The Determinants of Coagglomeration from Functional Employment Patterns

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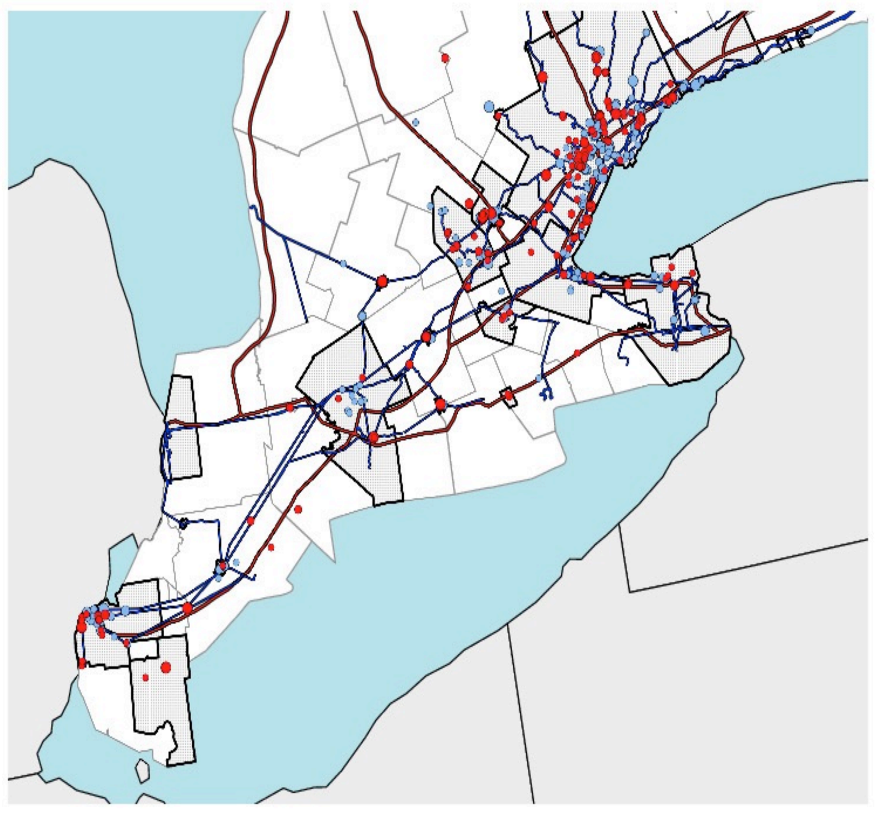
Motivation

Location patterns are not random.[1,2,3,4] The geographic concentration of individual industries—e.g., Silicon Valley or the City of London—or the **coagglomeration** of industry pairs—e.g., textile and apparel in 19th century NYC or Montréal—is driven by firms' and workers' desire to minimize the costs of moving 'goods, people, and ideas'. It has positive effects on outcomes like productivity or innovation.

Functional patterns are not random either.[5,6,7] Progress in ICT allows firms to split different activities across different locations. This can be observed at the international scale—e.g., outsourcing of production to China—but also nationally—research and management in large cities, and production in less urban areas.

Identifying the mechanisms of geographic concentration is challenging. Yet, **different locations are specialized in different industries and functions**, and this variation is useful to identify those mechanisms. Do industries cluster because of the costs of moving goods, people, and ideas? Or because of reasons unrelated to those factors (e.g., access to infrastructure)? Little is known about how agglomeration forces drive jointly location patterns and functional patterns.[8,9]



What is coagglomeration?
In Figure 1, plants in 'Motor vehicle manufacturing' (red dots) and 'Motor vehicle parts manufacturing' (blue dots) tend to locate together. They are also both close to major infrastructure.

How do we measure it?
We estimate continuous measures from geocoded establishment data: kernel densities of the distribution of bilateral distances between all pairs of plants in two different industries.[2]

Figure 1. Coagglomeration of NAICS 3361 (red) and 3363 (blue) in Ontario. Census metro divisions in grey shades.

Main objective and key idea

We want to better **identify the determinants of geographic concentration** using variation in both location and functional patterns. The key idea is the following:

- Different functions require different interactions. Production may be more sensitive to the local presence of vertically linked suppliers and skilled workers, whereas research may be more sensitive to the local presence of knowledge.
- Industry pairs that intensively share 'ideas' should coagglomerate their 'idea-intensive' functions (e.g., research)—while industry pairs that share of lot of 'goods' should coagglomerate their 'goods-intensive' functions (e.g., production).

Data and methodology

We combine two key **datasets**:

- Canadian special census tabulations that split industry-level employment by census division, functional type, and rural-urban status.
- Business register geocoded plant-level data, with extensive coverage of the manufacturing sector (we work with NAICS 4-digit manufacturing industries).

Empirical strategy:

- Use census tabulations to split plant-level employment into broad functional types ('Management and research'; 'Clerical'; 'Retail and services'; 'Production').
- Estimate 10,710 industry-pair coagglomeration kernel densities for 2001, 2003, and 2005. Done for overall employment and each broad functional type.
- Run multivariate regressions to identify the determinants of coagglomeration, using both overall employment and employment by functional type.

