**Economic Complexity and Levelling up**

**Executive Summary**

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**Introduction**

* The government has announced levelling up the country has an objective and CfC has recently defined levelling-up in i) standards of living ii) help places each its productivity potential.
* On the productivity front, UK’s productivity is below France and Germany but there is a geography to it. Previous CfC research shows that the national productivity lag is mostly driven by large cities located outside the South East as they do not outperform non-urban areas as we would expect.
* Economic complexity helps us understand better the underlying economic capacities of each city. This allows identifying which places are lagging the most, when compared with their productivity potential.
* A comparative analysis between today and 1981 provides guidance on what work and what doesn’t in terms of changing the economic fortunes of a city.

**This paper attempts to understand the productive capabilities of each British cities and it is divided as follows:**

* What is economic complexity and how it looks today in UK urban areas
* How urban complexity changed in the last four decades
* What does this mean for levelling up?

**What is economic complexity and how it looks today in UK urban areas**

* Economic complexity is a concept that infers the industrial structure of a place, based on which sectors it has a comparative advantage. It considers both the diversity of a place’s **exporting sector** but also how sophisticated are its exports (ubiquity), by comparing different areas (more details see box 1). **Complex economies**, with higher levels of accumulated knowledge, are generally associated with **better productivity and income levels.**

**Complex sectors tend to be in urban areas due to their underlying features**

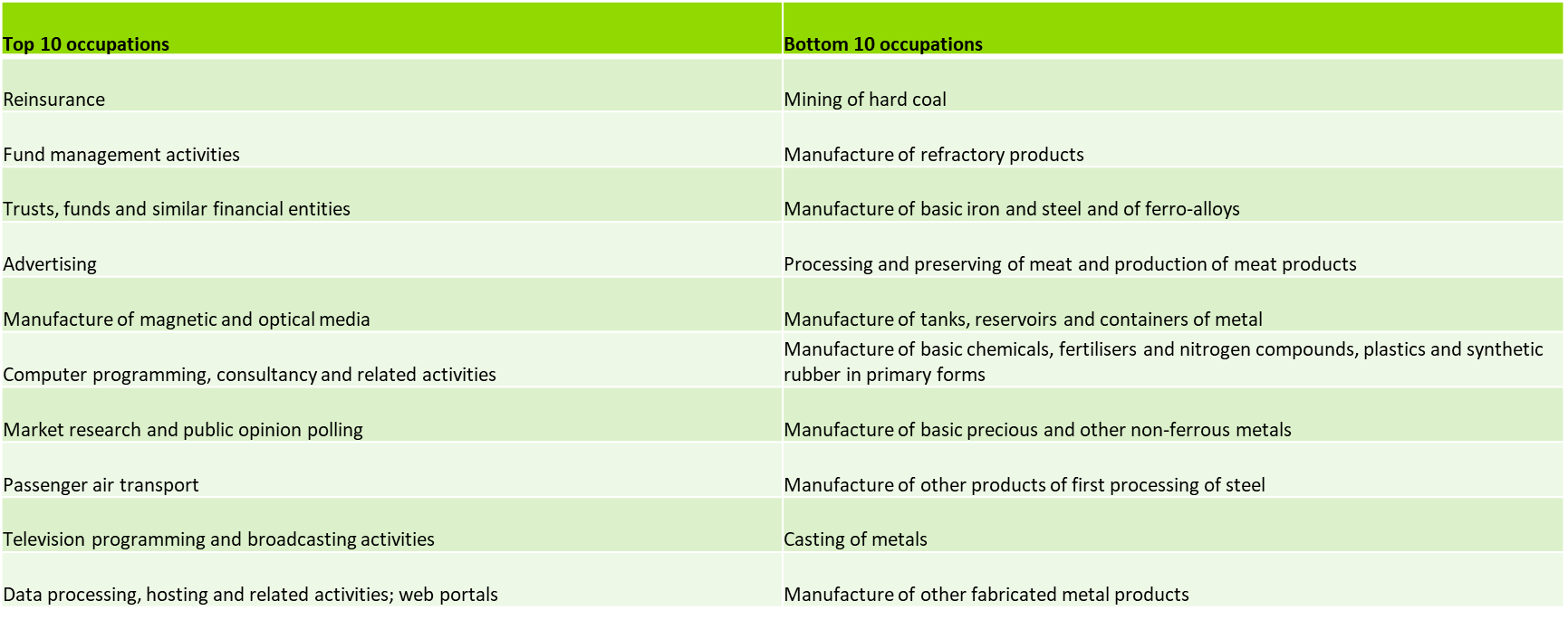
* Nowadays **urban areas in the UK tend to be more complex than non-urban areas, as Figure 1 suggests,** because cities present inherent benefits (e.g. large labour pools, sharing of inputs like roads, etc.) that are more suitable for complex activities, making them the UK’s engine of growth.

