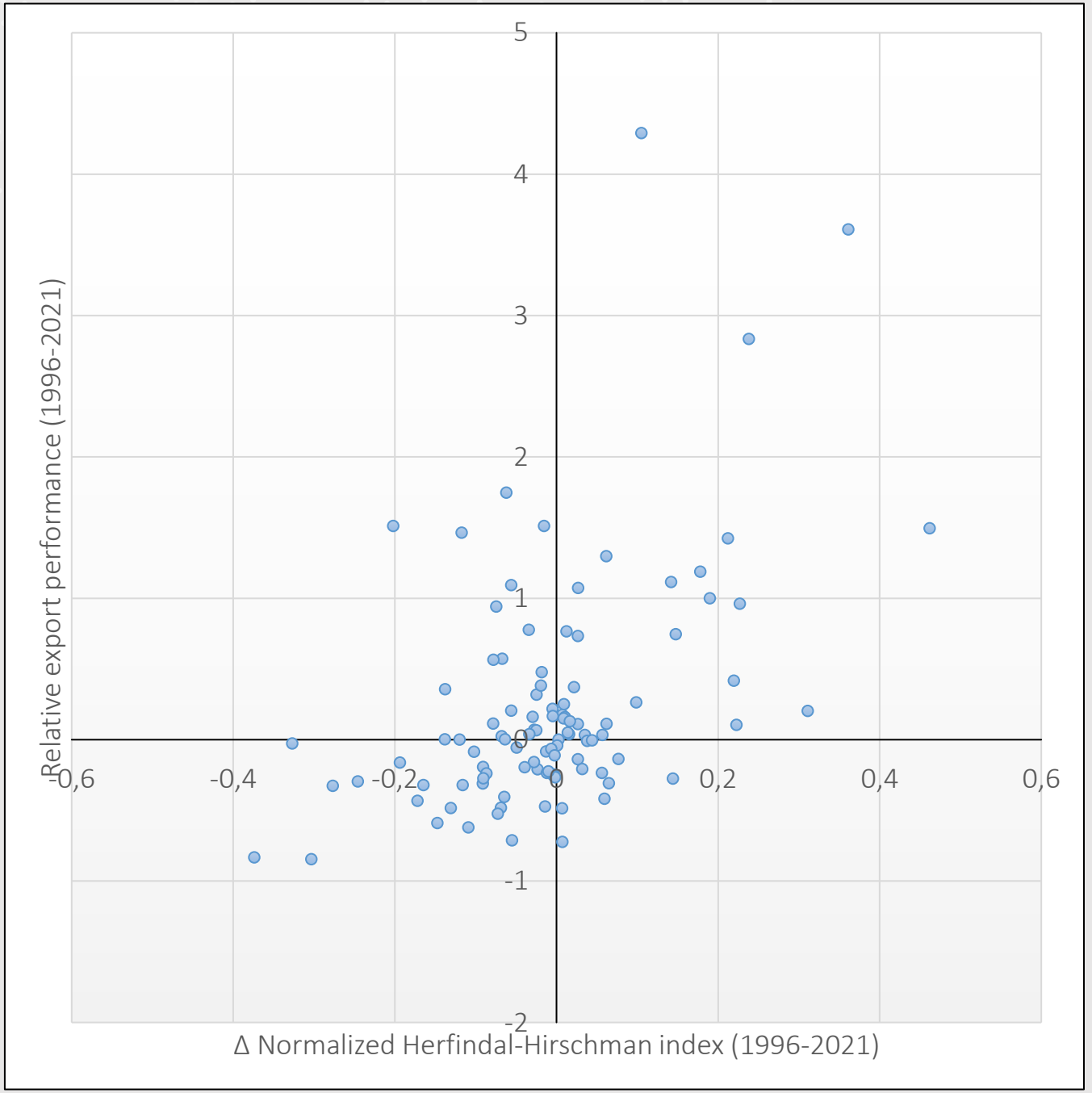
Correlation between change in the relative number of comparative advantage sectors and relative export performance