Different functions, different patterns

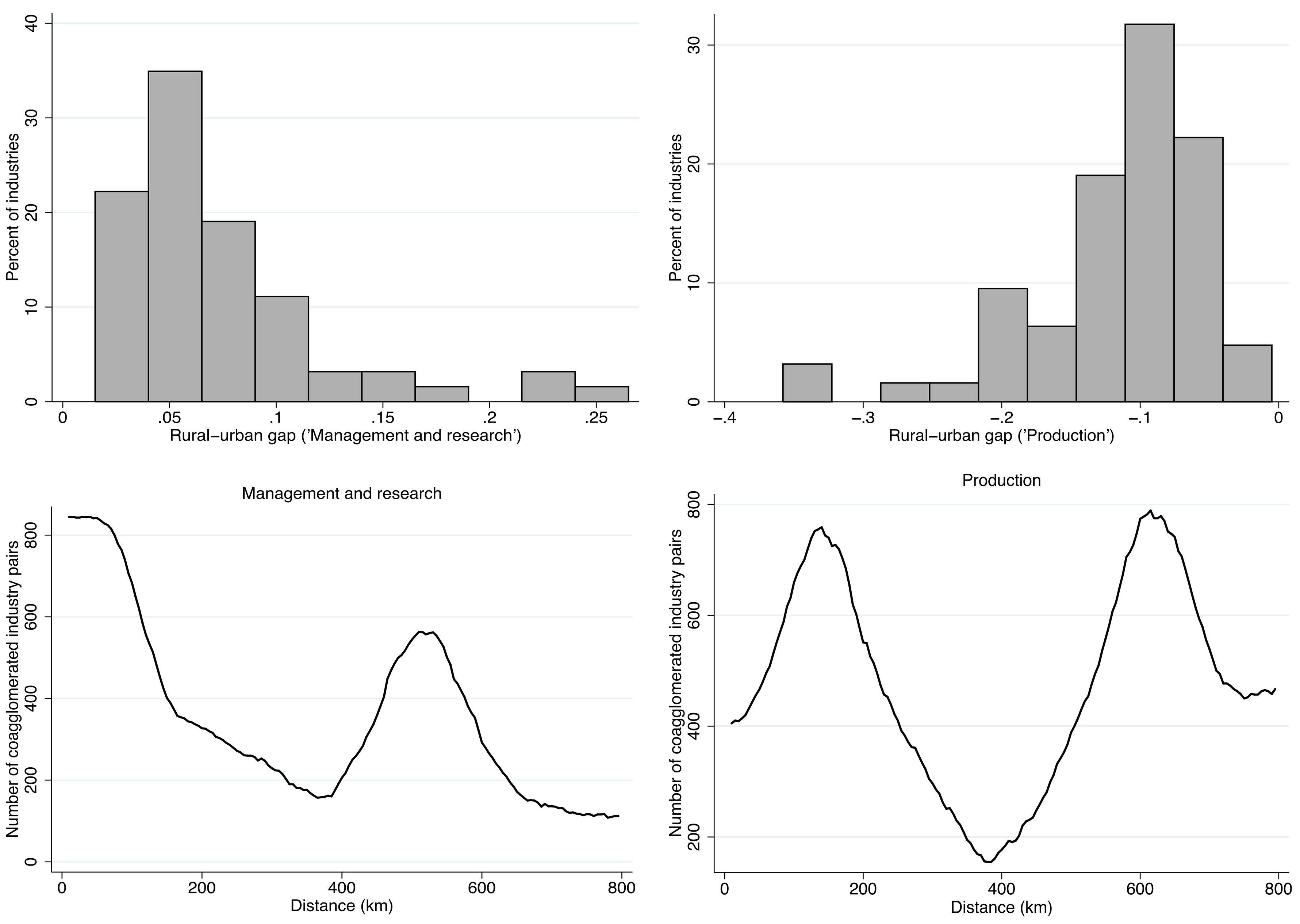


Figure 2. Functional splits by rural-urban (top), and # of coagglomerated pairs by function and distance (bottom).

Determinants of coagglomeration

We run regressions of the following form:

$$\text{coagglo}_{ijt}^{f} = \alpha_{io}\text{io}_{ijt} + \alpha_{oes}\text{oes}_{ijt}^{f} + \alpha_{know}\text{know}_{ijt} + \mathbf{X}_{ijt}\beta + \xi_i + \xi_j + \delta_t + \epsilon_{ijt}$$

- Proxies for the agglomeration forces: 'goods' (input-output links, io); 'people' (labor similarity, oes); 'ideas' (knowledge sharing, know).
- Controls (X_{ijt}), industry- and time-fixed effects (ξ_i, ξ_j, ξ_t), i.i.d. error term (ε_{ijt}).

	All functions	Mgmt and research	Production
Input-output links	0.025[a]	0.017[a]	0.025[a]
Labor similarity	0.024[a]	-0.038[a]	0.022[a]
Knowledge sharing	0.003	0.008[c]	0.001

Table 1. OLS regression results, industry and year fixed effects included. With controls. N=10,292.

Key findings

Different functions display different location patterns—some with short and some with long spatial ranges. Different functions also benefit differently from access to 'goods, people, and ideas'. In particular:

- Input-output links ('goods') and labor similarity ('people') are about equally important—the former operating across larger spatial scales.
- Knowledge sharing ('ideas') is important for the coagglomeration of management and research and clerical employment, but not for other functions.
- The average effects across all functions that we estimate when using total employment masks substantial heterogeneity.

Our findings also point to the importance of rather neglected **identification issues**:

- Coagglomeration of A and B can be due to a third industry C, even when there are no agglomeration benefits between A and B (but between A-C and B-C).
- Coagglomeration often takes place within firms—multiple complementary activities—but we cannot measure it usually.

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