**Figure 1: Urban areas are more likely to be complex than non-urban areas.**

Source: ONS, Business Register and Employment Survey (BRES). Centre for Cities’ own calculations. Weighted-average of economic complexity scores at the Local Authority level; the higher the score, the more complex the economy is. The most complex Local Authority is the City of London, followed by Tower Hamlets, while Dumfries and Galloway ranks last. Note that complexity scores are relative to other local authorities, meaning that there will always be local authorities with negative scores.

* Today’s most complex exporting activities are typically knowledge intensive services like Finance, Advertising and programming, while the least complex occupations are associated with exporting goods (e.g. mining and manufacturing). Previous research from the Centre for Cities shows that services’ exports – more likely to be complex – tend to locate in cities, particularly in city centres that allow them benefit from agglomeration.[[1]](#footnote-1) Exporters of goods (lower complexity) are most likely to locate in comparatively small cities or non-urban areas as land and premises are cheaper.

**Table 1:** Exporting occupations by complexity (2019)



Source: ONS, Business Register and Employment Survey (BRES).

* + Box 1: with overall complexity developed by Hidalgo and Hausman, definition and formula. Rare products are not necessarily complex. State the authors argue it is a predictive force of future economic growth

**Differences in intra-urban complexity are substantial**

* Even though cities are more complex and UK’s engine of growth, **urban areas are not equally complex and some even perform below the average non-urban areas**. Figure 2 show a clear relationship between productivity and complexity in UK’s cities. This supports the view that productivity differences across regions are mainly result of differences between their exporting structure, rather than underperformance of existing businesses or lack of exporting jobs.[[2]](#footnote-2)
* Most of cities and large town that have both high complexity and productivity levels are mostly located in the Greater South East. Research has shown that high-skilled exporters are more prevalent in urban areas in the Greater South East because they offer a large number of skilled workers and networks of highly-skilled businesses.[[3]](#footnote-3) The most productive and complex firms and sectors are willing to pay a premium – in form of more expensive commercial space – to access such advantages.
* Almost all cities with lower complexity also present productivity levels[[4]](#footnote-4) below the urban average; these cities generally located in the North and Midlands. In order to increase productivity levels, these places should not keep replicating their existing (low productivity) comparative advantages that will require moving towards more complex sectors.

**Figure 2:** Complexity and productivity are highly correlated

**Urban average**

Source: ONS, Regional gross domestic product (GDP) reference tables; ONS, Business Register and Employment Survey (BRES). Centre for Cities’ own calculations. Note that complexity scores are relative to other cities, meaning that there will always be cities with negative scores.

**Complexity suggests that large cities are the ones with the highest productivity gap**

* That said, there are a significant number of cities (bottom right) - like Manchester, Glasgow and Leeds - that simultaneously present **low productivity levels but high complexity**. These places are the ones we expect the largest “productivity gap”.[[5]](#footnote-5)
* As the UK economy shifts towards a knowledge-intensive service-based economy, agglomeration effects will play an important role promoting economic growth. L**arger cities with pools of workers and networks of businesses are more likely to promote those benefits and attract complex activities (Figure 3).** The cities that currently have a significant “productivity gap” are typically comparatively large cities where its intrinsic features are suitable for today’s knowledge-economy.

**Figure 3:** Agglomeration effects from larger cities promote a knowledge-based economy

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 2011. Centre for Cities’ own calculations.