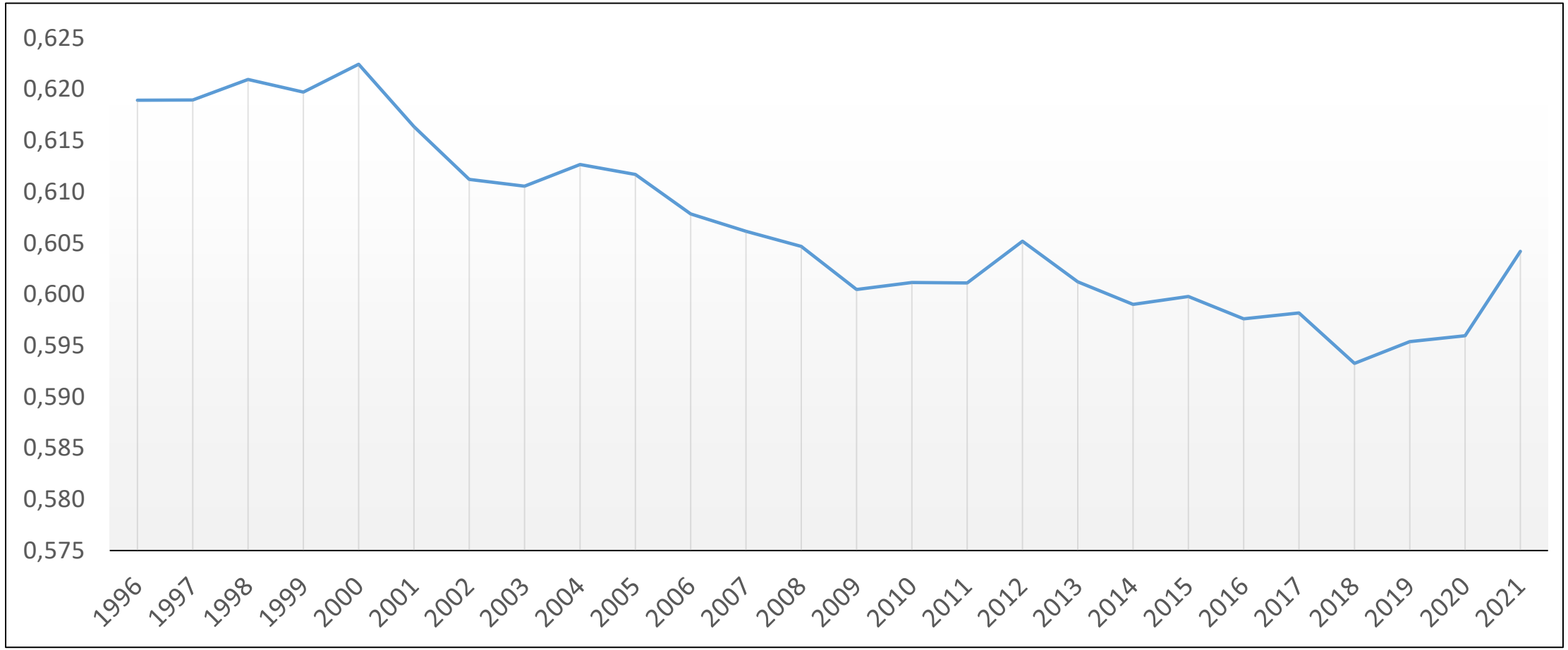
Normalized Herfindahl-Hirschmann sectoral concentration index (average of Italian provinces)