* One of the reasons why such places continue lagging in terms of productivity is the **size of its complex exporting base, in particular the larger cities**. Figure 4 highlights that the most productive cities are associated with a higher share of workers allocated to its’ most complex sectors.
* Despite similar complexity levels, Glasgow has 13 per cent of jobs in its top 5 complex sector while Brighton is 54 per cent. Similar patterns are found in other large cities suggesting that they have some comparative advantages in complex industries that still employ a comparatively low number of workers.

**Figure 4:** Complex cities with low productivity levels lack a large complex export base

Source: ONS, Business Register and Employment Survey (BRES). Centre for Cities’ own calculations.

* That said, the existing “productivity gap” of British cities is not only about the size of its most complex sectors. When compared with the its French and German competitors, as illustrated in **Box 1**, UK’s urban economies (mainly the largest cities, except London) present comparatively low levels of economic complexity.
* Box 1: British complexity and its international competitors
* British cities, specially the large, are substantially less complex than French and German cities with the same size, which reflects in low productivity levels. Only London, Bristol and Leeds have complexity levels comparable to similar sized cities in France and Germany.

**Figure 5: British cities, especially the large, lagging their German and French competitors**

* Source: Eurostat, xxxxxx.
* For complex cities with a “productivity gap”, their challenge is mostly about fueling the existing process of reinvention (unlike the other low productivity cities) by improving its skills base; promote efficient public transport systems; provide high-quality and affordable commercial space.

**How urban complexity changed in the last four decades**

**Urban areas and large cities in particular had a process of divergence with the rest of the UK**

* Analysing the last four decades helps understand the reasons behind the current “productivity gap” in several British cities. As the economy has been moving from manufacturing towards knowledge-intensive services, urban areas in general and the largest cities in particular, are in a better position to prosper. Urban areas offer benefits that promote innovation, knowledge spillovers and consequently become complex and productive.

**Figure 6:** Cities, in particular the largest ones, have become more relevant in the last four decades

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981. Urban ECI computed at the Local Authority level including all local authorities. City’s ECI computed at the PUA level, including urban areas only. Largest cities measured by total employment and ECI scores are a weighted average considering each PUA’s size.

**Largest cities include:** Birmingham; Manchester; Glasgow; Liverpool; Sheffield; Newcastle; Leeds; Nottingham; Bristol.

**Complex places in the past, with a larger prevalence of KIBS, were more likely to reinvent themselves and keep productive**

* The existing correlation between 1981 and 2019 complexity also supports the idea that most complex economies are more likely to reinvent themselves, innovate and improve their productivity levels. The cities that were able to maintain its complexity above average from 1981 to 2019 – mostly located in the Greater South East – **typically had a higher prevalence of KIBS than the remaining places**.

**Figure 7:** Complexity changes 1981-2019, at the PUA level

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981. Centre for Cities’ own calculations. Note that complexity scores are relative to other cities, meaning that there will always be cities with negative scores. Scores are normalised. The bubble size here refers to percentage of jobs that were Knowledge-intensive business services in 1981.

* That said, complex economies remain productive not by replicating the existing advantages they had in 1981. They kept reinventing themselves, adapting to the changes in the economy and developed new advantages in sectors like IT, both Table 2 and Box 2 provide evidence of such process. Cities that have been historically creators of knowledge have higher knowledge businesses, which tend to have greater transferable skills.[[6]](#footnote-6)
  + Box with a bit of data and methodology for 1981
* Meanwhile, cities that lost its (relative complexity) continued specializing in the same activities they had four decades ago. As the British economy evolved over the decades, those places struggled reinvent themselves and change their economic base through innovation.

**Table 2:** Reinventors vs. Replicators, most prevalent occupation % of exporting jobs in 1981.

|  |  |  |  |
| --- | --- | --- | --- |
| **PUA** | **1981** | **2019** | **Complexity** |
| Edinburgh | Radio/electronic capital goods (8.2%) | Computer programming, consultancy and related activities (19.0%) | Remained high |
| London | Banking/bill-discounting (8.4%) | Computer programming, consultancy and related activities (16.8%) | Remained high |
| Reading | Electronic data processing equipment (4.8%) | Computer programming, consultancy and related activities (37.4%) | Remained high |
| Aberdeen | Extraction: mineral oil/natural gas (24.5%) | Extraction: mineral oil/natural gas (28.3%) | Deteriorated |
| Blackpool | Aerospace manufacture/repairing (20.6%) | Aerospace manufacture/repairing (26.7%) | Deteriorated |
| Swansea | Iron and Steel industry (12.1%) | Manufacture of basic iron and steel and of ferro-alloys (13.6%) | Deteriorated |

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981.

Box 2: London’s growth and the role of the financial sector

The rise of London in the last decades is generally associated with the “Big Bang”, a set of financial deregulation reforms by the mid-80s that lead to the expansion of the financial sector. However, London’s economic turnaround has been much more than finance.

• Today, finance and insurance activities became significantly more relevant when compared with 1981 but there were other urban areas – like Cardiff, Northampton or Gloucester – that presented similar trends.

**Figure 8.1: Rise of finance not specific of London**

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981.

• The rise in finance happened in a context of an overall economic shift towards the service sector. When compared with other knowledge and business services, London’s rise of finance-related jobs was dwarfed by sectors like programming, design, advisement or research.[[7]](#footnote-7)

**Figure 8.2**: Finance-related employment rose but not as much as other services.

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981.

• Moreover, national accounts from the last two decades also support the idea that finance and insurance sector has not been the main driver of London’s growth. The sector remained mostly unchanged, as a percentage of GVA. While Information and Communication; or Professional, scientific and technical activities have risen significantly, partially being the engine of London’s growth in the last decades.

**Figure 8.3:** Financial sector remained mostly stable in London, unlike other knowledge-intensive services

Source: ONS, Regional gross domestic product (GDP) reference tables.

* As illustrated in Box 3, some low complexity economies shifted to other low knowledge-activities, instead of exactly replicating their previous advantages. These activities tend not to benefit from knowledge spillovers, which would help cities to innovate and reinvent themselves.[[8]](#footnote-8) Most struggling urban areas seem to change their economic specialisation based on their inherent competitive advantages such as low cost labour or land.
  + Box about coal towns below:

**Box 3:** Coal economies – evolution in the last decades

From the 22 cities and large towns that had they complexity level below average for both 1981 and 2019, six of them were highly reliant on coal in 1981. Today, their economies had moved away from coal and become specialised in several different sectors, which typically require cheap labour and land. However, those competitive advantages had no economic relationship with coal mining; which means these economies did not benefit from accumulated knowledge of their previous specialisation.

**Table 3:** Most prevalent exporting occupation, 1981-2019



Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981.

This highlight how low complexity activities are unlikely to drive places towards economic sophistication through the gradual development of its existing sector (e.g. moving from mining to mining tool manufacturing, etc.). Instead, cities are likely to continue using their existing competitive advantages to attract new types of low complexity sectors that are unlikely to promote innovation.

**Sunderland’s previous strengths did not attract Nissan**

In 1984, the British government and Nissan reached an agreement to open a car plant in Sunderland and Nissan has been able to benefit from further government support in recent years.[[9]](#footnote-9) Before the car plant, Sunderland’s economy was dominated by coal mining, shipbuilding and other manufacturing activities. However, there is little evidence that Sunderland’s economic structure was the reason why Nissan located there.

If Nissan has moved to Sunderland mainly because of its industrial and labour capabilities, we should expect to see a strong relationship between those sectors (mining, shipbuilding, etc) and car manufacturing in other British cities. Figure 9 suggests that there is no relation between Sunderland’s past capabilities and the likelihood of producing car-related goods.

**Figure 9:** Cities with car manufacturing plants were not similar to Sunderland in the early 80s

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981.

Urban economies with some degree of specialisation in car manufacturing today (Luton, Birmingham or Oxford) did not share Sunderland’s economic features in 1981. At the same time, places focused in mining and shipbuilding like Portsmouth or Doncaster did not shift their economy towards car manufacturing. Sunderland was able to attract Nissan due to other benefits that were not directly related to its industrial base like public subsidies; and availability of cheap land and labour.

**Some cities were able to break out of a low complexity position**

* Cities that were able to improve its complexity levels since 1981 presented a particular set of conditions, when compared with the remaining low complexity economies. This group, **mainly composed by larger cities, has intrinsic features that are promote agglomeration, leading to knowledge spillovers and innovation.**
* The combination of relatively large “productivity gaps” with complexity gains in the last decades, suggest that these economies are in an ongoing process of transition that needs to be supported.