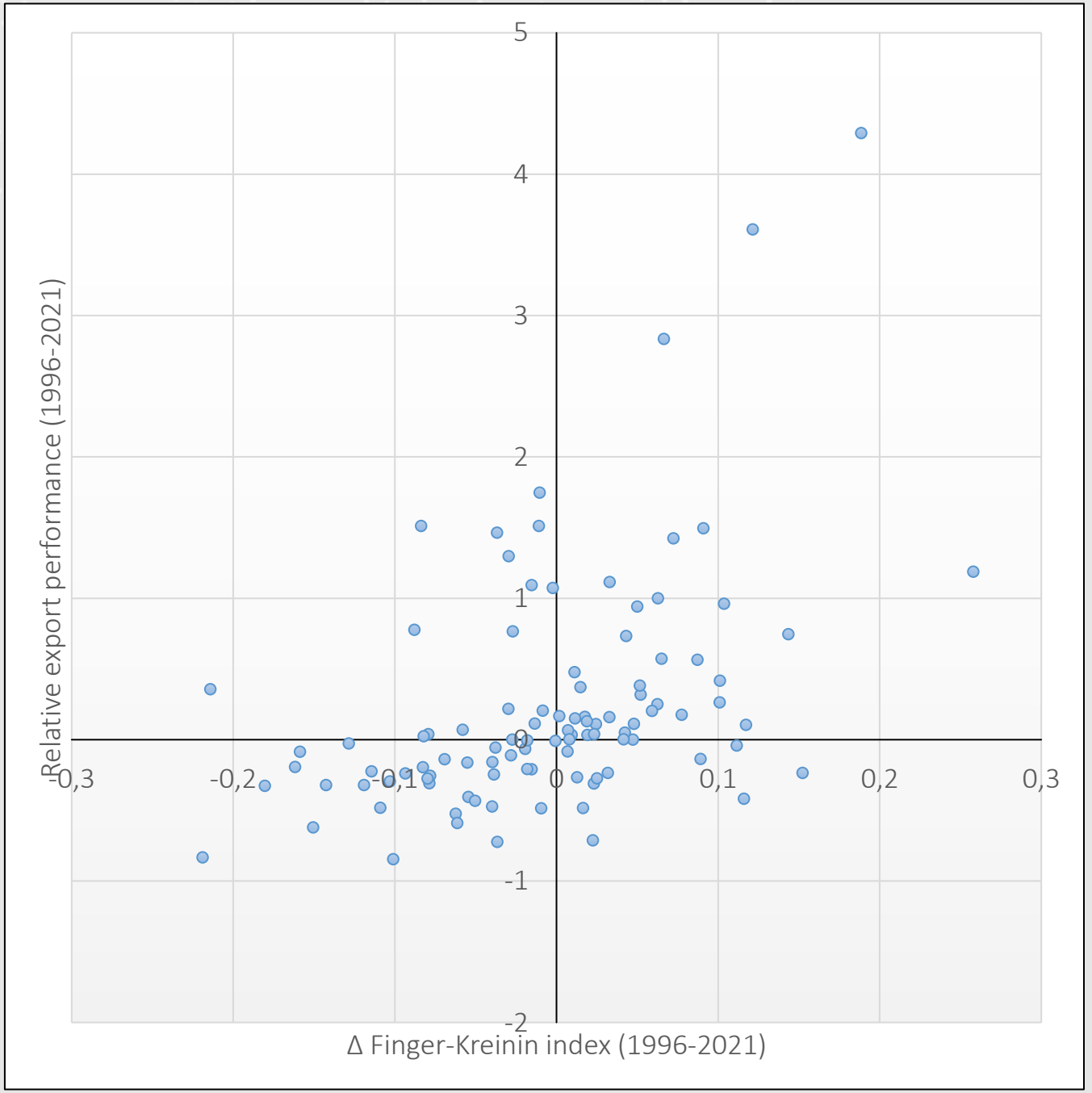
Correlation between the change in sectoral concentration and relative export performance



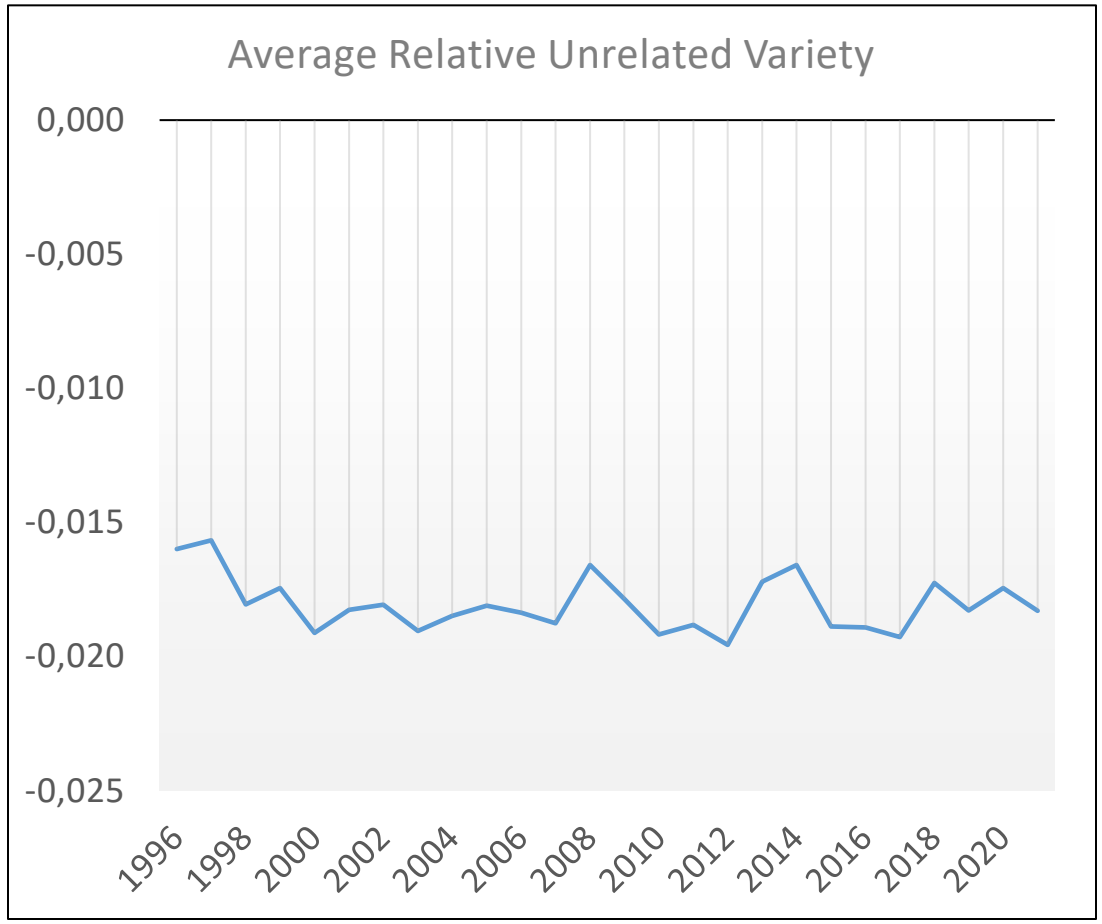
Finger-Kreinin export dissimilarity index (average of Italian provinces)