**Large economies, with some knowledge jobs and low concentration**

* When compared with other low complexity economies in 1981, the places that were able to improve had a comparatively high number of *“incipient complex jobs”*: jobs in complex sectors without a comparative advantage. This was also associated with a comparatively high number of KIBS in 1981.
* However, the existence of knowledge-related jobs in 1981 does not seem to explain the differences between **the cities that gained complexity and the ones that deteriorated**, in relative terms. The degree of labour market concentration between the two groups is likely to have played an important role in the process. Formerly complex places had, on average, 17.5 per cent of its exporting jobs in the same sector (1981), in line with places that have always been low complexity. While, cities as Manchester, Glasgow and Nottingham had quite low levels concentration, allowing their incipient complex sectors to flourish and benefit from agglomeration effects. [[10]](#footnote-10)

**Figure 10:** Economies with incipient complex sectors and low degree of concentration, were able to overcome its low complexity position

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981. Incipient complex jobs defined exporting jobs in the 20 most complex occupations, only if the city does not present a comparative advantage in the sector.

* There are several cases in which cities with the same competitive advantages and different degrees of concentration, moved in opposite directions (Table 4). Low concentration economies, were able to benefit from agglomeration effects, reinvent themselves and increase their complexity. At the same time, economies that were highly reliant on a single sector, were less likely to specialise in knowledge-intensive services in the decades ahead, leading to a relative decline as the economy kept evolving.

**Table 4:** Divergence between cities with the same specialisation in 1981

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PUA** | **Most prevalent sector (1981)** | **Sectorial concentration: % exporting jobs** | **KIBS % private jobs (1981)** | **KIBS % Private jobs(2019)** | **Most complex activity (2019)** | **Complexity (1981-2019)** |
| Glasgow\* | Shipbuilding and repairing | 4.3 | 7.4 | 14.2 | Wireless telecommunications activities | Improved |
| Plymouth | 36.8 | 5.7 | 8.0 | Manufacture of irradiation, electromedical and electrotherapeutic equipment | Deteriorated |
| Liverpool | Motor vehicle bodies | 10.8 | 7.2 | 12.7 | Data processing, hosting and related activities; web portals | Improved |
| Luton | 16.7 | 4.1 | 10.3 | Passenger air transport | Deteriorated |
| Nottingham | Deep coal mines | 6.8 | 5.2 | 12.6 | Data processing, hosting and related activities; web portals | Improved |
| Mansfield | 26.6 | 3.1 | 6.3 | Photographic activities | Remained low |

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981. Centre for Cities’ own calculations. Note that complexity scores are relative to other cities, meaning that there will always be cities with negative scores. Scores are normalised. \* Shipbuilding was the second most prevalent occupation in Glasgow according to Centre for Cities’ current definition of Glasgow city. Previous Centre for Cities’ city definition would consider Shipbuilding as the most prevalent sector in Glasgow by 1981.

**Cities can attract new innovative sectors**

* Employment data suggests that in some cases, cities were able to bring new complex sectors even without having previous experience/knowledge in similar sectors, as box 4 illustrates. These cases highlight the power of cities in promoting growth and innovation by bringing people and firms together. The combination of some knowledge-intensive jobs, low levels of sector concentration and some incipient complex activities allowed some urban areas to innovate and bring some new comparative advantages, some of them even unrelated with the previous exporting base.
* Large cities, those that improved their complexity, are the ones in the best position to generate agglomeration benefits and close the existing productivity gap. Places with deep labour markets and existing networks or businesses are more likely to attract new innovative firms.

**Box 4:** Cities can develop sectors without previous knowledge in relatable areas

Some British cities were able to become relatively more complex recently, specialized in new activities in the last decades. Data at the occupational level suggests that in some circumstances, the observed improvements did not depend on the previous industrial features of a place.

**Computer-related sectors**

Today, economies with a strong IT sector generally had a comparative advantage in electronics-related occupations in 1981 (Figure 10); both sectors are seen as complex in 2019 and 1981, respectively. Half of the cities with a comparative advantage in the IT sector – like Reading, Slough, London or Brighton – were specialised in the electronics sector in 1981. Nevertheless, Leeds and Nottingham were able to become some of the few cities with a comparative advantage in IT, without having electronics’ legacy from 1981: Nottingham ranked 37th out of 62 cities in terms of being specialised in electronics.