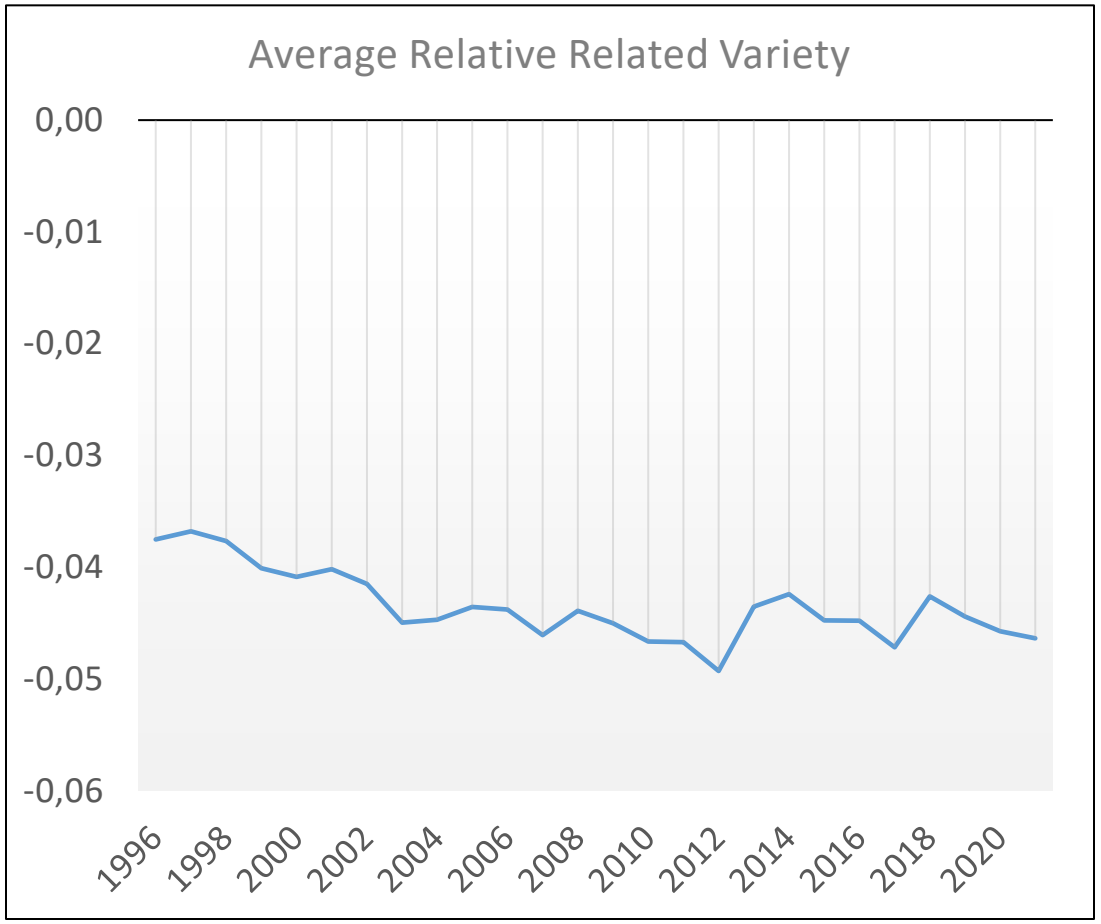


Correlation between changes in export dissimilarity and relative export performance

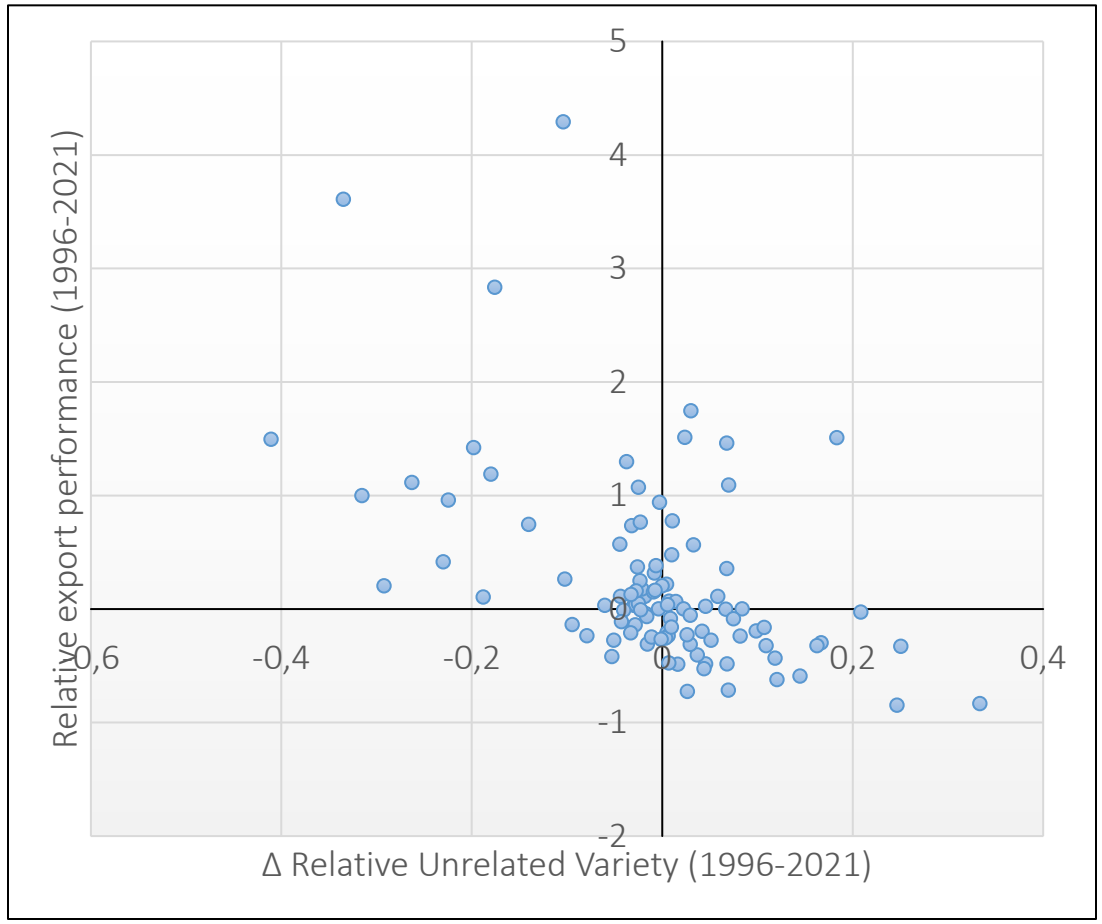


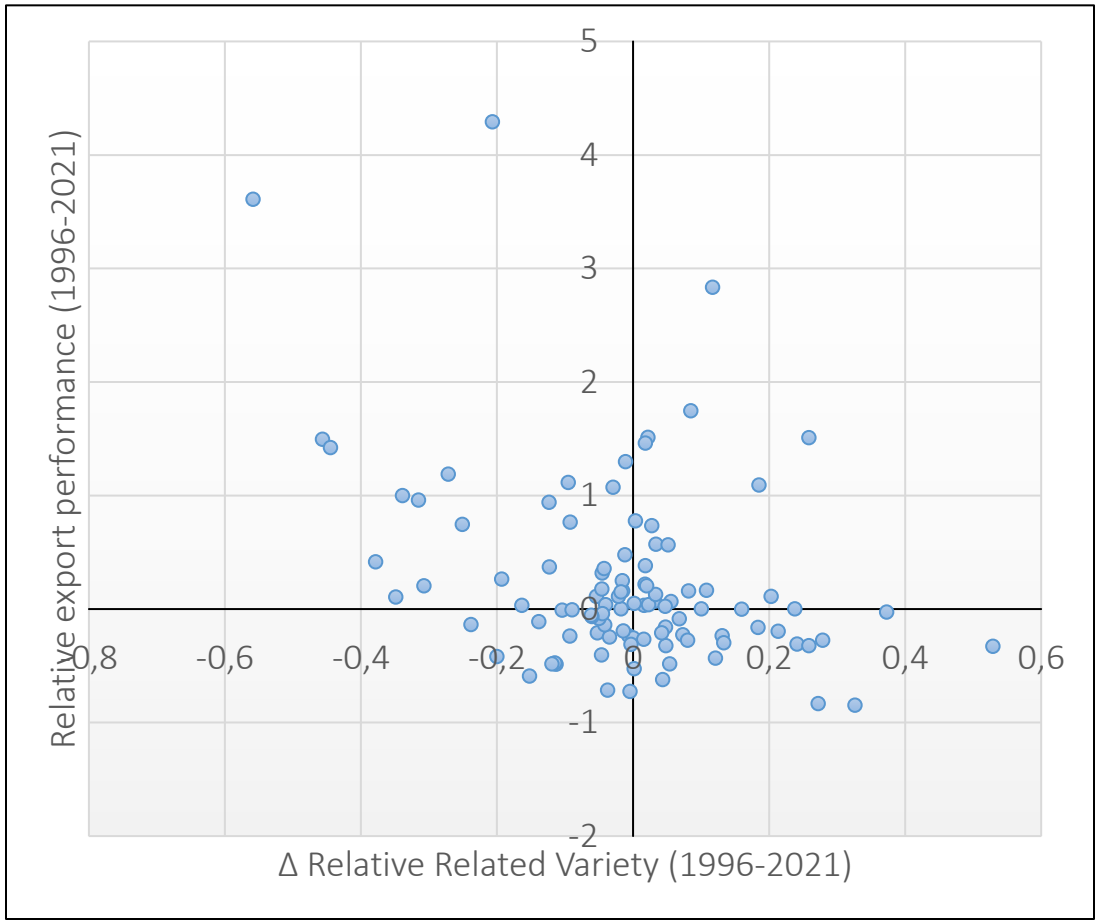
Relative unrelated and related variety (average of Italian provinces)