**Figure 11:** Economies focused on electronics were more likely to move towards IT-related occupations but there are exceptions

Source: ONS, Business Register and Employment Survey (BRES); ONS, Census 1981. IT-related occupations include “Computer programming, consultancy and related activities” and “Data processing, hosting and related activities; web portals”; and Electronics-related occupations include “Electronic data processing equipment” and “Radio/electronic capital goods”.

A similar trend is found in Research-related activities, one of the most complex sectors today. Liverpool was able to build a comparative advantage in that sector, without presenting a strong legacy, as it ranked 49th out of 63 cities in Research and Development activities in 1983.[[11]](#footnote-11) Moreover, Manchester, Nottingham and Slough were some of the least specialised economies in the telecommunications in 1981 and today they present a comparative advantage in Wireless telecommunications activities.

**What does this mean for levelling up?**

**Recognise the central role of cities in levelling-up the economy**

* Cities are more complex than non-urban economies because the overall economy is moving towards knowledge-intensive services
* Urban economic complexity, like previous CfC research, supports the idea that levelling up is not making all places equally productive.
* Ad-hoc pots of money to towns can improve local wellbeing but not solve the productivity challenges.

**Within cities, different places present different challenges, depending on its economic base**

**High complexity, low productivities**

* Cities that improved their complexity substantially since 1981, typically large cities that offer agglomeration benefits to knowledge-intensive sectors, are still in a transition process. Unlocking its productivity potential is key to level up the country as whole. Central and local governments must support cities expand on their emerging strengths.
  + **Central government rec:** End local government austerity, give further devolved power, etc.
  + **Local government rec:** use devolved powers to improve people’s skills; strengthen transport networks; improve conditions for business (office space quality); etc.

**Low complexity, low productivity**

* Central government should not expect these places as a whole to improve their productivity levels rapidly: our research shows that cities that had complexity gains in the last four decades are still lagging in terms of productivity showing how gradual the process can be.

* That said, cities can reinvent themselves and turn things around. In order to achieve it, it will fundamental to diversify the existing economy instead of building their existing strengths, which keeps cities in a cycle of replication. Strategies based on attracting large manufacturing plants or freeports will do little to change the strengths of an economy in the decades to come.
  + **Central government rec:** support incomes and wellbeing in the areas, guarantee health and education levels converge with the rest of the country.
  + **Local government:** make cities better places for businesses (office space improvements) and adult education, etc

1. Trading places – add the footnote later [↑](#footnote-ref-1)
2. The wrong tail and trading places 2 – add the footnote correctly later [↑](#footnote-ref-2)
3. The wrong tail – add the footnote correctly later [↑](#footnote-ref-3)
4. The few exceptions – like Aberdeen and Sunderland – are places where earnings and claimant count are quite low for its productivity levels. [↑](#footnote-ref-4)
5. Reference to Paul’s Level up briefing [↑](#footnote-ref-5)
6. Add footnote: A century of cities CfC [↑](#footnote-ref-6)
7. **Other knowledge-related services include (2019):** Activities of head offices; Management consultancy activities; Research and experimental development on natural sciences and engineering; Research and experimental development on social sciences and humanities; Advertising; Market research and public opinion polling; Specialised design activities; Photographic activities; Translation and interpretation activities; Other professional, scientific and technical activities n.e.c.; Computer programming, consultancy and related activities; Data processing, hosting and related activities; web portals; Other information service activities.

   **Other knowledge-related services include (1981):** Business services (Other); Advertising; Professional/technical services (Other); Research/development [↑](#footnote-ref-7)
8. Graham D (2007) Agglomeration Economies and Transport Investment, Journal of Transport Economics and Policy 41 (3) [↑](#footnote-ref-8)
9. Is your blog enough as reference about the subsidies? [↑](#footnote-ref-9)
10. Moretti mentions something similar to this in the New Geography of Jobs when he speaks about Detroit and the Valley. [↑](#footnote-ref-10)
11. Ranked by sector’s jobs as percentage of all exporting jobs [↑](#footnote-ref-11)