Correlation between changes in relative variety (unrelated and related) and relative export performance





Econometric analysis

Econometric strategy

- We estimate the effects of structural changes in the specialization patterns of Italian provinces on their export performance by regressing their **export performance** (as measured by CMS analysis) against each of the five different specifications of the **degree of sectoral diversification/concentration of their exports**.
- Trade data from 103 Italian provinces (NUTS-3) for 104 sectors in the period 1995-2021
- After applying the Hausman test, we employ a fixed effects (FE) estimation model with province and time-fixed effects

Econometric strategy

- Estimating equation:

$$\Delta Y_{it} = \beta_0 + \sum_{j=o}^{5} \beta_{1j} \Delta X_{it-j} + \beta_2 \Delta VA\_pc_{it} + \mu_i + \eta_t + \epsilon_{it}$$

- where:
  - **Y**: relative export performance
  - **X**: diversification indicators (RCAN, NHH_index, FK_index, RUV, RRV) delayed up to 5 years
  - **VApc**: value added per capita, chosen as a proxy for productivity
- The equation also includes province-fixed effects, denoted by **μ**, and time-fixed effects, denoted by **η**

Econometric strategy

- To explore the influence of economic size on the relationship between diversification and export performance, we repeat the analysis for the 26 largest provinces (in terms of total export value).
- In doing so, we aim to find an answer to our main research question, namely to what extent the impact of diversification on export performance is influenced by the size of the local economy.
- We expect that in the case of large (small) provinces a higher concentration in sectors with comparative advantages may be favourable (detrimental) to export performance, as their resource endowment is (not) rich enough to allow for an effective diversification process.

Results 1/4: Relative number of comparative advantage sectors

	Total	Largest provinces
d_RCAN	-0.739***	-0.283***
	(0.0813)	(0.1145)
d_RCAN_L1	0.0764	0.123
	(0.0890)	(0.1229)
d_RCAN_L2	0.0616	0.0776
	(0.0880)	(0.1220)
d_RCAN_L3	0.220*	0.202
	(0.0894)	(0.1241)
d_RCAN_L4	-0.0446	0.0643
	(0.0908)	(0.1263)
d_RCAN_L5	0.142	0.0314
	(0.0938)	(0.1300)
d_VA_pc	0.00000170	-1.01e-06
	(1.57e-06)	(1.34e-06)
Constant	-0.000860	-0.000179
	(0.000430)	(0.000918)
Observations	2060	520
R-squared	0.178	0.171
Number of provinces	103	26

Standard errors in parentheses

*** p¡0.01, ** p¡0.05, * p¡0.1

- An increase in diversification can diminish the export performance of a province, relative to the rest of Italy. However, when considering time lags, this adverse effect seems to fade over time.
- The negative impact of greater diversification is less pronounced in relatively larger provinces, suggesting that, given their stock of resources, they can better address the challenges posed by enriching their portfolio of comparative advantages.

Results 2/4: Normalized Herfindahl-Hirschman index

	Total	Largest provinces
d_NHH	0.570***	0.521***
	(0.0438)	(0.1052)
d_NHH_L1	-0.0934*	-0.125
	(0.0473)	(0.1187)
d_NHH_L2	-0.0319	0.00854
	(0.0489)	(0.1237)
d_NHH_L3	-0.108*	-0.0489
	(0.0494)	(0.1250)
d_NHH_L4	-0.0180	0.0638
	(0.0504)	(0.1275)
d_NHH_L5	-0.0777	-0.0896
	(0.0511)	(0.1297)
d_VA_pc	1.60e-06	1.70e-06
	(1.50e-06)	(1.91e-06)
Constant	-0.000696	-0.00233
	(0.0019)	(0.0020)
Observations	2,060	520
R-squared	0.202	0.185
Number of provinces	103	26

Standard errors in parentheses

*** p¡0.01, ** p¡0.05, * p¡0.1

- Provinces that tend to specialize in a more limited number of sectors tend to perform better in terms of relative exports, although this effect tends to weaken and even reverse over time.
- The influence of economic size appears to be less clear-cut, but still suggests that for larger provinces the advantage of concentration is relatively weaker.

Results 3/4: Finger-Kreinin dissimilarity index

	Total	Largest provinces
d_FK	1.024***	4.872***
	(14.07)	(12.00)
d_FK_L1	-0.150	0.0522
	(-1.91)	(0.11)
d_FK_L2	-0.123	-1.122*
	(-1.52)	(-2.28)
d_FK_L3	-0.0805	-0.624
	(-0.97)	(-1.21)
d_FK_L4	-0.00843	0.579
	(-0.10)	(1.09)
d_FK_L5	-0.100	-0.821
	(-1.14)	(-1.50)
d_VA_pc	0.00000112	0.00000361
	(1.06)	(1.31)
Constant	-0.000194	-0.00678
	(-0.10)	(-1.16)
Observations	2060	520
R-squared	0.187	0.169
Number of provinces	103	26

t statistics in parentheses

*** p¡0.01, ** p¡0.05, * p¡0.1

- Better competitive results are obtained by provinces that have managed to differentiate their specialization pattern compared to the rest of Italy.
- In the larger provinces, this positive effect is much stronger than average.
- A conjecture to explain this result could be linked to the nature of the FK indicator: a greater differentiation compared to other provinces does not necessarily imply a greater concentration in a few sectors (as for the HH index), but could also be obtained by diversifying the specialization model, which is easier for larger provinces.

Results 4/4: Relative variety

An increase in variety has a significant negative impact on export performance, consistent with what emerges from the other indicators.

This impact is stronger for larger provinces, which is more difficult to explain.

Table 5: Fixed effects regression results for relative unrelated variety (RUV)

	Total	Largest provinces
d_RUV	-0.750***	-1.256***
	(0.051)	(0.054)
d_RUV_L1	0.094	0.140***
	(0.056)	(0.059)
d_RUV_L2	0.068	0.014
	(0.057)	(0.060)
d_RUV_L3	0.132*	0.120*
	(0.058)	(0.061)
d_RUV_L4	0.041	-0.014
	(0.060)	(0.062)
d_RUV_L5	0.101	0.081
	(0.061)	(0.065)
d_VA_pc	1.57e-06	6.35e-06**
	(1.07e-06)	(2.86e-06)
Constant	-0.0013	-0.0081
	(0.0019)	(0.0061)
Observations	2,060	520
R-squared	0.178	0.171
Number of provinces	103	26

Standard errors in parentheses
*** p¡0.01, ** p¡0.05, * p¡0.1

	Total	Largest provinces
d_RRV	-0.4095***	-2.1458***
	(0.0349)	(0.2171)
d_RRV_L1	0.0538	-0.0363
	(0.0373)	(0.2472)
d_RRV_L2	0.0476	0.3885
	(0.0387)	(0.2534)
d_RRV_L3	0.0602	0.4487
	(0.0393)	(0.2614)
d_RRV_L4	0.0221	-0.0993
	(0.0404)	(0.2796)
d_RRV_L5	0.0605	0.5716*
	(0.0413)	(0.2931)
d_VA_pc	1.64e-06	6.35e-06**
	(1.07e-06)	(2.86e-06)
Constant	-0.0013	-0.0081
	(0.0019)	(0.0061)
Observations	2,060	520
R-squared	0.0669	0.1711
Number of provinces	103	26

Standard errors in parentheses
*** p¡0.01, ** p¡0.05, * p¡0.1

Preliminary conclusions: specialization or diversification?

- For small economies, the advantages of specialization still appear relevant.
- However, excessive concentration exposes to the risk of asymmetric shocks
- On the other hand, not all types of diversification are useful for the dissemination and development of knowledge

Future research

- Improving the econometric specification for the role of economic size
- Extending the analysis to complexity and fitness indicators
- Controlling for other local conditions, e.g.:
  - Innovation and productivity
  - Multinational presence
  - Industrial districts
  - Urban systems
  - Social capital
  - Infrastructures
- Controlling for inter-regional effects

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